Roadside Vegetation and Conservation Values in the Shire of Denmark

Photos by: K. Payne, RCC

November 2011

Roadside Conservation Committee

Roadsides - The vital link

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Report compiled by Kylie Payne and Edna McLaughlin, Roadside Conservation Committee (RCC)

Map produced by Produced by Geographic Information Services (GIS) Section, Department of Environment and Conservation (DEC). Data supplied by RCC from Shire of Denmark roadside surveys conducted by local volunteers and RCC staff.

Executive Summary

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

Aware of the need to conserve roadside remnants, the Shire of Denmark and local community members liaised with the Roadside Conservation Committee (RCC) to survey roadsides in their Shire. Surveys to assess the conservation values of roadside remnants were conducted between October 2010 and May 2011. Approximately, 64.5% of the Shire's 680km 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 61% of the roadsides surveyed in the Shire, with medium-high conservation value roadsides accounting for 19% Medium-low and low conservation value roadsides occupied 8% and 12%, 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 would provide visitors with an insight into the remnant vegetation of the district; and
- incorporating into Landcare or similar projects for '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 9 years. This trend indicates that without appropriate protection and management, roadside reserves will become veritable biological wastelands within 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 Denmark 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 by 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 potentially more suitable remnant patches. It is therefore important that all native vegetation is protected regardless of the apparent conservation value it contains. It is important to acknowledge that even degraded roadsides have the ability to act as corridors for the dispersal of a variety of fauna.

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 (Source: DEC's DEFL database March 2011);
- provide the basis for our important wildflower tourism industry, the aesthetic appeal of well-maintained roadsides potentially improving local tourism and proving a sense of place;
- often contain sites of Aboriginal /European historic or cultural significance;
- provide windbreaks and stock shelter areas for adjoining farmland by helping to stabilise temperature and reduce evaporation;
- assist with erosion and salinity control, 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 local Shire and a Department of Environment and Conservation (DEC) permit are required prior to collection. Guidelines for seed and timber harvesting can be found in Appendix 7.

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 and that the clearing is actually necessary and that the necessary 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 (LGA's) in this zone, 10 have less than 10% of the original remnant vegetation and a further 38 LGA's 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.

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.

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

In 2004, amendments to the *Environmental Protection Act* 1986 (EP Act) put in place a permit application process designed to assess proposed 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 pg 10-11). These amendments are designed to provide improved protection for native vegetation, maintain biodiversity and allow for some incidental clearing activities to continue; such as day-to-day farming practices, 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.
Photo D. Lamont

The RCC's policy on fire management is:

- roadside burning should not take place without the consent of the managing authority;

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

- 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 within the Road Reserve should be permitted 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 Fire and Emergency Services Authority (FESA) should be called in to arbitrate.

Burnt roadsides showing signs of regeneration of natives and weeds including African lovegrass (below). Follow up weed control needs to occur after burning to ensure flammable weeds don't establish after burning.

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, whether they are of Aboriginal or European origin.

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

2.4 Weeds

Weeds are generally disturbance opportunists and as such the road verge often provides a vacant niche which is easily colonised. 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.

African Lovegrass is a widespread and serious roadside weed. It forms dense monocultures, creating large fuel loads and a fire hazard. Burning results in increased regeneration of this weed.

Image used with permission of the WA Herbarium, DEC. (http://florabase.dec.wa.gov.au/browse/profile/376. Accessed October 2011.

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*)
- Watsonia (*Watsonia sp.)*
- Pittosporum (*Pittosporum undulatum*)
- Victorian Tea Tree *(Leptospermum laevigatum)*
- Sydney Golden Wattle (*Acacia longifolia*)
- Taylorina (*Psoralea pinnata*)

Pittosporum is a native to eastern Australia.
A tree which grows up to 5m high.
Dispersed by birds, possums and garden refuse.
Fire will kill most adult plants.
A garden escape and was used in revegetation.

Photo used with permission of the WA Herbarium, DEC. http://florabase.dec.wa.gov.au/browse/profile/16322. Accessed October 2011.

Roadside populations of these weeds can be observed on the weed overlays provided with the Denmark Roadside Conservation Value map (2011). The Roadside Conservation Value 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.

Watsonia is an invasive weed spread by corms & seed, prevalent in damp areas.

It grows to 2.5m high and flowers from September to December.

A garden escape brought in from South Africa.

It generally survives and flowers prolifically after fire.

Photo used with the permission of the WA Herbarium, DEC http://florabase.dec.wa.gov.au/browse/profile/18108. Accessed October 2011

Victorian Tea Tree or Coast Teatree is a Garden escape originally planted for dune stabilization and for windbreaks. It is now a major bushland weed which is spreading rapidly along roadsides between Jurien Bay and Esperance.

Photo used with permission of the WA Herbarium, DEC; http://florabase.dec.wa.gov.au/browse/profile/5850 Accessed October 2011

Sydney Golden Wattle is a garden escape which now grows on roadsides, creeklines, swamps and bushland between Manjimup and Albany. It is a dense bushy shrub or small tree up to 10m with cylindrical yellow flower spikes.

Photo used with permission of the WA Herbarium, DEC. http://florabase.dec.wa.gov.au/browse/profile/17861. Accessed October 2011.

Taylorina, also known as African Scurf pea, has become a dominant weed along roadsides. It was introduced from southern Africa as a source of honey for bees. (Hussey et al, 2007)

Photo used with permission of the WA Herbarium, DEC. http://florabase.dec.wa.gov.au/browse/profile/4155 Accessed October 2011

2.5 Dieback (Phytophthora cinnamomi)

One of the major threats to the biodiversity of Western Australia's ecosystems is dieback disease. Approximately one third of the native flora in the south-western part of WA is susceptible to attack. It is a major issue on the south coast and roadsides provide an avenue for its spread. Phytophthora dieback disease is caused by the microscopic soil-borne pathogen *Phytophthora cinnamomi*. From the soil it feeds on the roots of plants causing 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.

Dieback can cause:

- Significant loss of biodiversity including loss of key 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.

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

In field studies of south western plant communities, the families with the highest proportion of susceptible species were **Proteaceae**, such as Banksia, Grevillea, Hakea (92 per cent), **Ericaceae** (Heath family) (80 per cent), **Fabaceae** (Pea family) (57 per cent) and **Myrtaceae**, such as Eucalyptus, Myrtles and Melaleuca (16 per cent) (DEC, 2011, http://www.dec.wa.gov.au/content/view/213/548/1/2/)

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.

Dieback disease does not have a cure. However, through research, it has been shown plants can improve their resistance to the pathogen by spraying or injecting plants with the fungicide, Phosphite (a derivative of phosphorus acid).

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

Management practices include:

- information signs and education;
- seasonal and permanent road and trail closures;
- vehicle washdown using established cleaning stations to avoid transport of contaminated soil and vegetative material. *Please note: Dry cleaning (cleaning vehicles/machinery when dry) is preferable to wash-down;*
- clean any equipment including footware and tools that comes in contact with soil or plant material;
- carry a Field Hygiene Kit;
- use of dieback free construction and revegetation material. Ensure gravel is sourced from a dieback free supplier/location; and
- phosphite treatment.

Roadside dieback front - Conspicuous Beach Rd.
Photo: E. Edmonds, South Coast NRM

(DEC, 2011, http://www.dec.wa.gov.au/content/view/5729/2305/)

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

- schedule activities for low rainfall months/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; and
- *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 the 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 in contact with any soil or plant material*.

Dieback tends to occur in the Walpole Wilderness in low lying areas following drainage lines, flats, swamps etc. Upland areas tend to be dieback free and it 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.

Based on the roadside surveys conducted in 2010 there are 21 sections of roads suspected of dieback in the Shire of Denmark. These sections are on the following roads:
Barnes Rd, Board Rd, Brenton Rd, Dingo Flat Rd, Gully Rd, Happy Valley Rd, Harewood Rd, Hazelvale Rd, Lights Rd, Mclean Rd, Nunn Rd, Randall Rd, Warham Rd and Woodward Hts.

Testing would be needed to confirm whether or not these are actually dieback and there may be infestations on other roads which were not noted. It would be best to liaise with local NRM Dieback Project Officer's and the Dieback Working Group.

More information about managing 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*'.

