

**The vegetation and flora
of
heritage bushland
on
David & Colleen Lawrence's property
"Mindah"
in the
Benjaberring Catchment
Shire of Wyalkatchem**



by

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Bushcare

Bushcare: The National Vegetation Initiative

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Support was also provided by the Department of Conservation and Land Management*

SUMMARY & HIGHLIGHTS

- This vegetation and flora survey of wheatbelt bushland represents collaboration between the:
 - Wildflower Society of Western Australia (Inc)
 - Natural Heritage Trust Bushcare Program (funding grant)
 - volunteers (time, travel, experience)
 - Department of Conservation and Land Management (time, expertise, access to WA Herbarium, public liability insurance)
 - Department of Environmental Protection (time, expertise, information)
 - Department of Agriculture (time, expertise, information) and
 - botanists (time, expertise).
- 61 individuals contributed to the survey, including 25 local community volunteers and Wildflower Society member volunteers from Wyalkatchem, Merredin, Bodallin and Perth who assisted with the field survey in Spring 1999.
- Twelve permanent 10mx10m quadrats have been established in the Mindah bushland – which can be used for ongoing monitoring and learning.
- Species richness within the 10mx10m quadrats ranged from 27 to 59 (including 5 weeds in both).
- Species richness of these sites is as rich as any comparable woodland or mallee community elsewhere in the western wheatbelt, again demonstrating the intact nature of the block.
- Eleven woodland, mallee and shrubland communities were distinguished.
- 241 species were recorded both in the survey quadrats and as opportunistic collections across the study area including:
 - 215 native species as 4 trees, 8 mallees, 79 shrubs, 8 grasses, 102 herbs, 3 twiners, 1, fern and 10 sedges/rushes
 - 3 priority taxa (*Phlegmatospermum drummondii*, *Melaleuca grieviana* and *Melaleuca sclerophylla*)
 - 2 species at the limit of their known range (*Acacia saxatilis* and *Baeckea cryptonoma*)
 - 26 species (11%) of introduced/exotic flora, commonly known as weeds
 - 103 species (43%) recorded only once.
- A six folder 'Mindah Field Herbarium' that contains an example of each of the 241 species recorded on the block has been compiled and presented to the land owners and catchment group.
- Although only 32ha in size this bushland block is now a large and important remnant in the Shire of Wyalkatchem where:
 - only 12% of original bushland remains as a result of extensive clearing, and
 - less than 15% of this original bushland is within areas of greater than 20ha.
- The most serious threats to the condition and conservation values of the bushland are weeds and a rising water table causing waterlogging and salinisation.

Cover photograph: Volunteers surveying Quadrat WYHO01 at 'Mindah' on 4th September 1999.

[crouching L-R] Kate Brown (Perth) and Neil Gibson (Perth).
[standing L-R] Margaret Collins (Perth), Nicole O'Sullivan (Community Landcare Coordinator, Wyalkatchem),
David Lawrence (property owner, Wyalkatchem) and Robyn Shaw (Perth).

(Photo: Brian Moyle)

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1. INTRODUCTION

1.1 "MINDAH" [Avon Location No. 18220]

The Holdsworth Road Bushland on David and Colleen Lawrence's property "Mindah" is in Benjaberring Catchment (which nestles within the Avon Catchment and ultimately the Swan-Avon Catchment). The property is within the Shire of Wyalkatchem.

This report provides a vegetation and flora record using the 'Community Bushland Plant Survey Process' (Keighery BJ 1994) as developed and managed by the Wildflower Society of Western Australia (Inc).

It was agreed with David and Colleen that survey outputs would include a vegetation map, plant species list, brief report, field herbarium (for retention by the land managers, with access by the Catchment Group and others) and presentation of the Survey Report to the Benjaberring Catchment Group.

The bush block and its land managers

The Lawrence's property totals 2,307ha, of which 107ha (or 4.6%) are bush. The property was settled in the 1930s by David's family when the first agricultural settlements began and bushland was cleared to develop arable land. Today wheat, white lupins, barley and chickpeas are the major farming enterprises, with some sheep. The 32ha 'bush block' surveyed is the largest remnant on "Mindah" (Avon Location No. 18220).



PHOTO 1: View of "Mindah Bush Block", looking from west across adjoining farmland

(C. Keating 10/99)

The 'bush block' has been fenced for over 50 years, has not been grazed for over 30 years and in recent times has not been used for timber cutting, firewood collecting or dumping. The current owners have no recollection of fire in this bushland during their lifetimes.

The Lawrence's have also registered this bush block in the *Land for Wildlife* program coordinated by Department of Conservation and Land Management, sponsored by the State Government and the Natural Heritage Trust. *Land for Wildlife* is a voluntary scheme that aims to encourage and assist private landholders in Western Australia to provide habitats for wildlife on their property, even though the property may be managed for other purposes.

1.1 THE BUSHLAND PLANT SURVEY PROJECT

The Wildflower Society's *Bushland Plant Survey Project* is a community-based project that has been in existence since 1988. It combines **understanding plants in the bushland** (ie working with living plants), **learning through involvement** and **bushland conservation** through the specific objectives:

- To foster cooperation, understanding and city-rural links between experienced volunteers and the broader community, towards the ongoing conservation and management of bushland.
- To introduce the community to bushland plant survey techniques, in particular recognition of native plants and plant communities.
- To survey remnant vegetation which meets the selection criteria in order to provide baseline flora and vegetation information for managing and monitoring bushland.
- To help landowners and managers interpret this information as an aid in land management planning, particularly with respect to protecting remnant vegetation and developing revegetation programs.

The need to protect remnant vegetation is a premise of the project. The Wildflower Society conducts survey projects at sites where the landholders have demonstrated that past and future protection measures have been taken, particularly fencing and no grazing.

Coordination, management and resources

Whilst coordinated and managed by the Wildflower Society of Western Australia (Inc) the *Bushland Plant Survey Project* receives essential support from the Natural Heritage Trust (NHT) – Bushcare, the Department of Conservation and Land Management (DCLM) and the Wildflower Society of WA.

Participants

One of the most valued elements of the survey approach, is participation and the associated action learning – participation of the community (both local and distant) and the participation of ‘experts’. Across all aspects of this project, from field survey, through pressing plant specimens, sorting specimens, identifying specimens, confirming identifications, collating field herbarium, updating field survey sheets, correcting specimen tags, photographing quadrats, reviewing the report drafts – volunteers have been significant contributors. Section 7 acknowledges in greater detail the 61 individuals who contributed directly to this survey. The cover photograph shows some of the volunteers recording information during the September 1999 Field Survey.

The role of the botanists is to coordinate the project, complete the plant identifications, ensure the work is completed to a scientific standard, prepare the vegetation map and accompanying vegetation and flora report, and to return to the catchment group and land manager to present the findings of the survey.

1.3 TERMINOLOGY

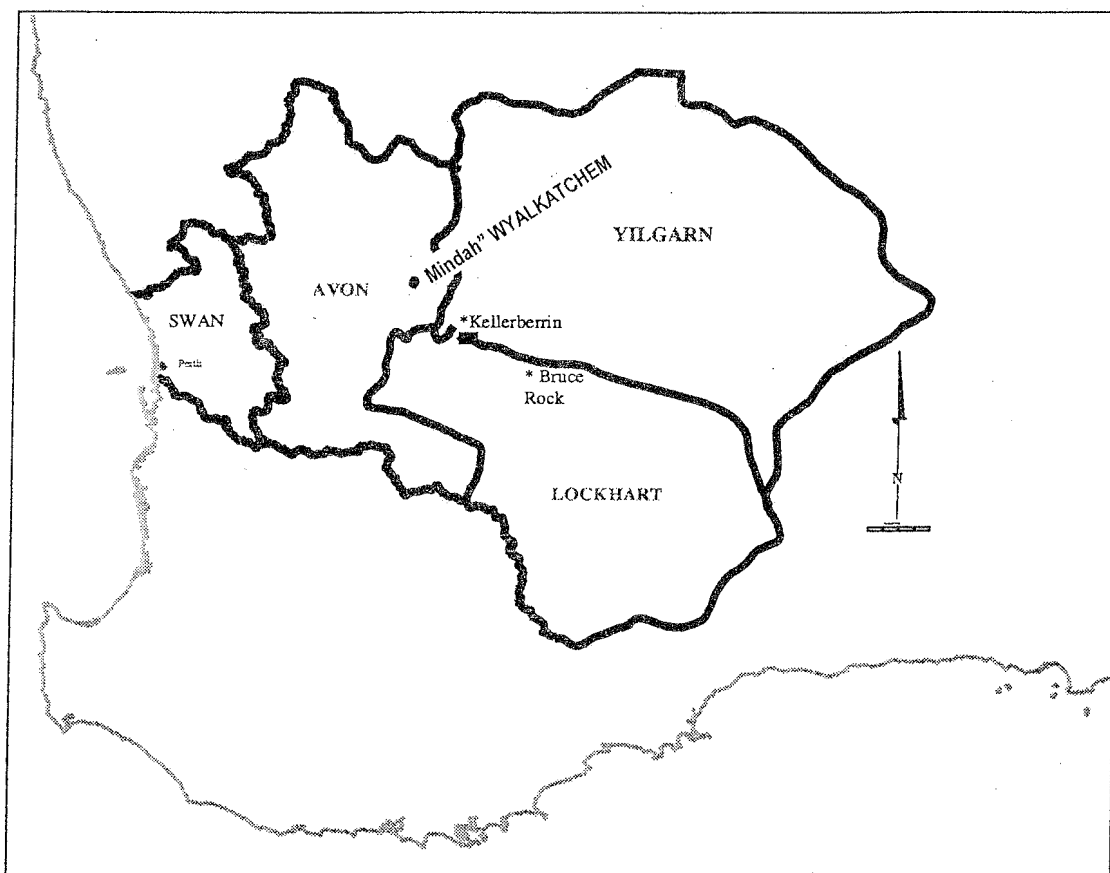
Bushland plant survey involves a range of old and new concepts, methods and language. Although the words are shared, there may be different understandings of what they mean – a common understanding reduces ambiguity and assists with communication. Appendix A defines some of the terms used in the *Bushland Plant Survey*, this report and bushland management in general.

2. STUDY AREA AND BACKGROUND INFORMATION

2.1 LOCATION

The subject of this report is a block of remnant vegetation on David and Colleen Lawrence's property "Mindah" in the Shire of Wyalkatchem. Wyalkatchem is approximately 280km east, north-east of Perth. "Mindah" is approximately 7km north of the Wyalkatchem Townsite. The bush block is within the **Benjaberring Catchment**, which is nestled in the **Avon Catchment** which in turn is one of the four Catchments which make up the **Swan-Avon Catchment/Drainage Basin** (Refer Map 1).

MAP 1: Avon, Yilgarn, Swan and Lockhart Catchments of the Swan-Avon Catchment / Drainage Basin and location of 'Mindah' survey area (Penny & McKane 1999)



2.2 CLIMATE

The climate of the Wyalkatchem study area which is characterised by cool wet winters (April to September) and warm dry summers (October to March) falls into the 'Mediterranean Climatic Regime'. Mediterranean climates can be further classified on the length of the dry season. Using this method the study area is 'Dry Warm Mediterranean' (ie in contrast to the Cape Naturaliste area which is 'Moderate Mediterranean'). The following rainfall and temperature data is extracted from the Commonwealth Bureau of Meteorology (2000) Climate Information Website for the closest Official Weather Recording Station to the study area, the Town of Wyalkatchem (Station No. 010140).

2.2.1 Rainfall

Rainfall for the study area is strongly seasonal, with somewhat reliable winter rains. Although rain in summer is unreliable, there can be sporadic heavy falls from thunderstorms (see figures for January below).

The mean average rainfall for Wyalkatchem is 336mm, of which 197.4mm (>58%) falls during the four month period May to August, over 8-12 wet days per month. 154mm (>45%) falls during the three winter months of May, June and July over 9-13 days per month.

The driest months are November to January with monthly averages ranging from 10.3mm to 14.4 mm, received over 2-2.8 days per month. Summer thunderstorms have been responsible for heavy downpours, for example although the mean average rainfall for the month of March is 20.6mm, the record from 90 years of recording is 165.5mm received in 1971. The highest daily fall on record of 90.9mm was from another late summer thunderstorm on 19th March 1917.

2.2.2 Temperature

The average maximum temperature at Wyalkatchem ranges from 33.9°C in January to 16°C in July. Average minimum temperatures range from 17.7°C in January to 6.1°C in August.

Wyalkatchem experiences a cool winter, with a mean daily temperature of 16.6°C (ranging from 16°C to 17°C). Summer is mild to hot with a mean daily temperature of 33.2°C (ranging from 32.4°C to 33.9°C). January is consistently the hottest month with a mean daily maximum of 33.9°C, and a mean average of 3.2 days >40°C and 24.4 days >30°C. The highest maximum recorded of 44°C is also for January.

2.3 TOPOGRAPHY, GEOLOGY, HYDROGEOLOGY AND SALINITY

2.3.1 Geology and Topography (extracted from Penny & McKane 1999 and Weaving 1994)

The study area and the Shire of Wyalkatchem fall into the Avon Catchment, part of the Swan-Avon Catchment or Drainage System (Refer Map 1), where the present day landscape is a result of geomorphological processes. The landscape that is now present has gently undulating low relief, with slopes that are long and gentle. The drainage divides are wide and convex, with the main valley wider and containing salt lakes. These are extensive in the areas of sandplain. Significant features in the landscape include part of Lake Wallambin (which falls to the north of the Shire and the study area), Carribin Rock and Derdibin Rock.

The Catchment lies on the Yilgarn Block, which is the area east of the Darling Fault (Map 2). The Yilgarn Block is a mass of granite and gneiss from the Archaen Age, some sections being 4,600 to 3,000 million years old.

Sedimentary rocks underpinning the Yilgarn Block

Granite is a coarse grained igneous rock, its composition is approximately 30% quartz (clear grains), 60% feldspar (opaque creamy white) and 10% mica (black plate-like material).

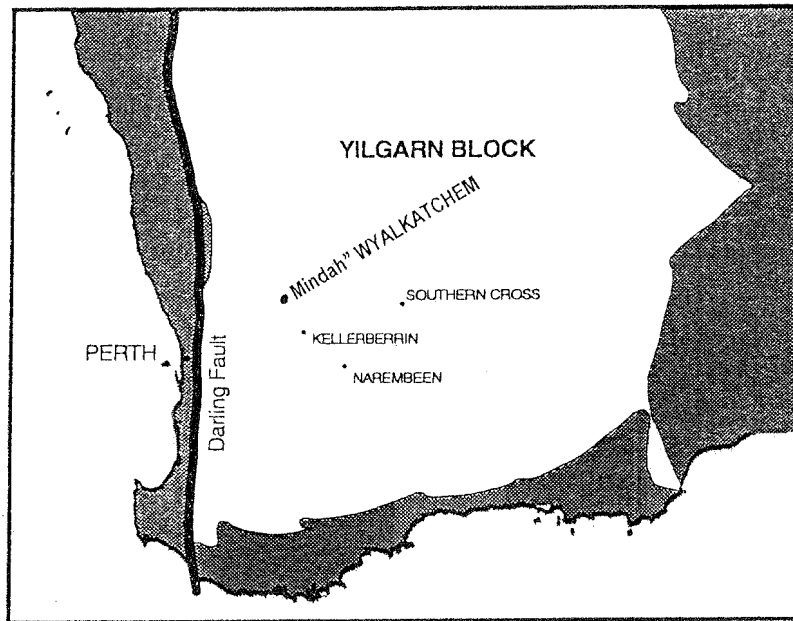
Gneiss is a metamorphic rock, generally made up of bands which differ in colour and composition, some bands being rich in feldspar and quartz, others rich in hornblende or mica.

Wyalkatchem is underlain by granitic rocks covered by alluvia in the major valleys. Mainly the rock is deeply weathered and covered by the “pallid zone”¹, capped by soil or massive laterite² ironstone gravels or sand. Locally, massive granite, which is resistant to weathering, approaches the surface or crops out to form rock domes and tors.

¹ pallid zone = the lower portion of a lateritic soil profile, comprising a near-white kaolin-rich clay, with few mottles, but often showing some fabric of the parent rock into which it merges through a transition below.

² laterite = formed from soft and clay-rich soils that have been allowed to dry (either seasonally or by exposure) they irreversibly harden through an oxidation process.

MAP 2: Showing the location of the Yilgarn Block in South-Western Australia (Penny & McKane 1999)



2.3.2 Soils (extracted from Lantzke & Fulton 1992, Weaving 1994)

The Shire of Wyalkatchem falls within one physiographic region with characteristic landforms, vegetation and soils – **The Zone of Ancient Drainage**. The landscape consists of a gently undulating plateau, with wide divides, long gentle slopes and broad valleys that contain salt lakes at their lowest points.

Within this **Zone** are nine **Soil Landscape Units (SLU)** that differ mainly in their position within the topographic profile and form a mosaic of soil landscapes, eight of which occur within the Shire of Wyalkatchem. The “Mindah” study area is contained within the Booran/Nembudding Soil Landscape Unit where the soils are characteristically hardsetting grey to brown sandy loams over mottled yellow and brown clays or loamy sands over clays. These occur on long hillslopes often below the Ulva SLU, separated by a breakaway (McArthur 1992).

2.3.3 Hydrogeology and salinity (extracted from Penny & McKane 1999, Government of WA 1999)

Interplay of geomorphic and geologic factors governs the movement of water from the time it reaches the land surface until the time of leaving it. Geomorphic features control in large measure the distribution of rainfall and the amount of rainfall that contributes to run-off and ground-water recharge. The nature, distribution and structure of geologic formations control the occurrence, movement, quality and availability of ground-water.

The water-table represents the ground-water reservoir level and changes in its level represent change in ground-water storage. Diurnal or semi-diurnal fluctuations in the water-table are mainly caused by barometric pressure. Water-table fluctuations are also caused by:

- evapotranspiration – controlled mainly by climate and vegetation (type, density, stage of growth)
- soil permeability
- proximity of the water-table to the ground surface.

Primary salinity develops naturally, mainly in areas where rainfall is insufficient to leach salts from the soil profile and evapotranspiration is high. Over thousands of years salt slowly accumulated beneath the south-west of WA, causing changes in biological systems and landscape form and function.

Secondary salinity (which takes the form of dryland or irrigation salinities) is the result of clearing of native vegetation and replacing it with shallow-rooted crops and pasture that use less water, causing changes to the hydrology of the landscape. Much of the indigenous vegetation of Australia is perennial and deep rooted, well adapted to surviving both floods and drought and effective in its use of water. Annual crops and pastures do not use as much of the incoming rainfall and this unused water either runs-off or infiltrates beyond the root zone and accumulates as ground-water (recharge). Much of the land in the south-west agricultural region was prone to salinity prior to clearing. It has been estimated that the region has an average of about 2,000 tonnes of salt stored below every hectare in the soil profile between the surface and the bedrock, with as little as 300t/ha in uplands and as much as 10,000t/ha in saline valleys. In many areas this accumulation of salt has become mobilised with the rise in ground-water levels, emerging where water is forced to the land surface.

As saline ground-water comes close to the surface, salt enters the plant root zone leading to the death of native plants, crops and pastures that are not salt tolerant. Plants also suffer from increased waterlogging. Saline ground-waters discharge at the soil surface and are concentrated by evaporation, damaging soils on site and down slopes, eventually draining into streams, rivers and lakes, degrading wetland habitats and water resources. Seepage areas and scalds are the surface expression of salinity, although salt can also be present in areas where only marginal reductions in plant vigour and crop yield can be seen.

2.4 NATIVE VEGETATION and BIODIVERSITY

2.4.1 Phytogeographical and Biogeographical Regions

The study area and the Wyalkatchem Shire fall in the Avon Phytogeographical Region of Beard (Beard 1980). The Avon Phytogeographical Region corresponds to the **Avon Wheatbelt Region** (Refer Map 3) as mapped in the Interim Biogeographic Regionalisation of Australia³ (Thackway and Cresswell 1995).

Each of the Phytogeographical Regions contains a series of vegetation systems. The “Mindah” study area falls in the **Jibberding System** (Beard 1980). The characteristic landscape and vegetation units identified in this system are:

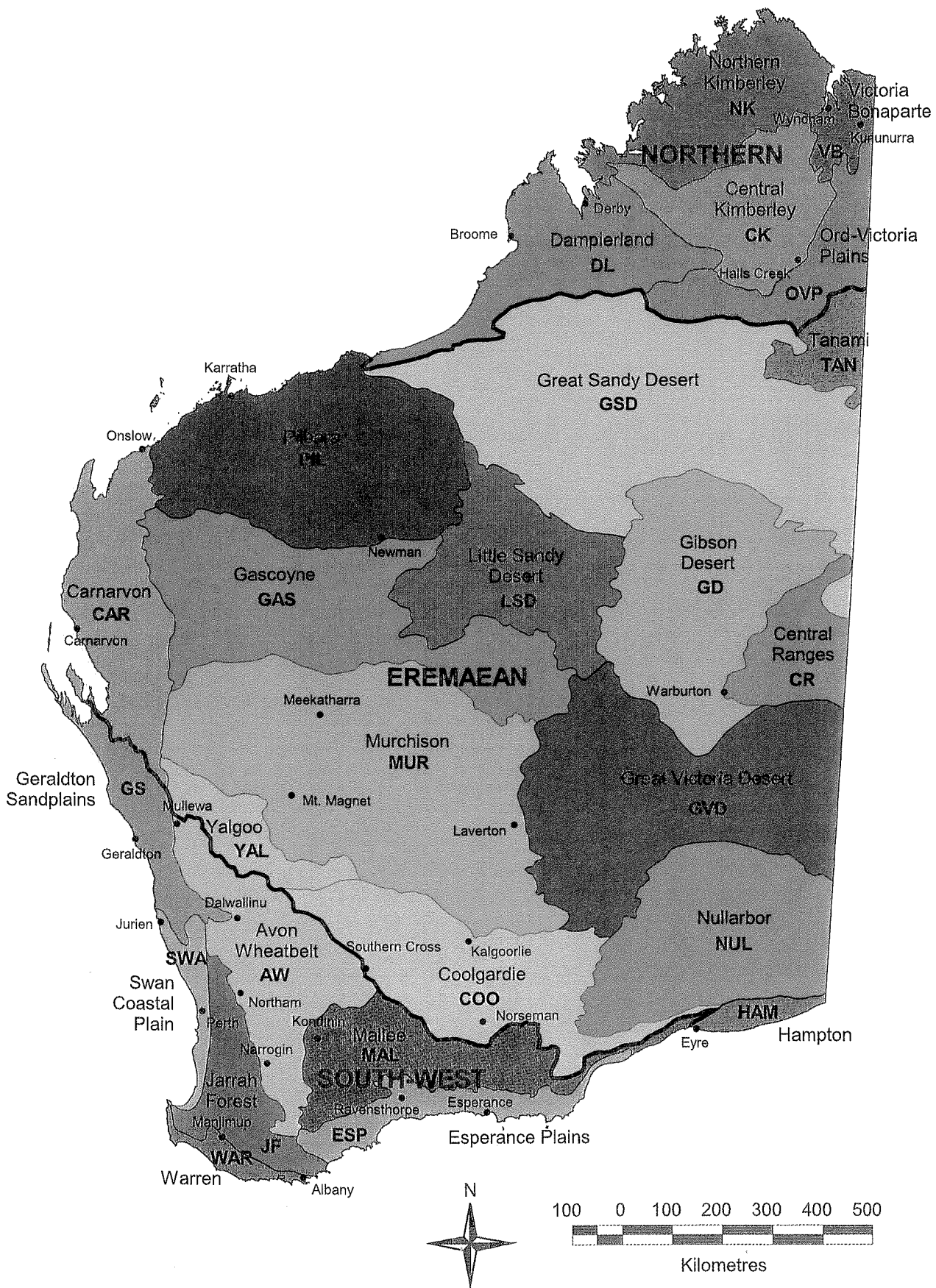
- moderately dissected landscape with broad valleys and interfluves
- red bottomland soils in the valleys, occupied by some major salt lake systems
- sandplains on the interfluves
- Woodlands with Gimlet (*Eucalyptus salubris*), Wheatbelt Wandoo (*Eucalyptus capillosa* ssp. *capillosa*) and Salmon Gum (*Eucalyptus salmonophloia*)
- Tree/Shrub Mallees dominated by *Eucalyptus* and *Allocasuarina*
- Open Shrublands through to Dense Thickets, often dominated by species from the Myrtaceae, Proteaceae and Casuarinaceae and often with two distinct structural layers
- Open areas that often come alive during spring with carpets of small annual herbs, grasses and sedges.

Comparison of vegetation cover over time

Maps 4 and 5 provide a graphic contrast of the expected (pre-settlement) and existing vegetation cover of the area. Note the more fertile soils that supported Wheatbelt Wandoo, York Gum, Salmon Gum, Morrel and Gimlet have been the most extensively cleared.

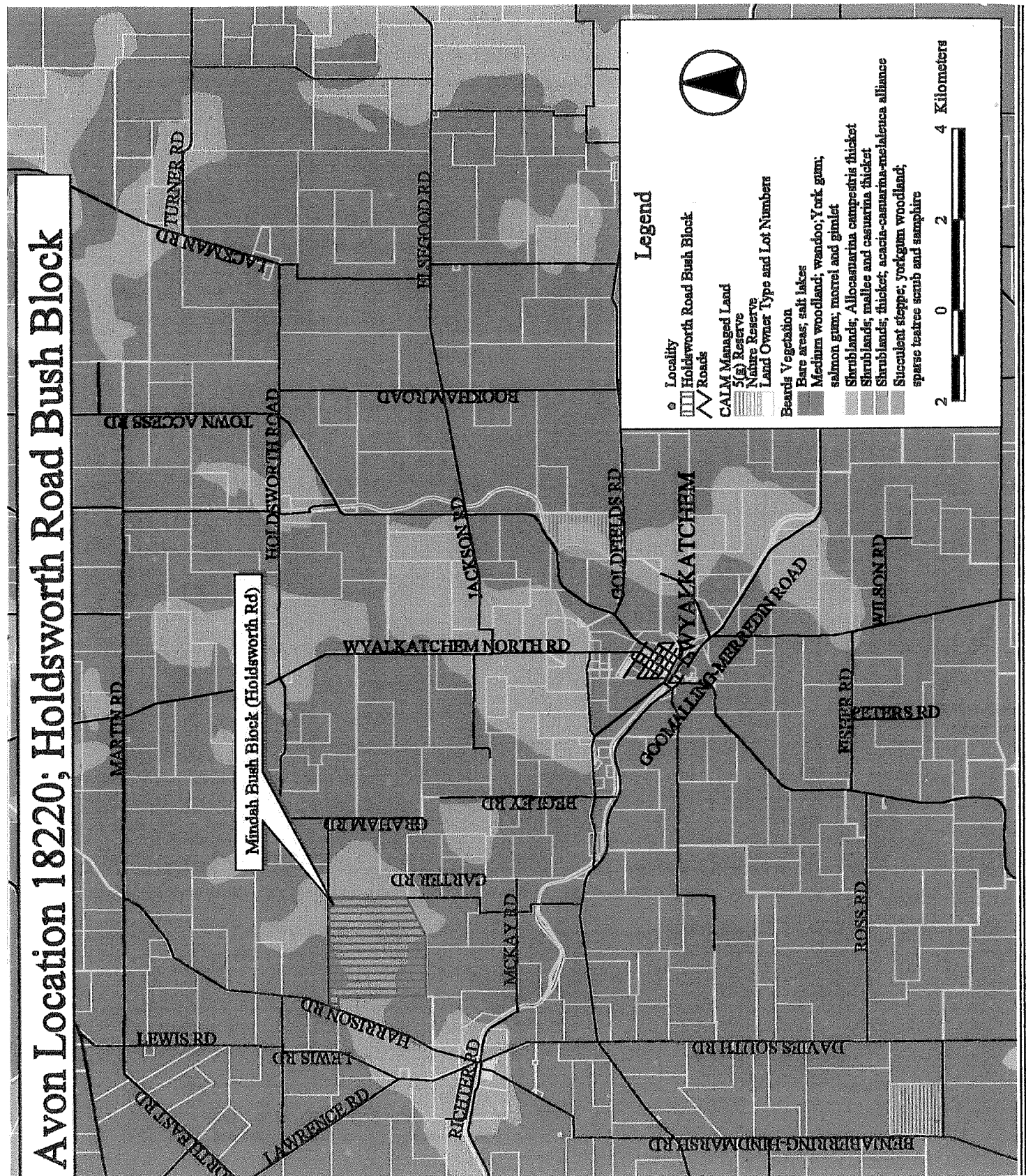
³ The Interim Biogeographic Regionalisation of Australia identifies biogeographic units across Australia (Thackway and Cresswell 1995). Eighty Interim Biogeographic Regions (commonly called IBRA Regions) were mapped in Australia, with 26 in WA. In Western Australia the boundaries broadly match those of the Phytogeographical Regions in Beard (1980, 1981). The South West of WA encompasses seven IBRA regions – the Geraldton Sandplains, Swan Coastal Plain, Jarrah Forest, Avon Wheatbelt, Mallee, Jarrah Forest, Warren and Esperance Plains.

MAP 3: Interim Biogeographic Regions of Western Australia, including the Avon Wheatbelt (AW)
(Thackway & Creswell 1995, extracted from Paczkowska & Chapman 2000)



Map by Paul Gioia, Western Australian Herbarium

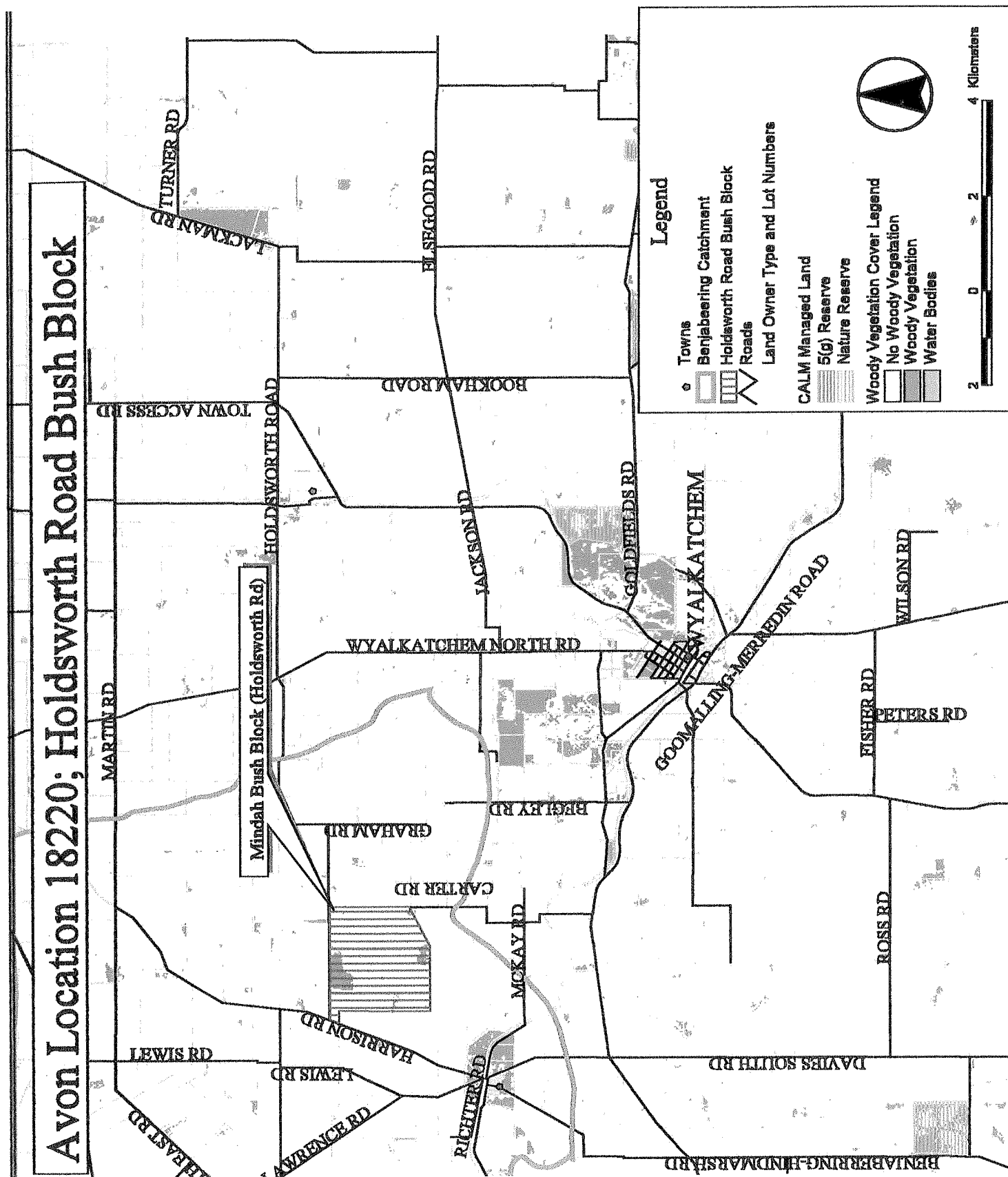
MAP 4: Projection of Beard vegetation types as would have been expected prior to agricultural settlement and associated clearing – showing anticipated vegetation for study area as *Shrublands; thicket; Acacia-Casuarina-Melaleuca alliance*
(Prepared by the Department of Environmental Protection, with permission from the Land Monitor Project⁴)



⁴ The information contained in this map is necessarily based in part upon assumptions and predictions. The Land Monitor Project [comprising the WA State Govt. agencies (Dept of Agriculture, Dept of Environmental Protection, Dept of Land Administration, Main Roads and Water & Rivers Commission) and the Commonwealth agency (CSIRO Mathematical & Information Science)] accepts no responsibility for any inaccuracies in this map and persons relying on this map do so at their own risk.

