Native Vegetation Handbook for the Shire of Kulin

Bec Ryan

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Native Vegetation Handbook for the Shire of Kulin
Native Vegetation Handbook for the Shire of Kulin

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Spatial Resource Information Group
Agriculture Western

Mapping by Julie Wyland

February 1999
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Copies of the Native Vegetation Handbook for the Shire of Kulin are available by contacting:

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Natural vegetation-general management
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The Native Vegetation Handbook for the Shire of Kulin is one of a series covering the agricultural region of Western Australia. Other Handbooks in the series include:

The Shire of Augusta-Margaret River
The Shire of Beverley
The Shire of Boyup Brook
The Shire of Bridgetown-Greenbushes
The Shire of Brookton
The Shire of Broomehill
The Shire of Bruce Rock
The Shire of Corrigin
The Shire of Cunderdin
The Shire of Dumbleyung
The Shire of Katanning
The Shire of Kellerberrin
The Shire of Kent
The Shire of Kojonup
The Shire of Kondinin
The Shire of Kulin
The Shire of Lake Grace
The Shire of Merredin
The Shire of Mingenew
The Shire of Narrogin
The Shire of Northam
The Shire of Pingelly
The Shire of Tammin
The Shire of Toodyay
The Shire of Trayning
The Shire of Wagin
The Shire of West Arthur
The Shire of Wickepin
The Shire of Williams
The Shire of Woodanilling
The Shire of Wyalkatchem
The Shire of York
1 Introduction

1.1 Purpose of this Handbook

The purpose of this handbook is to provide information to the people in the Shire of Kulin to assist in revegetation and management of remnant native vegetation within agricultural systems.

This handbook is one of a series describing the agricultural region of Western Australia. It has arisen from the demand for information from people in rural communities, land conservation districts, catchment groups and local government authorities. This information will benefit the regional, catchment and local management of remnant native vegetation within rural areas.

The management of agricultural land and native vegetation is closely related. Since they are interrelated, they should be managed together. For example, native vegetation affects the hydrology of agricultural land, while nutrients and weeds can be transported from farmland to remnants of native vegetation.

This handbook provides land managers with information relating to the natural resources of the Shire of Kulin, including the landscape, geology, soils, drainage systems, native flora and fauna. Information about native flora and vegetation has been drawn from a variety of sources, including surveys that estimated the distribution of plant communities prior to clearing, recent surveys of privately owned remnants, herbarium collections, surveys of nature reserves and roadside surveys. Some of the problems relating to the management of these resources within the shire and ideas and community initiatives to solve these problems are also discussed. It is hoped that this information will contribute to the long term viability of the agricultural landscape and the conservation of native vegetation within the shire.

1.2 The Shire of Kulin

The Shire of Kulin covers an area of 466,712 hectares and is mostly located in the Lockhart Catchment of the Avon Basin, with a small south-west section in the Blackwood Basin (see cover map). Cadastral boundaries in the shire are shown in Figure 1, and the 1,572 kilometres of road network in the shire are shown in Figure 2.

The Number One Rabbit Proof Fence runs on a straight line north-west to south-east, and marks the eastern boundary for the Kulin Shire and several eastern wheatbelt shires to the north and south of Kulin (Webb, 1988). The Rabbit Proof Fence marks the end of the wheatbelt area, and to the east of it is bushland on vacant Crown land, pastoral leases and the Goldfields.

The major townsite in the Shire is Kulin, with other small townships at Dudinin, Jitarning, Pingaring and Holt Rock. The population of the shire was 987 in 1996 (Australian Bureau of Statistics, 1996).
Climate

The Shire has a Mediterranean climate, with cool, moist winters and hot, dry summers. Kulin receives an average of 364 mm rainfall per year. Average maximum temperatures range from 33.2 °C in January to 15.9 °C in July and average minimum temperatures range from 15.8 °C in February to 4.4 °C in August.

Natural Resource Zones

The south-west of Western Australia has been divided into Natural Resource Zones by overlaying the boundaries of native vegetation types, river catchments and drainage basins and rainfall (Allison et al., 1993). Natural Resource Zones were designed to aid the understanding of natural boundaries in the landscape in order to plan and make decisions that enable productive farming while ensuring that the environment is protected.

There are 84 zones, every one different from any other in terms of biological and physical characteristics. Each zone has a unique code of six characters:

- The first two characters show the native vegetation type. There are nine regions defined by Dr. John Beard that are characterised by areas of similar plant communities, soils, geology, climate and landforms (hills, valleys and plains).

- The second two characters indicate the river catchment and drainage basin. There are 21 river catchments and drainage basins in the South West Land Division; some are major river catchments such as the Avon and Blackwood catchments, while some are areas made up of several smaller catchments such as near Albany and Esperance.

- The last two characters denote the rainfall zone. The 500 mm, 700 mm and 1100 mm rainfall lines divide the South West Land Division into four rainfall zones.

The Shire of Kulin contains parts of four Natural Resource Zones (Figure 3).

<table>
<thead>
<tr>
<th>Number</th>
<th>Code (Vegetation, Catchment, Rainfall)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>AvBl R4</td>
</tr>
<tr>
<td>62</td>
<td>AvAvR4</td>
</tr>
<tr>
<td>68</td>
<td>RoAvR4</td>
</tr>
<tr>
<td>71</td>
<td>RoBl R4</td>
</tr>
</tbody>
</table>

The western part of the shire lies within the Avon Botanical District (Av, commonly known as the Wheatbelt), while the eastern part lies within the Roe Botanical District (Ro, commonly known as the Mallee Region). Most of the shire is within the Avon River catchment (Av), with a small southern portion within the Blackwood Basin (Bl). The shire receives less than 500 mm of rainfall each year, and therefore all three zones have a rainfall code of R4.
Agricultural production

The Australian Bureau of Statistics (ABS) agricultural survey found that in 1995-96 the 436,387 hectares of agricultural land in the Shire of Kulin was run by 170 land managers. Over 180,100 hectares was sown with major cereal crops (Table 1a), and over 152,700 hectares was sown for pasture (Table 1b). Nearly 511,000 head of livestock were raised in the shire (Table 2).

<table>
<thead>
<tr>
<th>Cereal</th>
<th>Area (hectares)</th>
<th>Production (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>135,447.3</td>
<td>260,934.1</td>
</tr>
<tr>
<td>Oats (for grain)</td>
<td>6,451.0</td>
<td>10,388.7</td>
</tr>
<tr>
<td>Oats (for hay)</td>
<td>1,463.7</td>
<td>-</td>
</tr>
<tr>
<td>Barley</td>
<td>12,154.5</td>
<td>21,526.0</td>
</tr>
<tr>
<td>Lupins</td>
<td>23,388.0</td>
<td>-</td>
</tr>
<tr>
<td>Fieldpeas</td>
<td>1,200.0</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pasture</th>
<th>Area (hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pasture legumes*</td>
<td>12,274.0</td>
</tr>
<tr>
<td>Sown pasture*</td>
<td>74,867.5</td>
</tr>
</tbody>
</table>

* not lucerne

Table 2: Livestock raised in the Shire of Kulin (ABS, 1995-96).

<table>
<thead>
<tr>
<th>Livestock</th>
<th>Number of animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep</td>
<td>149,344</td>
</tr>
<tr>
<td>Lambs and Hoggets</td>
<td>357,742</td>
</tr>
<tr>
<td>Dairy cattle</td>
<td>16</td>
</tr>
<tr>
<td>Meat cattle</td>
<td>887</td>
</tr>
<tr>
<td>Pigs</td>
<td>2,975</td>
</tr>
</tbody>
</table>

Land Conservation District Committee and Catchment Groups

The Kulin Land Conservation District Committee (LCDC) was formed in 1990 and is roughly based on the shire’s boundaries. A small portion of the Pingaring LCDC is located in the south of the Kulin Shire, but most is in the Shire of Lake Grace. The LCDCs formed because of community concern over increasing salinity in the shire, and are now tackling sustainable land management throughout the shire.

Catchment groups have formed where groups of neighbouring farmers work together to address landcare problems. There are currently six catchment groups active in the Shire. Five catchments fall in the Kulin LCD: the Upper West Kulin and Lower West Kulin (formerly combined in the West Kulin Catchment), Walyurin, Traysurin Hill and South Kulin. The shire also contains a small portion of the Blackwood Basin, incorporating the Fence Road Catchment. Other catchments within the Kulin Shire include the farming area east of Jilakin Lake surrounding Dandagin Rocks and the Pingaring/Holt Rock area. These areas currently have a low catchment activity.
2 Natural Resources of the Shire of Kulin

2.1 Landscape

The Shire of Kulin is contained within the Merredin Plateau Landscape Character Sub-type. Landscape descriptions have been adapted from *Reading the Remote, Landscape Characters of Western Australia*, (CALM, 1994). This survey divided the State into a number of areas defined by their landscape character type.

The Shire of Kulin is dominated by expanses of cereal crops and open views over wide, shallow, undulating valleys of the ancient drainage channels. Valley systems are almost indistinguishable and waterbodies take the form of a series of saline wetlands or large salt lakes such as Jilakin Lakes. The edges of these wetlands are usually fringed with swamp sheoak (*Casuarina obesa*) and salt-water paperbark (*Melaleuca cuticularis*) with low succulent sapphires growing on moist salt flats. Adjacent trees are frequently dead and skeletonised, signifying the increasing salinity problem in the wheatbelt.

This view is interrupted by infrequent pockets of remnant vegetation. Tall, smooth pink-barked salmon gum (*Eucalyptus salmonophloia*) dominates the small patches of remnant woodland on the richer, pale loamy clay soils. Confined examples of sturdy, mottled silver inland wandoo (*E. capillosa*) are scattered across the landscape or in small groups with redwood (*E. transcontinentalis*), red morrel (*E. longicornis*), gimlet (*E. salubris*) and low bushy jam tree (*Acacia acuminata*) at the eastern border. The sparse understorey includes sheoaks (*Allocasuarina Fraseriana*) and Acacias with occasional slender olive Banksias, flat-topped yate (*E. occidentalis*) and bushy roadside teatree (*Leptospermum erubescens*).

In remnant patches on the sandplain, where the soils are predominantly pale apricot to soft yellow sandy loams, there is a mallee-heath combination. This is dominated by Acacias, tamma (*Allocasuarina Campestris*), broombush (*Melaleuca uncinata*) and honey-myrtles (*Melaleuca spp.*). During springtime, these heath areas are carpeted with colourful wildflowers.

Isolated granite outcrops are a distinct visual feature contrasting with the local topography. Jilakin Rock, surrounded by a medium woodland including clumps of jarrah, is an impressive example of this.

A Digital Elevation Model illustrating the topography of the shire may be seen in Figure 4.
2.2 Geology

The Shire of Kulin is underlain by granite rocks covered by alluvial soil in the major valleys. The landscape is gently undulating and of low relief.

The wheatbelt is mostly underlain by the Yilgarn Block, a rigid continental mass composed mainly of Archean granite and gneiss, with some altered volcanics and sediments. The Yilgarn Block is one of the oldest land masses on earth and has been a relatively stable part of the earth’s crust for 2,400 million years.

Gneisses are hard crystalline banded rocks that were metamorphosed (affected by high pressure and temperatures) when they were several kilometres below the earth’s surface. The minerals present are commonly quartz and feldspars.

Granites are hard crystalline rocks which are also dominated by quartz and feldspars but have very few dark minerals and are not banded. Granites form when very large masses of molten rock are intruded (pushed up) into the earth’s crust, where the magma cools and crystallises.

Earth movements over millions of years have uplifted the basement rocks. Around 40 million years ago the eastern part of the Yilgarn Block lifted 300 m, tilting the western part of the block downwards towards the ocean. This produced two distinctive landscapes: the Zone of Rejuvenated Drainage and the Zone of Ancient Drainage. Each broad zone has characteristic soils, landscapes and vegetation, but the boundaries between the zones are often indistinct and can merge over a distance of up to ten kilometres.

Zone of Rejuvenated Drainage
This zone is west of the Meckering line. The landscape has undergone much recent erosion (past 40 million years) and is dissected, forming steep, narrow valleys that contain rivers and creeks that flow in winter. Small remnants of sandplain occur, often bordered by a scarp or breakaway.

Zone of Ancient Drainage
This zone is east of the Meckering line, and has experienced less erosion. The landscape consists of gently undulating plateau, with wide divides, long gentle slopes, and broad valleys that contain salt lakes. Dissection of the lateritic profile on the slope has resulted in the formation of hardsetting grey duplex soils with some loose, sandy surfaced duplex soils on the lower slopes (Lantzke and Fulton, 1993).

Over thousands of millions of years the Yilgarn Block has been eroded down into the almost flat landscape present today. Most of the rock basement is covered with a layer of soil, but there are occasional granite outcrops at the surface. These granite outcrops may be massive dome-shaped rocks, piles of tumbled boulders or flat sheets at soil level. The rock surface may vary due to the mineral composition of the granite, from a smooth to a rough sculptured surface with fissures and cracks.
Granite rocks are impervious to water and concentrate run-off at their base. Damp areas around granite rocks can be thought of as "refuges" where plants and animals that flourished during periods of wetter climates can persevere during arid periods (Hussey, 1998). This feature enables jarrah trees to grow at Jilakin Rock, where the climate would normally be too dry to support them.

2.3 Soils

While the Yilgarn Block was eroding, a lateritic soil was being formed. This consisted of a sandy surface, a gravelly clay subsoil, underlyng weathered mottled and pallid zone materials and saprolite (McArthur, 1991). This laterite profile represents extremes in soil formation. In the past 2 million years, climate fluctuations have greatly altered the landscape, differentially eroding the surface of the Yilgarn Block. Erosion extended to different depths and exposed both weathered and unweathered materials which became soil parent materials. Physical, chemical and biological weathering of the parent material has led to soil formation. Much of the soils were washed away, transporting smaller clay particles into valleys and leaving sands and gravels higher in the landscape.

The distribution of soil-landscape systems of the Shire of Kulin is presented in Figure 5. These systems fall within the Zone of Ancient Drainage and are described below (Verboom and Galloway, unpublished). Further information is available from the Natural Resources Assessment Group (NRAG), Agriculture Western Australia, South Perth.

**Bendering System** (Bn): Gently undulating rises of old lateritic surface with occasional breakaways, in the zone of ancient drainage. Gravelly soils and yellow loamy earths predominate. Tammar scrub, sandplain heath and mallee.

**Bilgering Systems** (Bi): Undulating low hills of lateritic plateau largely stripped by erosion in the southern areas of the Zone of Ancient Drainage. Predominant soils are gravelly and shallow duplex soils. Major vegetation types include scrub heath and *Allocasuarina* thicket on old surface and wandoo (*Eucalyptus wandoo*) and gimlet on new surface.

**Carrajon System** (Cj): Broad flat valleys in the eastern areas of the Zone of Ancient Drainage. Calcareous loamy earths and shallow loamy duplexes are the predominant soils. The major vegetation types are wandoo, York gum (*Eucalyptus loxophleba*) and *Allocasuarina* woodlands.

**Coblinine System** (Cb): Broad valley floors, in the south-western Zone of Ancient Drainage (Blackwood Catchment), with saline wet soil, alkaline grey shallow sandy duplex and deep sandy duplex. Salmon gum-wandoo woodland, mallee scrub and samphire flats.

**Damon System** (Dm): Lower slopes and foot slopes adjacent to salt lakes in the eastern Zone of Ancient Drainage. The main soil types are loamy earth (mostly calcareous), grey sandy duplex and sandy earth.
Figure 5: Soil Landscape Systems in the Shire of Kulin
**Hope System** (Ho): Broad valley floors on greenstone in the eastern Zone of Ancient Drainage. Grey sandy duplex (often alkaline) and loamy earth (usually calcareous) are the major soil types.

**Hyden System** (Hy): Undulating to rolling low hills with granitic outcrops in the eastern Zone of Ancient Drainage. The main soil types are shallow sand, grey sandy duplex and brown sandy earth.

**Jitarning System** (Ji): Undulating low hills of stripped old lateritic plateau in the Zone of Ancient Drainage. The predominant soil types are alkaline grey shallow to deep sandy or loamy duplexes, and gravels. The main vegetation types are scrub heath and *Allocasuarina* thicket on sandplain; wandoo, gimlet, mallee elsewhere.

**Kalgarin System** (Ka): Undulating low hills with granitic outcrops in the eastern Zone of Ancient Drainage. Shallow sand, grey sandy duplex and sandy earth are the main soil types.

**Kuender System** (Kd): Undulating low hills in the Zone of Ancient Drainage. The main soils are alkaline red shallow sandy and loamy duplexes, red or brown loamy or sandy earths. Gimlet, wandoo, salmon gum and mallee woodland are the principal vegetation types.

**Kukerin System** (Kk): Gently undulating rises and narrow alluvial plains. Main soils types include grey deep sandy duplexes with sandy gravels and alkaline grey shallow sandy duplexes.

**Kulin System** (Kn): Gently undulating rises of partly intact old laterite surface with few breakaways in the Zone of Ancient Drainage. Soils include yellow sandy earths, gravels and alkaline grey shallow or deep sandy duplexes. The main vegetation types are tamma scrub and sandplain heath.

**Kunjin System** (Kj): Gently undulating rises of partly intact old laterite surface with few breakaways in the Zone of Ancient Drainage. Yellow sandy earths, gravels and alkaline grey shallow or deep sandy duplexes are the main soil types. The principal vegetation types are tamma scrub and sandplain heath, wandoo, York gum, jam and gimlet.

**Kwelkan System** (Kw): Occurs in undulating to rolling low hills with granite rock outcrops. The system has a low relief with gently to moderately inclined slopes. Stream channels are common. The main vegetation type is York gum and jam bushland. Major soils are gritty quartz sand to sandy loam formed in weathered granite and granite colluvium.

**Lagan System** (La): Salt lake chains, in the eastern Zone of Ancient Drainage, with salt lake soil and calcareous loamy earth. Vegetation comprises mallee, morrel woodland and saltbush-bluebush-sampire flats.
**Maublaring System** (Mb): Undualting low hills of old lateritic plateau. Shallow and moderately deep sandy gravels. Scrub heath and casuarina thicket on old surface; wandoo and gimlet on new surface.

**Nesheeb System** (Ns): Very gently inclined foot slopes and lower slopes in the eastern Zone of Ancient Drainage. The soils comprise grey sandy duplex and sandy earth.

**Newdegate System** (Nw): Undulating rises, in the south-eastern Zone of Ancient Drainage, with grey sandy duplex (shallow and deep), alkaline grey shallow duplex (sandy and loamy), pale deep sand and shallow gravel. Mallee-heath.

**Nungarin System** (Nu): Gently undulating plains, in the central Zone of Ancient Drainage, with grey sandy duplex (shallow and deep) and grey shallow loamy duplex (often alkaline). Salmon gum-gimlet-wandoo woodland and mallee scrub.

**Springfield System** (Sp): Undulating low hills in the southern area of the Zone of Ancient Drainage.

**Traysurin System** (Ty): Undulating low hills of old lateritic plateau in upper parts of the Zone of Ancient Drainage. Principal soils are sandy and loamy gravels. Vegetation comprises scrub heath, *Allocasuarina* thicket and kwongan heath on sandplain, wandoo, gimlet, mallee and black marlock (*Eucalyptus redunca*) elsewhere.

**Trayning System** (Tr): Valley floors in the Zone of Ancient Drainage with alkaline red shallow loamy duplex, alkaline grey sandy duplex (shallow and deep), calcareous loamy earth and hard cracking clay as the major soil types. Main vegetation types include salmon gum, gimlet, wandoo and York gum woodland.

**Walyuring System** (Wy): Undulating low hills of largely intact lateritic surface in the Zones of Ancient and Rejuvenated Drainage. Shallow to deep sandy gravels and pale deep sands make up the soils. Christmas tree (*Nuysia floribunda*), *Banksia* and *Allocasuarina* occur with sandplain heath.

**Wickepin System** (Wp): Major valleys in Zone of Rejuvenated Drainage and secondary valleys in Zone of Ancient Drainage. Grey shallow to deep sandy duplexes. Wandoo, york gum, jam and casuarina woodlands.

**Yeerakine System** (Yk): Gently undulating rises of largely stripped old lateritic surface in Zone of Ancient Drainage. Principal soil types are gravels, loamy earths and sandy or loamy duplexes. Tamma scrub, sandplain heath and mallee are the main vegetation types on sandplain with gimlet and black marlock elsewhere.
2.4 Wetlands

Wetlands are defined by the Wetlands Advisory Committee (1977) as "... areas of seasonally, intermittently or permanently waterlogged soils or inundated land whether natural or otherwise, fresh or saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries and tributaries".

The majority of the Shire of Kulin lies within the Avon Basin and associated salt-lake drainage network and a smaller area falls within the Blackwood Basin.

The Avon Basin drains a land mass of 120,000 square kilometres, spanning from Dalwallinu, Southern Cross and Lake Grace to Toodyay. One of the major sub-regions in the Avon Basin is the Lockhart, where the Shire of Kulin is located. In the Lockhart System, drainage is poor, there are no major streams and local runoff accumulates in the salt lakes. Only in very wet years do all the lakes join up and flow on the surface, although they are interconnected by very sluggish groundwater movement. Normally, the lakes are sumps where water and salts accumulate. Evaporation rapidly removes exposed water, leaving broad expanses of crystalline salts.

The major drainage systems in the Shire of Kulin are shown in Figure 6.

The Lockhart System of salt lakes lies along the floor of a broad shallow valley with a north-south trend. The Lake Grace and Lake Chinocup lake chain converges near Jilakin Lake with three similar lake chains. These lake chains originate near Lake Bryde, Lake Magenta and Lake Pallarup. The resulting system gradually turns westward converging with several other easterly and northerly trending lake chains. Eventually, the drainage system becomes part of the Avon headwaters, near Beverley (McKenzie and Youngson, 1975).

The Blackwood Basin covers an area of 22,500 square kilometres and spans over 300 km from Dumbleyung to Augusta. The upper reaches of the basin are drained by creeks, rivers, wetlands and lakes that are rarely continuous. The Fence Road Catchment covers 19,000 hectares of the Shire of Kulin, and is the only catchment of the Blackwood Basin that is contained within the shire. It drains southwards towards Dongolocking Creek, eventually draining into Lake Dumbleyung.

The Shire of Kulin contains several wetland areas within its boundaries, some of which are located on private land. Figure 6 shows the major drainage systems in the Shire of Kulin. Wetland chains include:

- Lake Varley and Lake Hurlstone, the link between Lake Pallarup and Lake King in the Lake Grace Shire to Lake Carmody in the Kondinin Shire.
- Jilakin Lake and associated ephemeral lakes that run north-east, connecting the southern Lockhart lake chains of Lake Grace, Lake Bryde and Lake Magenta through Lake Kondinin to the headwaters of the Avon.
Lake Varley is a large hypersaline seasonal lake, that covers nearly 970 hectares. There is an extensive area of samphire marsh above the water mark that becomes damp in winter but has no surface water. As the ground rises the marsh is replaced by eucalypt woodland.

Jilakin Lake is a large hypersaline lake that covers nearly 100 hectares. There is a large area of samphire marsh that contains species of Halosarcia and Atriplex. To the south-west of the lake, the marsh is replaced by eucalypt woodland.

The wetlands of the wheatbelt have suffered enormous changes as a result of the rise of salty groundwater. Most of the wetlands in the Shire of Kulin have increased in salinity since the 1940s. These changes were quickly followed by the death of vegetation that fringed lakes and wetlands.

Many of the vertebrate animals that were once common to wetlands and the surrounding areas have now disappeared. These included waterbirds, reptiles, frogs, and the water-rat (Hydromys chrysogaster). This could be a result of various factors, such as increased salinity of the wetlands, destruction of their habitat, decline of their prey and/or predation by introduced feral animals.

The Biological Survey Group of CALM's Science Division is currently conducting a survey of 75 wetlands in the southern wheatbelt. Parameters studied include water chemistry, waterbirds, vegetation and aquatic invertebrates. This work is carried out in conjunction with flora surveys under the Western Australia Salinity Action Plan.
2.5 Original Plant Communities

The following descriptions of plant communities are based on plant distribution studies by J.S. Beard, who described vegetation communities and their estimated extent prior to European settlement and clearing for agricultural production. Further detail can be obtained from Beard (1979, 1980). An estimate of the original distribution of the dominant vegetation types based on Beard’s work is illustrated in Figure 7 (Hopkins et al., 1996).

The Shire of Kulin contains vegetation types from two of Beard’s Vegetation Systems: the Corrigin and Hyden Vegetation Systems.

The *Corrigin Vegetation System* of the Avon Botanical District has a typical “outer wheatbelt” landscape. It is drained by the upper reaches of the Avon River. There is a well organised drainage pattern but dissection is shallow and slopes are gentle. The higher ground is capped by large patches of sand and laterite. While laterite usually appears at the surface of the edges of such sandplains it rarely forms breakaways. There are some salt lakes near Yealering with halophytes on adjacent flats but not all bottomlands are saline. The vegetation consists of kwongan (thickets and heath) on sandplains, woodlands on slopes and flats, patches of intermittent mallee and teatree thickets and samphire in the bottomlands.

**Kwongan**

Kwongan vegetation occurs on yellow-brown loamy sand with about 80% laterite pebbles and local exposures of laterite pavement. Large patches of sand and laterite cap the higher ground, and while laterite usually appears at the surface at the edges of such sandplains it rarely forms breakaways. There is a great diversity of species that intermingle, tending to sort according to the predominance of laterite pebbles or sand in the soil profile.

Dominant species vary over the diverse understorey. In some parts, open stands of 2-4 m tall tamma shrubs tower over 1 m tall *Dryandra cirsoides* and other shrubs with scattered taller mottlecah (*Eucalyptus macrocarpa*) and *Hakea subsulcata*. In other parts a 2-4 m thicket is equally dominated by tamma and *H. subsulcata*. Laterite favours *Allocasuarina, Dryandra, Gastrolobium, Leptospermum* and most *Hakea* species. Sand favours *Actinostrobus, Banksia, Conospermum, Eremaea, Grevillea, Lambertia, Nyctiopsis* and *Verticordia*. Acorn banksia (*Banksia prionotes*) may appear on deep sand, but is not found in a *Banksia-Xylomelum* alliance.