Universal Dieback signage system

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 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 and *Environmental Protection Act* 1986 and cannot be taken unless it is taken in a lawful manner. In addition to the general provisions relating to protected flora under the *Wildlife Conservation Act*, special protection is afforded to flora that is declared as rare or threatened under Section 23F of the *Wildlife Conservation Act.*

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

State legislation:

- *Aboriginal Heritage Act* 1972
- *Agriculture and Related Resources Protection Act* 1976
- *Bush Fires Act* 1954
- *Conservation and Land Management Act* 1984
- *Environmental Protection Act* 1986
- *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

Legalisation introduced under the *Environmental Protection Act 1986* 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.

This assessment process is designed to provide a more comprehensive and stringent land clearing control system. There are two land clearing permits available: an area permit; and a purpose permit. For example, where clearing is for a once-off clearing event such as pasture clearing or an agricultural development, an area permit is required. Where ongoing clearing is necessary for a specific purpose, such as road widening programs, a purpose permit is needed. Shire road maintenance activities are exempt, to the width and height previously legally cleared for that purpose in the last 10 years (refer to Schedule 2 of the *Environmental Protection (Clearing of Native Vegetation) Regulations* 2004).

A clearing permit is required for road upgrades. More information can be found on DEC's website www.dec.wa.gov.au/nvc or contact DEC's Native Vegetation Conservation Branch on 9219 8744.

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

An Environmentally Sensitive Area (ESA) is an area that requires special protection. Some of the reasons include:

- protection of rare or threatened species of native plants;
- protection of wetlands and water courses;
- protection of sites that have other high conservation, scientific or aesthetic values; and/or
- protection of 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* 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.
Photo by K. Jackson

To ensure that knowledge of rare 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.

During the survey, three roadsides with ESA markers in the Shire of Denmark were found, these roads include:

- Denmark Mt Barker Road
- McIntosh Road
- Vigus Road

Local Government's are encouraged to permanently mark ESA's to prevent inadvertent damage to rare 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 8). 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 four Flora Roads which have been recently declared within the Shire of Denmark. The roadside survey and the RCV map also highlighted a number of other roadsides that have the potential to be declared as Flora Roads. These and other roads may be investigated further to see if they warrant a declaration as a Flora Road (see Part C of this report).

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

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 Area Register*.

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

Recently declared Flora Roads in the Shire of Denmark - Tindale Road and pea flowers on Ficifolia Road
Photos: K. Payne, RCC & K. Gillies

PART B

THE NATURAL ENVIRONMENT IN DENMARK

1.0 Flora

On a global scale Western Australia has almost ten times the amount of vascular plant varieties than countries such as Great Britain. In fact, Western Australia has some 4.8% of the 250,000 known vascular flora present on Earth. Western Australian flora is also unique, with the majority of species being endemic: That is, found nowhere else in the world. Up to 75% of the 6,000 species in the south west, are endemic.

The WA Herbarium has recorded over 1600 species of native plants from the Shire of Denmark. The most prolific genera are Proteaceae (103 species), Orchidaceae (132 spp.), Myrtaceae (119 spp.) and Fabaceae (177 spp.). The complete list of recorded flora can be seen in Appendix 4 of this report.

2.0 Threatened Flora (Declared Rare Flora)

Threatened Flora species, or populations, 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 ESA's and should be delineated by yellow markers. It is the responsibility of the road manager to ensure these markers are installed. The RCC suggests using the publication *Guidelines for Managing Special Environmental Areas in Transport Corridors* as a guideline for managing these sites.

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

As of January 2011, there are 10 species of Threatened Flora and 99 species of Priority Flora throughout the Shire of Denmark. 26 Priority species are found in 68 roadside locations in the Shire, these are:

Priority Flora

- *Alexgeorgea ganopoda* Priority 3
- *Amperea protensa* P3
- *Andersonia amabile* P3
- *Andersonia auriculata* P3
- *Andersonia* sp. Mitchell River *(*B.G. Hammersley 925*)* P3
- ***Aotus franklandii* P2 (only occurs on roadside)**
- *Boronia virgata* P4
- *Borya longiscapa* P3
- *Daviesia mesophylla* P2
- *Drosera binata* P2
- *Gastrolobium elegans* P2
- *Gonocarpus simplex* P3
- *Goodenia* sp. South Coast (A.R. Annels ARA1846) P3
- *Juncus meianthus* P2
- *Lambertia rariflora* subsp. *lutea* P3

Lambertia rariflora* subsp. *lutea

- **Open shrub or small tree; grows up to 10m high.**
- **Flowers are yellow or orange from November to April.**
- **Priority 3 species.**

DEC,FloraBase http://florabase.dec.wa.gov.au/browse/profile/16872. Used with the permission of the Western Australian Herbarium, DEC. Accessed January 2011.

- *Lasiopetalum* sp. *Denmark (*B.G. Hammersley 2012*)* P3
- *Laxmannia jamesii* P4
- *Lysinema lasianthum* P4
- *Marianthus sylvaticus* P3
- *Meeboldina crassipes* P3
- *Meeboldina thysanantha* P3
- *Ornduffia submersa* P4
- ***Rulingia apella* P1 (only occurs on roadside)**
- *Sphenotoma parviflora* P3
- *Spyridium riparium* P2
- *Stylidium leeuwinense* P3

Spyridium riparium

- **Priority 2 species.**
- **Erect shrub, Grows to between 0.8 and 1.5 m high.**
- **White/cream flowers between July and October.**
- **Found on sandy or gravelly soils over laterite, river banks and slopes.**

DEC, FloraBase (http://florabase.dec.wa.gov.au/browse/profile/14813) Used with the permission of the Western Australian Herbarium, DEC. Accessed October 2011. Photos: A.D Crawford.

For definitions of Threatened and Priority Flora refer to Appendix 3. For more detailed information regarding Threatened and priority flora in the Shire of Denmark, contact the DEC Threatened Flora Administrative Officer in Species and Communities Branch at Kensington flora.data@dec.wa.gov.au or the Conservation Officer (Flora) for the Warren Region, Frankland District DEC office on 9849 0400. In addition, the information provided in this report will not remain current, thus it is important that the Shire check with DEC periodically to avoid inadvertent damage to newly registered populations of Threatened. If roadworks are to be carried out near known Threatened sites, it is advisable to contact the DEC at least six weeks in advance.

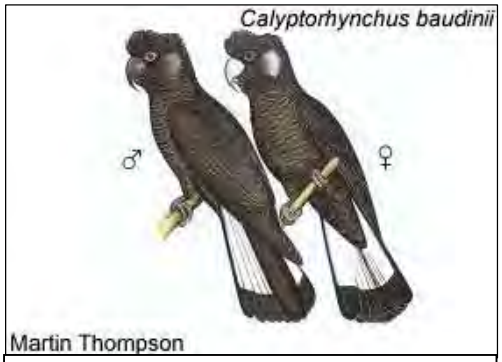
Stylidium leeuwinense

- **Erect perennial, herb,**
- **Grows to between 0.15 and 0.6m high.**
- **Pink flowers from February to May.**
- **Found in heath sedgeland or low woodland.**
- **It is a Priority 4 species.**

DEC, FloraBase (http://florabase.dec.wa.gov.au/browse/profile/17411). Used with the permission of the Western Australian Herbarium, DEC. Accessed November 2011.

3.0 Fauna

The Western Australian Museum records approximately 282 species of fauna from the Denmark area (Appendix 5). 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 Denmark area, there were 193 bird, 14 amphibia, 36 mammal, 5 fish, 8 invertebrate and 26 reptile species.



Baudin's Black-Cockatoo is almost exclusively found in the south-west of WA
Used with the permission of the WA Herbarium, DEC
http://florabase.calm.wa.gov.au/help/photos#reuse

Many fauna species, particularly small birds need continuous corridors of dense vegetation to move throughout the landscape. Roadsides therefore are of particular importance to avifauna because they can contain the only continuous linear 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". Based on distributional data from the DEC, 46 species of threatened and priority fauna have been recorded or sighted throughout the Shire of Denmark, and these are listed below.