MAP 5:

Existing woody vegetation cover – illustrating the importance of the 'Mindah' bushland (Prepared by the Department of Environmental Protection, with permission from the Land Monitor Project⁵)

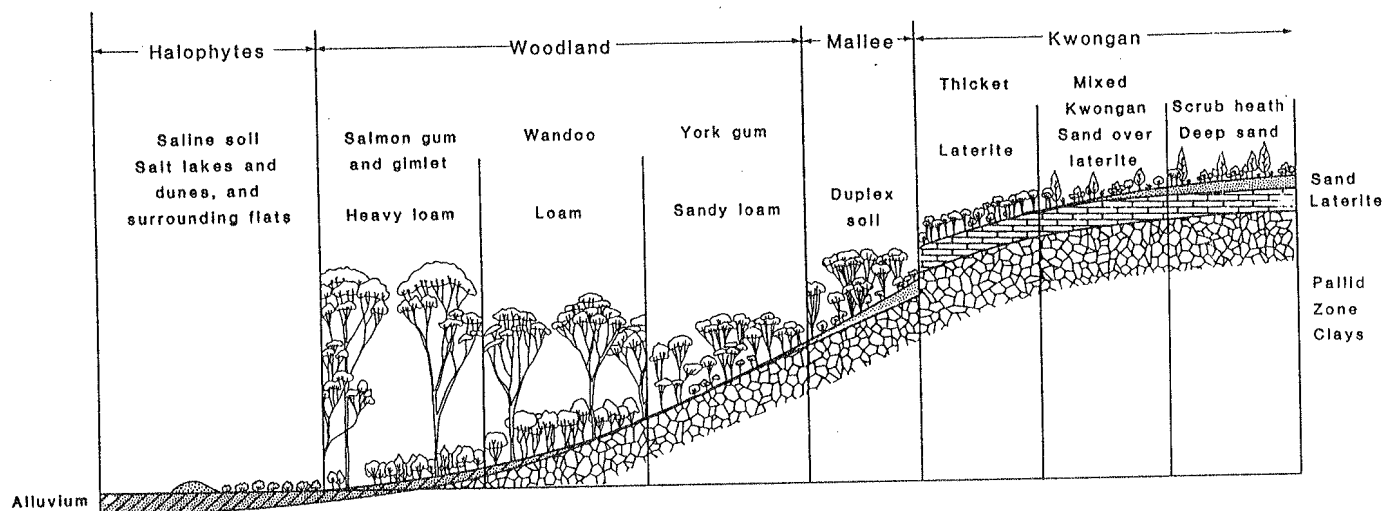


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Relationship between plants, landform, soils and moisture

Figure 1 is a pictorial representation of the main vegetation units as illustrated by John Beard in his publication *Plant Life of Western Australia* (1990). Although it is obviously simplified it provides a clear illustration of the relationship between plants, landform, soils and moisture.

FIGURE 1: Diagrammatic catenary sequence for the Wheatbelt Region showing idealised relationship of vegetation and soils (Beard 1990, page 116)



2.4.2 Biodiversity and Landscape Management

Overview (extracted from Environmental Protection Authority 1999)

Western Australia is both unusual and special in terms of both the environmental processes acting at the landscape level as well as in biodiversity. Biodiversity is important not only because of the plants and animals as species but because of the ecological functions they perform. Reduction in biodiversity or removal of species can therefore lead to significant effects at the level of how ecological systems function.

The particular geological and climatic history and the naturally nutrient depauperate status of the soils have provided somewhat extreme conditions to which WA's native plants have become adapted. This, combined with a long period of isolation from other land masses, has provided an extended period of time in which subtle adaptations to the extreme conditions could take place, resulting in the very high level of biodiversity of plant species in Western Australia, particularly in the South West region. The South West is frequently referred to as a mega-biodiverse region on a world scale. Much of the region has species numbers commonly in the order of 80-100 species per hundred square metres. This compares with values regarded as high in other parts of the world in the order of 30 species per hundred square metres. Furthermore, adding to the south west's complexity – although the number of species may remain the same over distance, the actual species represented can alter.

We do know that in agricultural areas the removal of biodiversity has already been too much and agricultural practices have not been able to mimic the ecological function performed by the former native plant communities. Starting again with the wisdom of hindsight, we would need a very cautious approach to such mass clearing and removal of biodiversity. In terms of hydrological function alone, most of the agricultural area would need to retain deep-rooted vegetation at a level in the order of 60-70% cover. Recent figures from Tom Hatton (CSIRO Land and Water) suggest that to have a chance of restoring hydrological function in catchments the figure for planting deep-rooted vegetation would need to be in the order of 85% catchment cover, because of the hysteresis effect (when you push a natural system too far then you have to go even further to bring about a rebound and return it to close to the previous position, if this is possible at all).

Stocktake and systematic survey (extracted from Safstrom 1999 and Keighery GJ 2000)

The Avon Working Group contracted Environs Consulting in association with other specialists (Safstrom 1999) to collate information on 'The Current State of Biodiversity in the Avon River Basin'. The consultants brought together in one document a range of information relating to:

- the wide range of zonings and classifications around which understanding is gained and decisions are made (eg water catchments, Shire boundaries, natural resource zones, biogeographic regions)
- physical characteristics
- biodiversity – its evolution, original occurrences and distribution
- past impacts of European settlement
- current occurrence, distribution and condition of biodiversity
- Rare and Threatened Species and Threatened Ecological Communities
- threats to biodiversity and management of threats
- values people place on ecological communities
- gaps in information, and
- trends relating to biodiversity in the region.

Highlights of this information are also available on the Avon Integrated Catchment Management (ICM) Website (Avon Catchment Working Group 2000).

Under the banner of the State Salinity Strategy (Government of WA 2000b), and in response to salinity – the greatest environmental threat facing Western Australia – a four year systematic survey of the wheatbelt terrestrial and aquatic plants and animals is being undertaken by the Department of Conservation and Land Management's CALMScience Biological Survey Group, together with a range of agencies and specialists.

In an update of this work Greg Keighery, Principal Research Scientist and Leader of the Program, highlighted some of the background and findings (Keighery GJ 2000):

“The wheatbelt of WA stretches from Kalbarri to east of Esperance. It contains all or significant parts of six (Geraldton Sandplains, Swan Coastal Plain, Avon Wheatbelt, Jarrah Forest, Mallee and Esperance Sandplains) of the eight biogeographic regions recognised in temperate WA (NOTE: Refer Map 3, this report).

Rising saline groundwater – the result of clearing – threatens about 30% of the agricultural area of WA. This will have major impacts on the region’s native plants and animals.

The agricultural zone has an estimated 4,000 species of flowering plants, and more than 60% of these grow nowhere else. The region is the centre of diversity for many of the species-rich genera of trees and shrubs (such as *Acacia*, *Dryandra*, *Eucalyptus*, *Grevillea* and *Verticordia*) that characterise the south west of Western Australia.

It is already abundantly clear that the biodiversity of the agricultural zone is much higher than was previously thought. For example the small Quairading Shire Reserve (surveyed by community volunteers under the *Bushland Plant Survey Project* coordinated by the Wildflower Society of WA) has more than 500 plant species including two that are new to science and the largest populations of two critically endangered taxa.

Quadrats in the agricultural zone contain at least 20 and sometimes 90 species, the equal to most heathland areas, normally considered the most species-rich sites.

More than 1,500 of the 4,000 species in the agricultural zone grow low in the landscape, in riverine valleys, fresh water or primary saline lands. Of these 450 grow only in the wheatbelt and are in grave danger of extinction as a result of encroaching salt. Areas affected by Secondary salinisation also show major declines in biodiversity. Rich and complex plant communities are replaced by a few succulents and weeds. Most lowland communities including tall woodlands, mallee and melaleuca shrublands, fresh water and naturally saline wetlands, will be lost unless remedial action is taken. The wheatbelt will lose much of its landscape character with the loss of these communities and paddock trees.”

2.4.3 Cultural and historical ties (extracted from Weaving 1994)

Much of the landscape of the Avon catchment is of cultural and historical significance. Until European settlements, Aborigines inhabited the area. The first European to explore the Avon Valley was Ensign Robert Dale in 1830, looking for suitable agricultural land for settlers and he first found the site of York, which was settled by September 1831. He explored the rest of the Avon Valley on later expeditions, travelling out to Mount Caroline, near Kellerberrin and then south into the Beverley area. Much of the area was explored during the first year and within ten years most of the river frontage was occupied.

2.4.4 Active and passive clearing of native vegetation (incl extracts from Safstrom 1999 & Weaving 1994)

Western Australia wheatbelt

Approximately 93% of the wheatbelt area of Western Australia has been cleared, mainly for agriculture in the last 100 years (Beard 1990). Broadscale clearing for agriculture since the 1940’s has meant only 12% of the Shire of Wyalkatchem still retains original native vegetation (Refer Table 1).

Most of the remaining vegetation surviving in the wheatbelt is as scattered patches on private farmlands and in public reserves. In addition to clearing for production, grazing by livestock and rabbits, weed invasion, rising soil salinity and landuse pressures all contribute to the degradation of the remaining native vegetation.

Avon River Basin

The native vegetation in the Avon River Basin has been progressively modified and cleared, where the majority of land clearing in the Shire of Wyalkatchem has been for agriculture. In the early days of settlement, the woodlands provided grazing and then the heavy valley floors were cleared for crops.

Later with the advent of fertilisers and trace elements it was possible to develop the lighter soils. When clearing was at its height, and machinery alleviated more labour intensive practises, nearly all the vegetation was removed, often as guided by government instructions. Towards the end of broadscale clearing, wider road reserves and reserves for conservation were left. We thus have a differentiated clearing pattern across the agricultural areas of the Avon River Basin.

Map 6 shows the extent of clearing in the Benjaberring and Mortlock River East Sub-catchments as well as the Wyalkatchem Shire – indicating also the location of the study area, north-west of the Wyalkatchem Townsite.

Shire of Wyalkatchem

The Shire of Wyalkatchem was settled late in the nineteenth century by Europeans. Initially most of the land was held under pastoral lease. There were two main periods of clearing in this area; 1900-1930 and 1950-1980 after World War II during Soldier Settlement. The Government set aside areas of native vegetation as crown reserves for townsites, water catchments and gravel extraction. Many of these patches of vegetation were designated as nature reserves in the 1960s and 1970s including Wallambin Nature Reserve⁶. Some vegetation associations have been more widely cleared than others, for example areas of York Gum, Salmon Gum, Gimlet and Morrel woodlands were considered indicators of first class agricultural land by early settlers and therefore extensively cleared. Table 1 shows the clearing statistics for the Shire of Wyalkatchem.

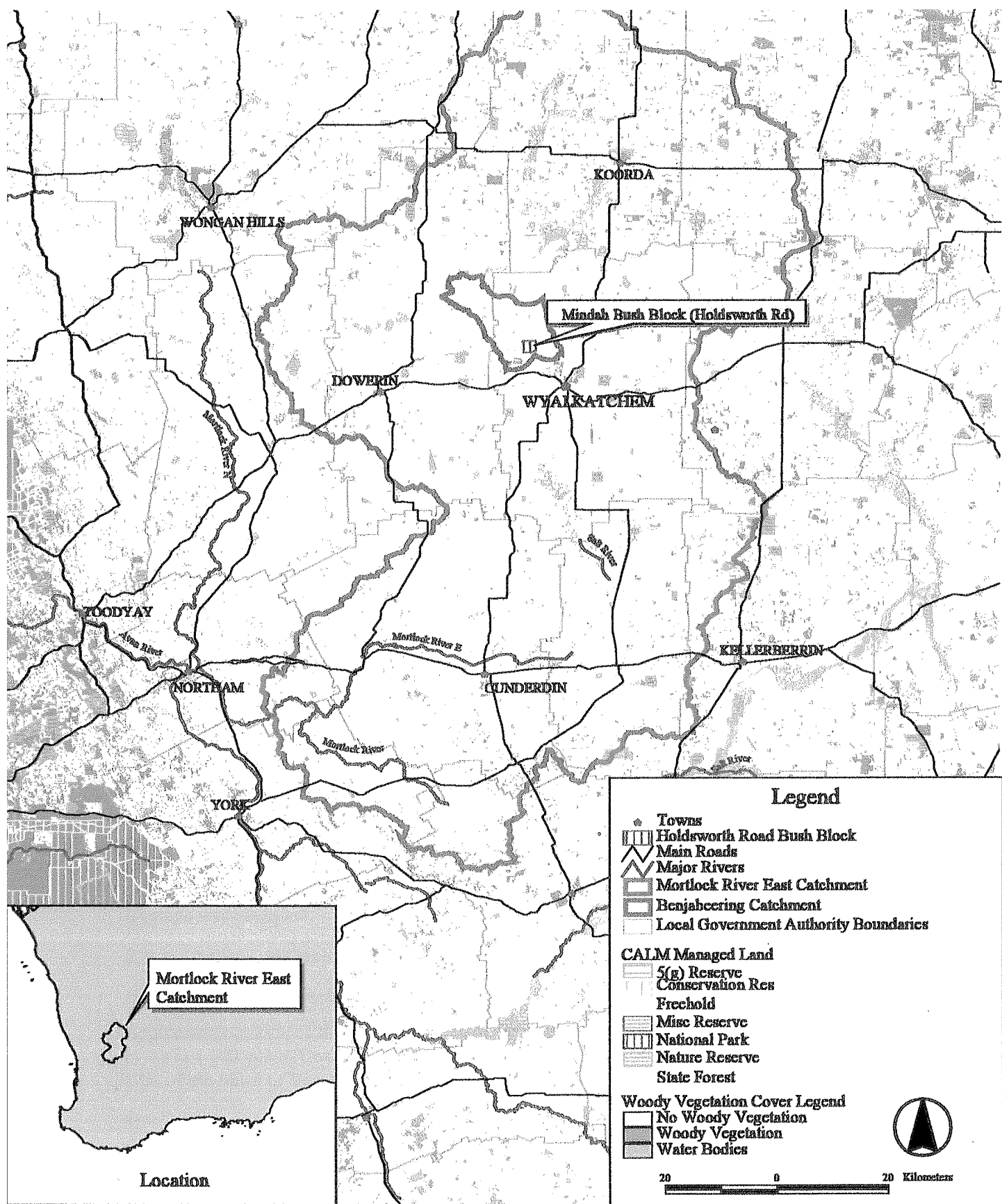
TABLE 1: Clearing statistics for the Shire of Wyalkatchem (Beeston *et al.* 1994)

Area (ha) of Shire of Wyalkatchem	% of Shire with remnant* vegetation on public and private land	% of Shire with remnant* vegetation on private land	% of remnant* vegetation in areas of less than 20ha
158 004ha	12.85%	4.68%	85%

NOTE: For these statistics 'remnant vegetation' has been calculated by also including modified vegetation. Modified vegetation is degraded understorey with reduced number of native species and includes weeds; obvious human disturbance including clearing, mining, grazing and weeds; salt affect as well as narrow corridors of vegetation which are more likely to be affected by edge effect (Weaving 1999).

⁶ Wallambin Nature Reserve = 12.5km north-east from the "Mindah" study area

MAP 6: Existing woody vegetation cover (and thus extent of clearing) vegetation in the Benjaberring and Mortlock River East Sub-catchments (of the Avon River Basin)
(Prepared by the Department of Environmental Protection, with permission from the Land Monitor Project⁷)



⁷ The information contained in this map is necessarily based in part upon assumptions and predictions. The Land Monitor Project [comprising the WA State Govt. agencies (Dept of Agriculture, Dept of Environmental Protection, Dept of Land Administration, Main Roads and Water & Rivers Commission) and the Commonwealth agency (CSIRO Mathematical & Information Science)] accepts no responsibility for any inaccuracies in this map and persons relying on this map do so at their own risk.

3. METHODOLOGY AND LIMITATIONS

3.1 AIMS

The aims or purpose of the flora and vegetation survey were:

- To collect, identify and list as much as possible of the flora of the study area.
- To document populations of rare, priority and geographically restricted flora.
- To produce a map showing the broad plant communities (vegetation units) of the study area, with accompanying descriptions of each unit and comments on their distribution.

3.2 METHODS

The Survey techniques are well described in the Wildflower Society publication '*Bushland Plant Survey for the Community*' (Keighery BJ 1994). The methods have proved most successful for volunteer and community participation whilst ensuring scientific rigour is maintained. The quadrats and data sheets provide a systematic procedure for the collection of information and avoid concentrating on just common and obvious species. They provide the baseline information for the plant species and plant community descriptions. The following is a brief outline of the methodology used.

3.2.1 Site Selection

As with all properties surveyed as part of the *Bushland Plant Survey Project*, the Land Manager or local Catchment Group responded to an initial open invitation from the Wildflower Society to participate in the Project. Many bush blocks met the selection criteria (Refer Table 2), but unfortunately due to a combination of limited resources and pressures on volunteers only a small number of surveys could be done each year.

TABLE 2: Selection criteria for participation in *Bushland Plant Survey Project*

Selection of properties was made on:

- Land ownership – may be either privately owned, local government land or vested crown reserve. National Parks and Nature Reserves cannot be included in this program
- Degree of disturbance – the least disturbance, ranked higher priority
- Current level of knowledge about the site – if poor then there is a greater need for the survey work to be done, thus ranked higher priority
- Level of community participation – by the local community
- Conservation value of the bushland – in a local and regional context
- Accessibility to the site – given the limited time and the involvement of volunteers
- Size of the site – preferable to conduct the initial field survey over a one or two day period
- Protection of the site – the bushland needs to have long term security
- Conservation commitment – a demonstrated commitment by the land owner and/or community group to manage the bushland for conservation
- Written submission and site visit.

3.2.2 Field Survey

The vegetation mapping was based on the interpretation of 1:25,000 scale coloured aerial photographs of the study area. Areas of similar colour and texture were outlined on the photographs as an anticipated reflection of similar vegetation and soil types. This photo-interpretation was then assessed in the field during the initial visit (14/8/99) and vegetation units were further defined and boundaries altered where necessary. In order to sample the range of plant communities, survey quadrats or recording sites were selected within each of these major vegetation units.

Survey work on "Mindah" was conducted by groups of volunteers during the 1999 early Spring flowering (4/9/99 + 5/9/99). Each group was led by a botanist or experienced volunteer. A later visit (28/11/01) enabled collection of species that were in flower and/or fruit later in the season, thus assisting with the identifications and boosting the knowledge of the area. It also enabled the vegetation descriptions to be further checked.

Twelve 10 metre x 10 metre quadrats were located and described within each of the pre-determined vegetation units. The quadrat markers have been left in position so that the landholders can revisit the sites, and changes over time can be monitored. Copies of the quadrat data sheets are given back to the landholders. Photographic records made of each quadrat at the time of the survey provide another useful monitoring tool (Refer Appendix C). Additional colour slides compliments of Brian Moyle also accompany this report.

Plant Collections and Identification

In the field, specimens were collected and tagged with a Quadrat Specific Code (eg WYHO 04) as well as an individual specimen number (eg species #17). Opportunistic collections of species either not recorded 'in' or 'adjacent' to quadrats, or specimens with better diagnostic features (eg bud, flower, fruit) were also made as the participants moved through the "bush block". On the evening of the first field day, some identifications were done both as a way to introduce newcomers to the ways of plant identification, as well as to best utilise the skills of the field team.

Following the survey, specimens were dried (to preserve) and frozen (to kill any insects and disease) at the Western Australian Herbarium, in South Perth.

The initial Reference Herbarium Session was used to do a first sort of the collections into Family and Genus and where possible Species. Following this, volunteers, botanists and the survey coordinator/botanist carried out plant identifications in regular sessions at the WA Reference Herbarium. Where necessary additional verifications were made in the WA Herbarium Main Collection and flora specialists assisted with identifications in their specialist field (Refer Acknowledgments, Section 7).

Field Herbarium

A "Mindah" Field Herbarium was prepared, largely with the assistance of volunteers. It is presented in six arch-lever files on card in clear plastic sleeves. To assist with further developing knowledge of plants and to make it easier for identifications to be made in the field, the Field Herbarium organises the plant specimens into a number of groupings:

- Firstly, **Growth Forms** (climbers, grasses, herbs, sedges/rushes, shrubs and trees/mallees)
- Secondly, **Plant Families** (eg Asteraceae, Proteaceae, Myrtaceae) with a several species per page for ease of comparison
- Thirdly, into alphabetical order of **Plant Genera** (within these Family Groupings), for example:
Asteraceae = *Brachyscome*, *Rhodanthe* and *Waitzia*
Proteaceae = *Grevillea*, *Hakea* and *Persoonia*
Myrtaceae = *Baeckea*, *Eucalyptus* and *Melaleuca*.

Weeds were grouped together (within their Family Groupings) regardless of Growth Form.

The Field Herbarium was photocopied for easier use in the field, allowing space also for notes on flower colour and flower/seed time etc to be added. It also ensures the quality of the Field Herbarium proper is maintained.

3.2.3 Vegetation Descriptions

The vegetation was mapped applying the Vegetation Structural Classification from Keighery (1994)⁸ (Refer Table 3) on the basis of a combination of its:

- **life form and height** and
- **crown cover** (percentage cover of total area under an imaginary line bounded by the extremities of the plants in each group described).

Plant communities were further distinguished by their **floristics** (composition of plant species).

⁸ The Vegetation Structural Classification Model of Keighery was originally developed by Specht (1970) and then modified by Muir (1977), Aplin (1979) and Keighery (1994).

A practical advantage of the *Bushland Plant Survey Sheets* (Keighery BJ 1994) is that the surveyors/field recorders are guided to collect vegetation within these categories.

TABLE 3: Vegetation Structural Classification (Keighery B.J. 1994, adapted from Aplin 1979)

Life Form/ Height Class		Trees >30m	Trees 10-30m	Trees <10m	Mallee >8m	Mallee <8m
c c a o n v o e p r y .	71-100% DENSE	Tall Closed Forest	Closed Forest	Low Closed Forest	Closed Tree Mallee	Closed Shrub Mallee
	31-70% MID-DENSE	Tall Open Forest	Open Forest	Low Open Forest	Tree Mallee	Shrub Mallee
	11-30% SPARSE	Tall Woodland	Woodland	Low Woodland	Open Tree Mallee	Open Shrub Mallee
	2-10% VERY SPARSE	Tall Open Woodland	Open Woodland	Low Open Woodland	Very Open Tree Mallee	Very Open Shrub Mallee

Life Form/ Height Class		Shrubs >2m	Shrubs 1-2m	Shrubs <1m
c c a o n v o e p r y .	71-100% DENSE	Tall Closed Scrub	Closed Heath	Low Closed Heath
	31-70% MID-DENSE	Tall Open Scrub	Open Heath	Low Open Heath
	11-30% SPARSE	Tall Shrubland	Shrubland	Low Shrubland
	2-10% VERY SPARSE	Tall Open Shrubland	Open Shrubland	Low Open Shrubland

Life Form/ Height Class		Grasses	Herbs	Sedges
c c a o n v o e p r y .	71-100% DENSE	Closed Grassland	Closed Herbland	Closed Sedgeland
	31-70% MID-DENSE	Grassland	Herbland	Sedgeland
	11-30% SPARSE	Open Grassland	Open Herbland	Open Sedgeland
	2-10% VERY SPARSE	Very Open Grassland	Very Open Herbland	Very Open Sedgeland

Appendix B shows how this Vegetation Structural Classification was applied to the field survey data.

3.2.4 Vegetation Condition (extracted from Keighery BJ 1994, page 54)

Vegetation Condition Scale

An assessment of disturbance in relation to the ability of the bushland to maintain itself has been used as the basis for condition rating of plant communities (Refer Table 4 below). The condition is related to the vegetation structure; that is the impact of disturbance on each of these layers and consequently on the ability of the natural plant community to regenerate. To determine a condition rating it is not necessary to be able to define each disturbance factor. However, defining the disturbance factor does become necessary in the management of bushland.

TABLE 4: Vegetation Condition Scale (Keighery B.J. 1994 page 27)

1	Pristine Pristine or nearly so, no obvious signs of disturbance.
2	Excellent Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. For example: <ul style="list-style-type: none"> • damage to trees caused by fire • the presence of non-aggressive weed species • occasional vehicle tracks
3	Very Good Vegetation structure altered, obvious signs of disturbance. For example: <ul style="list-style-type: none"> • disturbance to vegetation structure caused by repeated fires • the presence of some more aggressive weeds • partial clearing, dieback, and/or grazing
4	Good Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example: <ul style="list-style-type: none"> • disturbance to vegetation structure caused by very frequent fires • the presence of some very aggressive weeds at high density • partial clearing, dieback and/or grazing
5	Degraded Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example: <ul style="list-style-type: none"> • disturbance to vegetation structure caused by very frequent fires • the presence of some very aggressive weeds • partial clearing, dieback and/or grazing
6	Completely Degraded The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species, with isolated native trees or shrubs.

Weeds

Weeds are plants which are not native to bushland and/or commonly invade areas of natural vegetation following disturbance such as flooding, grazing, fire and soil disturbance. They can be exotic species or non-local native species. Weeds are generally what are called 'colonising species', plants that establish in bare areas quickly. Weed diversity and density are among the most useful guides in assessing condition, as the density of weeds increases as a result of general disturbance. Undisturbed vegetation will resist weed establishment in the understorey.

Weeds can be categorised by their severity of impact on the vegetation structure or ability for plants to regenerate, as:

- Non-aggressive Weeds – having apparently little impact on the vegetation structure or ability to regenerate – generally annuals (eg **Aira* spp.)
- Aggressive Weeds – having impact on the vegetation structure or ability to regenerate – generally perennial species (eg **Avena barbata* (Wild Oats) an annual grass species).

3.3 LIMITATIONS

The limitations of the flora and vegetation survey were:

- The survey was conducted over one flowering season. It included a preliminary visit and a revisit later in the season when extra species were noted. Recording over several seasons and times of the year would be necessary to document the full complement of species.
- The sampling of flora is biased towards the quadrats (ie WYHO vegetation recording sites) due to the objectives of the survey, restricted time available and size of the study area.
- Species that were not in flower at the times that the quadrats were visited were less likely to have been collected.
- No attempt was made to collect fungi, lichens, liverworts, mosses or stoneworts, such survey would add considerably to the knowledge of the area.
- Soil descriptions are based on only basic field observations without any analysis.

4. VEGETATION SURVEY

4.1 LEVELS OR SCALE OF VEGETATION MAPPING

Vegetation can be described at different levels, depending on levels of scale observable and/or requirements of the survey. At a very coarse level the bush block could be divided into three types:

- (1) Woodland (2) Mallee (3) Shrubland.

This correlates very closely to John Beard's broadscale (1:250,000) vegetation map of the area (1980) where the vegetation on "Mindah" is within the 'Jibberding System', falling into two categories:

- E6/8Mi** *Eucalyptus loxophleba* (York Gum) and *Eucalyptus salmonophloia* (Salmon Gum) Woodlands
anSc *Acacia* (Wattle), *Allocasuarina* (Sheoak) and *Melaleuca* (Honeymyrtle) Thickets.

As a broadscale survey, Beard's work provides a significant contribution to understanding the original vegetation and associated soils and landscape and 21+ years after publication continues to be used extensively as a resource.

Using the detailed data collected from the survey quadrats, the aerial photograph and from more general observations of the bushland vegetation, the natural vegetation of the Mindah survey area can be mapped at a finer scale into the following eleven sub-units within Woodland, Mallee and Shrubland.

4.2 PLANT COMMUNITIES OF "MINDAH" HERITAGE BUSHLAND

The eleven plant communities⁹ (Refer Map 8) of the study area reflect variations in underlying rock, topography, soil type, aspect and drainage. The vegetation mapping units each contain a range of plant communities with the same dominants in the upper stratum and where there were significant differences in the understoreys, a further division was made. The at times considerable range of vegetation within a unit needs to be borne in mind when using the map to ensure an over simplistic interpretation of the vegetation is not made. To avoid this the map should be read in conjunction with the accompanying text descriptions.

Woodland

- **OW¹** *Eucalyptus salmonophloia* (Salmon Gum) Open Woodland
- **OW²** *Eucalyptus salmonophloia* (Salmon Gum) Open Woodland over *Melaleuca* species Shrubland
- **OW³** *Eucalyptus salmonophloia* (Salmon Gum) Open Woodland with *Eucalyptus salubris* (Gimlet).

Mallee

- **OM-M** *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) and *Eucalyptus erythronema* var. *marginata* (Red-Flowered Mallee) Open Mallee to Mallee
- **OM/TCS** *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) Open Mallee over *Melaleuca* Tall Closed Scrub-Tall Shrubland
- **VOM-M** *Eucalyptus erythronema* var. *marginata* (Red-Flowered Mallee) Open Mallee
- **OM** *Eucalyptus subangusta* ssp. *subangusta* Open Mallee

Shrubland

- **TS-TOS** *Melaleuca* Tall Shrubland to Tall Open Scrub [not mapped]
- **TOS** *Allocasuarina*/*Melaleuca* Tall Open Scrub [not mapped].
- **TSh** *Allocasuarina acutivalvis* (Black Tamma) and *Acacia stereophylla* ssp. *stereophylla* Tall Shrubland
- **Sh** *Baeckea crispiflora* and *Calothamnus gilesii* Shrubland/Heath with Emergent Mallee.

⁹ The term 'plant community' is interchangeable with 'vegetation unit' and/or 'vegetation association'.

