TOOLS FOR IDENTIFYING 'INDICATIVE HIGH CONSERVATION' TUART WOODLANDS

Department of Conservation and Land Management

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DEPARTMENT OF ENVIRONMENT AND CONSERVATION

REPORT FOR THE DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

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Summary

Tools for Identifying 'Indicative High Conservation' Tuart Woodlands

Tuart (*Eucalyptus gomphocephala*) occurs over a 400 kilometre range from the Sabina River near Busselton in the south to Jurien Bay in the north. Vegetation clearing and grazing since European colonisation has reduced the extent of tuart dominated communities on the Swan Coastal Plain by approximately 65% and since the mid-1990s there has been a noticeable decline in the health of tuart trees at Yalgorup. While tuart the species is not considered threatened, some of the vegetation communities containing tuart are not adequately conserved or protected, and are particularly susceptible to threatening processes.

Fine-scale mapping of tuart's present extent, canopy density and understorey condition has been recently completed by Ecoscape Pty Ltd., using aerial photo interpretation. An *Atlas of Tuart Woodlands of the Swan Coastal Plain* was subsequently released by the Minister for the Environment in December 2003. The 'tuart atlas' data provides the basis for assessing the conservation status of remnant tuart woodlands.

This report develops criteria to determine areas of 'indicative high conservation' tuart woodland. The matrix and associated datasets resulting from the application of the criteria can be used as a tool to determine specific areas of tuart woodland that merit further consideration for conservation management. The report does not detail specific conservation areas, rather it provides two outputs, namely (i) an 'indicative high conservation' matrix of tuart woodlands, and (ii) spatial data necessary for assessing criteria values and nominating target areas.

The results of the analysis indicate that most tuart woodland remnants with low visible disturbance understorey occur on the Spearwood Soil System within the 700-900 mm rainfall zone. Tuart woodlands with low visible disturbance understoreys outside these areas occur at the limits of tuart's natural range and merit further consideration for future conservation management. A final decision on conservation status requires nominated tuart areas to be ground-truthed so as to validate the actual vegetation community, ecosystem and species values of selected tuart woodlands.

1.0 Introduction

Tools for Identifying 'Indicative High Conservation' Tuart Woodlands

1.1 Background

Tuart (*Eucalyptus gomphocephala*) occurs over a 400 kilometre range from the Sabina River near Busselton in the south to Jurien Bay in the north (Keighery *et al.* 2002). Within this distribution, tuart is usually found on the near coastal Quindalup and Spearwood Dunes, although it can also occasionally be found further inland along river and estuary margins (Keighery *et al.* 2002). Vegetation clearing and grazing since European settlement has reduced the extent of tuart dominated communities on the Swan Coastal Plain by approximately 65% (Hopkins *et al.* 2001). Since the mid-1990s, there has been a noticeable decline in the health of some tuart trees at Yalgorup between Mandurah and Bunbury.

While tuart is not considered threatened, some of the vegetation communities containing tuart are under-represented in conservation reserves, or are not adequately protected on private lands, and are particularly susceptible to threatening processes such as land clearing, climate variability, changes in vegetation structure resulting from altered fire regimes and past grazing, hydrological factors and weed invasion (Government of Western Australia 2002).

Fine-scale mapping of tuart's present extent, canopy density and understorey condition was recently completed by Ecoscape Pty Ltd., using aerial photo interpretation. An *Atlas of Tuart Woodlands of the Swan Coastal Plain* (Government of Western Australia 2003) was subsequently released by the Minister for the Environment in December 2003. The 'tuart atlas' data provides an improved empirical basis for assessing the conservation status of remnant tuart woodlands.

1.2 Purpose of this Report

This report describes processes for determining areas of 'indicative high conservation' tuart woodland. It does not detail specific areas but rather provides a tool that can be used to determine suitable areas that merit consideration for future conservation management. Specific outputs are:

- an 'indicative high conservation' matrix summarising areas of tuart woodland with low visible disturbance understorey for each mapped polygon relative to specific criteria; and

- GIS (Geographic Information System) data layers consisting of tuart woodlands with low visible disturbance understorey intersected with other layers (ie. soils systems, rainfall zones, land category, rare and priority flora, threatened and priority fauna and threatened ecological communities) that are used to estimate the criteria values for each polygon.