**Mallee**

Mallee species are predominantly black marlock (*Eucalyptus redunca*), ridge-fruitered mallee (*E. incrassata*), tall sand-mallee (*E. eremophila*) and capped mallee (*E. pileata*). These communities vary in height and density. A closed low-shrub understorey is usually present.
Eucalypt woodland - low woodland

On laterite breakaways brown mallet (*Eucalyptus astringens*) is found. Powderbark wandoo (*E. accedens*) is found in the western reaches, and is replaced by blue mallet (*E. gardneri*) in some localities. Covering the upper slopes below the sandplain are open stands of 16-20 m tall wandoo, with little understorey but scattered *Gastrolobium crassifolium* and *Melaleuca laxiflora*. On middle slopes, 10-16 m tall York gum tends to stand over sparse jam trees 4-6 m tall with scattered emergent salmon gum up to 20 m tall. There is a grass ground layer of *Enneapogon caeruleus*. Jam may form low woodland without eucalypts.

On flats with heavy soil, salmon gum and red morrel occur. Along major fresh-water creeks flooded gum is found with *Callistemon phoeniceus*. Where creeks are saline the vegetation changes to swamp sheoak and *Melaleuca hamulosa*, with the samphire *Halosarcia bidens* along the creek margins.

The **Hyden Vegetation System** in the Mallee Region is one of the largest components of the Roe Botanical District. The landscape is very gently undulating with wide flat valleys and long gentle slopes rising to broad interfluves. The interfluves are capped by residual laterite and sands of the prior surface and rarely occur as breakaways. Perhaps because of the gentle slopes, soils are very variable and the highly mosaic character exhibited by the wheatbelt vegetation is even more pronounced. Plant cover varies in structure and composition every few metres. There is a characteristic catena comprising kwongan (heath and thicket) on sandplains, mallee on the slopes covering the bulk of the area, mallee with patches of woodland on upper valley soils, woodland on lower valley soils and a mosaic of woodland, shrubland and samphire in saline areas.

**Woodland**

Medium-height woodland occurs on the lower valley soils, consisting of York gum and jam, York gum and salmon gum, wandoo and gimlet, or gimlet and salmon gum. Height and density vary. Heights of up to 12-15 m are common, with salmon gum reaching 22 m, while some stands are less than 10 m tall and are classed as low woodland. Canopy cover ranges from 2 to 70%.
Figure 8 Profile of a York gum woodland

The understorey varies according to the overstorey species. York gum usually has a small 2-5 m tree layer of jam and sandalwood and a ground layer of sedges with annual grass and forbs in winter. Wandoo covers scattered shrubs, primarily *Gastrolobium crassifolium*. Salmon gum and gimlet commonly have a scattered tall shrub layer of honey-myrtles, or sometimes smaller scattered shrubs such as *Acacia erinacea* and *Templetonia sulcata* with a ground layer of pincushions (*Borya sphaerocephala*) and *Wilsonia humilis*.

Figure 9 Profile of a salmon gum woodland

**Low woodland**

Smaller trees or "marlocks" replace woodlands in the mallee; for example, silver mallet (*Eucalyptus ornata*) and blue mallet (*Eucalyptus gardneri*) replace brown mallet that occurs on laterite plateaux and breakaways further west. There are only small occurrences of brown mallet below the breakaway. On very heavy clay soils open-fruited mallee (*Eucalyptus annullata*) replaces gimlet.
Vegetation shown is original natural vegetation presumed to have existed prior to European settlement.

Figure 7. Major Beard vegetation Types in the Shire of Kulin
Low woodlands are sensitive to fire and regenerate from seed, forming even-aged stands of single-stemmed trees. The principal association is of silver mallet and blue mallet on laterite, with heavy cover and heights usually around 6-8 m. Old stands up to 16 m tall with sparse cover may also be found. Low woodland stands have understorey shrub species similar to that of mallee.

**Mallee**

A great variety of eucalypt species form mallee communities. They usually occur on gradational acid soils. True mallees are multi-stemmed species which have resprouted from rootstock after fire. Height varies and is probably related to the age of the stand; if fire is eliminated the vegetation may become a woodland. Most mallee stands are about 3-5 m tall with open cover, and have a dense understorey of sclerophyll shrubs 1-2 m tall.
Mallee heath

Mallee heaths are dominated by the spreading, straggly Burracoppin mallee (*Eucalyptus burracoppinensis*). They can occur on gradational acid soils and also on uniform and neutral soils, with a yellow colour which is unlike other mallee soils. Numerous clumps of Burracoppin mallee are scattered over a heath-like understorey of many shrub species. Occasionally, *Grevillea eriostachya* or *Hakea coriacea* stand above the mallee stratum. The upper layer of the mallee-heath ranges from 1-5 m tall, sometimes reaching 6-8 m. The lower heath layer may reach up to 1 m. Both layers vary in cover density.

Shrublands

Shrublands are thickets exceeding 2 m with dense canopy cover, along a watercourse, dominated by *Allocasuarina acutivalvis* and/or *A. campestris*, jam or *A. signata*, or *Melaleuca lateriflora* and *M. acuminata*. An understorey is formed by numerous species but is relatively sparse.

Heath

Heath formations appear similar in some respects to shrublands – slightly shorter stratification and the same dominants especially *Allocasuarina acutivalvis* - but do not reach 2 m high. The general structure consists of an upper open layer of large shrubs less than 2 m tall and a lower closed layer of smaller shrubs, although occasionally only a low heath layer is present with no distinctive dominants. Mixed species, particularly Proteaceae, make up the upper layer without distinct patterns. However, *Dryandra cirsoides* may be prominent over laterite.

Rock Outcrops

Outcrop areas often carry very complex mosaics of several associations. On bare granite rock with moss (*Grimmea sp.*) and lichens (mostly *Parmelia* species) shallow soil layers support herbs such as pincushions and shrubs such as roadside teatree, *Dodonaea attenuata* and *Hibbertia enervia*. Where soil is deeper a mosaic of low woodland of wilyuurwu (*Acacia lasiocalyx*) or thickets of *Allocasuarina campestris* occur. Low woodland of jam frequently surrounds outcrops or forms the cover between expanses of granite pavement. All woodlands may contain scattered York gums.

Breakaways

The platform above the breakaway is covered by *Allocasuarina campestris* thicket. The scree area is also covered by *A. campestris* except where a laterite scarp 1-2 m high is present, where the scree has a low woodland of *E. astringens*. Where breakaways are more pronounced, higher and steeper, the scarp and scree are almost bare of vegetation, while the outwash is sparsely vegetated with tall trees of *Callitris canescens* and shrubs such as *Melaleuca undulata* and *Grevillea huegelli*. 
In the *Hyden Vegetation System* of the Eyre Botanical District of the South-western Botanical Province, the landscape is somewhat dissected. Areas of residual sandplains are limited to relatively small patches on interfluves, while valleys are wide. Scrub heath occurs on the sandplain ridges, mallee on the middle slopes covering the bulk of the area, and sclerophyll woodland or mallee with woodland patches in the bottomlands. On the most saline sites teatree scrub replaces woodland. Granite outcrops that occur throughout the area have their own characteristic vegetation.

**Scrub heath**

The *Allocasuarina* thicket formation associated with scrub heath occurs as small patches on lateritic soil. It consists of large shrubs over 1 m tall of tamma, *A. acutivalvis*, *A. corniculata* and *A. pinasta*, and small shrubs 30-50 cm high of a variety of genera.

![Figure 10. Profile of an Acacia-Allocasuarina thicket](image)

**Mallee**

In mallee, the larger plants are exclusively eucalypts, with a dense mixed understorey of other genera. Small trees or “marlocks” 3-10 m tall occur locally in small patches, with the trees rising out of the mallee. Tall sand-mallee is the most common and consistent mallee species, with its associations changing locally. York gum are found around large granite rocks, while coarse-leaved mallee (*Eucalyptus grossa*) occurs at the edge of rock outcrops. Swamp mallet occurs in low-lying, winter-wet places. Understorey is commonly dominated by *Melaleuca* species, forming a continuous layer with other species interspersed.
Sclerophyll woodland

The dominating eucalypts in sclerophyll woodland vary. They include salmon gum and gimlet, morrel near salt lakes and yorrell (*E. gracilis*), Kondinin blackbutt (*E. kondininensis*) and swamp mallet in saline areas. The shrub layer is generally dominated by 3.5 m tall *Melaleuca pauperiflora* that are irregularly scattered. In less saline areas the ground layer consists of shrubs with a broombush habit and grasses, but in alkaline areas near lakes saltbush and greybush are dominant.
Teatree scrub

Teatree scrub replaces woodland in more saline areas, and surrounds hypersaline sites that are either bare of vegetation or carry samphires. Several species of *Melaleuca* are represented, including broombush, *M. hamulosa*, *M. cymbifolia* and *M. thyoides*. There may be small eucalypts, especially swamp mallet and yorrell. Teatree scrubs often have a ground layer of samphire species.

Granite rocks

Most outcrops are bare and only covered with lichens. Pools of water that form in winter support numerous ephemeral lifeforms, such as microscopic plants, algae, diatoms, and invertebrates. Patches of soil lodged in clefts are colonised by characteristic species that are usually confined to this habitat, such as the trees wilyurwur and rock sheoak (*Allocasuarina huegeliana*) and sedge *Lepidosperma* species. Flat, sheltered rock outcrops are often colonised by pincushions and are surrounded by a zone of dense *Verticordia preissii*.

Communities that surround granite rocks include woodlands of York gum or rock sheoak, thickets of wilyurwur or jam, or mixed thickets of tamma, *Dodonea attenuata*, one-sided bottlebrush (*Calothamnus quadrifidus*) and *Melaleuca elliptica*.

In *How to Manage Your Granite Outcrops*, Hussey (1998) suggests that the topography of the rock outcrop determines which plants and animals can survive on and around it and creates sharply defined zones of different habitat (Table 3). A more varied rock will have more diverse habitats and will be able to support a wider range of wildlife.
Table 3: The large range in habitat types of granite outcrops support a variety of wildlife (Hussey, 1998).

1. Rock Sheets
- Lichens, mosses and blue-green bacteria (dormant during the dry season).
- Invertebrates such as insects and spiders (active in wet season) and basking lizards.

2. Small Cracks and Crevices under Rocks
- Horizontal cracks shelter lizards, geckos and many invertebrates (eg ants, spiders).
- Vertical cracks provide root spaces for plants such as ferns, pincushions and shrubs.
- Cracks may channel and hold water.

3. Holes and Caves under/among Tumbled Boulders
- Where light enters and fine soil collects delicate plants may grow.
- Large holes provide shelter for larger mammals such as echidnas, rock-wallabies and kangaroos and large reptiles such as goannas and carpet pythons.
- Smaller holes are used by smaller mammals such as dunnarts and native mice.

4. Rock Pools
- Shallow pools only hold water over winter, and support numerous microscopic plants, algae and diatoms; quillwort in mud; crassulas in drying edges.
- Water supports invertebrates (water-fleas, shrimp-like creatures, midge larvae), dragon-fly larvae and tadpoles.
- Deeper pools called ‘gnэмmas’ by Nyoongah people were an important water source.

5. Rock Meadows or Swards
- Meadow or ‘swards’ develop where soil accumulates in rock depressions or on shallow soil around the edge of the outcrop.
- Support different small plants that flower through the winter and spring, and have various mechanisms to survive the long hot summer, when soil is baked dry.
- Pincushions, lichens, moss, nancies, orchids, triggerplants and daisies.
- Habitat for many small invertebrates that supply food for frogs, lizards and birds.
- Favourite feeding places for rock-wallabies, bandicoots and kangaroos.

6. Shrubby Islands on the Rock
- Islands of shrubs or trees may form where soil accumulates to any depth.
- Plants often gnarled, twisted and very old as their isolation protects them from fire.

7. Shrubby Thickets
- Dense shrubby thickets form where channelled water collects over the rock and the soil is deep enough.
- Common shrubs include teatrees, bottlebrush, honeymyrtles, tammas, hakeas, grevilleas, wattles and occasionally mallees.
- Plants may produce copious nectar, an important food source for insects and birds.
- Dense thickets ideal nesting sites for small birds.

8. Sheoak Woodlands
- Rock sheoak is characteristic tree around granite outcrops, dropping thin branches (or ‘needles’) that carpet the ground and suppress other plants.
- Foraging woylies (or brush-tailed bettongs, Bettongia penicillata) may turn the soil and needle carpet while searching for fungi.
- Habitat for red-tailed phascogales, western rosellas and Port Lincoln ringnecks.

9. Surrounding Woodlands
- Outcrops would have been surrounded by bushland of jarrah, wandoo, York gum, salmon gum or gimlet before clearing.
2.6 Current Vegetation

Native vegetation has been degraded in numerous ways, as a result of altered land use throughout Western Australia since the arrival of Europeans over 150 years ago. In the South West Land Division, 85-95% of the native vegetation has been removed (Hamilton et al., 1991). This area had the greatest diversity of native flora. Therefore the impact of clearing for broadscale agriculture has been the most significant. The most productive soils were widely cleared leaving little vegetation. The loss of native vegetation has been exacerbated by the inadequate coverage by nature reserves of all habitats and species found throughout Western Australia (CALM, 1992). Therefore, privately owned remnants of native vegetation in the agricultural areas of the south-west are an important component of the State’s biodiversity and a great conservation resource (Allison et al., 1993).

There are 1,881 bush remnants on private land in the Shire of Kulin. These remnants have been mapped from aerial photographs into three classes of vegetation condition (Beeston et al., 1994).

---

**Remnant Vegetation:**
- most closely reflects the natural state of vegetation for a given area
- intact understorey
- structurally diverse and complex
- minimal disturbance by agents of human activity

**Modified Vegetation:**
- degraded understorey
- obvious human disturbance (clearing, mining, grazing)
- saline incursions

**Scattered Trees:**
- cleared parkland with no understorey present
- no canopy continuity
- no significant chance of regeneration

---

Of these bush remnants, 855 are regarded as “Remnant Vegetation”, 967 as “Modified Vegetation”, and 59 are classed as “Scattered Trees”. Of all bush remnants in the shire, 106 are greater than 50 hectares in area (Beeston et al., 1994).

Approximately 12% of the total area of the Shire of Kulin remains covered by perennial, native vegetation, (Table 4). Of this area, nearly half is found on private land, the combination of “remnant” and “modified” classes. The remaining half exists as public reserves, such as nature reserves, water reserves, Crown land and gravel pits, but not all of the public land has a cover of native vegetation (Figure 13).
Figure 13. Existing Native Vegetation on Public and Private Land in Kulin
Table 4: The condition of remnant vegetation on private land in the Shire of Kulin (Beeston et al., 1994).

<table>
<thead>
<tr>
<th>Class</th>
<th>Area (hectares)</th>
<th>% of Shire Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remnant Vegetation</td>
<td>17865.4</td>
<td>3.8</td>
</tr>
<tr>
<td>Modified Vegetation</td>
<td>7869.6</td>
<td>1.7</td>
</tr>
<tr>
<td>Scattered Trees</td>
<td>15.7</td>
<td></td>
</tr>
<tr>
<td>Private Land</td>
<td>25750.7</td>
<td>5.5</td>
</tr>
<tr>
<td>Public Land</td>
<td>29131.2</td>
<td>6.2</td>
</tr>
<tr>
<td>Shire Total</td>
<td>466712.0</td>
<td></td>
</tr>
</tbody>
</table>

Appendix 1 lists common names for major species. Species found in the Shire of Kulin from 1970 to the present have been listed in Appendix 2. This brief list has been compiled from various sources, including reserve surveys found in Section 2.7. Soil types are given for individual species and the general life-form of the plant is shown i.e herb, shrub or tree.

In 1993, Frans Mollemans surveyed nine bush remnants on private land in the Shire of Kondinin. Detailed botanical information from this survey can be found in Appendix 3. Figure 13 shows the locations of the surveyed bush remnants. Copies of the findings are available by contacting the Spatial Resources Information Group, Agriculture Western Australia.

The Biological Survey Group of CALM's Science Division is conducting further survey work throughout the wheatbelt, under the Western Australia Salinity Action Plan. This study aims to investigate over 1,000 sites over the following years to produce a floristic and wetland survey at a regional scale.

2.7 Nature Reserves

There are nearly 40 nature reserves in the Shire of Kulin that are vested in the National Parks and Nature Conservation Authority (NPNCA) for the conservation of flora and fauna, and are managed by Department of Conservation and Land Management (CALM) on behalf of the NPNCA. In addition, there are 14 vested reserves under the control of the shire and other authorities.

Notes from surveys of some of the Nature Reserves in the shire are provided below. Plant species found on each of these Nature Reserves are listed in Appendix 6 and 7. In addition, a brief description of the vegetation types within each area of the CALM-managed conservation estate in the Shire of Kulin can be found in Appendix 4. Orchid surveys of Nature Reserves in the Shire have been conducted by various volunteer collectors affiliated with the WA Native Orchid Group and the WA Herbarium; species lists can be found in Appendix 8.
Dragon Rocks Nature Reserve

Dragon Rocks Nature Reserve (36128) is an A class reserve and covers 32,218 hectares. It is vested in the NPNCA and set aside for the conservation of flora and fauna. It is situated 30 km north of Newdegate and 20 km south-east of Hyden, lying within both the Shires of Kulin and Lake Grace. Dragon Rocks was gazetted in 1979 after investigation initiated by a suggestion from Mr. Richard J. Lane, the Secretary of Lake Grace Farmers Union at that time. It is listed on the Register of the National Estate. The landscape consists of high-level undulating, scrub-covered sandplains with laterite breakaways and ridges giving way to long, gradual slopes supporting mallee communities. There are many granite rock exposures that are typically surrounded by tamma scrub, including one named Dragon Rock after the presence of the dragon lizard (*Amphibolorus ornatus*). Shallow drainage lines contain stands of salmon gum.

A biological survey conducted by McKenzie, Burbidge and Marchant in 1973 found 15 native fauna species, 59 birds, 19 reptiles and 4 frogs (Appendix 12). The reserve was generally well vegetated. Table 5 shows the seven vegetation formations observed at the reserve, based on life-form and height, and the density of foliage of the tallest strata (following Specht, 1970).

Coates (1991) surveyed the reserve and mapped 28 vegetation types including woodlands (8), mallee (7), kwongan (11) and lithic complexes such as granite and breakaways. A total of 563 native plant species were identified, and of these 61 were undescribed, eight were declared rare flora and 13 were priority flora. These species are listed in Appendix 7. Coates suggested that Dragon Rocks Nature Reserve was “outstanding for its size, complexity of vegetation and diversity of flora”.

More recent surveys from 1980 to 1987 (Graham, 1988) found 17 native mammal species, 23 reptiles, 4 amphibians (incomplete list) and 93 bird species. The diversity of birds reflects the diverse dryland habitats that are represented on the reserve.
Table 5: Seven vegetation formations observed at Dragon Rocks (McKenzie et al., 1973)

<table>
<thead>
<tr>
<th>Vegetation Formation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woodland</td>
<td>Salmon gum on narrow belts of alluvial soil along well defined drainage lines running EW from ridge. Associated shrubs include <em>Acacia merrallii</em>, <em>Boronia capitata</em>, and species of <em>Eremophila</em>, <em>Thryptomene</em> and <em>Santalum</em>. Morrel on more alkaline soils with poorer drainage.</td>
</tr>
<tr>
<td>Low Open Forest</td>
<td>White and blue mallet as small trees or marlocks 10 m, with well developed litter layer and sparse understorey, including <em>E. incrassata</em>, <em>Melaleuca pungens</em>, <em>Acacia ericifolia</em>, <em>Hybanthus floribundus</em>, <em>Leptospermum erubescens</em> and <em>Pimelea suaveolens</em>. Occurs on gravelly rises, near breakaways.</td>
</tr>
<tr>
<td>Open Scrub</td>
<td>2-8 m high, medium dense and closely packed, <em>E. eremophila</em> common.</td>
</tr>
<tr>
<td>High Shrubland</td>
<td>Scattered <em>E. eremophila</em>, <em>E. redunca</em> and <em>E. albida</em>. Rich understorey (including <em>Gastrolobium spinosum</em>).</td>
</tr>
<tr>
<td>High Open Shrubland</td>
<td>Very scattered <em>E. eremophila</em>, <em>E. redunca</em> and <em>E. albida</em>, with heath understorey</td>
</tr>
<tr>
<td>Open Heath</td>
<td>Medium dense heath about 2 m tall, on gravel or sandy gravel, with <em>Allocasuarina campestris</em> common. This formation was richest in the number of species.</td>
</tr>
</tbody>
</table>
| Lithic Complexes     | Granitic outcrops form most of ridge.  
- outcrop subsurface: dense cover of *Borya sphaerocephala*, *Verticordia preissii*, and ephemeral and sedge species.  
- soil thick: *A. lasioclayx*, *A. huegeliana*, *Melaleuca elliptica*, *M. radula*, *Calothamnus quadrifidus*, *Phylanthus calycinus*.  
- breakaways: brown mallet and the most northerly record of the south coast *Acrotiche ramiflora*. |

Flat Rock Nature Reserve

The Flat Rock Nature Reserve (27487) is a C class reserve vested in the NPNCA for the conservation of flora and covers 1,467.8 hectares. Large granite outcrops exist in the south-west section of the reserve and in other areas smaller outcrops of low profile occur (Wallace, 1979). A major breakaway system occupies the central area of the reserve and the ridge continues northwards as an area of high ground. The predominant vegetation formations on the reserve are heath and mallee, with smaller areas of woodland.

Wallace (1979) identified 71 species in four major vegetation associations:

1. Heaths - on a variety of soil types including lateritic loams, sand and shallow soils over granite, supporting a range of heath plants. Formations ranged from those dominated by a few species (tamma - *Melaleuca elliptica* and tamma-broombush) on shallow soils over granite, to heaths of
a complex of species on sandy soils. Much of the heath contains emergent mallee, particularly white-leafed mallee (E. albida).

2. Mallee - seven different species of mallee were found. Tall sand-mallee was the most common, with square-fruit mallee (Eucalyptus calycogona) predominant on flatter areas. Most mallee areas contained a shrub understorey, with tamma dominant.

3. Woodland - three woodland areas were found, but none were extensive. White mallet was most common; others include brown mallet, gimlet and blue mallet. Understorey was generally open and consisted of a variety of species.

4. Lithic Complex - two major lithic complexes occur, carrying a typical flora, with some species of Melaleuca and Allocasuarina.

Native mammals observed by Wallace (1979) on the reserve include the western grey kangaroo (Macropus fuliginosus), the western brush wallaby (Macropus irma), western mouse (Pseudomys occidentalis) and echidna (Tachyglossus aculeatus), but it is likely that there are more mammals present on the reserve in habitats that were not fully surveyed. Rabbits and foxes were also present. Two reptile species were identified: the ornate dragon-lizard (Ctenophorus ornata) and tree-stella (Gehyra variegata). Over thirty species of birds were identified by Wallace in 1979, including the malleefowl (Leipoa ocellata), but in a survey in 1986 Silvester found only 21 bird species (Silvester, 1986).

Harrismith Nature Reserve (Silvester, 1988)

The Harrismith Nature Reserve (13258) is a C class reserve vested in the NPNCA for the conservation of flora and fauna. Covering 40.4 hectares, this reserve has predominantly sandy loam soils and there is an old dam (Silvester, 1987).

Wallace (1982) identified three vegetation associations on the reserve:

1. Low heath of Allocasuarina campestris over dwarf scrub of A. microstachya and Verticordia chrysanth, over few open herbs.
2. Open tall woodland of salmon gum over very open tree mallee of York gum, over an open low woodland of Acacia microbotrya and herbs.
3. Open low woodland of wandoo over an open scrub of Hakea species, Allocasuarina campestris and Hibberia pungens over herbs.

The Harrismith Nature Reserve provides nest hollows in woodlands and is utilised by bird species as a resting and feeding area. There were few weeds observed by Wallace in 1982.

Hopkins Nature Reserve (Brown, 1979)

The Hopkins Nature Reserve (35134) is a large C class reserve vested in the NPNCA for the conservation of flora. The 578.8 hectare reserve has a very gently sloping landscape with a north-west aspect. Laterite underlies the soil, which is generally a brown sand.
A survey by Brown (1984) described the vegetation as heath, with no obvious dominants. Shrubs rise to 2 m tall and included *Melaleuca*, *Hakea* and *Dryandra* species.

There has previously been gravel mining on the reserve, but this area is now rehabilitated. Rabbits have been found on the reserve.

**Jilakin Nature Reserve**

The reserve at Jilakin Lake and Jilakin Rock combines two reserves: 15385 and 18698. Reserve 15385, vested in the Minister for Water Resources, is reserved for the purpose of park lands and water and covers an area of 99 hectares. Nature Reserve 18698, with an area of 99 hectares, is vested in the NPNCA for the conservation of flora and fauna but until 1990 was a National Park. A few jarrah trees are found, in these reserves which is the most easterly and isolated location of this species (Beard, 1980). The jarrah trees are growing at the foot of Jilakin Rock where runoff is received and along a channel about 100 m to the east and are naturally irrigated.

A draft management plan for Jilakin Rock Reserve (15385) was prepared by CALM in conjunction with the Shire of Kulin, the Friends of Jilakin Rock and other local contributors in 1996. The management goals are:

1. To conserve the indigenous species of plants and animals, the aesthetic values and the natural environmental process occurring on the reserve.
2. To protect the landscape amenity provided by the reserve.
3. To facilitate the public enjoyment of the natural attributes of the reserve, by providing for passive recreational activities in a manner that does not compromise the conservation, landscape protection and other management objectives.

The management plan specifies two classes of activities that must be managed by the Shire Council. Firstly, the Shire Council must manage prohibited activities, including those activities which involve the removal of raw materials, disturbing fauna, taking of any flora and depositing of litter. Secondly, the Shire Council must manage restricted activities, including those which involve making tracks, interfering with watercourses, use of firearms, exotic animals, clearing, lighting fires, discharging dangerous substances, interfering with natural environment and erecting buildings, sheds or fences.

The management plan also contains three management guidelines listed in the plan’s Schedule One.

1. There is an outlying population of jarrah and a priority listed species *Acacia coweniana* that occur on the Reserve. To ensure their survival, the recreation site is to be redesigned and relocated to be able to accommodate a greater number of visitors and prevent the compaction of soil around the root zone of these species.
2. The control of wildfires is considered a priority by Council and the community. Fire will be managed by the maintenance of an effective
volunteer Bush Fire Brigade, an external 3 m wide firebreak and the relocation of the barbecue away from the immediate vicinity of the jarrah.