Aerial Photograph of "Mindah" Bushland,
[Part Avon Loc. 16220], Holdsworth Road, Wyalkatchem

LEGEND

DOLA
Aerial Photo

WA 3457(c) DOWERIN & EXTENSIONS RUN 4
(5024-5046) FRAME 5032 1:25000 2-NOV-94

Scale

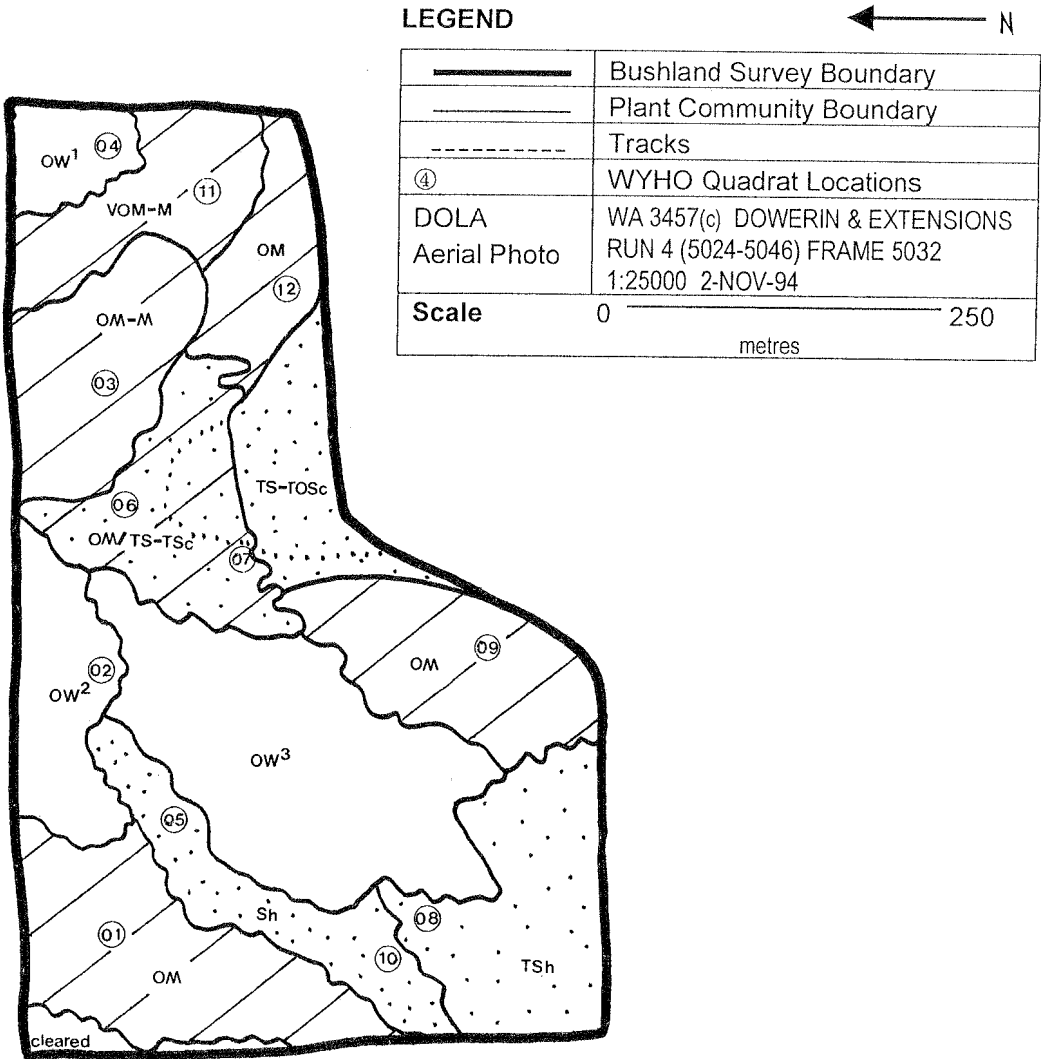
0

250

metres



MAP 8: Plant Communities of "Mindah" Bushland,
[Part Avon Loc. 18220], Holdsworth Road, Wyalkatchem



Plant Communities

WOODLAND		OW ¹	<i>Eucalyptus salmonophloia</i> (Salmon Gum) OPEN WOODLAND
		OW ²	<i>Eucalyptus salmonophloia</i> (Salmon Gum) OPEN WOODLAND over <i>Melaleuca</i> SHRUBLAND
		OW ³	<i>Eucalyptus salmonophloia</i> (Salmon Gum) OPEN WOODLAND with <i>Eucalyptus salubris</i> (Gimlet)
MALLEE		OM-M	<i>Eucalyptus loxophleba</i> ssp. <i>lissophloia</i> (York Gum) and <i>E. erythronema</i> var. <i>erythronema</i> (Red-Flowered Mallee) OPEN MALLEE to MALLEE
		OM/TCS _c	<i>Eucalyptus loxophleba</i> ssp. <i>lissophloia</i> (York Gum) OPEN MALLEE over <i>Melaleuca</i> TALL SHRUBLAND to TALL CLOSED SCRUB
		VOM-M	<i>Eucalyptus erythronema</i> var. <i>erythronema</i> (Red-Flowered Mallee) VERY OPEN MALLEE to MALLEE
		OM	<i>Eucalyptus subangusta</i> OPEN MALLEE
SHRUBLAND		TS-TOS _c	<i>Melaleuca</i> TALL SHRUBLAND to TALL OPEN SCRUB [not mapped]
		TOS _c	<i>Allocasuarina campestris</i> ssp. <i>campestris</i> (Tamma) and <i>Melaleuca</i> TALL OPEN SCRUB [not mapped]
		TSh	<i>Allocasuarina acutivalvis</i> (Black Tamma) and <i>Acacia stereophylla</i> ssp. <i>stereophylla</i> TALL SHRUBLAND with emergent mallee
		Sh	<i>Baeckea crispiflora</i> and <i>Calothamnus gilesii</i> SHRUBLAND

4.3 PLANT COMMUNITIES AND THE VEGETATION MAP

As with some other wheatbelt bushland, many of the plant communities recorded at “Mindah” are not uniform. Instead they are a complex mosaic of smaller units reflecting a number of variables including changes in soil type, soil moisture content and/or aspect, as well as plant competition and fire history. Within the study area many variations in the canopy cover of the dominant species were recorded from predominantly 10-30% to distinct patches of 30-70%. Often this mosaic which is very obvious on the ground, is not sufficiently distinctive to be clearly identified on the aerial photograph – nor for the purpose of this report is it useful to dissect the natural changes in vegetation communities to such a fine scale.

Woodland

The Open Salmon Gum Woodlands which dominate the study area have been further distinguished by the three distinct understoreys which occur – these changes are reflected strongly both on the ground and in the aerial photograph.

OW¹ *Eucalyptus salmonophloia* (Salmon Gum) Open Woodland [Quadrat WYHO04]

This Salmon Gum unit is distinctive for the height of the dominant tree as well as the relatively open understorey. It occurs on very gently undulating to seemingly flat surfaces to the north-east corner of the site on brown sandy loams. This unit is not uniform and has other smaller distinct sub-units which cannot be distinguished in the aerial photograph. Occurrences include:

- *Eucalyptus salmonophloia* (Salmon Gum) **Open Woodland** over *Eucalyptus salubris* (Gimlet) **Low Open Woodland** over *Acacia merrallii* (Merrall's Wattle), *Olearia muelleri* (Goldfields Daisybush) and *Rhagodia preissii* ssp. *preissii* **Low Open Shrubland** over **Occasional Grasses and Herbs** (Quadrat WYHO04, Photo 2 – page 51)
- Occasional trees of *Eucalyptus salubris* (Gimlet), with a canopy cover ranging from <2% to 30%.
- *Eucalyptus salmonophloia* (Salmon Gum) **Open Woodland** over *Eucalyptus erythronema* ssp. *marginata* (Red-Flowered Mallee) **Low Open Mallee** over **Occasional Shrubs** of *Exocarpos aphyllus* (Leafless Ballart).
- *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) **Open Mallee** with occasional emergent trees of *Eucalyptus salmonophloia* (Salmon Gum) and *Eucalyptus salubris* (Gimlet) over occasional shrubs of *Exocarpos aphyllus* (Leafless Ballart).

OW² *Eucalyptus salmonophloia* (Salmon Gum) Open Woodland over *Melaleuca* species Shrubland [Quadrat WYHO02]

This Salmon Gum unit occurs on very gentle ground adjoining Holdsworth Road and is distinguished by the presence of a distinctive understorey layer dominated by *Melaleuca* species. The density of the tall (>2m) shrub layer varies from 11-30% (Tall Shrubland) to 31-70% (Open Tall Scrub) and the surface soil had a distinct red-brown colour with moderately high levels of clay. The number of distinct understorey layers varied from one to three. Occurrences included:

- *Eucalyptus salmonophloia* (Salmon Gum) **Open Woodland** over *Melaleuca acuminata* ssp. *websteri* and *Melaleuca adnata* **Tall Shrubland** over *Olearia muelleri* (Goldfields Daisybush) and *Rhagodia preissii* ssp. *preissii* **Low Open Shrubland** over **Occasional Grasses** of *Austrostipa elegantissima* (Feather Speargrass) and *Vulpia myuros* and **Occasional Mixed Herbs** (Quadrat WYHO02, Photo 3 – page 51).
- *Eucalyptus salmonophloia* (Salmon Gum) **Open Woodland** over *Melaleuca acuminata* ssp. *websteri* **Tall Open Scrub**. (Note: very patchy occurrence of *Melaleuca* canopy cover, ranging from 11-30% to 31-70%).

Eucalyptus salmonophloia (Salmon Gum) **Open Woodland** over *Melaleuca acuminata* ssp. *websteri* and *Melaleuca adnata* **Tall Closed Scrub** over *Eremophila decipiens* ssp. *decipiens*, *Olearia muelleri* (Goldfields Daisy) and *Westringia cephalantha* **Low Open Shrubland**. (Note: canopy cover of *Melaleuca* species very patchy).

OW³ *Eucalyptus salmonophloia* (Salmon Gum) Open Woodland with *E. salubris* (Gimlet)

This Salmon Gum unit occurs on the gentle east-facing slopes above the flowline that dissects the bushland block. By ground area, it covers the largest size in the study area – and although mapped as the same unit has a broad range of understoreys. Similar to OW¹, this unit also has a very open and patchy understorey, and has been further distinguished by the orange-red surface and sub-surface soils with scattered quartz and exposed laterite. In the aerial photograph (Refer Map 7) this orange-red surface soil is very clear. In addition, Chenopodiaceae species, particularly Bluebush (*Maireana*) feature in this unit. Distinct sub-units include:

- *Eucalyptus salmonophloia* (Salmon Gum) **Woodland** with occasional *Eucalyptus salubris* (Gimlet) over *Eucalyptus subangusta* ssp. *subangusta* **Open Mallee over occasional Shrubs, Grasses and Herbs.**
- *Eucalyptus salmonophloia* (Salmon Gum) **Woodland** with occasional *Eucalyptus salubris* (Gimlet) over *Melaleuca adnata*, *Melaleuca lateriflora* and *Exocarpos aphyllus* **Tall Shrubland.**
- *Eucalyptus salmonophloia* (Salmon Gum) **Woodland** with occasional *Eucalyptus salubris* (Gimlet) over **occasional shrubs** of *Exocarpos aphyllus* (Leafless Ballart), *Leptomeria preissiana* and *Santalum acuminatum* (Quandong) over *Acacia erinacea* (Spiny Wattle), *Acacia colletioides* (Wait-a-While Wattle) and *Olearia muelleri* (Goldfield's Daisy) **Low Open Shrubland.**
- *Eucalyptus salmonophloia* (Salmon Gum) **Woodland** with occasional *Eucalyptus salubris* (Gimlet) over **occasional shrubs** of *Acacia merrallii*, *Dodonaea larreoides*, *Grevillea huegelii* and *Maireana* species.

Mallee Plant Communities**OM-M *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) and *Eucalyptus erythronema* var. *marginata* (Red-Flowered Mallee) Open Mallee - Mallee [Quadrat WYHO03, WYHO05]**

This York Gum – Red-Flowered Mallee unit occurs on the brown sandy loams (to depth) upslope from the flow-line. Characteristics include the intermittent dark and silvery-white trunks of two Mallees and the multi layered structure of the unit with the taller shrubs dominated by *Melaleuca* species. Occurrences include:

- *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) and *Eucalyptus erythronema* var. *marginata* (Red-Flowered Mallee) **Mallee over *Melaleuca acuminata* ssp. *websteri* Tall Open Shrubland – Tall Shrubland over *Acacia colletioides* and *Melaleuca adnata* Open Heath over *Acacia erinacea*, *Acacia hemiteles* and *Olearia muelleri* Low Open Shrubland over *Austrodanthonia setacea* Very Open Grassland over *Hyalospermum glutinosum* ssp. *glutinosum* and *Waitzia acuminata* ssp. *acuminata* (Orange Immortelle) Herbland and Occasional Sedges.** (Quadrat WYHO03, Photo 4 – page 52).
- *Eucalyptus erythronema* ssp. *erythronema* (Red-Flowered Mallee) **Very Open Mallee** with occasional emergent mallees of *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) over *Melaleuca acuminata* ssp. *websteri* **Tall Open Scrub.**
- *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum), *Eucalyptus myriadena* ssp. *myriadena* **Open Mallee over *Melaleuca adnata* and *Melaleuca radula* (Graceful Honeymyrtle), Tall Open Scrub over *Amphipogon strictus* Open Grassland and Mixed Herbland with occasional Sedges. Occasional Creepers of *Thysanotus patersonii* (Twining Fringe Lily) also occur through the lower layers.** (Quadrat WYHO05, Photo 5 – page 52).

OM/TCSc *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) Open Mallee over *Melaleuca* species Tall Closed Scrub-Tall Shrubland [Quadrat WYHO06]

This York Gum unit occurs both within and beside the flow-line that runs north-south through the study site. Although the soils change with distance from the flow-line they are predominantly duplex valley floor soils with a brown sandy-loam over a brown loamy-clay. Clay continues to increase with

depth. The flow-line is intermittent and during the wetter months has a carpet of annual sedges growing in the wetter portions. During the spring survey the water spanned 1.2m across the depression to a depth of 5-6cm, whilst in summer the flow-line was dry cracking clays with very little herb and no sedge growth. Tadpoles and leeches were sighted during the spring survey.

Although the unit has been mapped as York Gum (reflecting canopy cover), this mallee is patchy in occurrence and the *Melaleuca* species dominate, often forming a dense tall scrub. On the aerial photograph this unit is distinguished from others by darker, much denser foliage cover with little surface soil projecting through. Sub-units include:

- *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) and *Eucalyptus subangusta* ssp. *subangusta* **Very Open Mallee** with occasional emergent *Eucalyptus salubris* (Gimlet) over *Melaleuca acuminata* ssp. *websteri* **Tall Open Scrub** over *Austrostipa elegantissima* (Feather Speargrass) and *Austrostipa trichophylla* **Very Open Grassland** and *Isolepis congrua*, *Schoenus elegans* and *Schoenus sculptus* (Gimlet Bog Rush) **Very Open Sedgeland** with **Occasional Herbs**. (Quadrat WYHO06, Photo 6 – page 53).
- *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) **Open Mallee** over *Melaleuca acuminata*, *M. adnata*, *M. lateriflora* and *M. uncinata* **Tall Closed Scrub**.

VOM-M *Eucalyptus erythronema* var. *marginata* (Red-Flowered Mallee) **Very Open Mallee - Mallee**
[Quadrat WYHO11]

This Red-Flowered Mallee unit occurs in the eastern portion of the bushland block on a gentle north-west facing slope of light-brown loam over red-brown loam between York Gum Open Mallee and Salmon Gum Open Woodland units. The white trunks of the Red-Flowered Mallee are characteristic of this unit and although both the yellow-flowering and red-flowering variants of *Eucalyptus erythronema* var. *marginata* were present, the red dominated. Sub-units included:

- *Eucalyptus erythronema* var. *marginata* (Red-Flowered Mallee) **Very Open Mallee** with occasional emergent Mallees of *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) and *Eucalyptus subangusta* ssp. *subangusta* over *Acacia acuminata* (Jam) and *Melaleuca radula* (Graceful Honeymyrtle) **Tall Shrubland** over *Acacia acuaria*, *Acacia hemiteles* and *Melaleuca lateriflora* ssp. *lateriflora* **Shrubland** over *Eremophila drummondii* **Low Open Shrub** over *Amphipogon strictus* (Greybeard Grass), *Austrostipa trichophylla* and *Spartochloa scirpoidea* **Tall Open Grassland** and **Mixed Open Herbland** and **Occasional Sedges**. **Occasional Creepers** of *Thysanotus patersonii* (Twining Fringe Lily) also occur through the lower layers. (Quadrat WYHO11, Photo 7 – page 53)
- *Eucalyptus erythronema* var. *marginata* (Red-Flowered Mallee) **Open Mallee** with occasional emergent trees of *Eucalyptus salmonophloia* (Salmon Gum) and *Eucalyptus salubris* (Gimlet).
- *Eucalyptus erythronema* var. *marginata* (Red-Flowered Mallee) **Mallee** with occasional emergent trees of *Eucalyptus salmonophloia* (Salmon Gum) and *Eucalyptus salubris* (Gimlet) over *Melaleuca adnata* **Tall Open Shrubland**.
- *Eucalyptus erythronema* var. *marginata* (Red-Flowered Mallee) **Mallee** over *Acacia hemiteles* and *Exocarpos aphyllus* **Open Shrubland** over *Acacia mackeyana* **Low Open Shrubland**. (Note: outcrops of ironstone & laterite).

OM *Eucalyptus subangusta* ssp. *subangusta* **Open Mallee** [Quadrat WYHO01, WYHO09, WYHO12]

This *Eucalyptus subangusta* ssp. *subangusta* plant community occurs on the gentle facing upper slopes of gritty brown loams with decomposing granite sub-strata through to deeper yellow sands. This mallee unit was not uniform and other co-dominant mallees included the Red-Flowered, Horn Fluted, Yorrel and York Gum. The tall tussock grass *Spartochloa scirpoidea* formed a distinctive open grass layer in some of the sub-units.

- *Eucalyptus subangusta* ssp. *subangusta* and *Eucalyptus yilgarnensis* (Yorrel) **Open Mallee** with occasional emergent mallees of *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) over *Acacia hemiteles*, *Acacia mackeyana* and *Daviesia nematophylla* **Open Heath** over *Acacia merrallii* (Merrall's Wattle) and *Westringia cephalantha* **Open Low Heath** over **Ehrharta longifolia* **Very Open Grassland** and *Velleia cynopotamica* **Herbland**. (Quadrat WYHO09, Photo 8 – page 54)

- *Eucalyptus subangusta* ssp. *subangusta* and *Eucalyptus erythronema* var. *marginata* (Red-Flowered Mallee) **Open Mallee** over *Melaleuca coronicarpa* **Open Shrubland** over *Spartochloa scirpoidea* Tall Open Grassland.
- *Eucalyptus subangusta* ssp. *subangusta* **Open Mallee** with occasional emergent mallees of *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) and *Eucalyptus erythronema* ssp. *marginata* (Red-Flowered Mallee) over *Allocasuarina campestris* ssp. *campestris*, *Grevillea paniculata* and *Melaleuca uncinata* **Tall Open Shrubland** over *Spartochloa scirpoidea* **Tall Open Grassland**.
- *Eucalyptus subangusta* ssp. *subangusta* and *Eucalyptus stowardii* (Fluted Horn Mallee) **Open Mallee** with occasional emergent mallees of *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) over *Melaleuca uncinata* (Broom Bush) **Shrubland** over *Baeckea crispiflora* and *Hibbertia eatoniae* **Open Low Heath** over *Borya constricta* (Pincushions) and *Waitzia acuminata* (Orange Immortelle) **Herbland**. (Quadrat WYHO01, Photo 9 – page 54)
- *Eucalyptus yilgarnensis* (Yorrel) **Open Mallee** with occasional emergent trees of *Eucalyptus salmonophloia* (Salmon Gum) over *Exocarpos aphyllus* (Leafless Ballart) **Tall Open Shrubland** over *Olearia muelleri* (Goldfields Daisy) **Low Open Shrubland** over **Occasional Grasses and Herbs**. (Quadrat WYHO12, Photo 10 – page 55)

Shrubland

All of the plant communities recorded with a dominant shrub layer as the tallest structural layer occur in the south west of the study area – on the deeper sands. Smaller occurrences also occur scattered across the study site, however due to their small size they are mapped within broader mallee and woodland communities.

TS-TOSc *Melaleuca* species Tall Shrubland to Tall Open Scrub [Quadrats WYHO07] NOT MAPPED

Although this plant community is distinctive on the ground, it is not easily discernible on the aerial photo and as such has not been mapped. It occurs on the higher edges on the flow-line and has been mapped within the plant community *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) Open Mallee over *Melaleuca* Tall Closed Scrub-Tall Shrubland (EIOM/MTOSc) – which has a similar understorey structure, with a Mallee canopy York Gum. The presence of both the *Melaleuca* species and the tall tufted grass *Spartochloa scirpoidea* are indicators of good moisture availability and often an increase of clay in the soils. Termite mounds (20-40cm tall) were also present in this unit.

- *Melaleuca acuminata*, *M. lateriflora* and *M. uncinata* **Tall Open Shrubland** over *Baeckea crispiflora* **Open Shrubland** over *Spartochloa scirpoidea* **Very Open Tall Grassland** over *Amphipogon strictus* **Open Low Grassland** and Mixed **Very Open Herbland**. (Quadrat WYHO07, Photo 11 – page 55)

TOSc *Allocasuarina campestris* ssp. *campestris* (Tamma) and *Melaleuca* spp. Tall Open Scrub NOT MAPPED

Although distinctive on the ground, this plant community was not of sufficient size nor was it sufficiently discernible on the aerial photograph for confident mapping. It occurs within a number of the shrubland and mallee units.

- *Allocasuarina campestris* ssp. *campestris* (Tamma), *Melaleuca acuminata* ssp. *websteri* and *Melaleuca adnata* **Tall Open Scrub** with occasional emergent mallees of *Eucalyptus subangusta* ssp. *subangusta* and trees of *Eucalyptus salubris* (Gimlet).
- *Allocasuarina campestris* ssp. *campestris* (Tamma) and *Melaleuca uncinata* (Broom Bush) **Tall Open Scrub**.

TSh *Allocasuarina acutivalvis* (Black Tamma) and *Acacia stereophylla* ssp. *stereophylla* **Tall Shrubland** [WYHO08]

This Black Tamma/Wattle unit occurs near the south-western boundary of the bushland block on brown loamy sands to creamy-yellow sands. The age and height of the Black Tamma indicate the area has been without fire for a considerable length of time.

- *Allocasuarina acutivalvis* (Black Tamma) and *Acacia stereophylla* ssp. *stereophylla* **Tall Shrubland** over *Grevillea paradoxa* (Bottlebrush Grevillea) and *Hibbertia eatoniae* **Open Shrubland** over **Occasional Grasses, Herbs and Sedges/Rushes** (including *Ecdeiocolea monostachya*). **Occasional Creepers** of *Thysanotus patersonii* (Twining Fringe Lily) also occur through the lower layers. (Quadrat WYHO08, Photo 12 – page 56). (Note this unit was patchy in height).
- *Acacia stereophylla* ssp. *stereophylla* and *Allocasuarina acutivalvis* (Black Tamma) **Tall Shrubland** over *Ecdeiocolea monostachya* **Tall Open Sedgeland**. (Note: Yellow creamy sand).

Note: *Acacia stereophylla* with its long phyllodes and cylindrical flower heads is often confused in the field with *Acacia acuminata* (Jam) – distinguishing features to be aware of include the overall shape of the shrubs and the form of the phyllode tips (Jam comes to a sharp point – this is what gives it the specific name of *acuminata* meaning ‘pointy’, whilst *A. stereophylla* has a blunted tip. The flowering spikes of *A. stereophylla* are larger than Jam). Another distinctive plant form in this unit was the tall (20-40cm) clump rush *Ecdeiocolea monostachya*. Variations in this plant community included:

Sh *Baeckea crispiflora* and *Calothamnus gilesii* **Shrubland** [Quadrat WYHO10]

The largest occurrence of this unit was against the western boundary of the study area on a very gentle slope with brown loamy sands and exposed granite. The granite was also dominant as bedrock within 20-25cm of the surface. The occurrence of the resurrection or pincushion plants *Borya sphaerocephala* is also an indicator of the granitic soils. Smaller occurrences of this unit are on the northern side of the bushland block, but due to their size they have been mapped within the more dominant Salmon Gum Open Woodlands.

- *Baeckea crispiflora* and *Calothamnus gilesii* **Shrubland** with occasional emergent *Eucalyptus* over *Hibbertia eatoniae* **Low Open Shrubland** over *Amphipogon strictus* (Greybeard Grass) and *Neurachne alopecuroides* (Foxtail Mulga Grass) **Very Open Grassland** and *Borya sphaerocephala* (Pincushion) **Herbland**. **Occasional Creepers** of *Thysanotus patersonii* (Twining Fringe Lily) also occur through the lower layers. (Quadrat WYHO10, Photo 13 – page 56) (Note: Adjacent patches of mallee 10-30%).

4.4 VEGETATION CONDITION

The 12 quadrats were located in areas of best condition across the bushland. Ten of the quadrats were rated *Excellent* or *Pristine* (Refer Table 4) with two quadrats rated very good to excellent reflecting impacts from past logging and grazing. The lack of any tracks or firebreaks through the bushland has ensured there is less disturbance from weeds and soil erosion and it is understood the bushland has not experienced a fire for at least 50 years.

The main disturbance factors were:

- concentrated kangaroo access to the dam in adjoining paddock
- clearing and associated weed infestation in the north-west corner
- rabbit warrens and grazing in the south-west corner, correlating with the deeper yellow sands. The major threat from grazing is the prevention of native seedling regeneration. Such warrens can be a significant source of disturbance and erosion.

Weed presence in the bush block was minimal, with only 26 weed species recorded, representing 11% of the total flora (Refer Section 5). Considering the block is surrounded on all four sides by cropping land this is an excellent illustration of how healthy bush can resist the invasion of weed species. Although the two weeds **Arctotheca calendula* (Capeweed) and **Hypochaeris glabra* (Flatweed) appeared in 9 of the 12 WYHO Quadrats, they only occurred as small numbers.

5. FLORA SURVEY

5.1 OVERVIEW

The total indigenous or native flora recorded for the 32ha study area was 214 vascular plant taxa from 60 plant Families and the total weed or exotic taxa recorded was 26 from 10 plant Families (Refer Appendix E). It is considered that the survey will have recorded 80-90% of the plants species in the remnant, and although no attempt was made to collect fungi, lichens, liverworts, mosses or stoneworts – lichens and fungi were observed during the survey.

Some interesting statistics (Refer to Tables 5 and 6 for summaries) include:

- Seven of the 62 plant families contributed more than half (56%) of the taxa
- The Myrtaceae family contributed 13%
- Annual native herbs made up 26% of the total flora, whilst perennial native shrubs made up 33% of the total, with the high number of annual herbs reflecting the vegetation communities present in the bush block, being predominantly woodlands and mallee communities rather than heaths or shrublands
- *Eucalyptus* trees and mallees made up 5% of the total flora
- Weed species in Asteraceae (daisies) and Poaceae (gasses) made up 6% of the total flora
- The Genera with the greatest number of species was *Acacia* (wattles) with 13 species and *Eucalyptus* (gum trees and mallees) with 12 species
- 103 (43%) of the total 241 taxa were recorded only once, 80 in or adjacent to the WYHO quadrats and 23 from opportunistic collections made whilst wandering through the bush. This is typical of much of the plant communities of South-West Western Australia, where rapid species turnover characterises this species rich flora. It means that many areas are rarely easily replicated elsewhere, as each block has it's own assemblage of species.

TABLE 5: Summary of the seven families and associated genera that contributed 56% of the taxa

Plant Family • Genera = No. Species	No. Native Species	No. Weed Species	Total No. Species
Myrtaceae (myrtles) <ul style="list-style-type: none"> • <i>Astartea</i> = 1 • <i>Baeckea</i> = 2 • <i>Calothamnus</i> = 1 • <i>Calytrix</i> = 1 • <i>Chamelaucium</i> = 1 • <i>Eucalyptus</i> = 12 • <i>Hypocalymma</i> = 1 • <i>Leptospermum</i> = 1 • <i>Melaleuca</i> = 9 • <i>Micromyrtus</i> = 2 	31	0	31
Asteraceae (daisies) <ul style="list-style-type: none"> • <i>Actinobole</i> = 1 • <i>Angianthus</i> = 1 • <i>*Arctotheca</i> = 1 • <i>Asteridea</i> = 1 • <i>Blennospora</i> = 1 • <i>Brachyscome</i> = 1 • <i>Calotis</i> = 1 • <i>Ceratogyne</i> = 1 • <i>Chthonocephalus</i> = 1 • <i>Erymophyllum</i> = 1 • <i>Hyalosperma</i> = 2 • <i>*Hypochoeris</i> = 1 • <i>Isotropis</i> = 1 • <i>Lawrencella</i> = 1 • <i>Millotia</i> = 1 • <i>Olearia</i> = 1 • <i>*Osteospermum</i> = 1 	23	4	27

* = weed

Plant Family • Genera = No. Species	No. Native Species	No. Weed Species	Total No. Species
<ul style="list-style-type: none"> • <i>Podolepis</i> = 3 • <i>Pogonolepis</i> = 1 • <i>Rhodanthe</i> = 2 • <i>Senecio</i> = 1 • *<i>Sonchus</i> = 1 • <i>Waitzia</i> = 1 			
Orchidaceae (orchids) <ul style="list-style-type: none"> • <i>Caladenia</i> = 12 • <i>Cyanicula</i> = 2 • <i>Diuris</i> = 1 • <i>Eriochilus</i> = 1 • <i>Prasophyllum</i> = 1 • <i>Pterostylis</i> = 2 • <i>Thelymitra</i> = 1 	20	0	20
Mimosaceae (wattles) <ul style="list-style-type: none"> • <i>Acacia</i> = 13 	13	0	13
Proteaceae <ul style="list-style-type: none"> • <i>Grevillea</i> = 6 • <i>Hakea</i> = 2 • <i>Persoonia</i> = 2 	10	0	10
Poaceae (grasses) <ul style="list-style-type: none"> • *<i>Aira</i> = 1 • <i>Amphipogon</i> = 1 • <i>Austrodanthonia</i> = 2 • <i>Austrostipa</i> = 2 • *<i>Avena</i> = 2 • *<i>Bromus</i> = 3 • *<i>Ehrharta</i> = 1 • *<i>Hordeum</i> = 1 • *<i>Lolium</i> = 1 • <i>Neurachne</i> = 1 • *<i>Pentaschistis</i> = 1 • <i>Spartochloa</i> = 1 	7	11	18
Chenopodiaceae <ul style="list-style-type: none"> • <i>Atriplex</i> = 2 • <i>Enchylaena</i> = 1 • <i>Maireana</i> = 4 • <i>Rhagodia</i> = 1 • <i>Enchylaena</i> x <i>Maireana</i> = 1 	9	0	9
Cyperaceae <ul style="list-style-type: none"> • <i>Isolepis</i> = 1 • <i>Lepidosperma</i> = 2 • <i>Schoenus</i> = 4 	7	0	7

* = weed

TABLE 6: Summary of the growth forms and life forms

PLANT Growth Form	% of TOTAL	TOTAL SPECIES	NATIVE SPECIES		*WEED SPECIES	
			ANNUAL	PERENNIAL	*annual	*perennial
Climbers	1%	3	-	3	-	-
Ferns	1%	1	-	1	-	-
Grasses	8%	19	-	8	11	-
Sedges/Rushes	4%	10	6	4	-	-
Herbs	48%	117	62	40	15	-
Shrubs	33%	79	-	79	-	-
Mallees	3%	8	-	8	-	-
Trees	2%	4	-	4	-	-
TOTALS	100%	241	68	147	26	0

5.2 SPECIES DIVERSITY OF VEGETATION UNITS

Consistently whenever people are first introduced to the survey technique, there is an expression of surprise at the number of species that can be found in such a small, defined area. It is so easy for us to overlook the less obvious, but they are all an important part of the diverse natural system. As noted above the *Bushland Plant Survey* process ensures that each structural layer and each species is observed and recorded.

The number of species found in each 10m x 10m quadrat varied from a minimum of 27 species (22 natives, 5 weeds – Quadrat WYHO12, Photo 10) to a maximum of 59 species (55 natives, 4 weeds – Quadrat WYHO09, Photo 8) – both were Open Mallee plant communities. Species richness of these sites is as rich as any comparable woodland or mallee community elsewhere in the western wheatbelt, again demonstrating the intact nature of the block.

Table 7 summarises the species richness (or species diversity) recorded for each of the Quadrats. It also shows the number and type of structural layers. There does not appear to be any strong correlations between species diversity, structure type and/or canopy cover.

TABLE 7: Showing species diversity (decreasing order) for each WYHO quadrat

Mindah Quadrat	No. of native species	No. of *weed species	No. of structural layers	Plant Community Structural Layers
WYHO09	54	*4	5	Open Mallee / Open Heath / Open Low Heath / Very Open Grassland / Herbland
WYHO11	49	*4	6	Very Open Shrub / Tall Shrubland / Shrubland / Low Open Shrub / Open Grassland / Mixed Open Herbland
WYHO01	44	*5	3	Open Mallee / Shrubland Open Low Heath / Herbland
WYHO03	43	*8	5	Very Open Mallee / Tall Open Shrubland – Tall Shrubland / Open Heath / Low Open Shrubland / Herbland
WYHO05	43	*6	4	Open Mallee / Tall Open Scrub / Open Grassland / Mixed Herbland
WYHO10	41	*1	4	Shrubland / Low Open Shrubland / Very Open Grassland / Herbland
WYHO07	39	*5	5	Tall Open Shrubland / Open Shrubland / Very Open Tall Grassland / Open Low Grassland / Very Open Herbland
WYHO08	35	*4	2	Tall Shrubland / Mixed Open Shrubland
WYHO06	35	*3	4	Very Open Mallee / Tall Open Scrub / Very Open Grassland / Very Open Sedgeland
WYHO04	29	*8	2	Open Woodland / Low Open Woodland
WYHO02	28	*2	3	Open Woodland / Tall Shrubland / Low Open Shrubland
WYHO12	22	*5	3	Open Mallee / Tall Open Shrubland / Low Open Shrubland

5.3 SIGNIFICANT FLORA – SPECIES OF SPECIAL INTEREST

5.3.1 Declared Rare and Priority Flora

Rare and Threatened species are protected under the *Wildlife Conservation Act 1950* and their management falls under the jurisdiction of the Department of Conservation and Land Management (CALM). Priority taxa are those which have uncertain conservation status. A 'Declared Rare Flora and Priority Flora List' is published each year by CALM (Atkins 2000). The various categories relating to threatened flora and their meanings are summarised in Table 8.