This report contains contributory processes and analysis necessary for the development of the Government's *Tuart Conservation and Management Strategy and Action Plan.* It will be used when workshopping the draft 'tuart strategy' to guide community feedback on (i) proposed additions to the secured conservation reserve system, (ii) areas that warrant special protection management on freehold land, and (iii) locations for the development of wildlife linkages between reserved and protected lands.

The final 'tuart strategy and action plan' will reflect these Government and community-based decisions for enhancing the conservation and protection status of remnant tuart woodlands. This will include processes for ground-truthing biodiversity values, quantifying natural-cultural heritage and socio-economic values, and nominating areas for formal conservation, freehold protection and linkage.

2.0 Methods and Analysis

Tools for Identifying 'Indicative High Conservation' Tuart Woodlands

2.1 Criteria Development

The Department of Conservation and Land Management and Ecoscape Pty Ltd. jointly developed the selection criteria for identifying areas of 'indicative high conservation' tuart woodland. Important factors considered included (i) the current extent and understorey condition of tuart woodlands, (ii) environmental variables likely to determine tuart's range and extent, (iii) locations of rare, priority or threatened fauna, flora and ecological communities, (iv) the capacity for effective tuart conservation management, and (v) the availability of relevant spatial data.

Primary and secondary criteria were determined as follows:

Primary Criteria:

- Tuart with low visible disturbance understorey.
- Size of tuart remnant.

Secondary Criteria

- Representation on uncommon soil types.
- Representation in uncommon rainfall zones.

Polygons satisfying both primary criteria and one secondary criterion were rated as **priority one** 'indicative high conservation' tuart woodlands[1]. Polygons satisfying the primary criteria only were rated as **priority two** 'indicative high conservation' tuart woodlands. This approach allows for selected polygons to be further prioritised based on (i) land category, and/or (ii) the presence of threatened flora and fauna, and/or (iii) the presence of threatened ecological communities.

[1] Rather than specify a defined cut-off patch size that (i) would limit **Priority One** candidates, (ii) and may change depending on the conservation management status of a particular tuart area, polygons were instead ranked in order of size. Minimum sizes for conservation are then able to be adjusted depending on the weight of other selection criteria and specific management objectives.

2.2 Criteria Rationale, Description and Analysis

2.2.1 Understorey present

Tuart remnants with a substantial component of their understorey visibly intact were assumed (relative to disturbed understorey) to have high floristic, vegetation community, habitat and ecological values. Tuart understorey condition was mapped as part of the 'tuart atlas' project using three classes:

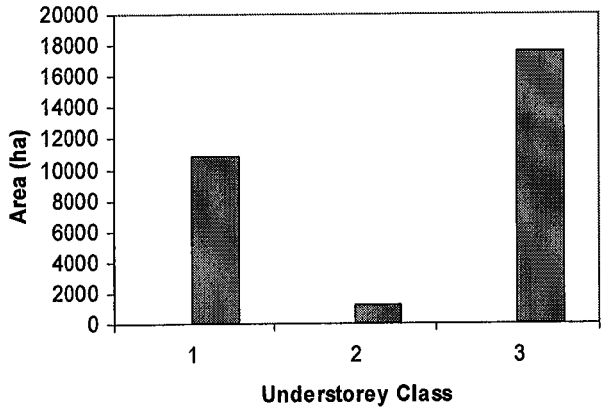
1. **Understorey present**
   - Visible understorey showing minimal signs of physical disturbance such as tracks and bare areas.

2. **Uninterpretable**
   - Understorey was not visible and the level of disturbance requires further evaluation.

3. **Understorey absent of highly disturbed**
   - No visible understorey, or visible understorey showing high density of tracks and bare areas.

Figure 1 shows the distribution of understorey classes for tuart vegetation communities. Approximately 10,864 hectares (36%) of 30,311 hectares of remaining mapped tuart communities were assessed as having low visible disturbance understorey present. These polygons were extracted from the 'tuart atlas' and formed the primary dataset for intersection with the spatial data of other designated criteria, and the estimation of 'indicative high conservation' tuart areas.

