Avon Baseline Project
Benchmarking Wheatbelt vegetation communities
Part 1 Classification of Eucalyptus Woodlands

Eucalyptus accedens woodland Tutanning Nature reserve JH

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wheatbelt natural resource management

Department of Environment and Conservation

Our environment, our future

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Eucalypt Woodlands

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Summary

An important outcome of baseline biodiversity data collection in the Wheatbelt Natural Resource Management Region (Wheatbelt NRM) is an understanding of the vegetation communities occurring within this region. The Wheatbelt NRM covers an area equivalent to the Avon River catchment and encompasses a complex array of vegetation associations For the purpose of exploring the concept of Benchmarking we focussed on the woodlands. A benchmark is a description of a community in "pristine condition" (after Keighery 1994). Before such a benchmark can be determined the vegetation communities need to be identified and organised into some sort of hierarchy and described in terms of floristics and structure.

Since February 2009 an attempt has been made to classify Wheatbelt Woodland communities based on site and polygon sourced floristic data, statistical classifications, raw data collection sheets, photographs and Geographic Information Systems (GIS) based spatial data. This information was provided by:

1. *Salinity Action funded Wheatbelt biodiversity survey (1997-2001)*
2. *WWF Woodland Watch surveys in 2000 – 2008*
3. *Ted Griffin (occasional surveys for a variety of purposes)*
4. *The Wheatbelt reserves database*
5. *Woodland polygons from mapping projects being databased by Ben Bayliss as part of the Avon Baseline project*
6. *Field surveys as part of this project*

Greg Keighery has compiled a list of communities based on his experience and knowledge of the area. We are also talking to Nathan McQuoid, Malcolm French, Suzanne Prober, Ted Griffin and the WWF team.

A total of 1248 survey sites and polygon descriptions and were used to produce a classification of 20 major eucalypt woodland communities (including a group of 8 species of mallets) and around 70 sub groups (some of these represent single site occurrences, either through being poorly sampled, an unusual or restricted occurrence). The 20 communities are described in terms of their major associated species, soils, topography and IBRA locations taking into account the number of sample sites, their distribution in relation to the Avon Catchment and the purpose of the respective surveys. The sub-communities are primarily described on vegetation structure, major associated species and soil and topography where important.

A PATN analysis by Ted Griffin in 2008 has been the basis for the classification. Data was then manually added to the classification from the WWF 2007 and 2008 sites and other data mentioned above (Points 4-6)..

Although we are focussing on the Wheatbelt NRM Region we need to make some comparison with what is outside the region to see what may be unique to it. So SAP, WWF sites extend out of the region but the vegetation mapping is restricted to the region.

This classification forms the first part of the report. The second part will be the Benchmark descriptions of what the woodland communities look like when they are in Pristine or excellent condition

To help collect consistent information for the classification and benchmark descriptions we are drafting a survey methodology with reference to National Vegetation Information System (NVIS) manual, incorporating environmental variables and a condition assessment attributes. We are consulting similar vegetation condition assessment methods being developed by the

- *National soil and land field handbook*
- *Wildflower Society of WA survey methods*
- *Resources Condition Monitoring (RCM) Native Vegetation Integrity (NVIP)*
- *Vegetation and flora Survey for Environmental Impact Assessment*
- *Ecoscapes Threat Assessment and Habitat Description survey*
- *DEC's Reserve Database,*
- *Rapid Biodiversity Surveys for the SWAN region*
- *Vegetation clearing assessment group.*
-

This will form part 3 of the report.

The work may also provide information which will contribute to the nomination of potential Threatened Ecological Communities (TECs).

1. INTRODUCTION

1.1 Background

The Baselining Project is one of the natural diversity projects funded largely by the Federal government through the Wheatbelt Natural Resource Management region (previously Avon Catchment Council (ACC). The project's primary purpose is to collate the biodiversity data of the Avon Natural Resource Management Region (ANRMR) and interpret these data to support other projects in the ACC's natural diversity theme. A preliminary role of Baselining was to identify key knowledge and operational gaps in natural diversity conservation within the region.
One of the 5 foundational gaps (typically higher-order gaps in knowledge that are required to inform the development, management and evaluation of natural diversity projects) identified the need to benchmark vegetation communities and to develop a condition assessment methodology (Richardson and Gamblin, 2009). Currently there is little knowledge of the type, extent and condition of vegetation communities within the region (Richardson et al 2007).

Knowledge of vegetation condition is critical for many of the Avon's natural diversity projects; vegetation condition is required to identify management actions, prioritise on-ground work and as a tool to evaluate success of project outputs. Assessing condition against Benchmarks is an established way of identifying management actions and monitoring changes (Parkes et al 2004). Benchmarks are defined as a mature long undisturbed state.

Before Benchmark descriptions can be developed, the unit of assessment needs to be defined.

The native vegetation in the Avon Catchment Region is very diverse and complex with high species turnover at a patch and landscape scale and a mosaic of structural formations varying with climate, topography, soils and hydrology (Beard 1990). These are the challenges facing those trying to map the vegetation.

The vegetation associations mapped by Beard at 1:250,000 and further defined by systems by Hopkins (ref_) are (in the majority) largely based on structure and dominant species, are broad and do not account for the fine scale variation in the vegetation. For example many of the woodland associations in the Wheatbelt are mapped as large units with up to 6 eucalypt species. These eucalypts do not all occur together but rather in patches, some together and other in mono-specific stands on localised specific soil types e.g. Mallet on breakaways. Vegetation is strongly linked to soil type which in turn is determined by the gently undulating landscape (Beard 1990)

Communities have been mapped at reserves scale (1:100,000?) using a variety of methods (e.g Muir, Coates, Mattiske). The maps are being digitised and attributes standardized according to the National Vegetation Information System (NVIS) (Richardson et al 2008 ? Ben)

Vegetation classifications tend to be based on either physiognomic characteristics (structure and dominant species (e.g. Beard and Muir) or on numerical analysis of floristic composition (species presence or presence and absence) (e.g. Gibson et al 2004, E. A. Griffin and Associates 2008) or environmental factors (site groupings) (Gibson et al 2004) which may take into account soil types and climatic variables.

There are inherent problems with defining vegetation communities as the vegetation may gradually change across the landscape and time since fire, grazing pressure, nutrient enrichment, weed infestation, salinity, and hydrological changes may influence floristic composition and structure.

Due to the complexity of the Wheatbelt vegetation and the knowledge available from understanding eastern state woodlands it was decided to initially focus on the woodlands. Also a relatively high

proportion of woodlands have been cleared compared to other communities (Shepherd et al 2002) and a number of woodlands types have been identified as Priority Ecological Communities (DEC 2007)

The Wheatbelt Woodlands are easily recognisable in the landscape, the Eucalypts species are relatively easy to identify and they have been the focus of surveys (WWF), guides (Bamford 1995, Hussey, 1999, McQuoid (in prep), descriptive catalogues, French (in prep), and reviews (Yates, Hobbs & True 2000).

Future extension of this exercise for the Mallee, Shrublands and Kwongan will be challenging due to the way these formations intergrade, the high species richness and the lack of dominant species.

The following classification is based on over 1248 site and polygon descriptions, a numerical classification of 630 sites, photographic interpretation and expert opinion from botanists working in the region.

1.2 Aims of the project

As of September 2009 the objectives and outputs of the Vegetation community Benchmarking component of the Avon Baselining Project is to

- To classify and describe Avon [Woodland] vegetation communities based on available data from floristic surveys, GIS analysis, Baseline vegetation mapping and expert opinion. (Report Part 1)
- To develop condition assessment methodology based on a selection of attributes and methods developed and tested in the eastern states, and those being developed in WA , and expert consultation (Report Part 2)
- To document benchmarking methodology and prepare benchmark descriptions of the selected communities (Report Part 3)
- To develop a framework for benchmarking other communities with case studies

Additional outputs
Recommend necessary research and surveys to support nomination of potential communities as Priority Ecological Communities or Threatened ecological communities

1.3 Intended users

The classification and benchmark descriptions are intended to assist;

- The Wheatbelt NRM to better understand the diversity and variability of these communities, in monitoring and evaluating restoration activities and to assess their conservation status.
- DEC regional staff doing reserve surveys to assess the conservation significance of woodlands on their reserves and crown land being considered for reserves
- DEC native vegetation (clearance applications) assessment
- WWF systematically survey of woodlands communities predominantly on private land through the Woodland Watch and Healthy Terrestrial Ecosystems initiatives
- Land for Wildlife assessors and Landholders identify woodlands and their condition.
- DEC, WWF and Wheatbelt NRM to prepare nominations for listing of woodland communities as Threatened and Priority Ecological communities.

1.4 Study Area

The area of focus for this project is the Avon River Catchment which defines the Wheatbelt NRM (previously the Avon Catchment Council) and referred to here forth as WNRM. Figure 1 show the WNRM in relation to the Interim Biogeographic Regionalisation (IBRA) of the South west.
However in assessing whether communities are confined to the WNRM Region site observations from outside the region were incorporated in the classification.

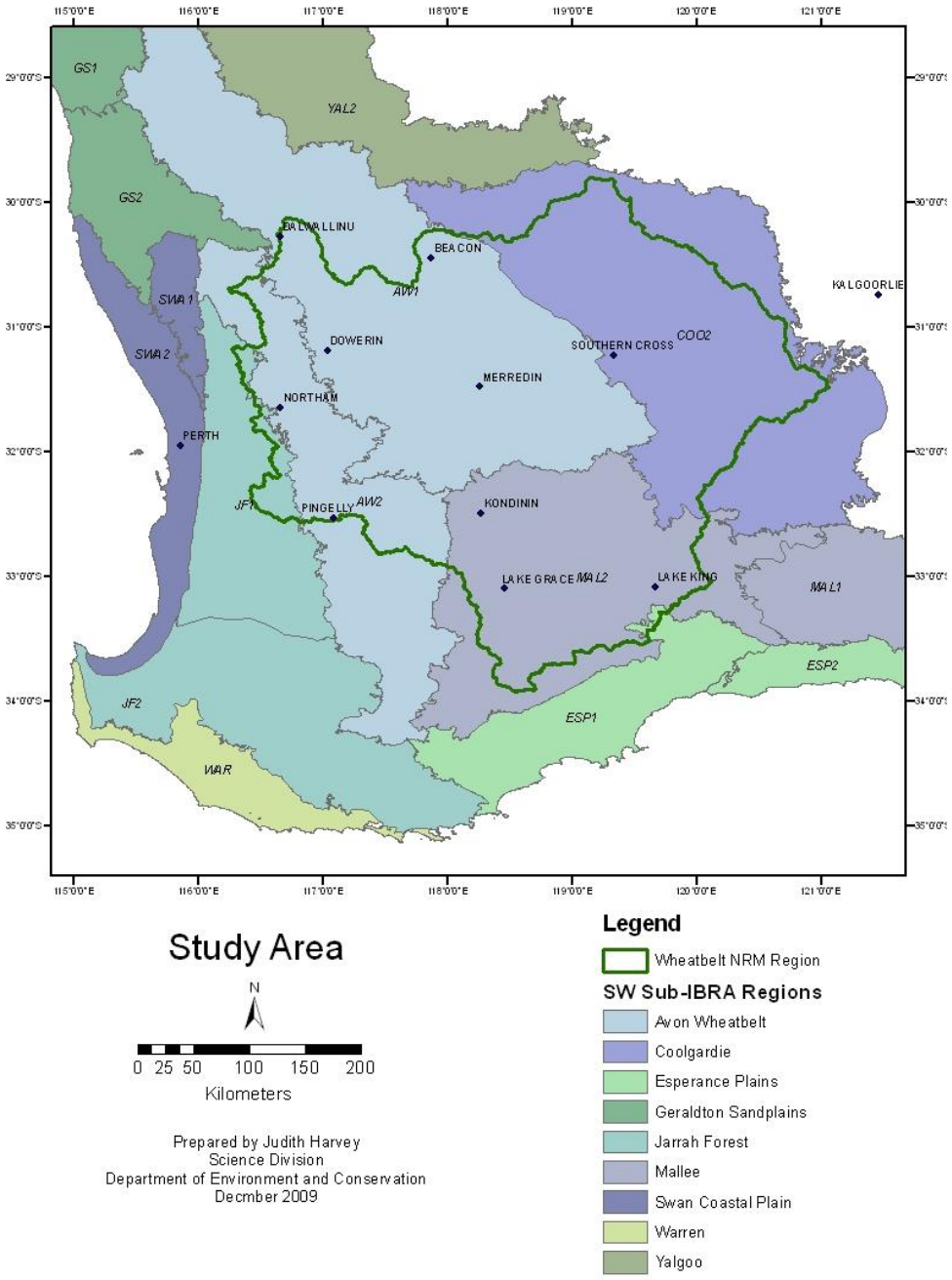

Figure 1 The Avon Catchment area which defines the Wheatbelt NRM Region in relation to the IBRA Sub regions of the South west of WA.Three IBRA regions cover most of the WNRM region.

The Wheatbelt is historically referred to as the agricultural area east of the forest and west of the rabbit proof fence and goldfields woodlands extending form Geraldton to east of Esperance. The IBRA Avon Wheatbelt and Mallee Bioregions approximate this area and are defined by topography, climate and vegetation.

The Avon Wheatbelt region is a dissected plateau of Tertiary laterite in the Yilgarn Craton. Its climate is semi-arid (dry) warm Mediterranean. There are two subregions – the eastern and western parts. The eastern subregion is an ancient, gently undulating plain of low relief and ancient drainage that has dissected the plateau. There is no connected drainage; salt lake chains occur as remnants of the ancient drainage systems and now only function in very wet years. Residual lateritic uplands are dominated by derived yellow sandplain covered in proteaceous scrub heaths, which have a high number of endemic

plant species. Mixed eucalypt, sheoak and jam woodlands dominate on Quaternary alluvials and eluvials. The western subregion comprises gently undulating rises to low hills with abrupt breakaways. Its drainage is rejuvenated and comprises continuous stream channels that flow in most years. Alluvial and eluvial processes are active. Residual lateritic uplands and derived sandplains are covered by areas of proteaceous scrub heaths (which are rich in endemics). Quaternary surfaces of erosional slopes and valley floors support woodlands of wandoo, York gum, jam and Casuarina. Land uses are primarily dryland agriculture and grazing. Smaller areas include Crown reserves (mainly conservation estate), mining operations and rural residential communities. The region has been extensively (94%) cleared (Shepherd et al 2002) for agriculture and grazed by stock, and consequently has numerous environmental problems, threatened ecological communities and species at risk. It is an interface between the south-western forests and the Transitional Rainfall Zone, and its rich flora includes many endemics, particularly in Grevillea, Hakea, Verticordia, Eucalyptus, Acacia, Dryandra, Lhotskya, Eriostemon, Wehlia, Baeckea, Melaleuca, Chamelaucium, Micromyrtus, Thryptomene and the Asteraceae family. Approximately 25 per cent of the declared rare flora in WA occurs in eucalypt woodlands in this region. Rare features include extant populations of critical weight range mammals, plant communities of granite outcrops, gypsum dunes, the Wongan Hills greenstone belt and associated laterite-capped mesas and Toolibin Lake. McKenzie, et al (2004)

The Mallee region occurs on the south-eastern part of Yilgarn Craton which is gently undulating, with partially occluded drainage. The climate is Mediterranean to semi-arid, with winter rainfall of between 250 and 500mm. There are two subregions – the Eastern Mallee and the Western Mallee. The Avon Catchment covers most of the Western Mallee region which has more relief than its eastern counterpart. Its main surface-types comprise clays and silts underlain by kankar, exposed granite, sandplains, isolated uplands of laterite pavements and salt lake systems (on a granite basement). Mallee communities can be found on a variety of surfaces and Eucalyptus woodlands occur mainly on fine-textured soils, with scrub-heath on sands and laterite. The region is 56% cleared (79% in the western subregion) with land use is mainly grazing of improved pasture and dryland agriculture, with lesser areas of conservation, unallocated Crown land and Crown reserves, roads and other easements, and forestry plantation. Rare features include granite outcrops. gypsum dunes, numerous endemic plant species, belonging to the genera Grevillea, Hakea, Eucalyptus, Acacia, Dryandra and Asteraceae freshwater wetlands Lake Bryde, East Lake Bryde and Lake Cronin.