TABLE 8: Definitions of Declared Rare Flora and Priority Flora (after CALM 1997 and Atkins 2000)

'Declared Rare Flora

'Declared Rare Flora — Extant Taxa (R): Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been declared under section 23F of the *Wildlife Conservation Act 1950* to be "rare flora".

'Declared Rare Flora — Presumed Extinct Taxa (X): Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been declared under section 23F of the *Wildlife Conservation Act 1950* to be "rare flora".

Priority Flora are taxa that are under consideration for declaration as 'rare flora' but are in need of further survey or continued monitoring. The list recognises four categories of Priority Flora:

'Priority One — Poorly Known Taxa (1): Taxa which are known from one or a few (generally < 5) populations which are under threat, either due to small population size, or being on lands under immediate threat (e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc). May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as "rare flora", but are in urgent need of further survey.

'Priority Two — Poorly Known Taxa (2): Taxa which are known from one or a few (generally < 5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as "rare flora", but are in urgent need of further survey.

'Priority Three — Poorly Known Taxa (3): Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as "rare flora", but are in urgent need of further survey.

'Priority Four — Rare Taxa (4): Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5–10 years.'

Three rare taxa (priority taxa, that is taxa in consideration for declaration as Declared Rare Flora) were located in the 'Mindah' bushland. Voucher material has been submitted to the Western Australian Herbarium.

Priority Flora

Brassicaceae

Phlegmatospermum drummondii

Previously listed as rare, now a priority three (P3) species. Known from scattered records from near Paynes Find, Kalbarri, Wongan Hills and Cowcowing. This is the fifth known locality.

Myrtaceae

Melaleuca grieviana ms

A poorly known priority one (P1) species, which has not been recorded from any conservation reserve. The only confirmed record is between Kulin and Lake Grace, the other three records (Shackleton, Muntadgin and Cowcowing) are all given as aff. *grieviana*. This is one of the few confirmed records of this species.

Melaleuca sclerophylla

A priority three (P3) species with scattered records in the Wheatbelt ranging from Kalbarri, inland to Morawa, Mannmaning and Dallwallinu, then south to near York. The record from Wyalkatchem is the furthestmost east this species has been recorded.

5.3.2 Populations of species at the ends of the plant's known range

The distribution of species that have been collected throughout the State and incorporated into the collection of the Western Australian Herbarium is recorded on FloraBase (WA Herbarium 1998). Field experience combined with this information enables a picture of species to be developed. The information provided here is current at the time of writing, however, as more survey work is carried out in Western Australia, the knowledge of species occurrences will continue to change. For example, results from the CALMScience Biological Survey of the wheatbelt, will doubtless increase the number of recordings and locations of many flora.

The survey recorded two species near the limits of their previously known range:

Mimosaceae

Acacia saxatilis

A tall shrub that ranges from Kalbarri, south to Coorow then south-east to Bruce Rock and Cramphorne. Wyalkatchem is at the north-eastern margin of the species range.

Myrtaceae

Baeckea cryptonoma

A low shrub that ranges from Morawa to Dalwallinu. Wyalkatchem is the eastern margin of this species range.

5.3.3 Significant Species Co-occurrences

At times some species are difficult to tell apart as they have appear quite similar. This may be because they are closely related or have evolved in a similar way. The co-occurrence of such species with no intermediates is good evidence that they are distinct species.

Proteaceae

Grevillea magnifica and *Grevillea petrophiloides*

These two species were segregated by Olde and Marriott (1994) in the *Grevillea* Book, but were reduced to subspecies by Mackinson (2000) in *Flora of Australia*. This locality is one of the only known where both species have been recorded close together and could be a vital locality for the definition of these species.

5.3.4 Plants of general interest

Often we overlook the importance and or interest of species that are considered 'common'. However, many of these have importance for a variety of reasons, not least their aesthetics or their contribution to 'sense of place'.

The majestic wheatbelt trees *Eucalyptus salmonophloia* (Salmon Gum) and *Eucalyptus salubris* (Gimlet) are present across much of the block. These woodlands once characterised much of the western Wheatbelt and maintaining remnants like 'Mindah' retains a sense of place for this landscape.

The block also had a high numbers of *Acacia* (13) and *Eucalyptus* (12) species.

6. DISCUSSION

6.1 NATURE CONSERVATION VALUES¹⁰

The values of the study area can be explored through a series of factors that contribute to the conservation values of bushland areas. These clearly illustrate that the "bush block" is a highly significant natural heritage area of outstanding nature conservation value.

Habitat or plant communities typical and representative of the region

A principal aim of conservation is to keep, in each local area and region, representations of the communities and species typical of, and associated with, the local area regardless of their rarity at a regional level. It is this typical bushland that contributes to each place's 'sense of locality' (Keighery and Gray 1993).

"Mindah bush block" has significant value as it contains communities typical of the area and region (including the Jibberding Vegetation System) and populations of many plants that represent a significant number of the known individuals of the taxon in the region and/or populations of a mixture of different-aged individuals — mature adults to seedlings.

Amplifying this is the paucity of such flora and plant communities in the conservation reserve system.

Perimeter to area ratio

Overall the "bush block" has a compact shape and does not have any internal tracks apart from those made and used by local native animals and rabbits. Compact shapes have larger area to edge ratios making them less prone to degrading edge effects such as fertiliser drift, increased water run-off (often nutrient enriched), exposure to wind and weed invasion. The results of the Flora Survey (Refer Section 5) highlighted the lack of weeds recorded in this block and the ability of native vegetation in good vigour to resist invasion by weeds.

Size of Remnant

The larger the remnant, the greater the conservation value. In the Wyalkatchem Shire, more than 85% of all bushland remnants are less than 20ha in size (Weaving 1994). Although not as large as desirable, this bushland remnant of 32 hectares is larger than the average for the shire, thus adding to its value.

Diversity of plant communities and flora

An area with a diverse flora and range of plant communities is considered to have more value than an area with few taxa or plant communities. With the eleven plant communities mapped and 215 native vascular plants recorded, the "Mindah bush block" supports a diverse assemblage of plant communities and native plants. Quadrats contained 27 to 59 species, with an Open Mallee over Heat plant community recording the highest species diversity.

There is a tendency to attribute greater value to areas or plant communities such as Shrublands (kwongan or heath) which are rich in species, than to areas with a low species diversity. Where species richness is low because of degrading processes, then the value of that area is lessened, but areas such as Salmon Gum Woodland and Tamma Thicket that are often naturally species poor have their own unique value and are of no less importance than naturally diverse areas. Such variation in the vegetation types adds another dimension to the diversity.

It is anticipated that if the area had been surveyed over a longer period of time, the number of species recorded would have increased in particular with the addition of annuals.

¹⁰ These are based on a framework used in the Wildflower Society of WA's (WSWA) *Bushland Plant Survey Reports* contributed to by Ann Guinness (WSWA), Bronwen Keighery (WSWA & Department of Environmental Protection), Greg Keighery (WSWA & Department of Conservation & Land Management (CALM)) and Neil Gibson (WSWA & CALM) some of which are linked back to the MOU framework (Government of WA 1997).

Communities not well conserved elsewhere

Wyalkatchem has a number of small reserves with the primary purpose for conservation values, flora and fauna, with most of these vested in the Conservation Commission and by the Department of Conservation and Land Management.

Due to the lack of survey information for the surrounding remnants it is not possible to determine how many plant communities recorded for the study area are.

Presence of rare, threatened or significant species

Confirmed threatened species (*Phlegmatospermum drummondii*, *Melaluca greiveana* and *Scaevola sclerophylla*), two species near the limits of their previously known geographical range (*Stylidium axatilis* and *Baeckea cryptonoma*) and two species with significant co-occurrences (*Grevillea* and *Grevillea petrophiloides*) increase the conservation value of the site.

Presence of threatened ecological communities (including extracts from Government of WA 1998)

In addition to Rare and Priority Flora, considerable work by CALM's WA Threatened Species and Communities Unit (WATSCU), with financial assistance from Environment Australia has been done in the identification of 'threatened ecological communities' (English and Blyth 1997). Ecological communities are defined as 'naturally occurring biological assemblages that occur in a particular type of environment'. Information on the geographic extent of each ecological community and the threatening processes that may be operating on the community is used to determine if an ecological community is 'threatened'.

Threatened ecological communities are those that have been assessed and assigned to one of four categories related to the status of the threat to the community:

Extinct

Critically Endangered

Endangered

Vulnerable

Other categories are also distinguished:

Presumed Extinct – usually communities with poorly known distributions that are suspected of being in one of the threatened categories

At Risk – describes communities that are well enough known and surveyed and not considered to be under threat.

As there is insufficient regional information on the Wheatbelt to generally recognise threatened ecological communities in the 'Mindah' bush block. Communities that may be of conservation value are the York Gum Woodlands (Hopkins *et al* 1996). The completion of the detailed floristic survey of the Wheatbelt being conducted by the Department of Conservation and Land Management as part of the Salinity Action Plan (Refer Section 2.4.2) will allow for the identification of the threatened ecological communities in the region.

Assessment of the plant communities

Condition is an assessment of disturbance in relation to the ability of the bushland to regenerate itself. The condition is related to the vegetation structure; that is the impact of disturbance on the canopy layers and consequently on the ability of the natural plant community to regenerate. Condition of most of the plant communities was excellent and pristine. One of the factors used to assess condition is the presence of weeds. The presence of weeds for 'Mindah' was relatively low, 1%.

The survey program selects for bushland in good quality it is not surprising that the presence of weeds was low – another indication of the value of this remnant. Comparison to other recent surveys (Wildflower Society of WA's Bushland Plant Survey Program) of remnant bushland in the East Yornaning, Woodanilling, Konnongorring, Wickepin and Quairading shows weed levels of 10-15%.

Linkage (including extracts from Government of WA 1998)

The natural processes occurring in ecosystems are complex and poorly understood though it is generally accepted that large consolidated areas are best options for viable conservation of natural ecosystems and populations. Within the Avon Wheatbelt there are few large areas available for conservation with many of the existing Reserves being relatively small in size and isolated from other natural bushland areas. Issues of particular concern in fragmented ecosystems are:

- the requirement of vertebrates (such as some bird and mammal species) and many invertebrates of a large area for their home range and hence their survival
- the movement of animals being essential to maintaining genetic diversity in plant communities by moving pollen from one remnant to another
- the populations of plants and animals being effectively isolated from other populations, leaving populations susceptible to local extinction
- the loss of genetic diversity through inbreeding.

"Mindah bush block" has significant and important linkages both to other remnant bushland on the "Mindah" property and to remnants on adjoining properties, including the Nature Reserve to the south. The continued maintenance of these connections is an integral part of maintaining the biodiversity and habitat values of the bushland and the fauna which depend on it.

Other special attributes

Sense of Place – Western Australian Wheatbelt There has been an increasing awareness, understanding and promotion of 'sense of place' or 'sense of locality' and how it contributes to both personal and community/social wellbeing. The Mallee, Heaths, Shrublands and Woodlands are all recognised natural elements of Western Australia's sense of place.

The Wyalkatchem Shire was assessed as having retained only 12% of its original native vegetation (Weaving 1994). This figure highlights the significant contribution this remaining bushland makes to the Shire and the region's 'sense of Western Australian Wheatbelt'.

Habitat Another layer to be added is the habitat value, both for resident fauna as well as other animals such as birds which may use the site for feeding, whilst breeding in other bush blocks. Fauna which are active in the bush block include:

- birds (foraging, resting and nesting - September '98, October '00 and November '01)
- echidnas (foraging and resting - September '99 and October '00)
- kangaroos (foraging and resting - September '99, October '00 and November '01)
- lizards and skinks (foraging, resting and burrowing - September '99 and October '00)
- ants, spiders, insects (general activity of foraging, nest building and resting - September '99, October '00 and November '01).

The fauna also contribute to 'sense of place'.

Role in sustainable land management In addition to their intrinsic value as natural areas, it is now widely recognised (Government of WA 2000b) that these remnants play a vital role in contributing to sustainable agriculture and in managing salinity by managing the water table. The value of good quality remnant vegetation, such as the study area, in keeping water tables at acceptable levels to maintain agriculture, infrastructure and to maintain other nearby remnants should not be underestimated. Remnant vegetation utilises water in and out of season, is already established, and capable of using maximum water volumes now and in the future. Native plants have the ability to change and adapt their water use depending on water availability (Southwell 1995). Hussey (1995), Wallace (1995), Southwell (1995) and Brown and Holt (2000) provide some greater discussion of this issue as well as some practical ideas for managing bushland both for nature conservation aims and for enhancing agricultural production.

6.2 CONCLUDING COMMENTS

This “Mindah” bush block is an important area of conservation value. The variation and condition of the plant communities, with the limited disturbance and the relative absence of weeds adds to its value. The corridors of vegetation which help link the survey area to the nearby nature reserve, as well as other bush blocks and trackside vegetation on the Lawrence’s property also contribute to the importance of this remnant.

From both natural capital and conservation value perspectives, the “Mindah bush” is a very significant and unique area of remnant bushland at various scales including – the Shire of Wyalkatchem, the Avon Catchment and the Western Australia wheatbelt. As discussed above, aspects which contribute to this significance include:

- size of the remnant (32ha) – significant contribution to the extremely low level (only 12 %) of remnant vegetation remaining in the Wyalkatchem Shire, with only 15% of the all remnants being greater than or equal to 20ha in size(Weaving 1999)
- compact shape of the remnant – less prone to degrading edge effects
- connections of the remnant – particularly adjoining other remnants to south and west
- health/condition of the remnant – generally excellent to pristine
- contribution the remnant can make to lessening the threats of ‘salinity’ – to this remnant, surrounding remnants, properties and infrastructure
- natural values of the bush – use and enjoyment by the land manager, wildflower/fauna/landscape enthusiasts, tourists and researchers
- species diversity (richness) – with 215 native plant taxa
- sense of place – with flora, plant communities, fauna and landscape typical of the WA Wheatbelt.

It is now well accepted that the retention of existing remnant vegetation is of vital importance in supporting private and public efforts to reverse land degradation and biodiversity loss, and to prevent these problems worsening while solutions are found and implemented. All remaining remnants are valuable resources for the maintenance of biodiversity and command a high priority for conservation. Added to our better understanding of the role remnants play in our wheatbelt environment are the findings of the Native Vegetation Working Group (Government of WA 2000a) which included:

“The true value of standing vegetation is generally far more than the market or financial values of the land, and in WA the definable costs of clearing so outweigh the benefits, that more detailed analysis is unnecessary”.

In concert with this, Western Australia is now accepting of the salinity problem and supportive of the State Salinity Strategy and the National Action Plan – implementation of which should result in the retention of all remnant vegetation in the Western Australian wheatbelt, for reasons including, but not limited to biodiversity.

Final reflections

The “Mindah” bush block was another wonderful remnant in our eastern wheatbelt, whose plants and animals have been enjoyed by many, in particular the land owners David and Colleen Lawrence. Added to this, the Lawrence family has been active in fencing the remnant and in welcoming the Wildflower Society and associated volunteers in an attempt to getting to know the area more and in joining the ‘*Land for Wildlife*’ program.

Colleen and David, we thank you for including “Mindah” in the *Bushland Plant Survey Project* and we wish you well as you continue to manage your bushland with nature conservation as the primary objective.

7. ACKNOWLEDGMENTS

One of the highlights has been working with our "Mindah" bushland hosts David and Colleen Lawrence and other volunteers within the key guiding values of the *Bushland Plant Community Survey* of:

- **understanding plants in the bushland** (ie working with the living plants where they grow)
- **learning through involvement** (such as field survey, plant identifications and peoples generosity in sharing) and
- **bushland conservation** (with the intent of understanding and managing the bush block for nature conservation).

The level of support from all volunteers including was tremendous and as such, Greg Keighery and Colma Keating extend thanks to the following for their:

- valuable contribution to this flora and vegetation survey
- infectious enjoyment and enthusiasm whilst being amongst bushland plants (both flourishing in Wyalkatchem and dried between sheets of newspaper in the Herbarium)
- company and willingness to share their time and their knowledge.

We learnt lots and enjoyed much. Appendix C includes photographs showing some of the volunteers assisting with the field survey in Spring 1999.

Assistance with information

- Ann Gunness (Wildflower Society – Bushland Plant Survey Management Committee)
- Anthony Langdon (Department of Environmental Protection)
- Ben Carr (Department of Environmental Protection)
- Brendon Ward (Department of Environmental Protection)
- Damien Shepherd (Agriculture WA – South Perth)
- Colleen Lawrence (Property Owner – Wyalkatchem)
- David Lawrence (Property Owner – Wyalkatchem)
- Greg Beeston (Agriculture WA – South Perth)
- Heather Adamson (Land for Wildlife – CALM Merredin)
- Karen Clarke (Coordinator, Wildflower Society – Bushland Plant Survey Project)
- Lyn Tyler (Friends of Wyalkatchem Reserves – Wyalkatchem)
- Lindsay Bourke (Department of Environmental Protection)
- Nicole O'Sullivan (Community Landcare Coordinator – Wyalkatchem)
- Rod Safstrom (Envirocons Consulting)

Application Assessment Site Visit (5/5/99)

- Brian Moyle (Perth – Attadale)
- Colleen Lawrence (Wyalkatchem – property owner)
- David Lawrence (Wyalkatchem – property owner)
- Karen Clarke (Wildflower Society – Bushland Plant Survey Project Coordinator)
- Nicole O'Sullivan (Community Landcare Coordinator – Wyalkatchem)

Pre-Survey Visit (14/8/99)

- Amy Bachrach (Perth – Leederville)
- Colleen Lawrence (Wyalkatchem – property owner)
- David Lawrence (Wyalkatchem – property owner)
- Grecian Sandwell (Perth – Shelley)
- Simon Cox (Perth – Leederville)

Field Survey (4/9/99 – 5/9/99)

- Alan Bellman (Cooloongup)
- Anne Bellman (Cooloongup)
- Brian Moyle (Perth – Attadale)
- Bronwen Keighery (Perth – Subiaco)
- Buddy Kent (Bodallin)
- Peter Arnold (Merredin)
- Colleen Lawrence (Wyalkatchem – property owner)
- David Garlick (Perth – Sawyers Valley)
- David Lawrence (Wyalkatchem – Property owner)

<ul style="list-style-type: none"> • Felicity McGeorge (Perth – Bibra Lake) • Heather Adamson (Land for Wildlife – Merredin) • Jeff Faulkener (Perth – Wembley) • Kastle Adamson (Merredin) • Kate Brown (Perth – Shenton Park) • Kim Dravnieks (Perth – Kardinya) • Logan Anderson (Donnybrook) • Margaret Collins (Perth – Melville) • Margaret Pieroni (Perth – Attadale) • Mary Bremner (Perth – Wembley) • Neil Gibson (Perth – Shenton Park) • Nicole O'Sullivan (Community Landcare Coordinator – Wyalkatchem) • Rachel McGeorge (Perth – Bibra Lake) • Robyn Shaw (Perth – Dianella) • Rosemary Graham (Perth – Bicton) • Sylvia Garlick (Perth – Sawyers Valley)
<p>Initial specimen sorting and plant identification – WA Herbarium (11/11/99)</p> <ul style="list-style-type: none"> • Andrew Thomson (Perth – Waterford) • Angela Carr (Urban Bushland Council) • Anne Bellman (Cooloongup) • Brian Moyle (Perth – Attadale) • Damien Staude (Perth – Kensington) • Felicity McGeorge (Urban Bushland Council) • Isobella Jennings (Urban Bushland Council) • Neil Goldsborough (Perth) • Phil Spencer (WA Herbarium) • Sylvia Garlick (Perth – Sawyers Valley)
<p>Plant Identification, including specialist plant groups (11/11/99 – 4/8/01)</p> <ul style="list-style-type: none"> • Andrew Brown (CALMSscience) – Orchids • Andrew Thomson – weeds • Ann Gunness – general • Barbara Rye (WA Herbarium) – <i>Euryomyrtus</i> • Brian Moyle – <i>Eucalytus</i> + general • Damien Staude – general • Dorothy Perret – general • Elizabeth George – <i>Verticordia</i> + general • Malcolm Trudgen – <i>Baeckea</i> + <i>Micromyrtus</i> + <i>Rinzia</i> + <i>Thryptomene</i> • Mike Hislop (WA Herbarium) – general • Neil Gibson – general • Neil Golsborough – general • Patricia Wenham – general • Paul Wilson (WA Herbarium) – <i>Chenopodiaceae</i> • Rob Davies (WA Herbarium) – general • Stan Webster – <i>Acacia</i> • Sylvia Garlick – general
<p>Transcribing data, updating Survey Sheets and Collecting Tags (11/11/99 – 10/01)</p> <ul style="list-style-type: none"> • Alice Stubber (Perth – Wanneroo) • Andrew Thomson (Perth – Waterford) • Anne Bellman (Cooloongup)
<p>Preparing Field Herbarium (7/00 – 8/01)</p> <ul style="list-style-type: none"> • Anne Bellman (Cooloongup) • Andrew Thomson (Perth – Waterford) • Elizabeth George (Perth – Alexander heights) • Grecian Sandwell (Perth – Shelley) • Sylvia Garlick (Perth – Sawyers Valley)
<p>Access to the WA Herbarium and use of the WA Reference Herbarium</p> <ul style="list-style-type: none"> • Neville Marchant – access to facilities and general project support • Beng Siew Mahon – assistance with reference materials • Chang Sha Fang – access to facilities and general project support

- Marilyn Mawkes – general support
- Mike Hislop – Reference Herbarium and general project support
- Phil Spencer – specimen management and general support

Review of Draft Report – Wildflower Society – Bushland Plant Survey Management Committee

- Ann Gunness
- Brian Moyle
- Bronwen Keighery
- Mary Gray

REFERENCES & FURTHER READING

General

- Aplin, T.E.H. (1979) *The Flora. IN: Environment and Science* (Ed B.J. O'Brien) University of WA Press, Perth, WA.
- Atkins, K.J. (2000) *Declared Rare and Priority Flora List for Western Australia*, Department of Conservation and Land Management, Como, WA.
- Beard, J.S. (1990) *Plant Life of Western Australia*, Kangaroo Press, Kenthurst, NSW.
- Beard, J.S. (1980) *Vegetation Survey of Western Australia: The Vegetation of the Kellerberrin Area Western Australia – Map and Explanatory Memoir 1:250,000 Series*, Vegmap Publications, Perth, WA
- Beeston, G.R., Mlodawski, G., Sanders, A. and True, D. (1994) *Remnant vegetation inventory in the southern agricultural areas of Western Australia*, Agriculture Western Australia, South Perth, WA.
- Commonwealth Bureau of Meteorology (2000) *Climate Information Website* [<http://www.bom.gov.au/cgi-bin/climate/>] developed and maintained by Commonwealth Bureau of Meteorology, East Perth, WA and Canberra, ACT.
- Commonwealth of Australia (1996) *The National Strategy for the Conservation of Australia's Biological Diversity*, Commonwealth Dept of Environment, Sports and Territories, Canberra, ACT.
- English, V.J. and Blyth, J. (1997) *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province*, Project Number N702, Final Report to Environment Australia, Department of Conservation and Land Management, Como, WA.
- Environmental Protection Authority (1999) *Environmental Protection of Native Vegetation in Western Australia – Preliminary Position Statement No. 2*, EPA, Perth, WA.
- FloraBase** refer WA Herbarium reference below.
- Government of Western Australia (2000a) *Final Report of the Native Vegetation Working Group*, Government of WA, Perth, WA.
- Government of Western Australia (1997) *Memorandum of Understanding between the Commissioner for Soil and Land Conservation, Environmental Protection Authority, Department of Environmental Protection, Agriculture Western Australia, Department of Conservation and Land Management and Water and Rivers Commission for the protection of remnant vegetation on private land in the agricultural region of Western Australia*, Government of WA, Perth, WA.
- Government of Western Australia (2000b) *Natural Resource Management in Western Australia - The Salinity Strategy*, Government of WA, Perth, WA.
- Government of Western Australia (1998) *Perth's Bushplan – keeping the bush in the city (Volumes 1 & 2)*, Government of WA, Perth, WA.
- Gunness A.G. and Volunteers of the Bushland Plant Survey Project (1999) *A Survey of Vegetation and Flora of the Heritage Bushland on the McBurney's "Nyamutin Farm", East Yornaning LCDC, Shire of Cuballing*, Wildflower Society of WA, Nedlands, WA.
- Hopkins, A.J.M., Coker, J., Beeston., G.R., Bowen, P. and Harvey, J.M. (1996) *Conservation Status of Vegetation Types throughout Western Australia*, Project Number N703, Final Report to Australian Nature Conservation Agency, National Reserves Systems Co-operative Program, Department of Conservation and Land Management, Como and Department of Agriculture, South Perth, WA.
- Keighery, B.J. (1994) *Bushland Plant Survey: A guide to plant community survey for the community*, Wildflower Society of WA, Perth, WA.

- Keighery, B.J. and Gray, M. (1993) *Towards an Urban Bushland Policy for the National Trust (WA). A Discussion Paper* IN: National Trust of Australia (WA) Urban Bushland Policy. National Trust of Australia (WA), Wildflower Society of Western Australia (Inc) and The Tree Society (Inc), Perth.
- Keighery, G.J. (2000) *Wheatbelt wonders under threat* IN: *Landscape (Volume 16, No. 2)*, Department of Conservation and Land Management, Kensington, WA.
- Morgan, D., Best, E., Betjeman, K., Pitman, M., Thomson, J., Lee, A. and Nicholas, J. (1973) *Biological Science: the web of life (2nd Ed)*, Australian Academy of Sciences, Canberra, ACT.
- Lantzke, N. (1992) *Soils of the Northam Advisory District – The Zone of Ancient Drainage* Bulletin No. 4244, Department of Agriculture, South Perth, WA.
- McArthur, W.M. (1992) *Land Resources of the Kellerberrin Region* Technical Report 134, Division of Resource Management, Department of Agriculture, South Perth, WA.
- Muir, B.G. (1977) *Biological Survey of the Western Australian Wheatbelt, Part 2*, Records of the Western Australian Museum, Supplement No. 3, WA Museum, Perth, WA.
- Patrick, S. (1997) *How to Create a Local Herbarium*, Land for Wildlife and Department of Conservation and Land Management, Como, WA.
- Penny, S.A. and McKane B.J (1999) *Yilgarn Land Management Manual* National Landcare Program and Agriculture WA, Merredin, WA.
- Safstrom, R. (1999) *The Current State of Biodiversity in the Avon River Basin*, prepared for the Avon Working Group, Perth, WA.
- Southwell C. (1995) *Remnant Vegetation and Ground Water* IN: *Weeds, Wire and Woodland* Proceedings from Conference held in Merredin, 11/4/95, Department of Agriculture, Merredin, WA.
- Thackway, R. and Creswell, J.D. (1995) *An Interim Biogeographic Regionalisation for Australia*, Australian Nature Conservation Agency, Canberra, ACT.
- Weaving, S. (1999) *Avon and Upper Hotham Region: Natural Resource Atlas*, Spatial Resource Information Group, Agriculture Western Australia, South Perth, WA.
- Weaving, S. (1994) *Native Vegetation Handbook for the Shire of Wyalkatchem*, Spatial Resource Information Group, Western Australian Department of Agriculture, South Perth, WA.

Some useful references for plant identification and species list compilation

- Bennett, E.M. (1993) *Common and Aboriginal Names of Western Australian Plant Species*, Wildflower Society of WA, Eastern Hills Branch, Glen Forest, WA.
- Blackall, W.E. and Grieve, B.J. (various dates) *How To Know Western Australian Wildflowers*, University of Western Australia Press, Nedlands, WA.
- Brooker, M.I.H. and Kleinig D.A. (1990) *Field Guide to Eucalyptus, Volume 2 – South-Western and Southern Australia*, Inkata Press, Melbourne VIC and Sydney NSW.
- Chippendale, G.M. (1981) *Eucalyptus Buds and Fruits*, Australian Government Publishing Service, Canberra, ACT.
- Green, J.W. (1985) *Census of Vascular Plants in Western Australia*, Department of Agriculture, South Perth, WA.
- Grieve, B.J. (various dates) *How To Know Western Australian Wildflowers*, University of Western Australia Press, Nedlands, WA.
- Harris, J.G. and Harris, M.W. (1997) *Plant Identification Terminology – An Illustrated Glossary*, Spring Lake Publishing, Payson, UT, USA.
- Hussey, B.J.M., Keighery, G.J., Cousens, R.D., Dodd, J and Lloyd, S.G. (1997) *Western Weeds: A guide to the weeds of Western Australia*, Plant Protection Society of WA, Victoria Park, WA.

- Mackinson, R.O. (2000) *Flora of Australia - Grevillea* Vol.17A. ABRS/CSIRO, Melbourne, VIC.
- Olde, P. and Marriott N. (1994) *The Grevillea Book*, Vol 1 (p79), Kangaroo Press, Kenthurst, NSW.
- Paczkowska, G. and Chapman, A.R. (2000) *The Western Australian Flora – a descriptive catalogue*, Wildflower Society of WA (Inc), Western Australian Herbarium CALM and Botanic Gardens & Parks Authority, Perth, WA.
- WA Herbarium (1998-) *FloraBase – information on the WA flora*
[<http://www.calm.wa.gov.au/science/florabase>] Department of Conservation and Land Management, South Perth, WA

<p>Some useful references for practical management of bushland</p>

- Bradby, K., Gisborne, E. and True (Eds) (2001) *Buying Bush: a how-to guide*, World Wide Fund for Nature (WA), Soil & Land Conservation Council (WA) and Real Estate Institute of WA, Perth, WA.
- Bradshaw (2001) *Critters & Crops – the critical connection*, Greening Australia Western Australia Fremantle, WA.
- Brown, L. and Holt, C. (2000) *Eucalypt Woodlands – A Guide to Management*, World Wide Fund for Nature, Perth and Agriculture Western Australia, Narrogin, WA.
- Department of Conservation and Land Management (1997 –) *Western Wildlife – newsletter of Land for Wildlife*, Edited by P. Hussey, CALM, Kensington, WA.
- Holt C. and Bradby. K. (2000) *The value and benefits of healthy farm bush* Farmnote No. 141/2000, Department of Agriculture, South Perth, WA.
- Holt C., Bradby. K. and Hay, S. (2001) *Reducing rates and taxes on farm bushland* Farmnote No. 2/2001, Department of Agriculture, South Perth, WA.
- Hussey B.J.M. (1995) *Why Manage Remnant Vegetation?* IN: *Weeds, Wire and Woodland* Proceedings from Conference held in Merredin, 11/4/95, Department of Agriculture, Merredin, WA.
- Hussey, B.J.M. and Wallace, K.J. (1993) *Managing Your Bushland*, Department of Conservation and Land Management, Como, WA.
- Ochtman, M. and Holt C. (2000) *Vegetation Buffer Zones* Farmnote No. 38/2000, Department of Agriculture, South Perth, WA.
- Wallace K.J. (1995) *Integrating Remnant Vegetation in Agriculture* IN: *Weeds, Wire and Woodland* Proceedings from Conference held in Merredin, 11/4/95, Department of Agriculture, Merredin, WA.
- Wheatbelt Remnant Vegetation Committee (1995) *Weeds, Wire and Woodland* Proceedings from Conference held in Merredin, 11/4/95, Department of Agriculture, Merredin, WA.