Figure 1: Distribution of understorey classes for tuart communities



2.2.2 Area of Tuart

The maintenance of ecosystem processes in remnant vegetation is a function of patch size. Larger patches are more able to support a variety of plants and animals of different types and contribute to the conservation of biodiversity, compared to smaller patches. The fine-scale 'tuart atlas' mapped all areas of tuart woodlands greater than one hectare (Government of Western Australia 2003). From this mapped data, tuart woodlands with low

visible disturbance understorey were included in the 'indicative high conservation' analysis. In some cases, these formed part of a larger vegetated area that was (i) dominated by another species (eg. *Eucalyptus calophylla*), and/or was associated with (ii) tuart woodlands with disturbed understorey. This is particularly the case towards the north of tuart's range, where tuart is generally confined to areas low in the landscape.

Rather than specify a defined cut-off patch size that (i) would limit **Priority One** candidates, (ii) and may change depending on the conservation management status of a particular tuart area, polygons were instead ranked in order of size. Minimum sizes for conservation are then able to be adjusted depending on the weight of other selection criteria and specific management objectives.

2.2.3 Representation in Soil Systems and Rainfall Zones

At the broadest landscape scale, the distribution of tuart woodlands is affected by climatic gradients and geomorphological soil patterns. These patterns interact with tuart's physiological limits to determine the potential range of species (Ruthrof *et al. 2002)*. Additionally the major environmental variables, which determine floristic composition, have been found to be soil type and rainfall (Gibson *et al.* 2002).

Tuart communities found within soil systems and rainfall zones with a low representation of tuart woodlands merit consideration for conservation management as they are tuart communities which are (i) rare, due to naturally low occurrence at the extremes of their natural geographical range, or (ii) tuart that has been heavily impacted from human land uses and/or degrading processes. The understorey communities in the former sites are likely to be uniquely associated with tuart. At the southern extreme of its distribution, tuart is relatively well protected within the Tuart Forest National Park, while populations at the northern and eastern extremes generally have smaller populations and variable degrees of protection.

Representation in Rainfall Zones

The spatial layer associated with rainfall was derived from an analysis of data provided by the Bureau of Meteorology's National Climate Centre. The data contained a grid of annual mean rainfall values at 0.025 degrees (approximately 2.5 kilometres) resolution analysed over the period 1961 to 1990. Rainfall was categorised into 100 mm annual mean rainfall zones. The distribution of tuart woodlands with low disturbance understorey within these rainfall zones is shown in Figure 2.

The northern extent of tuart's distribution near Jurien Bay receives an average annual rainfall of approximately 600 mm, while the southern extent near Busselton receives approximately 800 mm at the coast increasing to 1,000 mm to the east towards the Darling Scarp. Tuart response to rainfall is reflected in its form, reaching its greatest height at the southernmost end of its distribution (Ruthrof *et al. 2002)*. The majority of tuart woodlands occur in the 700 mm to 900 mm rainfall zone.

Representation in Soil Systems

Geomorphology and soil types are thought to be important factors in the distribution of tuart woodlands, with the most common occurrences on the two aeolian dune belts, the

Quindalup Dune System and the Spearwood Dune System (Keighery *et al.* 2002). Populations also occur on the Moore River, Vasse and Bassendean Dune Systems. Floristic analysis of site data has shown major differences in species composition between tuart understories growing on the Spearwood and Quindalup Dune Systems (Gibson *et al.* 2002). Differences in representation on different soil systems can be attributed to the tuart's soil requirements, the extent of soil systems[2] and the degree of clearing and disturbance[3].

The dataset used to analyse this criterion was sourced from Agriculture Western Australia's 'Soil-Landscape Mapping in South Western Australia' with boundaries captured at 1:50,000 (AGWA, 2003). The extent of tuart woodlands with low visible disturbance understorey on the various soil systems is shown in Figure 3.

Figure 2: Distribution of tuart woodlands with low visible disturbance understorey present within 100 mm rainfall zones.