The Coolgardie bioregion is also within the Yilgarn Craton. Its granite basement includes Archaean Greenstone intrusions in parallel belts. Drainage is occluded. The climate is arid to semi-arid warm Mediterranean with 250-300mm of mainly winter rainfall. Diverse woodlands, rich in endemic eucalypts, occur on low greenstone hills, on alluvial soils on the valley floors, around the saline playas of the region's occluded drainage system, and on broad plains of calcareous earths. The granite basement outcrops at mid-level in the landscape. It supports swards of 'granite grass', wattle shrublands and York Gum. The playa lakes support dwarf shrublands of samphire. Sand lunettes are associated with playas along the broad valley floors, and sand sheets surround the granite outcrops. Upper levels in the landscape are the eroded remnants of a Tertiary lateritic duricrust, with yellow (in the Southern Cross subregion) or red (in the Eastern Goldfields subregion) sandplains, gravel plains and laterite breakaways which support scrubs and mallee. In the west, these scrubs are rich in endemic Proteaceae; in the east they are rich in endemic acacias. Three subregions are defined and the western or Southern Cross subregion covers the eastern third of the Avon catchment gently undulating uplands on granite strata are interspersed with broad valleys with bands of low greenstone hills. This is largely uncleared and a major component of the Great Western Woodlands

For a full description of the bioregions and there components see May & McKenzie (2003)

All of the Coolgardie Bioregion together with parts of the Mallee Bioregion form the area now known as the Great Western Woodlands (Watson et al 2008). This area is being recognised for its high species richness (over 3000 plant species including in Eucalyptus species (>350) and as the last intact healthy large area (16Mha) of temperate woodland in the world.

1.5 Woodlands of the South West

Woodlands are defined as widely spaced trees with a canopy cover of less that 30% (Specht 1970, Muir NVIS. Cover may exceed 30% after a disturbance even such as fire but over time this tends to thin out. Woodlands featured here are all dominated by Eucalyptus species. Other woodlands of Sheoak and Banksia also occur in the Wheatbelt Figure 2a and 2b.
Woodland trees include Salmon Gum, York Gum and Gimlet which tend to regenerate from seed but may resprout from the stem and form multiple stems if logged. Some such as York Gum may develop lignotubers and develop multiple stems following disturbance. Another group known as Mallets only regenerated from seed, are killed by fire and have no lignotuber. These include E. astringens, E gardneri, E. urna and E sargentii.

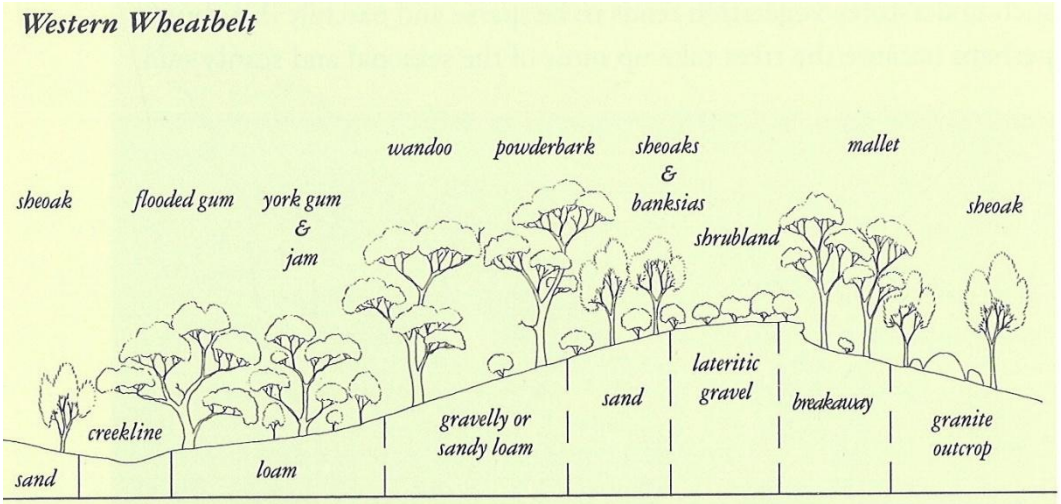

Figure 2 Woodlands of the western Wheatbelt in relation to topography and soils (Banford 1995)

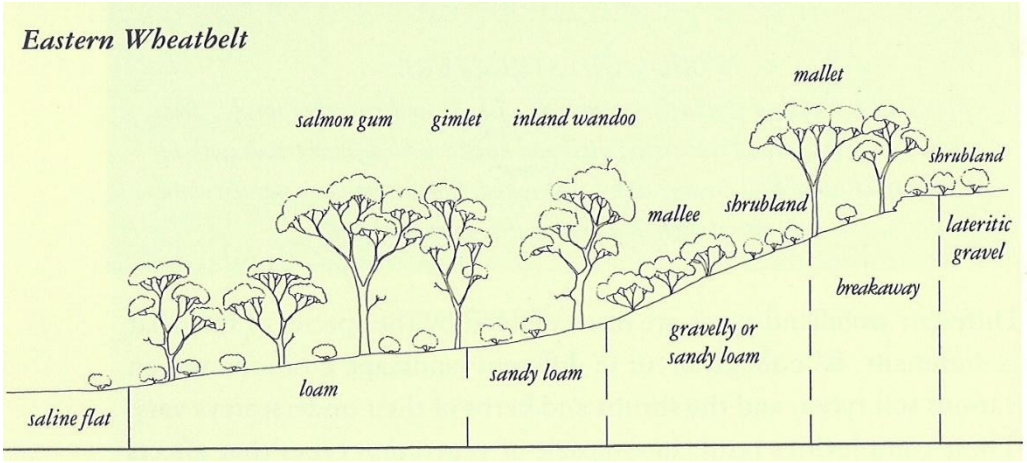

Figure 3 Woodlands of the eastern Wheatbelt in relation to topography and soils (Banford 1995)

2. CLASSIFICATION

2.1 Introduction

Vegetation is classified on the basis of Structure (the vertical and horizontal distribution of vegetation: its growth form, height, cover and strata) and floristics (dominant general or species in various strata and characteristic plant species Hanatiuk et al 2009. A system of classification levels has been developed see table1 (Hopkins 2008)

Classifying vegetation communities is important for;

a. Systematically mapping the vegetation
b. Assessing conservation values (how much is left and how much is in reserves).

c. Identifying Threatened Ecological Communities and Priority Ecological Communities.
d. Developing Benchmark descriptions which are required to effectively assess and monitor changes in vegetation condition
e. Helping land managers and land owners identify their bush remnants
f. Guiding and monitoring revegetation activities
g. Planning fire management

Defining vegetation communities is required by land managers to underpin many of their activities and so is used for administrative purposes such as surveys or restoration activities that focus on fro example York Gum woodlands. (Helena Mills pers comm.)

There has been an evolution of vegetation classification hierarchy in Australia (Hnatiuk et al 2009 Table1)

Key Attributes	Walker and Hopkins, M 1990	NVIS (ESCAVI 2003)	Hnatiuk Thackway and Walker 2009	Examples
Life form and cover	N/A	I Class	1 Formation	Tree
Growth form, cover and height of the dominant stratum and emergents	Structural formation	II Structural formation	2. Structural formation	Open woodland
Growth form, cover, height and characteristic species/genera in the dominant stratum	Floristic association	II Broad floristic formation	3 Broad floristic formation	Eucalyptus open woodland
Above plus the dominant genera for each stratum (upper mid and ground)	Structural sub formation	IV Broad floristic sub formation	4 Broad floristic sub formation	Eucalyptus open woodland\Acacia tall sparse shrubland\Austrostipa open grassland
Above with three dominant or co-dominant species in each stratum		V Association	Species can be added for substrata	U+^Eucalyptus salmonophloia, \Eucalyptus\^tree\7\i;MAcacia acuminata\Acacia\shrub\3\r;GAcacia erinacea\Acacia\shrub\1\r;
Above with five dominant or co-dominant species in each stratum		VI Subassociation	Species can be added for substrata	U1+^Eucalyptus salmonophloia, \Eucalyptus\^tree\7\i;U2Eucalyptus wandoo\Eucalyptus\tree\6\r;M1Acacia acuminata\Acacia\shrub\3\r;M2^Olearia muelleri\Olearia\^shrub\3\i;G1Acacia erinacea\Acacia\shrub\1\r;G2^^Lepidosperma pubisquameum,Loxocarya "asper",Stipa sp.,Stypandra glauca,Lepidosperma brunonianum\Lepidosperma\^sedge,tussock grass,rush\1\i

Table 1Comparison of vegetation classification systems

The term vegetation community is widely used to describe vegetation at a range of scales.

An [plant] ecological community has been defined in WA as naturally occurring biological assemblage (group of plants) that occurs in a particular type of habitat. Community structure is defined as follows: "The spatial organisation, construction and arrangement of the biological elements comprising a biological assemblage" (eg. *Eucalyptus salmonophloia* woodland over scattered small shrubs over dense herbs. (DEC2007). It is noted that the scale at which ecological communities are defined will often depend on the level of detail in the information source; therefore no particular scale is specified.

For this Benchmarking Project we consider a vegetation community on a broader scale as being characterised by floristic and structural features that are more or less consistent across its range. It may include specific topographic or soil parameters.

A vegetation community needs to be

1. Scientifically recognised and defensible;
    a) Sufficiently consistent floristics and structure to allow it to be recognised in the field. It may occur in various states as it recovers from fire, grazing or other disturbance. There is some knowledge about this for some communities e.g. Salmon Gum (Yates etc) (more discussion later). A community affected by dieback is transformed permanently and may be described as a different (post dieback) community. In Tasmania successional stages may be classed as communities if they are temporally stable for about 20 years Harris & Kitchener (2005).
    b) Based on accepted vegetation classification system. E.g Muir or NVIS.
    c) Derived from floristic pattern analysis (optional)
    d) Considered by botanical experts to be a common and/or recognisable unit.
2. Mappable
    a) A vegetation community is mappable if it can be defined on aerial photography, consistently recognised on the ground,
    b) With the use of Geographical Information Systems communities can be mapped down to quite a small size 25 x 25 m (vegetation of the reserves south coast Sandiford et al).Remote sensing may assist in defining boundaries
    c) Defined at the appropriate resolution for incorporation into a statewide vegetation map. In the south west of WA this is probably at a scale of 1:50,000. This may not be a necessary requirement with the current flexibility of GIS.
    d) Small patches of unusual vegetation may be listed as Threatened Ecological Communities.
    e) Future vegetation maps may be based on statistical analysis and classification of sites based floristic data

The community needs to be based on a state wide perspective if the development of Benchmarks in this pilot study can be extended through out the State.

A vegetation community in Tasmania is characterised by floristics and structural features that are more or less consistence across its range. Harris, S and Kitchener, A (2005). Vegetation communities are derived from large scale forest and plant community mapping and are the basic units described and mapped in the TASVEG statewide vegetation map. Michaels K. (2006)

In Victoria the units of vegetation classification used to base benchmark descriptions on is the Victorian Ecological Vegetation Classes (EVCs). These are defined by a combination of floristics, lifeform, position in the landscape, and an inferred fidelity to particular environments (www.dse.vic.gov.au). There are about 300 EVCs that have been mapped or modelled at either the 1:100,000 or 1:25,000 scale. They are defined

as ‘consisting of one or a number of floristic communities that appear to be associated with a recognisable environmental niche, and which can be characterised by a number of their adaptive responses to ecological processes that operate at the landscape scale level. Each ecological vegetation class is described through a combination of its floristic, life-form and reproductive strategy profiles, and through an inferred fidelity to particular environmental attributes’.

In Queennsland the vegetation is mapped as Regional ecosystems which are compiled of vegetation communites that are consistanly associated with a particular combination of geology, landform and soil. Neldner et al (2005)

In WA 820 egetation associations were mapped by Beard at 1:250,000 as the Pre European extent these were further subdivided by Beards ‘Systems’ into 2155 units by Hopkins (Hopkins 2008). These associations are (in the majority) largely based on structure and dominant species and are broad and do not account for the fine scale variation in the vegetation. For example many of the woodland associations in the Wheatbelt are mapped as large units with up to six Eucalyptus species. These eucalypts do not all occur together but rather in patches, some together and other in mono-specific stands on localised specific soil types e.g. Mallet on breakaways. At a finer scale mapping developed by Muir (1977) is commonly used. The classification system of Muir has been matched with the NVIS system (ESCAVI 2003) and the system developed in MacDonald et al (1990) (Bayliss pers com).

For this project, Eucalypt woodland communities are defined primarily by the dominant Eucalyptus species and a generalisation of understorey, topographic position, soils and distribution based on the sub community descriptions. These in turn are based on commonly observed structural formations, common co-dominant tree or commonly occurring understorey genera or species based on available sites descriptions, species lists and photographs.. A level of detail expanding on the single species woodlands e.g. Eucalyptus wandoo woodland is needed on which to base meaningful benchmark descriptions and identify uncommon occurrences of sub-communities.

2.2 Limitations to classifying vegetation

The classification of vegetation communities is fraught with difficulties due to gradual changes across the landscape between and within communities due climatic and soil gradients and the intricate ‘marbling’ (Prober pers comm.) pattern in soils and topography in the south west. As communities intergrade it becomes difficult to define and map them. The dynamic nature of species turnover across the landscape further complexes the matter [Muir 1977, Burgman 1988, Brown 1989]. Simply put the short comings of the classification process is that vegetation communities don’t fit neatly into boxes and there is inevitable overlap between them.

Within any one community there may be different ‘states’ due to time since fire, grazing pressure, nutrient enrichment, weed infestation, salinity, and hydrological changes which influence floristic composition and structure. A ‘State in Transition” model based on one developed in the rangelands by Westoby et al (1989) was developed to help understand the pressures and so better manage the grassy box Woodlands across Queensland, New South Wales and Victoria (Caring for our Country 2009). This model has also been applied WA to the Salmon Gum (Standish et al 2009, Yates & Hobbs 1997), York gum (Prober et al 2009), and more implicitly to Wandoo woodlands (Hussey 1995). The federal Department of Environment Water Heritage and Arts now recognize the significance of such ‘states’ and have incorporated this concept into their listing of the Box Gum Grassy Woodland as a nationally threatened ecological community under the Environment Protection and Biodiversity Conservation Act (DEH 2006).

Standish et al (2009) recognises 8 vegetation states ranging from undegraded woodland to sparsely vegetated saline land, as well as 17 transitions between states and 3 restoration thresholds.

Ongoing taxonomic revisions (see French and Nicolle in prep) are an additional complicating factor in the classification of vegetation communities, especially for the structurally significant tree species. For example a tree may develop a lignotuber and regenerate as a mallee after a fire or scrub-rolling therefore there has been some splitting of tree Eucalypts into tree species and mallee species (see section 4.2 for details).

Although appearing like a large mallee York gum is described as atree and rarely a multistemmed mallee (Brooker and Kleining 2001, French and Nicolle (in prep) and FloraBase. It is traditionally regarded as forming woodlands in the Western Wheatbelt

It may be difficult to reconcile existing concepts of ecological communities with what is seen on the ground (Mike Hislop pers com) and conversely difficult to assign what is seen at a site to a community classification.

2.3 **Data input**

Following on from similar exercises in the eastern states (Harris, S and Kitchener, A (2005), the woodland classification for this project has been based on a synthesis of existing survey data, ordination analyses, available maps at appropriate scales and expert opinion.

The information used in the classification consists of

- Quadrat data from
    - Department of Environment and Conservation (DEC) Biodiversity Survey of the Agricultural Zone (Gibson et al 2004, Lyons et al 2004) funded by the Salinity Action Plan (SAP) ,
    - World Wildlife Fund (WWF) surveys for Woodland Watch (2002 – 2006) and Healthy Terrestrial ecosystems (2007 -2008) DEC WA Herbarium (2002-2008).
    - selected surveys by Ted Griffin
    - Surveys on reserves and private land for the DEC Wheatbelt Region
- Woodland polygons (available to date) extracted from a database of vegetation maps being compiled as part to the Baseline project
- Input from botanists Greg Keighery, Nathan McQuoid, Mike Hislop, Anne Rick and Jenny Borger and naturalists Mike Griffiths and Phil Lewis who have expert knowledge of the region.
- Interpretation of site photographs where available.

A major input into the process was a PATN analysis conducted on the site based on woodland floristic data collected by WWF (2002 – 2006), SAP and Ted Griffin (Griffin 2008) and the analyses carried out on the terrestrial and wetlands vascular floristic components of the SAP data (Gibson et al 2004) was also considered

DECs' Biodiversity Survey of the Agricultural Zone funded by the Salinity Action Plan (SAP) covered terrestrial flora and vegetation (Gibson et al 2004) and wetland vegetation (Lyons et al 2004). The 682 terrestrial sites were located across an area from Kalbarri to Esperance (bounded by the 300 and 600mm isohyets) to pick up the geographical, edaphic and geomorphic variation with a focus on common plant communities. Sites were selected as representative of a good (?) sized patch of homogenous vegetation in good to very good condition. Complementing this was the sampling of 813 quadrats focussing on wetland vegetation. These sites varied in condition. Many of these sites were surveyed twice. Griffin (2008) selected 336 sites based on the presence of typical Wheatbelt tree species, e.g. salmon gum, York gum, wandoo etc. Sites with the only jarrah or marri were excluded. Based on similar criteria, 69 sites were selected from Griffin (1994). All WWF and Lake Bryde site data were used by Griffin

WWF selected sites were based on four targeted species *E. longicornis, E. salmonophloia, E. salubris* and *E. loxophleba* surveyed mainly on private land or in shire reserves. Sites were sometimes placed in ecotones between communities to capture the maximum species diversity. Sites were generally in very good condition but were only visited once. Species lists used in the analysis were based on specimens lodged in the Herbarium. Annual project reports, site distribution maps and site species lists are available through DEC FloraBase web site http://florabase.dec.wa.gov.au/wwatch/. Twenty of the WWF sites were not Eucalypt woodland (e.g. Allocasuarina, Banksia woodlands) so the total of WWF sites used was 212 including 39 sites surveyed from 2007 and 2008. These sites were manually added to the classification

Other data sources included

- 68 sites from the northern agricultural region were selected on similar criteria to the above SAP and WWF data were surveyed by Griffin (1994) and used in his analysis. Several of these sites were in poor condition.
- 257 site descriptions extracted from the Wheatbelt Reserves Database This data set was supplied by Brett Beecham (DEC Wheatbelt Region Narrogin) and was designed by Environs Consulting Pty Ltd for DEC. The database was set up to help manage data relevant to assessing

the nature conservation values of native vegetation remnants in the context of other land management and social values. It contains 896 records from various surveys.