8. APPENDICES

APPENDIX A: TERMINOLOGY OF BUSHLAND PLANT SURVEY

Bushland Plant Survey involves a range of old and new concepts, methods and language. Although the words are shared, there may be different understandings of what they mean. A common understanding reduces ambiguity and assists with communication. This table defines some of the terms used both in the *Bushland Plant Survey Process*, this report and bushland management in general.

biodiversity or biological diversity	The variety of all life forms – the different plants, animals and micro-organisms, the genes they contain, and the ecosystems of which they form a part. It is not static, but constantly changing – it is increased by genetic change and evolutionary processes and reduced by processes such as habitat degradation, population decline and extinction. The concept emphasises the interrelatedness of the biological world. ¹
climber / creeper / scrambler	Plants often in need of other plants or objects to be supported. Woody and non-woody.
condition (of vegetation)	Rating given to bushland to categorise disturbance related to human and associated activities. The rating refers to the degree of change in the structure, density and species present in the bushland, in relation to undisturbed bushland of the same type. It gauges the impact of disturbance on each of the vegetation layers and consequently on the ability of the natural plant community to regenerate. ⁴
dicotyledon / dicot	Woody or non-woody flowering plant with 2 seed leaves (cotyledons), leaf veins in a network (reticulate), flower parts mainly in 4s or 5s, and a single main root (tap root) with lesser side branches (eg eucalypts, grevilleas, pea flowers, sundews, trigger plants). ⁴
ecosystem	A dynamic complex of plant, animal, fungal and micro-organism communities and the associated non-living environment interacting as an ecological unit. ¹
Family (in plant classification)	The level where all similar genera are grouped together. . The beginning of the name is often taken from one of the Genera and the ending '-aceae' indicates a family name when discussing plants (eg Droseraceae, Goodeniaceae, Santalaceae). ⁵
grasses	Non-woody plants that have inconspicuous individual flowers that are pollinated by wind (and are all in the plant family POACEAE). ⁴ These can be further described by their growth form [eg tussock grasses or bunch grasses] or by their height [eg tall or low grasses].
growth form	How a plant grows - its shape and ability to lay down woody tissue (eg tree, mallee, shrub, grass, sedge, rush, grass, herb, creeper) ⁴
habitat	The place or type of site in which an organism naturally occurs. ¹
herb/s	Non-woody plants with stems, generally under 0.5m tall, that are not grasses, sedges or rushes. ⁴
life form	For this report, it refers to whether the plant has an annual, bi-annual or perennial life span.
lignotuber	Swollen wood tissue (mallee-root), at or just under the ground from which stems arise. Serves as food reserve and is capable of putting forth new stems at intervals, eg after bushfires, and repeating this performance seemingly indefinitely, in some case for over a century. ²
mallee/s	Plants with many trunks arising from a lignotuber (eg <i>Eucalyptus leptopoda</i> , <i>Eucalyptus subangusta</i> ssp. <i>subangusta</i>). ⁴ For the purpose of vegetation classification, mallees are divided into categories based on their height and stem no. Mallee [>8m, with <5 trunks] or Shrub Mallee [<8m, with >5 trunks]
monocotyledon / monocot	Non-woody flowering plant with 1 seed leaf (cotyledon), leaf veins parallel, flower parts in 3s, and a fibrous root system where all roots are of equal importance (eg. grasses, sedges, orchids, lilies). ⁴
perennial	Refer to life form
plant names (Genus species)	The binomial or 'two word' nomenclature was developed by Linnaeus. The first word is the 'Genus' name, meaning Latin for 'kind'. The second name is the 'descriptive' or 'trivial' name and indicates which particular species it is. Both words are Latin or Latinized Greek or Latin forms of other words. (Note: Genus is spelt with a capital letter, the species, usually an adjective is spelt with a small letter. Scientific names are either presented in <i>italics</i> or <u>underlined</u>). ⁵
Plant Community or	Pattern in the way plants grow together. The particular assemblage of plants in each community is

Vegetation Type/Unit/Association	<p>determined by the plant species, soil, water, light and temperature. Different plant communities may form wherever one of these factors alters. These factors are continuous variables, so the assemblage of plants in the community also changes in this way.</p> <p>In an attempt to understand the diversity of plant communities and to be able to compare one with another, botanists have developed many ways of describing plant communities. A simplistic order is imposed on the continually changing communities that describes an 'average' assemblage of plants from a community. ⁴</p>
plant taxon (plural = taxa)	<p>The named classification unit to which individuals or sets of species are assigned following logical taxonomic sorting (or systematics) such as kingdom, phyla, class, order, family, genus and species (also for some plants, sub-species, varieties &/or affinities). ¹ The scientific names given to plant species.</p> <p>For example, for the 'Jam Wattle':</p> <p>Kingdom = Plant Phylum = Tracheophyta (vascular plants) Class = Angiospermae (flowering plants) Sub-class = Magnoliopsida (Dicotyledon) Family = Mimosaceae Genus = <i>Acacia</i> Species = <i>acuminata</i> ..thus Plant Taxon = <i>Acacia acuminata</i></p>
rushes	Refer sedge/s + rush/es
scramblers	Refer climber
sedge/s + rush/es	<p>Non-woody, tufted or spreading plants. Most have inconspicuous flowers that are pollinated by wind.</p> <p><u>Sedges</u> come from the plant family CYPERACEAE</p> <p><u>Rushes</u> come from the plant families ECDEIOCOLEACEAE, JUNCACEAE, RESTIONACEAE, TYPHACEAE and XYRIDACEAE</p>
shrub/s	<p>Woody plants with one or many woody stems, foliage all or part of the total height of the plant. ⁴ For the purpose of vegetation classification, shrubs are divided in to categories based on their height Tall [>2m], Medium [1-2m] and Low [<1m].</p>
species (in plant classification)	<p>A group of plants capable of interbreeding freely with each other to produce vigorous, fertile seed. In classification terms, indicates a 'unit of sameness'. (Refer also to plant names and taxon)</p>
species richness	<p>The number of species in a given area (eg Quadrat WYHO09 recorded 59 species, and is richer than WYHO12 which recorded 27 species).</p>
taxon (plural = taxa)	Refer to plant taxon
tree/s	<p>Woody plants with a trunk and canopy, the canopy is less than or equal to 2/3 of the height of the trunk, no lignotuber apparent. ⁴</p> <p>For the purpose of vegetation classification, trees are divided into categories based on their height Tall [>30m], Medium [10-30m] and Low [<10m].</p>
Vegetation Unit/Type	Refer to Plant Community
weed/s	<p>Plants which are not native to bushland and/or commonly invade areas of natural vegetation following disturbance such as flooding, grazing, fire and soil disturbance. They can be exotic species or non-local native species. Undisturbed vegetation will resist weed establishment in the understorey. ⁴</p>

¹ Commonwealth of Australia (1996); ² Gardner CA (1979); ³ Government of WA (1998); ⁴ Keighery BJ (1994); ⁵ Morgan *et al* (1973)

APPENDIX B: EXAMPLE OF APPLYING THE 'VEGETATION STRUCTURAL CLASSIFICATION MODEL' (Refer Table 3 – page 17)

As a quick demonstration of how the classification is applied, the following Table shows the information or data collected in the field and the resultant vegetation unit or plant community description determined in the office using the Vegetation Structural Classification Model.

Note even if there are species within a life form or height class (eg Shrubs 1-2m), if the Canopy Cover is not more than or equal to 2%, it is considered not of sufficient density to form a distinct vegetation structural layer. The plants are still important and can be recorded in the vegetation description as 'occasionals' or, where appropriate, 'emergents'.

FIELD SURVEY INFORMATION COLLECTED			VEGETATION DESCRIPTION
Life Form/ Height Class	Dominant Plant Species	Canopy Cover	
Trees >30m	<i>Eucalyptus salmonophloia</i>	31-70%	<i>Eucalyptus salmonophloia</i> Tall Open Forest , over <i>Eriochilus dilatatus</i> and <i>Lawrencella rosea</i> Very Open Herbland
Shrubs 1-2m	<i>Melaleuca acuminata</i> + <i>Daviesia nematophylla</i>	<2	
Herbs	<i>Eriochilus dilatatus</i> + <i>Lawrencella rosea</i>	2-10%	
Trees >30m	<i>Eucalyptus salmonophloia</i>	<2%	<i>Olearia muelleri</i> and <i>Rhagodia preissii</i> Low Shrubland , with Occasional Emergent Trees of <i>Eucalyptus salmonophloia</i> over <i>Eriochilus dilatatus</i> and <i>Lawrencella rosea</i> Very Open Herbland
Shrubs <2m	<i>Olearia muelleri</i> + <i>Rhagodia preissii</i>	11-30%	
Herbs	<i>Eriochilus dilatatus</i> + <i>Lawrencella rosea</i>	2-10%	
Shrubs >2m	<i>Acacia stereophylla</i> + <i>Allocasuarina acutivalvis</i>	2-10%	<i>Acacia stereophylla</i> and <i>Allocasuarina acutivalvis</i> Tall Open Shrubland over <i>Baeckea crispiflora</i> , <i>Calothamnus gilesii</i> and <i>Thryptomene kochii</i> Open Heath over <i>Neurachne alopecuroidea</i> Very Open Grassland
Shrubs 1-2m	<i>Baeckea crispiflora</i> + <i>Calothamnus gilesii</i> + <i>Thryptomene kochii</i>	31-70%	
Grasses	<i>Neurachne alopecuroidea</i>	2-10%	

APPENDIX C: PHOTOGRAPHS OF THE "MINDAH" BUSHLAND PLANT SURVEY

ERRATUM – Unfortunately photos 2-15 are mirror-images of reality. Thus, take care when using in the field to relocate quadrats.



PHOTO 2: *Eucalyptus salmonophloia* (Salmon Gum) Open Woodland [OW¹] which occurred in the north-east corner of the study area on brown sandy loams.

– **Quadrat WYHO04** recorded 29 native species and 8 weed species (Photo: B. Moyle 9/99)

PHOTO 3: *Eucalyptus salmonophloia* (Salmon Gum) Open Woodland over *Melaleuca* species Shrubland [OW²].

– **Quadrat WYHO02** recorded 28 native species and 2 weed species (Photo: B. Moyle 9/99)

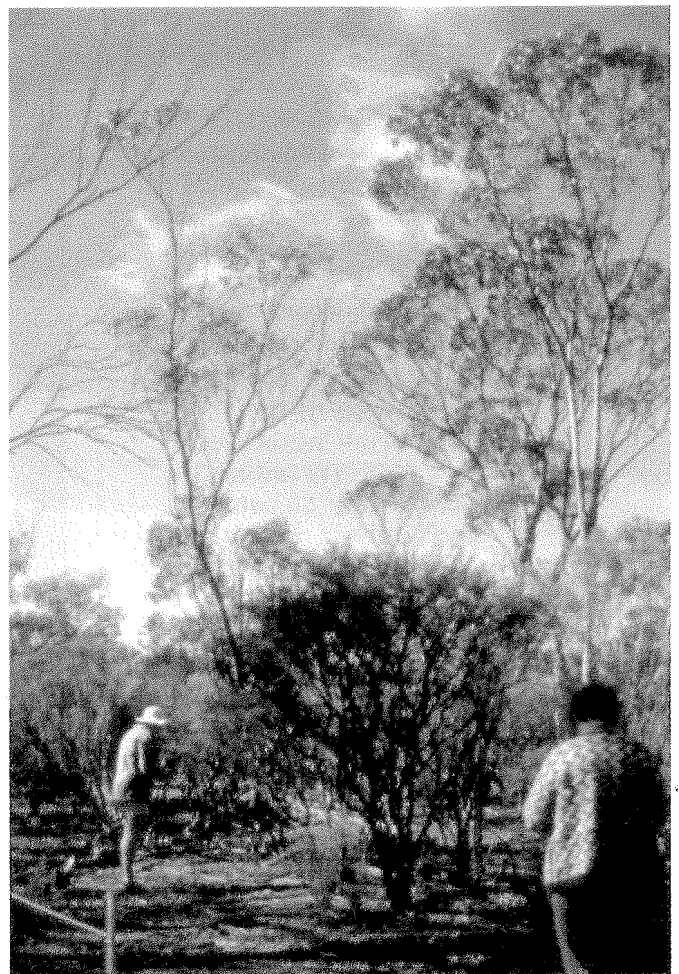




PHOTO 4: *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) and *Eucalyptus erythronema* var. *marginata* (Red-Flowered Mallee) Open Mallee – Mallee [OM-M] which occurred upslope from the flow-line, just to the east of the centre of the study area. Note the dark and silver-white trunks of the two mallees and the multi layered structure of the unit.
– Quadrat WYHO03 recorded 43 native species and 8 weed species (Photo: B. Moyle 9/99)

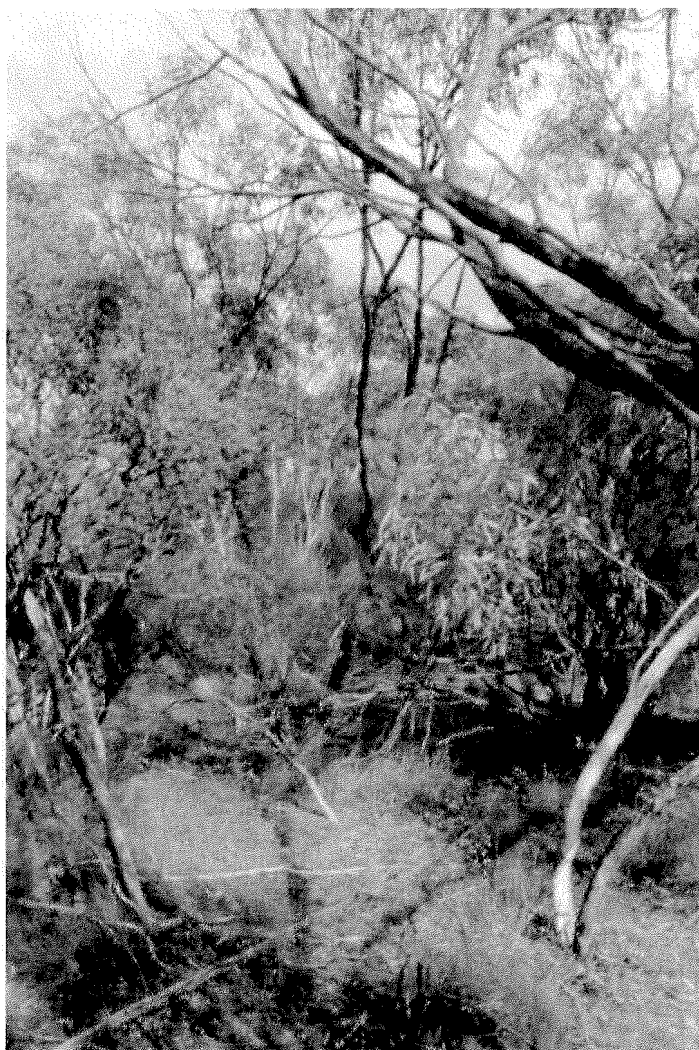


PHOTO 5: *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum), *Eucalyptus myriadena* ssp. *myriadena* Open Mallee over *Melaleuca adnata* and *Melaleuca radula* (Graceful Honey myrtle), Tall Open Scrub [OM-M] occurred on the western slopes above the flow-line.
– Quadrat WYHO05 recorded 43 native species and 6 weed species (Photo: B. Moyle 9/99)



PHOTO 6: *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) Open Mallee over *Melaleuca* species Tall Closed Scrub-Tall Shrubland [OM/TCSc] which occurred both within and beside the flow-line that runs north-south through the study area.
 – Quadrat WYHO06 recorded 35 native species and 3 weed species (Photo: B. Moyle 9/99)



PHOTO 7: *Eucalyptus erythronema* var. *marginata* (Red-Flowered Mallee) Very Open Mallee - Mallee [OM-M] which occurred in the eastern portion of the bushland block on a gentle north-west facing slope of light-brown loam over red-brown loam between York Gum Open Mallee and Salmon Gum Open Woodland units.
 – Quadrat WYHO11 recorded 49 native species and 4 weed species (Photo: B. Moyle 9/99)



PHOTO 8: *Eucalyptus subangusta* ssp. *subangusta* and *Eucalyptus yilgarnensis* (Yorrel)
Open Mallee with occasional emergent mallees of *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) [OM] occurred on the gentle facing upper slopes of gritty brown loams with decomposing granite sub-strata through to deeper yellow sands.
– Quadrat WYHO09 recorded 54 native species and 4 weed species, being the highest species richness of all the quadrats. (Photo: B. Moyle 9/99)



PHOTO 9: *Eucalyptus subangusta* ssp. *subangusta* and *Eucalyptus stowardii* (Fluted Horn Mallee)
Open Mallee with occasional emergent mallees of *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) [OM] which occurred in the north-west corner of the study area.
– Quadrat WYHO01 recorded 44 native species and 5 weed species (Photo: B. Moyle 9/99)

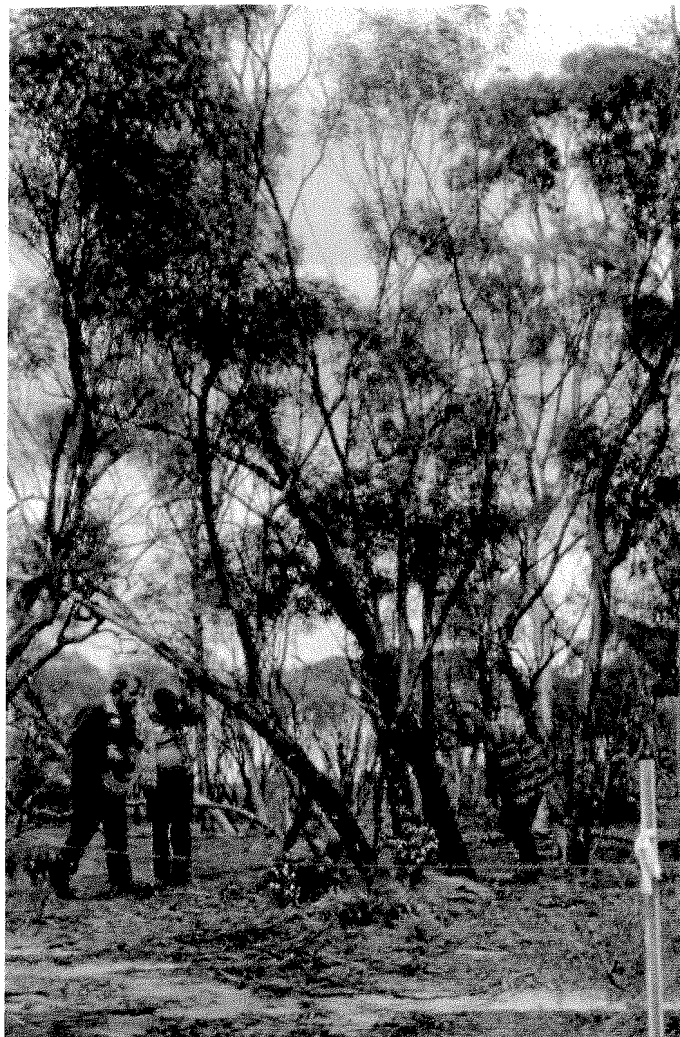


PHOTO 10:

***Eucalyptus yilgarnensis* (Yorrel)**
Open Mallee with occasional emergent trees of *Eucalyptus salmonophloia* (Salmon Gum) [OM] occurred towards the south-east of the study area, upslope from the flow-line.
– **Quadrat WYHO12** recorded 22 native species and 5 weed species (Photo: B. Moyle 9/99)



PHOTO 11: *Melaleuca* species Tall Shrubland to Tall Open Scrub [Ts-TOSc] which occurred on the higher edges on the flow-line. Although the *Melaleuca* species and the tall tufted grass *Spartochloa scirpoidea* make this plant community distinctive on the ground - it is not easily discernible on the aerial photo. As such it has been mapped as part of the *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) Open Mallee over *Melaleuca* Tall Closed Scrub-Tall Shrubland (OM/TOSc) – which has a similar understorey structure, with a Mallee canopy of York Gum. Termite mounds (20-40cm tall) were also present in this unit.

– **Quadrat WYHO07** recorded 39 native species and 5 weed species (Photo: B. Moyle 9/99)



PHOTO 10:

Eucalyptus yilgarnensis (Yorrel)
Open Mallee with occasional emergent trees of *Eucalyptus salmonophloia* (Salmon Gum) [OM] occurred towards the south-east of the study area, upslope from the flow-line.
– **Quadrat WYHO12** recorded 22 native species and 5 weed species (Photo: B. Moyle 9/99)



PHOTO 11: *Melaleuca* species Tall Shrubland to Tall Open Scrub [Ts-TOSc] which occurred on the higher edges on the flow-line. Although the *Melaleuca* species and the tall tufted grass *Spartochloa scirpoidea* make this plant community distinctive on the ground - it is not easily discernible on the aerial photo. As such it has been mapped as part of the *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) Open Mallee over *Melaleuca* Tall Closed Scrub-Tall Shrubland (OM/TOSc) – which has a similar understorey structure, with a Mallee canopy of York Gum. Termite mounds (20-40cm tall) were also present in this unit.

– **Quadrat WYHO07** recorded 39 native species and 5 weed species (Photo: B. Moyle 9/99)



PHOTO 12: *Allocasuarina acutivalvis* (Black Tamma) and *Acacia stereophylla* ssp. *stereophylla* Tall Shrubland [**TSh**] occurred towards the south-western boundary of the bushland block on brown loamy sands to creamy-yellow sands.
– Quadrat WYHO08 recorded 35 native species and 4 weed species (Photo: B. Moyle 9/99)



PHOTO 13: *Baeckea crispiflora* and *Calothamnus gilesii* Shrubland [**Sh**] which occurred against the western boundary of the study area on a very gentle slope with brown loamy sands and exposed granite. (Note: smaller patches of this plant community occurred on the northern side of the bushland block, but due to their size they have been mapped within the more dominant Salmon Gum Open Woodlands.)
– Quadrat WYHO10 recorded 41 native species and 1 weed species (Photo: B. Moyle 9/99)



PHOTO 14: The Wildflower Society Bushland Plant Survey program attracts a broad range of volunteers, including rural program staff, land managers from previous surveys, naturalists and specialists – all of whom enjoy being in our natural environment and sharing their knowledge. This photo highlights some of diversity amongst volunteers - surveying Quadrat WYHO3.

Standing (L-R) **Greg Keighery** (Perth – Department of Conservation & Land Management + 'Mindah' Project Botanist), **Felicity McGeorge** (Perth – Urban Bushland Council), **Buddy Kent** (Bodallin - landowner for 1998 Bushland Plants Survey), and **Peter Arnold** (Merredin). Sitting (L-R) **Colma Keating** (Perth - 'Mindah' Project Botanist + Coordinator), **Bronwen Keighery** (Perth - botanist) and **Heather Adamson** (Merredin – Land For Wildlife Officer). (Photo: Brian Moyle)



PHOTO 15: Volunteers mixing both plant identification, specimen pressing and a social evening at the Wyalkatchem farm house accommodation. **Buddy Kent** (Bodallin - landowner for 1998 Bushland Plants Survey), **Margaret Collins** (Perth), **Nicole O'Sullivan** (Community Landcare Coordinator, Wyalkatchem), **David & Colleen Lawrence** ('Mindah' property owners Wyalkatchem) and **Felicity McGeorge** (Perth). (Photo: Brian Moyle)

APPENDIX D: WYHO QUADRAT DESCRIPTIONS – as recorded 4 & 5 September 1999

(including location, site details, species composition, plant community structural layers and condition rating)

LEGEND (Refer also Appendix A for explanation of terminology)

WYHO QUADRATS = the 12 10mx10m quadrats surveyed (a = adjacent to the Quadrat, but same plant community)

Open Mallee [OM] = plant community description (Refer Section 4) and reference on vegetation map (Map 8)

bold = dominant species

* = introduced plant / weed

▲ = priority flora (Refer Section 5)

ms = manuscript name (recently described species, awaiting acceptance)

WYHO01

Open Mallee [OM]

Location: Lat: 31°06.792"S Long: 117°18.668"E

Aspect: very gentle south-west facing slope

Soil: brown gritty loam over brown gritty loam to depth – decomposing granite

Drainage: well drained

Bare Ground: 40% cover

Litter: 20% cover, to depth of 1cm

No. Plant Species: 49 (44 native + 5 *weed)

Condition Rating: pristine

Eucalyptus aff. *erythronema* (Red-Flowering Mallee) and *Eucalyptus stowardii* (Horn Fluted Mallee) **Open Mallee** over *Melaleuca uncinata* (Broom Bush) **Shrubland** over *Baeckea crispiflora* and *Hibbertia eatoniae* **Open Low Heath** over *Borya constricta* (Pincushions) and *Waitzia acuminata* (Orange Immortelle) **Herbland**.

Shrub Mallee [<8m]	<i>Eucalyptus</i> aff. <i>erythronema</i>	Red Flowering Mallee
	<i>Eucalyptus stowardii</i>	Horn Fluted Mallee
Shrubs – tall [>2m]	<i>Allocasuarina campestris</i> ssp. <i>campestris</i>	Tamma
	<i>Melaleuca radula</i>	Graceful Honeymyrtle
Shrubs – med [1-2m]	<i>Dodonaea divaricata</i>	Hop Bush
	<i>Hakea scoparia</i>	
	<i>Melaleuca uncinata</i>	Broom Bush
	<i>Phebalium tuberculatum</i>	
	<i>Westringia cephalantha</i>	
Shrubs – low [<1m]	<i>Baeckea crispiflora</i>	
	<i>Gastrolobium bennettianum</i>	Cluster Poison
	<i>Hibbertia eatoniae</i>	
Grasses – perennial - tall	<i>Austrostipa elegantissima</i>	
	<i>Spartochloa scirpoidea</i>	
Grasses – perennial	<i>Amphipogon strictus</i>	
	<i>Neurachne alopecuroides</i>	Foxtail Mulga Grass
Grasses – annual WEED	* <i>Aira caryophyllaea/cupaniana</i>	Silvery Hairgrass
	* <i>Bromus rubens</i>	Red Brome
	* <i>Vulpia myuros</i>	Rat's Tail Fescue
Climber – perennial	<i>Comesperma volubile</i>	Love Creeper
Herbs – perennial climber	<i>Thysanotus patersonii</i>	Twining Fringe Lily
Herbs – perennial	<i>Borya constricta</i>	Pincushions
	<i>Caladenia vulgata</i>	Common Spider Orchid
	<i>Eriochilus dilatatus</i> ssp. <i>undulatus</i>	Crinkle-Leafed Bunny Orchid
	<i>Drosera subhirtella</i>	Sunny Rainbow
	<i>Thelymitra antennifera</i>	Vanilla Orchid
Herbs – annual	<i>Asteraceae</i> sp. A	
	<i>Blennospora drummondii</i>	
	<i>Calandrinia calypttrata</i>	
	<i>Centrolepis aristatus</i>	Pointed Centrolepis
	<i>Crassula colorata</i> ssp. <i>acuminata</i>	Dense Stonecrop

	<i>Melaleuca adnata</i>	
Shrubs – med [1-2m]	<i>Alyxia buxifolia</i>	Dysentery Bush
	<i>Daviesia nematophylla</i>	
	<i>Eremophila drummondii</i>	
Shrubs – low [<1m]	<i>Enchylaena tomentosa</i>	Barrier Saltbush
	<i>Grevillea acuaria</i>	
	<i>Maireana georgei</i>	Satiny Bluebush
	<i>Maireana marginata</i>	
	<i>Olearia muelleri</i>	Goldfields Daisy
	<i>Rhagodia preissii</i> ssp. <i>preissii</i>	
Grasses – perennial	<i>Austrostipa elegantissima</i>	Feather Speargrass
Grasses – annual WEED	* <i>Vulpia myuros</i>	Rat's Tail Fescue
Herbs – perennial	<i>Pterostylis setulosa</i> ms	
Herbs - annual	<i>Angianthus tomentosus</i>	Camel Grass
	<i>Bulbine semibarbata</i>	Leek Lily
	<i>Calotis hispidula</i>	Bindy Eye
	<i>Crassula colorata</i> ssp. <i>acuminata</i>	Dense Stonecrop
	<i>Daucus glochidiatus</i>	Small Pennywort
	<i>Hydrocotyle rugulosa</i>	
	<i>Lawrencella rosea</i>	Pink Everlasting
	<i>Ptilotus holosericeus</i>	
	<i>Rhodanthe laevis</i>	Smooth Sunray
	<i>Stellaria filiformis</i>	Thread Spurry
	<i>Trachymene cyanopetala</i>	
	<i>Waitzia acuminata</i> ssp. <i>acuminata</i>	Orange Immortelle
Herbs – annual WEED	* <i>Arctotheca calendula</i>	Capeweed

Plants adjacent to WHY002

Shrubs – med [1-2m]	<i>Exocarpos aphyllus</i>	Leafless Ballart
Shrubs – low [<1m]	<i>Acacia erinacea</i>	Spiny Wattle
Herbs – annual	<i>Asteridea athrixioides</i>	

WYHO 03**Open Mallee – Mallee [OM-M]****Location:** Lat: 31°06.759"S Long: 117°18.964"E**Aspect:** very gentle south-west facing slope**Soil:** brown sandy loam with no exposed surface rock over brown sandy loam to depth**Drainage:** well drained**Bare Ground:** 30% cover, with majority covered by lichens**Litter:** 10-30% cover, of single leaf depth**No. Plant Species:** 51 (43 native + 8 *weed)**Condition Rating:** excellent

Eucalyptus loxophleba ssp. *lissophloia* (York Gum) and *Eucalyptus erythronema* var. *erythronema* (Red-Flowered Mallee) **Very Open Mallee** over *Melaleuca acuminata* ssp. *websteri* (Jam) **Tall Open Shrubland – Tall Shrubland** over *Acacia colletioides* and *Melaleuca adnata* **Open Heath** over **Mixed Low Open Shrubland** over *Austroanthonia setacea* **Very Open Grassland** over *Hyalospermum glutinosum* ssp. *glutinosum* and *Waitzia acuminata* ssp. *acuminata* (Orange Immortelle) **Herbland** and **Occasional Grasses** and **Sedges**.

Mallee [>8m]	<i>Eucalyptus loxophleba</i> ssp. <i>lissophloia</i>	York Gum
Mallee [<8m]	<i>Eucalyptus erythronema</i> var. <i>erythronema</i>	Red-Flowered Mallee
Shrubs – tall [>2m]	<i>Melaleuca acuminata</i> ssp. <i>websteri</i> ms	
Shrubs – med [1-2m]	<i>Acacia colletioides</i>	Wait-a-While Wattle
	<i>Acacia hemiteles</i>	Tan Wattle
	<i>Acacia mackeyana</i>	
	<i>Melaleuca adnata</i>	

	<i>Crassula</i> sp.	
	<i>Drosera glanduligera</i>	Pimpernel Sundew
	<i>Hyalosperma glutinosum</i>	
	<i>Hydrocotyle rugulosa</i>	
	<i>Levenhookia pusilla</i>	
	<i>Lobelia</i> sp.	
	<i>Millotia tenuifolia</i>	Soft Millotia
	<i>Podolepis canescens</i>	Bright Podolepis
	<i>Poranthera microphylla</i>	Small Poranthera
	<i>Ptilotus</i> sp.	
	<i>Rhodanthe laevis</i>	Smooth Sunray
	<i>Velleia cynopotamica</i>	
	<i>Wahlenbergia preissii</i>	
	<i>Waitzia acuminata</i> ssp. <i>acuminata</i>	Orange Immortelle
Herbs – annual WEED	<i>*Arctotheca calendula</i>	Capeweed
	<i>*Hypochaeris glabra</i>	Flatweed
Sedges – perennial tall	<i>Lepidosperma</i> Sp. A2 Island Flat Keighery 7000	
Sedges – annual low	<i>Schoenus nanus</i>	Tiny Bog Rush

Plants adjacent to WYHO01

Shrubs – tall [>2m]	<i>Allocasuarina acutivalvis</i>	Black Tamma
	<i>Melaleuca adnata</i>	
	<i>Santalum acuminatum</i>	Quandong
Shrubs – med [1-2m]	<i>Acacia hemiteles</i>	Tan Wattle
	<i>Acacia heteroneura</i> var. <i>petila</i>	
	<i>Acacia mackeyana</i>	
	<i>Acacia saxatilis</i>	
	<i>Grevillea paradoxa</i>	Bottlebrush Grevillea
	<i>Micromyrtus racemosus</i> var. <i>racemosus</i>	
Shrubs – low [<1m]	<i>Astroloma serratifolium</i> ssp. <i>horridulum</i>	Cankerry, Kondrung
	<i>Cryptandra apetala</i> var. <i>apetala</i>	
Grasses – annual WEED	<i>*Avena barbata</i>	Wild Oat, Bearded Oat
Herbs – perennial	<i>Caladenia saccharata</i>	Sugar Orchid
	<i>Diuris</i> aff. <i>corymbosa</i>	Rosy Cheeked Donkey Orchid
Herbs – annual	<i>Goodenia berardiana</i>	
Herbs – annual WEED	<i>*Mesembryanthemum crystallinum</i>	Iceplant

WYHO 02

Open Woodland [OW2]

Location: Lat: 31°06.552"S Long: 117°18.444"E

Aspect: very, very gentle north, north-west facing slope

Soil: red-brown clay over red-brown clay

Drainage: moderately drained

Bare Ground: 30% cover

Litter: 50% cover, to depth of 5cm

No. Plant Species: 30 (28 native + 2 *weed)

Condition Rating: very good (note: practically weed free)

Eucalyptus salmonophloia (Salmon Gum) **Open Woodland** over *Melaleuca acuminata* ssp. *websteri* and *Melaleuca adnata* **Tall Shrubland** over *Olearia muelleri* (Goldfields Daisybush) and *Rhagodia preissii* ssp. *preissii* **Low Open Shrubland** over **Occasional Grasses** of *Austrostipa elegantissima* (Feather Speargrass) and *Vulpia myuros* and Occasional Mixed Herbs.