3. Significant Nyoongah sites occur within the Reserve. To prevent the disturbance of such sites the shire will consult with local Nyoongah elders prior to conducting any works.

Jitarning Nature Reserve

The Jitarning Nature Reserve (29988) was gazetted for the conservation of fauna on September 26th, 1969 and vested in the NPNCA. The original area was about 17.9 hectares and this was increased to the present area of 19.9 hectares on May 26th, 1972. The irregular-shaped reserve is located at the corner of Jitarning Road West and Williams-Kondinin Road, 19 km south-west of Kulin.

There are five vegetation associations present on Jitarning Nature Reserve (Coates, 1990):

1. York gum woodland: Low forest of York gum with scattered shrubs and emergent salmon gum.
2. Salmon gum woodland: Salmon gum forest with scattered wandoo, and also scattered shrubs.
3. Wandoo woodland: Wandoo low forest over open dwarf scrub.
4. Mallee: A dense tree mallee of square-fruit mallee and black marlock. No understorey but scattered shrubs are present.
5. Tamma heath: Tamma dense heath with scattered wandoo.

The Jitarning Nature Reserve has a fairly diverse vegetation. The reserve contains nest hollows and is of value as a resting site for transient birds. There have been no weeds recorded in the reserve, but there has been past dumping of rubbish in the wandoo woodland. Coates (1990) recommended that the value of the reserve would be enhanced by the addition of adjacent uncleared land.

Kondinin Salt Marsh Nature Reserve

The Kondinin Salt Marsh Nature Reserve (26692 and 26905) is a large C class reserve of over 2,000 hectares reserved for the conservation of flora and fauna. The reserve lies on the boundary of the Kulin and Kondinin Shires. The majority of the reserve is covered by a succulent steppe with species including salt river gum (*Eucalyptus sargentii*), *E. brachycorys* and *Allocasuarina colletioides*.

Koolberin Nature Reserve

Koolberin Nature Reserve (16763) was originally gazetted for the purpose of "camping and public utility" on August 17th, 1917. The reserve was reclassified for the conservation of flora and fauna on June 13th, 1969 and vested in the NPNCA, and was officially renamed on February 25th, 1983. Koolberin Nature Reserve is located about 16 km south-south-west of the Kulin townsit eand is roughly rectangular, with an area of 17 hectares. It is bordered on the south by Jitarning Road South and on the west by Koolberin Road.
Although it is small, the reserve is diverse in plant associations and habitat types, containing nest hollows and also resting sites for transient birds (Coates, 1990). Coates (1990) identified six vegetation associations present on the reserve:

1. Wandoo woodland: Low woodland of wandoo over tamma dense thicket.
2. Blue mallet woodland: Low forest of blue mallet with no understorey present.
3. York gum woodland: Low forest of York gum over an open low woodland of jam.
5. Mallee area B: Tree mallee of York gum and square-fruited mallee. No understorey but scattered shrubs including *Acacia erinacea* are present, with salmon gum on edge.

Infestations of weeds were observed, including wild oats in the York gum woodland and in the south-west and south-east corners of the reserve. Hair grass (*Aira* sp.) was also recorded.

**Kulin Nature Reserve**

The Kulin Nature Reserve (22739) is situated within the Kulin townsite on the southern boundary, and is divided into three sections with a total area of 13.9 hectares (Coates, 1990). The reserve was originally gazetted for the conservation of native flora on February 13th, 1948 and vested in the Shire of Kulin, and was amended to reduce the area from the original size of 16.2 hectares.

The vegetation in sections 1 and 2 of Kulin Nature Reserve is a mosaic of:

1. Open tree mallee over *Melaleuca* dense thicket with *Melaleuca* understorey, and
2. Dense tree mallee with no understorey.

In section 3 of the reserve there are three vegetation associations:

1. Open tree mallee over *Melaleuca* dense thicket similar to that found in sections 1 and 2.
2. Dense tall sedges.
3. Open tree mallee with scattered wandoo. No understorey is present but scattered scrubs and introduced grasses were recorded. Many dead trees present.

Sections 1 and 2 of the reserve are in fairly good condition. They are separated by Drain Reserve (22738), an area of uncleared land; incorporation of this area into the reserve would minimise any management difficulties. Section 3 poses major
management difficulties because it is small and in poor condition. Weeds are a major problem and the land surrounding it has been developed for recreation, commerce and water supply.

**Kulin Soak Nature Reserve**

The Kulin Soak Nature Reserve (10772) is a C class reserve vested in the Minister for Water Resources. The 66.4 hectare reserve is situated on Kulin Rock Road, near Kulin Hill. This reserve is in an area which lacks large nature reserves or good areas of bush in general. Brown to dark brown loams cover most of the reserve. The vegetation is salt affected on the western side and in the centre of the reserve (Silvester, 1986a).

Atkins (1984) identified six vegetation associations on the reserve:

1. Jam low woodland with emergent York gum. The understorey commonly has sandalwood and is heavily weed invaded.
2. York gum forest with associated overstorey of jam, sandalwood and Pittosporum phylliraeoides, and an open weed-invaded understorey.
3. Salmon gum tall woodland graded with York gum and gimlet. The understorey is more developed and less weed invaded, and varies between a mixed low scrub and a dwarf scrub of *Acacia erinacea*.
4. Gimlet woodland similar to the salmon gum woodland.
5. Herbland with emergent sandalwood and York gum.
6. Chenopodiaeous low heath on the salt affected area, with species including *Maireana brevifolia* and *Atriplex* species.

The presence of large, dead trees and good areas of woodland provide suitable nest hollows. The western grey kangaroo has been observed on the reserve, along with 15 bird species. There is a heavy infestation of weeds such as wild oats and *Ursinia anthemoideos* under the jam and York gum, which is typical for these vegetation types.

**Lake Hurlstone Nature Reserve**

The Lake Hurlstone Nature Reserve (27927) is an A class reserve vested in the NPNCA for the conservation of flora and fauna. It covers an area of 2,388.5 hectares. Reserve 27927 is one of three adjacent reserves named Lake Hurlstone located about 50 km east of Hyden on the Lake King-Hyden Road. The remaining reserves 27837 and 24417 fall within the Shire of Kondinin.

A survey by Burgman (1985) identified over 200 plant species in a total of 26 different vegetation types on the three reserves. The vegetation types can be grouped according to the landforms with which they were associated.

**Salt Lake Features**

1. Bare clay pan with a dwarf scrub of *Halosarcia* species.
2. Dwarf scrub of *Halosarcia* species.
3. Dwarf scrub/heath of *Atriplex* and *Frankenia* species.
4. Open low woodland of *E. yilgarnensis* over dwarf scrub.
5. Tall shrubland/thicket of *Melaleuca* species.

Breakaway
1. Breakaway complex, with a low woodland of eucalypts.

Granite Exposure
1. Granite rock scrub.
2. Low woodland/thicket *Allocasuarina* and *Acacia* species.

Upland Plain
1. Tall shrubland of *Allocasuarina* and *Melaleuca* species.
2. Scrub of *Allocasuarina, Banksia* and *Callitris* species.
3. Low heath.
4. Low heath of *Dryandra* species.
5. Shrub mallee.
6. Low woodland of gimlet and merrit.
7. Woodland of salmon gum.

Valley Bottom
1. Low woodland of *E. yilgarnensis*.
2. Aeolian sand heath.
3. Woodland of *Melaleuca quadrifaria*
4. Dense shrub mallee of swamp mallet and broombush.
5. Shrub mallee/low heath of swamp mallet.
7. Open shrub mallee/low heath of York gum.
8. Open woodland of salmon gum.
9. Woodland of red morrel.
10. Open woodland of eucalypts.
11. Low woodland of salt river gum.

Weed species are rare on the Lake Hurlstone Nature Reserve, with only wild turnip (*Brassica tournefortii*) near farms and smooth catsear (*Hypochaeris glabra*) around granite rocks and salt lakes.

**Lake Varley Nature Reserve**

Lake Varley Nature Reserve (27928) is an A class reserve vested in the NPNCA for the conservation of flora and fauna. The reserve is 1,051 hectares and contains Lake Varley, a 967 hectare hypersaline seasonal lake. Above the water mark is an extensive area of samphire marsh that becomes damp in winter but has no surface water (Halse *et al.*, 1993). As the ground rises the marsh is replaced by eucalypt woodland.

**Maubralring Nature Reserve**

The Maubralring Nature Reserve (29835) was gazetted for the conservation of flora and fauna on June 27th, 1969 and vested in the NPNCA. The reserve is rectangular in
shape and covers an area of 52.1 hectares. It is located 1 km off Kuender Road, 33 km south south-east of the Kulin townsite on the shire boundary.

There are eight vegetation associations present on the Maublarling Nature Reserve (Coates, 1990). These have been summarised into the following main groups:

1. Blue mallet woodland: Low forest of blue mallet over low heath. A large area burnt in 1964-65 has good regeneration of blue mallet and recovery of understorey.
2. White mallet woodland: White mallet (Eucalyptus falcata) low woodland with scattered shrubs.
3. Mallee with varying dominant species over low heath, including E. conglobata and black marlock shrub mallee, merrit (E. flocktoniae) open tree mallee, and square-fruited mallee, salt river mallet and E. conglobata scrub mallee.

While the weedy species Aira cupaniana and Ursinia anthemoides were found, weeds were generally not a problem on the reserve.

The Maublarling Nature Reserve is diverse in associations and habitat types (Coates, 1990). It is also rich in plant species, with over 50 species recorded. The reserve is isolated and accessible only through neighbouring farm land, and there is very little human disturbance.

**Morton Nature Reserve**

The Morton Nature Reserve (31360) is an A class reserve vested in the NPNCA for the conservation of flora and fauna. This 114 hectare reserve is virtually pristine and has had minimal weed invasion.

Eight vegetation associations were identified on the reserve by Lyons (1988):

1. Mixed shrub mallee of red-flowered mallee and redwood over a mixed low shrub of Melaleucas.
2. Very open tree mallee of 6 m tall York gum over low woodlands of jam over dense herbs.
3. Open tall woodland of salmon gum over mixed tree mallee of various eucalypts.
4. Dense thicket of tamma over open herbs.
5. Low forest of blue mallet over thicket of Allocasuarina acutivalvis.
6. Mixed scrub mallee of various Eucalypts over open scrub of Melaleuca adnata.
7. Very open tree mallee of York gum over open low scrub of broombush.
8. Low woodland of blue mallet over low scrub of Melaleuca species.

**North Jitarning Nature Reserve**

The North Jitarning Nature Reserve (27979) was originally gazetted for the purpose of “Government Requirements” on February 18th, 1966. The reserve was reclassified as
an A class reserve for the conservation of flora and fauna on September 4th, 1970 and was vested in the NPNCA. The 44.5 hectare reserve is situated on the Williams-Kondinin Road north-east of the Jitarning townsite, and has a roughly triangular shape.

Coates (1990) identified six vegetation associations present on the reserve:

1. Wandoo woodland A: Open low woodland of wandoo over dense heath.
2. Wandoo woodland B: Open low woodland of wandoo over tamma dense heath.
3. Mallee area A: Squared-fruited mallee, tall sand-mallee and *Eucalyptus anceps* dense tree mallee. In the northern section the understorey is *Melaleuca undulata* low shrub.
4. Mallee area B: Open tree mallee of white-leafed mallee and ridge-fruited mallee over low heath.
5. *Melaleuca* heath: Low heath with *M. pungens* prominent and scattered white-leafed mallee and scattered shrubs of tamma and *Banksia sphaerocarpa*.

The North Jitarning Nature Reserve is of great value because the vegetation is diverse and rich in plant species, contains some nest hollows and provides resting sites for transient birds (Coates, 1990).

**Pederah Nature Reserve**

The Pederah Nature Reserve (30267) is a C class reserve vested in the NPNCA for the conservation of flora and fauna, and covers 403.2 hectares. There are several laterite ridges in the centre of the reserve, and the soils are a reddish gravelly loam. Until 1990 gravel was removed from pits on the reserve, but these are now rehabilitated.

Morrison (1970) described the upperstorey as dominantly mallee, with scattered taller eucalypts and a few scattered salmon gums. The lower storey consisted of *Acacias, Allocasuarinas, Dryandra* and other mallee scrub. Fauna observed included the western grey kangaroo, western brush wallaby and echidna, and nearly 30 bird species.

**Pingaring Nature Reserve**

The Pingaring Nature Reserve (23993) is a C class reserve of 66.7 hectares, and was reserved for the conservation of water, flora and fauna. To the south are two adjacent reserves (Water 18926 and Recreation 27574) that are bushland with an 18 hole golf course.

Atkins (1984a) identified 66 species in six vegetation associations on Pingaring Water Reserve:

1. Tamma scrub/thicket with *Hakea scoparia* and a sparse understorey.
2. Heath of *Hakea scoparia* and *Melaleuca cordata* over a low heath of a mixture of species.
3. Open shrub mallee of several eucalypts over a heath of tamma or Myrtaceae species.
4. Broombush heath over pincushions.
5. Granite associations - varies between pincushions and an open low woodland of sheoak over scrub and grasses.
6. Low heath of *Hakeas* and *Melaleuca* with other emergent shrubs.

Around the granite areas the soils are a brown sandy loam with some gravel in the south-east heath areas and white sands in the north-west. Fauna observed on the reserve included the western grey kangaroo and the western brush wallaby.

**Plain Hills Nature Reserve**

The Plain Hills Nature Reserve (36558) is a C class reserve vested in the NPNCA for the conservation of flora and fauna. Situated on Grays Road, the reserve covers an area of 217 hectares. The landscape has a gentle slope with an easterly aspect. The soil is a brown sandy gravel, with underlying laterite.

The vegetation consists of a heath 0.5 m tall, with no obvious dominants. Characteristic species include *Melaleuca subtrigona*, *Verticordia chrysantha* and *Isopogon teretifolia*, with over 120 flora species (Brown, 1984)

**Rose Road Nature Reserve**

The Rose Road Nature Reserve (34136) was gazetted for the conservation of flora and fauna on August 6th, 1976 and vested in the NPNCA. The rectangular reserve covers 49.7 hectares and is located 21.5 km south-east of the Kulin townsite on Rose Road.

There are eight vegetation associations present on the Rose Road Nature Reserve (Coates, 1990), which can be summarised into the following main groups:

1. York gum woodland: Low forest of York gum with scattered jam trees.
2. Jam woodland: Low forest of jam with scattered emergent York gum (7m).
3. Gimlet woodland: Low forest of gimlet with scattered shrubs.
4. Salmon gum woodland: Open woodland of salmon gum over an open shrub mallee of mirret over dwarf shrub.
5. Mallee: Varying dominance by merrit, mirret (*Eucalyptus celastroides*), swamp mallet (*E. spathulata*), tall sand-mallee and York gum tree mallee with varying grades of density.

The diverse vegetation within the Rose Road Nature Reserve provides numerous habitats for fauna including nest hollows. The reserve is isolated and supports a large number of resident and transient bird species. However, the lack of undergrowth in places may indicate past grazing of stock, which may have increased the susceptibility to infestation of weedy grasses in the jam and York gum woodlands.
South Kulin Nature Reserve

The South Kulin Nature Reserve (34833) was gazetted for the conservation of flora and fauna on August 26th, 1977 and vested in the NPNCA. Triangular in shape, the reserve covers 12.9 hectares and is located on the Williams-Kondinin Road 13 km south-south-west of the Kulin townsite.

Coates (1990) identified five vegetation associations on the South Kulin Nature Reserve:

1. Blue mallet woodland: Blue mallet low forest over dwarf shrub.
2. Mallee A: Open tree mallee of ridge-fruited mallee and black marlock over shrub over dwarf shrub.
3. Mallee B: Shrub mallee of tall sand-mallee and York gum over broombush heath.
4. Mallee C: A very open shrub mallee of white-leafed mallee over dense low heath.
5. Tamma thicket: Tamma dense thicket with emergent eucalypts.

Although the South Kulin Nature Reserve is small, it is diverse in plant associations and habitat types. It is of value as a resting site for transient birds. While there are no weeds recorded in the reserve, in the western corner there is a gravel pit into which blue metal has been dumped. Coates (1990) recommended that this area should be rehabilitated.

Sparks Road Nature Reserve

The Sparks Road Nature Reserve (13232) is an A class reserve vested in the NPNCA for the conservation of flora and fauna. This 20 hectare reserve contains an old dam that seasonally fills with water. The soils of the reserve range from white sands to yellow loam sands and some soils contain gravel.

Burbidge (1980) identified two vegetation formations that were most extensive on the reserve:

1. Open low woodland of sheoak and acorn banksia over an open low scrub and herbs.
2. Open low sedges over very open herbs. Scattered through this formation are a number of shrubs.

There is also an open low scrub of Acacia species, and wandoo are scattered throughout the reserve. Wallace (1981) observed some infestations of weeds such as Guildford grass (Romulea rosea).

Tapper Road Nature Reserve

The Tapper Road Nature Reserve (33713) is a C class reserve vested in the NPNCA for the conservation of flora and fauna. It covers an area of 116.8 hectares. Atkins
(1983) identified over 60 plant species, including six *Acacias*, three *Allocasuarinas*, seven eucalypts, eight *Melaleucas* and five *Verticordias*.

### 2.8 Roadsides

Roadsides can provide corridors between areas of remnant vegetation for the movement of wildlife. They are often the only remaining areas of some vegetation types and occasionally contain threatened species.

Well vegetated roadsides are also beneficial to agriculture. They provide windbreaks to adjacent farmland and shelter for stock.

The Roadside Conservation Committee (RCC) was formed in 1985, having evolved from the Road Verge Conservation Committee that originated in 1969. The RCC conducts surveys and inventories of the flora conservation value of roadside conservation. The RCC relies on the involvement of local communities and uses a qualitative approach to determine vegetation structure.

There are 1,572 km of road throughout the Shire of Kulin (Figure 2). The Roadside Conservation Committee (RCC) surveyed 137 km of roadside vegetation in 1987, only 9% of the roads in the shire. Roads surveyed include:

- Gorge Rock - Lake Grace Road
- Gnarning Road East
- Holland Track
- Kulin - Dumbleyung Road
- Pingaring - Varley Road
- Williams - Kulin Road.

### 2.9 Flora

The international fame of the flora of Western Australia derives not only from its rich and colourful array of species, but also from its uniqueness. The majority of species are found nowhere else in the world. In the south-west, around 75% of the 6,000 species are confined to the region, giving it one of the highest levels of endemism in the world (Hopper *et al.*, 1990). Investigations into the geographical distribution of Western Australia’s rare and threatened species have shown that they are concentrated in the wheatbelt and adjoining areas where there has been extensive clearing or modification of native vegetation.

The Shire of Kulin contains many unique plant species. Within the shire, several Declared Rare Flora and many Priority Flora species have been found. In addition, there is a rare localised population of jarrah that can be found at Jilakin Rock, the most eastern population found in the south-west.
Declared Rare Flora

Most of Western Australia's rare and threatened species have sporadic localised populations in the wild, and are therefore vulnerable to accidental destruction. However, their protection poses little direct financial burden on the informed and interested land owner.

Declared Rare Flora are any protected flora that the Minister for Environment considers to be rare, in danger of extinction or otherwise in need of special protection. They are declared by listing in the Governmental gazette to ensure their continued survival in the wild. Once a taxon has been gazetted as Declared Rare Flora no-one is permitted to take (gather, pluck, cut, pull up, destroy, dig up, remove or injure) it from wild populations anywhere in Western Australia without a permit approved by the Minister or delegated representative.

The following Declared Rare Flora have been reported within the Shire of Kulin (supplied by Department of Conservation and Land Management).

*Caladenia hoffmanii* subsp *graniticola* ms (Hoffman's Spider Orchid)
An orchid up to 30 cm high with a solitary leaf that rises from the base of the hairy stem and a tapering labellum that is curled only at the tip. Orchids are characterised by their stamens and style combined into a column. Occurs under tall shrubs and sheoaks on and around large granite outcrops. Found on land vested in the Minister for Water Resources for the purpose of water.

*Calectasia arnoldii*
A member of the Xanthorrhoeaceae, a family of monocotyledoneae angiosperms, *Calectasia* species have solitary flowers at the ends of short branches. Found on land vested in the NPNCA for the purpose of conservation of flora and fauna.

*Conostylis rogeri* (Kulin Conostylis)
A tufted herb with flat leaves 10 cm long and solitary yellow flowers in September. Occurs in sandheath near Kulin. Found on land vested in the NPNCA for the purpose of conservation of flora.

*Eremophila veneta* ms
Found on land vested in the NPNCA.

*Eremophila verticillata* (Whorled Eremophila)
Forms a low spreading shrub to 80 cm with a distinctive odour that is strong and slightly offensive. Plants have erect branches and narrow appressed leaves, and flowering takes place from October to January. Grows in brown powdery loam under open low eucalypt woodland. Found on private land.
Eucalyptus olivacea ms
Grows in sandy soils receiving runoff at the base of granite outcrops. Difficult to distinguish individuals as the mallees occur in “clump” formations. Found on land vested in the NPNCA for the purpose of conservation of flora and fauna.

Grevillea involucrata (Lake Varley Grevillea)
A spreading shrub to 0.5 m high and 2 m across with deeply divided leaves. Plants have a whorl of deep pink persistent bracts surrounding the flowers, and flowering takes place from June to July. Grows in shallow sand over laterite in open heath. Found on land vested in the NPNCA for the purpose of conservation of flora and fauna, and on road verges vested in the shire.

Tribonanthes purpurea (Granite Pink)
A dwarf perennial herb to 4 cm high. Flowers are solitary and glabrous, tubular and partially enclosed by two broad overlapping leaf-like bracts. Grows on seasonally saturated soil pockets on a few granite outcrops near Pingaring.

Verticordia staminosa subsp cylindracea var cylindracea (Wongan Featherflower)
A small spreading or sometimes upright columnar shrub to 60 cm high. Plants are distinguished by their solitary flowers with long protruding stamens, from June to August. Grows in shallow soils on granite outcrops between Wongan Hills and Lake Grace. Found on land vested in the Minister for Water Resources for the purpose of water.

Priority Flora

Many Western Australian plants listed as rare, endangered or threatened by various authors are not gazetted as Declared Rare Flora because of CALM’s stringent requirements for adequate field surveys to reliably assess conservation status (Hopper et al., 1990). To provide some priorities for survey of these plants, CALM maintains a Flora Priority List for species that have an uncertain conservation status and need more research, or have been surveyed but need to be monitored. This list ranks flora into four priority groups:

Priority 1 Taxa that are known from one or a few populations (generally less than five) of this species, living on land under threat. These species are under consideration for declaration as Declared Rare Flora but are in need of urgent further survey.

Priority 2 Taxa that are known from one or a few (generally less than five) populations, at least some of which are not believed to be under immediate threat.

Priority 3 Taxa that are known from several populations and are not believed to be under immediate threat.

Priority 4 Taxa that are considered to have been adequately surveyed and that, while being rare in Australia, are not currently threatened.
Once surveys have established the conservation status of listed species, a particular species may have been found to be abundant and under no present threat and its priority is decreased, or it may be gazetted as Declared Rare Flora.

The Shire of Kulin contains nearly 120 priority species on the Reserve List, including adjacent areas. Priority flora within and directly adjacent to the shire are listed in Appendix 9. Figure 14 illustrates the approximate locations of priority species in the Shire of Kulin.

Weeds

Weeds are any plants growing where they are not wanted. Introduced ("exotic") plants that replace the original native vegetation are environmental weeds. Weeds are undesirable from an ecological perspective but not necessarily from an economic one. Areas that have been long settled show the greatest number of weed species, especially if the site has been disturbed by grazing, logging, rubbish dumping, stock and vehicle movements.

Weedy exotic species that have invaded natural bushland in the Shire of Kulin include Guildford grass (Romulea rosea), soursob (Oxalis pes-caprae), wild oats (Avena sp.) and bridal creeper (Myrsiohyllum asparagoides) (Rhoda Giles, personal communication).

Weeds can have a major influence on native vegetation. Hussey and Wallace (1993) outline how weeds may negatively affect native vegetation:

- Competing directly with established native vegetation.
- Replacing diverse native vegetation communities with more uniform weed communities, and thus decreasing species composition.
- Inhibiting the regeneration of native plants through competition.
- Altering the nutrient cycling of natural communities.
- Altering the soil acidity.
- Altering the fire hazard.
- Changing the resources available for fauna by changing habitats or food availability.

2.10 Fauna

Animals commonly seen in the Shire of Kulin include western grey kangaroos, emus, echidnas, carpet snakes, race horse goannas and Gould's bats. Animals less commonly or rarely seen include the malleefowl, the bush turkey, the black swan, the smoker parrot, the dunnart, and the chuditch (Rhoda Giles, personal communication). Lists of animals observed in the Shire of Kulin provided by local residents and CALM can be found in Appendices 10, 11 and 12.
Some species have adapted to agricultural development and have increased in number, such as the twenty-eight parrot, the galah, the crested pigeon and the brush-tailed possum.

Extinction of wheatbelt fauna

The clearing of large tracts of natural bushland for agriculture, the introduction of exotic feral animals, alterations fire regimes and other disturbances have caused the local extinction of nearly 40% of the 42 species of mammals recorded in the wheatbelt since European settlement. Mammals in the wheatbelt region thought to be at high risk of extinction include the red-tailed phascogale, the numbat and the western mouse. The following descriptions are taken from Strahan (1988) *The Mammals of Australia*.

The Red-tailed Phascogale is largely arboreal, but appears to feed extensively on the ground. It is an opportunistic feeder, taking a wide range of insects, small birds and small mammals, particularly the feral house mouse (*Mus musculus*). It does not need to drink even during long periods of drought. Red-tailed phascogales are confined to isolated reserves that exceed 450 hectares, but can live in reserves as small as 65 hectares. They inhabit dense vegetation and have a preference for mature wandoon and rock sheoak communities, particularly when they are adjacent. Wandoon has an abundance of hollow logs and limbs that provide numerous nest sites, while rock sheoak communities have an almost continuous canopy that provides easy passage through the foliage. Red-tailed phascogales are threatened by fire that destroys the mature vegetation alliances of wandoon-rock sheoak and also by predation by foxes and cats.