- 15 woodland and open woodland sites from the Biological Survey of the Eastern Goldfields of WA Part 11 Boorabbin-Southern cross (Newbey et al. 1995) and Hyden-Lake Johnson (Newbey, K. R. & Hnatiuk R.J (1988)
- 348 vegetation descriptions attributed to polygons were extracted from the Avon vegetation Mapping database (data to November 2009) Some of these included additional environmental descriptions (e.g.soil, topography, disturbance level). This data set is confined to the WNRM region and consists of many reserve and non reserve vegetation maps carries out by a range of people and organisations (Bayliss in prep).
- 23 sites surveyed by Judith Harvey in 2009. These were based on reference sites nominated by Nathan McQuoid, Penny Hussey and Greg Keighery as well as collecting additional condition data collected during revisits to several SAP sites.

Some sites were deleted from the final classification if:

- as the woodlands were dominated by Allocasuarina or Banksia,
- the sites had very limited information or
- The vegetation descriptions represented different permutations of a single complex source description (Avon Vegetation Mapping)

A total of 1248 sites/polygons descriptions were used in the Baseline Woodland project classification. This is probably grossly inadequate considering that in Victoria 15,000 data points were analysed for its state wide vegetation classification. (ref?)

The distribution of sites is shown in figure 4.[not finalised yet] The SAP and WWF surveys extend beyond the Avon catchment and these were included to give an indication of those communities confined to the catchment.

Figure 4 Distributuon of sites used in the classification

Most sites selected in the SAP and WWF surveys were not recently burnt, SAP sites were ungrazed and presence of saline soils recorded. The presence of weeds is very seasonal and can be determined from species lists and an idea of cover obtained from photographs and site descriptions

Data inputs are described more specifically below;

- General vegetation descriptions were provided by the surveyors or complied by Griffin from the data sheets. These descriptions usually followed the format developed by Muir (1977) specifically for Wheatbelt vegetation.
- Dendogram based on presence of woody species produced by Griffin and printed out with dominant Eucalypts highlighted
- Appendix 7 in Griffin (2008) which indicated the main associated species for each of the 25, 50,100 and 200 groups derived from Griffins ordination.
- Further refinement some groups down to a 50,100 or 200 group levels (22 groups without mallee and shrublands) by Keighery . Six of these needing further sub groups defined due to size e.g. salmon gum and York gum.
- A table of Wheatbelt vegetation types (G J Keighery pers comm. Appendix 1 base on general knowledge and the classification of the SAP sites with assigned 25,50,100 & 200 groups from Griffin's ordination.
- Site locations (realizing possible inaccuracies) were overlayed in the GIS to relate provide additional information on
    - IBRA Regions (not a lot of importance placed on this)
    - Proximity to granite rocks and salt lakes (Wheatbelt Wetland layer produced in a sister project for Avon Baselining) and
    - Landscape context and vegetation from digital Orthophotos
- FloraBase maps and descriptions Individual specimen collection data was not examined.
- Site species lists (important in herb-rich sites which were not identified in the woody plant only classification) not available for vegetation mapping polygons .
- Occurrence of indicator (commonly recorded) species in sites descriptions and species lists

- Site photos which were not available for all sites and none of the map polygons.

2.4 Limitations of the data

There were many limitations of the data some of which are listed below.

1. Data is biased by the survey coverage and purpose; SAP is fairly representative, WWF focusing on 4 main species, some reserves and private property surveyed intensively
2. Descriptions that were incomplete or did not follow a standard or consistent schema such as Muir (1977) or NVIS and so could not be compared. For example only truncated vegetation descriptions available for 202 records (RLB, RTR and TL33 quadrats) from the Reserves database but these did have structural descriptions and species lists so could be reconstructed. Some of the vegetation mapping descriptions were very comprehensive NVIS level 6
3. WWF quadrats may have been placed on sites of maximum soecies diversity more representative of an ecotone rather that of a homogeneous community. There were also a few inconsistencies between site descriptions and species lists e.g. the common Eucalypt was not sampled and therefore did not appear on the species list however checking the data sheets usually resolved this.
4. Taxonomic problems due to name changes, incorrect identifications, confusing similar species e.g. E. kondininensis may be mistaken for E. yilgarnensis. Sub species were not always indicated for a species so it was difficult to allocate the appropriate community e.g. E. loxophleba may be a mallee (*E. Loxophleba* subsp. *lissophloia)* or a tree (*E. loxophleba* subsp *loxophleba*)
5. SAP and Wheatbelt database site locations (georeferences) were not accurate e.g. some SAP sites appeared in paddocks when viewed in the GIS data overlay.
6. A general site/polygon description from the Avon Mapping data base may be repeated as it derived from permutations of a source description.
7. Soil descriptions were not consistent.
8. Other environmental descriptions and site photographs were not available for all sites.
9. Eucalypt taxonomy may have been out of date with several species of mallee being re named see Table 2 (input from Peter White Nature Conservation Advisory Officer Wheatbelt Region DEC and Malcolm French Eucalypt enthusiast and author of Wheatbelt Eucalypts. E.g E. argyphea and E. falcata were considered the same but now the different growth forms are considered different species – eg the mallet form of what people often E falcate is now know as E.argyphea or E. recta. [check]

Tree/Mallet	Mallee
Eucalyptus salmonophloia	
Eucalyptus longcornis	
Eucalyptus salubris	*Eucalyptus effusa*
Eucalyptus argyphea	***Eucalyptus falcata***
Eucalyptus recta	***Eucalyptus falcata***
Eucalyptus purpurata	
Eucalyptus ornata	
Eucalyptus rugulata	
Eucalyptus urna	***Eucalyptus flocktoniae subsp flocktiniae***
Eucalyptus transcontinentalis	*Eucalyptus moderata*
	Eucalyptus neutra
Eucalyptus kondininensis* subsp. *kondininensis	~~*Eucalyptus kondininensis* subsp. *tuberosa*~~
Eucalyptus gardneri* subsp. *gardneri	*Eucalyptus pluricaulis*
***Eucalyptus gardneri* subsp?**	
Eucalyptus sargentii* subsp. *sargentii	*Eucalyptus sargentii subsp. onesia*
Eucalyptus occidentalis	*Eucalyptus sporadica*
Eucalyptus astringens	*Eucalyptus thamnoides*

Eucalyptus astringens subsp. redacta	
Eucalyptus extensa	***Eucalyptus annulata***
Eucalyptus prolixa	***Eucalyptus calycogona***
Eucalyptus valens	***Eucalyptus conglobata***
Eucalyptus singularis	***Eucalyptus incrassata***
Eucalyptus conferruminata	***Eucalyptus lehmannii***
Eucalyptus spreta	***Eucalyptus pileata***
Eucalyptus eremophila	*Eucalyptus tenera*
Eucalyptus spathulata	*Eucalyptus vegrandis*

Table 2 Recent name changes in Wheatbelt Eucalypts

2.5 Methods [will summarise and put details into appendix]

a. Extracted the main associated species from the Tables in Ted's Appendix 7.
b. Plotted distribution
c. Compared to GKs initial grouping of SAP sites (Beard veg and Bens map units)
d. Searched description for indicator species (see below)
e. Overlayed Beards granite rocks and salt lakes, Avon granite rock and major and minor drainage lines. Zoomed in and eyeballed sites but not comprehensively. Could produce a buffer around each feature and intersect with points to see if sites were near rock, salt lakes or drainage (particularly for York Gum gear Wandoo and salt lakes (Query the accuracy of the sites locations?) Also Checked against Beard's mapped samphire units to see if there was a correlation with salt lakes on Orthophotos
f. Intersected with Wheatbelt Wetlands database and recorded wetland type including granite rock within 250m of site
g. Using dissolved Salt layer (from J:\Salinity\SHP\salt.shp) allocated sites that fell within salt polygons 'Saline" and those within 250m nr saline. Not relayable as this is really land of low productivity
h. Intersected (linked) with Geological layer Regolith. Again not 100 % reliable due to resolution of layer and accuracy of plots
i. Zoomed in on orthophotos so see if sites were located near salt lakes and granite rocks as required (also may not be useful due to inaccurate sites locations)
j. Viewed available photos of SAP and WWF sites in the Avon (currently do not have photos for sites outside the Avon and appear not to have some of the WWF photos or edited reports for inside the Avon (Sites <WWF123). Do not have photo for Ted's sites
k. Searched for associated species or groups e.g.Jam or sedges in descriptions (some of these were incomplete and had to be surmised from data sheets)
l. Viewed WWF data sheets to cross check species listed. Several inconsistanccies fond between data sheets and species list used inb the analysisi ast the latter was compiled from speciments lodged in the Herbarium.
m. Downloaded sites descriptions (topography, soils and some condition) of WWF sites from Flora base>themes>Community Projects>Woodland Watch. Soils desc for SAP sites roughly calculated from % sand, clay and Silt form soil analysis using Triangular textue diagram bases on international a fractions (Marshall 1947 in Australian soil and land survey field book third edition) see soil summary table in SAP data folder)
n. Compared with classification groups produced by SAP and Ted
o. Complied a list of indicator species e.g. Saline indicator species; Rhagodia drummondii Rhagodia preisii, Mairiana spp, Enchylaena, Halosarcia, Mesembryanthemum,*Parapholis incurve, Spergularia marina
p. Preliminary assessment of weedy component of rich herby understoreys to make a division between sites in excellent condition and those in poor condition (Keighery 1994 rating). Several sites mainly DEC wetland sites were removed from the classification as they had a weed dominated understorey.
q. Species richness to identify potential herb/grass rich understoreys. This is shown to relate to composition (Gibson et al 2004) in conjunction with p).
r. Manually incorporated WWF 2007/08 site reports, species lists, data sheets and photos. Condition information collected and entered
s. Extracted woodland polygons from Avon Vegetation mapping database by

I. Queried Veg_ description, Map Unit and Data_Set Tablesto get Map_ID, Veg_ID, Source code, L1, L2, L3, L4, L5, L6, and Environmental descriptions. Query name = vegDecJH
II. Extracted query results to Excel and sorted on Level 1 to extract Tree and tree Mallee i.e. removed all but Tree and tree mallee in L1.
III. Removed all but Eucalyptus on L3
IV. Removed mallee species e.g E.erythronema, E. redunca? E. sp aff redunca = melanophita ?]
V. Sorted to extract unique level 6 descriptions
VI. Assigned community codes primarily based in L6 descriptions but with reference to Source description and Environmental description.

t. Eleven open woodland and low open woodland sites in the Avon catchment and dominated by eucalypts that occurred in the Wheatbelt chosen from the Biological Survey of the Eastern Goldfields. The vegetation descriptions were entered into the spread sheet and coded along with information of landform, soil, species richness litter disturbance and time since last fire. Four relevant photos were also scanned.
u. Using the Reserves Database, 'Quadrat Description' table, the 'Brief Vegetation Description' field was manually edited to provide consistent vegetation formation e.g. Forest, Woodland, Mallee, Shrubland etc. It was then sorted to extract woodlands and those sites imported into excel along with any available environmental data, Muir code and location. This table was modified so that it could be added to the Site spreadsheet and coded. The coordinates were extracted for plotting in the GIS. Duplicates with Avon Veg Mapping polygons were removed.

The assigned codes reflect a mixture of compositional (codominant species e.g.other eucalyptus species, Jam, Sheoak), understorey structure (heath, scrub, herbs) understorey composition (Chenopods), and occasionally geographic position.

2.6 Limitations of the classification

1. The allocation of sites to the sub communities was ultimately subjective based on available data and information. Where available the site photographs were a useful supplementary input into the decision process
2. Sites may be assigned to two or more sub communities. Where there was another specific Eucalypt commonly present this took precedence over whether it was over scrub or heath or herbs. If the next dominant Eucalyptus sp was not common and not recognised by the experts as importantly unique the code reflected the understorey structure. E.g. *Eucalyptus wandoo, E. astringens, Allocasuarina huegeliana* Low woodland A over open or *Polianthion wichurae* moderately dense shrubs. May be assigned to Ewanast (E wandoo/astringens) EwanSheoak or EwanScrub. The photo graph and data sheet indicate very low cover of E. astringens, and greater cover of shrubs (especially *Allocasuarina campestris* mentioned on the data sheet but not given a cover value). The resulting classification was EwanSheoak.
3. For the Avon Vegetation Map database, the vegetation descriptions reflected a mapped interpretation rather than an explicit set of site point data. As a result, the synoptic nature of these descriptions may mean that they encompassed, and could be equally allocated to several sub communities. E.g *Eucalyptus longicornis* and *Eucalyptus salubris* Woodland over *Eucalyptus loxophleba* subsp *lissophloia* and *Eucalyptus sheathiana* Open Tree Mallee over *Melaleuca pauperiflora* and *Acacia multispicata* Open Scrub may be ElonsaluMel, ElonMallee or E lonMel. ElonMallee was chosen as the mallee contributed a higher cover that shrubs
4. Complete environmental and condition data not always available to clearly allocate sites to sub communities. Future data collection from JH sites helps ascertain the particular (transitional) state a vegetation community currently represents
5. General variation within sub community e.g. Esalmloxsalu over jam, chenopods or herbs and grasses. EwanScrub may have a variety of understorey species.
6. Site descriptions of dominant Eucalypts change locally across a small distance as is seen by the difference descriptions between the quadrat and transects carried out by Jenny Borger on the northern WWF sites e.g.193 Esalmwan for 10x10 quadrat and Ewansalm for transect and WWF 195 Transect of Eucalyptus loxophleba subsp. loxophleba and E. wandoo subsp. pulverea open forest adjacent to a quadrat described as Eucalyptus loxophleba subsp. loxophleba open woodland.

2.7 Results

Results of previous floristic analyses
SAP 25 assemblages defined from the species classification of (removing taxa recorded from less than 5 quadrats) showed significant geographical partitioning across the study are and could be described in term of soils and principle taxa.

Removing sites with 1-3 species (and species only occurring once) left 760 quadrats which were analysed using detailed cluster analysis producing 26 quadrat groups

A species cluster analysis produced 29 coherent species groups.
Of these 270 [check] were selected as woodlands
A subset of 81 sites were identified (by Ted?) as being woodland communities based on the presence of typical Wheatbelt tree species e.g. salmon gum, York gum, wandoo excluding sites with only jarrah or marri)

The PATN classification by Griffin (2008) used was based on large (woody) native species to compensate for the seasonal variation in annuals and geophytes recorded during surveys carried out at different times of the year. It is worth noting that Gibson et al (2004) found that overstorey species were a poor surrogate for diversity patterns in the complete flora of a region. The resulting analysis of Griffins classification produced a hierarchy of sites divided into 25, 50, 100 or 200 groups). The 25 groups listed in Table 1 include some mallee and shrublands which were not included in the current classification as it is purely focused on woodlands.

Group No	Description	Number of sites
1	Eucalyptus wandoo subsp pulverea	13
2	Eucalyptus accedens	14
3	Allocasuarina campestris shrublands with a number of distinct different trees, eg E. loxophleba, E. salmonophylla, E. wandoo, E. oldfieldii	7
4	Melaleuca undulata shrubland, often with Dodonaea bursariifolia and or Allocasuarina acutivalvis	16
5	Isopogon buxifolius and or Banksia media shrublands	6
6	Heterogeneous unit Many apparently distinct units each with a number of different eucalypts	16
7	Eucalyptus myriadena	5
8	Eucalyptus astringens subsp redacta	2
9	Eucalyptus capillosa subsp capillosa	12
10	Melaleuca acuminata subsp acuminata	10
11	Eucalyptus astringens subsp astringens, often with E. wandoo	14
12	Eucalyptus loxophleba subsp lissophloia	23
13	Eucalyptus longicornis	18
14	Rhagodia drummondii	16
15	Rhagodia drummondii	32
16	Rhagodia drummondii	19
17	Eucalyptus loxophleba subsp loxophleba	51
18	Eucalyptus salmonophylla	79
19	Eucalyptus salubris, some E salmonophloia	77
20	Eucalyptus wandoo subsp wandoo	73

21	Eucalyptus wandoo subsp, wandoo	28
22	Eucalyptus occidentalis	12
23	Eucalyptus occidentalis	21
24	Eucalyptus occidentalis	21
25	Eucalyptus loxophleba subsp loxophleba & Acacia acuminata	50

Table 3 Classification groups at the 25 group level from Griffin et al 2008.