Tree – tall [>30m]	<i>Eucalyptus salmonophloia</i>	Salmon Gum
Tree - low	<i>Eucalyptus loxophleba</i>	York Gum
Mallee	<i>Eucalyptus yilgarnensis</i>	Yorrel
Shrubs – tall [>2m]	<i>Melaleuca acuminata</i> ssp. <i>websteri</i> ms	

Shrubs – low [<1m]	<i>Acacia merrallii</i>	Merral's Wattle
	<i>Enchylaena tomentosa</i>	Barrier Saltbush
	<i>Olearia muelleri</i>	Goldfields Daisy
	<i>Maireana marginata</i>	Bluebush
	<i>Rhagodia preissii</i> ssp. <i>preissii</i>	
Grasses – perennial tall	<i>Austrostipa elegantissima</i>	
Grasses – perennial low	<i>Austrodanthonia setacea</i>	
	<i>Austrostipa trichophylla</i>	
Grasses – annual WEED	* <i>Aira caryophyllea/cupaniana</i>	Silvery Hairgrass
	* <i>Avena barbata</i> x <i>fatua</i>	Wild Oat, Bearded Oat
	* <i>Bromus madritensis</i>	Madrid Brome
	* <i>Ehrharta longiflora</i>	Annual Veldt Grass
Herbs – perennial	<i>Arthropodium curvipes</i>	
	<i>Caladenia exilis</i> ms	
	<i>Erodium cygnorum</i>	Blue Storksbill
	<i>Ptilotus spathulatus</i>	
Herbs – annual	<i>Blennospora drummondii</i>	
	<i>Brachyscome perpusilla</i>	Tiny Daisy
	<i>Bulbine semibarbata</i>	Leek Lily
	<i>Calandrinia granulifera</i>	Pygmy Purslane
	<i>Calotis hispidula</i>	Bindy Eye
	<i>Centrolepis cephaloformis</i>	
	<i>Crassula colorata</i> ssp. <i>acuminata</i>	Dense Stonecrop
	<i>Goodenia berardiana</i>	
	<i>Hyalosperma demissum</i>	
	<i>Hyalosperma glutinosum</i>	
	<i>Hydrocotyle medicaginoides</i>	Small Pennywort
	<i>Isoetopsis graminifolia</i>	Cushion Grass
	<i>Lobelia</i> sp.	
	<i>Parietaria debilis</i>	Pellitory
	<i>Plantago</i> Sp. Nov. (aff. <i>hispida</i>)	
	<i>Podolepis canescens</i>	Bright Podolepis
	<i>Podolepis tepperi</i>	
	<i>Pogonolepis stricta</i>	
	<i>Ptilotus gaudichaudii</i> var. <i>gaudichaudii</i>	
	<i>Rhodanthe laevis</i>	Smooth Sunray
	<i>Trachymene cyanopetala</i>	
	<i>Trachymene ornata</i>	Spongefruit
	<i>Velleia cynopotamica</i>	
	<i>Waitzia acuminata</i> ssp. <i>acuminata</i>	Orange Immortelle
Herbs – annual WEED	* <i>Arctotheca calendula</i>	Capeweed
	* <i>Hypochaeris glabra</i>	Flatweed
	* <i>Micropterum papulosum</i>	
	* <i>Sonchus oleraceus</i>	Common Sowthistle

Plants adjacent to WYHO03

Shrubs – med [1-2m]	<i>Acacia acuaria</i>	
Shrubs – low [<1m]	<i>Acacia erinacea</i>	Spiny Wattle
	<i>Trymalium daphnifolium</i>	
Climbers – perennial	<i>Thysanotus patersonii</i>	Twining Fringe Lily

WYHO 04**Open Woodland [OW¹]****Location:** Lat: 31°06.806"S Long: 117°19.035"E**Aspect:** flat, no discernible slope**Soil:** brown sandy loam over brown sandy loam**Drainage:** moderately well drained**Bare Ground:** 70% cover, to depth of 10cm**Litter:** 2-10% cover**No. Plant Species:** 37 (29 native + 8 *weed)**Condition Rating:** very good[note: area has been selectively logged in the distant past]

Eucalyptus salmonophloia (Salmon Gum) **Open Woodland** over *Eucalyptus salubris* (Gimlet) **Low Open Woodland** over **Occasional Low Shrubs, Grasses and Herbs.**

Tree – med [10-30m]	<i>Eucalyptus salmonophloia</i>	Salmon Gum
Tree – low [<10m]	<i>Eucalyptus salubris</i>	Gimlet
Shrubs – med [1-2m]	<i>Eremophila drummondii</i>	
	<i>Exocarpos aphyllus</i>	Leafless Ballart
Shrubs – low [<1m]	<i>Acacia erinacea</i>	Spiny Wattle
	<i>Acacia merrallii</i>	Merrall's Wattle
	<i>Atriplex acutibractea</i> ssp. <i>karoniensis</i>	
	<i>Atriplex vesicaria</i>	Bladder Saltbush
	<i>Maireana x Enchylaena</i> hybrid	
	<i>Maireana georgei</i>	Satiny Bluebush
	<i>Olearia muelleri</i>	Goldfields Daisy
	<i>Rhagodia preissii</i> ssp. <i>preissii</i>	
Herbs – perennial	<i>Thysanotus pyramidalis</i>	Fringe Lily
Grasses – perennial tall	<i>Austrostipa elegantissima</i>	
Grasses – annual WEED	* <i>Bromus diandrus</i>	Great Brome
	* <i>Bromus rubens</i>	Red Brome
	* <i>Hordeum leporinum</i>	Barley Grass
Herbs – annual	<i>Asteraceae</i> sp. A	
	<i>Calandrinia calyptata</i>	Pink Purslane
	<i>Calotis hispidula</i>	Bindy Eye
	<i>Crassula colorata</i> ssp. <i>acuminata</i>	Dense Stonecrop
	<i>Crassula decumbens</i>	Rufous Stonecrop
	<i>Daucus glochidiatus</i>	Small Pennywort
	<i>Erymophyllum ramosum</i>	
	<i>Hyalosperma glutinosum</i> ssp. <i>glutinosum</i>	
	<i>Lepidium rotundum</i>	Veined Peppergrass
	<i>Parietaria debilis</i>	Pellitory
	<i>Podolepis lessonii</i>	
	<i>Pogonolepis stricta</i>	
	<i>Rhodanthe laevis</i>	Smooth Sunray
	<i>Stellaria filiformis</i>	Thread Spurry
	<i>Trachymene cyanopetala</i>	
Herbs – annual WEED	* <i>Arctotheca calendula</i>	Capeweed
	* <i>Brassica tournefortii</i>	Wild Turnip
	* <i>Mesembryanthemum crystallinum</i>	Iceplant
	* <i>Spergula arvensis</i>	Corn Spurry
	* <i>Trifolium hirtum</i>	Rose Clover

Plants adjacent to WYHO04

Mallee – low [<10m]	<i>Eucalyptus erythronema</i> var. <i>erythronema</i>	Red-Flowered Mallee
Herbs – annual	<i>Angianthus tomentosus</i>	Camel Grass

WYHO 05

Open Mallee – Mallee [OM-M]

Location: Lat: 31°06.788"S Long: 117°18.812"E

Aspect: gentle south-east facing slope

Soil: red-brown (wet) loam grading to a red-brown clay at depth

Drainage: well drained

Bare Ground: 10% cover 50

Litter: <5% cover, to depth of 2cm

No. Plant Species: 49 (43 native + 6 *weed)

Condition Rating: excellent

Eucalyptus loxophleba ssp. *lissophloia* (York Gum), *Eucalyptus myriadena* ssp. *myriadena* **Open Shrub Mallee** over *Melaleuca adnata* and *Melaleuca radula* (Graceful Honeymyrtle), **Tall Open Scrub** over *Amphipogon strictus* **Open Grassland** and **Mixed Herbland with occasional Sedges. Occasional Creepers** of *Thysanotus patersonii* (Twining Fringe Lily) also occur through the lower layers.

Mallee [<8m]	<i>Eucalyptus loxophleba</i> ssp. <i>lissophloia</i>	York Gum
	<i>Eucalyptus myriadena</i> ssp. <i>myriadena</i>	
Shrubs – tall [>2m]	<i>Acacia acuminata</i>	Jam
	<i>Melaleuca acuminata</i> ssp. <i>websteri</i> ms	
	<i>Melaleuca adnata</i>	
	<i>Melaleuca lateriflora</i> ssp. <i>lateriflora</i> ms	Gorada
	<i>Melaleuca radula</i>	Graceful Honeymyrtle
Shrubs – med [1-2m]	<i>Dodonaea larraeoides</i>	
Grasses – perennial tall	<i>Austrostipa elegantissima</i>	
Grasses – perennial low	<i>Amphipogon strictus</i>	
Grasses – annual WEED	* <i>Bromus madritensis</i>	Madrid Brome
	* <i>Ehrharta longiflora</i>	Annual Veldt Grass
	* <i>Pentaschistis airoides</i>	False Hairgrass
	* <i>Vulpia barbata</i>	Rat's Tail Fescue
Herbs – perennial climber	<i>Drosera macrantha</i> ssp. <i>macrantha</i>	Bridal Rainbow
	<i>Thysanotus patersonii</i>	Twining Fringe Lily
Herbs – perennial	<i>Caladenia</i> ? <i>vulgata</i> X <i>footeana</i>	
	<i>Caladenia dimidia</i>	Chameleon Orchid
	<i>Caladenia exilis</i> ms	
Herbs – annual	<i>Actinobole uliginosum</i>	Flannel Cudweed
	<i>Blennospora drummondii</i>	
	<i>Brachyscome perpusilla</i>	Tiny Daisy
	<i>Calandrinia granulifera</i>	
	<i>Centrolepis aristatus</i>	Pointed Centrolepis
	<i>Centrolepis cephaloformis</i>	
	<i>Crassula colorata</i> ssp. <i>acuminata</i>	Dense Stonecrop
	<i>Crassula decumbens</i>	Rufous Stonecrop
	<i>Daucus glochidiatus</i>	Small Pennywort
	<i>Gonocarpus nodulosus</i>	
	<i>Goodenia berardiana</i>	
	<i>Hyalosperma demissum</i>	Tiny Sunray
	<i>Hydrocotyle pilifera</i> var. <i>glabrata</i>	
	<i>Lawrencella rosea</i>	Pink Everlasting
	<i>Levenhookia dubia</i>	Trumpet Stylewort
	<i>Lobelia</i> sp.	
	<i>Millotia tenuifolia</i>	Soft Millotia
	<i>Phyllangium paradoxum</i>	Wiry Mitrewort
	<i>Podolepis tepperi</i>	
	<i>Poranthera microphylla</i>	Small Poranthera
	<i>Rhodanthe laevis</i>	Smooth Sunray
	<i>Stylidium ecorne</i>	Foot Trigger Plant
	<i>Trachymene ornata</i>	Spongefruit
	<i>Triglochin calcitrapum</i>	Spurred Arrowgrass

	<i>Velleia cynopotamica</i>	-
	<i>Wahlenbergia preissii</i>	
	<i>Waitzia acuminata</i> ssp. <i>acuminata</i>	Orange Immortelle
Herbs – annual WEED	* <i>Arctotheca calendula</i>	Capeweed
	* <i>Hypochaeris glabra</i>	Flatweed
Sedges – low	<i>Schoenus nanus</i>	Tiny Bog Rush

Plants adjacent to WYHO05

Fern	<i>Cheilanthes austrotenuifolia</i>	Common Rock Fern
Grasses – perennial	<i>Austrostipa trichophylla</i>	
Herbs – annual	<i>Erymophyllum ramosum</i>	
	<i>Plantago</i> Sp. Nov. aff. <i>hispida</i>	
	<i>Rhodanthe pygmaea</i>	Pink Sunray

WYHO 06

Open Woodland [OW²]

Location: Lat: 31°06.785"S Long: 117°18.904"E

Aspect: gentle west facing slope

Soil: brown sandy loam over brown loamy-clay

Drainage: poor drained [note: standing water at time of survey, 4/9/99, anticipate wet during winter and spring]

Bare Ground: 30% cover

Litter: 40% cover, to 5cm

No. Plant Species: 38 (35 native + 3 *weed)

Condition Rating: excellent [note: less weed disturbance outside of plot]

Other comments: tadpoles and leeches in the water

Eucalyptus loxophleba ssp. *lissophloia* (York Gum) and *Eucalyptus subangusta* ssp. *subangusta* **Very Open Mallee** with occasional emergent *Eucalyptus salubris* (Gimlet) over *Melaleuca acuminata* ssp. *websteri* **Tall Open Scrub** over *Austrostipa elegantissima* (Feather Speargrass) and *Austrostipa trichophylla* **Very Open Grassland** and *Isolepis congrua*, *Schoenus elegans* and *Schoenus sculptus* (Gimlet Bog Rush) **Very Open Sedgeland** with **Occasional Herbs**.

NOTE: Quadrat WYHO06 is not the best representation of this flow-line unit – as the size of the quadrat is too large for the width of the flow-line and thus a true representation of the flow-line proper is not captured. This is reflected in the density of cover of *Melaleuca acuminata* ssp. *websteri* which is consistently greater outside of plot. A transect, or smaller quadrats could be used to gain a better picture.

Tree – low [<10m]	<i>Eucalyptus salubris</i>	Gimlet
Mallee	<i>Eucalyptus erythronema</i> ssp. <i>marginata</i>	Red-Flowered Mallee
	<i>Eucalyptus loxophleba</i> ssp. <i>lissophloia</i>	York Gum
	<i>Eucalyptus subangusta</i> ssp. <i>subangusta</i>	
Shrubs – tall [>2m]	<i>Melaleuca acuminata</i> ssp. <i>websteri</i> ms	
	<i>Melaleuca lateriflora</i> ssp. <i>lateriflora</i> ms	Gorada
Shrubs – med [1-2m]	<i>Acacia acutaria</i>	
	<i>Olearia muelleri</i>	Goldfields Daisy
Shrubs – low [<1m]	<i>Acacia merrallii</i>	Merrall's Wattle
Grasses – perennial tall	<i>Austrostipa elegantissima</i>	Feather Speargrass
Grasses – perennial	<i>Austrostipa trichophylla</i>	
Grasses – annual WEED	* <i>Bromus madritensis</i>	Madrid Brome
Herbs – perennial	<i>Arthropodium</i> sp.	
climber	<i>Drosera macrantha</i> ssp. <i>macrantha</i>	Bridal Rainbow
	<i>Caladenia exilis</i> ms	
	<i>Erodium cygnorum</i>	Blue Storksbill
climber	<i>Thysanotus patersonii</i>	Twining Fringe Lily
Herbs – annual	<i>Actinobole uliginosum</i>	Flannel Cudweed
	<i>Asteraceae</i> sp. A	
	<i>Blennospora drummondii</i>	

	<i>Bulbine semibarbata</i>	Leek Lily
	<i>Crassula closiana</i>	
	<i>Crassula colorata</i> ssp. <i>acuminata</i>	Dense Stonecrop
	<i>Daucus glochidiatus</i>	Small Pennywort
	<i>Goodenia berardiana</i>	
	<i>Hyalosperma glutinosum</i> ssp. <i>glutinosum</i>	
	<i>Hydrocotyle medicaginoides</i>	Small Pennywort
	<i>Lawrencella rosea</i>	Pink Everlasting
	<i>Phyllangium sulcatum</i>	
	<i>Podolepis tepperi</i>	
	<i>Rhodanthe laevis</i>	Smooth Sunray
	<i>Trachymene cyanopetala</i>	
	<i>Triglochin calcitrapum</i>	Spurred Arrowgrass
	<i>Wahlenbergia</i> sp.	
	<i>Waitzia acuminata</i> ssp. <i>acuminata</i>	Orange Immortelle
Herbs – annual WEED	* <i>Arctotheca calendula</i>	Capeweed
	* <i>Hypochaeris glabra</i>	Flatweed
Sedges – annual low	<i>Isolepis congrua</i>	
	<i>Schoenus elegans</i>	
	<i>Schoenus sculptus</i>	Gimlet Bog Rush
Plants adjacent to WYHO06		
Shrubs – med [1-2m]	<i>Eremophila decipiens</i> ssp. <i>decipiens</i>	Slender Fuschia
	<i>Eremophila drummondii</i>	
Grasses – annual	<i>Austroanthonia</i>	
Grasses – annual WEED	* <i>Ehrharta longiflora</i>	Annual Veldt Grass
Herbs – perennial	<i>Caladenia mesocera</i> ms	
	<i>Eriochilus dilatatus</i> ssp. <i>undulatus</i>	
	<i>Pterostylis setulosa</i> ms	
Herbs – annual	<i>Calandrinia calyptrata</i>	Pink Purslane
	<i>Plantago</i> Sp. Nov. aff. <i>hispida</i>	
	<i>Podolepis canescens</i>	Bright Podolepis

WYHO 07**Tall Shrubland – Tall Open Scrub [TS-TOSc]**

Location: Lat: 31°06.810"S Long: 117°18.875"E

Aspect: gentle north facing slope

Soil: brown sandy loam over brown loamy-clay at depth

Drainage: poor [note: anticipate site with saturated soil during winter]

Bare Ground: <2% cover

Litter: <2% cover [note: water run-off has washed away the litter movement]

No. Plant Species: 44 (39 native + 5 *weed)

Condition Rating: excellent

Other comments: large ant hills in south-east corner of plot

Melaleuca acuminata, *M. lateriflora* and *M. uncinata* **Tall Open Shrubland** over *Baeckea crispiflora*
Open Shrubland over *Spartochloa scirpoidea* **Very Open Tall Grassland** over *Amphipogon strictus*
Open Low Grassland and **Mixed Very Open Herbland**.

Tree	<i>Eucalyptus capillosa</i> ssp. <i>capillosa</i>	Wheatbelt Wandoo
Shrubs – tall [>2m]	<i>Acacia acuminata</i>	Jam
	<i>Allocasuarina campestris</i> ssp. <i>campestris</i>	Tamma
	<i>Melaleuca acuminata</i> ssp. <i>websteri</i> ms	
	<i>Melaleuca lateriflora</i> ssp. <i>lateriflora</i>	
	<i>Melaleuca radula</i>	
	<i>Melaleuca uncinata</i>	Broom Bush
Shrubs – med [1-2m]	<i>Baeckea crispiflora</i>	
Shrubs – low [<1m]	<i>Maireana georgei</i>	

	<i>Trymalium daphnifolium</i>	
Grasses – perennial tall	<i>Austrostipa elegantissima</i>	
	<i>Spartochloa scirpoidea</i>	
Grasses – perennial	<i>Amphipogon strictus</i>	
Grasses – annual WEED	<i>*Pentaschistis airoides</i>	False Hairgrass
	<i>*Vulpia myuros</i>	Rat's Tail Fescue
Herbs – perennial	<i>Borya sphaerocephala</i>	Pincushions
	<i>Diuris</i> aff. <i>corymbosa</i>	Rosy Cheeked Donkey Orchid
climber	<i>Drosera macrantha</i> ssp. <i>macrantha</i>	Bridal Rainbow
climber	<i>Thysanotus patersonii</i>	Twining Fringe Lily
Herbs – annual	<i>Blennospora drummondii</i>	
	<i>Centrolepis aristatus</i>	Pointed Centrolepis
	<i>Centrolepis drummondii</i>	
	<i>Crassula decumbens</i>	Rufous Stonecrop
	<i>Daucus glochidiatus</i>	Small Pennywort
	<i>Drosera glanduligera</i>	Pimpernel Sundew
	<i>Gonocarpus nodulosus</i>	
	<i>Goodenia berardiana</i>	
	<i>Goodenia</i> sp.	
	<i>Hyalosperma glutinosum</i> ssp. <i>glutinosum</i>	
	<i>Hydrocotyle medicaginoides</i>	Small Pennywort
	<i>Lawrencella rosea</i>	Pink Everlasting
	<i>Levenhookia dubia</i>	Trumpet Stylewort
	<i>Parietaria debilis</i>	Pellitory
	<i>Podolepis canescens</i>	Bright Podolepis
	<i>Podolepis lessonii</i>	
	<i>Pogonolepis stricta</i>	
	<i>Rhodanthe laevis</i>	Smooth Sunray
	<i>Stylidium ecorne</i>	Foot Trigger Plant
	<i>Trachymene ornata</i>	Spongefruit
	<i>Waitzia acuminata</i> ssp. <i>acuminata</i>	Orange Immortelle
Herbs – annual WEED	<i>*Arctotheca calendula</i>	Capeweed
	<i>*Erodium botrys</i>	Long Storksbill
	<i>*Hypochaeris glabra</i>	Flatweed
Sedges	<i>Schoenus sculptus</i>	
Plants adjacent to WYHO07		
Shrubs – med [1-2m]	<i>Acacia coolgardiensis</i> ssp. <i>coolgardiensis</i>	Spinifex Wattle
	<i>Hakea invaginata</i>	
Shrubs – low [<1m]	<i>Hibbertia glomerosa</i>	Guinea Flower
Sedges - perennial	<i>Lepidosperma</i> Sp. A2 Island Flat Keighery 7000	

WYHO08**Shrubland [Sh]**

Location: Lat: 31°07.014"S Long: 117°18.664"E

Aspect: very gentle south facing slope

Soil: brown loamy sand over brown loamy sand to depth

Drainage: well

Bare Ground: ~50% cover

Litter: 5% cover, to depth of <1cm

No. Plant Species: 39 (35 native + 4 *weed)

Condition Rating: excellent

Acacia stereophylla ssp. *stereophylla* and *Allocasuarina acutivalvis* (Black Tamma) **Tall Shrubland** over **Mixed Open Shrubland** over **Occasional Grasses, Herbs and Sedges**. **Occasional Creepers** of *Thysanotus patersonii* (Twining Fringe Lily) also occur through the lower layers.

Shrub – med [>2m]	<i>Acacia stereophylla</i> var. <i>stereophylla</i>	
	<i>Acacia yorkrakinensis</i> ssp. <i>acrita</i>	Yorkrakine Wattle
	<i>Allocasuarina acutivalvis</i>	Black Tamma
Shrubs – med [1-2m]	<i>Astartea heteranthera</i>	
	<i>Chamelaucium pauciflorum</i>	
	ssp. <i>thryptomenioides</i> ms	
	<i>Grevillea paradoxa</i>	Bottlebrush Grevillea
	<i>Hibbertia eatoniae</i>	
	<i>Melaleuca conothamnoides</i>	
	<i>Micromyrtus obovata</i>	
	<i>Persoonia quinquenervis</i>	
	<i>Phebalium tuberculatum</i>	
Shrubs – low [<1m]	<i>Psammomoya choretroides</i>	
	<i>Astroloma serratifolium</i> ssp. <i>horridulum</i>	Cankerberry, Kondrung
Climbers	<i>Comesperma volubile</i>	Love Creeper
Grasses – perennial - tall	<i>Austrostipa elegantissima</i>	
Grasses – perennial	<i>Neurachne alopecuroidea</i>	Foxtail Mulga Grass
Grasses – annual WEED	* <i>Ehrharta longiflora</i>	Annual Veldt Grass
	* <i>Lolium</i> sp.	Annual Rye Grass
Herbs – perennial climber	<i>Drosera macrantha</i> ssp. <i>macrantha</i>	Bridal Rainbow
	<i>Thysanotus patersonii</i>	Fringe Lily
Herbs – perennial	<i>Eriochilus dilatatus</i> ssp. <i>undulatus</i>	Crinkle-Leafed Bunny Orchid
	<i>Pterostylis setulosa</i> ms	
Herbs – annual	<i>Actinobole uliginosum</i>	Flannel Cudweed
	<i>Asteraceae</i> Sp. A	
	<i>Ceratogyne obionoides</i>	Wingwort
	<i>Crassula closiana</i>	
	<i>Crassula colorata</i> ssp. <i>acuminata</i>	Dense Stonecrop
	<i>Crassula decumbens</i>	Rufous Stonecrop
	<i>Daucus glochidiatus</i>	
	<i>Drosera glanduligera</i>	Pimpernel Sundew
	<i>Hyalosperma demissum</i>	Tiny Sunray
	<i>Lepidium rotundum</i>	Veined Peppergrass
	<i>Rhodanthe laevis</i>	
	<i>Trachymene</i> sp.	Spongefruit
	<i>Velleia cynopotamica</i>	
Herbs – annual WEED	* <i>Arctotheca calendula</i>	Capeweed
	* <i>Hypochaeris glabra</i>	Flatweed
Sedges – perennial	<i>Schoenus hexandrus</i>	
Sedges – annual	<i>Schoenus nanus</i>	Tiny Bog Rush
Plants adjacent to WYHO08		
Mallee	<i>Eucalyptus oldfieldii</i>	Oldfield's Mallee
Shrubs – low [<1m]	<i>Grevillea magnifica</i>	
Shrubs – med [1-2m]	<i>Grevillea didymobotrya</i>	
	ssp. <i>didymobotrya</i>	
Rushes – tall	<i>Ecdeiocolea monostachya</i>	

WYHO09**Open Mallee [OM]****Location:** Lat: 31°06.928"S Long: 117°18.802"E**Aspect:** gentle north, north-east facing slope**Soil:** red-brown (wet) sandy loam over red (dry) clay to depth**Drainage:** moderate [note: anticipate site wet during early winter]**Bare Ground:** 5-10% cover**Litter:** 30-40% cover, to depth of 2cm**No. Plant Species:** 58 (54 native + 4 *weed)**Condition Rating:** excellent [note: at time of survey Annual Veldt Grass (**Erharta calycina*) had cover of 20%]

Eucalyptus subangusta ssp. *subangusta* and *Eucalyptus yilgarnensis* (Yilgarn Mallee) **Open Shrub Mallee** over *Acacia hemiteles*, *Acacia mackeyana* and *Daviesia nematophylla* **Open Heath** over *Acacia merrallii* (Merrall's Wattle) and *Westringia cephalantha* **Open Low Heath** over **Ehrharta longifolia* **Very Open Grassland** and *Velleia cynopotamica* **Herbland**.

Tree Mallee [>8m]	<i>Eucalyptus loxophleba</i> ssp. <i>lissophloia</i>	York Gum
Shrub Mallee [<8m]	<i>Eucalyptus subangusta</i> var. <i>subangusta</i>	
	<i>Eucalyptus yilgarnensis</i>	Yorrel
Shrubs – tall [>2m]	<i>Acacia acuminata</i>	Jam
Shrubs – med [1-2m]	<i>Acacia hemiteles</i>	Tan Wattle
	<i>Acacia mackeyana</i>	
	<i>Daviesia nematophylla</i>	
	<i>Dodonaea laraeoides</i>	
	<i>Eremophila drummondii</i>	
Shrubs – low [<1m]	<i>Acacia erinacea</i>	Spiny Wattle
	<i>Acacia merrallii</i>	Merrall's Wattle
climber	<i>Comesperma</i> sp	
	<i>Enchylaena tomentosa</i>	Barrier Saltbush
	<i>Westringia cephalantha</i>	
Grasses – perennial tall	<i>Austrostipa elegantissima</i>	
Grasses – perennial	<i>Austroanthonia occidentalis</i>	
Grass – annual WEED	* <i>Bromus diandrus</i>	Great Brome
	* <i>Ehrharta longiflora</i>	Annual Veldt Grass
	* <i>Pentaschistis airoides</i>	False Hairgrass
Herbs – perennial	<i>Caladenia exilis</i> ms	
	<i>Caladenia footeana</i> ms	Common Spider Orchid
	<i>Cyanicula gemmata</i> ms	
climber	<i>Drosera macrantha</i> ssp. <i>macrantha</i>	Bridal Rainbow
	<i>Erodium cygnorum</i>	Blue Storksbill
	<i>Pterostylis setulosa</i> ms	
	<i>Thysanotus speckii</i>	Fringe Lily
climber	<i>Thysanotus patersonii</i>	Twining Fringe Lily
Herbs – annual	<i>Actinobole uliginosum</i>	Flannel Cudweed
	<i>Brachyscome perpusilla</i>	Tiny Daisy
	<i>Bulbine semibarbata</i>	Leek Lily
	<i>Calotis hispidula</i>	Bindy Eye
	<i>Centrolepis humillima</i>	Dwarf Centrolepis
	<i>Chthonocephalus pseudevax</i>	Woolly Groundheads
	<i>Crassula closiana</i>	
	<i>Crassula colorata</i> ssp. <i>acuminata</i>	Dense Stonecrop
	<i>Drosera glanduligera</i>	Pimpernel Sundew
	<i>Erodium cygnorum</i>	
	<i>Goodenia berardiana</i>	
	<i>Hyalosperma glutinosum</i> ssp. <i>glutinosum</i>	
	<i>Hydrocotyle medicaginoides</i>	Small Pennywort
	<i>Hydrocotyle rugulosa</i>	
	<i>Isoetopsis graminifolia</i>	Cushion Grass
	<i>Levenhookia dubia</i>	Trumpet Stylewort

	<i>Lobelia</i> sp.	
	<i>Phyllangium paradoxum</i>	Wiry Mitrewort
	<i>Plantago</i> Sp. Nov. aff. <i>hispida</i>	
	<i>Podolepis lessonii</i>	
	<i>Podolepis tepperi</i>	
	<i>Rhodanthe laevis</i>	Smooth Sunray
	<i>Rhodanthe pygmaea</i>	Pink Sunray
	<i>Stellaria filiformis</i>	Thread Spurry
	<i>Trachymene cyanopetala</i>	
	<i>Trachymene ornata</i>	Spongefruit
	<i>Triglochin calcitrapum</i>	Spurred Arrowgrass
	<i>Velleia cynopotamica</i>	
	<i>Waitzia acuminata</i> ssp. <i>acuminata</i>	Orange Immortelle
Herbs – annual WEED	* <i>Hypochaeris glabra</i>	Flatweed
Sedges – annual low	<i>Schoenus nanus</i>	Tiny Bog Rush

Plants adjacent to WYHO09

Shrub- 2	<i>Acacia coolgardiensis</i> ssp. <i>coolgardiensis</i>	Spinifex Wattle
	<i>Acacia acuaria</i>	
	<i>Acacia saxatilis</i>	
	<i>Baeckea cryptonoma</i> ms	
	<i>Exocarpos aphyllus</i>	Leafless Ballart
	<i>Olearia muelleri</i>	Goldfields Daisy
Shrubs – low [<1m]	<i>Grevillea acuaria</i>	
	<i>Grevillea paradoxa</i>	Bottlebrush Grevillea
	<i>Hibbertia glomerosa</i>	Guinea Flower
	<i>Trymalium daphnifolium</i>	
Herbs – perennial	<i>Borya constricta</i>	Pincushions
	<i>Caladenia roei</i>	Ant Orchid
	<i>Caladenia vulgata</i> X <i>hirta</i>	
	<i>Stypandra glauca</i>	Blindgrass
Herbs – annual	<i>Angianthus tomentosus</i>	Camel Grass
	<i>Calandrinia granulifera</i>	Pygmy Purslane
	<i>Lawrencella rosea</i>	Pink Everlasting
	<i>Podolepis canescens</i>	Bright Podolepis
Herbs – annual WEED	* <i>Zaluzianskya divaricata</i>	Zedweed

WYHO 10

Shrubland [Sh]

Location: Lat: 31°06.935"S Long: 117°18.645"E
Aspect: very gentle westerly facing slope
Soil: brown loamy sand with exposed granite over granite at 20cm depth
Drainage: moderate [note: not a wetland, but water collects over rock]
Bare Ground: 35% cover
Litter: 5% cover, to depth of <1cm
No. Plant Species: 42 (41 native + 1 *weed)
Condition Rating: pristine to excellent

Baeckea crispiflora and *Calothamnus gilesii* **Shrubland** over *Hibbertia eatoniae* **Low Open Shrubland** over *Amphipogon strictus* (Greybeard Grass) and *Neurachne alopecuroidea* (Foxtail Mulga Grass) **Very Open Grassland** and *Borya sphaerocephala* (Pincushions) **Herbland**. **Occasional Creepers** of *Thysanotus patersonii* (Twining Fringe Lily) also occur through the lower layers.