The Numbat is strongly dependent on termites for food, restricting its habitat to areas where these insects are reasonably abundant. Its present habitat is eucalypt forest, particularly areas dominated by wandoon or jarrah, but it was earlier found in mulga woodland. These vegetation types provide the numbat with hollow logs and branches for its shelter, and provide food and support for termites. The numbat sleeps at night and feeds by day, an usual feature among marsupials and possibly response to the activities of its prey. It is the only member of the family Myrmecobiidae and the only marsupial adapted to feeding exclusively on colonial insects. Numbats are threatened by drought, predation by foxes and also by too frequent burning of their habitat.

The Western Mouse is a nocturnal herbivore, with a diet of fibrous plant material. It has a mixture of dark grey and yellowish-buff fur with greyish-white below and white paws, measuring 90-110 mm long and weighing up to 50 g. The western mouse has been collected from habitats greater than 200 hectares with extremely variable vegetation, including sparse low shrubland, tall dense shrubland, sparse to dense shrub mallee and mid dense woodlands, but these sites are consistently on sandy clay loam or sandy loam, frequently with a mixture of gravel. Dominant upper vegetation includes species of *Isopogon, Acacia, Allocasuarina, Melaleuca* and *Eucalyptus*.
Local extinctions

Local extinctions have been caused by numerous human disturbances of the natural environment, including the broadscale clearing of natural bushland for agricultural production, the introduction of stock and feral animals (including both grazing and predatory species), and alterations to fire regimes.

Table 6 lists several animals that were once common in the shire but have been reported to have since disappeared (Rhoda Giles, personal communication).

Table 6: Animals that are thought to have disappeared from the Shire of Kulin.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilby (or Dalgyte or Rabbit-eared Bandicoot)</td>
<td>Macrotis lagotis</td>
</tr>
<tr>
<td>Black-footed Rock Wallaby</td>
<td>Petrogale lateralis</td>
</tr>
<tr>
<td>Numbat</td>
<td>Myrmecobius fasciatus</td>
</tr>
<tr>
<td>Dingo</td>
<td>Canis familiaris dingo</td>
</tr>
<tr>
<td>Tammar Wallaby</td>
<td>Macropus eugenii</td>
</tr>
<tr>
<td>Double-banded Plover</td>
<td>Charadrius bicinctus</td>
</tr>
<tr>
<td>Eastern Curlew</td>
<td>Numenius madagacariensis</td>
</tr>
</tbody>
</table>

Threatened Fauna

Threatened and Priority Fauna are afforded special protection under the Wildlife Conservation Act 1950 that is administered by CALM. There are two major categories of specially protected fauna: Threatened and Priority. Threatened Fauna are rare or likely to become extinct and are declared under Schedules 1 to 4 of the Act. In the Shire of Kulin, the following Threatened Fauna have been found:

Schedule 1 - Some fauna that are rare or likely to become extinct, without implementing recovery actions such as fox baiting.

- **Chuditch (Dasyurus geoffroii)**
  The chuditch is a medium-sized predator and feeds on a wide variety of small mammals, birds, insects and carrion. It moves swiftly on the ground, climbs efficiently and digs or occupies existing holes in the ground. Activity is greatest around dawn and dusk. This Aboriginal name echoes the explosive call the chuditch makes when it is in an aggressive mood or is threatened; it is also known as the western quoll (Strahan, 1988).

- **Shortridge’s Mouse (Pseudomys shortridgei)**
  Shortridge’s mouse, also known as the heath rat, occurs almost exclusively in recently burnt, species-rich, dry heathlands. It is found in south-western Victoria and has virtually disappeared from WA where it was originally discovered (Strahan, 1988). Shortridge’s mouse colonises patches of suitable heathland when the initial flush of growth after fire provides adequate cover and then disappears when important food species decline. The survival of the species requires a
mosaic of areas of differing maturity. However, negative human impacts, such as reducing the size of bush remnants and imposing fire controls, have caused the disappearance of Shortridge’s mouse from much of its former range.

- **Malleefowl (Leipoa ocellata)**
  The big-footed malleefowl scratches soil and vegetation into a large mound to incubate their eggs. Males usually manage the mounds and control the incubating temperature by adding or removing material to the mound. A pair mates for life and inhabits a large territory. When pressed, malleefowls fly well but heavily. Malleefowls are camouflaged in open scrubby country by the black chest line that breaks up the bird’s pattern as it stands quietly among small mallee eucalyptus boughs.

**Schedule 4 - Other specially protected fauna.**

- **Peregrine Falcon (Falco peregrinus)**
  Peregrine falcons prey on ground-dwelling small vertebrates and insects. They have powerful bills and kill their prey by severing the neck vertebrae with a bite. Peregrine falcons breed on rock ledges on cliffs, exposed rock ledges, tree hollows or in disused stick nests of other species. Falcons are among birds most severely affected by pesticides. DDT affects the shell gland, causing egg-shell thinning and reducing reproductive success.

**Priority Fauna**

Priority Fauna are protected under the *Wildlife Conservation Act 1950*. Priority Fauna are under consideration for declaration as Threatened Fauna but need urgent survey and evaluation of conservation status. Priority Fauna are in need of special protection and are ranked into Priorities 1 to 4:

- **Priority 1**
  Taxa with few, poorly known populations on threatened lands, such as agricultural or pastoral lands, urban areas and active mineral leases.

- **Priority 2**
  Taxa with few, poorly known populations on lands that are not under immediate threat of habitat destruction or degradation, such as national parks, nature reserves, vacant Crown land and water reserves.

- **Priority 3**
  Taxa with several, poorly known populations, some on conservation lands and are not believed to be under immediate threat.

- **Priority 4**
  Taxa that are in need of monitoring. These are considered to have been adequately surveyed and not considered currently threatened, but could be if present circumstances change.

In the Shire of Kulin, two Priority Fauna have been found:

- The native bee (*Hyaleus globuliferus*) is a Priority 3 insect.
The western mouse (*Pseudomys occidentalis*) is a Priority 4 mammal.

**Western Shield**

Foxes and feral cats have contributed to the extinction of ten native mammals and decline of others in Western Australia. The mid weight range mammals are most at risk. These mid-weight range mammals have generally disappeared from smaller reserves. They are still found in larger reserves and this is why large reserves such as Dragon Rocks is baited. These mammals are at risk without measures to control cats and foxes. Native animals known to be preyed on by foxes and cats include the numbat, malleefowl, Gilbert's potoroos (*Potorous gilberti*), dibblers (*Parantechinus apicalis*), western ground parrot, western swamp tortoise, python, chuditch, brush-tailed phascogale, bilby (*Macrotis lagotis*), tammar wallaby, mardo, quenda, western pygmy possum, brushtail possum, ringtail possum, woylie, western brush wallaby, quokka, water rat and southern bush rat.

Western Shield is a program designed to bring Western Australia’s wildlife back from extinction by targeting foxes and feral cats. There are three major elements of the program: increasing fox baiting; increasing research and operations for feral cat control; and returning native animals to former habitats. Dried meat baits are injected with 1080 poison (pronounced ten-eighty), the manufactured version of the chemical compound sodium monofluoroacetate that occurs naturally in Western Australia in poison peas or *Gastrolobium*. Native animals have evolved with these poisonous peas and have developed high levels of tolerance to the poison and are not harmed by the baits containing 1080 poison.

Baiting foxes, captive breeding and reintroduction programs have resulted in increases in populations and security of small mammals, including the numbat, chuditch and red-tailed phascogale.

Baiting occurs in the northern section of the Dragon Rocks Reserve which is contained in the Shire of Kulin.

**Rabbit management**

Wild rabbits (*Oryctolagus cuniculus*) are a serious animal pest in Australia. They are responsible for extensive environmental damage. It has been estimated that rabbits cause an estimated $600 million of economic damage per year, including production losses and the cost of control (Coman, 1997). Rabbits have caused a loss of vegetation by eating tree seedlings and shrubs resulting in the failure of natural regeneration and a gradual loss of mature trees. Rabbits encourage soil erosion by burrowing, removing vegetation and disturbing soil, and often compete with livestock for pasture. In addition, rabbits have contributed to the extinction of many native plant and animal species, and continue to threaten native birds, mammals and insects that rely on plants for food and shelter.

The Rabbit Calicivirus Disease (RCD) aims to control wild populations by reducing numbers to a level so that long-term controls (such as myxomatosis) are more effective and cheaper. Other control measures that should be used in conjunction with
RCD include warren destruction by ripping, removal of pest plants that provide shelter (such as gorse, blackberry and boxthorn) and fumigation of warrens so they will eventually collapse from lack of use. RCD was officially released in 24 shires of Western Australia in October 1996, but spread naturally throughout the Kulin Shire.
3 Land Management and Degradation Issues

3.1 History

The wheatbelt of Western Australia has undergone extensive changes since the early 1900s when Europeans first settled the south-west of Australia. The most obvious change in the wheatbelt has been the removal of native vegetation for agricultural development, predominantly the cultivation of cereal crops, pasture grasses, and the grazing of stock (mainly sheep). The wheatbelt occupies about 14 million hectares of the south-west of Western Australia, 13 million hectares of which has been cleared of its original vegetation. Over half of the wheatbelt's native vegetation was removed after 1945. The remaining native vegetation is now restricted to remnants of varying sizes, shapes, vegetation associations, isolation, ownership and history of land use (Saunders et al., 1987).

Kulin was permanently settled between 1902 and 1912 and after 1912 clearing began.

The extensive removal of native vegetation, its replacement by exotic species, and the fragmentation and isolation of the remaining vegetation has resulted in the widespread loss of indigenous species from the wheatbelt. Conservation of much of the original wheatbelt biota, particularly those that depend on native vegetation for all or part of their resources, now relies on maintaining remnant native vegetation.

3.2 Current Land Use

The dominant land use in the shire is agricultural production. The type of production practices depends mainly on rainfall, and mostly consist of farming properties with varying proportions of sheep grazing and cropping. Other land uses include piggeries, emu farming and mallee plantations. A summary of agricultural production can be found on page 3.

3.3 Land Degradation

European settlement in the south-west of Western Australia and the subsequent clearing of native vegetation and its replacement with crops and pastures have given rise to various problems. These problems include land degradation, the loss of agricultural production and the loss of conservation values. The most obvious problems are associated with changes in hydrology, such as rising water tables that cause secondary salinity and waterlogging.
Rising water tables and salinity

Rising water tables are usually considered to be caused by increased recharge of groundwater. There is abundant evidence that clearing of deep-rooted perennial vegetation, and the introduction of shallow-rooted crops and pastures, has resulted in small increases in the rate of direct recharge from rainfall, and consequently the development of secondary salinity. A synthesis of WA salinity data found that 10% of the central and eastern wheatbelt was affected by salinity by 1994 (Ferdowsian et al, 1996). The extent of salinity is predicted to double in the next 15 to 25 years.

The development of secondary salinity requires both a source of salt and a transport process to move salt into the root zone of plants or to the soil surface. The major source of salt in the wheatbelt comes from the accumulation of salts from rainfall that originated off the coast of Western Australia. The salinity of rain is close to 10 mg/L on the west coast of WA, and over millions of years these salts have accumulated deep in the soil. When water tables rise, they redistribute the salts stored deep in the soil profile upwards. The evaporation and transpiration of such saline soil water in shallow water tables can further concentrate salts.

A soil is said to be saline when it contains a quantity of soluble salts that significantly reduces plant growth. Plants may experience water stress because the presence of salts in soil water lowers the partial free energy of water below that of salt-free water. This effect, known as osmosis, causes water to move out of the cell walls of plant roots into the more saline soil water. Hence, water vacates the plant roots, causing water stress that can inhibit growth, cause wilting and eventually death of plants.

The number of hectares affected by salinity in the Shire of Kulin increased from 1,760 hectares in 1979 to 4,254 hectares in 1989, more than a doubling of the land affected by salinity over ten years (George, 1990).

Biological methods used to decrease recharge and inhibit the increase in salinity include planting deep-rooted perennial vegetation, and adopting farming practices that utilise more water. While drainage and pumping methods can be used to drain limited areas of land, drainage water may be detrimental further down the catchment.

Waterlogging

A soil is waterlogged when it is completely saturated by water. Waterlogging results from poor internal and surface drainage, the inability of the soil to store much water and the low permeability of the subsoil. Waterlogging is exacerbated by the removal of deep-rooted perennial vegetation, rising water tables, cultivation and the compaction of soil by stock trampling and heavy machinery. It reduces plant growth, particularly where soils are affected by salinity.

Waterlogging is most prevalent in areas of above 400 mm annual rainfall. It is particularly common on duplex and clay soils in plains and valley floors with a high risk of inundation.
Waterlogging can be reduced by decreasing the amount of runoff entering the soil and by improving the internal drainage of soil by surface or underground drainage lines. This can be achieved by increasing the uptake of water by plants and re-establishment of deep-rooted perennial vegetation. Contour banks can be used in some circumstances provided water can be disposed of safely.

**Acidity**

Soils in the Agricultural Zone of Western Australia are becoming more acidic as a result of farming practices, such as the use of ammonium-based fertilisers and clover pastures (non- legume). Acidification can inhibit the growth of roots of both native and pasture plants (State of the Environment Report, 1992).

Acidic soil can reduce plant cover because it leads to a very high availability of aluminium in soil that reduces or inhibits root growth. Consequently, acid soils are more susceptible to degradation by wind and water erosion and produce more salinity downhill than other soils.

Efforts to ameliorate soil acidity include the rotation of legume-based pastures with non-legume pastures, reduction in the use of chemical fertilisers, and the application of lime. It has also been found that acidification is less under deep-rooted perennial vegetation.

**Soil compaction**

Soil compaction by stock and heavy farm machinery is a major degradation problem experienced by many wheatbelt shires. Stock and heavy machinery compress the soil and prevent infiltration of both water and air, reducing root development. This results in reduced plant growth and an increase in wind and water erosion. It is possible to rectify this situation by deep ripping, using lighter farm machinery and restricting machinery traffic by applying minimum or zero tillage to establish crops. Fencing remnant vegetation will prevent stock causing soil compaction in the bush.

**Wind erosion**

The eastern wheatbelt is particularly susceptible to wind and water erosion because of the special hazards of summer and autumn thunderstorms, more frequent cropping and sparser vegetation cover.

Wind erosion is the removal of topsoil by the wind and deposition downwind. Soil that is removed can be blown over crops; or into streams, rivers and lakes, polluting the waterbodies with sedimentation and nutrients.
Susceptibility to wind erosion is related to the moisture content of soils; wet soils do not blow. Wind erosion occurs on agricultural land in two periods. These are late summer because of the grazing of dry pasture and in early winter due to the cultivation of soil for cropping. Wind erosion results from the exposure of the soil by the destruction of ground cover, leaving the surface soil loose and fine, and strong winds. Plant cover is reduced by grazing, cultivation, burning, trampling, herbicides, drought, acidity and salinity. Soil may be loosened by trampling, weed control, cultivation, harrowing or seeding, and lack of rain after cultivation can leave the soil loose and powdery.

The three major processes of wind erosion are related to the size of the individual soil particles (Hunt and Gilkes, 1992). Surface creep is the rolling or sliding along the soil surface of large particles. Saltation is the bouncing of medium sized soil particles. Suspension is the movement of dust particles parallel to the ground surface and upward, that may be carried hundreds of kilometres.

Wind erosion can be reduced by appropriate grazing management, farming according to soil type, modifying tillage, direct seeding into stubble, and the establishment of windbreaks. Windbreaks present a barrier to wind movement and reduce wind velocity, help bind the soil thus making it less susceptible to wind damage, and trap drifting soil (Figure 14). Windbreaks should be several rows wide at right angles to the prevailing wind, and consist of a mix of both trees and understorey (Oates, 1995). If appropriately designed, windbreaks can also serve as wildlife corridors linking areas of native vegetation.

Figure 14: The effect of a windbreak on wind velocity. Wind is deflected upward by the trees and is slowed down even before reaching them. On the leeward side further reduction occurs, and the effect may be felt as far away as 20 times the height of the trees.
Water erosion

Water erosion results from surface runoff that reduces or prevents the infiltration of water into the soil. It results in fertility loss, reduced crop yield and siltation of waterways. There are six major factors that affect water erosion:

1. Rainfall and runoff - the amount of rainfall, its intensity, and the seasonal distribution.
2. Soil erodibility - the inherent erodibility of a soil, affected by its infiltration capacity and structural stability.
3. Length of slope – the greater the extension of the inclined area, the greater the concentration of the flooding water.
4. Slope gradient or steepness – a larger gradient increases the velocity of the water and the amount of water likely to run off.
5. Cover and management – the influence of cropping systems and management variables on soil loss, determined by the crop being grown, crop stage and tillage method.
6. Erosion control practice – reflects the benefits of contouring, strip cropping, alley farming and grassed waterways.

The three main types of water erosion are sheet, rill and gully. Sheet erosion is relatively uniform erosion from every part of the slope. Rill erosion is initiated when the water concentrates in tiny channels (rills) as it runs off the soil. Gully erosion creates deep channels that are formed by undermining and downward cutting and cannot be erased by cultivation. Although gully erosion looks more catastrophic, the less obvious sheet and rill erosion cause a greater total loss of soil.

3.4 Clearing

The Shire of Kulin has been extensively cleared since 1912, and there remains a small area of original native vegetation cover on farms and public reserves. Much of the native vegetation that remains was set aside by the government as Crown reserves, water catchments and sites of gravel extraction. Many of these small patches of native vegetation were designated by the government as conservation reserves in the 1960s and 1970s. However, their conservation value varies; most patches of vegetation that are now conservation reserves are fragmented and represent only a very small percentage of the region's vegetative cover.

Current clearing guidelines recommend that for an area receiving an annual rainfall of 500 mm or less (such as the Shire of Kulin), the minimum proportion of native vegetation considered necessary to uptake sufficient groundwater to ensure water tables remain stable is 20% (Holm, 1994). Currently, the shire has 12% remnant native vegetation cover (Beeston et al., 1994).
The State government and local government authorities have undertaken several actions to address the clearing of native vegetation. Clearing of vegetation on private land is currently under the control of the Soil and Land Conservation Act. This Act requires all landholders to give notice of their intent to clear land greater than one hectare to the Commissioner of Soil Conservation and to advertise in the *West Australian* newspaper. The guidelines for assessing notices of intent are aimed at preventing further land degradation problems (Select Committee into Land Conservation, 1992). In addition, many local government authorities have implemented planning schemes that give them scope to effectively control the clearing of land.

### 3.5 Revegetation

Revegetation of trees and shrubs is being undertaken in some areas of the wheatbelt as part of the solution to land degradation and loss of water quality. Revegetation is carried out for a variety of reasons (Lefroy *et al.*, 1991):

- to reclaim already degraded areas
- to prevent further degradation, such as wind and water erosion, salinity and waterlogging
- to beautify the landscape
- to provide habitat for wildlife
- to increase the productivity of farm land by providing windbreaks and shelter belts for plants and animals
- to provide a future renewable source of income, such as firewood, honey and wildflowers.

A barrier to replanting in the past has been a lack of information about revegetation methods and what to plant. Many people are now focusing on local native plants for the following reasons:

- a large choice of species enables matching of plants to sites and revegetation goals
- introduced plants may become weeds
- the natural combination of local plants maintains biodiversity, provides natural habitat values and is probably best for local fauna
- local species provide regional identity
- local species appear to be robust in the long term.

In conjunction with the herbarium, it is hoped that the species lists provided in this handbook will encourage the use of local plants throughout the Shire of Kulin.

*The Revegetation Guide to the Central Wheatbelt* by Lefroy, Hobbs and Atkins (1991) attempts to address land degradation problems by providing an understanding of soils and matching plants to soils. This resource book is particularly useful because it provides colour photographs of many of the recommended plants and revegetation hints.
3.6 Managing Existing Vegetation

Protecting existing vegetation is often easier and is considered to be a greater priority than revegetation. These remnants of natural systems will be the building blocks for future revegetation. The survival of existing bushland, which is often in small fragmented patches, is affected by a number of different factors including:

- grazing by stock in unfenced bush (passive clearing)
- changes in hydrology
- increased exposure to the elements
- increased fertiliser regimes
- herbicides
- pests and weed invasion.

Native plants are often choked or covered by fast growing introduced plants that become weeds when they escape from pastures or gardens. Weeds compete with native vegetation for nutrients and water, increase the risk of fire and often do not provide the food and shelter that native fauna need.

Specific recommendations for managing existing vegetation are provided in *Managing your Bushland: A Guide for Western Australian Landowners* (Hussey and Wallace, 1993).
4 Bringing it all Together

4.1 Landcare Progress

There are two Land Conservation District Committees (LCDC) in the Shire of Kulin; the Kulin and Pingaring LCDCs. These two LCDCs and the six catchment groups are the focus for improving land management for both agricultural sustainability and nature conservation in the Shire of Kulin.

The Kulin LCDC was formed in 1990, and meets two to four times a year. The Kulin LCDC has been able to attract support and funding from diverse sources such as:

- Alcoa Trees for Community Groups Program for 15,000 seedlings in 1991;
- National Landcare Program (NLP) for $1,400 for a Satellite Image in 1990;
- Understanding Local Conservation Initiative for $300 for educational material and white board in 1992-93;
- National Soil Conservation Program (NSCP) grant for $10,000 for a drilling rig to share with Lake Grace and Kondinin;
- Grain Pool of WA for $100/year from 1991 to 1996.

The Shire of Kulin has also received external support from the NLP Land and Water program for over $50,000 for community funding 1984-1994.

There are six catchment groups within the Kulin Land Conservation District. The following brief outline of their activities was taken from Summary of Catchments in the Kulin Shire by Claudia Hadlow, Kulin LCDC Coordinator, November 1997.

**West Kulin** This was a large catchment that experienced vastly different issues across its range. Landcare activities were prominent throughout the mid to lower catchment. Revegetation with native and fodder trees was undertaken on susceptible areas in the lower catchment. Several farmers received a Plants for Conservation Grant in 1994-95 of 1,170 seedlings for “Linking of remnant bush to create a green corridor”. It was been split into the Upper and Lower West Kulin catchments because of its large size. Catchment activity has increased since this time.

**Upper West Kulin** Formed from the splitting of West Kulin Catchment into two smaller groups. Conducted several field days, including a tour of Lake Toolibin. No surface salinity has been observed in the upper reaches of the catchment, but there is a large area threatened by the rising water table.

**Lower West Kulin** Formed from the splitting of West Kulin Catchment into two smaller groups. Small but active group that has implemented tree planting, contouring, drainage and the fencing of remnants for over 5 years. In consultation with a drainage contractor, has submitted a Notice of Intent (NOI) in November 1997 to commence deep-drainage in 1998.
**Walyurin** A recently formed and very enthusiastic group covering 14,000 hectares. This group applied for funding in 1997 to the State Revegetation Scheme (SRS) but was rejected due to unavailability of GIS information to present adequate maps. They have since purchased maps and have manually collated information.

**Traysurin Hill** This catchment is located east of Dudinin.

**South Kulin** This is a large catchment that includes several tributaries and includes over 15 properties. The catchment group is very enthusiastic because of the urgency of the salinity problems occurring along the valley floor. Activities have included a bus tour of the catchment and a planning workshop that included a presentation on oil mallee. The catchment previously included a separate East Kulin Catchment that extended to Jilakin Lakes, originally formed to deal with valley floor drainage and the rising water table. Its activities included the 1992 LCDC Tree Planting on the Main Creek System at Baldocks’ Crossing and surface water control and revegetation (including alley plantings) on individual properties.

**Fence Road** Half of this 40,000 hectare catchment of the Blackwood Basin is contained within the Shire of Dumbleyung. Formed in 1992, this very active group has held Farm Planning Workshops, Soils Information days, drainage information days, piezometer installation, magnometer demonstrations and a World Geo Science Salt map information day and installed piezometers. In 1995, a part-time coordinator was employed with NLP, shire and farmer contributions. Eight farmers from the Shire of Kulin received $14,935 under the State Revegetation Scheme in 1996. In 1997, a grant from the Gordon Reid Foundation of $24,090 funded projects such as a flora and fauna survey of 3 farm sites and 3 reserves, revegetation of 6 km of a widened road reserve, 10 km of fencing of farm remnants and local seed collection with assistance from the ACTIV Foundation. A survey of honeyeater pollination of revegetated sites is continuing under the Kings Park specialised program. Monitoring of water levels and salinity is now conducted monthly with an increase in the number of piezometers throughout the catchment in 1998.

The Pingaring Land Conservation District Committee (LCDC) has been active for over ten years (Ian Wyatt, personal communication). Projects that have received funding grants in the past include:

- The installation of 30 piezometers to demonstrate and monitor fluctuations in the local water table.
- The purchase of a tree-planting machine for use by members of the group in catchment and individual landcare activities.
- Bus tour of Wickepin catchment and Lake Toolibin.
- Tree planting along the railway line.

Both the Kulin and Pingaring LCDCs welcome inquiries from anyone who is interested in forming or joining a local catchment group.

The “Lake Grace Landcare Survey 1996” was conducted to measure landcare attitudes and practices of landholders (Curtin et al., 1996). Ninety-eight farmers were
randomly selected from the Shires of Kondinin, Kulin, Lake Grace, Kent and eastern Dumbleyung. When asked what were the main factors inhibiting people from carrying out more landcare activities, 61% suggested a lack of money or financial incentive, 11% stated a lack of time, while 8% thought it was not necessary. Table 7 presents a portion of the main results from the survey.

**Table 7:** Respondents answers to landcare questions from the “Lake Grace Landcare Survey 1996” (summarised from Curtin *et al.*, 1996).