The woodland classification groups identified from Griffins PATN analysis were considered when forming the current classification however sites making up groups 4,5 were not included in the current classification and sites in groups 14,15 and 16 were re-allocated according to their dominant Eucalypt rather than *Rhagodia drummondii*.

From Communities surveyed by Denise True as part of a review of grassy woodlands in the WA Wheatbelt (Mattiske and assoc 1995) four Eucalypt woodlands groups were identified

1. York Gum – Jam low woodlands over tall shrubs/low trees over closed grasses and herbs (3 sites)
2. York Gum Mallee (subsp lissophloia) over open tall shrubs/low trees over tall grasses (1 site)
3. Wandoo woodlands over tall open shrubs over closed grasses and herbs (4 sites)
4. Mixed Eucalypt Woodland over tall open shrubs/low trees over grasses and herbs (1 site)

Table 5 presents the 20 communities with about 80 sub communities classification based on

1. Understorey lifeflorm, e.g Elonscrub E longicornis over scrub
2. Dominant understorey genus e.g. EsalmMel
3. Dominant understorey species e.g. EloxJam
4. Co dominant overstorey species e.g Esalmsalu
5. Subspecies EloxN and EloxE
6. Geographic distribution EloxN refers to *Eucalyptus loxophleba* subsp *supralaevis*

FIELDS

The following fields appear in the table

Codes for each community or sub community (e.g. Eloxwan for Eucalyptus loxophleba and E. wandoo Sub- community or EwanHeath for Eucalyptus wandoo over heath) were derived for this project to assist with sorting, analysis and GIS display.

Main associated species were derived from several sources;

1. Extracts from the main associated species given in Griffin's Appendix 7.
2. Vegetation description (commonly mentioned species)
3. Full species list for all sites grouped on sub community code and number of occurrences of each species presented in a pivot table. Annuals and weed species were often more common than an indicator shrub species.

There is generally such high species turnover that it is not possible to clearly define characteristic species and the species listed are only a small sample of species that may be found in the community. In general species names have not been updated.

Topography compiled from available descriptions, existing GIS spatial data such as contours, wetlands, granite rocks and orthophoto images as well as information compiled from herbarium specimens (FloraBase). There may be a range of topographic positions for sites within a floristic community.

Soil descriptions were available of most sites but the notation was inconsistent. There are often a range of soil descriptions for the sites within a community and it is difficult to summarise. The final soil description for each community includes information from FloraBase

Distribution within **IBRA** sub regions calculated from the intersection of all sites with the IBRA Region GIS layer. Additional species (Eucalyptus) distribution data was obtained form FloraBase. Outliers were ignored and IBRA regions with relatively few r3ecords are noted in Brackets

The **number of sites** totals 1248 but highlights the need for further sampling of many of the communities e.g.Eucalyprus melanoxylon, some of the Mallets, E. salicola. E sargentii

As this project focuses on the **Avon** Catchment it is necessary to know the extent of each community to ascertain which communities are confined to the NRM region. The classification included SAP, WWF and Griffin's sites outside the Catchment area to try and get an idea of the relative distributions. FloraBase distributions were also used to help compile the distribution of communities outside the Avon Catchment area especially where data was only available for the Catchment (e.g. Avon vegetation Mapping).

Table 4 .The Classification (or the greyed out rows in the big table) 20 communities representing first cut based on dominant overstorey Eucalypt species

Community Description*	Community Code	*Main associated spp*	Topography	Soil	IBRA	No. of sites	Avon NRM	Comments
Eucalyptus longicornis (Red Morrel)	**Elon**	***Sclerolaena diacantha, Lycium australe, Maireana trichoptera, Rhagodia drummondii***	valley floor	Dark red loams	**AW, MAL, ,COO, ESP**	**58**	**extends to SW amd east**	**Widespread but uncommon due to clearing or naturally uncommon. Co occurs with many other Eucalypt species.**
E. longicornis over Melaleuca	ElonMel	*Melaleuca teuthidoides, M. lanceolata, M. pauperiflora, Olearia muelleri, Atriplex vesicaria and other Chenopods & ocasional Mallee*	mid to lower slopes	Calcareous loamy earth, clay loam, loamy sand	AW1 (7) , MAL2 93)	26		OK group but may need to split these as different Mels occurring dif conditions although many occur on lake side dunes
E. longicornis/E. salubris	ElonsaluMel	*E. salubris, Melaleuca lanceolata, M. adnata*	mid slope of undulating plain	Loam/sandy clay	AW1	9		
E. longicornis over Chenopods	ElonChen	*Atriplex vesicaria, A paludosa,Rhagodia drummondii, Eucalyptus myriadena,*	valley flats	loam	AW1	5		Needs further survey check for more sites
E. longicornis on Dunes	ElonDune	*Callitris tuberculata (gypsum) Atriplex paludosa Scaevola spinescens*	dune	gypsum, clayey sand	AW1, MAL2	2		Unusual on dunes but composition is very similar to ElonChen
E. longicornis/E. wandoo	Elonwan	*E. wandoo, Acacia acuminata, Gastrolobium spp, Olearia dampieri subsp. eremicola or herbs and grasses*	mid to upper slopes	Deep grey sandy duplex	AW2	3		odd group momre like wandoo with Elon
E. longicornis/E. melanoxylon	Elonmel	*E. melanoxylon, Atriplex vesicaria, A. acutibractea Olearia muelleri, Eremophila decipiens*	lower slope, lake edge	clay loam	WA1, MAL2	2		Unusual may be some ID confusion no wWWF voucher.
E. longicornis/E. loxophleba	Elonlox	*E.loxophleba, Acacia acuminata over Austrostipa hemipogon or Desmocladus aspe*	upper slope valley or near granite	loamy sand	AW2	2		May be better in with Elox
E. longicornis over Mallee	ElonMallee	*E. phenax , E. yilgarnensis, E myriadena over Melaleuca acuminta, Acacia collectoiodes, A erinacea*	upper slope, lower slope	laterite, sandy loam/clay	AW1,AW2	4		2 very separate sites WK34 WWF sites on ecotones?
E. longicornis over scrub	ElonScrub	*Dwarf scrub of mixed Melalueca uncinata group, Acacia erinacea, Eremophila ionanthaand sedges*	mid slope	Loam/sandy clay	AW1	4		mixed group WWF on ecotone? GWW site,
E. longicornis/E. astringens	Elonast	*E.astringens, E wandoo* over little understorey	upper slope	loamy sand?	AW2	1	in	Unusual site WK29 see WWF 2008 site

Community Description*	Community Code	*Main associated spp*	Topography	Soil	IBRA	No. of sites	Avon NRM	Comments
Eucalyptus salmonophloia (Salmon Gum)	**Esalm**	***Acacia erinacea, Sclerolaena diacantha, Olearia muelleri, Rhagodia drummondii***	Plains & low hills; upper lopes (west) broad valleys (east)	Red clay loam or clay, red sand, often with gravel;Granitic soils (west) Calcareous and red loams (east)	**AW, MAL,COO, GS (JF, ESP, MUR)**	**343**	**Partly**	**grows with many other Eucalypts. And distribution extends well into the GWW**
E. salmonophloia over scrub	EsalmScrub	Mixed understorey including often with *Acacia erinacea, Olearia muelleri, Scaevola spinescens, Acacia hemiteles, Templetonia sulcata, Erempophgila spp. Pittosporum angustifolium, ccasional E loxophleba, E salubris* Ground layer includes *Lepidospersma, Lomandra effusa, Austrostipa elegantisima*	upper slope	sandy clay,loam	AW1 (8), AW2 (8), MAL2 (3),	**60**		OK group variable species heath and open scrub Ground cover variable in cover and species.
E. salmonophloia over Chenopod scrub	EsalmChen	*Rhagodia preissii, R. drummondii, Sclerolaena dicantha, Atriplex paludosa, A stipitata, Encylaena tomentosa, Maireana spp*	Lower slopes.	brown loam		**10**		Pulled out chenopod sites from EsalmScrub but some overlap.
E. salmonophloia/E. wandoo	Esalmwan	*Eucalyptus wandoo,* occasional *E . loxophleba Allocasuarina campestris, Acacia accuminata, A. erinacea, Gastroplobium parviflorum,* Mallee *E sheathiana over Borya spp, Lomandra effusa, Desmocladus, Austrostipa spp. Neurachne.*	Lower, mid & upper slopes	sandyclay, loam	AW1, AW2	**40**		Common but variable group, mainly in the west Grassy sites recognised bt Mattiske 1995
E. salmonophloia/E. salubis	Esalmsalu	*Eucalyptus salubris,* over Acacia and or Melaleuca scrub, Chenopods, mallee or herbs. *Santalum acuminatum, Acacia erinacea, Acacia merrallii, Exocarpos aphyllus, Melaleuca adnata, M. pauperiflora, Olearia muelleri, Rhagodia presseii.* Other Eucalypts include *E.loxophleba, E. longicornis, , E capillosa,*	upper slope	loam	AW1 (17) MAL2	**56**		Common groups these sites had an obvious dominance of Esalm. Mesembryanthum (3sites) See also Esalusalm.
E. salmonophloia/ E.loxophleba	Esalmlox	*Eucalyptus loxophleba subsp. loxophleba, Acacia acuminata, Acacia erinacea, Rhagodia preissii, R. drummondii, Oleraia muelleri Melaleuca uncintat group, M adnata, Acacia hemiteles, Templetonai sulcata* Mallees *E. erythronema. occasional E. wandoo E salubris,*	lower slopes	Loam near granite in the west	AW2 (10) AW1 (6), MAL2	**49**		Recognised in the west as a sub community (GK) but may also be an artefact of sampling across boundaries.

Community Description*	Community Code	*Main associated spp*	Topography	Soil	IBRA	No. of sites	Avon NRM	Comments
E. salmonophloia over Melaleuca spp	EsalmMel	*Melaleuca acuminta, M. uncinata group, M. adnata, M. lateriflora, Templetonia sulcata, Olearia muelleri, Acacia erinacea, Santalum acuminatum*	Upper mid and lower slopes	loamy sand,sandy clay,clay	MAL2 (9), AW1 (3), JF1	**34**		split melaleucas? Colin Yates?
E. salmonophloia/ E.longicornis	Esalmlon	*E. longicornis, Rhagodia preissii, Santalum acumintaum, Templetonia sulcata, Acacia erinacea,Olearia muelleri, Grevillea huegelii*	mid to upper slopes	clay loan , sandy clay	AW1 (4), AW2 (3), MAL2 (3), JF1, COO2	**19**		includes Elonsalm as proportions vary. Many WWF sites which may be on ecotones.
E. salmonophloia over mallee	EsalmMallee	*Eucalyptus eremopiha, E.sheathiana, E. calycogona, E phenax, E loxophleba subsp lissophloia, E.celastroides, E.yilgarnensis, Oleraia muelleri, Acacia erinacea*	mid slopes	sand, loamy sand	AW1(5), MAL2 (4) AW2 (3)	**42**		Some (2-3)sites have only scattered Esalm and may be should be taken out as Mallee sites
E. salmonophloia/ E.capillaris	Esalmcap	*E. capillaris, E.loxophleba, E. salubris, Acacia acuminata, Santalum acuminata and S. spicatum,Melaleuca uncinata group.Acacia hemiteles, Olearia muelleri*	upper slopes	sandy gravel, sandy loam	AW1 (6) AW2	**18**		may have low scrub, open dwarf scrub or just herbs and grasses cf Mattiske '95
E. salmonophloia on Dunes	EsalmDune	*E kondininensis, E myriadena, Atriplex vesicaria, Acacia microbotrya, A. erinacea, Olearia dampieri empltonia sulcata, , Austrostipa elegantissima*	around salt lakes	sand	MAL2(4), AW1,AW2	**6**		All SAP sites GK recognised this group. FIristically over laps with EsalmScrub
E. salmonophloia/ E.urna	Esalmurn	*E. urna, E pheax, Melaleuca adnata, M. lateriflora*	lower slope	laom	MAL2	1		Is this worthy of a group or put un with EsalmMel
Eucalyptus salubris (Gimlet)	**Esalu**	***Acacia erinacea, Sclerolaena diacantha, Enchylaena lanata***	Undulating plains, slopes	Red clay loam or loam, yellow or red sand, laterite	**AW, MAL, COO (ESP,YAL,GVD,MUR,JF,GS)**	**125**	**Small part**	
E. salubris over Melaleuca	EsaluMel	*Melaleuca pauperiflora , M. lateriflora, M. acuminata, M. adnata, M. cucullata*	variable	variable including gilgais	AW1 (6), Mal2 (6)	**30**		open to dense Melaleuca Over 12 spp.
E. salubris over open scrub	EsaluScrub	*Olearia muelleri, Acacia erinacea, A. merrallii, A.mackyana A. colletioides, Santalun acuminatum, Eremphila oppositifolia, Exocarpus aphyllus, , Rhagodia drummondii, Melaeluca puperiflora,*	mid to upper slopes	loams	AW1 (16), MAL2, COO2	**46**		often very sparse shrubs but also open dwarf scrub to scrub
E. salubris/E. salmonophloia	Esalusalm	*E. salmonophloia, Santalum acuminatum, Melaleuca adnata, Olearia muelleri, Acacia erinacea*	Mid slopes	brown loam	AW1 (7), AW2, MAL2	**21**		these sites had dominance of Esalu. With emergent Esalm See also Esalmsalu understorey varies from scattered

								shrubs,dence herbs to bare
Community Description*	**Community Code**	***Main associated spp***	**Topography**	**Soil**	**IBRA**	**No. of sites**	**Avon NRM**	**Comments**
E. salubris over mallee	EsaluMallee	*Eucalyptus celastroides , E. erythronema, E. yilgarnensis, E. sheathiana, Melaleuca pauperiflora, M. lateriflora, M. uncinata,*	Upper slopes	Brown loam/clay	AW1	**14**		Melaleuca thickets and scrub may be present
E. salubris with E. loxophleba	Esalulox	*E loxophleba subsp. loxophleba, & Acacia acuminata, A. hemiteles, Exocarpus aphylla , Olearia muelleri scrub & various mallees*	lower slopes	silty/clay loam	AW1	**8**		GJK recognises a Esalulox group but eight sites are variable; not a tight group
E. salubris on Dune	EsaluGyp	*Casuarina obesa* (dominant*) Hakea preissii, Grevillea acuaria*	Dune adj to degraded salne wetland	Gypsum	AW1	**1**		Unusual site SPS085C (?more sites in WWF 2007 data)
Eucalyptus loxophleba subsp. loxophleba (York Gum)	**Elox**	***Acacia acuminata, Allocasuarin huegeliana, herbs and grasses***	Around granite and on lower slopes	Loam, rocky loam, clay loam, sand	AW,GS,MAL,JF, (SWA),	**199**	**Extends to NW and SW**	**naturally herby grassy understoreys are prone to weed invasion Jam may have been present but now grazed out.**
E. loxophleba subsp. loxophleba with Acacia acuminata over sparse shrubs and dense Herbs	EloxJamHerbs	*Acacia acuminata, Neurachne alopecuroidea, Podolepis lessonii, Austrostipa elegantissima, Trachymene cyanopetala, T. ornata, Goodenia berardiana, Velleia cycnopotamica, Atinobole uliginosum,Parentucellia latifolia, Crassula colorata, Lawrencella rosea , Waitzia acuminata var. acuminataBorya shaerocephala may include rare mergent E. salmolophloia and Allocasuarina heugeliana*	lower - mid slopes often near granite	Brown (sandy) loam over granite	AW1 (9) AW2 (15) JF1 (1)	**79**		This group includes a few sites without Jam (may have grazed out) Jam or be similar to 4j and be on shallow soils over granite. Few shrubs. A community recognised by S.Prober. Highly susceptible to weed invasion.e.g
E. loxophleba subsp. loxophleba with Acacia acuminata over open scrub and Herbs	EloxJamScrubHerbs	*Acacia acuminata, Allocasuarina huegeliana, Acacia acuaria, A. hemeteles, Enchylaena tomentosa, Scaevola spinescens, Podolepis lessonii, Austrostipa elegantissima, Neurachne alopecuroidea, Borya nitida, Waitzia acuminata, , Lawrencella rosea,Crassula colorata*	mid to upper slopes	Brown (sandy) loam over granite	AW2 (3) AW1 (2) MAL2 (1), GS2 (1)GS1 (2)	**34**		Shrub layer may vary due to time since fire and or grazing, 2 sites WWF026, WWF050 have a denser scrub layer with a lower spp richness Av of 23
E. loxophleba subsp. loxophleba over mixed scrub	EloxScrub	*Acacia hemites, A. lineolata A. erinacea A. microbotya, Hakea lissocarpha, Melaleuca cardiophylla, M. stenophloia, Atriplex nummularium*	often around granites	loam	AW1 (3), SWA1 (3), AW2 (1), GS2, JF1,YAL4	**13**		mainly to the north of the Avon