Adjacent patches of Mallee 10-30%

Shrubs – tall [>2m]	<i>Melaleuca uncinata</i>	Broom Bush
Shrubs – med [1-2m]	<i>Baeckea crispiflora</i>	
	<i>Calothamnus gilesii</i>	

	<i>Dodonaea divaricata</i>	Hop Bush
	<i>Hakea scoparia</i>	
	<i>Micromyrtus racemosus</i> var. <i>racemosus</i>	
Shrubs – low [<1m]	<i>Astroloma serratifolium</i> ssp. <i>horridulum</i>	Cankerberry, Kondrung
climber	<i>Comesperma volubile</i>	Love Creeper
	<i>Gastrolobium bennettsianum</i>	Cluster Poison
	<i>Hibbertia eatoniae</i>	
	<i>Hypocalymma angustifolium</i>	White Myrtle
Grasses – perennial tall	<i>Austrostipa elegantissima</i>	
	<i>Spartochloa scirpoidea</i>	
Grasses – perennial low	<i>Amphipogon strictus</i>	
	<i>Neurachne alopecuroides</i>	Foxtail Mulga Grass
Herbs – perennial	<i>Arthropodium curvipes</i>	
	<i>Borya sphaerocephala</i>	Pincushions
	<i>Caladenia pulchra</i> ms	
	<i>Drosera subhirtella</i>	Sunny Rainbow
	<i>Diuris</i> aff. <i>corymbosa</i>	Rosy Cheeked Donkey Orchid
	<i>Eriochilus dilatatus</i> ssp. <i>undulatus</i>	Crinkle-Leafed Bunny Orchid
	<i>Pterostylis sanguinea</i>	Dark Banded Greenhood
	<i>Stylidium petiolare</i>	Horn Triggerplant
climber	<i>Thysanotus patersonii</i>	Twining Fringe Lily
Herbs – annual	<i>Actinobole uliginosum</i>	Flannel Cudweed
	<i>Blennospora drummondii</i>	
	<i>Centrolepis aristatus</i>	Pointed Centrolepis
	<i>Centrolepis humillima</i>	Dwarf Centrolepis
	<i>Crassula closiana</i>	
	<i>Crassula colorata</i> ssp. <i>acuminata</i>	Dense Stonecrop
	<i>Hyalosperma demissum</i>	Tiny Sunray
	<i>Hydrocotyle rugulosa</i>	-
	<i>Isotoma hypocrateriformis</i>	Woodbridge Poison
	<i>Lobelia</i> sp.	
	<i>Podolepis lessonii</i>	
	<i>Poranthera microphylla</i>	Small Poranthera
	<i>Rhodanthe laevis</i>	Smooth Sunray
	<i>Velleia cynopotamica</i>	-
	<i>Waitzia acuminata</i> ssp. <i>acuminata</i>	Orange Immortelle
Herbs – annual WEED	<i>*Hypochaeris glabra</i>	Flatweed
Rushes – perennial tall	<i>Ecdeiocolea monostachya</i>	
Sedge – annual low	<i>Schoenus nanus</i>	Tiny Bog Rush
Plants adjacent to WYHO10		
Shrubs – tall [>2m]	<i>Melaleuca radula</i>	Graceful Honeymyrtle
	<i>Santalum acuminatum</i>	Quandong
Shrubs – med [1-2m]	<i>Acacia acuarria</i>	-
	<i>Acacia stereophylla</i> var. <i>stereophylla</i>	-
	<i>Grevillea paradoxa</i>	Bottlebrush Grevillea
	<i>Westringia cephalantha</i>	-
Shrubs – low [<1m]	<i>Calytrix breviseta</i> ssp. <i>stipulosa</i>	

WYHO 11

Open Mallee - Mallee [OM-M]

Location: Lat: 31°06.852"S Long: 117°18.927"E
Aspect: gentle north-west facing slope
Soil: light brown loam over re-brown loam to depth
Drainage: moderate [note: anticipate site would be wet in winter]
Bare Ground: 10-20% cover
Litter: 20-30% cover, to depth of 1-2cm
No. Plant Species: 53 (49 native + 4 *weed)
Condition Rating: excellent

Eucalyptus erythronema var. *erythronema* (Red-Flowered Mallee) **Very Open Shrub Mallee** with occasional emergent mallees of *Eucalyptus loxophleba* ssp. *lissophloia* (York Gum) and *Eucalyptus subangusta* ssp. *subangusta* over *Acacia acuminata* (Jam) and *Melaleuca radula* (Graceful Honeymyrtle) **Tall Shrubland** over *Acacia acuaria*, *Acacia hemiteles* (Tan Wattle) and *Melaleuca lateriflora* ssp. *lateriflora* (Gorada) **Shrubland** over *Eremophila drummondii* **Low Open Shrub** over *Amphipogon strictus* (Greybeard Grass), *Austrostipa trichophylla* and *Spartochloa scirpoidea* **Open Grassland** and **Mixed Open Herbland** and **Occasional Sedges. Occasional Creepers** of *Thysanotus patersonii* (Twining Fringe Lily) also occur through the lower layers.

Shrub Mallee [<8m]	<i>Eucalyptus erythronema</i> var. <i>erythronema</i>	Red-Flowered Mallee
	<i>Eucalyptus loxophleba</i> ssp. <i>lissophloia</i>	York Gum
	<i>Eucalyptus subangusta</i> var. <i>subangusta</i>	
Shrubs – tall [>2m]	<i>Acacia acuminata</i>	Jam
	<i>Melaleuca lateriflora</i> ssp. <i>lateriflora</i> ms	Gorada
	<i>Melaleuca radula</i>	Graceful Honeymyrtle
Shrubs – med [1-2m]	<i>Acacia acuaria</i>	
	<i>Acacia hemiteles</i>	Tan Wattle
	<i>Melaleuca lateriflora</i> ssp. <i>lateriflora</i> ms	Gorada
	<i>Dodonaea larraeoides</i>	
Shrubs – low [<1m]	<i>Eremophila drummondii</i>	
	<i>Olearia muelleri</i>	Goldfields Daisy
Grasses – annual WEED	* <i>Bromus madritensis</i>	Madrid Brome
	* <i>Ehrharta longiflora</i>	Annual Veldt Grass
Grasses – perennial tall	<i>Austrostipa elegantissima</i>	
	<i>Spartochloa scirpoidea</i>	
Grasses – perennial low	<i>Amphipogon strictus</i>	
	<i>Austrostipa trichophylla</i>	
Herbs – perennial	<i>Caladenia roei</i>	Ant Orchid
	<i>Caladenia vulgata</i>	Common Spider Orchid
	<i>Cyanicula gemmata</i> ms	
climber	<i>Drosera macrantha</i> ssp. <i>macrantha</i>	
	<i>Pterostylis setulosa</i> ms	
	<i>Ptilotus spathulatus</i>	
climber	<i>Thysanotus patersonii</i>	Twining Fringe Lily
	<i>Thysanotus speckii</i>	Fringe Lily
Herbs – annual	<i>Actinobole uliginosum</i>	Flannel Cudweed
	<i>Blennospora drummondii</i>	
	<i>Brachyscome perpusilla</i>	Tiny Daisy
	<i>Bulbine semibarbata</i>	Leek Lily
	<i>Calotis hispidula</i>	Bindy Eye
	<i>Crassula closiana</i>	
	<i>Daucus glochidiatus</i>	Small Pennywort
	<i>Drosera glanduligera</i>	Pimpernel Sundew
	<i>Erymophyllum ramosum</i>	
	<i>Goodenia berardiana</i>	
	<i>Hyalosperma demissum</i>	Tiny Sunray
	<i>Hydrocotyle rugulosa</i>	-

	<i>Hydrocotyle</i> sp.	
	<i>Lobelia</i> sp.	
	<i>Phyllangium paradoxum</i>	Wiry Mitrewort
	<i>Podolepis lessonii</i>	
	<i>Podolepis tepperi</i>	
	<i>Poranthera microphylla</i>	Small Poranthera
	<i>Rhodanthe laevis</i>	Smooth Sunray
	<i>Trachymene cyanopetala</i>	
	<i>Trachymene ornata</i>	Spongefruit
	<i>Velleia cynopotamica</i>	
	<i>Waitzia acuminata</i> ssp. <i>acuminata</i>	Orange Immortelle
Herbs – annual WEED	* <i>Arctotheca calendula</i>	Capeweed
	* <i>Hypochaeris glabra</i>	Flatweed
Sedges – annual	<i>Schoenus elegans</i>	-
	<i>Schoenus nanus</i>	Tiny Bog Rush

Plants adjacent to WYHO11

Shrubs – tall [>2m]	<i>Melaleuca acuminata</i> ssp. <i>websteri</i> ms	
	<i>Melaleuca adnata</i>	
Herbs – annual	<i>Gunnipopsis septifraga</i>	
	<i>Phlegmatospermum drummondii</i>	Drummond's Phlegmatospermum

WYHO 12**Open Mallee [OM]**

Location: Lat: 31°06.882"S Long: 117°19.056"E
Aspect: flat area, with possible very, very gentle north facing slope
Soil: light brown sandy loam over dark brown loam to depth
Drainage: moderate [note: anticipate wet during winter]
Bare Ground: 20% cover
Litter: 70% cover, to depth of 1-2cm
No. Plant Species: 27 (22 native + 5 *weed)
Condition Rating: very good

Eucalyptus yilgarnensis (Yorrel) **Open Mallee** with occasional emergent trees of *Eucalyptus salmonophloia* (Salmon Gum) over *Exocarpos aphyllus* (Leafless Ballart) **Tall Open Shrubland** over *Olearia muelleri* (Goldfields Daisy) **Low Open Shrubland** over Occasional Grasses and Herbs

Tree – tall [>30m]	<i>Eucalyptus salmonophloia</i>	Salmon Gum
Shrub Mallee [<8m]	<i>Eucalyptus yilgarnensis</i>	Yorrel
Shrubs – tall [>2m]	<i>Exocarpos aphyllus</i>	Leafless Ballart
Shrub – med [1-2m]	<i>Eremophila</i> sp.	
Shrubs – low [<1m]	<i>Olearia muelleri</i>	Goldfields Daisy
	<i>Acacia erinacea</i>	Spiny Wattle
	<i>Enchylaena tomentosa</i>	Barrier Saltbush
	<i>Maireana carnosa</i>	Cottony Bluebush
	<i>Maireana marginata</i>	Bluebush
	<i>Rhagodia preissii</i> ssp. <i>preissii</i>	
Grasses – perennial tall	<i>Austrostipa elegantissima</i>	
Grasses – annual WEED	* <i>Bromus madritensis</i>	Madrid Brome
	* <i>Lolium rigidum</i>	Wimmera Ryegrass
	* <i>Pentstemon airoides</i>	False Hairgrass
Herbs – perennial	<i>Ptilotus spathulatus</i>	
Herbs – annual	<i>Angianthus tomentosus</i>	
	<i>Calandrinia calyptrata</i>	
	<i>Calotis hispidula</i>	Bindy Eye
	<i>Crassula colorata</i> ssp. <i>acuminata</i>	Dense Stonecrop
	<i>Daucus glochidiatus</i>	Small Pennywort
	<i>Menkea australis</i>	Fairy Spectacles

	<i>Podolepis tepperi</i>	
	<i>Rhodanthe laevis</i>	Smooth Sunray
	<i>Trachymene cyanopetala</i>	-
	<i>Triglochin calcitrapum</i>	Spurred Arrowgrass
Herbs – annual WEED	* <i>Arctotheca calendula</i>	Capeweed
	* <i>Spergula ? diandra</i>	Lesser Sand Spurry

Adjacent WYHO12

Herb – annual	<i>Senecio glossanthus</i>	Slender Groundsel
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WYHO OPPORTUNISTIC COLLECTIONS – not recorded in/adjacent to survey quadrats

Mallee	<i>Eucalyptus tenera</i>	
Shrubs – tall [>2m]	<i>Grevillea petrophiloides</i>	Poker Grevillea
Shrubs – med [1-2m]	<i>Acacia fragilis</i>	
	<i>Dodonaea viscosa</i> ssp. <i>angustissima</i>	Sticky Hop Bush
	<i>Eremophila ionantha</i>	Violet Flowered Eremophila
	<i>Leucopogon obtusatus</i>	
	<i>Melaleuca coroncarpa</i>	
	<i>Microcybe multiflora</i> var. <i>multiflora</i>	
	<i>Stenanthemum pomaderroides</i>	
Shrubs – low [<1m]	<i>Maireana georgei</i>	
	▲ <i>Melaleuca sclerophylla</i>	
Herbs – perennial	<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	Blue Squill
	<i>Prasophyllum ? macrostachyum</i>	Laughing Leek Orchid
	<i>Stylidium emarginatum</i>	Biddy-Four-Legs
Herbs – annual WEEDS	* <i>Anagallis arvensis</i> var. <i>caerulea</i>	Pimpernel
aquatic	* <i>Crassula natans</i> var. <i>minus</i>	
	* <i>Osteospermum clandestinum</i>	Stinking Roger
Sedges - perennial	<i>Lepidosperma brunonianum</i>	

APPENDIX E1: FLORA RECORDED FOR "MINDAH" BUSHLAND, WYALKATCHEM

- SHOWING OCCURRENCE IN WYHO QUADRATS

Plant Family Order (Recordings and collections made 8/9/98, 9/9/98, 31/10/98, 25/10/00 and/or 27/11/01)

LEGEND (Refer also Appendix A for explanation of terminology)

- FAMILY, GENUS, SPECIES = PLANT TAXA
- NO. = Plant Family Reference Number, as used in classification by WA Herbarium
- LIFE FORM = 'A' for annual + 'P' for perennial
- GROWTH FORM = shape & ability of plant to lay down woody tissue
- WYHO QUADRATS = the 12 10mx10m quadrats surveyed (a = adjacent to the Quadrat, but same plant community)
- OPPO = opportunistic collection (ie not in or adjacent to WYHO Quadrats)
- * = introduced plant / weed
- ▲ = priority flora (Refer Section 5)
- ms = manuscript name (recently described species, awaiting acceptance)

- aff. = affinity
- sp. = species
- ssp. = subspecies
- var. = variety
- x = hybrid

FAMILY	No.	GENUS (botanical/scientific name)	SPECIES	COMMON NAME	LIFE	FORMS GROWTH	WYHO QUADRATS												oppo
Adiantaceae	7	<i>Chelanthus austrotenuifolia</i>		Common Rock Fern	P	fern													
Juncaginaceae	26	<i>Triglochin calcitrapum</i>		Spurred Arrowgrass	A	herb													
Poaceae	31	* <i>Aira caryophyllae/cupaniana</i>		Silvery Hairgrass	A	grass weed	1												12
Poaceae	31	<i>Amphipogon strictus</i>		Greybeard Grass	P	grass	1												
Poaceae	31	<i>Austrodanthonia occidentalis</i>			P	grass													
Poaceae	31	<i>Austrodanthonia setacea</i>		Small Flower Wallaby Grass	P	grass													
Poaceae	31	<i>Austrodanthonia</i> sp.				grass													
Poaceae	31	<i>Austrostipa elegantissima</i>		Feather Speargrass	P	grass	1												
Poaceae	31	<i>Austrostipa trichophylla</i>			P	grass													
Poaceae	31	* <i>Avena barbata</i>		Wild Oat	A	grass weed	1a												
Poaceae	31	* <i>Avena barbata</i> X <i>fatua</i>		Wild Oat hybrid	A	grass weed													
Poaceae	31	* <i>Bromus diandrus</i>		Great Brome	A	grass weed													
Poaceae	31	* <i>Bromus madritensis</i>		Madrid Brome	A	grass weed													
Poaceae	31	* <i>Bromus rubens</i>		Red Brome	A	grass weed	1												
Poaceae	31	* <i>Ehrharta longiflora</i>		Annual Veldt Grass	A	grass weed													
Poaceae	31	* <i>Hordeum leporinum</i>		Barley Grass	A	grass weed													
Poaceae	31	* <i>Lolium rigidum</i>		Wimmera Ryegrass	A	grass weed													
Poaceae	31	* <i>Lolium</i> sp.		Ryegrass	A	grass weed													
Poaceae	31	<i>Neurachne alopecuroides</i>		Foxtail Mulga Grass	P	grass	1												
Poaceae	31	* <i>Pentascistis airoides</i>		False Hairgrass	A	grass weed													
Poaceae	31	<i>Spartochloa scirpoides</i>			P	grass	1												

FAMILY	No.	GENUS (botanical/scientific name)	SPECIES	COMMON NAME	FORMS LIFE GROWTH	WYHO	Q	U	A	D	R	A	T	S	oppo
Poaceae	31	<i>*Vulpia myuros</i>		Rat's Tail Fescue	A grass weed	1	2		5		7				
Cyperaceae	32	<i>Isolepis congrua</i>			A sedge			6							
Cyperaceae	32	<i>Lepidosperma brunonianum</i>			P sedge										✓
Cyperaceae	32	<i>Lepidosperma</i> sp. A2			P sedge	1		7a							
		Island Flat (GJ Keighery 7000)													
Cyperaceae	32	<i>Schoenus ? sculptus</i>		Gimlet Bog Rush	A sedge			7							
Cyperaceae	32	<i>Schoenus elegans</i>			A sedge			6						11	
Cyperaceae	32	<i>Schoenus hexandrus</i>			P sedge					8					
Cyperaceae	32	<i>Schoenus nanus</i>		Tiny Bog Rush	A sedge	1			5		8	9	10	11	
Cyperaceae	32	<i>Schoenus sculptus</i>		Gimlet Bog Rush	A sedge			6							
Cyperaceae	32	<i>Schoenus</i> sp.		Gimlet Bog Rush	A sedge	1							10a		
Edeiocoleaceae	39A	<i>Edeiocolea monostachya</i>			P rush					8a			10		
Centrolepidaceae	40	<i>Centrolepis aristatus</i>		Pointed Centrolepis	A herb	1			5		7		10		
Centrolepidaceae	40	<i>Centrolepis cephaloformis</i>			A herb			3	5						
Centrolepidaceae	40	<i>Centrolepis humillima</i>		Dwarf Centrolepis	A herb							9	10		
Dasypogonaceae	54C	<i>Chamaeeros macranthera</i>			P herb										✓
Phormiaceae	54E	<i>Dianella revoluta</i>		Blueberry Lily	P herb			6a							
Phormiaceae	54E	<i>Stypandra glauca</i>		Blindgrass	P herb							9a			
Anthericaceae	54F	<i>Arthropodium curvipes</i>			P herb			3					10		
Anthericaceae	54F	<i>Arthropodium</i> sp.			P herb						6				✓
Anthericaceae	54F	<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>		Blue Squill	P herb										
Anthericaceae	54F	<i>Thysanotus patersonii</i>		Twining Fringe Lily	P climber	1		3a	5	6	7	8	9	10	11
Anthericaceae	54F	<i>Thysanotus pyramidalis</i>		Fringe Lily	P herb			4							
Anthericaceae	54F	<i>Thysanotus speckii</i>		Fringe Lily	P herb								9	11	
Asphodelaceae	54G	<i>Bulbine semibarbata</i>		Leek Lily	A herb			2	3		6		9	11	
Boryaceae	54L	<i>Borya constricta</i>		Pincushions	P herb	1							9a		
Boryaceae	54L	<i>Borya sphaerocephala</i>		Pincushions	P herb						7		10		
Orchidaceae	66	<i>Caladenia anomala</i>			P herb										✓
Orchidaceae	66	<i>Caladenia dimidia</i>		Chameleon Orchid	P herb				5						
Orchidaceae	66	<i>Caladenia exilis</i> ms			P herb			3	5	6		9			
Orchidaceae	66	<i>Caladenia footeana</i> ms			P herb								9		
Orchidaceae	66	<i>Caladenia mesocera</i> ms			P herb						6a				
Orchidaceae	66	<i>Caladenia pulchra</i> ms			P herb								10		
Orchidaceae	66	<i>Caladenia roei</i>		Ant Orchid	P herb							9a		11	
Orchidaceae	66	<i>Caladenia saccharata</i>		Sugar Orchid	P herb			1a							

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Orchidaceae	66	<i>Caladenia vulgata</i>		Spider Orchid	P	herb	1								
Orchidaceae	66	<i>Caladenia ? vulgata X footeana</i>		(Hybrid)	P	herb		5						11	
Orchidaceae	66	<i>Caladenia vulgata X hirta</i>		(Hybrid)	P	herb							9a		
Orchidaceae	66	<i>Caladenia</i> sp. Wyalkatchem WSWA WYHO 4/9/99			P	herb									✓
Orchidaceae	66	<i>Cyanicula deformis</i>			P	herb									✓
Orchidaceae	66	<i>Cyanicula gemmata</i> ms			P	herb							9	11	
Orchidaceae	66	<i>Diuris</i> aff. <i>corymbosa</i>		Rosy Cheeked Donkey Orchid	P	herb	1a	7						10	
Orchidaceae	66	<i>Eriochilus dilatatus</i> ssp. <i>undulatus</i>		Crinkle-Leaved Bunny Orchid	P	herb	1	6a	8					10	
Orchidaceae	66	<i>Prasophyllum ?</i> <i>macrostachyum</i>		Laughing Leek Orchid	P	herb									✓
Orchidaceae	66	<i>Pterostylis sanguinea</i>		Dark Banded Greenhood	P	herb								10	
Orchidaceae	66	<i>Pterostylis setulosa</i> ms			P	herb		2					6a	8 9	11
Orchidaceae	66	<i>Thelymitra antennifera</i>		Vanilla Orchid	P	herb	1								
Casuarinaceae	70	<i>Allocasuarina acutivalvis</i>		Black Tamma	P	shrub	1a						8		
Casuarinaceae	70	<i>Allocasuarina campestris</i> ssp. <i>campestris</i>		Tamma	P	shrub	1	7							
Urticaceae	88	<i>Parietaria debilis</i>		Pellitory	A	herb		3	4						
Proteaceae	90	<i>Grevillea acuraria</i>			P	shrub		2						9a	
Proteaceae	90	<i>Grevillea didymobotrya</i> ssp. <i>didymobotrya</i>			P	shrub							8a		
Proteaceae	90	<i>Grevillea magnifica</i>			P	shrub							8a		
Proteaceae	90	<i>Grevillea paniculata</i>			P	shrub									✓
Proteaceae	90	<i>Grevillea paradoxa</i>		Bottlebrush Grevillea	P	shrub	1a						8 9a	10a	
Proteaceae	90	<i>Grevillea petrophiloides</i>		Poker Grevillea	P	shrub									✓
Proteaceae	90	<i>Hakea invaginata</i>			P	shrub						7a			
Proteaceae	90	<i>Hakea scoparia</i>			P	shrub	1							10	
Proteaceae	90	<i>Persoonia angustiflora</i> ssp. <i>burracoppinensis</i>			P	shrub									✓
Proteaceae	90	<i>Persoonia quinquenervis</i>			P	shrub							8		
Santalaceae	92	<i>Exocarpos apophyllus</i>		Leafless Ballart	P	shrub		2a					9a	12	
Santalaceae	92	<i>Santalum acuminatum</i>		Quandong	P	shrub	1a		4					10a	
Chenopodiaceae	105	<i>Atriplex acutibractea</i> ssp. <i>karoniensis</i>			P	shrub			4						

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					LIFE	GROWTH												
Chenopodiaceae	105	<i>Atriplex vesicaria</i>		Bladder Saltbush	P	shrub		4										
Chenopodiaceae	105	<i>Enchylaena tomentosa</i>		Barrier Saltbush	P	shrub		2	3					9				
Chenopodiaceae	105	<i>Maireana carnosae</i>		Cottony Bluebush	P	shrub												12
Chenopodiaceae	105	<i>Maireana georgei</i>		Satiny Bluebush	P	shrub		2		4								12
Chenopodiaceae	105	<i>Maireana marginata</i>		Bluebush	P	herb		2	3									
Chenopodiaceae	105	<i>Maireana triptera</i>		3 Winged Bluebush	P	shrub												
Chenopodiaceae	105	<i>Maireana x Enchylaena hybrid</i>			P	shrub												
Chenopodiaceae	105	<i>Rhagodia preissii</i> ssp. <i>preissii</i>			P	shrub		2	3	4								12
Amaranthaceae	106	<i>Ptilotus gaudichaudii</i> var. <i>gaudichaudii</i>			A	herb			3									
Amaranthaceae	106	<i>Ptilotus holosericeus</i>		Mulla Mulla	P	herb		2										
Amaranthaceae	106	<i>Ptilotus spathulatus</i>			P	herb			3						11			12
Amaranthaceae	106	<i>Ptilotus</i> sp.			P	herb		1										
Aizoaceae	110	<i>*Mesembryanthemum crystallinum</i>		Iceplant	A/B	herb weed		1a		4								
Aizoaceae	110	<i>Gunnioopsis septifraga</i>			A	herb												11a
Aizoaceae	110	<i>*Micropterum papulosum</i>			A	herb weed			3									
Portulacaceae	111	<i>Calandrinia calyptrata</i>		Pink Purslane	A	herb			4		6a							12
Portulacaceae	111	<i>Calandrinia granulifera</i>		Pygmy Purslane	A	herb			3		5			9a				
Portulacaceae	111	<i>Calandrinia</i> sp.			A	herb				4								
Caryophyllaceae	113	<i>*Spergula ?diandra</i>		Lesser Sand Spurry	A	herb weed												12
Caryophyllaceae	113	<i>*Spergula arvensis</i>		Corn Spurry	A	herb weed			4									
Caryophyllaceae	113	<i>Stellaria filiformis</i>		Thread Spurry	A	herb		2		4				9				
Brassicaceae	138	<i>*Brassica tournefortii</i>		Wild Turnip	A	herb weed			4									
Brassicaceae	138	<i>Lepidium rotundum</i>		Veined Peppercress	A	herb			4				8					
Brassicaceae	138	<i>Menkea australis</i>		Fairy Spectacles	A	herb												12
Brassicaceae	138	<i>Phlegmatospermum drummondii</i>		Drummond's Phlegmatospermum	A	herb												11a
Droseraceae	143	<i>Drosera glanduligera</i>		Pimpernel Sundew	A	herb		1			7	8	9		11			
Droseraceae	143	<i>Drosera macrantha</i> ssp. <i>macrantha</i>		Bridal Rainbow	P/A	herb climber				5	6	7	8	9		11		
Droseraceae	143	<i>Drosera subhirtella</i>		Sunny Rainbow	P/A	herb		1							10			
Crassulaceae	149	<i>Crassula ? exserta</i>			A	herb				4								
Crassulaceae	149	<i>Crassula closiana</i>			A	herb					6		8	9	10			11
Crassulaceae	149	<i>Crassula colorata</i> ssp. <i>acuminata</i>		Dense Stonecrop	A	herb		1	2	3	4	5	6		8	9	10	12

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Crassulaceae	149	<i>Crassula decumbens</i>		Rufous Stonecrop	A	herb				4	5	7	8				
Crassulaceae	149	* <i>Crassula natans</i> var. <i>minus</i>			A	herb weed [aquatic]											✓
Mimosaceae	163	<i>Acacia acutaria</i>			P	shrub		3a			6			9a	10a	11	
Mimosaceae	163	<i>Acacia acuminata</i>		Jam	P	shrub	1				5	7		9		11	
Mimosaceae	163	<i>Acacia colletioides</i>		Wait-a-While Wattle	P	shrub		3									
Mimosaceae	163	<i>Acacia coolgardiensis</i> ssp. <i>coolgardiensis</i>		Spinifex Wattle	P	shrub						7a		9a			
Mimosaceae	163	<i>Acacia erinacea</i>		Spiny Wattle	P	shrub		2a	3a	4				9		12	
Mimosaceae	163	<i>Acacia fragilis</i>			P	shrub											✓
Mimosaceae	163	<i>Acacia hemiteles</i>		Tan Wattle	P	shrub	1a	3						9		11	
Mimosaceae	163	<i>Acacia heteroneura</i> var. <i>petila</i>			P	shrub	1a										
Mimosaceae	163	<i>Acacia mackeyana</i>			P	shrub	1a	3						9			
Mimosaceae	163	<i>Acacia merrallii</i>		Merrall's Wattle	P	shrub		3	4		6			9			
Mimosaceae	163	<i>Acacia saxatilis</i>			P	shrub	1a							9a			
Mimosaceae	163	<i>Acacia stereophylla</i> var. <i>stereophylla</i>			P	shrub						8			10a		
Mimosaceae	163	<i>Acacia yorkkrakensis</i> ssp. <i>acrita</i>		Yorkkrakine Wattle	P	shrub						8					
Caesalpinaceae	164	<i>Senna artemisioides</i>			P	shrub					6						
Papilionaceae	165	<i>Daviesia nematophylla</i>			P	shrub		2						9			
Papilionaceae	165	* <i>Trifolium hirtum</i>		Rose Clover	A	herb weed				4							
Papilionaceae	165	<i>Gastrolobium bennettianum</i>		Cluster Poison	P	shrub	1								10		
Geraniaceae	167	* <i>Erodium botrys</i>		Long Storkbill	A	herb weed						7					
Geraniaceae	167	<i>Erodium cygnorum</i>		Blue Storkbill	P	herb		3			6			9			
Rutaceae	175	<i>Microcybe multiflora</i> var. <i>multiflora</i>			P	shrub											✓
Rutaceae	175	<i>Phebalium tuberculosum</i>			P	shrub	1					8					
Polygalaceae	183	<i>Comesperma volubile</i>		Love Creeper	P	climber	1					8			10		
Euphorbiaceae	185	<i>Poranthera microphylla</i>		Small Poranthera	A	herb	1			5				10		11	
Celastraceae	199	<i>Psammomoya choretroides</i>			P	shrub						8					
Sapindaceae	207	<i>Dodonaea divaricata</i>		Hop Bush	P	shrub	1								10		
Sapindaceae	207	<i>Dodonaea laraeoides</i>			P	shrub				5				9		11	
Sapindaceae	207	<i>Dodonaea viscosa</i> ssp. <i>angustissima</i>		Sticky Hop Bush	P	shrub											✓
Rhamnaceae	215	<i>Cryptandra apetala</i> var. <i>anomala</i>			P	shrub	1a										

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Rhamnaceae	215	<i>Stenanthemum pomaderroides</i>			P shrub											✓
Rhamnaceae	215	<i>Trymalium daphnifolium</i>			P shrub	3a		7						9a		
Dilleniaceae	226	<i>Hibbertia ? glomerosa</i>		Guinea Flower	P shrub											
Dilleniaceae	226	<i>Hibbertia eatoniae</i>			P shrub	1							8		10	
Dilleniaceae	226	<i>Hibbertia glomerosa</i>		Guinea Flower	P shrub			7a						9a		
Myrtaceae	273	<i>Astartea heteranthera</i>			P shrub								8			
Myrtaceae	273	<i>Baeckea crispiflora</i>			P shrub	1		7							10	
Myrtaceae	273	<i>Baeckea cryptonoma</i> ms			P shrub									9a		
Myrtaceae	273	<i>Calothamnus gilesii</i>			P shrub										10	
Myrtaceae	273	<i>Calytrix breviseta</i> <i>ssp. stipulosa</i>			P shrub										10a	
Myrtaceae	273	<i>Chamelaucium pauciflorum</i> <i>ssp. thryptomenioides</i>			P shrub								8			
Myrtaceae	273	<i>Eucalyptus capillosa</i> <i>ssp. capillosa</i>		Wheatbelt Wandoo	P tree				7							
Myrtaceae	273	<i>Eucalyptus erythronema</i> <i>var. marginata</i>		Red Flowered Mallee	P mallee		3	4a	6						11	
Myrtaceae	273	<i>Eucalyptus loxophleba</i> <i>ssp. lissophloia</i>		York Gum	P mallee		2	3	5	6				9	11	
Myrtaceae	273	<i>Eucalyptus myriadena</i> <i>ssp. myriadena</i>			P mallee				5							
Myrtaceae	273	<i>Eucalyptus oldfieldii</i>		Oldfield's Mallee	P mallee								8a			
Myrtaceae	273	<i>Eucalyptus salmonophloia</i>		Salmon Gum	P tree		2		4							
Myrtaceae	273	<i>Eucalyptus salubris</i> <i>var. salubris</i>		Gimlet	P tree				4							
Myrtaceae	273	<i>Eucalyptus stowardii</i>		Fluted Horn Mallee	P mallee	1										
Myrtaceae	273	<i>Eucalyptus subangusta</i> <i>var. subangusta</i>			P mallee								9		11	
Myrtaceae	273	<i>Eucalyptus tenera</i>			P mallee											✓
Myrtaceae	273	<i>Eucalyptus transcontinentalis</i>	Redwood		P tree											✓
Myrtaceae	273	<i>Eucalyptus yilgarnensis</i>	Yorrel		P mallee	2							9			
Myrtaceae	273	<i>Hypocalymma angustifolium</i>	White Myrtle		P shrub										10	
Myrtaceae	273	<i>Leptospermum erubescens</i>	Roadside Teatree		P shrub											✓
Myrtaceae	273	<i>Melaleuca acuminata</i> <i>ssp. websteri</i> ms			P shrub		2	3	5	6	7				11a	
Myrtaceae	273	<i>Melaleuca adnata</i>			P shrub		1a	2	3	5					11a	
Myrtaceae	273	<i>Melaleuca conothamnoides</i>			P shrub								8			