Red tailed black cockatoo
© Babs & Bert Wells/DEC

Amphibian

- *Spicospina flammocaerulea (*Sunset Frog*)* **T**

Bird

- *Ardeotis australis (*Australian Bustard*)* **P4**
- *Atrichornis clamosus (*Noisy Scrub-bird*)* **T**
- *Botaurus poiciloptilus (*Australasian Bittern*)* **T**
- *Calyptorhynchus banksii* subsp. *naso (*Forest Red-tailed Black-Cockatoo*)* **T**
- *Calyptorhynchus baudinii (*Baudin's Cockatoo*)* **T**
- *Calyptorhynchus latirostris (*Carnaby's Cockatoo) **T**
- *Charadrius rubricollis (*Hooded Plover*)* **P4**
- *Dasyornis longirostris (*Western Bristlebird*)* **T**
- *Diomedea melanophris* subsp*. melanophris* **T**
- *Falco peregrinus (*Peregrine Falcon*)* **S**
- *Falco peregrinus* subsp*. macropus* **S**
- *Falcunculus frontatus* subsp*. leucogaster* **P4**
- *Ixobrychus flavicollis* subsp*. australis* **P3**
- *Leipoa ocellata (*Malleefowl*)* **T**
- *Pezoporus wallicus* subsp*. flaviventrus* **T**
- *Pomatostomus superciliosus* subsp. *ashbyi (*White-browed Babbler*)* (western wheatbelt))**P4**
- *Psophodes nigrogularis* subsp*. nigrogularis* **T**
- *Thalassarche chlororhynchos (*Atlantic Yellow-nosed Albatross*)* **T**

Malleefowl
© Babs & Bert Wells/DEC

Fish

- *Galaxias truttaceus* subsp. *hesperius* (Western Trout Minnow) **T**
- *Galaxiella munda* (Western Mud Minnow) **T**
- *Galaxiella nigrostriata* (Black-stripe Minnow) **P3**
- *Nannatherina balstoni* (Balston's Pygmy Perch) **T**

Invertebrate

- *Austrarchaea mainae* (Western Archaeid Spider) **T**
- *Austromerope poultoni* (Scorpion fly) **P2**
- *Cynotelopus notablis* (WA Pill Millipede) **T**
- *Engaewa walpolea* (Walpole Burrowing Crayfish) **T**
- *Geotria australis* (Pouched Lamprey) **P1**
- *Moggridgea tingle* (Tingle Trapdoor Spider) **T**
- *Westralunio carteri* **P4**

Brush- tailed phascogale
© Babs & Bert Wells/DEC

Mammal

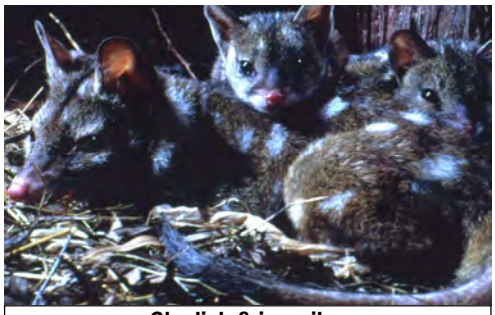
- *Arctocephalus forsteri* (New Zealand Fur Seal) **S**
- *Bettongia penicillata* subsp. *ogilbyi* (Brush-tailed Bettong, Woylie) **T**
- *Dasyurus geoffroii* (Western Quoll, Chuditch) **T**
- *Eubalaena australis* (Southern Right Whale) **T**
- *Falsistrellus mackenziei* (Western False Pipistrelle) **P4**
- *Hydromys chrysogaster* (Water-rat) **P4**
- *Isoodon obesulus* subsp. *fusciventer* (Southern Brown Bandicoot, Quenda) **P5**
- *Macropus irma* (Western Brush Wallaby) **P4**
- *Myrmecobius fasciatus* (Numbat, Walpurti) **T**
- *Neophoca cinerea* (Australian Sea Lion) **S**
- *Phascogale tapoatafa* subsp. ssp. (WAM M434) (Brush-tailed Phascogale, Wambenger)**T**
- *Physeter macrocephalus* (Sperm Whale) **P4**
- *Pseudocheirus occidentalis* (Western Ringtail Possum)**T**
- *Setonix brachyurus* (Quokka) **T**

Woylie or Brush-tailed Bettong
© Babs & Bert Wells/DEC

Reptile

- *Caretta caretta* (Loggerhead Turtle) **T**
- *Elapognathus minor* (Short-nosed Snake) **P2**

Conservation Status
T - Rare or likely to become extinct
S - Other specially protected fauna
P1 – P5: Priority 1 – Priority 5



Chudich & juveniles
© Babs & Bert Wells/DEC

Quokka
© Babs & Bert Wells/DEC

Western ringtail possum
© Babs & Bert Wells/DEC

4.0 Remnant Vegetation Cover

77.5% of the original native vegetation remains in the Shire of Denmark and this is located in a variety of tenures from nature reserves to privately owned land (Table 1a). While this is higher than some other shires, the remaining native vegetation can easily be further depleted if proactive measures are not taken to manage this priceless resource.

Table 1a. Remnant vegetation remaining in the agricultural areas of the Shire of Denmark and surrounding Shires (Shepherd, Beeston and Hopkins, 2009).

Shire	Total Area (ha)	Area Cleared (ha)	Vegetation Cover Remaining	
			(ha)	(%)
Denmark	**190,534**	**42,829**	**147,705**	**77.52**
Manjimup	697,371	108,122	589,249	84.5
Plantagenet	487,974	260,215	227,759	46.67
Albany	431,375	270,000	161,375	37.41

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.

4.1 Denmark Vegetation Associations

The vegetation associations known from the Shire of Denmark, noted in Table 1b, provide an indication of the assemblages of native vegetation present prior to European settlement. It should be noted that these assemblages are indicative of the shire per se and not specifically representative of roadside remnants

Table 1b. Vegetation types and percentages remaining in the Shire of Denmark (Shepherd, Beeston and Hopkins, 2009).

Denmark Vegetation Association Types	% Remaining
Tall forest; karri (Eucalyptus diverscolor) (1)	55.34
Medium forest; jarrah-marri (3)	82.25
Low forest; jarrah (14)	92.45
Low woodland; Agonis flexuosa (22)	100.00
Low woodland; jarrah-banksia (23)	92.18
Low woodland; paperbark (Melaleuca sp.) (27)	84.60
Shrublands; teatree thicket (37)	77.09
Shrublands; mixed heath (49)	92.31
Sedgeland; reed swamps, occasionally with heath (51)	56.79
Bare areas; salt lakes (125)	5.24
Bare areas; freshwater lakes (126)	21.63
Bare areas; rock outcrops (128)	100.00
Bare areas; drift sand (129)	66.83
Shrublands; Acacia scrub-heath (unknown spp.) (423)	77.17
Mosaic: Medium forest; jarrah-marri / Low forest; jarrah (969)	46.25
Low forest; teatree & casuarinas (977)	78.33
Low forest: peppermint (Agonis flexuosa) (990)	80.51
Shrublands; peppermint scrub, Agonis flexuosa (1109)	98.36
Shrublands; Jacksonia horrida heath (1113)	85.69
Tall forest; karri & red tingle (Eucalyptus jacksonii) (1130)	64.32
Medium woodland; jarrah (south coast) (1134)	100.00
Tall forest; karri & yellow tingle (Eucalyptus guilfoyleii) (1139)	96.98
Tall forest; karri & Rates tingle (Eucalyptus brevostylis) (1140)	100.00
Tall forest; karri, red tingle & yellow tingle (1150)	93.12
Medium forest; jarrah & red tingle (1151)	94.37
Medium forest; jarrah & yellow tingle (1152)	97.72
Medium forest; jarrah & Rates tingle (1153)	88.34
Sedgeland; sedges with low tree savanna woodland; paperbarks over & various sedges (2051)	98.56

Note: Numbers in brackets relate to the vegetation associations listed in Shephard (2009)

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

PART C

ROADSIDE SURVEYS IN THE SHIRE OF DENMARK

1.0 Introduction

The roadside survey and mapping program was developed to provide a method of readily 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.

Denmark Survey Training Day – October 2010
Photo: K.Payne, RCC

The majority (438.7km, or 64.5%) of the Shire of Denmark's 680km of rural roads, were surveyed by 17 local volunteers and then assessed by the RCC to determine the conservation status of the road reserves. Most of the surveys were carried out during October 2010, with some follow up surveys in May 2011. The enthusiastic effort of the local roadside surveyors, and the support provided by Denmark Shire Council and in particular by the local coordinator and NRM Officer, Yvette Caruso, ensured that this project was successfully completed. The roadside surveyors were:

- Judy Barfett
- Jess Beckerling
- Carl & Emma Dusenberg
- Lee Ewing
- Kelli Gillies
- Barry & Sue Goldsmith
- Lucia Golebiowski
- Melissa Howe
- Donald Hunt
- Donna Marie
- Pauline McHenry
- Mark Parre
- Jill Rule
- Joseph van Vlijmen
- Judy Wheeler
- Caron Macneall
- Kylie Payne

1.1 Methods

The roadside surveys were undertaken in a vehicle, generally with two people per vehicle. The passenger recorded all the roadside survey data using the handheld devices or PDA's shown in Appendix 1. The Denmark surveys were conducted using new devices and a new survey program which was developed specifically for the roadside surveys. The new devices have inbuilt GPS and camera and collect more data, including vegetation type, tree decline, environmentally sensitive areas and additional weeds. There were some teething problems with the new system, but the Denmark volunteers have paved the way and given useful feedback for further refining the survey system.