E. loxophleba subsp. loxophleba over Melaleuca spp	EloxMel	*Melaleuca lateriflora, M. uncinata group, M. acuminata, M.radula, M.atroviridis M. adnata, Allocasuarina acutivalvis*	nr fw lake	clay	GS2	**14**		low trees, tall shrublands or shrubland. Includes an unusual site on clay
Community Description*	**Community Code**	***Main associated spp***	**Topography**	**Soil**	**IBRA**	**No. of sites**	**Avon NRM**	**Comments**
E. loxophleba subsp. loxophleba in saline areas	EloxSaline	*Enchylaena tomentosa, Rhagodia drummondii, Comesperma integerrimum Olearia dampieri, Halosarcia lepidosperma*	lower slopes	Alluvial	AW1 (6), AW2 (2), GS2(2), MAL2 (2) YAL2	**17**		A community recognised by S. Prober. Elox can tolerate mild salinity. Has varying composition and structure. May overlap with other groups. susceptible to weeds
E. loxophleba subsp. loxophleba with Acacia acuminata over dense Herbs on sand dune	EloxJamHerbsDune	*Senecio glossanthus, Calandrinia calyptrata, Goodenia berardiana, Mesembryanthemum nodiflorum(1)*	lower slope	sand	AW1,AW2	**2**		One site on steep sandy dune Mullewa, one on edge of lake East of Katanning
E. loxophleba subsp. loxophleba with Allocasuarina huegeliana +/- Acacia acuminata near granite outcrops	EloxSheoak	*Allocasuarina huegeliana, A, campestris, Acacia acuminata, Austrostipa nitida, Calandrinia calyptrata*	near granite	Brown (sandy) loam over granite	AW1 (2) AW1, MAL2	4		Probably more common. Sites may have been put into 4j. York Gum & Sheoak is a Priority Beard Veg Assoc. Eastern outlier HY18 no Jam
Eucalyptus loxophleba subsp. supralaevis (York Gum Northern Mallee)	**EloxN**	***Acacia acuminata, Scaevola spinescens, Rhagodia drummondii, scattered dwarf scrub and rich in herbs Asteraceae***	Mid to lower slopes	Brown sandy loams	**AW,GS,YAL,COO**	**28**	**mostly to the NW**	**needs further survey (WWF 2007?) SP recognises a N YG comm. on red loam near granite with shrub understorey**
E. wandoo subsp. wandoo (Wandoo)	**Ewan**	***Hakea lissocarpha , Hibbertia commutata, Bossiaea eriocarpa,***	Undulating terrain	Sandy, often gravelly soils over laterite or granite	**JF, AW,SWA,MAL**	**174**	**mostly to the west and SW**	**Common and extensive, replaces E. accedens moving east.**

E. wandoo subsp. wandoo over heath in the West	EwanHeathW	*Corymbia calophylla Xanthorrhoea drummondii,Trymalium ledifolium, Hakea lissocarpha, Allocasuarina humilis, Acacia pulchella Hakea varia, Hypocalymma angustifolium, Meeboldina coangustata, Petrophile squamata*		laterite	JF1 (31), AW2 (4), JF2 (2)	**33**		Difficult to distinguish W from S may need to lump together [check GIS]

Community Description*	Community Code	*Main associated spp*	Topography	Soil	IBRA	No. of sites	Avon NRM	Comments
E. wandoo subsp. wandoo over heath South	EwanHeathS	*Hakea lissocarpha, Allocasuarina heugeliana, Santalum acuminatum, Allocasuarina campestris, Hakea prostrata Hypocalymma angustifolium*	Flats and mid slopes	mixed sandy	AW2 (5), JF2 (3) JF1, ESP	**12**		
E. wandoo subsp. wandoo North over heath	EwanHeathN	Heath *Melaleuca coronicarpa*			JF1 (4), AW1	**5**		Product of Ted's sampling
E. wandoo subsp. Wandoo with Acacia acuminata over sedges, mat plants herbs and grasses.	EwanJam	*Acacia acumintata, scattered Hake lissocarpha Loxcarya spp. Lepiosperma spp, Harperia sp, Neurachne sp*	Lower slopes	deep sands	AW2 (4), JF1 (3)	**5**		recognised group (Bamford) Variable shrub layer rich in herbs susseptable to weed invasion
E. wandoo subsp. wandoo over Herbs, sedges, grasses,dwarf shrubs and mat plants	EwanHerbs	*Borya sphaerocephala, Desmocladus spp, Lomandra spp, Austrostipa spp, Austrodanthonia spp, Neurachne alopecurioides, Gahnia sp, Dampiera spp and Corymbosa sp. Scattered shrubs include Hakea lissocarpha,*	winter wet drainage flats	clay loams and	AW1, AW2, JF1	**19**		Herb rich 'Grassy woodland'. Generally long unburnt sites or winter wet sites.
E.wandoo subsp.wandoo over mixed scrub	EwanScrub	Mixtures of *Acacia accuminata, A. lasiocalyx, A. erinaceae, Allocasuarina campestris, Gastrolobium parviflorum, Calothamnus quadrifidus,Melaleuca uncinata group. Borya spp, loxocarya spp*	Lower slopes, often poorly drained	sandy clay		**18**		Variable understory in cover heigh an composition. Ground layer 'herbaceous' or open or not stated
E. wandoo subsp. wandoo with Allocasuarina huegeliana over scrub of variable cover and height.	EwanSheoak	*Allocasuarina huegeliana, Gastrolobium parviflorum,Calothamnus quadrifidus, Acacia acuminata, [A. lasiocarpa, Dryandra sessilis, Hakea lissocarpha, H pertiolaris, Dampiera lindleyi, D. juncea, Borya sphaerocephala, Lepidosperma viscidum, L. resinosum. Melaleuca resinosum, Eucalyptus salmonophlioa, E astringins]*	Mid slopes often near granite	Deep sandy duplex, yellow brown-sand, light brown sandy clay	AW2	**20**		Variable understory species [single occurences] Sheoak appears to be invading certain vegetation types (Bamford)
E.wandoo ssp wandoo with tamma	EwanTamma	*Allocasuarina campestris [Lepidopsperma sp, Melaleuca uncinata*	Low lying poorly drained	Brown sandy loam, grey clay loam		**11**		Tammar - Allocasuarina campestris or A. acutivalvis often with Melaleuca ?uncinata, Acacia stereophylla? (Fox1997). These sites/polygons Herbs uncommon

Community Description*	Community Code	*Main associated spp*	Topography	Soil	IBRA	No. of sites	Avon NRM	Comments
E. wandoo subsp. wandoo over Melaleuca spp over heath, scrub or herbs	EwanMel	*Melaleuca uncinata* group, *M. coronicarpa, M.acuminata, Gastrolobium trilobum. Allocasuarina microstachya, Dampiera lindleyi*	upper slope		AW2 (3), GS2	**4**		Variable group
E. wandoo subsp. wandoo in saline ares	EwanSaline	*E. loxophleba (1), Casuarina obesa(1)*	lower clopes valley floor		AW2 (2), JF1 (2)	4		Community threatened by increasing salinity and changes in hydrology. Needs further survey
E. wandoo subsp. wandoo/ Corymbia calophylla	Ewancal	*Banksia sphaerocarpa, Halea lissocaphha, H. trifurcata, Hypocalymma angustifolium*		gravelly soils		3		
E. wandoo subsp. wandoo/ E. accedens	Ewanacc	*Dryandra sessilis, Hibbertia hypericoides, Acacia lasiocarpa, Gastrolobium parviflorum and Petrophile divaricata*	upper slopes and breakaways	gravely	JF1	**8**		
E. wandoo subsp. wandoo/ E. loxophleba	Ewanlox	*E. loxophleba,*			JF1, AW	6		variable
E. wandoo subsp. wandoo/E. occidentalis	Ewanocc	*E. occidentalis, Acacia lasiocarpa, Allocasuarina lehmanniana, Hakea lissocarpha, Daviesia trifloraand* sedges, mat plant ,lilies andherbs	valley flats	sandy duplex	AW2	2		Suseptable to weeds
E. wandoo subsp. wandoo/ E. rudis	Ewanrudis	herb rich	Drainage lines	aluvial sands	JF1	2		Unusual Suspectable to weeds
E. wandoo subsp. pulverea low forest or woodlands over heath or scrub.	EwanNHeath	*Hakea lissocarpha, Xanthorrhoea preissii, Grevilia delta, Hypocalymma linifolium Heath or Scrub with rare E. salmonophloia& Eloxophleba*	Upper slopes	on laterite and clay loam	GS2 (8), SWA1	12		on laterite near Mt Lesueur and clay loam near Badgengarra. Strong group in PATN analysis. Many weedy sites.
E. wandoo subsp. pulverea North	EwanN	*E.loxophleba (1),* Herbs	Upland	laterite	GS2, SWA1	3		Ted's sites only, no photos, need more sites. May be old sites where shrub layer has thinned out

Community Description*	Community Code	*Main associated spp*	Topography	Soil	IBRA	No. of sites	Avon NRM	Comments
Eucalyptus capillosa Subsp capillosa (Eastern Wandoo)	**Ecap**	***With and without a shrub layer; mixed Shrubs such as Acaica acuaria, A. erinacaea, Nemcia tricuspidata,Gastropobium trilobum, Hakea lissocarpha;*** *Borya spp., Lomandra spp. and Austrostipa spp,dominate the ground cover.* ***E. loxophleba, Acacia acuminata & Allocasurina acutivalvis may occur & rare*** **Mallee s such as E erythronema, E moderata Also *Callitris canescens* occurs where the woodland is open**	Decomposing granitic breakaways	Red, white or grey sand, sandy loam, clay.	**AW, COO**	**25**	**Mostly confined**	
Eucalyptus accedens (Powderbark)	**Eacc**	***Hakea lissocarpha, Hibbertia hypericoides, Hovea chorizemifolia***	Upland Lateritic Breakaways or stony ridges	lateritic gravelly soils, clay loam	**AW,GS,JF (SWA)**	**30**	**Extends to NW and west**	**Mid-strata describes variation in this group.**
Eucalyptus accedens West	**EaccW**	*E.marginata, Dryandra armata, Hibbertia hypericoides, Petrophile divaricate, Nemcia tricuspidate,*	Breakaway, Upper slope	gravel, sandy duplex	JF1 (12) AW2	**23**		
Eucalyptus accedens North	**EaccN**	*Melaleuca uncinata* group *(Hypocalymma angustifolium, Xanthorrhoea drummondii)*	upper slope	gravely sand	GS2 (2) SWA AW2	**4**		all out of ACC not sure how different these are
Eucalyptus kondininensis (Blackbutt)	**Ekon**	***E. longicornis,Acacia merrallii, Eremophila deserti, Atriplex vesicaria, Olearia muelleri***	Salty flats, near salt lakes, seasonally waterlogged areas, rises	Clay, sandy clay, gravel, laterite, gypsum	**MAL, AW**	**31**	**Confined**	**Uncommon and localised, susceptible to increase in salinity. Need major disturbance event to regenerate.**
E. kondinensis over chenopod dwarf scrub	EkonChen	*Atriplex paludosa, A. vesicaria, Rhagodia drummondii, Lycium australe, Templetonia sulcata. Ocasional E. longicornis, E.urna and E salmonphloia.*	Usulally on satly flats and associated dunes		MAL2 (9) AW1	**14**		ID may be confused with E. yilgarnensis.
E. kondiniensis over Melaueca spp	EkonMel	*Melaleuca acuminata, M. lateriflora M. thyoides, M. pauperiflora Thickets and scrub with occasional Chenopods*	Usulally on satly flats and associated dunes		MAL2	**17**		
Eucalyptus myriadena subsp myriadena (Blackbutt)	**Emyr**	***Eucalyptus urna* and mallees *Ecalygogona, E. yilgarnensis, Rhagodia drummondii, Rhagodia preissii, Senna artemisioides,***	valley floors	Clay, often saline, sandy clay, gravelly loam over kankar	**AW, MAL (COO, GS, ESP)**	**10**	**Mostly confined small extentiosn to NW and SW**	**Poorly sampled, Extends into the GWW**

Community Description*	Community Code	*Main associated spp*	Topography	Soil	IBRA	No. of sites	Avon NRM	Comments
Eucalyptus melanoxylon (Black Morrel)	**Emel**	***E. salmonophloia, E. longicornis, Olearia muelleri, Melaleuca pauperiflora, Erempophila scoparia, Templetonia sulcata Acacaia merrallii, Atriplex vesicaria***	valley floor depressions and flats	Sand, clay loam.	**AW, MAL, COO,ESP,**	**2**	**Extends well to the east**	**poorly sampled, Rare?**
Eucalyptus salicola (Salt Salmon Gum)	**Esali**	***Rhagodia drummondii, Olearia dampieri subsp. eremicola***	Near salt lakes & salt pans on plains, low rises and dunes	Yellow or red sand, red clay, loam and calcareous soils	**AW, MAL, COO.**	**15**	**Extends to the east**	
Eucalyptus sargentii (Salt River Gum)	**Esar**	***Rhagodia drummondii, Melaleuca uncinata group, M. brevifolia***	Salt swamps & flats, along creek lines, flood plains, drainage lines.	Yellow sand, sandy clay or clay, grey loam;calcareous soils	**AW,MAL**	**5**	**Largely confined**	**Community threatened by increasing salinity and changes in hydrology. Needs further survey**
Eucalyptus astringens subsp. astringens (Brown Mallet)	**East**	***E.wandoo, Nemcia tricuspita, few herbs and grasses***	Rocky outcrops, ridges, breakaways, hills, occasionallyvalley floors	Red-brown gravelly clay, brown clayey sand, sandy loam, spongolite, laterite, sandstone	**AW,ESP, MAL, JF**	**27**	**Extends to SW**	**on isolated lateritic uplands**
E. astringins	East	*Very little or no understorey rare herbs, grasses and sedges. E wandoo often present*	Below Breakways	Gravel over clay	AW2 (2), JF1	**7**		
E. astringins over scrub	EastScrub	*scrub ovf varying hts and cover; Melaleuca uncinata group, Exocarpos aphyllus, Allocasuarina spp., Nemcia tricuspidata Other trees include E. salmonophlois E. gardneri, E. urna , E. wandoo and mallees such as*	Breakaways	clay beneath breakaway	AW2, MAL2	**12**		
E. astringins over mallee	EastMallee	*E falcata, E.phenophylla*				**2**		limited information avaialble.
E. astringins/E urna	Easturn	*Melaleuca uncinata grp*	Breakaways			**3**		Unusual sites? eastern one is an E. astringins outlier
E.astringens subsp redacta South	EastS	*E. astringens* subsp. r*edacta*	Breakaways	clay beneath breakaway	ESP 1	**2**	outside	Poorly surveyed (2 sites) southern outliers
E. astringins/E. occidentalis	Eastocc	*E.occidentalis,Ewandoo*	Valley floor		AW2	1		unique ST26 (no photo)

Community Description*	Community Code	*Main associated spp*	Topography	Soil	IBRA	No. of sites	Avon NRM	Comments
Eucalyptus argyphea (Silver Mallet)	**Earg**	***Often with no understorey or scrub of varying ht, cover and species. Occasionallly includes E astringens, E. wandoo, E.gardneri, and some Mallee spp.***	Upper slopes, Lateritic rises	Sandy clay with gravel, sandy loam, yellow sand	**AW, MAL**	**47**	**extends to SW**	**nearly bare understorey**
Eucalyptus gardneri subsp gardneri (Blue Mallet)	**Egar**	***Eucalyptus argyphea, E urna, [E. astringens subsp. astringens, E. exstensa, E. longicornis, E. recta,*** & E. wandoo and mallees ***E. drummondii, E. falcata, E. flocktoniae, E. incrassata, E. pluricaulis, & E. tenera (MF)] over Melaleuca acuminata, M. uncinata grp, Allocasuarina acutivalvis***	**Breakaways, upper lateritic ridges and slopes**	**Gravelly soils, laterite**	**AW,MAL.JF**	**7**	**Extends to the SW**	
Eucalyptus ornata (Silver Mallet)	**Eorn**	***Melaleuca laterifolia, M. pauperiflora, Allocasuarina acutivalvis***	**Ridges**	**Laterite**	**MAL**	**3**	**Confined**	
Euaclyptus spathulata (Swamp Mallet)	**Espa**	***E platypus, Melaleuca acuminata, M. paulreflora, M. thyoides, M. preissiana, M. brophyii***	**Flats, broad valley floors, saline depressions, edges salt lakes, rises**	**Grey-white sand, pale brown sandy clay over granite, saline soils**	**MAL, AW**	**6**	**Extends to the SW**	
Eucalyptus singulais (Mallet)	**Esin**	***Eucalyptus argyphea, Exocarpus aphyllus, Gastrolobium spinosum, Hakea multilineata***	**Rises**	**Shallow sand over laterite**	**MAL**	**2**	**Confined**	
Eucalyptus densa (Mallet)	**Eden**	***Santalum acuminatum, Exocarpos aphyllus Trymalium elachophyllum, Westringia cephalantha, Phebalium lepidotum***	**Lateritic ridges, flats, drainage lines**	**Clay loam, clay, sandy soils**	**MAL,ESP (AW)**	**1**	**Extends to the south and SE**	**Was E falcata**
Eucalyptus extensa (Mallet)	**Eext**	***Melalueca acuminata, M. pauperiflora, E salmonophloia***	**Sandplains, undulating areas**	**Red loam, grey sandy loam, sometimes gravelly.**	**MAL,ESP,AW**	**2**	**Extends to the south and SE**	**Tree or Mallee Wheatbelt form of E transcontinentalis which doesn't occur in the Wb (MF) Neeeds Futher survey (FloraBase)**
Eucalyptus recta (Mallet)	**Erec**	***Calothamnus aspera, Allocasuarina campestris Allocasuarina acutivalvis Acacia lasiocarpa, Alyxya buxifolia, Goodenia scapigera, Austrostipa sp.***	**Upper slopes**	**Sandy laterite**	**AW**	**1**	**Small population confined in NW**	