<table>
<thead>
<tr>
<th>Issue</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shire and LCDCs</td>
<td>52% did not know what LCDC they were administered by.</td>
</tr>
<tr>
<td>Catchment Groups</td>
<td>58% previously been involved in a catchment group.</td>
</tr>
<tr>
<td></td>
<td>49% had a farm plan, and 69% of these had started to implement the farm plan.</td>
</tr>
<tr>
<td>Remnant Vegetation</td>
<td>Each farm had an average of 10% of remnant vegetation.</td>
</tr>
<tr>
<td></td>
<td>55% of farm remnants were fenced.</td>
</tr>
<tr>
<td></td>
<td>58% had self-funded fencing of remnants.</td>
</tr>
<tr>
<td>Wind/Water Erosion</td>
<td>3% considered water erosion was major problem.</td>
</tr>
<tr>
<td></td>
<td>Farm protected with earthwork structures:</td>
</tr>
<tr>
<td></td>
<td>• 22% had more than half of their farm protected,</td>
</tr>
<tr>
<td></td>
<td>• 30% had between 10 and 50% protected,</td>
</tr>
<tr>
<td></td>
<td>• 32% had no banks.</td>
</tr>
<tr>
<td></td>
<td>10% considered wind erosion was major problem, 28% slight problem, 51% not a problem.</td>
</tr>
<tr>
<td></td>
<td>To control wind erosion:</td>
</tr>
<tr>
<td></td>
<td>• 85% used grazing management,</td>
</tr>
<tr>
<td></td>
<td>• 72% used stubble retention,</td>
</tr>
<tr>
<td></td>
<td>• 48% used wind breaks,</td>
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<tr>
<td></td>
<td>• 27% used no till,</td>
</tr>
<tr>
<td></td>
<td>• 20% used fencing off.</td>
</tr>
<tr>
<td>Salinity/Groundwater</td>
<td>Average area of salinity was 6% of farm.</td>
</tr>
<tr>
<td></td>
<td>Salinity on farm:</td>
</tr>
<tr>
<td></td>
<td>• 29% had none,</td>
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<tr>
<td></td>
<td>• 10% had more than 30% affected,</td>
</tr>
<tr>
<td></td>
<td>• 2% had more than half affected.</td>
</tr>
<tr>
<td></td>
<td>54% thought the amount of salinity on their farm would not change in next 10 years.</td>
</tr>
<tr>
<td></td>
<td>To control rising groundwater:</td>
</tr>
<tr>
<td></td>
<td>• 59% used revegetation,</td>
</tr>
<tr>
<td></td>
<td>• 43% used contour banks,</td>
</tr>
<tr>
<td></td>
<td>• 19% used salt bush/fodder shrubs,</td>
</tr>
<tr>
<td></td>
<td>• 12% used deep drains,</td>
</tr>
<tr>
<td></td>
<td>• 11% used high yielding crops,</td>
</tr>
<tr>
<td></td>
<td>• 6% used perennial grasses,</td>
</tr>
<tr>
<td></td>
<td>• 5% used lucerne.</td>
</tr>
<tr>
<td></td>
<td>31% monitor groundwater levels on farm.</td>
</tr>
</tbody>
</table>
Tree Planting

<table>
<thead>
<tr>
<th>Number of trees planted per year:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 3% planted over 5000,</td>
</tr>
<tr>
<td>• 20% planted 1000-5000,</td>
</tr>
<tr>
<td>• 43% planted 1-1000,</td>
</tr>
<tr>
<td>• 34% planted none.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location of tree planting:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 43% along fence lines,</td>
</tr>
<tr>
<td>• 35% as windbreaks,</td>
</tr>
<tr>
<td>• 32% along creek lines,</td>
</tr>
<tr>
<td>• 4% as corridors linking remnants.</td>
</tr>
</tbody>
</table>

Soil Acidity

<table>
<thead>
<tr>
<th>70% test pH on farm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>71% considered soil acidity as no problem at present.</td>
</tr>
<tr>
<td>28% considered soil acidity as slight to major problem.</td>
</tr>
</tbody>
</table>

Remnant fencing and tree planting - individual efforts

Several individuals have received assistance under the Remnant Vegetation Protection Scheme. From 1989 to 1997, more than 100 km of fencing was funded to protect over 1,100 hectares of native vegetation in the shire. Other funding bodies have also provided funding for individuals and groups undertaking conservation activities over the years (see Appendix 13).

The Kulin community has not relied solely on external funding to conduct landcare or bushcare activities. For example, farmers have erected 722 km of fencing around bush remnants in the last six years without external funding assistance (Claudia Hadlow, personal communication). The ABS survey of 1995-96 found that 1,446 hectares of remnant vegetation on private land was protected with 29.3 km of fencing, in that year.

A survey of local farmers estimated that in the last six years over 185,000 trees were planted on 30 farms, and an additional 20,000 trees were planted in community projects (Claudia Hadlow, personal communication). The ABS found that in the year 1995-96 at least 39,630 tree seedlings were planted and planted trees were isolated with 98.4 km of fencing (ABS, 1995-96).

Another method of estimating the level of tree planting activity throughout the Shire of Kulin is from the sale of seedlings from local nurseries. In 1997, the Dunroven Tree Nursery in Kulin sold an estimated 50,000 tree seedlings. These seedlings included a mixture of both trees and understorey species, such as *Eucalyptus, Allocasuarina, Melaleuca, Acacia* and various other species (Table 8). Most of the seedlings sold by the nursery are salt tolerant and are used specifically for land remediation activities.
Table 8: A rough breakdown of the number of particular species sold in 1997 by the Dunroven Tree Nursery, Kulin.

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Notes</th>
<th>Number of Seedlings</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Casuarina obesa</em></td>
<td>Swamp sheoak</td>
<td>Salt tolerant</td>
<td>4,000</td>
</tr>
<tr>
<td><em>E. kondininensis</em></td>
<td>Kondinin blackbutt</td>
<td>Shade and very salt tolerant</td>
<td>4,000</td>
</tr>
<tr>
<td><em>E. loxophleba</em></td>
<td>York gum</td>
<td>Salt tolerant</td>
<td>1,500</td>
</tr>
<tr>
<td><em>E. sargentii</em></td>
<td>Salt River mallet</td>
<td>Salt tolerant</td>
<td>3,500</td>
</tr>
<tr>
<td><em>E. spathulata</em></td>
<td>Swamp mallet</td>
<td>Fast growing</td>
<td>4,000</td>
</tr>
<tr>
<td><em>E. camaldulensis</em></td>
<td>River gum</td>
<td>Victorian, shelter and windbreak</td>
<td>3,000</td>
</tr>
<tr>
<td><em>E. occidentalis</em></td>
<td>Flat-topped yate</td>
<td></td>
<td>3,500</td>
</tr>
<tr>
<td><em>E. leucoxylon</em></td>
<td>Rosea</td>
<td>Easy to grow</td>
<td>3,800</td>
</tr>
</tbody>
</table>

4.2 Past and Future Projects

During the past six years there has been significant landcare and conservation activity in the Shire of Kulin.

The Kulin-Kondinin Herbarium was opened in 1995 and is housed in the Old School, Day Street. It now houses over 300 specimens collected over the two shires that are all referenced with the State Herbarium (Appendix 4). The Kulin-Kondinin Herbarium provides both an educational resource and expertise in flora identification.

The Friends of Jilakin Rock were involved in the development of the Jilakin Rock Management Plan in conjunction with CALM and the Shire of Kulin in 1996. The volunteer members of this group have been involved in the protection of jarrah seedlings and the removal of weeds from the reserve over several years. A grant was received by the group to lay gravel paths and erect bollards to restrict vehicle traffic through the reserve and protect emerging jarrah seedlings.

The Shire of Kulin has an ongoing project of reinstating gravel pits on private land. Of the 50 gravel pits in the Shire, seven have been rehabilitated. This involves the removal of gravel and planting local species on the site. The Shire Council plans to continue this work in the future. For more information, contact Len Hobson, Shire Engineer.

Projects to be commenced in 1998

The Kulin LCDC applied for Natural Heritage Funding in 1998-99 to employ a Vegetation Management Officer (VMO) for the Kulin Region, in partnership with the Shire of Kulin, the Kulin-Kondinin Herbarium Group, CALM and the local community. Based at the Kulin Landcare Centre, the VMO will be instrumental in the development of an ecologically and economically sustainable vegetation management plan for Kulin. The VMO will coordinate nature conservation projects.
in the Kulin region that will be catalytic in the adoption of on-farm nature conservation activities. The expected environmental outcomes of the activities of the VMO will be an increase in the area of protected native bush, the protection of existing flora and fauna, and the creation of wildlife habitats.

The Walyurin Catchment applied for funding from the State Revegetation Scheme in 1998-99 for their project “Walyurin Catchment Revegetation and Rehabilitation Conservation Project”. This project aims to protect 63 hectares of native bush from livestock with 28 km of fencing, in a catchment with less than 10% of native vegetation remaining in the landscape. It also aims to establish 45 hectares of vegetation with 18,300 seedlings, using a mix of 18 local plant species. This project will help to minimise recharge, buffer existing remnant bushland, and provide and extend wildlife habitats. The use of deep-rooted perennials aims to prevent wind and water erosion by stabilising the soil structure.

The Pingaring LCDC has recently undertaken a project that aims to reclaim sandplain seeps in the catchment. Small seeps on hills that are associated with waterlogging will be ameliorated by planting trees above the seepage patches. Such patches are generally 2–3 hectares, and the seedlings will be fenced for protection from grazing. The group has received assistance from the Swan-Avon ICM, which has contributed 50% of the cost of seedlings and fencing material.

The Fence Road Catchment has many projects underway and commencing in 1998. The catchment was selected as a Focus Catchment under the Salinity Action Plan and is currently undergoing the process of intensive consultation. Continuing projects in 1998 include a legume trial, fox and rabbit baiting, and bird monitoring in conjunction with Birds Australia. The Water Harvesting Project funded by a grant from the Blackwood Basin Group involves the collection of saline water in dams for black bream and trout aquaculture, fencing of remnants and planting trees and salt tolerant species to assist in the recovery of saline land. The catchment submitted four applications to the RVPS for fencing assistance of various sites in 1998. One such site is Taylor’s Bush, a remnant of 100 hectares where the Wildflower Society and catchment members will conduct a flora survey in August 1998.

The Sustainable Seed Banks Project aims to establish a resource base of local provenance seeds of native vegetation to be used in local revegetation activities. The project is jointly funded by Greening WA and the Natural Heritage Trust. By the end of 1998, the project aims to establish 25 seed banks and 12 seed orchards throughout the agricultural region that will be community owned and operated. Greening WA will provide community groups involved in the project with materials, technical advice and training in plant identification, seed collection and orchard establishment.

4.3 Landcare Support

There are a number of groups and funding bodies that provide support for landcare activities, in addition to the LCDCs and catchment groups.

The Avon Working Group was established in 1995. The group provides financial, human and technical resources to undertake catchment planning, farm planning and
demonstration of rehabilitation techniques that tackle soil and water degradation problems.

A list of programs of support and/or funding aimed at land and nature conservation and the contact details are found in Appendix 13.

4.4 Future Directions

There are several activities complementary to conventional agriculture that can generate extra dollars to supplement farming incomes. Many Western Australian farmers are earning money by capturing economic benefits from selected sustainable uses of remnant vegetation. Possible sustainable economic uses of remnant vegetation include:

- Wildflowers
- Ecotourism (camping, nature trails)
- Native plant seed collection
- Timber for fences and structures
- Firewood
- Brushwood
- Honey production (and other apiary products)
- Tree fruits
- Essential oils
- Charcoal
- Tannins
- Stock and crop shelter
- Water quality and salinity control
- Soil stabilisation (against wind and water erosion)
- Insect control (by resident insectivores)

Table 9 presents a comparison of the returns of several remnant vegetation enterprises with returns from conventional agriculture. When making such comparisons, four issues should be considered:

1. Not all farms are suitable or capable of achieving these returns. Factors that affect this suitability include soil type, climate, composition of the bush, distance to market and accessibility to main tourist routes.

2. Many remnants were deliberately left because they were located on areas that have poorer soils or were difficult to clear. Such areas were deemed unsuitable for conventional agriculture, but returns from remnant vegetation enterprises on this “unproductive” land may provide additional income.

3. Many remnant bush activities take place when there is a lull in conventional farm activities. Therefore returns from remnant vegetation enterprises can be viewed as an additional source of farm returns.
4. The economic returns from remnant vegetation enterprises do not include indirect environmental benefits, such as:
   - Stock and crop shelter
   - Soil stabilisation against wind and water erosion
   - Water conservation and salinity control
   - Natural pest control from resident insectivores

Table 9: The net cash operating returns for sustainable vegetation enterprises in the Western Australian wheatbelt compared to net cash returns from conventional agricultural enterprises (1992-93). Adapted from ACIL (1993).

<table>
<thead>
<tr>
<th>Use</th>
<th>$ per operator day worked</th>
<th>$ per hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wildflower production</td>
<td>up to 248</td>
<td>124-232</td>
</tr>
<tr>
<td>Ecotourism</td>
<td>50-90</td>
<td>5-1,500</td>
</tr>
<tr>
<td>Timber products</td>
<td>Fence posts</td>
<td>152-575</td>
</tr>
<tr>
<td></td>
<td>Firewood</td>
<td>63</td>
</tr>
<tr>
<td>Brushwood</td>
<td></td>
<td>10-100</td>
</tr>
<tr>
<td>Native plant seed collection</td>
<td></td>
<td>16-120</td>
</tr>
<tr>
<td>Cropping</td>
<td></td>
<td>150-244</td>
</tr>
<tr>
<td>Sheep</td>
<td>(1992-93)</td>
<td>12-31</td>
</tr>
<tr>
<td>(long term)</td>
<td></td>
<td>26-95</td>
</tr>
</tbody>
</table>

Remnant vegetation improves the aesthetic appeal of the property landscape and improves the resale value of a property. Even if there is no current economic use of the remnant vegetation, it provides the opportunity in the future to make these returns and realise the economic benefits. This can be particularly important during periods of cyclical downturn in farming activities. Future generations can benefit from the flexibility that remnant bush provides, particularly if new products are developed that require raw materials sourced from native plants. For example, researchers from an American drug company investigated tail bush (*Anthocercis littorea*), a common plant in coastal scrub, to see if a chemical it contains could be useful as a drug for the treatment of AIDS (*West Australian*, 1990).

Many of the endangered plants of Western Australia have yet to be investigated for their economic or other uses. Some are well established in cultivation as attractive garden plants and are sold in nurseries (Hopper *et al.*, 1990), for example:
   - *Acacia guineetii*
   - *Eremophila denticulata*
   - *Eucalyptus rhodantha*
   - *Kennedia macrophylla*

**Bushfoods**

There is a huge variety of native plants with edible parts in Western Australia (Table 10). Bushfoods have been shown to be highly nutritious, more so than their farmed European relatives. Bushfoods have created great interest in restaurants, catering and
food manufacturing. Some bushfoods are more readily available to consumers than others. For further information, see the reading list and contact information. *Australian Bush Foods* magazine is published bimonthly and contains current information about growing, purchasing and preparation of bushfoods.

The management of native vegetation can serve two purposes: restoration, landcare and commercial production. Both objectives support the management of the whole ecosystem, from trees and shrubs to herbs and grasses. In recognising the value of our own home-grown resources, there is potential to create unique international markets for Australian products, with a range of cultural, social, economic and environmental benefits (Council of Aboriginal Reconciliation, 1994).

**Table 10:** Examples of bushfoods that may occur naturally or could be cultivated in the eastern wheatbelt. Adapted from J. Robins (1996) *Wild Lime*.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Species Name</th>
<th>Uses</th>
<th>Growing Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bush Tomato</td>
<td><em>Solanum centrale</em></td>
<td>Dried ripe fruit with spicy piquant flavour used as spice or flavouring rather than as a tomato.</td>
<td>Small hardy shrubs widely dispersed throughout inland Australia, in sandy warm and dry conditions.</td>
</tr>
<tr>
<td>Quandong</td>
<td><em>Santalum acuminatum</em></td>
<td>Fleshy fruit is made into jam and stewed fruit, similar to apricots.</td>
<td>Found throughout the wheatbelt.</td>
</tr>
<tr>
<td>Bush Cucumber</td>
<td><em>Cucumis melo subsp agrestis</em></td>
<td>Ripe flesh inside the green cucumber fruit, smaller version of traditional cucumbers.</td>
<td>Grows extensively in wild throughout the outback.</td>
</tr>
<tr>
<td>Appleberry (Karrawang)</td>
<td><em>Billardiera scandens, B. cymosa, B. longiflora.</em></td>
<td>Berry fruit is dull forest green in colour (like Kiwi fruit), tasty raw, or cooked as sauce for pork, veal and chicken.</td>
<td>Coastal forests of QLD and south-west WA.</td>
</tr>
<tr>
<td>Samphire</td>
<td><em>Sarcocornia quiqueflora</em></td>
<td>Succulent fleshy stems used as vegetable and a salt substitute.</td>
<td>Coastal and inland.</td>
</tr>
<tr>
<td>Cumbungi (Bulrush)</td>
<td><em>Typha domingensis, T. orientalis.</em></td>
<td>Shoots used in salads or steamed like artichokes, stems like leek, pollen like saffron with nutty flavour.</td>
<td>Throughout all Australian States along waterbodies.</td>
</tr>
<tr>
<td>Common Name</td>
<td>Species Name</td>
<td>Uses</td>
<td>Growing Conditions</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------</td>
<td>-------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Wattleseed</td>
<td>various <em>Acacia</em> species.</td>
<td>Pods are steamed or roasted, ground then used in baking, ice-cream and savoury sauces.</td>
<td>Throughout Australia.</td>
</tr>
</tbody>
</table>
5 Local Contacts

Kulin Landcare Office.
Coordinator: Claudia Hadlow.
Kulin Memorial Hall, Johnston Street, Kulin. PO Box 205, Kulin 6365.
Telephone (08) 9880 1056. Fax (08) 9880 1057.

Kulin Land Conservation District Committee.
Secretary: Mrs Patricia Tyson. C/- PO Kulin 6365.
Telephone/Fax (08) 9889 8011.

Pingaring Land Conservation District Committee.
Secretary: Ian Wyatt. PO Box 13, Pingaring WA 6357.
Telephone (08) 9886 8060.

Upper West Kulin Catchment Group.
Rod and Jo Lewis. C/- PO Kulin 6365.
Telephone (08) 9880 9026. Fax (08) 9880 9038.

Lower West Kulin Catchment Group.
David Meikle. C/- PO Kulin 6365.
Telephone (08) 9880 9015. Fax (08) 9880 9040.

Walyurin Catchment Group.
Trish Tyson. C/- PO Kulin 6365. Telephone/Fax (08) 9889 8011.
Cheryl Dearlove Telephone/Fax (08) 9889 8039.

Traysurin Hill Catchment Group.
Trish Ledwith C/- PO Dundinin 6363.
Telephone/Fax (08) 9889 0049

Fence Road Catchment Group.
Project Officer: Jan Gray.
PO Box 46, Dumbleyung WA 6350.
Telephone: (08) 9864 1039 Fax: (08) 9864 1059.

Kulin-Kondinin Herbarium Group.
Sandra Murray. Day Street, Kulin 6365.
Telephone (08) 9880 1268.

Friends of Jilakin Rock.
C/O Kulin Shire Office. Telephone (08) 9880 1204.

Dunroven Tree Nursery
PO Box 154, Kulin WA 6365.
Telephone/Fax (08) 9880 4047.
Shire of Kulin.
Johnston Street, Kulin WA 6365.
Telephone (08) 9880 1204. Fax (08) 9880 1221.

Avon Working Group.
Northam AgWA District Office,
Northam WA 6401.
Telephone (08) 9690 2000.

Avon Catchment Network.
Wellington Street, Northam. PO Box 311, Northam WA 6401.
Telephone (08) 9622 7600. Fax: (08) 9662 7611.

Blackwood Basin Group.
PO Box 231, Boyup Brook.
Telephone: (08) 9765 1555. Fax: (08) 9765 1455.

Department of Conservation and Land Management.
Narrogin Regional and District Office.
Hough Street, Narrogin. PO Box 100, Narrogin WA 6312.
Telephone District: (08) 9881 1113 Fax: (08) 9881 1645

Agriculture Western Australia.
Narrogin District Office.
10 Doney Street, Narrogin WA 6312.
Telephone: (08) 9881 0222 Fax: (08) 9881 1950

Roadside Conservation Committee.
Wildlife Branch, CALM.
Telephone: (08) 9334 0404 Fax: (08) 9334 0278

Aboriginal Mallee Corporation.
PO Box 86, Kondinin 6367.
Don Collard. Telephone: (08) 9889 1227.
Jenny Hardy. Telephone: (08) 9889 1117.

Western Australian Wildflower Society Inc.
PO Box 64, Nedlands WA 6009.
Telephone: (08) 9383 1254.

Kings Park and Botanic Garden – General Inquiries
Fraser Ave, West Perth
Telephone: (08) 9480 3600

WA Native Orchid Study and Conservation Group.
PO Box 323, Victoria Park WA 6979.
(Meets 8pm on third Wednesday of month at the Kings Park Board lecture room.)
• Refer to Appendix 12 for funding program contacts.
6 References


Allison, H. E., Brandenburg, A. A. and Beeston, G. R. (1993) *Natural Resource Zones for the South-West Land Division of Western Australia*, Technical Series No. 55,


CALM (1994). *Reading the Remote, Landscape Characters of Western Australia*, Department of Conservation and Land Management, Como.


Council for Aboriginal Reconciliation (1994) *Valuing Cultures, Key Issues Paper No. 3*, AGPS.


Holm, A. (1994) *Procedures for the Administration and Assessment of Clearing and Protection of Native Vegetation in Western Australia*, Agriculture Western Australia, South Perth.


McKenzie, N. L., Burbidge, A. A. and Marchant, N. G. (1973) Results of a Biological Survey of the Proposed Wildlife Sanctuary at Dragon Rocks near Hyden, Western Australia, Western Australian Department of Fisheries and Fauna, Report 12.


Wetlands Advisory Committee (1977) *Guidelines to the Conservation and Management of Wetlands in Western Australia*, Department of Conservation and Environment, Perth.
7 Further Reading

Rural nature conservation


Bush regeneration, remnant vegetation and weeds


Additional information about weed issues in Western Australia from Information Notes, available from the Agricultural Protection Board, Agriculture WA.


**Seed growing and collection**


Seabrook, J. *Seeds of the Future. How to Establish a Native Seed Orchard*, WA Wildflower Society - Eastern Hills Branch, Western Australia.

**Direct seeding**


**Farm Investigation**

Revegetation


Revegetation Expert Software (REX) (1996) Copyright CALM, Agriculture Western Australia, Greening WA and Robin Road Software, Direct order on 1800 244 060. Cost is less than $100.


Wetlands


Whole farm planning

Plant identification


George, A.S. *The Banksia Book*, Kangaroo Press, NSW.


Hoffman, N. and Brown, A. *Orchids of South-West Australia*, University of Western Australia Press, Perth.


Mitchell, A.A. and Wilcox, D.G. (1988) *Plants of the Arid Shrublands of Western Australia*, University of Western Australia Press and Western Australian Department of Agriculture, Perth.


**Bushfoods**


General Reading


Department of Conservation and Land Management (1994) *Reading the Remote, Landscape Characters of Western Australia*, CALM.


8 Glossary

aff  allied to (Latin affinis); affinity is used for undescribed species that are very similar to named species yet different enough to be kept as a separate taxa.

alkaline soil  any soil that has pH > 7. Usually applied to surface layer or root zone but may be used to characterise any horizon or soil sample.

appressed  pressed closely against another part (e.g. leaves against stem).

arboreal  living in a tree or trees; as opposed to terrestrial, living on the ground; aquatic, living in water; amphibious, living on land and in the water; marine, living in the ocean.

basic rock  an igneous rock composed chiefly of dark-coloured minerals; relatively rich in iron, magnesium and/or calcium and with a relatively low silica content.

breakaway  the steep slope, usually not very high, where an old landscape is being cut away by wind and water erosion.

buffering capacity  the ability of a soil to resist changes in pH. Commonly determined by the presence of clay and humus.

calcareous soil  soil containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly when treated with cold 0.1 N hydrochloric acid.

carnivore  organism that feeds on animals

catena  sequence of soils of about the same age, derived from similar parent material, and occurring under similar climatic conditions, but having different characteristics because of variation in relief and in drainage.

contour  imagery line connecting points of equal elevation on the surface of the soil.

coppice  shoot developed from dormant bud of the main trunk of a shrub or tree.

crust  surface layer on soils that is much more compact, hard and brittle when dry than the materials immediately beneath it, ranging in thickness from a few millimetres to 3 cm.

cultivation  tillage operation used in preparing land for seeding or transplanting or later for weed control and for loosening the soil.

deciduous plant  plant that sheds all its leaves every year at a certain season.

endemic  found only in restricted, localised areas; peculiar to the state or country and not native elsewhere.

ephemeral  for waterbodies: holds water throughout the year in less than 20% of years, and frequently does not receive inflow. For plants: a short-lived annual plant.

eutrophication  process of aging of lakes whereby aquatic plants are abundant and waters are deficient in oxygen. The process is usually accelerated by the enrichment of waters with surface runoff containing nitrogen and phosphorus.

fertility, soil  quality of a soil that enables it to produce essential chemical elements in quantities and proportions for the growth of specified plants.

fertiliser  any organic or inorganic material of natural or synthetic origin added to a soil to supply certain elements essential to the growth of plants.

glabrous  having a shining surface without hairs.

granite  coarse-grained rock containing a high proportion of quartz and feldspar, with some mica.
greenstone compact, dark green altered or metamorphic basic igneous rock, that owes its colour to chlorite, actinolite or epidite (green-coloured minerals).
groundwater subsurface water in the zone of saturation that is free to move under the influence of gravity.
habitat the natural environment of a plant or animal
halophyte plant that requires or tolerates a saline environment.
heath low scrub about 0.5 m high, with scattered taller shrubs standing out above it. Heath is very widespread but the plant species vary according to the locality. The taller shrubs that can grow to about 4 m can include Acacias, Banksias, Allocasuarinas, etc.
herbicide chemical that kills plants or inhibits their growth; intended for weed control.
herbivore plant-eating animal.
horizon, soil layer of soil approximately parallel to the soil surface, with properties and characteristics different from adjacent layers below or above it.
humus the stable fraction of the soil organic matter remaining after the major portions of added plant and animal residues have decomposed. Usually it is dark in colour.
igneous rock rock that solidified from molten or partly molten material (e.g. from a magma). Igneous rocks are one of the three main rock classes, the others being metamorphic and sedimentary.
infiltration the downward entry of water into the soil.
insecticide chemical that kills insects.
kwongan indigenous term for the Western Australian sandplain and its vegetation. The vegetation consists of broombush thickets, scrub-heath and mallee-heath; the term could be extended to cover all types of sclerophyll shrubland.
labellum modified lower petal of orchids often referred to as the lip or tongue.
laterite iron-rich subsoil layer found in highly weathered tropical soil that, when exposed and allowed to dry becomes very hard and will not soften when rewetted. When erosion removes the overlying layers, the laterite is exposed and a virtual pavement exists.
legume pod-bearing member of the Leguminosae family, one of the most important and widely distributed plant families. Includes many valuable food and forage species such as peas, beans, peanuts, clovers and alfalfas. Nearly all legumes are associated with nitrogen-fixing organisms.
lichen an association between an algae or cyanobacterium and a fungus. Usually the partners of a lichen are unable to live apart.
lignotuber swollen, woody structure at the base of many eucalypts containing dormant buds.
lime in strict chemical terms, calcium oxide (CaO). In practical terms, a material used to neutralise soil and acidity containing the carbonates, oxides and/or hydroxides of calcium and/or magnesium.
loamy intermediate in texture and properties between fine-textured and coarse-textured soils. Includes all textural classes with the words loam or loamy as a part of the class name, such as clay loam or loamy sand.
mallee  mallee communities are formed by a great variety of eucalypt species, and are
distinguished from low woodlands by coppicing species that respout from
rootstock (lignotuber) after fire and hence are multi-stemmed. Most mallee
stands are about 3-5 m tall with open cover, and have a dense understorey of
sclerophyll shrubs 1-2 m tall.

metamorphic rock  rock derived from pre-existing rocks by mineralogical, chemical
and/or structural changes in response to changes (e.g. temperature, pressure)
that occur deep in the earth’s crust.

morphological  referring to form or shape of an organism and its parts.

ms  manuscript name, used to differentiate undescribed species within a particular
genera.

mulch  any material such as straw, sawdust, leaves, plastic film and loose soil that is
spread upon the surface of the soil to protect the soil and plant roots from the
effects of evaporation, raindrops, soil crusting, freezing, etc.

nitrogen fixation  the biological conversion of elemental nitrogen ($N_2$) to organic
combinations or to forms readily utilised in biological processes.

parent material  the unconsolidated and more or less chemical weathered mineral or
organic matter from which the upper and most weathered horizons of the soils
are developed.

permanent  when a waterbody holds water throughout the year in 80% of years.

physiographic  pertaining to the science of physical geography or geomorphology.

piezometers  tubes (usually of PVC) of varying diameter, with perforated sections or
screens, inserted in the ground to varying depths. Sand placed around the
screens allows water to enter, the screens being sealed at the top with
bentonite (a clay). The level to which water rises in the piezometer is a
measure of the groundwater pressure at the screen depth.

saline  a soil is saline when it contains such a quantity of soluble salts that plant
growth is significantly reduced.

samphire  an individual or community of plants that are adapted to saline soil;
usually low growing succulent or herbaceous species.

scarp  the steeply sloped side of a ridge or plateau.

scat  faecal pellet.

sclerophyll  pertaining to plants with tough leathery leaves.

seasonal  when a waterbody holds water throughout the year in 61-80% of years.

secondary salinity  when large areas of previously productive land become so saline
that crop production is seriously reduced or impossible. Differentiated from
primary salinity, shown by soils that are believed to have been saline for
thousands of years as a result of natural landscape processes.

sedimentary rock  layered rock resulting from the consolidation of sediment.
Examples include sandstone and coal.

semi-permanent  when a waterbody holds water throughout the year in 21-60% of
years, and receives inflow in most years.

soil conservation  combination of all management and land-use methods that
safeguard the soil against depletion or deterioration caused by nature and/or
humans.

stratum  distinct range of vegetation, such as overstorey and understorey.
**subspecies (subsp)** taxonomic term for a group consisting of individuals within a species that have distinguishing characteristics separating them from other members and forming a breeding group, but that can still interbreed with other members of the species. A synonym for subspecies is variety.