With the new system, the data is immediately uploaded to a purpose built RCC survey website, provided there is mobile coverage. This data is then downloaded and analysed by the RCC and then the RCC works with the DEC's Geographic Information Systems (GIS) Section to generate the Roadside Conservation Value Map

Training how to use the survey devices
Photo: Y. Caruso

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 system. All volunteers participate in a 1 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 PDA's and survey safety information.

The process involves scoring a set of pre-selected 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

(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 and
(v) environmentally sensitive areas (yellow hockey stick markers) (Scores: 0-3)

- width of vegetated roadside (Scores: 0-1).

Each of these attributes are 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, in the form of conservation status categories, are represented on the roadside conservation value map by the following colour codes.

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

- width of road reserve
- vegetation type
- tree decline
- revegetation
- clearing
- rabbits
- presence of utilities/disturbances;
- general comments; and
- presence and percentage of 6 nominated weeds;
- presence and percentage of additional weeds

It is felt 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 DEC's GIS section produce a computer-generated map (using GIS), at a scale of 1:100,000 for the Shire of Denmark. 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 Denmark. The data used to produce both the map and the following figures and tables are presented in Appendix 2.

Digital information of remnant vegetation and watercourses on both Crown estate and privately owned land used in the map was obtained from the (DEC), Main Roads WA and the Department of Agriculture and Food WA.

along Mt Lindsay Rd (above) and Tindale Rd (below) which contain relatively intact, undisturbed and diverse remnant vegetation.
Photos: K. Payne, RCC.

1.3 Roadside Conservation Value Categories

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

- intact natural structure consisting of a number of layers, i.e. ground, shrub, 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 environmentally sensitive areas.

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-high conservation value roadsides contain a moderate number of native species, some disturbance and weed invasion, but have relatively intact natural structure.
Photo: K. Payne, RCC.

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 ESA's with yellow hockey stick markers*.

Medium-low conservation value roadsides may contain Threatened Flora.
Photo: 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.
s: K. Payne, RCC

2.0 USING THE ROADSIDE CONSERVATION VALUE (RCV) MAP

The Roadside Conservation Value (RCV) map 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 assessed. This information can then be used to identify environmentally sensitive areas, high conservation roadsides or strategically important areas, and thus ensure their conservation. Conversely, it enables degraded areas to be identified as areas important for strategic rehabilitation or in need of specific management techniques 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.

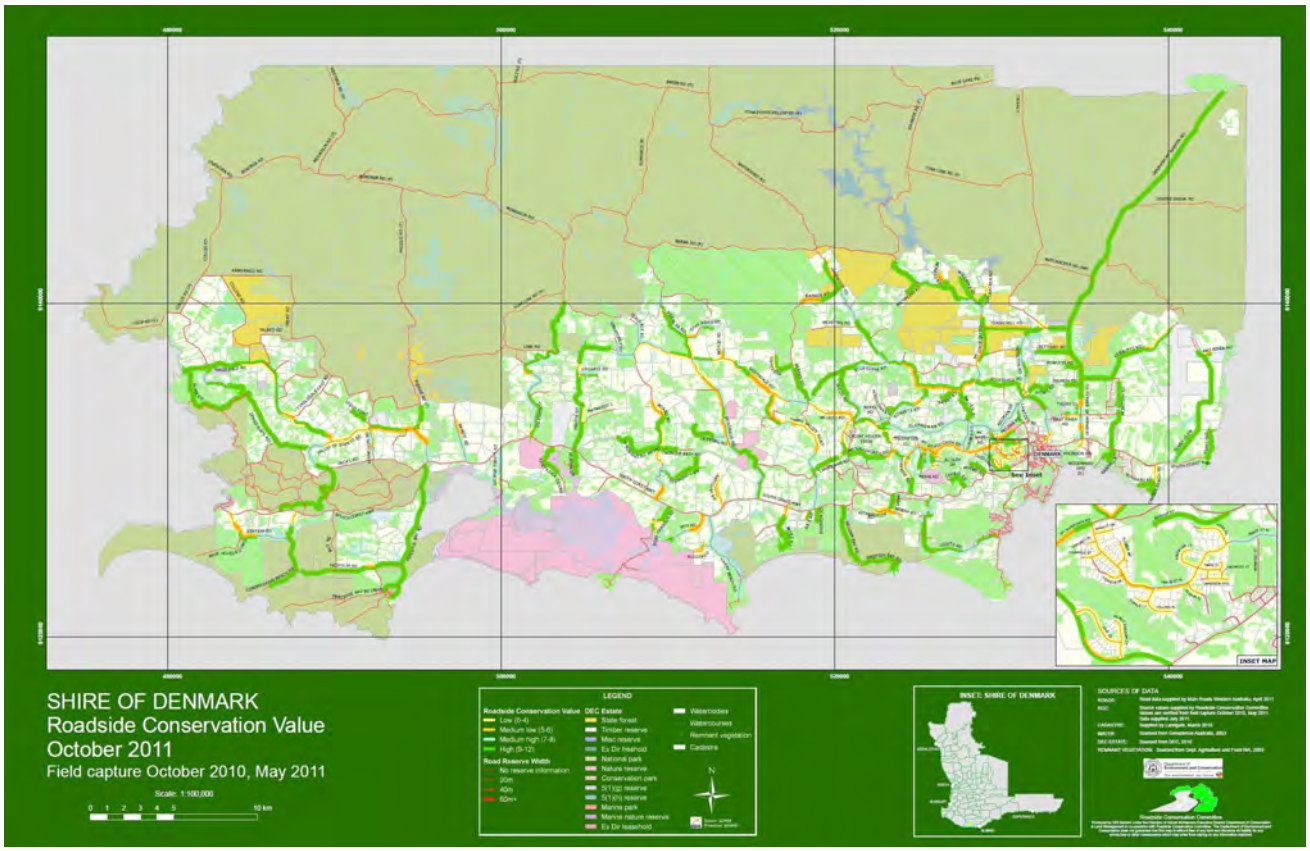


Figure 1. The RCV map depicts roadside conservation values in the Shire of Denmark.

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;
- Landcare and/or Bushcare 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 an insight to the flora of the district.

Catchment recovery projects, such as revegetation programs can utilise the information conveyed on roadside conservation value maps.
Photo: RCC

Weed control along a roadside.
Photo: Main Roads WA

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

The road manager can declare high conservation value roads as Flora Roads.
Photo: K. Gillies – Tindale Rd, Kentdale

3.0 RESULTS

Data collected during the Shire of Denmark roadside survey has been compiled and a summary is presented (Table 2). Total kilometres and percentages of roadside occupied by each of the conservation status categories and the attributes used to calculate the conservation values is provided. As roadsides occur on both sides of the road, roadside distances (km) are equal to *twice* the actual distance of road travelled.

Summary Information: Shire of Denmark

Length of roadsides surveyed: 877.42km (438.7km of road)

Roadside Conservation Status

	Total (km)	(%)
Low (0-4)	100.4	11.4
Medium-low (5-6)	73.0	8.3
Medium-high (7-8)	166.2	18.9
High (9-12)	537.92	61.3
Total	877.42	100%

Structure of Native Vegetation in Roadsides

	Total (km)	(%)
0 vegetation layers	42.05	4.79
1 vegetation layer	32.7	3.73
2-3 vegetation layers	802.67	91.48
Total	877.42	100%

Number of Native Plant Species

	Total (km)	(%)
0 to 5 species	128.05	14.59
6 to 19 species	286.55	32.66
Over 20 species	462.82	52.75
Total	877.42	100%

Predominant Adjoining Land Use

	Total (km)	(%)
Agricultural: completely cleared	172.2	19.6
Agricultural: scattered vegetation	279.0	31.8
Uncleared native vegetation	345.9	39.4
Plantation	42.8	4.9
Drain reserve	0.9	0.1
Urban or Industrial	13.0	1.5
Other	23.7	2.7
Total	877.42	100%

Weed Infestation

	Total (km)	(%)
Heavy >70% weeds	97.3	11.09
Medium 30-70% weeds	164.9	18.79
Light <30% weeds	615.22	70.12
Total	877.42	100%

Roadside Conservation Values

Score	Total (km)	(%)
0	21.4	2.4
1	27.15	3.1
2	16	1.8
3	7.7	0.9
4	28.1	3.2
5	33.75	3.8
6	39.2	4.5
7	74	8.4
8	92.2	10.5
9	63.05	7.2
10	157.6	18.0
11	161.4	18.4
12	155.87	17.8
Total	877.42	100%

Width of Vegetated Roadside

	Total (km)	(%)
1 to 5 m	610.20	69.5
5 to 20 m	267.22	30.5
Over 20 m	0.00	0.0
Unknown	0	0.0
Total	877.42	100%

Extent of Native Vegetation

	Total (km)	(%)
Less than 30%	141.9	16.17
30% to 70%	212.5	24.22
Over 70%	523.02	59.61
Total	877.42	100%

Habitat Features

	Total (km)	(%)
0	94.25	10.74
1	114.55	13.06
2	291.45	33.22
3 or more	377.17	42.99
Total	877.42	100%

Roadside surveys were carried out in the Shire of Denmark

Table 2. Summary of results from the roadside survey in the Shire of Denmark.