Community Description*	Community Code	*Main associated spp*	Topography	Soil	IBRA	No. of sites	Avon NRM	Comments
Eucalyptus urna (Merrit)	**Eurn**	***May co-occur with E. salubris E. kondininensis, E. longicornis, E. melanoxylon.****E. salmonophloia,* **, over mallee *E. cylindriflora, E. cylindrocarpa, E. extensa, E. olivina, E. phaenophylla, E. polita, E. subangusta, E. tenera, E. vittata, E. yilgarnensis, E. eremophila, E. annulata and E. phenax & E. platypus Melaleuca acuminata subsp. acuminata, Melaleuca adnata, Melaleuca lateriflora, Templetonia sulcata and chenopods***	Low in the landscape on small duces, more rarely on slopes of low rises.	Reddish brown alkaline sandy loams to soft, grey clay-loams over limestone(MF)	**MAL. AW, COO**	**22**	**extends to south east of ACC**	**Ususally ocurs over Melaleuca spp but may also with mallee or over Acacia scrub. Mallet form of E flocktoniae**
***Eucalyptus occidentlis* (Flat Topped Yate)**	**Eocc**	***Melaleuca strobophylla, M. cuticularis,***	Alluvial flats, low-lying wet areas, around salt lakes, hills	Sandy or clayey soils	**ESP, MAL,AW**	**74**	**Mostly to the south**	**Threatened by salinity, weeds, grazing, changed hydrology. Regenerates after winter rains. Priority Beard Veg Assoc.**
E.occidentalis West	EoccW	*Melaleuca viminea, M. rhaphiophylla, Baumaea articulata,*	bottom creeks and swamps	clay beneath breakaway	AW2, ESP1, JF2	8	out	no further investigations will be done as part of this project
E.occidentalis West (Dry)	EoccWDry	*E. wandoo,E. loxophleba , E decipiens, Acacia acuminata*				4	out	no further investigations will be done as part of this project
E.occidentalis Southern Wheatbelt	EoccSWb	*Melaleuca strobophylla, M.laterita, M. uncintata* group*, Olearia dampieri subsp eremicola*	bottom saline and freshwater basins		MAL2 (18), ESP1, AW2	20	Mostly in	an interesting group in need of further investigation. Yate & Mel. strobophylla recognised by DECas being under immediate threat from salinitaion. Mesembry (2 sites)
E.occidentalis Southern Wheatbelt (dry)	EoccSWbDry	*E. salmonpohloia, Melaeuca acuminata*	mid slopes		MAL2	2	all in	identified by Nathan McQuoid as an relictual community
South Coast E.occidentalis	EoccSCst	*Melaleuca cuticularis, Acacia cyclops*	Drainage lines		ESP2 (7), MAL1 (3)	26	All outside	no further investigations will be done as part of this project
South Coast E.occidentalis (Dry)	EoccSCstDry	*no Melaleuca spp. Baumea sp*	plain		ESP1	**1**	Outside	further investigations needed [?delete}

Community Description*	Community Code	*Main associated spp*	Topography	Soil	IBRA	No. of sites	Avon NRM	Comments
Eucalytpus rudis (Flooded Gum)	**Erud**	***Acacia acuminata, Allocasuarina huegeliana, Melaleuca viminea, Lepidosperma aff. tenue, Borya nitida***	**Wetter parts of south-western WA, flats, drainagelines, hillsides**	**Sandy or loam soils**	**JF,SWA,AW,WAR**	**2**	**Mostly to the SW**	**HM considers this an extinct community in the Wheatbelt due to clearing, cropping, additional nutients resulting in weed dominated understorey. Is Elox heading down that path?)**
Eucalyptus marginata (Jarrah)	**Emar**	***E. accedens, Dryandra nobilis, Hibbertia commutata* (check Tutanning and Jilakin Rock)**	**Rises, hillslopes (near Granite Rocks)**	**Grey sand, clay loam, laterite.**	**JF ,WAR, SWA, GS,ESP, AW (MAL)**	**2**	**All to the west 2 eastern outliers**	**Outlieing population near Jilakin rock may be natural or transported by Aboriginals.**
Eucalyptus moderata	**Emod**	***E. capilosa, E. subangustata E erythronema,Westringia cephalantha, Melaleuca hamulosa, M. undulata.***	**Flat sites or sites high in landscape, slopes, hillsides**	**Red sand to loam, laterite, granite**	**AW, COO,GS**	**6**	**Extends to the NW and NE**	
Euaclyptus yilgarnensis (Yorrell)	**Eyil**	***Acacia colletioides, Melaeuca hamulosa, Mcymbifolis, Grevilea acuaria, Atriplex paludosa. Rare E. Salomonophloia, E salubris,***	**Sandplains & rises.**	**Undulating plains, slopes**	**AW, MAL, COO MUR**	**5**	**Extends well into the NE**	**Was E gracilis**
OTHERS		* Shaded = Communities, unshaded = Sub communities						

2.8 Discussion

This draft floristic classification is an attempt to define communities according to a hierarchy of information attributes.

1. The 28 major groups are based on the common Eucalypt species. The mallets will be grouped together in the final descriptions reducing the list to 20.
2. The sub communities are defined by a range of noticeable attributes including occurrence of other Eucalypts, common associated species (e.g. Jam), understorey structure (scrub, herbs), proximity to granite rocks, salt lakes or geographical location (e.g. North). There may be more than one classification to which a community can be allocated and this is highlighted by common features mentioned in the community descriptions.
3. Several communities e.g. *E. longicornis* and *E. loxophleba* have been subdivided further to explore the range of communities that are present and to investigate whether the process will help identify and better describe potential Threatened Ecological Communities.
4. Other communities could be further subdivided many times according to the attributes mentioned previously but with the limited amount of sites and information it was decided not to proceed too far down this track as it would yield sub-communites base on few sites and produce an unmanageable number of options.
5. Many of the communities occurred on a range of soils and landforms. This may be more a reflection of the initial focus on floristics, (particularly for the dominant Eucalypts) or the different approaches to sampling underlying soil data. Improved soil mapping would help more accurately ascertain soil preferences of each community (if they exist) through a more informed stratification of soil sampling.

Very limited sampling (15 sites) was obtained from the uncleared part of the Avon where it intersects with the Great Western Woodlands therefore it is not possible to ascertain whether a Wheatbelt community is similar or different in the GWW. To answer this further sampling is needed of *E. longicornis, E. salmonophloia, E. salubris, E. melanoxylon, E. salicola, E. moderata (transcontinentalis*) and *E. yilgarnensis.*

In response to a preliminary version of the woodland classification presented at a workshop on Baseline vegetation projects? And individual consultation feed back, was Helena Mills, Chris Curnow, Mike Griffiths and Phil Lewis Jenny Borger (WWF).
Greg Keighery (DEC Science). Brett Beecham, Peter White (DEC Narrogin Region), Ken Wallace & Penny Hussey (Nat cons DEC); Mike Hislop, (Herbarium). Suzanne Prober CSIRO Ted Griffin (WA DAFF), Nathan McQuoid, Anne Coates Gil Craig (Consultants who work in the Wheatbelt) and Malcolm French amateur 'Eucalyptologist'

Still to do;
Comparisons with

1. Teds groups,
2. SAP assemblages
3. Greg's table
4. Beards mapping SAP quadrat classification showed poor correlation with Beards mapping indication a poor match between composition and life form (?structure)

25 assemblages defined from the species classification of (removing taxa recorded from les than 5 quadrats) showed significant geographical partitioning across the study are and could be described in term of soils and principle taxa.

2.9 Future outputs

A description (~5 pages) of each of the major species and the mallet groups is being prepared based on a database report generated from the classification plus other ecological information obtained from other references and experts. This will help gain an understanding of the ecology of the species and what might contribute to a general benchmark description of the community. These will then be condensed into 2 page fact sheets along the line of those produced in Victoria and Tasmania.

Drafts of E wandoo and E loxophleba are attached as examples.

2.10 Future field work

Field work
Visiting reference sites to collecting additional field data using field data sheets developed

GWW sample this Eucalypts that occur in the Wheatbelt to ascertain if the communities are similar of different. There will be regional variations in the understorey due to climatic and soil differences

3. DEFINITIONS

Woodland

Woodlands are defined as a combination of composition and structure. The species commonly recognised as Wheatbelt woodlands species rather that forest species LIST (with the exception of Wandoo which occurs in the forest and in the Wheatbelt)
Structurally woodlands contain trees with projected foliage cover of between 10 and 30%, ie crowns not touching ~ 5 – 20 trees per hectare. But many of the above species also occur in denser stands projected foliage cover of between 30 and 70% (strictly speaking a forest).

Community

An [plant] ecological community has been defined in WA as naturally occurring biological [plant] assemblage (group of plants) that occurs in a particular type of habitat. Community structure is defined as follows: "The spatial organisation, construction and arrangement of the biological elements comprising a biological assemblage" (eg. *Eucalyptus salmonophloia* woodland over scattered small shrubs over dense herbs. (DEC2007). It is noted that the scale at which ecological communities are defined will often depend on the level of detail in the information source; therefore no particular scale is specified.

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5. APPENDICIES

5.1 Wheatbelt Vegetation types after Keighery

ID	VEGETATION
1	**(1) Eucalyptus kondininensis over Melaleuca**
2	(a) Tall closed Forest over Tall Melaleuca Shrublands
3	(b) Tall closed Forest over Open Melaleuca Shrublands
4	(c) over Templetonia or Acacia Shrublands
5	**(2) Eucalyptus occidentalis over Melaleuca**
6	(a) Tall closed Forest over Melaleuca Low Woodland
7	(b) Tall Forest
8	(c) Low Forest
9	(d) Woodland
10	(e) Woodland over thicket (Mel)
11	(f) Low Woodland
12	**(3) Eucalyptus occidentalis/E. rudis**
13	(a) Tall Woodland
14	(b) Woodland
15	(c) E. occidentalis/E. rudis/Melaleuca preissiana
16	**(4) Eucalyptus wandoo/E. occidentalis Woodland**
17	(a) Tall Woodland
18	(b) Open Tall Woodland
19	(c) Woodland
20	**(5) (a) E. wandoo/E. occidentalis/E. marginata**
21	(b) E occidentalis/E. rudis/E. wandoo
22	(c) E. wandoo/E. decipiens/E. occidentalis
23	(d) E. occidentalis/E. decipiens/E. rudis
24	(f) E. calophylla/E. wandoo/E. decipiens/E. occidentalis
25	(g) E. wandoo/E. marginata/E. decipiens
26	(h) E. wandoo - E. marginata
27	(i) E. wandoo – calophylla
28	(k) E. wandoo – Melaleuca preissiana
29	(l) E. wandoo – E. calophylla - Melaleuca preissiana
30	**(6) Eucalyptus wandoo/E. occidentalis/E. decipiens Woodland**
31	(a) Tree Mallee
32	(b) Tall Woodland
33	**(7) Eucalyptus rudis Woodland**
34	(a) E. rudis over Melaleuca preissiana Woodland
35	(b) E. rudis over Melaleuca viminea over sedges
36	(c) E. rudis over Melaleuca rhaphophylla
37	(d) E. rudis Woodland with open understorey
39	(f) E. rudis/E. decipiens

ID	VEGETATION
40	**(8) Eucalyptus kondininensis – E. salmonophloia**
41	**(9) Eucalyptus rudis/E. wandoo**
42	(a) Open Tall Woodland
43	(b) Woodland
44	(c) Open Woodland
45	**(10) Eucalyptus salmonophloia**
46	(a) E. salmonophloia over Acacia acuminata
47	(b) E. salmonophloia (Lake dune) Woodland
48	(c) E. salmonophloia/E. salubris
49	(d) E. salmonophloia/E. wandoo
50	(e) E. salmonophloia/E. salubris/E. loxophleba
51	(f) E. salmonophloia/E. loxophleba
52	(g) E. salmonophloia over heath/shrubs
53	(h) E. salmonophloia/E. longicornis
54	(i) E. salmonophloia over Gahnia trifida
55	(j) E. salmonophloia over samphire
56	(k) E. salmonophloia over Tree Mallee
57	(l) E. salmonophloia/E. yilgarnensis over Melaleuca spp Thicket
58	(m) E. salmonophloia over Melaleuca spp
59	(n) E. salmonophloia/E. wandoo/E. salubris/E. loxophleba
60	(o) E. salmonophloia/E. capillosa/E. loxophleba
61	(p) E. salmonophloia over mallee
62	**(11) Eucalyptus longicornis**
63	(a) Low Forest
64	(b) E. longicornis/E. astringens
65	(c) E. longicornis/E. wandoo
66	(d) Woodland over Melaleuca
67	(e) E. longicornis/E. wandoo/E. salmonophloia
68	**(12) Eucalyptus wandoo**
69	(a) over Low sedges
70	(b) over Allocasuarina campestris Thicket
71	(c) over Melaleuca undulata
72	(d) E. wandoo/E. decipiens
73	(e) E. wandoo/E. loxophleba
74	(f) E. wandoo/E. marginata
75	(g) E. wandoo/Melaleuca uncinata
76	(h) over Heath
77	(i) over Gastrolobium microcarpus
78	(j) E. wandoo/E. calophylla
79	(k) E. wandoo – Acacia acuminata
80	(l) over Oxylobium parviflorum
81	(m) over Allocasuarina huegeliana
82	(n) over Melaleuca radula
83	(o) over mixed Melaleuca
84	(p) over Low Acacia/Calytrix
85	**(13) Eucalyptus loxophleba woodland**
86	(a) over Acacia acuminata
87	(b) mixed E. loxophleba/E. wandoo/E. salmonophloia
88	(c) E. loxophleba/E. spathulata, no understorey
89	(d) over Melaleuca
90	(e) over Dense Herbs, Grasses etc
91	(f) over Acacia microbotrya
92	(g) with Allocasuarina obesa
93	(h) over Shrubland or Heath
94	(i) over Acacia nyssophila Tall Shrubland
95	**(14) Eucalyptus capillosa Open Forest – Open Woodland**
96	(a) combinations with E. transcontinentalis
97	(b) combinations with E. loxophleba
98	(c) combinations with E. salmonophloia

ID	VEGETATION
99	(d) over Heath
100	(e) combinations with E. salmonophloia on Break ways
102	**(15) Eucalyptus astringens**
103	(a) E. astringens/E. accedens
104	**(16) Eucalyptus perangusta over Tall Sparse Shrubland**
105	**(17) E. urna**
106	(a) E. urna/E. salmonophloia/E. phenax over Melaleuca
107	(b) over Melaleuca Shrubland
109	**(18) Eucalyptus marginata**
111	(b) E. marginata – E. calophylla
112	(c) E. marginata – Dryandra
113	(d) E. marginata/E. falcata
114	(e) E. marginata/E. wandoo
115	(f) over Laterite Heath
116	(g) over Allocasuarina fraseriana
118	**(19) Eucalyptus calophylla**
119	(a) E. calophylla – E. marginata
120	(b) E. calophylla – E. wandoo
121	(c) E. calophylla – E. rudis
123	(e) E. calophylla/E. decipiens
124	(f) E. calophylla/E. accedens
126	**(20) Acacia acuminata**
127	(a) scattered E. loxophleba
128	(b) over Allocasuarina huegeliana
129	**(21) Eucalyptus salubris (Breakaways)**
130	(a) over Melaleuca Open Scrub
131	(b) over Senna nemophila
132	(c) over mallee
133	(d) over Dwarf Scrub
134	(e) E. salubris/E. loxophleba Woodland
135	(f) E. salubris/ E. transcontinentalis
136	(g) E. salubris/E. gracilis Low Woodland over Melaleuca Shrubland
137	(h) over Atriplex stipitate Low Shrubland
138	**(22) Allocasuarina Huegeliana**
139	(a) Allocasuarina Huegeliana/Acacia acuminata/E. wandoo
140	(b) Acacia lasiocalyx
141	(c) Forest, no understorey
142	(d) - E. wandoo/Allocasuarina huegeliana
143	(e) Allocasuarina huegeliana/E. loxophleba
144	/Allocasuarina campestris –
145	(f) Allocasuarina huegeliana/Banksia prionotes
146	(g) with scattered wandoo
147	**(23) Acacia lasiocalyx – Dense Low Forest or Low Forest**
148	**(24) Casuarina obesa**
149	(a) over Melaleuca strobophylla
150	(b) over Melaleuca cymbifolia High Shrubland
151	(c) over samphires
152	**(25) Banksia attenuata low woodland**
153	(a) B. attenuata/B. prionotes/Allocasuarina huegeliana
154	(b) B. attenuata/E. todtiana/B. menziesii over Low Scrub
156	**(26) Eucalyptus platypus Forest /Woodland**
158	**(27) Banksia prionotes low woodland**
159	(a) Forest
160	(b) Woodland over Heath
161	(c) with Allocasuarina huegeliana
162	(d) with Xylomelum over sedges
163	(e) Xylomelum/Banksia
167	**(29) Melaleuca Forests/Woodlands**
168	(a) M. cuticularis