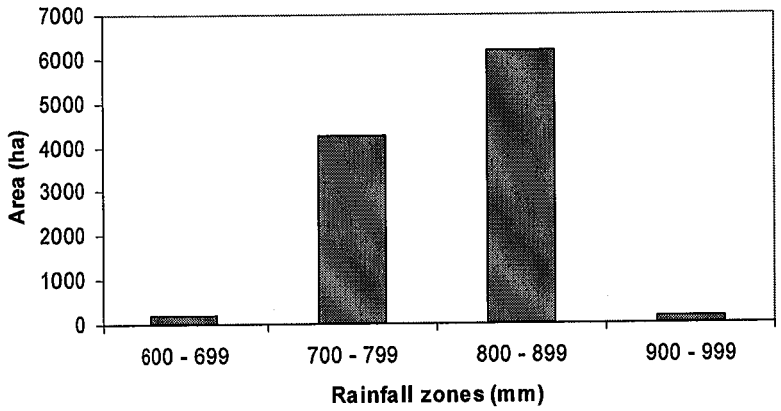
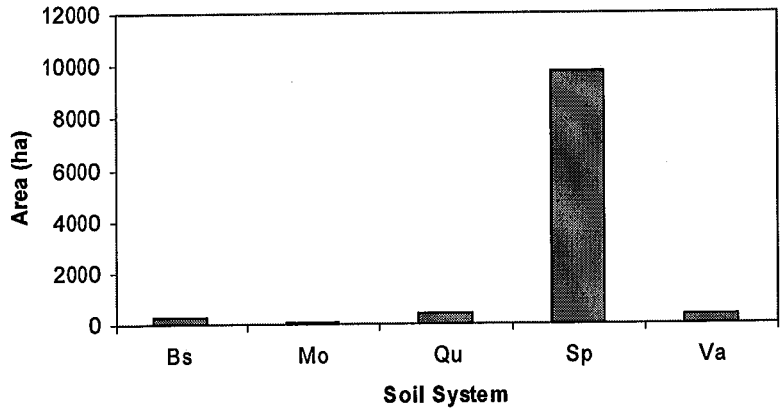


Figure 3: Extent of tuart woodlands with low visible disturbance understorey present within soil systems.



Bs=Bassendean, Mo= Moore River, Qu = Quindalup, Sp = Spearwood, Va = Vasse

[2] Spearwood soils underlie the majority of tuarts' natural range, while Moore River and Vasse soil systems are very reduced.

[3] Quindalup dunes have been heavily cleared during the expansion and urbanisation of the Perth metropolitan area

2.2.4 Land category

The land category criterion relates to the security of tenure and conservation management purpose for tuart woodlands. Lands vested in the Conservation Commission of Western Australia, and managed by the CALM (Table 1), provide the most straightforward opportunity to increase the security of tenure and conservation management purpose of tuart woodlands.

For example the Forest Management Plan 2004 – 2013 (Conservation Commission 2004) addressed the task of improving the conservation reserve system on the Swan Coastal Plain. When fully implemented the area of tuart woodlands in formal reserves vested in the Commission will increase from 6,160 hectares to 8,690 hectares (28.7% of the total area).

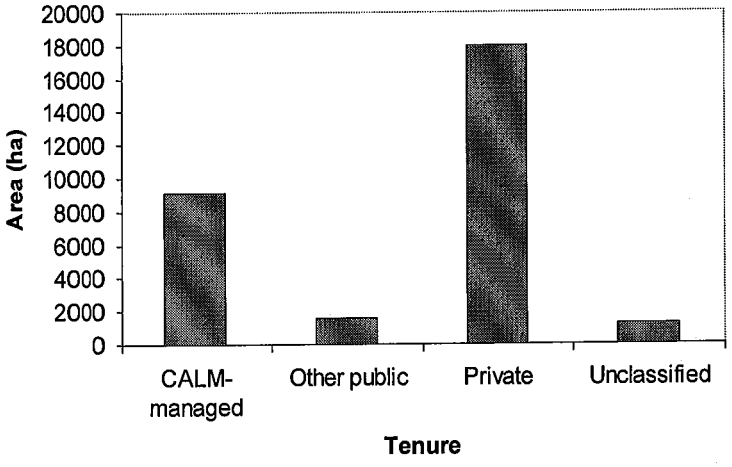
The ability to further improve tuart representation in formal conservation reserves through this mechanism is now limited as remaining tuart woodlands occur largely on private land (19,078 hectares or 63% of total area) and outside the existing or proposed reserve system.