Width of Road Reserve

The width of road reserves in the Shire of Denmark was recorded in increments of 20 meters. The majority of road reserves were 20 meters in width, with 389 km (89%) of roads falling into this category. Roadsides with a 40m reserve covered 29km (7%), whilst 5km (1%) of road reserves were 100 meters in width. There were no roads recorded with 60 or 80 meters in width. 15km (3%) of road reserves had an unknown width. (Table 3 and Figure 2).

Table 3. Width of Road reserves in the Shire of Denmark

Width of Road Reserve		
Width (m)	Distance (km)	%
20m	389.06	88.68
40m	29.4	6.70
100m	5	1.14
Unknown	15.25	3.48
Total	438.71	100.00

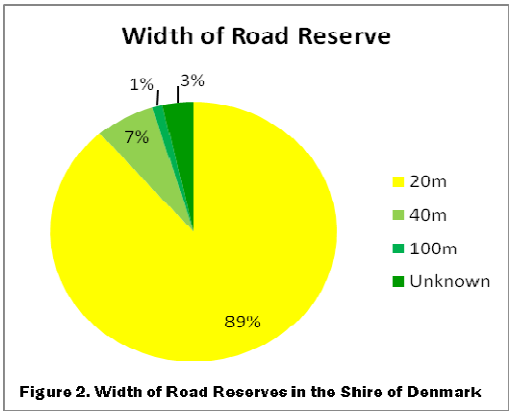


Figure 2. Width of Road Reserves in the Shire of Denmark

Width of Vegetated Road Reserve

The width of vegetated roadside was recorded by selecting one of three categories, 1-5 metres, 5-20 metres or over 20 metres in width. The left and right hand sides were recorded independently, and then combined to establish the total figures. Approximately 70% (610km) of roadside vegetation was between 1 to 5 metres in width, followed by 267km (30%) of roadsides where the width of vegetation was between 5 to 20m. There were no vegetated roadside recorded over 20m. (Table 2 and Figure 3).

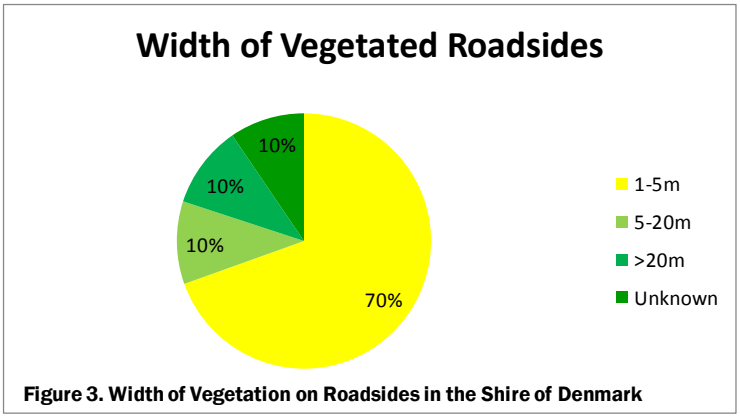


Figure 3. Width of Vegetation on Roadsides in the Shire of Denmark

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' value. Sections with two to three layers of native vegetation covered 91% of roadsides (803km), 4% (33km) of roadsides had only one layer and 5% (42km) had no layers of native vegetation (Table 2 and Figure 4).

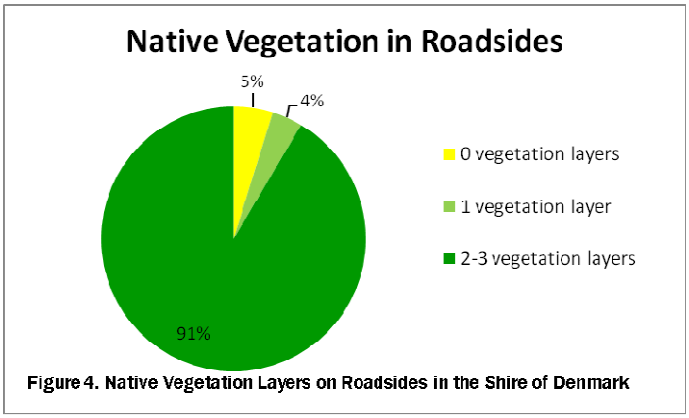


Figure 4. Native Vegetation Layers on Roadsides in the Shire of Denmark

Number of Native Plant Species

The 'number of native plant species' score provided a measure of the diversity of the roadside vegetation. Survey sections with over 20 plant species spanned 53% (463km) of the roadsides surveyed. Roadside sections with 6 to 19 plant species accounted for 33% (287km) of the roadsides while 14% (128km) of roadside contained less than 5 plant species (Table 2 and Figure 5).

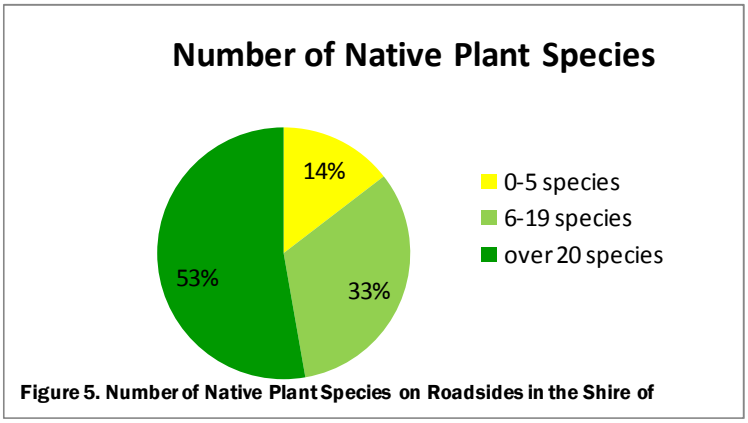


Figure 5. Number of Native Plant Species on Roadsides in the Shire of

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. Roadsides with extensive vegetation cover, i.e. greater than 70%, occurred along 60% (523km) of the roadsides surveyed. Survey sections with medium vegetation cover, i.e. 30% to 70%, accounted for 24% (212.5km) of the roadsides. The remaining 16% (142km) had less than 30% native vegetation and therefore a low 'extent of native vegetation' value (Table 2 and Figure 6).

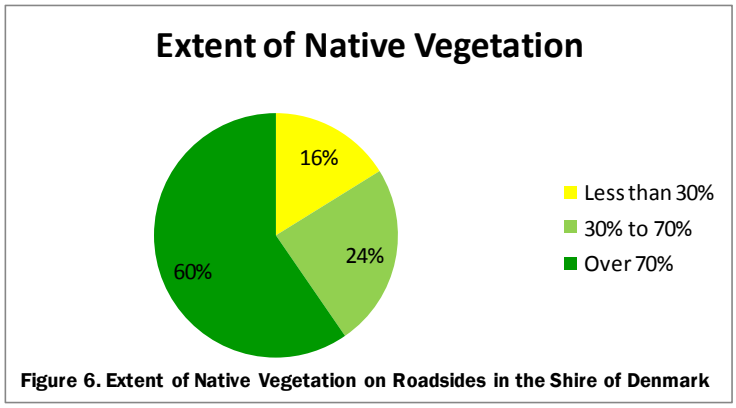


Figure 6. Extent of Native Vegetation on Roadsides in the Shire of Denmark

Habitat Value

This factor considered the presence of five attributes: connection of uncleared areas; presence of flowering shrubs; presence of large trees with hollows; presence of hollow logs and environmentally sensitive areas. Roadsides determined to have high number (more than 3 out of 5) of habitat features were present along 43% (377km) of the roadsides surveyed. Roadsides with medium high number (2 out of 5) of habitat features made up 33% (291km), and roadsides with a medium low number (1 out of 5) of habitat features occurred along 13% (115km) of the roadsides surveyed. Roadsides having no habitat features were recorded along 11% (94km) of the roadsides (Table 2 and Figure 7).