ID	VEGETATION
169	(b) M. rhaphiophylla
170	(c) M. preissiana over Thicket
172	**(30) Eucalyptus decipiens**
173	(a) E. decipiens/Banksia attenuata/B. prionotes
174	**(31) Eucalyptus suggrandis ssp alipes over Tall Sparse Shrubland**
175	**(32) Eucalyptus transcontinentalis complex**
176	**(33) Allocasuarina fraseriana**
181	**(35) Allocasuarina huegeliana woodland**
182	**(36) Eucalyptus accedens woodland**
183	(a) Lateritic Plateau (mixed with E. calophylla/E. marginata/E. wandoo)
184	(b) over Heath (Dryandra Thicket)
185	(c) open Low Heath
186	**(37) Eucalyptus gardneri woodland**
188	**(39) Eucalyptus falcate**
189	(a) E. falcata/E. gardneri
190	(b) E. falcata/E. gardneri/E. astringens
191	**(40) Eucalyptus annulata Low Open Forest**
192	(a) over Tall Shrubland Melaleuca acuminata
193	**(41) Eucalyptus flocktoniae woodland**
194	**(42) Acacia rostellifera Forest**
196	**(44) Eucalyptus gracilis (?mallee) woodland**
198	**(46) Eucalyptus leptocalyx Low Woodland**
199	(a) over Low Open Scrub
201	**(48) Callitris glaucophylla Low Woodland**
202	(a) over Melaleuca/Acacia/Allocasuarina Low Shrubland
203	**(49) Banksia menziesii**
204	(a) Xylomelum angustifolia over mixed Scrub and Dwarf Scrub
205	**(50) Eucalyptus incrassata Woodland**
206	**(51) Eucalyptus densa Woodland**
207	**(52) Eucalyptus spathulata Open Low Woodland**
209	**(53) Callitris columellaris Low Forest**
210	**(54) Eucalyptus myriadena woodland**
220	**(2) Eucalyptus eremophila**
221	a. very Open over Melaleuca Scrubland
223	c. over Melaleuca uncinata Open Shrubland
224	d. E. calycogona/E. pileata Tall Open Mallee Woodland over Melaleuca
225	e. E. pileata/E. flocktoniae over Tall Shrubland
227	**(3) Eucalyptus ?sporadica (occidentalis)**
228	a. Tree Mallee over Melaleuca
229	b. Shrub Mallee over Melaleuca
230	**(4) Eucalyptus transcontinentalis (Complex)**
232	b. with E. eremophila over Melaleuca
233	c. with E. redunca complex over Scrub
234	d. E. scyphocalyx over Melaleuca spp Heath
235	e. E. conglobata/E. spp over Melaleuca spp over Heath
236	f. E. redunca/E. calycogona/E. eremophila
251	**(7) Eucalyptus incrassata**
252	a. E. incrassata – Banksia media Scrub over Low Heath
253	b. E. pluricaulis ssp pluricaulis
256	**(8) Eucalyptus leptocalyx**
257	a. over Dwarf Scrub and Low Grass
259	c. E. gracilis over Melaleuca over Heath
266	**(10) Eucalyptus platypus**
267	a. E. transcontinentalis over Melaleuca Heath/Scrub
268	b. E. annulata, E. transcontinentalis over Melaleuca Thicket over Heath
269	c. over Dwarf Scrub
270	d. over Melaleuca spp Heath
271	**(11) Eucalyptus scyphocalyx**
272	a. E. transcontinentalis/E. spp over Heath

ID	VEGETATION
275	d. E. eremophila/E. flocktoniae over Tall Open Shrubland
279	**(14) Eucalyptus conglobata**
281	b. E. eremophila
282	c. over Melaleuca Scrub over Heath
288	**(17) Eucalyptus erythronema**
289	a. E. myriadena/E. redunca/E. eremophila/E. transcontinentalis over scattered Shrubs
291	c. with E. yilgarnensis
292	d. over Melaleuca acuminata/M. adnata Thicket
309	**(21) Eucalyptus burracoppinensis**
310	a. – Allocasuarina campestris Heath
311	b. – Heath
314	**(23) Eucalyptus suggrandis ssp alipes**
315	a. Mallee Forest, E. calycogona over Tall Melaleuca
316	b. Mallee Forest, E. calycogona, E phenax, E. perangusta over Tall Melaleuca
317	**(24) Eucalyptus phenax**
318	a. Tall Open Mallee, E. suggrandis/E. perangusta over Tall Melaleuca
319	b. Tall Open Mallee, E. perangusta/E. scyphocalyx over Tall Melaleuca
320	c. Tall Open Mallee, E. perangusta /E. sporadica over Tall Melaleuca
321	**(25) Eucalyptus phaenophylla**
322	a. – over Tall Melaleuca Shrubland
323	b. – E. leptophylla/E. conglobata
324	c. – E. aff. occidentalis
325	**(26) Eucalyptus sheathiana**
326	a. over Melaleuca acuminata
327	**(27) Eucalyptus calycogona**
328	a. – E. sheathiana over Melaleuca uncinata
329	b. Tree Mallee – E. calycogona/E. densa – no understorey
330	c. – E. conglobata/E. sargentii over Low Heath
331	d. – E eremophila/E. sheathiana/E. transcontinentalis with scattered E. capillosa
333	f. Shrub Mallee – E calycogona/E. eremophila – no understorey
334	g. over Phebalium tuberculosum
335	**(28) Eucalyptus celastroides**
336	a. – E. eremophila/E. spathulata/E. flocktoniae over Heath
337	**(29) Mixed Mallee**
338	a. – E. brachycorys/E. erythronema marginata/E. flocktoniae/E. oldfieldii/E. pluricaulis and E. tenera
339	b. E. transcontinentalis/E. subangusta over Allocasuarina acutivalvis
340	c. Eucalyptus Scrub Mall and Melaleuca nesophila Heath over Low Heath
341	d. E. flocktoniae/E. eremophila/E. conglobata/E. pluricaulis
342	**(30) Eucalyptus tenera**
343	a. – E. erythronema ssp marginata
344	**(31) Eucalyptus oldfieldii**
345	a. – E. flocktoniae
346	**(32) Eucalyptus rigidula**
348	**(33) Eucalyptus capillosa ssp polyclada**
349	a. – over Tall Melaleuca Shrubland
350	**(34) Eucalyptus flocktoniae**
351	a. – E. phenax over Melaleuca Tall Shrubland
353	c. – E. incrassata or E. conglobata
354	d. over Heath
372	**(43) Eucalyptus subangusta ssp subangusta**
373	a. – over Allocasuarina campestris Heath
374	**(44) Eucalyptus pileata (Very Tall Open Mallee Forest)**
376	**(45) Eucalyptus falcata**
381	**(48) Eucalyptus hypochlamydea**
383	**(49) Eucalyptus brachycorys**
384	a. – with E. hypochlamydea (E. comitae-vallis) over Melaleuca uncinata
387	**(51) Eucalyptus annulata**
388	**(52) Eucalyptus decipiens**

ID	VEGETATION
393	**(1) Tamma**
394	a. Acacia acuminata – Allocasuarina – Melaleuca spp
395	b. mixed Dense Low Heath with emergent Tamma
396	c. Tamma/Hakea subsulcata over Dryandra/Melaleuca Low heath
397	d. over Borya nitida
398	e. over Ecdeicolea Open Low Sedges
403	**(4) Allocasuarina acutivalvis**
404	a. over Melaleuca spp
405	b. over Proteaceae (Hakea scoparia/H. francisiana), Melaleuca uncinata
407	d. over Melaleuca uncinata
408	**(5) Melaleuca**
409	a. – Melaleuca uncinata
410	b. Hakea erecta
411	c. Melaleuca viminea
412	d. Melaleuca lateriflora + M. uncinata
413	e. Melaleuca thyoides with Casuarinas and Samphires
414	f. Melaleuca hamulosa/Cal phoen etc
417	i. Melaleuca acuminata over shalLow swamp
420	**(6) Acacia**
422	b. Acacia acuminata and Melaleuca uncinata
425	e. Acacia multispicata with no understorey or Melaleuca
430	**(8) Actinostrobus/Banksia Scrub Heath**
431	a. Banksia/Xylomelon
434	**(10) Leptospermum erubescens**
435	a. Very Open Tall
436	**(11) Hakea varia – Scrub (Open)**
438	**(1) Baumea articulata**
439	a. Tall Sedgeland

5.2 SAP classification

5.3 Appendix 3 Woodland Community Descriptions

1. Wandoo

Eucalyptus wandoo Blakely subsp*. wandoo*

Identification

Tree to 25m with non powdery bark that is pale yellow when fresh, ageing to while or grey and branchlets not glaucous: juvenile leaves up to 10 x 7 cm. Flowers December to May. Differs from sbsp pulvera in the absence of powder bark, its consistently yellow new bark, its smaller seedling leaves and it non-glaucous branchlets. (Brooker & Hopper 1991). Leaves are dull greyish green, buds horn-shaped and flowers cream (Hussey 1999)

Soils and Landforms

Gravely loams on sloping sides of valleys in the west (Bamford 1995) and lower slopes/valley floors especially in the eastern part of its range where it searches out extra moisture. Preferred soils are predominately fine textured in undulating terrain. (Brooker & Hopper 1991) Wandoo typically grows on dark brown loamy sands or sandy loams. Usually clay occurs at depth, and in valleys the soil may be clay loam (Hussey 1999). A biotic crust layer may consist of lichens, moss and other 'biological material'.

Yates et al (2000) intersected Beards vegetation units with McArthur soils and conclude that wandoo mainly occurrs on Yellow duplex soil but also on Yellow earth red earth and Red duplex soil.

Distribution/IBRA Subregions

Darling Range and adjacent foothills and coastal plain from Gingin and Bindi Bindi southwards towards Donny brook and south east through the western part of the Wheatbelt to the Stirling Range and Pallinup River Western Wheatbelt (Brooker & Hopper 1991)
Avon
JF1 (48), AW2 (13), JF2 (7), AW1 (1); ESP1 (1), GS2 (1), MAL2 (1), SWA1 (1)

Community Description

Typically wandoo occurs as more or less pure stands forming an open forest. The understorey is usually open heath (Brooker & Hopper 1991). Hussey (1999) states that it may form a pure stand but often grows with other tree species. Broad areas mapped as wandoo woodlands by John Beard (swan sheet) contain patches of thickets, heath, granite rocks, creeklines or stands of mallet.

Upperstorey

Just west of the Wheatbelt Wandoo associates with Corymbia calophylla Marri and E. marginata Jarrah and E accedens on sloping sides of valleys. In the centre of the Wheatbelt it is found with Allocasuarina huegeliana and E. loxophleba (York Gum gum) E.salmonophloia (Salmon Gum) and the Mallets E.astringins, E gardnerii and E. argyphae. In the south and south east of its extent it occurs with E.occidentalis (Flat topped Yate and *E. rudis* (Flooded Gum) along valley flats and drainage lines (Hussey 1999).

Understorey; Medium and Ground

In the west on more gravely soils the species rich heath includes Hakea lissocarpha Dryandra sessilis, Hibbertia commutata, H. hypericoiodes Bossiaea eriocarpa, Xanthorrhoea drummondii, Trymalium ledifolium, Allocasuarina humilis, Acacia pulchella Hakea varia, Hypocalymma angustifolium, Petrophile squamata. Common tall shrub species on sandy loams in the central and eastern Wheatbelt Acacia accuminata, Allocasuarina huegelianna, A. campestris and

Melaleuca uncinata group. Lower shrubs may be Acacia. lasiocalyx, Gastrolobium parviflorum, G. trilobum Calothamnus quadrifidus, Melaleuca coronicarpa, M. acuminata,. Allocasuarina microstachya. While ground cover may be dominated by Dampiera lindleyi, D. juncea, Borya spp, loxocarya spp

Sub community descriptions

The analysis of 1200 sites across the Wheatbelt (Harvey part 1) revealed that Wandoo over heath is common in the west (37), southwest (10) and North (5) of its distribution. To the east it may be found over a rich herb and grass ground layer (6). Also occurs with Jam *Acacia acuminata* (7 sites), Allocasuarina spp(5 sites), Powderbark Wandoo E. accedens (4), Melaleuca thickets (4), York gum E. loxophleba (1), E. rudis (1) and E. occidentalis (1)

Wandoo over heath

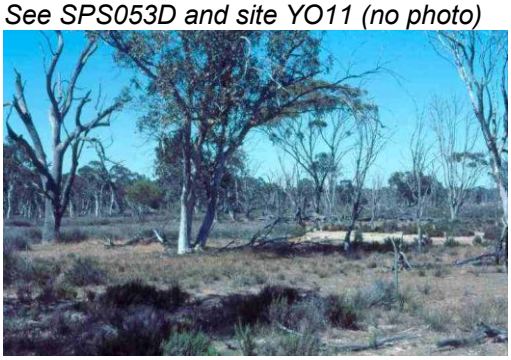
Although this is the most common sub community it demonstrated a wide range of floristic and structural diversity (cover and height). The shrub layer tends to be thicker, taller and more divers in the higher rainfall areas to the west becoming lower and sparser as the rainfall decreases (Hussey 1999). Species include *Hakea lissocarpha*, *Dryandra sessilis, Hibbertia commutata, H.hypericoiodes Bossiaea eriocarpa*, *Xanthorrhoea drummondii, Trymalium ledifolium, Allocasuarina humilis, Acacia pulchella Hakea varia, Hypocalymma angustifolium, Meeboldina coangustata, Petrophile squamata*

Wandoo over a rich herb and grass ground layer .
These can be further divided into winter wet flats and dry (long unburnt areas). The wet areas, where the drainage is poor support a wide range of mat plants e.g. Borya, grasses sedges, reed, geophytes such as orchids and lilies, grasses and annuals. At threat from salinity

TU

Wandoo in saline areas.

These may have been winter wet flats which become saline after adjacent land was cleared. Flora is reduced to salt tolerant species and the trees eventually die. This is not a natural state but is included to demonstrate a major threat to the fragmented woodlands of the Wheatbelt. See SPS053D and site YO11 (no photo)



Wandoo over scrub

This community may be an earlier post fire regenerative stage if the wandoo over rich herb and grass ground layer. Common shrubs include Gastrolobium parviflorum, Acacia lasiocarpa and Olearia muelleri. This community may also be influence by adjacent shrublands and include Allocasuarina campestris, A. acutuvalvis and Melaleuca uncinate group. Scattered Acacai acuminata or Allocasuarina huegeliana are common

Wandoo and Rock Sheoak

There are sites where Allocasuarina huegeliana (Rock sheoak) is co dominant with the E. wandoo or occurs as a significant low tree component. These may be adjacent to pure Allocasurina woodlands and have been considered as invading the Wandoo woodland (Bamford1995). Scrub species are variable and may include Gastrolobium parviflorum, Calothamnus quadrifidus, A. lasiocarpa, Dryandra sessilis, Hakea lissocarpha, H pertiolaris, Dampiera lindleyi, D. juncea, Borya sphaerocephala, Lepidosperma viscidum, L. resinosum. Melaleuca resinosum, Eucalyptus salmonophloia, E astringens]

Wandoo with Tammar or Melaleuca sp

Wandoo woodlands may intergrade with tamma thickets which are characterised by Allocasuarina campestris, and Melaleuca uncinata group. Other species include Leptospermum erubescens, Acacia acumintata, and Gastrolobium parviflorum

Wandoo and Jam

E wandoo may occur as am emergent over Acacia acuminata thickets or as woodland over A acuminata open scrub. Understorey may be scattered shrubs such as Hakea lissocarpha or over a ground cover over low sedge and rushes Lepidosperma spp, Desmocladus spp., and Harperia lateritiflora.