**tamma** scrub comprising Allocasuarinas, Eucalypts and Dryandras.

**taxon (plural taxa)** any defined unit (e.g. species, genus, family) in the classification of living organisms.

**taxonomy** the study of the rules, principles and practice of classifying living organisms.

**variety** taxonomic group below the species level, used in different senses by different specialists.

**waterlogged** saturated with water.

**water table** upper surface of groundwater or that level below which the soil is saturated with water. The height of the water table varies seasonally according to the amount of percolation occurring.

**weathering** process of disintegration and decay of rock. There are three types of weathering: **Physical**, e.g. cracking caused by continual heating and cooling of rocks; **Chemical**, e.g. caused by weak acid formed by carbon dioxide from the air dissolving in rain water; and **Biological**, e.g. the action of plant roots, moss and lichens that combines both physical and chemical action.

**wodjil** scrub containing various species of *Acacia*.
## Appendix 1. List of common names and associated scientific names.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acorn Banksia</td>
<td>Banksia prionotes</td>
</tr>
<tr>
<td>Blackbutt</td>
<td>Eucalyptus patens</td>
</tr>
<tr>
<td>Black Marlock</td>
<td>Eucalyptus reducna</td>
</tr>
<tr>
<td>Black Morrel</td>
<td>Eucalyptus melanoxylon</td>
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<tr>
<td>Blue Mallet</td>
<td>Eucalyptus gardneri</td>
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<tr>
<td>Bluebush</td>
<td>Atriplex paludosa</td>
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<td>Boorabin Mallee</td>
<td>Eucalyptus platycorys</td>
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<td>Boree</td>
<td>Melaleuca species</td>
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<td>Eucalyptus astringens</td>
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<td>Banksia grandis</td>
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<td>Eucalyptus laeliae</td>
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<td>Capped Mallee</td>
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<td>Chittick</td>
<td>Lambertia inermis</td>
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<td>Christmas Tree</td>
<td>Nycties floribunda</td>
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<td>Coarse-leafed Mallee</td>
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<td>Eucalyptus todtiana (also known as Pricklybark)</td>
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<td>Dryandra species</td>
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<td>Lesser Bottlebrush</td>
<td>Callistemon phoeniceus</td>
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<td>Common Name</td>
<td>Scientific Name</td>
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<tr>
<td>--------------------------------</td>
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<td>Manna Wattle or Gum</td>
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<td>Corymbia calophylla</td>
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<td>Merrit</td>
<td>Eucalyptus flocktoniae</td>
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<td>Eucalyptus macrocarpa</td>
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<td>Sheoak (Rock)</td>
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<tr>
<td>Sheoak (Swamp)</td>
<td>Casuarina obesa</td>
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<td>Eucalyptus ornata</td>
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<td>Banksia attenuata</td>
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<td>Snap and Rattle</td>
<td>Eucalyptus celeastroides (also known as Mirret)</td>
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<tr>
<td>Common Name</td>
<td>Scientific Name</td>
</tr>
<tr>
<td>----------------------------</td>
<td>----------------------------------------------------------</td>
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<td>Casuarina obesa (also known as swamp oak)</td>
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<td>Teatree</td>
<td>Leptospermum species</td>
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<td>Wait-a-while</td>
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<td>Wandoo, White or Silver Gum</td>
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<td>Wattle</td>
<td>Acacia species</td>
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<td>Yarri</td>
<td>Eucalyptus patens</td>
</tr>
<tr>
<td>Yate</td>
<td>Eucalyptus occidentalis</td>
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<td>York Gum</td>
<td>Eucalyptus loxophleba</td>
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<td>York Road Poison</td>
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<td>Yorrell</td>
<td>Eucalyptus gracilis (or sometimes E. yilgarnensis)</td>
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<tr>
<td>Zamia</td>
<td>Macrozamia reidlei</td>
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</table>
Appendix 2. Local plants for the Shire of Kulin.

This appendix lists major vegetation types and plants in the Kulin Shire. The life form of the species listed is abbreviated to:

- H = Herb
- S = Shrub
- T = Tree

Species are listed in alphabetical order within the vegetation type where they occur. Some species occur in more than one vegetation type. The presence of species on various soil types is indicated by ✓. Soil types are represented by the columns as indicated below:

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
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<td>Brown clay loam</td>
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<tr>
<td>2</td>
<td>Brown sandy clay loam</td>
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<tr>
<td>3</td>
<td>Orange sandy clay loam</td>
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<td>4</td>
<td>Yellow sandy clay loam</td>
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<tr>
<td><strong>Blue Mallet Woodland</strong></td>
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<tr>
<td><em>Lepidosperma drummondii</em></td>
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</tr>
<tr>
<td><em>Grevillea paniculata</em></td>
<td>S</td>
</tr>
<tr>
<td><em>Hakea scoparia</em></td>
<td>S</td>
</tr>
<tr>
<td><em>Leptospermum erubescens</em></td>
<td>S</td>
</tr>
<tr>
<td><em>Phebalium microphyllum</em></td>
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<tr>
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<td><em>Melaleuca acuminata</em></td>
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<td><em>Melaleuca adenata</em></td>
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</tr>
<tr>
<td><em>Eucalyptus salubris</em></td>
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</tr>
<tr>
<td><strong>Salmon Gum Woodland</strong></td>
<td></td>
</tr>
<tr>
<td><em>Dianella revoluta</em></td>
<td>H</td>
</tr>
<tr>
<td><em>Gastrolobium spinosum</em></td>
<td>S</td>
</tr>
<tr>
<td><em>Gastrolobium trilobum</em></td>
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</tr>
<tr>
<td><em>Grevillea patentiloba</em></td>
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<tr>
<td><em>Melaleuca acuminata</em></td>
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<td><em>Melaleuca adenata</em></td>
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<td><em>Melaleuca spicigera</em></td>
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<td><em>Olearia muelleri</em></td>
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<td><em>Olearia revoluta</em></td>
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<td><em>Acacia erinacea</em></td>
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<td><em>Eucalyptus gardneri</em></td>
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<td><strong>York Gum Woodland</strong></td>
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<td><em>Eucalyptus salmonophloia</em></td>
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<td><em>Hakea scoparia</em></td>
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<tr>
<td><strong>Wandoo Woodland</strong></td>
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<td><em>Acacia lasiolarpa</em></td>
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<td><em>Acacia microbotrya</em></td>
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<td><em>Billardiera bicolor</em></td>
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<td><em>Callicris roei</em></td>
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<tr>
<td><em>Calothamnus quadrifidus</em></td>
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**Melaleuca Heath or Thicket**

| Allocasuarina acutivalvis                    | T         |
| Allocasuarina campestris                     | T         |
| Allocasuarina humilis                        | T         |
| Banksia sphaeroarpa                           | T         |
| Beaufortia micrantha var puberula             | S         |
| Borya sphaerocephala                         | H         |
| Caustis dioica                               | H         |
| Dryandra cirsioides                           | S         |
| Dryandra conferta                             | S         |
| Dryandra nivea                                | S         |
| Eremaea pauciflora                            | S         |

- T: Tar Stony
- S: Sandy
- H: Humus
- ✓: Present
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Appendix 3. Detailed botanical information for fifteen bush remnants.

This appendix lists information from sites on private land surveyed in detail during the study: F. Mollemans (1993) Distribution and Ecological Significance of On-Farm Bush Remnants in the Southern Wheatbelt Region of Western Australia Phase I, Agriculture Western Australia. Please refer to Figure 13 for locations.

Survey of remnant 1

Kulin Shire [KU13] Hyden SI50-04 1:250 000; Mt Stewart 2832-IV 1:50 000; Roe Location 2799; J. Sullivan.

Surveyed: 16.08.91; 15 collections.
Location: 3.7 km SSE of Mount Stewart and 3 km NE of Jilakin Flat Rocks – Henderson Road junction;
32°39’55”S, 119°37’30”E; c. 375 m.
Description: Open shrub mallee over scrub over low heath; pale grey sand +/- laterite gravel and pebbles; pH acid.

Vegetation Associations:

a  Eucalyptus transcontinentalis dominant in the overstorey vegetation.
b  Leptospermum erubescens dominant or co-dominant variably in the mid-layer.
c  Beaufortia interstans, Verticordia roei, Hakea erecta and Gahnia ancistrophylla dominant or co-dominant in the lower layer.
d  A number of other species were present, including three Baeckeas, two grasses and moss.

Survey of remnant 2

Kulin Shire [KU13] Hyden SI50-04 1:250 000; Mt Stewart 2832-IV 1:50 000; Roe Location 2692; Henderson.

Surveyed: 16.08.91; 14 collections.
Location: 360 m NE of junction of Gregson and Jilakin Flat Rocks Roads;
32°41’05”S, 119°34’00”E; c. 355 m.

Vegetation Associations:

a  Mallee.
b  Heath with open shrub mallee on pale yellow sand with clay crust.
c  Scrub, low heath and dwarf scrub on and near granite on orange granite sand loam.
d  Sedge land on slightly more clayey sand soil.

Notes: Area has a small, old rubbish tip 200 m along track N of Jilakin Flat Rocks Road, and this track entrance is 300 m east of the Gregson Road junction.
Survey of remnant 3

Kulin Shire [KU13] Hyden SL50-04 1:250 000; Mt Stewart 2832-IV 1:50 000; Roe Location 1411; V. J. Cornwall.

Surveyed: 16.08.91; 38 collections.
Location: 3 km ENE of junction of Jilakin Flat Rocks and Varley North Roads; 32°41′05″ S, 119°31′30″ E; c. 360 m.

Vegetation Associations:
- a Woodland/scrub on white sand.
- b Mallee-broombush and mallee fringe on pale yellow brown sand.
- c Granite edge woodland.
- d Scrub and dwarf scrub on orange sand loam on granite – outer paddock-ward fringes affected by sheep grazing.

Notes:
1. In open woodland of Allocasuarina huegelliana near the edge of the granite on its NW side. Stylidium (30) fairly common, Caladenia filamenetosa var. denticulata (7 plants so fairly common), Caladenia deformis (1 plant fe – rare), Thysanotus patersonii, Pterosyis recurva (1 plant), and Leporella fimbriata (basal leaf of this orchid only found, patchy common, 30+ in a patch – all occur on white sand).
2. Allocasuarina huegelliana woodland at north fringe and NE extremity of granite – Lepidosperma sp. and Lomandra effusa common in a fairly open ground layer. Other species present include small leaf teatree Melaleuca sp. (21), Santalum acuminatum (Quandong – 2 plants), Bitter quandong (5-10 plants), and Acacia sp. (2 plants). Dense rushes occur in understorey of Allocasuarina woodland in granite outflow area in the NE.
3. Fungi in Allocasuarina huegelliana woodland include orange erect type (32) of which four were seen; orange bracket fungus on timber fc/uncommon = Polyporus cinnabarinus; and brown with white underside bracket fungus on Allocasuarina huegelliana.
4. Mallee includes Eucalyptus eremophila, with Banksia elderiana, at NW extremity of bush, where there are some piles of stone and mallee roots. In the north and NE outer fringe mallee species include Eucalyptus conglobata and E. hypochlamydea ssp “smooth bark” = mallee with E. socialis-like fruit but smaller – both are common.
5. On granite, dwarf scrub in sand loam pockets includes Crassula (6), Drosera (10), Cheilanthes (1), Asteraceae herb (4), with granite Borya present and common.
6. On granite at the southern fringe Thryptomene australis (22) is common with occasional Dodonaea angustissima fairly common – this vegetation is gradational into scrub and mallee-broombush to south with Melaleuca uncinata (18) common and Cassia (Senna) nemophila var. nemophila (4a) fairly common.
7. In mallee-broombush/scrub on east side towards north is dodder Cassytha (11), a fine leafed Acacia (13) and Calothamnus quadrifidus (which appeared much affected by rabbits) were present.
8. General occurrences of *Drosera macranthera* (9) and *Drosera* (6) observed.
9. Fauna seen included 28 parrots and crested pigeons overflying the area.

**Survey of remnant 4**

Kulin Shire [KU12] Hyden SI50-04 1:250 000; Gulson 2732-II 1:50 000; Roe Location 2096; Henderson.

Surveyed: 17.08.91; 33 collections.
Location: 1.25 km WNW of junction of Hyden – Lake King and Pingaring – Varley Roads; 32°45'40''S, 119°29'25'''E; c. 345 m.

Vegetation Associations:

a  Woodland over scrub of open nature on pale grey brown clay loam.
b  Mallee and scrub on pale grey sandy clay soil.

**Survey of remnant 5**

Kulin Shire [KU12] Hyden SI50-04 1:250 000; Hurlstone 2732-I 1:50 000; Roe Location 1415; Baker.

Surveyed: 17.08.91; 21 collections.
Location: 1 km SE of junction of Jilakin Flat Rocks and Kruppa Roads; 32°42'35'''S, 119°16'35'''E; c. 340 m.

Vegetation Associations:

a  Shrub mallee, *Melaleuca* scrub-heath and low heath. Soils heavy brown clay, very hard to dig. Outer fringe heavily grazed as is unfenced.
b  Tree mallet +/- mallee scrub on heavy grey brown soil. Vegetation south of track is in excellent condition internally; it is composed of *Eucalyptus salubris* as a small tree mallee form with very slender trunks, and *E. flocktoniae* mallee over *Melaleuca lateriflora* as dominant, with *M. adnata*, *Grevillea acuaria* and *Dodonaea stenozygma* also present. No *M. uncinata* or *M. pentagona* were observed in b but both species dominant in a.
Survey of remnant 6

Kulin Shire [KU11/12] Hyden SI50-04 1:250 000; Bottle Rock 2732-IV 1:50 000; Roe Location 2508; Baker/Henderson.

Surveyed: 17.08.91; 71 collections.
Location: 3.25 km SW of junction of Jilakin Flat Rocks and Kruppa Roads; 32°43’05”S, 119°14’30”E; c. 345 m.

Vegetation Associations:
a  Tree mallee and open scrub on stony soil derived from metamorphosed granite. Liverworts rare; mosses and lichens common.
b  Scattered mallee over 1.5 m heath on sand soil +/- stone fragments. Echidna digs and termite mounds present.
c  Slender mallee and scrub on sand/stony soil.

Survey of remnant 7

Kulin Shire [KU11] Hyden SI50-04 1:250 000; Bottle Rock 2732-IV 1:50 000; Roe Location 2506.

Surveyed: 18.08.91; 83 collections.
Location: 3.8 km ENE of junction of Jilakin Flat Rocks and Holland’s Track Roads; 32°40’42”S, 119°13’35”E; c. 420 m.

Vegetation Associations:
a  Heath on sand. Regenerating in part from clearing by chain.
b  *Eucalyptus grossa* – *Allocasuarina humilis* – *Melaleuca adnata* open scrub on heavy, dark grey/brown clay crab-hole soil.
c  Scrub about granite on orange brown granite sand loam. Liverworts rare; mosses and lichens +/- common.

Survey of remnant 8

Kulin Shire [KU11] Hyden SI50-04 1:250 000; Bottle Rock 2732-IV 1:50 000; Roe Location 1509; H. Johnson.

Surveyed: 18.08.91; 27 collections.
Location: 2.15 km east of Hyden South Road on Di Russo Road; 32°36’49”S, 119°06’28”E; c. 320 m.

Vegetation Associations:
a  Salmon gum woodland over open mallee community with gimlet.

Notes: Area waterlogged and salt affected; drains cut to east edge of area to alleviate the waterlogging and salt effects on adjacent farms.
Survey of remnant 9

Kulin Shire [KU08] Hyden SI50-04 1:250 000; Maublarling 2532-II 1:50 000; Roe Location 14248; Scadding.

Surveyed: 29.08.91; 83 collections.
Location: Carnooking-Pingaring Road; 6.4 km WSW of the junction with Dandagin Road (7.5 km by road), and 25 km ESE of Kulin;
32°46’04”S, 118°23’45”E; c. 285 m.

Vegetation Associations:
a  Flat granite area.
b  Salmon gum woodland.
c  Mallee – Eucalyptus-like sp. dominant.
d  Saline.

Notes: Fauna: Large moth case (like Bogong moth), echidna and kangaroo, galahs, 28 parrots, butcher birds, magpie, small hawk, and a robin present.
Plants: herbaceous daisy sp. (Asteraceae), two climbers, lichen, mosses and fungi present.

Survey of remnant 10

Kulin Shire [KU08] Hyden SI50-04 1:250 000; Maublarling 2532-II 1:50 000; Roe Location 15128; C. V. Hinkley and Co, “Mt Ironstone”.

Surveyed: 04.09.91.
Location: 5 km NE of the junction of Haese and Colbourne Roads, and 24 km SE of Kulin;
32°50’44”S, 118°17’46”E; c. 330 m.
Description: Heath with emergent mallee and scrub on the edges on skeletal sand over ironstone substrate.

Vegetation Associations:
a  Plateau area.
b  Eastern breakaway slope.
c  Eastern white breakaway gully (perhaps man-made by kaolin clay extraction).

Notes: Fauna: Echidna, babblers, 28 parrots, crested pigeon, brown goshawk, kangaroos, ants, spiders present.
Survey of remnant 10a

Kulin Shire [KU08] Hyden SI50-04 1:250 000; Maublarling 2532-II 1:50 000; Roe Location 15128; C. V. Hinkley and Co, “Mt Ironstone”.

Surveyed: 04.09.91.
Location: 4 km ENE of the junction of Haese and Colbourne Roads, and 24.5 km SE of Kulin;
32°51'21"S, 118°17'31"E; c. 340 m.

Vegetation Associations:
  a  *Eucalyptus* spp. tree/mallee over mixed open shrubland.
  b  Open heath/srub area in centre.

Notes: Area is part disturbed and is fenced; it contains the property rubbish dump and nearby is a central circular area of heath/scrub.

Survey of remnant 10b

Kulin Shire [KU08] Hyden SI50-04 1:250 000; Maublarling 2532-II 1:50 000; Roe Location 15128; C. V. Hinkley and Co, “Mt Ironstone”.

Surveyed: 04.09.91.
Location: 4.5 km east of the junction of Haese and Colbourne Roads, and 26.4 km SE of Kulin;
32°52'16"S, 118°18'08"E; c. 320 m.

Vegetation Associations:
  a  *Eucalyptus* spp. tree/mallee over mixed open shrubland.

Notes: Area is similar to remnant 10a but is more disturbed because, although fenced on the paddock side, it is open on the road/property boundary, and has probably suffered from use of the road as a stock route.
Survey of remnant 11

Kulin Shire [KU08] Hyden S150-04 1:250 000; Maublarling 2532-II 1:50 000; Roe Location 15151; Bradford/15499 (indicated to be part of remnant on map, but actually cleared apart from a few small breakaway isolates).

Surveyed: 04.09.91; 83 collections.
Location: 5 km SE of the junction of Haese and Colbourne Roads, and 29 km SSE of Kulin;
32°54'01''S, 118°17'43''E; 360 m.

Vegetation Associations:

a Main area (to west and south) of heath on clay sand with stone, with
Melaleuca scrub along south (lowland edge) boundary where there is
more clay in the soil; Melaleuca scrub to south as strip.
b Main area (to north and east) of scrub on skeletal sands over ironstone
rock outcrop.
c Chained mallee scrub on breakaways and adjacent slopes in NE; broad
gully from breakaway at east edge near NE corner towards west (but
not reaching west edge).
d Sand pocket of mallee heath in SE corner.
e Small area of 8-10 m woodland at south boundary dominated by Eucalyptus
spp. (minor component).

Notes: Fauna: Emu, woodswallow, kangaroos, lizard, bull-ants, weevils,
moths and praying mantis.

Survey of remnant 12

Kulin Shire [KU07] Hyden S150-04 1:250 000; Jilakin 2532-I 1:50 000; Roe Location
14646; A. and C. Riseborough, "Mallee Grove Farm".

Surveyed: 05.09.91; 83 collections.
Location: Immediately NE corner of Dandagin Road, 1 km ENE of Dandagin
Rock, and 28.25 km ESE of Kulin;
32°41'36''S, 118°27'19''E; 320 m.

Vegetation Associations:

a Scrub/dwarf scrub associated with granite outcrop and breakaway.
Fauna present included kangaroo, echidna, butcher bird, bobtail lizard,
dark red ants, black cockroach, termites and fox.
b Mallee broombush and Melaleuca spp. mostly sand with minor granite
boulder outcrop (north end). Fauna present included babblers, crows,
trapdoor spider, ants and rabbits. Weeds present included wild
mustard and cape weed encroaching into the north edge of the remnant.
c Mallee over Melaleuca scrub to 4 m on sandy soil; rabbits present..

Notes: Area large and undulose with breakaways and slopes.
Survey of remnant 13

Kulin Shire [KU07] Hyden SI50-04 1:250 000; Jilakin 2532-I 1:50 000; Roe Location 13669.

Surveyed: 05.09.91; 83 collections.
Location: Wedenin Hills, 2 km SE of Snake Rock, 13.5 km SSE of Kondinin; 32°37'05''S, 118°17'54''E; 300-344 m.

Description: Eucalyptus sp. with no understorey, and fringed by open woodland of salmon gum and gimlet over grass. Generally disturbed class of remnant bush ‘Modified Remnant Vegetation’.

Geology/soils: Uplands of lichen encrusted granite boulders and outcrop with dark red-brown clay loam soil.
Appendix 4. Flora species housed in the Kulin-Kondinin Herbarium.

This appendix lists plants housed in the Kulin-Kondinin Herbarium that have been collected across the Shires of Kulin and Kondinin from 1995 to 1998.