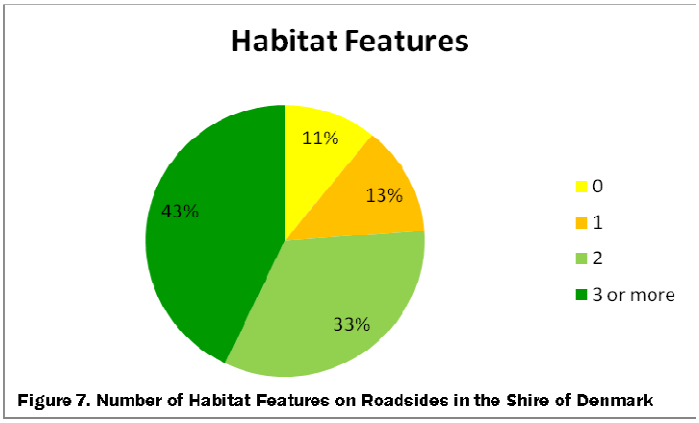


Figure 7. Number of Habitat Features on Roadsides in the Shire of Denmark

Roadside Vegetation Types

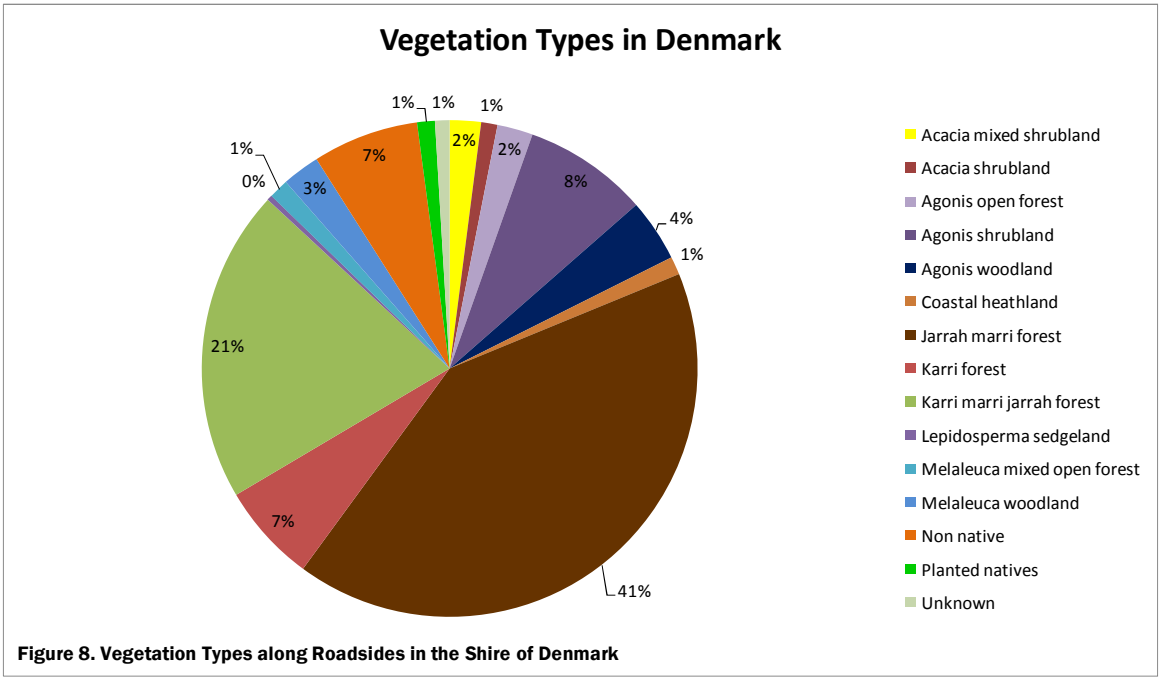


Figure 8. Vegetation Types along Roadsides in the Shire of Denmark

Surveyors were asked to record the main vegetation type along each section of roadside. The most dominant vegetation type was Jarrah Marri forest which was recorded along 362.2 km or 41% of roadsides in the Shire of Denmark. The next most common vegetation type was Karri Marri Jarrah forest 21% (178.72 km) followed by Agonis shrubland 8% (71.35 km). The Karri forest and Non Native vegetation types were found along 7% of roadsides (56.3 and 60.85 km respectively). Agonis woodland covered 4% of roadsides (35.7km) and Melaleuca woodland covered 3% (21.5 km). Acacia mixed shrubland and Agonis open forest vegetation types were identified along 2% of roadsides (17.9 and 20.4 km respectively). The vegetation types Acacia shrubland (9.4 km), Coastal heathland (10.3 km), Melaleuca mixed open forest (11.3 km), Planted Natives (10.1 km) and unknown vegetation type (8.4 km) all covered 1% each of roadsides. Lepidosperma sedgeland covered the least amount of roadsides with 3km. (Figure 8).

THREATS

Weed Infestation

Light levels of weed infestation (weeds comprising less than 30% of total plants), were recorded on 70% (615.22km) of the roadsides surveyed, medium level weed infestation (weeds comprising 30-70% of the total plants) occurred on 19% (164.9km) of the roadsides and 11% of roadsides (97.3km) were heavily infested with weeds (weeds comprising more than 70% of the total plants) (Table 2 and Figure 9).

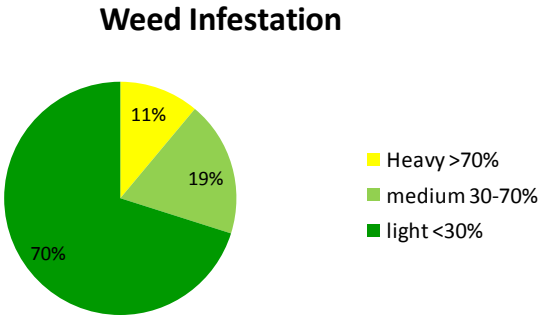


Figure 9. Weed Infestation along Roadsides in the Shire of Denmark

Nominated Weeds

The following weeds are depicted on clear overlays accompanying the 2011 Roadside Conservation Value map:

- African Lovegrass (*Eragrostis curvula*);
- Watsonia *(Watsonia* sp*);*
- Pittosporum (*Pittosporum undulatum*)
- Victorian Tea Tree *(Leptospermum laevigatum)*;
- Sydney Golden Wattle (*Acacia longifolia*);
- Taylorina (*Psoralea pinnata*).

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, and may need to be doubled where present on both sides of the road.