Wandoo and Salmon Gum
E wandoo often occurs as a lower tree layer under emergent *E salmonophloia* on loams on upper slopes in the western Wheatbelt and on the mid to lower slopes to the east. Understorey is varies and may include *Acacia acumintata*, *Allocasuarina campestris* over *Acacia erinacea*, occasional mallee such as *E. sheatheana* and *E. conglobata*. Ground cover is mainly grassy. This community and *E. salmonophloia* and *E. capillosa* (Inland Wandoo) are regards as one of the few grassy woodlands in Western Australia. (Matiskke 1995) (see also Salmon Gum and Wandoo)

Wandoo and York Gum
The Eucalyptus wandoo/ E loxophleba subsp loxophleba association is recognised By Hussey (1999), Banford 91995 and Yates et al (2000). Occasionally *Acacia acuminata* is present over a variable understorey which includes *Acacia merrallii*, *A. lasiocarpha*, *A. leptospermoides*, and *Melaleuca adnata* over grasses

Wandoo and Powderbark wandoo
In the west and north west of its range E. wandoo may occur with E accedens (Powderbark Wandoo). These species are very similar and maily distinguished by the powdering coating on E accedens. The occur together the lateritic (gravely) soils preferred by E accedens grade into the valley slopes where the Wandoo grow (Banford 1995, Hussey 2003) Understorey species include Gastrolobium microcarpum, Dryandra sessilis, Acacia lasiocarpa, and Hibbertia hyperricoides.

Wandoo and flooded gum or Yate
These are considered unusual communities ((GJK pers com) occurring in the south and south east of the main extent of E wandoo woodlands in the Wheatbelt. It occurs with *E rudis* in drainage lines in the east (McQuoid in prep) near the most easterly occurrence of both species. More centrally it may be joined by *Acacia acuminata* on lowland flats and *Hakea varia*, *Hypocalymma angustifolium, Dodonaea pinifolia* along creekline in more dissected landforms to the west. To the south *E. occidentalis* (Yate) is found to co occur with *E. wandoo* as an open woodland over *Allocasuarina lehmanniana Hakea lissocarpha*, *Daviesia triflora* or *Acacia lasiocarpha* on lowland flats. The ground layer may include Borya sphaerocephala, *Chamaexeros serra, Mesomelaena preissii, Harperia lateriflora* and *Dianella brevicaulis*

Outlier(s)

There is a distinct outlier on Twine Reserves, a granite rock 50 km east of Narembeen some 120 km to the east of the major occurrence. This has glossy leaves within the canopy and may warrant taxonomic recognition. This population is probably as relict from wetter times when the distribution of *E. wandoo* extended continuously to the eastern Wheatbelt. It is favoured here by the increased run-off from the granite rock. Two other outliers are east of Muntadgin also near the base of a granite rock and northeast of Wyalkatchem [more info](McQuoid in prep)

Recruitment

Continuous recruitment resulting in multi aged stands. Seedlings and young plant of other species should be present in excellent condition wandoo woodland.

Wandoo strongly regenerates from seed although it can resprout from epicormic buds and root bases (McQuoid in prep)

Under natural conditions, wandoo usually only germinates satisfactorily on an ashbed formed when a log or pile of branches burns out. A whole cluster of seedlings come up and gradually thin out over time giving the woodlands a clumped appearance. (Hussey 1999). It generally takes at least 3 years for the young plants to produce a crop of seed and good seed set may only occur once every three years. The seed is generally shed while the fruit is in the crown and fruits of several ages may be held on the tree. A heavy fall of seed may occur after a mild ground fire and seed may be burnt by a hot crown fire. Drought may also cause seed release. (Hussey (1999)

Successional stages

It has bee observed by Hussey (1999) and others that after fire the wandoo woodlands tend to contain a lot of shrubs which over time ? years thin out, reduce in height and are joined by more perennial sedges, grasses, annual and mat plants. Some species are long lived and present most of the time while others may be common only for certain period after a disturbance. But these species will still be present often as seeds in the soil. Plant competition around the base of the trees is reduced by certain chemicals produced by the Wandoo

Old growth/tree health

Up to 1.4m (Hussey 1999) JH recorded 0.8 m at Tutanning. Hollows are created by a combination of fire, insect (termite) activity fungi and drought. Hussey (1999) noted on average it takes 150 – 180 years fro hollow to develop although a hollow in a 100 year old tree was recorded. Many birds, reptiles, mammals and insects use the hollows, bark and canopy of the wandoo (See Hussey 1999 for more details)

Wandoo does not appear to be susceptible to the dieback fungus (*Phytophthora cinnamomi*). It is however susceptible to honey fungus (*Armillaria luteobubalina*). Wandoos may dieback from the crown due to the mechanical damage of aerial canker fungi or insect attack.

Organic litter

Common litter of leaves and twigs (Hussey 1999)

Fauna

The health of the Wandoo woodlands relies on animal diggings to speed up decomposition, create germination sites and recycle nutrients. Fungi are an important component of the system and require the presence of fauna to disperse the spores. The Shrub layer provides important shelter and food for a range of fauna. Termite mounds are common

Logs

Large logs often with hollows are often present in a typical Wandoo woodland.

Weediness

Open Wandoo woodlands in the west have been invaded by South African bulbs (Moraea fugax, collina and flaccida, Hesperantha and Sparaxis). Fewer weeds in the east of non invasive nature e.g. *Ursinia anthemoides*

Grazing

Poison bushes common in the understorey meant farmer kept stock out of uncleared woodland patches. If these were not present then grasses, saltbush and geophytes would have been severely impacted, other life forms grazed and most recruitment inhibited. Increased weeds would follow. Trampling would destroy the often present biotic crust layer

Fire

As mentioned previously fire is an important stimulus to the regeneration of Wandoo with strong germination occurring in ashbeds (soil heated intensely by burning logs) on the valley floors an occasionally on less intensely burnt ground on the gravely mid slopes. Seedlings on ashbeds exhibited superior growth and lower mortality than those growing off the ashbed. (Burrows et al 1990)

Management history

The very hard timber was favoured for flooring, fence posts, railway sleepers and decking (Bamford 1995)

Benchmark Description Summary

Intact site, all expected plant life forms, diversity of species present,
All expected Upper mid and lower/ground stratum
E. wandoo in multi aged stands, seedling or young plants and large old trees with hollows present
Native seedlings and young plants in appropriate sites show regeneration is occurring (Hussey 1999)
Little or no history of stock grazing
Few weeds, or along edges only
Little or no disturbance (e.g. tracks)
Evidence of native fauna activity

Reference sites

Tutanning
Brookton Hwy 51 km west of Brookton (western)

Conservation status

Widespread and abundant. Well represented in Conservation reserves (Brooker & Hopper 1991)

Vegetation Association	Vegetation description	Pre-European Extent	Current Extent	% Remaining	% Remaining in AW1	% Remaining in AW2
5	Medium woodland; wandoo & powderbark (Eucalytpus accedens)	51,733.89	23,119.83	44.69		46.17
946	Medium woodland; wandoo	54,965.69	12,922.91	23.51	22.03	11.72
1023	Medium woodland; York gum, wandoo & salmon gum (Eucalyptus salmonophloia)	1,602,165.85	103,063.93	6.43	4.57	7.09
1049	Medium woodland; wandoo, York gum, salmon gum, morrel & gimlet	833,384.87	30,023.15	3.60	3.40	4.05

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2. York Gum

Eucalyptus loxophleba Bent subsp*. loxophleba*

Identification

York Gum, *Eucalyptus loxophleba* subsp. *loxophleba* is largely restricted to the Wheatbelt, but one of the most common trees throughout the region. It is described as a small to medium sized tree, rarely a mallee Brooker and Kleining (2001). FloraBase states it is a Tree, to 15 m high, bark rough, persistent, fibrous-flaky. Fl. white, Jul–Jan. French and Nicolle (in press) describe it as Tree, often several-stemmed or more rarely a multi-stemmed mallee, 7–15 metres tall, lignotuberous. Historically it has been regarded as a woodland due to its height being greater than the average mallee. Hence its inclusion here.
See French and Nicolle (in press) and Brooker and Kleining (2001) for full taxonomic descriptions.
Other subspecies
E. loxophleba subspp. *supralaevis* described as a combination sprouter (a tree but becoming a mallee with repetitive disturbance events (Nicolle 2003)
E. loxophleba subsp. *lissophloia* is a mallee (lignotuber-sprouter) of widespread but sporadic distribution in the eastern Wheatbelt and extending into the Great Western Woodlands. It is the main species of mallee planted for oil production (W. O'Sullivan pers comm). It is not included in this classification)
E. loxophleba subsp. *gratiae* a mallee of the southern Wheatbelt (also included here)

Soils and Landforms

Soils are mainly loam, rocky loam, clay loam, sand (Flora base) derived from granite or deposited as alluvial flats. It is associated with granite outcrops but also occurs in in depressions (Brooker and Kleining) and valley floors. Preferring the richer red loans has meant that it has been largely cleared for agriculture Banford 1995, Shepherd et al 2002and is subject to weed invasion.

Distribution/IBRA Subregions

Widespread outside the wetter areas of the south west (Brooker and Kleining 2001) through the western and southern Wheatbelt (McQuoid) and FloraBase has specimens collected in the following IBRA Regions AW, ESP, GS, JF, MAL, SWA; COO (see Figure 1 for key to codes)

Community Description

Eucalyptus loxophleba subsp*. loxophleba* is often co occurs with Jam wattle *Acacia acuminata*. It occurs with Salmon Gum, Wandoo and occasionally Morrel and gimlet. The understorey ranges from dense scrub through to dense ground cover of herbs, grasses, sedges, rushes and mat plants. It also occurs near lake margins over chenopods .there tends to be gradients within and between communities and it is difficult to draw strict lines around and within them.
Generally where is York Gum there is granite somewhere (below or above ground, although on some sites there is an overlying layer of sand). There may also be a gradient perhaps in soil depth and productivity, probably matched by the abundance of Jam. (Prober pers com)

Upperstorey

Trees; Emergent *Eucalyptus salmonophloia*, co occurring *E. wandoo, E. salubris E. rudis E. myriadena, E. kondininensis E. longicornis E. sargentii* and Jam *Acacia acuminata* is nearly always present but tends to become less prominent on the richer loams (Prober et al 2009). Rock Sheoak *Allocasuarina huegeliana* may occur either a similar height or as a lower tree layer.
Mallee species which may be present include *E. celastroides* subsp. *virella, E. erythronema*, *E. moderata, E. orthostemon, E. phenax* (French and Nicolle in prep)

Understorey; Medium and Ground

Shrub layer is variable in height and cover depending on soils and time since disturbance.

Ground cover may be very dense especially in long unburnt sites and consist of a diverse range of life forms and species. (Prober et al 2009)
Grasses; Austrostipa, Neurachne alopecuroidea,, Austrodanthonia,
Herbs; *Lawrencella rosea, Gnephosis tenuissima, Gilberta tenuifolia, Waitzia acuminata*, *Trachymene cyanopetala*
Rushes; *Desmocladus flexuosus, Hypolaena pubescens*
Orchids;
Lilies *Thysanotus patersonii*
Sedges;
Mat plants *Borya sphaerocephala* and
Dwarf shrubs (<20cm) *Dampiera lavandulacea*

Sub community descriptions

1. Herb rich York Gum and Jam

Acacia acuminata is nearly always present and the ground cover commonly includes Neurachne alopecuroidea, Podolepis lessonii, Austrostipa elegantissima, and may include Trachymene cyanopetala, T. ornata, Goodenia berardiana, Parentucellia latifolia, Crassula colorata, Lawrencella rosea , Borya shaerocephala may include rare emergent E. salmonophloia and Allocasuarina heugeliana. Some sites did not have Jam present. These sites are very susceptible to weed invasion of species such as Ehrharta longiflora, Avena barbata, Bromus diandrus , B. rubens, Hordeum leporinum and Lolium perenne. This community is recognised as one of the few grassy woodlands in Western Australia Matiske 1996, Prober et al 2009

2. York Gum over scrub

A wide variety of shrub species are associated with York gum and may be present due to a recent fire or certain soil characteristics. Common species include *Acacia acuminata, Acacia microbotrya, Hakea preissii, Scaevola spinescens, Enchylaena tomentosa Acacia hemiteles* and *Dodonaea inaequifolia*. The ground cover is generally more open that the herb rich woodlands (party due to shading) and includes *Podolepis lessonii, Austrostipa elegantissima, Neurachne alopecuroidea, Borya nitida, Waitzia acuminata, Lawrencella rose* and *Crassula colorata*

3. York Gum and Salmon Gum

Acacia erinacea, Acacia acuminata, Dodonaea viscosa Chenopods *Melaleuca uncinata* group On loam. See Esalmlox. This is a real community around granite slopes in the Western Wheatbelt, but it is very highly cleared. Mostly as stated it is an artefact of mapping where the two species overlap; Salmon gum from up slope and York gum from lower slopes.

4. York Gum and Wandoo

The *Eucalyptus wandoo*/ *E. loxophleba* subsp *loxophleba* association is recognised by Hussey (1999), Banford (1995) and Yates et al (2000). Occasionally *Acacia acuminata* is present over a variable understorey which includes *Acacia merrallii, A. lasiocarpha, A. leptospermoides,* and *Melaleuca adnata* over grasses

5. York Gum and Gimlet

On lower slope in silty clay loam, over *Rhagodia drummondii, Acacia acuminata, A. hemiteles* or open *Olearia muelleri, Acacia merrallii, Acacia erinacea, Acacia hemiteles* Uncommon but recognised by GK

6. York Gum in Saline areas

Enchylaena tomentosa Rhagodia drummondii, Comesperma integerrimum Olearia dampieri Tecticornia spp. on flats and dunes associated with salt lake systems. *E. loxophleba* can tolerate low levels of salt (Macar et al (2002)
A community recognised by S. Prober. Has varying composition and structure. May overlap with other groups. Susceptible to weeds

7. York Gum and Sheoak

Brown (sandy) loam over granite. *Allocasuarina huegeliana, A, campestris, Acacia acuminata, Austrostipa nitida, Calandrinia calyptrata*. York Gum & Sheoak is a Priority Beard Veg Assoc. (Richardson et al 2007) Allocasuarina low woodland with ermargent E Loxophleba also Occur (SAP Site HY18)

Outlier(s)

Disjunct populations occur on the upper margins of lakes in the Lake Camm–Lake King region, in the far south-eastern Wheatbelt.(French)

CONDITION

Species Richness

Summary 20-50spp/100m2

Total 30 spp in 10x10, 25 spp ground layer,13 annual forbs, 8 perennial forbs, 5 grasses, 1.5 shrubs. (Prober et al 2008).

39 spp average of all E lox SAP sites (most sampled twice) 25 - 68

19 SPS wetland sites 11-60

22 E and VG sites surveyed by WWF

Average of 26 natives in all classification sites

Indicator species

Gilberta tenuifolia, Dampiera lavandulacea, Lawrencella rosea (Prober et al 2009)

Structure

Good cover of native understorey

Recruitment

Encouraged by extended rain periods which thoroughly wet the soil (McQuiod in prep)
Jam recruitment more common in fenced and reference sites (Prober et al)
Hobbs and Atkins (1991) suggested that recruitment of York gum is limited by lack of fire.
Prober et al 2009 observed that the three fenced plots where most York gum recruitment was recorded had been burnt or flooded within the past ten years.
York gum recruitment may be low, Jam recruits 5/1000m2

Successional stages
Shrubby layer thinning out to mixed ground cover post fire?

Old growth/tree health
Hollows not common in old growth. Multiple stems

Organic litter

Fauna

Logs

Prober et al average 77 m of logs >5cm diameter at the widest point with no significant difference between Fence, Unfenced and reference sites

Weediness
Summary <15%cover (Prober et al)
Prober reference sites averaged 1.06 species per 10x10?

Grazing
Minimal grazing by kangaroos

Nutrients
Total N <0.11%, P,3(-5) mg/kg (except on dolerite)

Fire

May promote regeneration of York gum if at 'appropriate' interval and intensity and followed by sufficient rain

Benchmark Description Summary
Intact site, all expected plant life forms, diversity of species present,
All expected Upper mid and lower/ground stratum
E. loxophleba in multi aged stands, seedlings or young plants and large old trees (with hollows?) present
Native seedlings and young plants in appropriate sites to show regeneration is occurring
Little or no history of stock grazing
Few weeds, or along edges only
Little or no disturbance (e.g. tracks)

- Evidence of native fauna activity

Reference sites

Namelkatchem reserve 6km west of Wyalkatchem,
Korrelocking Reserve
Tutanning?

Classification notes

Conservation status [still to come]

Vegetation Association	Vegetation description	Pre-European Extent	Current Extent	% Remaining	% Remaining in AW1	% Remaining in AW2

Recommendation

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