Acacia eremophila
Acacia erinacea
Acacia exocarpioides
Acacia flavopila subsp. flavopila
Acacia inophloia
Acacia leptopetala
Acacia microbotrya
Acacia multispicata
Acacia myrtifolia
Acacia pycantha
Acacia rostellata
Acacia sulcata var platyphylla
Actinostrobus arenarius
Actinotus superbus
Adenanthes cygnorum subsp. cygnorum
Aira caryophyllea
Allocasuarina campestris
Alyogyne hakeifolia
Alyxia buxifolia
Anagallis caerulea
Arctotheca calendula
Argentipallium niveum
Arthropodium curvipes
Asparagus asparagoides
Astroloma pallidum
Astroloma serratifolium var. horridulum
Avena barbata
Baeckea ef preissiana
Banksia baueri
Banksia gardneri var. hiemalis
Banksia prionotes
Banksia sphaerocarpa ssp sphaerocarpa
Beaufortia bracteosa
Beaufortia incana
Beaufortia microanthra
Beaufortia microanthra var puberula
Beaufortia orbifolia
Billardiera bicolor var bicolor
Blechnopora drummondii
Boronia coerulescens
Boronia cremulata subsp. viminea
Boronia cremulata var cremulata
Borya sp
Brachyloma delbi
Briza maxima
Briza minor
Caesia vittata
Caladenia falcata
Caladenia footeana
Caladenia hirta subsp. rosea
Caladenia reptans subsp. reptans
Caladenia saccharata
Caladenia varians subsp. hiemalis
Caladenia xantha
Callistemon phoeniceus
Callitris canescens
Calothamnus quadrifidus
Calytrix habrantha
Chamaexeros serra
Chamelaucium hamatum
Chamelaucium pauciflorum subsp. pauciflorum
Cheiranthera filifolia var. filifolia
Chondrilla juncea
Cicendia filiformis
Citrus lanatus
Cloanthus coccineus
Codonocalyx cotinifolius
Comesperma calympetalum
Comesperma scoparum
Comesperma volubile
Conospermum croniniae
Conospermum ephedroides
Conospermum filifolium subsp. filifolium
Conospermum stoehadies
Conostylis petrophiloides
Cooperornis strobilata
Cotula australis
Cotula sp
Cryptandra myriantha
Cucumis myriocarpus
Cyanicula deformis
Cyanostegia corifolia
Cyanostegia lanceolata
Dampiera juncea
Dampiera lavandulacea
Dampiera sacculata
Dampiera wellsianna
Darwinia diosmoides
Daviesia benthamii subsp. benthamii
Daviesia cardiophylla
Daviesia incrassata
Daviesia longfolia
Daviesia nudiflora
Daviesia pachylyma
Daviesia ramossissima
Daviesia sp
Daviesia uniflora
Dianella revoluta
Dierdastryis parvifolia
Dierdastryis velutina
Diploaena aff microcephala
Diuris corymbosa

96
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Leptosema daviesioides
Leptospermum nitens
Leptospermum roei
Leucopogon corynocarpus
Levenhookia stipitata
Lobelia heterophylla
Logania flaviflora
Lupinus cosentini
Lysiosepalum involucratum
Melaleuca adnata
Melaleuca carrii
Melaleuca cordata
Melaleuca coronicarpa subsp. coronicarpa (ms)
Melaleuca depauperata
Melaleuca elliptica
Melaleuca fulgens subsp. fulgens
Melaleuca haplantha
Melaleuca lanceolata
Melaleuca lateriflora subsp. lateriflora
Melaleuca pauperiflora subsp. fastigiata
Melaleuca pentagona var subulifolia
Melaleuca scabra
Melaleuca spicigera
Melaleuca tuberculata
Melaleuca uncinata
Melaleuca undulata
Melaleuca viminal
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Mesemelaena tetragona
Microcorys cephalantha
Microcorys exserta
Microcorys glabra
Microcorys virgata
Micromyrtus obovatus
Micromyrtus racemosa
Micromyrtus sp
Mirbelia floribunda
Mirbelia microphylla
Nemcia obovata
Nemcia tricuspidatum
Nyctys floribunda
Olearia aff revoluta
Olearia brachyphylla
Olearia muelleri
Olearia paucidentata aff. revoluta
Orthosanthus laxus
Osteospermum clandestinum
Oxalis purpurea
Oxalis sp
Ozothamnus hookeri
Pelargonium havilaseae
Persoonia striata
Petrophile ericifolia subsp. ericifolia
Petrophile brevifolia
Petrophile glauca
Petrophile seminuda
Petrophile squamata
Petrophile trifida
Petrochagia sp
Phebalium filifolium
Phebalium microphyllum
Physopsia lachnostachya
Pimelea brachyphylla
Pimelea craceris subsp. craceris
Pimelea erecta
Pimelea imbricata
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Pityrodia terminalis
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Polygonum aviculare
Portulaca oleracea
Prasophyllum isp
Psammomomoya choretroides
Pterostylis dilata
Pterostylis recurva
Pterostylidia sanguinea
Ptilotis manglaeii
Ptilotis polystachys
Radhyra farragei
Raphanus raphanistrum
Romula rosea
Romula flavo subsp. minor
Rumex sp
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Sceons armella
Senna cardiosperma subsp. cardiosperma
Senna eremophila
Senna pleurocarpa
Solanum hoplopetatum
Solanum nigrum
Solanum oldfieldii
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Stackhousia scoparia
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Stylium calcaratum
Stylium caricifolium subsp. caricifolium
Stylium dichotomum
Stylium leptophyllum
Stylium luteum
Stylium piliferum
Stylium schoenoides
Stylium squamellosum
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Appendix 5. Vegetation types occurring in each parcel of the CALM-managed conservation estate in the Shire of Kulin.

This appendix lists information from reserves investigated in Hopkins, A. J. M., Coker, J., Beeston, G. R., Bowen, P. and Harvey, J. M. (1996) Conservation Status of Vegetation Types throughout Western Australia, Australian Nature Conservation Agency National Reserves Systems Co-operative Program, Project Number N 703, CALM, Perth. Percentages indicate the proportion of the total reserve area covered by each vegetation type.

Key:  
P = Purpose of reserve  
F = Conservation of Flora  
F&F = Conservation of Flora and Fauna

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<th>%</th>
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<td>26692 &amp;</td>
<td>C</td>
<td>1,915</td>
<td>F&amp;F</td>
<td>Medium woodland (salmon gum and gimlet)</td>
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<td>26905</td>
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<td>Succulent steppe (yorrell and Kondinin blackbutt sparse woodland, teatree scrub and samphire)</td>
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<td>Shrublands (teatree thicket)</td>
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<td>Mosaic of Shrublands (mallee scrub, redwood and black marlock, with Medium woodland; wandoo and gimlet)</td>
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<td>Koolberrin</td>
<td>16763</td>
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<td>Lake Varley</td>
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<td>F&amp;F</td>
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<td>Bare areas (salt lakes).</td>
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<td>Maurblarling</td>
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<td>F&amp;F</td>
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<td>Morton</td>
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<td>Mosaic of shrublands (mallee scrub, redwood and black marlock) with medium woodland (wandoo and gimlet).</td>
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<td>North Jitarning</td>
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<td>Pingaring</td>
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<td>Plain Hills</td>
<td>36558</td>
<td>C</td>
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<td>Rose Road</td>
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<td>F&amp;F</td>
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<td>South Kulin</td>
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<td>Sparks Road</td>
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<td>Tapper Road</td>
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Note: Lake Hurlstone A 27927 was not surveyed, but the two Lake Hurlstone reserves 27837 and 24417 that fall in the Shire of Kondinin were surveyed.

### Unnamed Nature Reserves in the Shire of Kulin

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<td>16281</td>
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<tr>
<td>16560</td>
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<td>F&amp;F</td>
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<td>27485</td>
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<td>F&amp;F</td>
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<td>27486</td>
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<td>F&amp;F</td>
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<tr>
<td>28547</td>
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<td>505.8</td>
<td>F</td>
<td>Succulent steppe (teatree thicket over samphire). Mosaic of shrublands (mallee scrub, redwood and black marlock) with Medium woodland (salmon gum). Mosaic of shrublands (mallee scrub, redwood and black marlock) with medium woodland (wandoo and gimlet).</td>
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<td>F&amp;F</td>
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<td>48</td>
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<td>29451</td>
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<td>F&amp;F</td>
<td>Shrublands (scrub-heath).</td>
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<td>F&amp;F</td>
<td>Shrublands (mallee scrub, black marlock).</td>
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Appendix 6. Flora species observed on Nature Reserves in the Shire of Kulin.

These lists are taken from reserve surveys from a variety of authors, as indicated in the reserve descriptions in Section 2.4.

**Dragon Rocks Nature Reserve 36128**

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<thead>
<tr>
<th>Acacia ericifolia</th>
<th>Eucalyptus gardneri</th>
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<tr>
<td>Acacia merrallii</td>
<td>Eucalyptus incrassata</td>
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<tr>
<td>Acrotriche ramiflora</td>
<td>Eucalyptus redunca</td>
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<tr>
<td>Allocasuarina campetris</td>
<td>Gastrolobium spinosum</td>
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<tr>
<td>Allocasuarina huegeliana</td>
<td>Hybanthus floribundus</td>
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<td>Allocasuarina lasiocalyx</td>
<td>Leptospermum erubescens</td>
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<tr>
<td>Boronia capitata</td>
<td>Melaleuca elliptica</td>
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<tr>
<td>Borya sphaerocephala</td>
<td>Melaleuca pungens</td>
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<tr>
<td>Calothmnus quadrifidus</td>
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<tr>
<td>Eucalyptus astringens</td>
<td>Santalum species</td>
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<tr>
<td>Eucalyptus eremophila</td>
<td>Thryptomene species</td>
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**Flat Rocks Nature Reserve**

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<tr>
<td>Acacia lasiocalyx</td>
<td>Eucalyptus ornata</td>
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<td>Allocasuarina acutivalvis</td>
<td>Eucalyptus redunca</td>
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<td>Allocasuarina camelstris</td>
<td>Eucalyptus salubris</td>
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<tr>
<td>Allocasuarina humilis</td>
<td>Eucalyptus spathulata</td>
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<tr>
<td>Astroloma microphyllum</td>
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<tr>
<td>Astroloma serratifolium var horridum</td>
<td>Goodenia pinifolia</td>
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<td>Banksia audax</td>
<td>Grevillea aff baxteri</td>
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<tr>
<td>Banksia spaerocarpa</td>
<td>Hakea communata</td>
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<tr>
<td>Banksia violacea</td>
<td>Hakea crassifolia</td>
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<td>Beaufortia bracteosa</td>
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<td>Beaufortia micrantha</td>
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<tr>
<td>Beaufortia orbifolia</td>
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<td>Beaufortia schaveri</td>
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**Harrismith Nature Reserve**

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<td>Baeckea species</td>
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**Hopkins Nature Reserve**

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<td>Grevillea paniculata</td>
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### Kulin Nature Reserve

- Allocasuarina campestris
- Anthocercis genistoides
- Borya sphaerocephala
- Eucalyptus cylindriflora
- Eucalyptus eremophila
- Eucalyptus leptophylla
- Eucalyptus redunca
- Eucalyptus spathulata
- Eucalyptus transcontinentalis
- Eucalyptus uncinata
- Grevillea paniculata
- Hakea multilineata
- Hakea scoparia
- Juncus acutus
- Loxocarya species
- Melaleuca acerosa
- Melaleuca acuminata
- Melaleuca adnata
- Melaleuca lateriflora
- Melaleuca laxiflora
- Melaleuca seriata
- Melaleuca uncinata
- Olearia muelleri
- Olearia revoluta
- Oxylobium parvifolium
- Persoonia quinquinervium
- Santalum acuminatum

### Kulin Soak Nature Reserve

- Acacia acuminata
- Acacia erinacea
- Acacia lasiocalyx
- Acacia merrallii
- Acacia microbotrya
- Attriplex paludosa
- Borya sphaerocephala
- Dampiera lavandulacea
- Daviesia argillacea
- Dianella revoluta
- Dodonaea stenogyga
- Eremophila decipiens
- Eucalyptus loxophleba
- Eucalyptus salmonophloia
- Eucalyptus salubris
- Grevillea paniculata
- Hakea preissii
- Lomandra effusa
- Maireana brevifolia
- Melaleuca lateriflora
- Monotaxis lurida
- Olearia muelleri
- Pittosporum phylliraeoides
- Ptilotus exaltatus
- Ptilotus divaricatus
- Rhagodia preissii
- Rhyncharhena linearis
- Santalum acuminatum
- Santalum spicatum
- Stypandra imbricata
- Templetonia sulcata

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### Lake Varely Nature Reserve

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### Maublarling Nature Reserve

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### Morton Nature Reserve

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Astroloma serratifolium
Astroloma sp.
Banksia sphaerocarpa
Banksia sphaerocarpa var caesia
Beafoxia micrantha var pubera
Beafoxia bracteosa
Beafoxia incana
Beafoxia micrantha var pubera
Billardiera bicolor
Callitris roei
Calothamnus quadrifidus
Calytix leschenaultii
Cassytha sp.
Causitis dioica
Dodonaea bursarifolia
Dryandra cirsoides
Dryandra conferta
Dryandra nivea
Dryandra pteridifolia
Eremaea pauciflora
Eucalyptus albida
Eucalyptus anceps
Eucalyptus calycogona
Eucalyptus emerophila
Eucalyptus gardneri
Eucalyptus incrassata
Eucalyptus wandoor
Gastrolobium spinosum
Grevillea hookeriana
Grevillea huegelii
Hakea basteri
Hakea falcata
Hakea gilbertii
Hakea incrassata
Hakea lissocarpa
Hakea multilineta
Hakea scoparia
Hakea subsulcata
Isopogon polycaphalus
Isopogon teretifolius
Leptospermum dielsiana
Leptospermum erubescens
Leucopogon dielsiana
Melaleuca acuminata
Melaleuca leptospermoide
Melaleuca pungens
Melaleuca scabra
Melaleuca seriata
Melaleuca uncinata
Melaleuca undulata
Mesomelaena preissii
Persoonia quinquenervis
Petrophile brevifolia
Petrophile ericifolia
Petrophile heterophylla
Petrophile seminuda
Phebalium tuberculatum
Santalum acuminatum
Synaphaeea petiolaris
Verticordia brownii
Zanthorrhoea reflexa

Pederah Nature Reserve
Acacia species
Allocasuarina species
Dryandra species
Eucalyptus salmonophloia
Eucalyptus mallee species
Pingaring Nature Reserve
Acacia assimilis
Acacia lasiocalyx
Acacia lasiocarpa
Acacia trigonophylla
Allocasuarina campestris
Allocasuarina huegeliana
Allocasuarina humilis
Allocasuarina microstachya
Beaufortia micrantha
Billardiera coriacea
Borya sphaerocephala
Callitris caescens
Callitris preissii subsp verrucosa
Calothamnus quadrifidus
Cassytha glabellae
Cassytha melantha
Chamaexeros fimbrifolia
Dampiera preissii
Daviesia benthamii
Dianella revoluta
Dodonaea bursariifolia
Eucalyptus eremophila
Eucalyptus foecunda
Eucalyptus sheathiana
Eucalyptus transcontinentalis
Grevillea didymobotrya
Grevillea hookerianna
Grevillea huegelii
Guichenotia ledifolia
Haemodorum laxum
Hakea adelata
Hakea aff falcata
Hakea incrassata

Hakea petiolaris
Hakea scoparia
Haliganis preissiana
Hibbertia enervia
Isopogon scabriusculus
Leptospermum erubescens
Lepidothamnus preissianus
Loxocarya cinerea
Lysinemum ciliatum
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Melaleuca cordata
Melaleuca lateriflora
Melaleuca laxiiflora
Melaleuca seriatia
Melaleuca tuberculata
Melaleuca uncinata
Melaleuca undulata
Mesomelaena preissii
Oxylobium parviflorum
Petrophile divaricata
Phebalium tuberculatum
Platysace effusa
Psammomoya choreotropic
Santalum acuminatum
Spartochloa scirpoidea
Synaphea species
Templetonia sulcata
Thysanotus sparteua
Verticordia densiflora
Verticordia grandiflora
Verticordia roei

Plain Hills Nature Reserve
Acacia moirii subsp recurvistipula
Acacia pycnocephala
Adenanthos argyreus
Allocasuarina humilis
Allocasuarina microstachya
Allocasuarina thuyoides
Amphipogon turbinatus
Baeckea preissiana
Bankia sphaeroarpa var caesia
Bankia violacea
Beaufortia eriocephala

Hypochoeris glabra
Isopogon teretifolius
Isopogon villosus
Kunzea micromera
Laxmania palaceae
Lepidothamnus chaetocephalus
Lepidosperma gracile
Lepidosperma tenue
Leptomera spinosa
Leptospermum spinescens
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Rose Road Nature Reserve

Acacia acuminata
Allocasuarina acutivalvis
Allocasuarina campestris
Borya sphaerocephala
Eucalyptus aniceps
Eucalyptus celastroides
Eucalyptus eremophila
Eucalyptus flocktoniae
Eucalyptus loxophleba
Eucalyptus redunca
Eucalyptus salmonophloia
Eucalyptus salubris
Eucalyptus spathulata
Gastrolobium spinosum
Grevillea paniculata
Hakea scoparia
Leptospermum erubescens
Loxocarya pubescens
Melaleuca acuminata
Melaleuca adnata
Melaleuca lateriflora
Melaleuca laxiflora
Melaleuca scabra
Melaleuca spicigera
Melaleuca uncinata
Olearia muelleri
Oxypodium parviflorum
Santalum acuminatum
Spartochloa scirpoidea
Templetonia sulcata
Waitzia acuminata

South Kulin Nature Reserve

Acacia andrewsii
Acacia fragilis
Allocasuarina acutivalvis
Allocasuarina campestris
Allocasuarina humilis
Astroloma serratifolium
Beaufortia micrantha
Dianella revoluta
Dryandra cirsoides
Dryandra nivea
Eucalyptus albida
Eucalyptus eremophila
Eucalyptus gardneri
Eucalyptus incrassata
Eucalyptus loxophleba
Eucalyptus redunca
Eucalyptus wandoa
Gastrolobium spinosum
Grevillea hookeriana
Grevillea paniculata
Hakea lisscarpha
Hakea multilineata
Hakea scoparia
Hakea subsulcata
Hypocalymma angustifolium
Isopogon teretifolius
Lepidosperma drummondii
Leptospermum erubescens
Loxocarya sp.
Melaleuca platycalyx
Melaleuca pungens
Melaleuca seriata
Melaleuca spicigera
Melaleuca uncinata
Persoonia quinquenervis
Petrophile brevifolia
Phealium microphyllum
Phealium tuberculosum
Santalum acuminatum
Synapea petiolaris
Xanthorrhoea reflexa
Sparks Road Nature Reserve
Acacia acuminata
Acacia saligna
Adenanthos cygnorum,
Allocasuarina huegeliana
Banksia bauei
Banksia prionotes
Daviesia sp.
Eucalyptus loxophleba

Eucalyptus salmonophloia
Eucalyptus wandooh
Hakea prostrata
herb species
Mesoplaea uncinata
sedge species
Thryptomene species

Tapper Road Nature Reserve
Acacia beauverdiana
Acacia dielsii
Acacia erinacea
Acacia hemiteles
Acacia intricata
Acacia merrallii
Allocasuarina acutivalvis
Allocasuarina campestris
Allocasuarina corniculata
Alyxia buxifolia
Astroloma sp.
Atriplex sp.
Baekea sp.
Banksia elderana
Beauforta micrantha
Boronia sp.
Borya sphaerocephala
Callitris preissii var verrucosa
Cassyspa sp.
Cheiranthera filifolia var filifolia
Chorizema ericifolium
Daviesia benthamii subsp acanthocloena
Dodonaea stenozyga
Eremophila species
Eucalyptus calycegora
Eucalyptus eumorphila
Eucalyptus flocctoniae
Eucalyptus pileata
Eucalyptus salmonophloia

Eucalyptus salubris
Gastrolobium spinosum
Grevillea oncogyne
Grevillea huegelii
Hakea falcata
Hakea scoparia
Hibbertia sp.
Isopogon scabriusculus
Leptomeria sp.
Leptospermum erubescens
Melaleuca arenicola
Melaleuca cordata
Melaleuca elliptica
Melaleuca lateriflora
Melaleuca platycalyx
Melaleuca scaba
Melaleuca uncinata
Neurachne sp.
Santalum acuminatum
Scaevola spinescens
Stylopidium sp.
Stypandra sp.
Thryptomene australis
Thysanotus lavandulaceae
Verticordia chrysanth
Verticordia multiforma
Verticordia picta
Verticordia plumosa
Verticordia roei
Appendix 7. Flora observed on Dragon Rocks Nature Reserve.

This plant list is taken from ‘Flora and Vegetation Survey of Dragon Rocks Nature Reserve (No. A 36128)’ by Anne Coates, 1992. Only native species are included here.

**PTERIDOPHYTA (ferns)**

**ADIANTACEAE**
- Cheilanthes australenuifolia
- Cheilanthes distans

**GYMNOSPERMATAE**

**CUPRESSACEAE**
- Callitris canescens
- Callitris preissii subsp verrucosa
- Callitris roei

**MONOCOTYLEDONAE**

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Hibbertia gomera
Hibbertia gracilipes
Hibbertia aff. mucronata
Hibbertia recurvifolia
Hibbertia rupicola

Droseraceae
Drosera androsacea ms
Drosera barbigera
Drosera leucoblasta
Drosera macrantha subsp. planchonii
Drosera pynoblasta
Drosera strictucaulis
Drosera subhirtella subsp. subhirtella
Drosera zonaria

Epacridaceae
Acroriche patula
Andersonia lehmanniana subsp. pubescens
Andersonia parvifolia
Astroloma epacridis
Astroloma recurvum ms
Astroloma serratifolium
Coleanthera myrtoides
Leucopogon conostephioides
Leucopogon crassifolius
Leucopogon cuneifolius
Leucopogon dielsianus
Leucopogon hamulosus
Leucopogon minutifolius
Leucopogon obtusatus
Leucopogon oxycedrus
Leucopogon ozoanthmoides
Leucopogon tamminensis
Lysinema ciliatum
Styphelia tenuiflora

Euphorbiaceae
Beyeria brevifolia
Montaxis grandiflora
Phyllanthus calycinus
Ricinocarpus glaucus
Stachystemon polyandrus

Geraniaceae
Pelargonium havlasae

Goodeniaceae
Anthotinum rubriflorum
Cooperiokia stroppiopata
Dampiera angulata

Mimosaceae (continued)
Dampiera eriocephala
Dampiera heteroptera
Dampiera haematotricha
Dampiera lavandulacea
Dampiera obliqua
Dampiera oligophylla
Dampiera oligophylla subsp. juncea
Dampiera wellsiana
Goodenia caerulea
Goodenia incana
Goodenia pinifolia
Goodenia scapigera
Goodenia watsonii
Lechenaultia biloba
Lechenaultia formosa
Scaevola helmsii
Scaevola spinosculus
Velleia trinervis

Gyrosermaceae
Gyrosermon subnudus

Haloragaceae
Glischronyron aureum
Glischronyron flavescens

Lamiaceae
Microcorys ericifolia
Microcorys obovata
Microcorys subcanescens
Wrestringia cephalanatha
Wrestringia rigida

Lauraceae
Cassytha melantha
Cassytha pomiformis

Lobeliaceae
Isotoma hypocrateriformis
Lobelia rafisola

Loganiaceae
Logania flaviflora
Logania tortuosa

Mimosaceae
Acacia acanthocladia
Acacia acuminata
Acacia acuta
Acacia assimilis
Acacia assimilis subsp. atroviridis
Acacia beavanaugha
Acacia bidentat
Acacia brumalis ms
Acacia brachyclada
Acacia chrysellia
Acacia chrysocephala

Myrtaceae (continued)
Acacia chrysopoda
Acacia ephedroides
Acacia erinacea
Acacia intricata
Acacia laiocalyx
Acacia lasiocarpa var. sedifolia
Acacia lasiocarpa var. bracteolata
Acacia leptopetala
Acacia leptospermoides subsp leptospermoides
Acacia meriniphora
Acacia merrallii
Acacia microbotrya
Acacia mimicns ms
Acacia moirii subsp recurvistipula
Acacia multisipicata
Acacia myrtifolia
Acacia newbeyi
Acacia pulchella var. glaberrima
Acacia pulchella var. goadbyi
Acacia pycnocephala
Acacia rostellata ms
Acacia saligna
Acacia sedifolia subsp pulvinata
Acacia shuttleworthii
Acacia spachelata subsp recurva
Acacia spachelata subsp spachelata
Acacia sulcata var platyphylla
Acacia tetanophylla Dragon Rocks Variant
Acacia trigonophylla
Acacia uncinella
Acacia unifissilis
Acacia verrucula

MYOPOROACEAE
Eremophila decipiens
Eremophila drummondii

MYRTACEAE
Baeckea crispsiflora
Baeckea cryptandroides
Baeckea preissiana
Beaufortia bracteosa
Beaufortia interstans
Beaufortia micrantha
Beaufortia orbifolia
Beaufortia schaueri
Callistemon phoeniceus
Calothamnus huegelli
Calothamnus quadrifidus
Calytrix breviseta subsp stipulosa
Calytrix leschenaultii
Calytrix simplex subsp suboppositifolia
Calytrix stipulosa
Calytrix stringosa
Calytrix violacea
Chamelaucium ciliatum
Chamelaucium pauciflorum subsp pauciflorum

MYRTACEAE (continued)

Chamelaucium naviculum ms
Ereema pauciflora
Eucalyptus albida
Eucalyptus aniceps
Eucalyptus astringens
Eucalyptus argyrocaulon ms
Eucalyptus calycogona
Eucalyptus capillosa subsp polyclada
Eucalyptus celastroides
Eucalyptus densa
Eucalyptus dissimulata
Eucalyptus eremophila
Eucalyptus flocktoniae
Eucalyptus gardneri
Eucalyptus hypocalymyea subsp cedystiastes
Eucalyptus incrassata
Eucalyptus losophleba
Eucalyptus longicorns
Eucalyptus microschema
Eucalyptus occidentalis
Eucalyptus olivacea ms
Eucalyptus ornata
Eucalyptus phaenophylla
Eucalyptus pileata
Eucalyptus plauricaulis
Eucalyptus salmonphloia
Eucalyptus salubris
Eucalyptus spathulata
Eucalyptus sporadica ms
Eucalyptus aff transcontinentalis
Kunzea jucunda
Kunzea micromera
Kunzea preissiana
Kunzea pulchella
Leptospermum erubescens
Leptospermum incanum
Leptospermum inelegans
Leptospermum nitens
Leptospermum spinescens
Melaleuca acuminata
Melaleuca adnata
Melaleuca cordata
Melaleuca coronicarpa subsp coronicarpa ms
Melaleuca depauperata
Melaleuca elliptica
Melaleuca eleuterostachya
Melaleuca fissurata ms
Melaleuca fulgens
Melaleuca hamulosa
Melaleuca haplantha ms
Melaleuca lateriflora
Melaleuca laxiflora
Melaleuca lecanantha ms
Melaleuca leptospermoides
Melaleuca pentagona
Melaleuca platyclayx
Melaleuca pungens

PAPILIONACEAE (continued)
Melaleuca scabra  
Melaleuca seriatata  
Melaleuca spicigera  
Melaleuca subtrigona  
Melaleuca uncinata  
Micromyrtus ohovata  
Micromyrtus racemosus var latifolia  
Regelia inops  
Thryptomene australis  
Verticordia acerosa var pressii  
Verticordia chrysantha  
Verticordia chrysanthis  
Verticordia densiflora var cespitosa  
Verticordia eriocephala  
Verticordia gracilis  
Verticordia habrantha  
Verticordia inclusa  
Verticordia integra  
Verticordia multiflora subsp multiflora  
Verticordia multiflora subsp solox  
Verticordia penigera  
Verticordia picta  
Verticordia plumosa var incrassata  
Verticordia roei  
Verticordia serrata  
Verticordia tumida  
Verticordia tumida subsp therogana