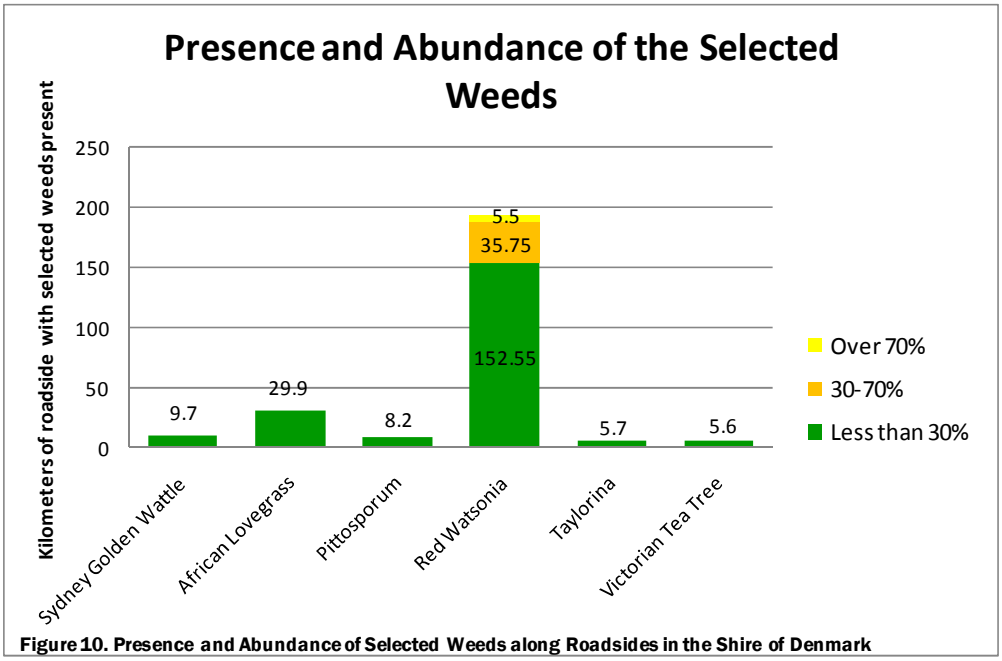
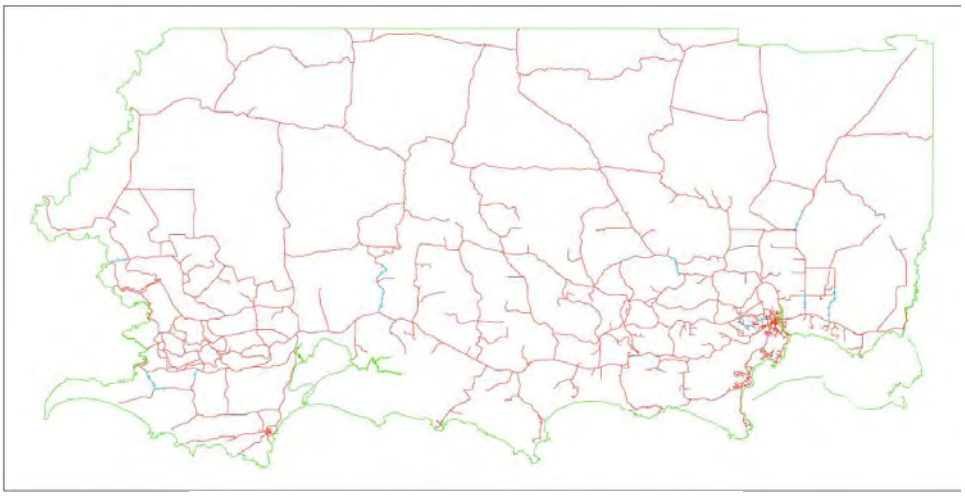


Figure 10. Presence and Abundance of Selected Weeds along Roadsides in the Shire of Denmark

Of the nominated weeds species, Watsonia was the most prevalent and was recorded along 193.8km of the roads surveyed. The next most commonly recorded weeds were African Lovegrass (29.9km) and Sydney Golden Wattle (9.7km). Pittosporum was the next most commonly recorded weed, occurring along 8.2km of roads. Taylorina and Victorian Tea Tree were the least recorded chosen weeds and recorded along 5.7km and 5.6km of roads respectively (Figure 10). Figure 11 shows the spatial extent of these weeds on the Denmark map. These are shown in more detail on the weed overlays provided with the Roadside Conservation Value map.

Appendix 6 provides a table and graphs of chosen and additional weeds recorded along roadsides (km) throughout October 2010 and May 2011 surveys. Appendix 2 includes a combined spreadsheet showing all weeds recorded along roadsides during the surveys.

Sydney Golden Wattle



African Lovegrass

Pittosporum

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

Watsonia

Taylorina

Victorian Tea Tree

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

Feral Animals – Rabbits

There was no evidence or presence of rabbits on 52% (452.9km) of the roadsides surveyed. On 48% (424.52 km) of road reserves there was evidence or presence of rabbits (Figure 12).

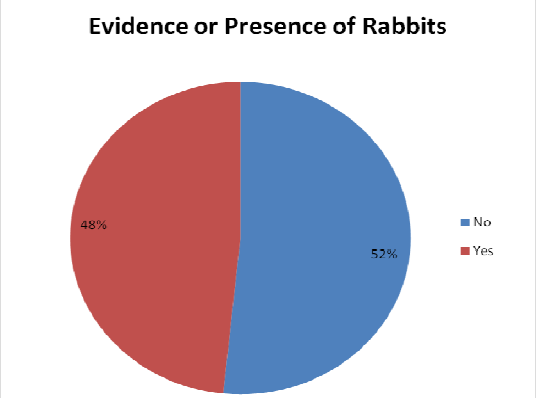


Figure 12. Evidence or Presence of Rabbits in the Shire of Denmark

Tree Decline

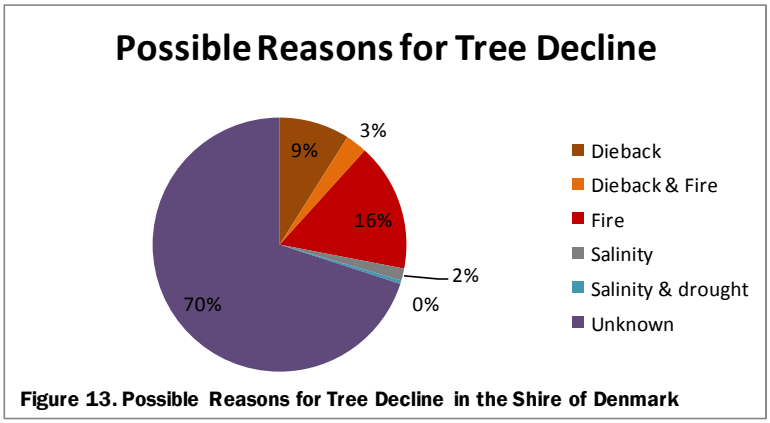


Figure 13. Possible Reasons for Tree Decline in the Shire of Denmark

Roadside surveyors were asked to record areas of tree decline and to record a possible reason for that decline. Of the roadsides surveyed 69% (603.52 km) did not have noticeable signs of tree decline. The majority of tree decline was from an unknown cause 70% (191.75 km). The second most common possible reason for tree decline was fire 16% (44.65 km). 9% of roadsides were possibly affected by Dieback disease (24.6 km) and 3% were possibly affected by a combination of Fire and Dieback (7.5 km). Salinity was a probable cause along 2% of roadsides (4.2 km) and a combination of salinity and drought may have affected 1.2 km of roadsides. (Figure 13).

Predominant Adjoining Land Use

Uncleared native vegetation was present on 39% (346km) of the land adjoining roadsides, whilst 20% (172km) of roadsides adjoined land that had been completely cleared for agriculture. Land cleared for agriculture, containing a scattered distribution of native vegetation comprised 32% (279km) of the roadsides. Plantations of non-natives adjoined 5% (43km) of roadsides and Urban or Industrial land uses adjoined 1% (13km) of roadsides. Drainage reserves adjoined 0.1% (0.9km) of roadsides and other Adjoining Land Uses were recorded along 3% (24km) of roadsides (Table 2 and Figure 14).