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Myrtaceae	273	<i>Melaleuca coronicarpa</i>			P	shrub												✓
Myrtaceae	273	<i>Melaleuca lateriflora</i> ssp. <i>lateriflora</i> ms		Gorada	P	shrub		5	6	7							11	
Myrtaceae	273	<i>Melaleuca radula</i>		Graceful Honeymyrtle	P	shrub	1										10a 11	
Myrtaceae	273	▲ <i>Melaleuca sclerophylla</i>			P	shrub												✓
Myrtaceae	273	<i>Melaleuca uncinata</i>		Broom Bush	P	shrub	1										10	
Myrtaceae	273	<i>Micromyrtus obovata</i>			P	shrub										8		
Myrtaceae	273	<i>Micromyrtus racemosus</i> var. <i>racemosus</i>			P	shrub	1a										10	
Myrtaceae	273	▲ <i>Melaleuca grieviana</i> ms			P	shrub												✓
Halbragaceae	276	<i>Gonocarpus nodulosus</i>			A	herb		5										
Apiaceae	281	<i>Daucus glochidiatus</i>		Small Pennywort	A	herb	2		4	5	6	7	8				11 12	
Apiaceae	281	<i>Hydrocotyle medicaginoideis</i>		Small Pennywort	A	herb				3							9	
Apiaceae	281	<i>Hydrocotyle pilifera</i> var. <i>glabrata</i>			A	herb				5								
Apiaceae	281	<i>Hydrocotyle rugulosa</i>			A	herb	1										9 10 11	
Apiaceae	281	<i>Hydrocotyle</i> sp.			A	herb											11	
Apiaceae	281	<i>Trachymene cyanopetala</i>			A	herb	2		3	4		6					9 11 12	
Apiaceae	281	<i>Trachymene ornata</i>		Spongefruit	A	herb				3							9 11	
Apiaceae	281	<i>Trachymene</i> sp.		Spongefruit	A	herb										8		
Epacridaceae	288	<i>Astroloma serratifolium</i> ssp. <i>horridulum</i>		Cankerry, Kondrung	P	shrub	1a										10	
Epacridaceae	288	<i>Leucopogon obtusatus</i>			P	shrub												
Primulaceae	293	* <i>Anagallis arvensis</i> var. <i>caerulea</i>		Pimpernel	A	herb weed												✓
Loganiaceae	302	<i>Phyllangium sulcatum</i>		Mitrewort	A	herb					5	6					9 11	
Apocynaceae	304	<i>Alyxia buxifolia</i>		Dysentry Bush	P	shrub	2											
Lamiaceae	313	<i>Westringia cephalantha</i>			P	shrub	1										9 10a	
Scrophulariaceae	316	* <i>Zaluzianskya divaricata</i>		Zedweed	A	herb weed											9a	
Myoporaceae	326	<i>Eremophila decipiens</i> ssp. <i>decipiens</i>		Slender Fuschia	P	shrub										6		
Myoporaceae	326	<i>Eremophila drummondii</i>			P	shrub												
Myoporaceae	326	<i>Eremophila ionantha</i>		Violet Flowered Eremophila	P	shrub	2		4		6						9 11	✓
Myoporaceae	326	<i>Eremophila</i> sp.			P	shrub											12	
Plantaginaceae	329	<i>Plantago</i> sp. Nov aff. <i>hispida</i>			A	herb				3		5a	6				9	
Campanulaceae	339	<i>Wahlenbergia preissii</i>			A	herb	1									5		

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Campanulaceae	339	<i>Wahlenbergia</i> sp.			A herb				6									
Goodeniaceae	341	<i>Goodenia berardiana</i>			herb	1a	3	5	6	7					11			
Lobeliaceae	340	<i>Isotoma hypocrateriformis</i>		Woodbridge Poison	A herb										10			
Lobeliaceae	340	<i>Lobelia</i> sp.			A herb	1	3	5			9	10	11					
Goodeniaceae	341	<i>Scaevola spinescens</i>		Currant Bush	P shrub											✓		
Goodeniaceae	341	<i>Velleia cynopotamica</i>			A herb	1	3	5		8	9	10	11					
Stylidiaceae	343	<i>Levenhookia dubia</i>		Trumpet Stylewort	A herb			5	7	9								
Stylidiaceae	343	<i>Levenhookia pusilla</i>		Stylewort	A herb	1												
Stylidiaceae	343	<i>Stylidium ecorne</i>			P herb			5	7									
Stylidiaceae	343	<i>Stylidium emarginatum</i>		Biddy-Four-Legs	P herb											✓		
Stylidiaceae	343	<i>Stylidium petiolare</i>		Horn Triggerplant	P herb									10		P		
Asteraceae	345	<i>Actinobole uliginosum</i>		Flannel Cudweed	A herb			5	6	8	9	10	11					
Asteraceae	345	<i>Angianthus tomentosus</i>		Camel Grass	A herb	2	4a				9a			12				
Asteraceae	345	<i>*Arctotheca calendula</i>		Capeweed	A herb weed	1	2	3	4	5	6	7	11	12				
Asteraceae	345	<i>Asteridea athrixoides</i>			P herb	2a												
Asteraceae	345	<i>Blennospora drummondii</i>			A herb	1	3	5	6	7		10	11					
Asteraceae	345	<i>Brachyscome perpusilla</i>		Tiny Daisy	A herb		3	5			9		11					
Asteraceae	345	<i>Calotis hispidula</i>		Bindy Eye	A herb	2	3	4			9	11	12					
Asteraceae	345	<i>Ceratogyne obionoides</i>		Wingwort	A herb					8								
Asteraceae	345	<i>Chthonocephalus pseudevax</i>		Woolly Groundheads	A herb						9							
Asteraceae	345	<i>Erymophyllum ramosum</i>			A herb		4	5a				11						
Asteraceae	345	<i>Hyalosperma demissum</i>		Tiny Sunray	A herb			5		8		10	11					
Asteraceae	345	<i>Hyalosperma glutinosum</i> ssp. glutinosum			A herb	1	3	4	6	7	9							
Asteraceae	345	<i>*Hypochaeris glabra</i>		Flatweed	A herb weed	1	3	5	6	7	8	9	10	11				
Asteraceae	345	<i>Isoetopsis graminifolia</i>		Cushion Grass	A herb		3				9							
Asteraceae	345	<i>Lawrencella rosea</i>		Pink Everlasting	A herb	2		5	6	7		9a						
Asteraceae	345	<i>Millotia tenuifolia</i>		Soft Millotia	A herb	1		5										
Asteraceae	345	<i>Olearia muelleri</i>		Goldfields Daisy	P shrub	2	3	4	6		9a	11	12					
Asteraceae	345	<i>*Osteospermum clandestinum</i>		Stinking Roger	A herb weed											✓		
Asteraceae	345	<i>Podolepis canescens</i>		Bright Podolepis	A herb	1	3		6a	7		9a						
Asteraceae	345	<i>Podolepis lessonii</i>			A herb		4			7	9	10	11					
Asteraceae	345	<i>Podolepis tepperi</i>			A herb		3	5	6		9		11	12				
Asteraceae	345	<i>Pogonolepis stricta</i>			A herb		3	4		7								
Asteraceae	345	<i>Rhodanthe laevis</i>		Smooth Sunray	A herb	1	2	3	4	5	6	7	8	9	10	11	12	
Asteraceae	345	<i>Rhodanthe pygmaea</i>		Pink Sunray	A herb			5a			9							

FAMILY	No.	GENUS (botanical/scientific name)	SPECIES	COMMON NAME	FORMS		WYHO QUADRATS										oppo
					LIFE	GROWTH											
Asteraceae	345	<i>Senecio glossanthus</i>		Slender Groundsel	A	herb											
Asteraceae	345	* <i>Sonchus tenerrimus</i>		Clammy Sowthistle	A	herb weed											
Asteraceae	345	<i>Waltzia acuminata</i> <i>ssp. acuminata</i>		Orange Immortelle	A	herb	1	2	3	5	6	7	9	10	11		
Asteraceae	345	<i>Asteraceae sp. A</i>			A	herb	1			4		6			8		

APPENDIX E2: FLORA RECORDED FOR "MINDAH" BUSHLAND, WYALKATCHEM

alphabetically by species (Recordings and collections made 8/9/98, 9/9/98, 31/10/98, 25/10/00 and/or 27/11/01)

LEGEND (Refer also Appendix A for explanation of terminology)

- FAMILY, GENUS, SPECIES = PLANT TAXA
- NO. = Plant Family Number Plant Family Reference Number, as used in classification by WA Herbarium
- LIFE FORM = 'A' for annual + 'P' for perennial
- GROWTH FORM = shape & ability of plant to lay down woody tissue
- * = introduced plant / weed
- ▲ = priority flora (Refer Section 5)
- ms = manuscript name (recently described species, awaiting acceptance)
- sp. = species
- ssp. = subspecies
- var. = variety
- x = hybrid

FAMILY	No.	GENUS (botanical/scientific name)	SPECIES	COMMON NAME	LIFE FORM	GROWTH FORM
Mimosaceae	163	<i>Acacia acuarua</i>			P	shrub
Mimosaceae	163	<i>Acacia acuminata</i>		Jam	P	shrub
Mimosaceae	163	<i>Acacia colletioides</i>		Wait-a-While Wattle	P	shrub
Mimosaceae	163	<i>Acacia coolgardiensis</i> ssp. <i>coolgardiensis</i>		Spinifex Wattle	P	shrub
Mimosaceae	163	<i>Acacia erinacea</i>		Spiny Wattle	P	shrub
Mimosaceae	163	<i>Acacia fragilis</i>			P	shrub
Mimosaceae	163	<i>Acacia hemiteles</i>		Tan Wattle	P	shrub
Mimosaceae	163	<i>Acacia heteroneura</i> var. <i>petila</i>			P	shrub
Mimosaceae	163	<i>Acacia mackeyana</i>			P	shrub
Mimosaceae	163	<i>Acacia merrallii</i>		Merrall's Wattle	P	shrub
Mimosaceae	163	<i>Acacia saxatilis</i>			P	shrub
Mimosaceae	163	<i>Acacia stereophylla</i> var. <i>stereophylla</i>			P	shrub
Mimosaceae	163	<i>Acacia yorkakinensis</i> ssp. <i>acrita</i>		Yorkrakine Wattle	P	shrub
Asteraceae	345	<i>Actinobole uliginosum</i>		Flannel Cudweed	A	herb
Poaceae	31	* <i>Aira caryophyllea</i> /cupaniana		Silvery Hairgrass	A	grass weed
Casuarinaceae	70	<i>Allocasuarina acutivalvis</i>		Black Tamma	P	shrub
Casuarinaceae	70	<i>Allocasuarina campestris</i> ssp. <i>campestris</i>		Tamma	P	shrub
Apocynaceae	304	<i>Alyxia buxifolia</i>		Dysentery Bush	P	shrub
Poaceae	31	<i>Amphipogon strictus</i>		Greybeard Grass	P	grass
Primulaceae	293	* <i>Anagallis arvensis</i> var. <i>caerulea</i>		Pimpernel	A	herb weed
Asteraceae	345	<i>Angianthus tomentosus</i>		Camel Grass	A	herb
Asteraceae	345	* <i>Arctotheca calendula</i>		Capeweed	A	herb weed
Anthericaceae	54F	<i>Arthropodium curvipes</i>			P	herb
Anthericaceae	54F	<i>Arthropodium</i> sp.			P	herb
Myrtaceae	273	<i>Astartea heteranthera</i>			P	shrub
Asteraceae	345	<i>Asteraceae</i> sp. A			A	herb
Asteraceae	345	<i>Asteridea athrixioides</i>			P	herb
Epacridaceae	288	<i>Astroloma serratifolium</i> ssp. <i>horridulum</i>		Cankerberry, Kondrung	P	shrub
Chenopodiaceae	105	<i>Atriplex acutibractea</i> ssp. <i>karoniensis</i>			P	shrub
Chenopodiaceae	105	<i>Atriplex vesicaria</i>		Bladder Saltbush	P	shrub
Poaceae	31	<i>Austrodanthonia occidentalis</i>			P	grass
Poaceae	31	<i>Austrodanthonia setacea</i>		Small Flower Wallaby Grass	P	grass
Poaceae	31	<i>Austrodanthonia</i> sp.				grass
Poaceae	31	<i>Austrostipa elegantissima</i>		Feather Speargrass	P	grass
Poaceae	31	<i>Austrostipa trichophylla</i>			P	grass
Poaceae	31	* <i>Avena barbata</i>		Wild Oat, Bearded Oat	A	grass weed
Poaceae	31	* <i>Avena barbata</i> X <i>fatua</i>		Wild Oat, Bearded Oat hybrid	A	grass weed
Myrtaceae	273	<i>Baeckea crispiflora</i>			P	shrub
Myrtaceae	273	<i>Baeckea cryptonoma</i> ms			P	shrub
Asteraceae	345	<i>Blennospora drummondii</i>			A	herb
Boryaceae	54L	<i>Borya constricta</i>		Pincushions	P	herb
Boryaceae	54L	<i>Borya sphaerocephala</i>		Pincushions	P	herb
Asteraceae	345	<i>Brachyscome perpusilla</i>		Tiny Daisy	A	herb
Brassicaceae	138	* <i>Brassica tournefortii</i>		Wild Turnip	A	herb weed
Poaceae	31	* <i>Bromus diandrus</i>		Great Brome	A	grass weed

FAMILY	No.	GENUS (botanical/scientific name)	SPECIES	COMMON NAME	LIFE FORM	GROWTH FORM
Poaceae	31	<i>*Bromus madritensis</i>		Madrid Brome	A	grass weed
Poaceae	31	<i>*Bromus rubens</i>		Red Brome	A	grass weed
Asphodelaceae	54G	<i>Bulbine semibarbata</i>		Leek Lily	A	herb
Orchidaceae	66	<i>Caladenia anomala</i>			P	herb
Orchidaceae	66	<i>Caladenia dimidia</i>		Chameleon Orchid	P	herb
Orchidaceae	66	<i>Caladenia exilis</i> ms			P	herb
Orchidaceae	66	<i>Caladenia footeana</i> ms		Common Spider Orchid	P	herb
Orchidaceae	66	<i>Caladenia mesocera</i> ms			P	herb
Orchidaceae	66	<i>Caladenia pulchra</i> ms			P	herb
Orchidaceae	66	<i>Caladenia roei</i>		Ant Orchid	P	herb
Orchidaceae	66	<i>Caladenia saccharata</i>		Sugar Orchid	P	herb
Orchidaceae	66	<i>Caladenia</i> Sp. Wyalkatchem WSWA WYHO 4/9/99			P	herb
Orchidaceae	66	<i>Caladenia vulgata</i>		Common Spider Orchid	P	herb
Orchidaceae	66	<i>Caladenia vulgata X hirta</i>			P	herb
Orchidaceae	66	<i>Caladenia ? vulgata X footeana</i>			P	herb
Portulacaceae	111	<i>Calandrinia calyptata</i>		Pink Purslane	A	herb
Portulacaceae	111	<i>Calandrinia granulifera</i>		Pygmy Purslane	A	herb
Portulacaceae	111	<i>Calandrinia</i> sp.			A	herb
Myrtaceae	273	<i>Calothamnus gilesii</i>			P	shrub
Asteraceae	345	<i>Calotis hispidula</i>		Bindy Eye	A	herb
Myrtaceae	273	<i>Calytrix breviseta</i> ssp. <i>stipulosa</i>			P	shrub
Centrolepidaceae	40	<i>Centrolepis aristatus</i>		Pointed Centrolepis	A	herb
Centrolepidaceae	40	<i>Centrolepis cephaloformis</i>			A	herb
Centrolepidaceae	40	<i>Centrolepis humillima</i>		Dwarf Centrolepis	A	herb
Asteraceae	345	<i>Ceratogyne obionoides</i>		Wingwort	A	herb
Anthericaceae	54F	<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>		Blue Squill	P	herb
Dasypogonaceae	54C	<i>Chamaexeros macranthera</i>			P	herb
Myrtaceae	273	<i>Chamelaucium pauciflorum</i> ssp. <i>thryptomenioides</i>			P	shrub
Adiantaceae	7	<i>Cheilanthes austrotenuifolia</i>		Common Rock Fern	P	fern
Asteraceae	345	<i>Chthonocephalus pseudevax</i>		Woolly Groundheads	A	herb
Polygalaceae	183	<i>Comesperma volubile</i>		Love Creeper	P	climber
Crassulaceae	149	<i>Crassula closiana</i>			A	herb
Crassulaceae	149	<i>Crassula colorata</i> ssp. <i>acuminata</i>		Dense Stonecrop	A	herb
Crassulaceae	149	<i>Crassula decumbens</i>		Rufous Stonecrop	A	herb
Crassulaceae	149	<i>Crassula ? exserta</i>			A	herb
Crassulaceae	149	<i>*Crassula natans</i> var. <i>minus</i>			A	herb weed [aquatic]
Rhamnaceae	215	<i>Cryptandra apetala</i> var. <i>anomala</i>			P	shrub
Orchidaceae	66	<i>Cyanicula deformis</i>			P	herb
Orchidaceae	66	<i>Cyanicula gemmata</i> ms			P	herb
Apiaceae	281	<i>Daucus glochidiatus</i>		Small Pennywort	A	herb
Papilionaceae	165	<i>Daviesia nematophylla</i>			P	shrub
Phormiaceae	54E	<i>Dianella revoluta</i>		Blueberry Lily	P	herb
Orchidaceae	66	<i>Diuris</i> aff. <i>corymbosa</i>		Rosy Cheeked Donkey Orchid	P	herb
Sapindaceae	207	<i>Dodonaea divaricata</i>		Hop Bush	P	shrub
Sapindaceae	207	<i>Dodonaea laraeoides</i>			P	shrub
Sapindaceae	207	<i>Dodonaea viscosa</i> ssp. <i>angustissima</i>		Sticky Hop Bush	P	shrub
Droseraceae	143	<i>Drosera glanduligera</i>		Pimpernel Sundew	A	herb
Droseraceae	143	<i>Drosera macrantha</i> ssp. <i>macrantha</i>		Bridal Rainbow	P/A	herb climber
Droseraceae	143	<i>Drosera subhirtella</i>		Sunny Rainbow	P/A	herb
Ecdeiocoleaceae	39A	<i>Ecdeiocolea monostachya</i>			P	rush
Poaceae	31	<i>*Ehrharta longiflora</i>		Annual Veldt Grass	A	grass weed
Chenopodiaceae	105	<i>Enchylaena tomentosa</i>		Barrier Saltbush	P	shrub
Myoporaceae	326	<i>Eremophila decipiens</i> ssp. <i>decipiens</i>		Slender Fuschia	P	shrub

FAMILY	No.	GENUS (botanical/scientific name)	SPECIES	COMMON NAME	LIFE FORM	GROWTH FORM
Myoporaceae	326	<i>Eremophila drummondii</i>			P	shrub
Myoporaceae	326	<i>Eremophila ionantha</i>		Violet Flowered Eremophila	P	shrub
Myoporaceae	326	<i>Eremophila</i> sp.			P	shrub
Orchidaceae	66	<i>Eriochilus dilatatus</i> ssp. <i>undulatus</i>		Crinkle-Leafed Bunny Orchid	P	herb
Geraniaceae	167	* <i>Erodium botrys</i>		Long Storksbill	A	herb weed
Geraniaceae	167	<i>Erodium cygnorum</i>		Blue Storksbill	P	herb
Asteraceae	345	<i>Erymophyllum ramosum</i>			A	herb
Myrtaceae	273	<i>Eucalyptus capillosa</i> ssp. <i>capillosa</i>		Wheatbelt Wandoo	P	tree
Myrtaceae	273	<i>Eucalyptus erythronema</i> var. <i>marginata</i>		Red Flowered Mallee	P	mallee
Myrtaceae	273	<i>Eucalyptus loxophleba</i> ssp. <i>lissophloia</i>		York Gum	P	mallee
Myrtaceae	273	<i>Eucalyptus myriadena</i> ssp. <i>myriadena</i>			P	mallee
Myrtaceae	273	<i>Eucalyptus oldfieldii</i>		Oldfield's Mallee	P	mallee
Myrtaceae	273	<i>Eucalyptus salmonophloia</i>		Salmon Gum	P	tree
Myrtaceae	273	<i>Eucalyptus salubris</i> var. <i>salubris</i>		Gimlet	P	tree
Myrtaceae	273	<i>Eucalyptus stowardii</i>		Fluted Horn Mallee	P	mallee
Myrtaceae	273	<i>Eucalyptus subangusta</i> var. <i>subangusta</i>			P	mallee
Myrtaceae	273	<i>Eucalyptus tenera</i>			P	mallee
Myrtaceae	273	<i>Eucalyptus transcontinentalis</i>		Redwood	P	tree
Myrtaceae	273	<i>Eucalyptus yilgarnensis</i>		Yorrel	P	mallee
Santalaceae	92	<i>Exocarpos aphyllus</i>		Leafless Ballart	P	shrub
Papilionaceae	165	<i>Gastrolobium bennettsianum</i>		Cluster Poison	P	shrub
Haloragaceae	276	<i>Gonocarpus nodulosus</i>			A	herb
Goodeniaceae	341	<i>Goodenia berardiana</i>				herb
Proteaceae	90	<i>Grevillea acuaria</i>			P	shrub
Proteaceae	90	<i>Grevillea didymobotrya</i> ssp. <i>didymobotrya</i>			P	shrub
Proteaceae	90	<i>Grevillea magnifica</i>			P	shrub
Proteaceae	90	<i>Grevillea paniculata</i>			P	shrub
Proteaceae	90	<i>Grevillea paradoxa</i>		Bottlebrush Grevillea	P	shrub
Proteaceae	90	<i>Grevillea petrophiloides</i>		Poker Grevillea	P	shrub
Aizoaceae	110	<i>Gunniopsis septifraga</i>			A	herb
Proteaceae	90	<i>Hakea invaginata</i>			P	shrub
Proteaceae	90	<i>Hakea scoparia</i>			P	shrub
Dilleniaceae	226	<i>Hibbertia eatoniae</i>			P	shrub
Dilleniaceae	226	<i>Hibbertia glomerosa</i>		Guinea Flower	P	shrub
Dilleniaceae	226	<i>Hibbertia ? glomerosa</i>		Guinea Flower	P	shrub
Poaceae	31	* <i>Hordeum leporinum</i>		Barley Grass	A	grass weed
Asteraceae	345	<i>Hyalosperma demissum</i>		Tiny Sunray	A	herb
Asteraceae	345	<i>Hyalosperma glutinosum</i> ssp. <i>glutinosum</i>			A	herb
Apiaceae	281	<i>Hydrocotyle medicaginoides</i>		Small Pennywort	A	herb
Apiaceae	281	<i>Hydrocotyle pilifera</i> var. <i>glabrata</i>			A	herb
Apiaceae	281	<i>Hydrocotyle rugulosa</i>			A	herb
Apiaceae	281	<i>Hydrocotyle</i> sp.			A	herb
Myrtaceae	273	<i>Hypocalymma angustifolium</i>		White Myrtle	P	shrub
Asteraceae	345	* <i>Hypochaeris glabra</i>		Flatweed	A	herb weed
Asteraceae	345	<i>Isoetopsis graminifolia</i>		Cushion Grass	A	herb
Cyperaceae	32	<i>Isolepis congrua</i>			A	sedge
Lobeliaceae	340	<i>Isotoma hypocrateriformis</i>		Woodbridge Poison	A	herb
Asteraceae	345	<i>Lawrencella rosea</i>		Pink Everlasting	A	herb
Brassicaceae	138	<i>Lepidium rotundum</i>		Veined Peppergrass	A	herb
Cyperaceae	32	<i>Lepidosperma brunonianum</i>			P	sedge
Cyperaceae	32	<i>Lepidosperma</i> sp. A2 Island Flat (GJ Keighery 7000)			P	sedge
Myrtaceae	273	<i>Leptospermum erubescens</i>		Roadside Teatree	P	shrub
Epacridaceae	288	<i>Leucopogon obtusatus</i>			P	shrub
Stylidiaceae	343	<i>Levenhookia dubia</i>		Trumpet Stylewort	A	herb
Stylidiaceae	343	<i>Levenhookia pusilla</i>		Stylewort	A	herb
Lobeliaceae	340	<i>Lobelia</i> sp.			A	herb

FAMILY	No.	GENUS (botanical/scientific name)	SPECIES	COMMON NAME	LIFE FORM	GROWTH FORM
Poaceae	31	<i>*Lolium rigidum</i>		Wimmera Ryegrass	A	grass weed
Poaceae	31	<i>*Lolium</i> sp.		Ryegrass	A	grass weed
Chenopodiaceae	105	<i>Maireana carnosa</i>		Cottony Bluebush	P	shrub
Chenopodiaceae	105	<i>Maireana georgei</i>		Satiny Bluebush	P	shrub
Chenopodiaceae	105	<i>Maireana marginata</i>		Bluebush	P	herb
Chenopodiaceae	105	<i>Maireana triptera</i>		Three Winged Bluebush	P	shrub
Chenopodiaceae	105	<i>Maireana x Enchylaena</i> hybrid			P	shrub
Myrtaceae	273	<i>Melaleuca acuminata</i> ssp. <i>websteri</i> ms			P	shrub
Myrtaceae	273	<i>Melaleuca adnata</i>			P	shrub
Myrtaceae	273	<i>Melaleuca conothamnoides</i>			P	shrub
Myrtaceae	273	<i>Melaleuca coroncarpa</i>			P	shrub
Myrtaceae	273	▲ <i>Melaleuca grieviana</i> ms			P	shrub
Myrtaceae	273	<i>Melaleuca lateriflora</i> ssp. <i>lateriflora</i> ms		Gorada	P	shrub
Myrtaceae	273	<i>Melaleuca radula</i>		Graceful Honeymyrtle	P	shrub
Myrtaceae	273	▲ <i>Melaleuca sclerophylla</i>			P	shrub
Myrtaceae	273	<i>Melaleuca uncinata</i>		Broom Bush	P	shrub
Brassicaceae	138	<i>Menkea australis</i>		Fairy Spectacles	A	herb
Aizoaceae	110	<i>*Mesembryanthemum crystallinum</i>		Iceplant	A/B	herb weed
Rutaceae	175	<i>Microcybe multiflora</i> var. <i>multiflora</i>			P	shrub
Myrtaceae	273	<i>Micromyrtus obovata</i>			P	shrub
Myrtaceae	273	<i>Micromyrtus racemosus</i> var. <i>racemosus</i>			P	shrub
Aizoaceae	110	<i>*Micropterum papulosum</i>			A	herb weed
Asteraceae	345	<i>Millotia tenuifolia</i>		Soft Millotia	A	herb
Poaceae	31	<i>Neurachne alopecuroidea</i>		Foxtail Mulga Grass	P	grass
Asteraceae	345	<i>Olearia muelleri</i>		Goldfields Daisy	P	shrub
Asteraceae	345	<i>*Osteospermum clandestinum</i>		Stinking Roger	A	herb weed
Poaceae	31	<i>*Pentaschistis airoides</i>		False Hairgrass	A	grass weed
Urticaceae	88	<i>Parietaria debilis</i>		Pellitory	A	herb
Proteaceae	90	<i>Persoonia angustiflora</i> ssp. <i>burracoppinensis</i>			P	shrub
Proteaceae	90	<i>Persoonia quinquenervis</i>			P	shrub
Rutaceae	175	<i>Phebalium tuberosum</i>			P	shrub
Brassicaceae	138	<i>Phlegmatospermum drummondii</i>		Drummond's Phlegmatospermum	A	herb
Loganiaceae	302	<i>Phyllangium sulcatum</i>		Mitrewort	A	herb
Plantaginaceae	329	<i>Plantago</i> sp. Nov aff. <i>hispida</i>			A	herb
Asteraceae	345	<i>Podolepis canescens</i>		Bright Podolepis	A	herb
Asteraceae	345	<i>Podolepis lessonii</i>			A	herb
Asteraceae	345	<i>Podolepis tepperi</i>			A	herb
Asteraceae	345	<i>Pogonolepis stricta</i>			A	herb
Euphorbiaceae	185	<i>Poranthera microphylla</i>		Small Poranthera	A	herb
Orchidaceae	66	<i>Prasophyllum ? macrostachyum</i>		Laughing Leek Orchid	P	herb
Celastraceae	199	<i>Psammomoya choretroides</i>			P	shrub
Orchidaceae	66	<i>Pterostylis sanguinea</i>		Dark Banded Greenhood	P	herb
Orchidaceae	66	<i>Pterostylis setulosa</i> ms			P	herb
Amaranthaceae	106	<i>Ptilotus gaudichaudii</i> var. <i>gaudichaudii</i>			A	herb
Amaranthaceae	106	<i>Ptilotus holosericeus</i>		Mulla Mulla	P	herb
Amaranthaceae	106	<i>Ptilotus spathulatus</i>			P	herb
Amaranthaceae	106	<i>Ptilotus</i> sp.			P	herb
Chenopodiaceae	105	<i>Rhagodia preissii</i> ssp. <i>preissii</i>			P	shrub
Asteraceae	345	<i>Rhodanthe laevis</i>		Smooth Sunray	A	herb
Asteraceae	345	<i>Rhodanthe pygmaea</i>		Pink Sunray	A	herb
Santalaceae	92	<i>Santalum acuminatum</i>		Quandong	P	shrub
Goodeniaceae	341	<i>Scaevola spinescens</i>		Currant Bush	P	shrub
Cyperaceae	32	<i>Schoenus elegans</i>			A	sedge
Cyperaceae	32	<i>Schoenus hexandrus</i>			P	sedge

FAMILY	No.	GENUS (botanical/scientific name)	SPECIES	COMMON NAME	LIFE FORM	GROWTH FORM
Cyperaceae	32	<i>Schoenus nanus</i>		Tiny Bog Rush	A	sedge
Cyperaceae	32	<i>Schoenus sculptus</i>		Gimlet Bog Rush	A	sedge
Cyperaceae	32	<i>Schoenus ? sculptus</i>		Gimlet Bog Rush	A	sedge
Cyperaceae	32	<i>Schoenus sp.</i>		Gimlet Bog Rush	A	sedge
Asteraceae	345	<i>Senecio glossanthus</i>		Slender Groundsel	A	herb
Caesalpinaceae	164	<i>Senna artemisioides</i>			P	shrub
Asteraceae	345	<i>*Sonchus tenerrimus</i>		Clammy Sowthistle	A	herb weed
Poaceae	31	<i>Spartochloa scirpoidea</i>			P	grass
Caryophyllaceae	113	<i>*Spergula arvensis</i>		Corn Spurry	A	herb weed
Caryophyllaceae	113	<i>*Spergula ? diandra</i>		Lesser Sand Spurry	A	herb weed
Caryophyllaceae	113	<i>Stellaria filiformis</i>		Thread Spurry	A	herb
Rhamnaceae	215	<i>Stenanthemum pomaderroides</i>			P	shrub
Stylidiaceae	343	<i>Stylidium ecorne</i>			P	herb
Stylidiaceae	343	<i>Stylidium emarginatum</i>		Biddy-Four-Legs	P	herb
Stylidiaceae	343	<i>Stylidium petiolare</i>		Horn Triggerplant	P	herb
Phormiaceae	54E	<i>Stypandra glauca</i>		Blindgrass	P	herb
Orchidaceae	66	<i>Thelymitra antennifera</i>		Vanilla Orchid	P	herb
Anthericaceae	54F	<i>Thysanotus patersonii</i>		Twining Fringe Lily	P	climber
Anthericaceae	54F	<i>Thysanotus pyramidalis</i>		Fringe Lily	P	herb
Anthericaceae	54F	<i>Thysanotus speckii</i>		Fringe Lily	P	herb
Apiaceae	281	<i>Trachymene cyanopetala</i>			A	herb
Apiaceae	281	<i>Trachymene ornata</i>		Spongefruit	A	herb
Apiaceae	281	<i>Trachymene sp.</i>		Spongefruit	A	herb
Papilionaceae	165	<i>*Trifolium hirtum</i>		Rose Clover	A	herb weed
Juncaginaceae	26	<i>Triglochin calcitrapum</i>		Spurred Arrowgrass	A	herb
Rhamnaceae	215	<i>Trymalium daphnifolium</i>			P	shrub
Goodeniaceae	341	<i>Velleia cynopotamica</i>			A	herb
Poaceae	31	<i>*Vulpia myuros</i>		Rat's Tail Fescue	A	grass weed
Campanulaceae	339	<i>Wahlenbergia preissii</i>			A	herb
Campanulaceae	339	<i>Wahlenbergia sp.</i>			A	herb
Asteraceae	345	<i>Waitzia acuminata ssp. acuminata</i>		Orange Immortelle	A	herb
Lamiaceae	313	<i>Westringia cephalantha</i>			P	shrub
Scrophulariaceae	316	<i>*Zaluzianskya divaricata</i>		Zedweed	A	herb weed