OLACACEAE  
Olax benthamiana

PAPILIONACEAE  
Bossiaea concinna  
Bossiaea pressii  
Bossiaea walkerii  
Chortizema aciculare  
Daviesia abnormis  
Daviesia audax ms  
Daviesia benthamii  
Daviesia hakeoides  
Daviesia intricata ms  
Daviesia lancifolia  
Daviesia patens ms  
Daviesia rhombifolia  
Daviesia spiralis  
Daviesia uncinata ms  
Daviesia uniflora  
Dillwynia uncinata  
Gastrolobium crassifolium  
Gastrolobium densifolium  
Gastrolobium parviflorum  
Gastrolobium spinosum  
Gastrolobium spinosum var crassifolium  
Gompholobium aristatum  
Gompholobium gompholobioide  
Isotropis drummondii  
Jacksonia condensata  

PROTEACEAE  
Adenanthos argyreas  
Adenanthos flavidiflorus  
Banksia audax  
Banksia elderiana  
Banksia spirocarpa var caesia  
Banksia violacea  
Conospermum bracteosum  
Conospermum crioniae ms  
Conospermum filifolium ms  
Conospermum stoechadis  
Dryandra cirsioide  
Dryandra drummondii  
Dryandra ericacephala  
Dryandra ferrugineae  
Dryandra aff nivea  
Grevillea cagiana  
Grevillea eriostachya  
Grevillea erystoides  
Grevillea didymobotrya subsp didymobotrya  
Grevillea haplantha  
Grevillea huegeli  
Grevillea integriformia subsp bifurmis  
Grevillea integriformia subsp shuttleworthiana  
Grevillea involucrata  
Grevillea oligantha  
Grevillea petrophiloides  
Grevillea pilosa

RUTACEAE
Grevillea prostrata
Grevillea teretifolia
Grevillea wittweri
Hakea corymbosa
Hakea crassifolia
Hakea cygna subsp. cygna
Hakea erecta
Hakea gilbertii
Hakea horrida
Hakea incrassata
Hakea lissocarphe
Hakea marginata
Hakea meisneriana
Hakea multilineata
Hakea newberryana
Hakea obliqua
Hakea petiolaris
Hakea prostrata
Hakea scoparia
Hakea strumosa
Hakea subsulcata
Hakea trifurcata
Isopogon aff. buxifolius
Isopogon divergens
Isopogon aff. formosus
Isopogon scabriusculus
Isopogon teretifolius
Isopogon villosus
Persoonia coriacea
Persoonia diadema
Persoonia hakeiformis
Persoonia quinquenervis
Persoonia striata
Persoonia trinervis
Petrophile circinata
Petrophile ericifolia
Petrophile longifolia
Petrophile seminuda
Petrophile squamata
Petrophile trifida
Stirlingia simplex
Synaphea aff. spinulosa

RHAMNACEAE
Cryptandra glabriflora
Cryptandra leucopogon
Cryptandra nutans
Cryptandra parvifolia
Cryptandra pungens
Spyridium subochreatum

RUBIACEAE
Opercularia vaginata

Boronia coerulescens
Boronia crassifolia
Boronia crenulata var. crenulata
Boronia subsessilis
Drummondia hassellii var. hassellii
Eriostemon gardneri
Microcybe multiflora var. baccharoides
Phebalium ambiguum
Phebalium filifolium
Phebalium lepidotum
Phebalium tuberculosum
Phebalium tuberculosum var. megaphyllum

SANTALACEAE
Exocarpos aphyllus
Exocarpos spartanus
Leptomeria pauciflora
Leptomeria preissiana
Santalum acuminatum
Santalum murrayanum

SAPINDACEAE
Dodonaea amblyophylla
Dodonaea bursariifolia
Dodonaea caespitosa
Dodonaea pinifolia
Dodonaea pteromicaefolia
Dodonaea viscosa subsp. angustissima

STACKHOUSSIACEAE
Stackhousia monogyna
Stackhousia muricata
Stackhousia scoparia
Tripterococcus brunonis

STERCULLIACEAE
Lasiorpetalum indutum
Lasiorpetalum microcardium
Lysiosepalum involucratum

STYLIIDACEAE
Levenhockia pauciflora
Levenhockia pusilla
Stylium breviscapum
Stylium calcaratum
Stylium dichotomum
Stylium leptophyllum
Stylium luteum subsp. olavatum
Stylium neglectum
Stylium nungarinense
Stylium piliferum
Stylium piliferum subsp. minor
Stylium repens
Stylium sacculatum ms
Stylium schoenoides
Stylium squamellulosum

THYMELAEACEAE
Pimelea aeruginosa
Pimelea angustifolia
Pimelea argentea
Pimelea brevifolia
Pimelea graniticola
Pimelea imbricata var piligera
Pimelea suaveolens subsp flava
Pimelea sulphurea

VIOLACEAE
Hybanthus floribundus
Appendix 8. Orchids found in the Shire of Kulin.

This appendix lists orchids observed in the Kulin Shire during surveys by:
- WA Native Orchid Study & Conservation Group (WANOSCG) in 1995, and/or

Species are listed in alphabetical order. The presence of species in various locations are indicated by ✓. Locations are represented by the columns as indicated:

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<td><em>Pterostylis echinulata ms</em></td>
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Appendix 9. Priority Flora within and adjacent to the Shire of Kulin.

Source: CALM, South Perth.

Priority 1 Flora

Acacia lanei
Acacia sclerophylla var. teretiuscula
Acacia tetraneura ms
Cryptandra intonsa
Dampiera scaveolina
Drosera grievei
Dryandra lindleyana subsp. agricola
Eucalyptus myriadea subsp. parviflora
Frankenia glomerata
Goodenia integerrima
Grevillea hulfitzii
Guichenotia seorsiflora ms

Priority 2 Flora

Acacia arcuratis ms
Acacia asepala ms
Acacia castanostegia ms
Acacia concolorans
Acacia cowaniana
Acacia deflexa
Acacia drewiana subsp. minor
Acacia heterochroa subsp. robertii
Acacia sclerophylla var. pilosa ms
Acacia tuberculata ms
Acrotriche patula
Andersonia carinata
Astroloma microphyllum
Blennospora phlegmatocarpa
Cryptandra dielsii ms
Daviesia elongata subsp. implexa
Daviesia lineata
Daviesia rhizomata
Dryandra epimicta

Hydrocotyle hexapetra
Hydrocotyle muriculata
Jacksonia debilis ms
Melaleuca agathosmoides
Melaleuca sculpnea
Phebalium drummondii
Pimelea halophila
Ptilotus caespitosus
Schoenus sp. Harrismith (G.J. Keighery 6475) ms
Stylidium sejunctum
Thysanotus lavanduliflorus
Thysanotus sabulosus

Dryandra erythrocephala var. inopinata
Dryandra foliosissima
Eucalyptus microschema
Eucalyptus mimica ms
Gastrolobium densifolium
Gastrolobium rigidum
Goodenia trichophylla
Grevillea witweri
Jacksoniatarinensis ms
Kulinia eludens ms
Micromyrtus racemosa var. latifolia ms
Millotia steetziana
Persoonia hakeiformis
Rinzia affinis
Synaphea canaliculata
Synaphea flexuosa
Synaphea tripartita
Thysanotus brachyantherus
Priority 3 Flora
Acacia inophloia
Acacia obesa
Acacia phlebopetala var. phlebopetala
Acacia repanda
Acacia sedifolia subsp. pulvinata ms
Acacia tetrapetra ms
Acacia undosa
Adenanthis gracilipes
Baeckea sp. Hyden (J.M. Brown 141)
Boronia penicillata
Calothamnus affinis
Calytrix nematoclada
Cryptandra polyclada subsp. polyclada
Daviesia uncinata
Dryandra drummondii subsp. hiemalis
Dryandra fasciculata
Dryandra ferruginea subsp. obliquiloba
Dryandra meganotia
Dryandra viscosa
Dryandra xylothemelia

Eucalyptus depauperata
Eucalyptus exigua
Frankenia drummondii
Grevillea australis
Grevillea insignis subsp. elliotii
Grevillea pilosa subsp. redacta
Gyroseton prostratus
Lasiopetalum fitzgibbonii
Melaleuca polycephala
Microcorys cephalantha
Microseris scapigera
Monotoca leucantha
Phylloce gracilis
Sarcocornia globosa
Schoenus calcutus
Stenanthemum tridentatum
Stylium neglectum
Synaphea bifurcata
Synaphe drummondii
Thysanotus cymosus
Verticordia gracilis

Priority 4 Flora
Calamphoreus inflatus ms
Daviesia purpurascens
Drosera granitica
Dryandra cynaroides
Dryandra porrecta
Eremophila racemosa
Eucalyptus caesia subsp. caesia
Eucalyptus deflexa

Eucalyptus latens
Grevillea asteriscosa
Grevillea cirsiifolia
Grevillea prostrata
Gyroseton ditrigynus
Melaleuca fissurata
Pilostyles collina
Appendix 10. Fauna species present in the Shire of Kulin.

This Appendix lists native fauna observed in the Shire by Rhoda Giles, Kulin. Some species may no longer be present.

### Mammals

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Species Name</th>
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<tbody>
<tr>
<td>Chuditch</td>
<td>Dasyurus geoffroii</td>
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<td>Common Dunnart</td>
<td>Sminthopsis murina</td>
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<td>Echidna</td>
<td>Tachyglossus aculeatus</td>
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<tr>
<td>Gould’s Bat</td>
<td>Nyctophilus gouldi</td>
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<tr>
<td>Red-tailed Phascogale</td>
<td>Phascogale calura</td>
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<tr>
<td>Western Grey Kangaroo</td>
<td>Macropus fuliginosus</td>
</tr>
<tr>
<td>Western Mouse</td>
<td>Pseudomys occidentalis</td>
</tr>
<tr>
<td>Honey-Possum</td>
<td>Tarsipes rostratus</td>
</tr>
<tr>
<td>Common Brushtail Possum</td>
<td>Trichosurus vulpecula</td>
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<tr>
<td>Western Pygmy Possum</td>
<td>Cercartetus concinnus</td>
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<tr>
<td>(Dormouse)</td>
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### Amphibians

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Species Name</th>
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<tr>
<td>Turtle Frog</td>
<td>Myobatrachus gouldii</td>
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<td>Pobblebonk (Burrowing, Western Banjo)</td>
<td>Limnodynastes dorsalis</td>
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### Reptiles

<table>
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<tr>
<td>Bandy bandy</td>
<td>Vermicella annulata</td>
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<tr>
<td>Black Tiger Snake</td>
<td>Notechis ater</td>
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<tr>
<td>Black-headed Snake ?</td>
<td>Unechis gouldii</td>
</tr>
<tr>
<td>Blind Snake</td>
<td>Ramphotyphlops australis</td>
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<tr>
<td>Carpet Python</td>
<td>Python spilotus</td>
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<td>Carpet Snake</td>
<td>Morelia spilota subsp variegata</td>
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<tr>
<td>Children’s Python</td>
<td>Liasis childreni</td>
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<tr>
<td>Common Death Adder</td>
<td>Acanthophis antarcticus</td>
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<tr>
<td>Dugite</td>
<td>Pseudonaja affinis</td>
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<tr>
<td>Gould’s Snake</td>
<td>Rhinoplocephalus gouldii</td>
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<tr>
<td>Gwardar (Western Brown Snake)</td>
<td>Pseudonaja nuchalis</td>
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<tr>
<td>King Brown Snake (Mulga Snake)</td>
<td>Pseudechis australis</td>
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<tr>
<td>Race Horse Goanna</td>
<td>Varanus tristis</td>
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<td>Yellow-faced Whip Snake</td>
<td>Demansia psammophis</td>
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<tr>
<td>Common Name</td>
<td>Species Name</td>
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<tr>
<td>LIZARDS</td>
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<td>Bobtail (Shingle-backed Lizard)</td>
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<td>Fraseri Legless Lizard</td>
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<td>Gecko</td>
<td><em>Diplodactylus ? spinigerus</em></td>
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<td>Longtailed Skink</td>
<td><em>Egernia ? carinata</em></td>
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<tr>
<td>Mountain Devil</td>
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<tr>
<td>Western Blue-tongued Lizard</td>
<td><em>Tiliqua occipitalis occipitalis</em></td>
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<td>Western Jew Lizard</td>
<td><em>Amphibolurus barbatus minor</em></td>
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Appendix 11. Birds present in the Shire of Kulin.

This Appendix lists birds that have been observed in the Shire by Michael Eyers, Heather Gibson, Rhoda Giles and David Quicke. Some species may no longer be present.

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<td>Australian Grey Teal</td>
<td>Anas gracilis</td>
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<td>Australian Hobby</td>
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<td>Australian Magpie Lark</td>
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<td>Australian Owlet-nightjar</td>
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<td>Australian Raven</td>
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<td>Banded Lapwing (Plover)</td>
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<td>Species Name</td>
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<td><em>Accipiter cirrhocephalus</em></td>
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<td>see Shining Bronze-Cuckoo</td>
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<tr>
<td>Golden Whistler</td>
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<tr>
<td>Grass</td>
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<tr>
<td>Grass Owl</td>
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<tr>
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<td>Grey Falcon</td>
<td><em>Falco hypoleucos</em></td>
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<td>Grey Fantail</td>
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<tr>
<td>Ground Cuckoo-shrike</td>
<td><em>Coracina maxima</em></td>
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<td>Ground Lark</td>
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<tr>
<td>Harvest Hawk</td>
<td>see Brown Falcon</td>
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<tr>
<td>Hooded Dotterel (Plover)</td>
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<tr>
<td>Hooded Robin</td>
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**Mammals**

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# Reptiles

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**Amphibians**

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**Birds**

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<td><strong>HIRUNDINIDAE</strong></td>
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<td>Welcome Swallow</td>
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### Birds (continued)

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<td>Weebill</td>
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<td>Varied Sittella</td>
<td>Daphnoenositta chrysoptera</td>
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### Birds (continued)

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<td>Yellow-plumed Honeyeater</td>
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<td>Crimson Chat</td>
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<td>Australian Magpie-lark</td>
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<td>Dusky Woodswallow</td>
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<td>Corvus bennetti</td>
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<tr>
<td>Australian Raven</td>
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Appendix 13. Land and Nature Conservation Programs.

Natural Heritage Trust
The Natural Heritage Trust (NHT) was established in 1996 and aims to take an integrated, long-term approach to the conservation and sustainable management of land, water and biodiversity. It seeks to foster cooperation between the Commonwealth, State and local governments and the community. Assistance through the NHT is delivered at a number of levels: community groups, regional strategies, national partnerships and the Commonwealth. The community groups component contains five programs:

- Bushcare (formerly the National Vegetation Initiative)
- National Landcare Program
- Murray-Darling 2001
- National Rivercare Initiative
- National Wetlands Program

A guide to the next round of applications in 1999 will be available by mid October 1998, and applications will close in February 1999.

Contact and further information:
John Holly, NHT Coordinator, Agriculture Western Australia, PO Box Y3455, East St Georges Tee, Perth WA 6832.
Telephone: (08) 9325 0000.

Bushcare
Bushcare, formerly known as the National Vegetation Initiative (NVI), commenced in 1997 and is part of the NHT. It aims to address Australia's land and water degradation problems. The primary objective of Bushcare is to reverse the long term decline in the extent and quality of Australia's native vegetation through:

- conservation of remnant vegetation
- conservation of biodiversity
- restoration (through revegetation) of environmental values and productive capacities of degraded land and water.

Bushcare builds on the work of former vegetation programs including One Billion Trees and Save the Bush. The next round of applications in 1999 will close in February 1999.

Contact and further information:
Keith Claymore, Bushcare Coordinator, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, WA 6983.
Telephone (08) 9334 0333.
National Landcare Program
The National Landcare Program (NLP) is a component of the NHT. The aim of the NLP is to encourage community groups to responsibly manage and conserve land, water, biological biodiversity and cultural heritage in their area. The program provides funds to government agencies, education institutions, research institutions, landcare and other community groups for soil conservation projects. Emphasis is given to fostering cooperation and coordination between government agencies and people in the community working on land degradation problems. The NLP evolved in 1991 from the National Soil Conservation Program (NSCP), established by the Federal Government in 1983 with the aim of developing and implementing a national strategy for the rehabilitation and sustainable use of Australia’s land and water resources.

The next round of applications will close in February 1999.

Contact and further information:
Natalie Moore, Agriculture Western Australia, PO Box Y3455, East St Georges Tce, Perth WA 6832. Telephone: (08) 9325 0000.

State Landcare Program
The State Landcare Program (SLP) was introduced by the Western Australian State Government in 1987 to support LCDCs and catchment groups in combating land degradation problems in rural areas. Financial support is provided to LCDCs to undertake projects in catchment planning, demonstrate conservation practices and for communications and training. There are two major programs in the SLP: the Remnant Vegetation Protection Scheme and the State Revegetation Scheme.

Contact and further information:
SLP Coordinator, Agriculture Western Australia, PO Box Y3455, East St Georges Tce, Perth WA 6832. Telephone (08) 9325 0000.

Remnant Vegetation Protection Scheme
The Remnant Vegetation Protection Scheme (RVPS) was introduced in 1988 to enhance soil and nature conservation through the protection of native vegetation on agricultural land. CALM and AgWA jointly administer the scheme, with AgWA as the lead agency. The scheme provides a subsidy towards the cost of fencing for native vegetation on farms, with landowners giving an understanding by covenant on title that the fenced vegetation will be managed for nature conservation for a period of at least thirty years.

To receive a subsidy, the area to be fenced must be at least five hectares, in good condition or be able to be rehabilitated to good condition. The condition of the vegetation is regularly monitored by conducting botanical surveys. This provides both an objective measure of the long term success of the scheme, and the opportunity for landowners to improve their management practices by providing them with a measure of the impact of their activities.
The next round of applications for the RVPS will be due by May 1999.

Contact and further information:
RVPS Coordinator, Agriculture Western Australia, PO Box Y3455, East St Georges Tce, Perth WA 6832. Telephone (08) 9325 0000.

Roadside Conservation Committee
The Roadside Conservation Committee (RCC) was established by the Western Australian Government in 1985 to coordinate and promote conservation and the effective management of rail and roadside conservation. The programme is administered by CALM and relevant data is administered by the Main Roads Department. In 1989, the RCC organised an assessment of roadside vegetation involving community volunteers on a shire basis, using a proforma designed by the RCC (Hussey, 1991), and has completed Roadside Conservation Value Maps for 24 shires in the wheatbelt. The RCC has begun a similar survey of roadside vegetation within the Shire of Kulin, but has not completed a map.

Contact and further information:
Neville Walliss, Roadside Conservation Committee, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, WA 6983. Telephone (08) 9334 0404.

Land for Wildlife
Land for Wildlife is a voluntary scheme that aims to encourage and assist private landholders to provide habitats for wildlife on their property. Started in 1996, Land for Wildlife is free and has no legal binds or limitation on property size or use for registration.

Land for Wildlife offers:
- on-site advice to individual landholders that apply for Land for Wildlife registration;
- contact with like-minded landholders, through publications, field days and other activities;
- regular newsletters and more detailed publications;
- help to create healthy ecosystems;
- contacts, such as where to find local plant seedlings; and
- information about other forms of assistance and incentives.

With full registration, the landholders receives a sign for the property free of charge that displays a numbat, knob-tailed gecko and pink rainbow plant. This acknowledges the efforts being made for wildlife conservation.

Contact and further information:
Penny Hussey (Coordinator), Land for Wildlife, Wildlife Branch, Department of Conservation and Land Management, Hayman Road, Como. Locked Bag 104, Bentley Delivery Centre, WA 6983. Telephone (08) 9334 00530. Fax (08) 334 0278
Avon Working Group
The Avon Working Group is an incorporated body that was formed in 1995. The group consists of nine community representatives from the Yilgarn, Lockhart and Avon Sub-catchments and the Avon River Management Authority. Senior members of natural resource and regional agencies work in partnership with the group and provide technical support. The major aim of the Avon Working Group is to improve regional prospects for present and future generations by ensuring there is sustainable use, enhancement and conservation of natural resources across the Avon River Basin. The group coordinates Integrated Catchment Management projects, determines regional priorities, manages State and Federal funds, provides information and advice to the Natural Heritage Trust and plans for improved land and water management.

The Avon Working Group offers Community Grants to groups and individuals for landcare and flora/fauna conservation activities in the Avon Catchment. The aim of the grants program is to catalyse and support a change in catchment management practices to ensure the sustainable use of natural resources. The grants also reduce the burden to the community of the financial and productive risk of developing and implementing new and innovative management techniques.

The grants program has been split equally between two funding categories:

1. Small grants to a maximum value of $10,000 for groups or individuals.
2. Much larger grant up to $50,000 per grant for community groups to develop and implement priority aspects of their catchment plans.

Contact and further information:
Andrew Huffer (Executive Officer), Avon Working Group, Agriculture
WA Northam District Office, Northam WA 6401.
Telephone (08) 9690 2000.

Avon Catchment Network
The Avon Catchment Network is the information arm of the Avon Working Group, and is a project funded by the NHT. Operating since 1997, the Network provides and collects information on natural resource management in the Avon Catchment, and acts as a contact point for individuals and groups within the catchment.

Contact and further information:
Avon Catchment Network Coordinator, Wellington Street, PO Box 311,
Northam WA 6401. Telephone (08) 9622 7600. Fax: (08) 9662 7611.
Website at http://www.au/
Community Conservation Grants
The Minister for the Environment The Hon. Cheryl Edwards offers Community Conservation Grants for projects that involve the conservation of fauna, flora and/or land rehabilitation of environmental benefit. Applications are open to individuals, local community groups or organisations, and may be in association with a State or local government authority. Grants are provided for materials, equipment hire, purchase of specialist or essential equipment (must be non-capital and each item less than $500) and services. Projects can include environmental inventories and surveys, preparation and implementation of an environmental management plan (including on-ground works). There are two funding categories:

1. Delegated Organisations: to assist major environmental organisations coordinate and undertake environmental projects. A total of $80,000 was distributed in 1998.
2. Direct Grants: for ‘grass-root’ community organisations and individuals to undertake on-ground projects, particularly for works on public land. These grants generally range between $500 to $5,000, and the total funding provided in 1998 was $85,000.

The assessment panel includes representatives of the Department of Environmental Protection and CALM. The closing date for applications is in December of each year.

Contact and further information:
Paul Biggs (Community Conservation Grants Coordinator), Office of the Minister for the Environment, 18th Floor Allendale Square, 77 St George’s Terrace, Perth WA 6000. Telephone (08) 421 7777.

World Wide Fund for Nature (WWF)
The WWF (formerly the World Wildlife Fund) is a national, non-profit conservation group that conducts many activities in the wheatbelt. The $50,000 Community Grants Programme provides support to group projects aimed at the protection of threatened species. Such community conservation activities can receive up to $5,000 assistance from the WWF. The next round of applications is expected to be in February/March 1999, and groups are encouraged to begin preparing their applications. The WWF has employed a Wheatbelt Biodiversity Officer who will actively aid the incorporation of biodiversity issues into wheatbelt land management.

The Threatened Species Network is a community-based program of WWF and the Endangered Species Program of the Biodiversity Group of Environment Australia. The emphasis is on increasing public awareness, empowering the community, and providing links between those that work on the conservation of threatened species and ecological communities. In particular, the Threatened Species Network works with the Mallee Fowl Group, monitoring the abundance and distribution of mallee fowl throughout the wheatbelt.
The group will commence monitoring mallee fowls in the Lake Magenta area in the Shire of Lake Grace in 1998, and invites volunteers to assist in this long-term monitoring programme.

Contact and further information:

Gordon Reid Foundation for Conservation
The Gordon Reid Foundation for Conservation aims to provide funds or other support for the purpose of enhancing community involvement in conservation within Western Australia. The objective of the Foundation is to encourage and sustain action by community organisations in conserving and restoring indigenous plants, animals and micro-organisms and their natural environments. Applications can be made throughout the year by non-profit groups, who must be incorporated if seeking more than $5,000. One million dollars each year are provided for:

- conservation of the Western Australian environment through projects that have integrated, sustainable outcomes, with emphasis on native flora and fauna;
- identification and conservation of critical habitats and ecosystems;
- conservation of rare, threatened and endangered species in WA;
- public education and awareness of environmental issues in WA; and
- research or other studies into other matters related to the above.

Contact and further information:
Michael Sandford (Executive Officer), Gordon Reid Foundation for Conservation, Lotteries Commission, 74 Walters Drive, PO Box 1113, Osborne Park, WA 6917. Telephone (08) 9340 5270.

Greening Western Australia
Greening Western Australia is a member of Greening Australia, and offers various forms of assistance with conservation activities.

Greening WA has recently employed Bushcare Coordinators for the wheatbelt who are based in Community Landcare Centres in Jerramungup and Southern Cross.

Contact and further information:
Greening Western Australia, Fremantle Gaol, 10-12 The Terrace, Fremantle, WA 6160. Telephone (08) 9335 8933, Fax (08) 9335 9203.
Email: landcare@iinet.net.au
Matt Inman Jerramungup: (08) 9835 1127.
Clinton, Southern Cross: (08) 9049 1001.
David Stappleton, Woodanilling: (08) 9823 1661.
Australian Trust for Conservation Volunteers (ATCV)
ATCV is a national, non-profit, non-political community based organisation that seeks to assist landholders with practical conservation projects. ATCV works with major environmental agencies, non-government organisations, community groups and individuals to provide real environmental and heritage conservation outcomes. Projects include fencing, tree planting, seed collection, flora and fauna surveys, walking trail construction and maintenance, and environmental monitoring. ATCV can supply teams of up to ten volunteers with an ATCV team leader to coordinate and supervise volunteers and liaise with project managers.

Contact and further information:
Australian Trust for Conservation Volunteers, 216 Queen Victoria Street, PO Box 188, North Fremantle, WA 6159. Telephone (08) 9339 3902.

SNANN or System Neutralisation of Non-Natives
A group of local young men with one aim to kill foxes and feral cats using a variety of methods. They have a system of property protection and have organised an awareness campaign.

Contact and further information
Michael Ayres
Telephone: (08) 98 809 034 Fax (08) 98 890 059