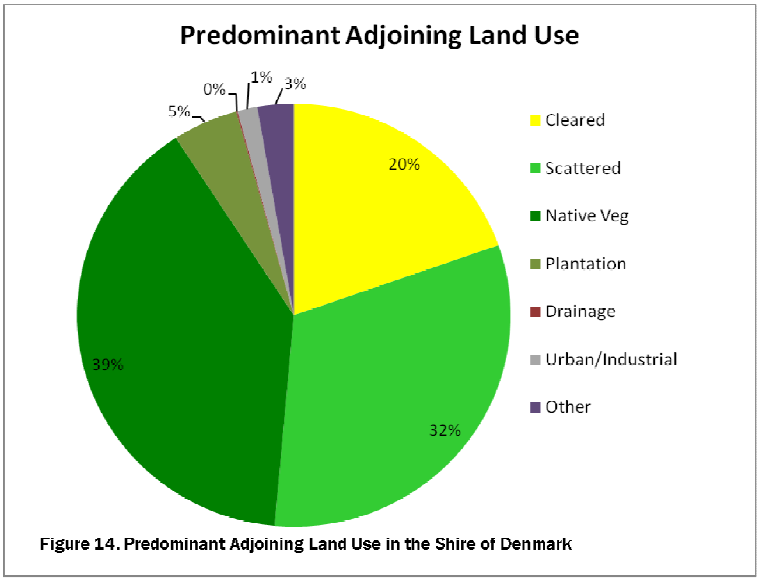


Figure 14. Predominant Adjoining Land Use in the Shire of Denmark

Conservation Value Scores

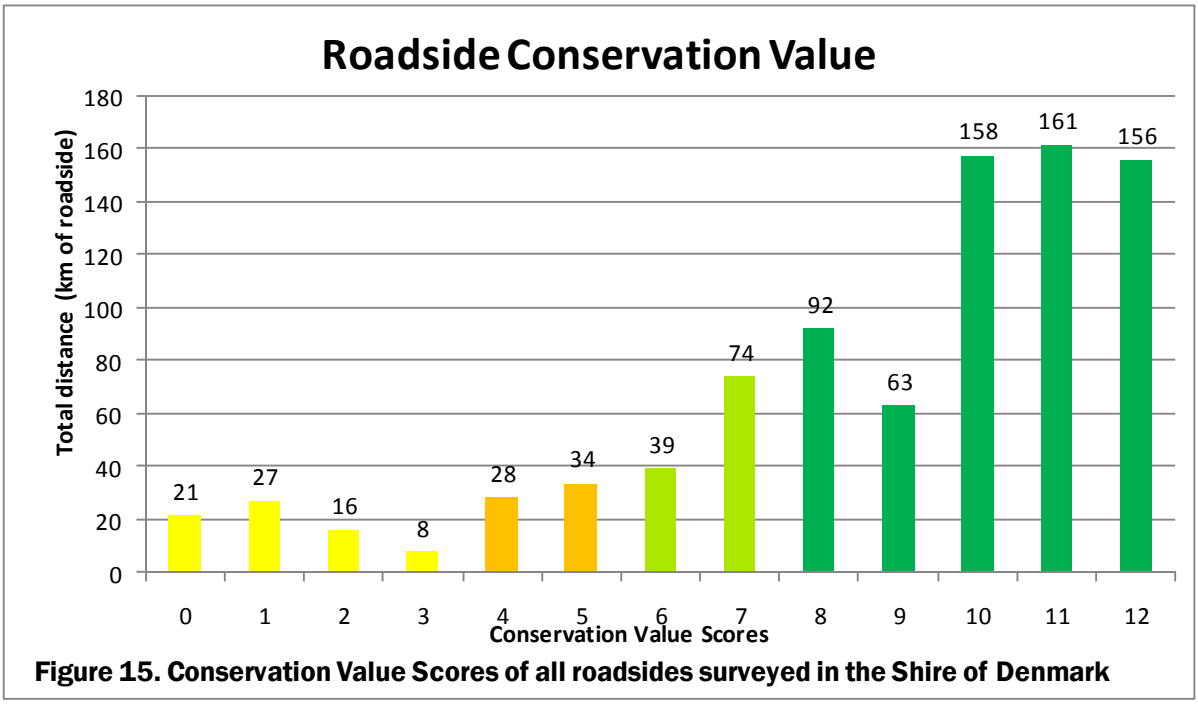


Figure 15. Conservation Value Scores of all roadsides surveyed in the Shire of Denmark

Conservation value scores were calculated for each section of roadside surveyed. Scores range from 0 to 12, from lowest to highest conservation value respectively (Figure 15). The most occurring roadside conservation value score was 11, with 161km of roadsides recording this score. Following this, a score of 10 was recorded along 158km of roadsides, a score of 12 covered 156km and a score of 8 was surveyed along 92km of roadsides. Roadsides with a score of 7 covered 74km, a score of 9 covered 63km, and roadsides with a score of 6 spanned 39km. Roadsides with a score of 5 spanned 34km, a score of 4 was surveyed along 28km of roadside and a score of 1 spanned 21km. Roadsides scoring 0 also covered 21km while a score of 2 spanned 16km. A score of 3 was the least recorded score which covered only 8km of roadside.

Conservation Status

The conservation status category indicates the combined conservation value of roadsides surveyed in the Shire of Denmark. Roadside sections of high conservation value covered 61% (538km) of the roadsides surveyed. Medium-high conservation value roadsides accounted for 19% of the total surveyed (166km); medium-low conservation roadside covered 8% (72km) of the total roadsides surveyed. Roadsides of low conservation value occupied 12% (100km) of the roadsides surveyed (Table 2 and Figure 16).

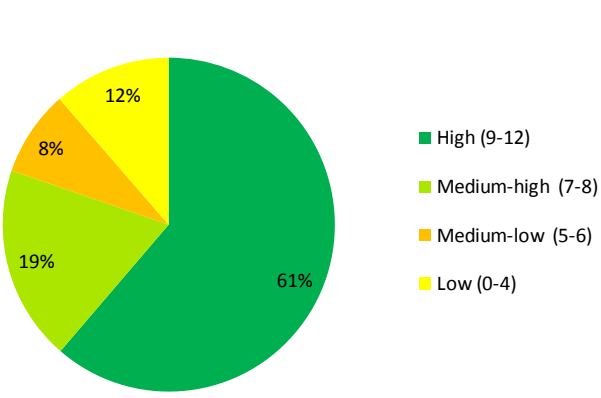


Figure 16. Conservation Value Scores of the Roadsides Surveyed in the Shire of Denmark

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 8).

Ficifolia Road, a recently declared Flora Road
Photos: K. Gillies (above), K. Payne, RCC (below)

There are currently four Flora Roads in the Shire of Denmark. These are Tindale, Scotsdale, Ficifolia and Mt Lindsay Roads. These roads were all surveyed during the 2010 survey period and declared in May 2011. Denmark Mt Barker Road, which is managed by Main Roads, has also been nominated and recommend but is yet to be formally declared. The roadside survey and the 2011 RCV map highlighted a number of other roadsides that have the potential to be declared as Flora Roads. Roadsides, or large sections of roadsides, determined as having high conservation value in the Shire of Denmark include:

- Sunny Glen
- Pratt Road
- McIntosh Road
- Settlers Road
- William Bay Road
- Parker Road
- Peaceful Bay Road
- Conspicuous Beach Road
- Nunn Road
- Dingo Flats Road

If nominated, these roadsides would need to be assessed by the RCC to determine their suitability as Flora Roads as landscapes, tourism, access and other factors, not just the roadside conservation value score, are taken into account.

Tindale Road (left) and Mt Lindsay Rd (right) both recently declared Flora Roads
Photos: K. Payne, RCC

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.

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*

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

This can be achieved by:

- retaining remnant vegetation;
- minimising disturbance to existing roadside vegetation;
- minimising disturbance to soil; and
- 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; and
- incorporating Flora Roads into tourist, wildflower and/or scenic drives.

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

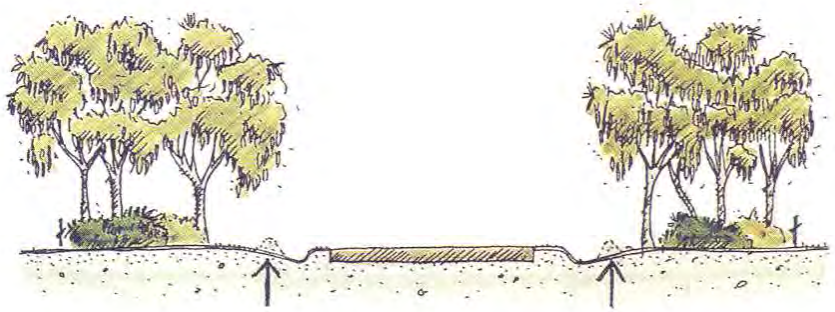
- minimising disturbance caused by machinery, adjoining land practices and incidences of fire;
- carrying out a targeted weed control program;
- retaining remnant trees and shrubs;
- allowing natural regeneration;
- spreading local native seed to encourage regeneration; and
- encouraging revegetation projects by adjacent landholders.

Revegetation area along Mt Lindsay Rd
Photo: K. Payne, RCC.

2.0 Minimising Disturbance

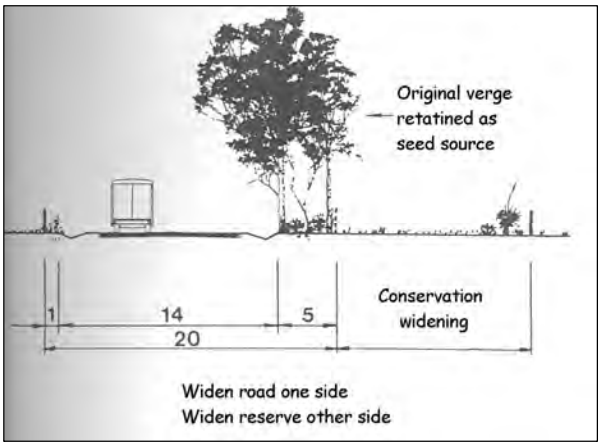
Minimal disturbance can be achieved by:

- adopting a road design that occupies the minimum space;
- diverting the line of a table drain to avoid disturbing valuable flora;
- pruning branches, rather than removing the whole tree or shrub;
- not dumping spoil on areas of native flora;
- 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'.*
- 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.



Widening 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 comprehensive models 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;
- Community education - use of innovative and pertinent 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 remnants, 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**
  - 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**
  - indigenous vegetation communities
  - fauna habitats and corridors

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