Table 1: Tenure categories used in the 'indicative high conservation' analysis for tuart woodlands

Tenure Category	Description
Vested in the Conservation Commission (CALM-managed lands)	Conservation park
	Miscellaneous Crown Reserves managed by CALM
	National park
	Nature reserve
	Section 5(1)(g) and s.5(1)(h) reserves
	State forest
Public Land	Crown reserves vested in local authorities
	Other Crown reserves
	Unallocated Crown land
	Unmanaged reserves
Private Land	Freehold land (includes owned by agencies and local authorities
Other Lands	Miscellaneous Lands - closed road
	Miscellaneous Lands – railway
	Miscellaneous Lands - road
	Miscellaneous Lands - water feature
	Pastoral lease

Analysis of the distribution of tuart woodlands with low visible disturbance understorey by land category (Figure 4) indicates that approximately 65% occur on CALM managed lands, with only 5% occurring on other public lands, 27% occurring on private lands, and the remainder (approximately 3%) occurring on unclassified lands.

Figure 4: Extent of tuart woodlands with low visible disturbance understorey present by land category



The composition of the land categories used in the analysis is outlined above in Table 1, and is further described below.

Land vested in the Conservation Commission (CALM-managed lands)

Tuart woodlands on this land category (Table 1) provide the highest level of secured tenure and conservation management purpose. They include:

- Nature reserves
- National parks
- Conservation parks
- State forests
- Section 5(1)(g) and s.5(1)(h) reserves
- Miscellaneous CALM reserves

Nature reserves: These are areas where the protection of nature conservation values is paramount and where permitted recreational activities must be compatible with conservation, scientific and educational objectives for the area.

National parks: These areas are reserved for wildlife and landscape conservation, scientific study and preservation of features of archaeological, historic or scientific interest, together with recreational enjoyment by the public. The classification of national park applies to areas which have national or international significance for scenic, cultural or biological values.

Conservation parks: These areas differ from national parks only in their significance, size or condition. They are managed as if they were national parks. The differences are that these areas may not necessarily have major national or international significance, may be relatively small in size or where their landscape or biota has been affected by past land use.

State forests: These are multiple use areas where the overall objective for land management is for biodiversity to be conserved, the health, vitality and productive capacity of ecosystems to be sustained, and for the social, cultural and economic benefits valued by the community to be produced, taking into account the principles of ecologically sustainable forest management.

Section 5(1)(g) and s.5(1)(h) reserves: These reserves have a wide variety of purposes, but normally are related to recreation, wildlife conservation, historical features and approved commercial uses. This classification is often transitional, and on further evaluation, the classification can be changed to a more appropriate one.

Public Land

Tuart woodlands on this land category (Table 1) provide an intermediate level of secured conservation purpose. They include:

- Crown reserve vested in local authorities
- Unallocated Crown land
- Unmanaged reserves
- Other Crown reserves

This land category includes lands where some activities are managed by CALM (ie. unallocated Crown land and unmanaged reserves) and lands managed by local authorities. Unallocated Crown land and unmanaged reserves may be vested in the Conservation Commission and added to the reserve system should this be approved by the Government. Some of the lands within this public land category, while outside of the reserve system, are managed in a way that is complementary to the reserve system. This includes some local government authority reserves managed for conservation and recreation.

Private Land

Tuart woodlands on private lands provide the lowest security of conservation purpose. Some of these include public freehold lands owned by Government agencies and local government (Table 1).

Other Land

This land category represents lands that could not be classified in any of the above categories (Table 1). The extent of tuart woodlands with low disturbance understorey on unclassified land is very small (approximately 2%). They include:

- Miscellaneous lands - closed road
- Miscellaneous lands – railway
- Miscellaneous lands – road
- Miscellaneous lands - water feature
- Pastoral lease

2.2.5 Threatened Flora and Fauna

This criterion is based on the number of declared rare and priority flora and fauna within a polygon of tuart woodland with low visible disturbance understorey. Rare and priority flora and fauna are important for the conservation of biodiversity as they may be threatened, have reduced range, or are poorly known. This criterion was derived from locations of priority flora and fauna in CALM's Rare Flora and Fauna databases. A buffer of 500 metres was placed around point locations when intersecting with the other datasets.

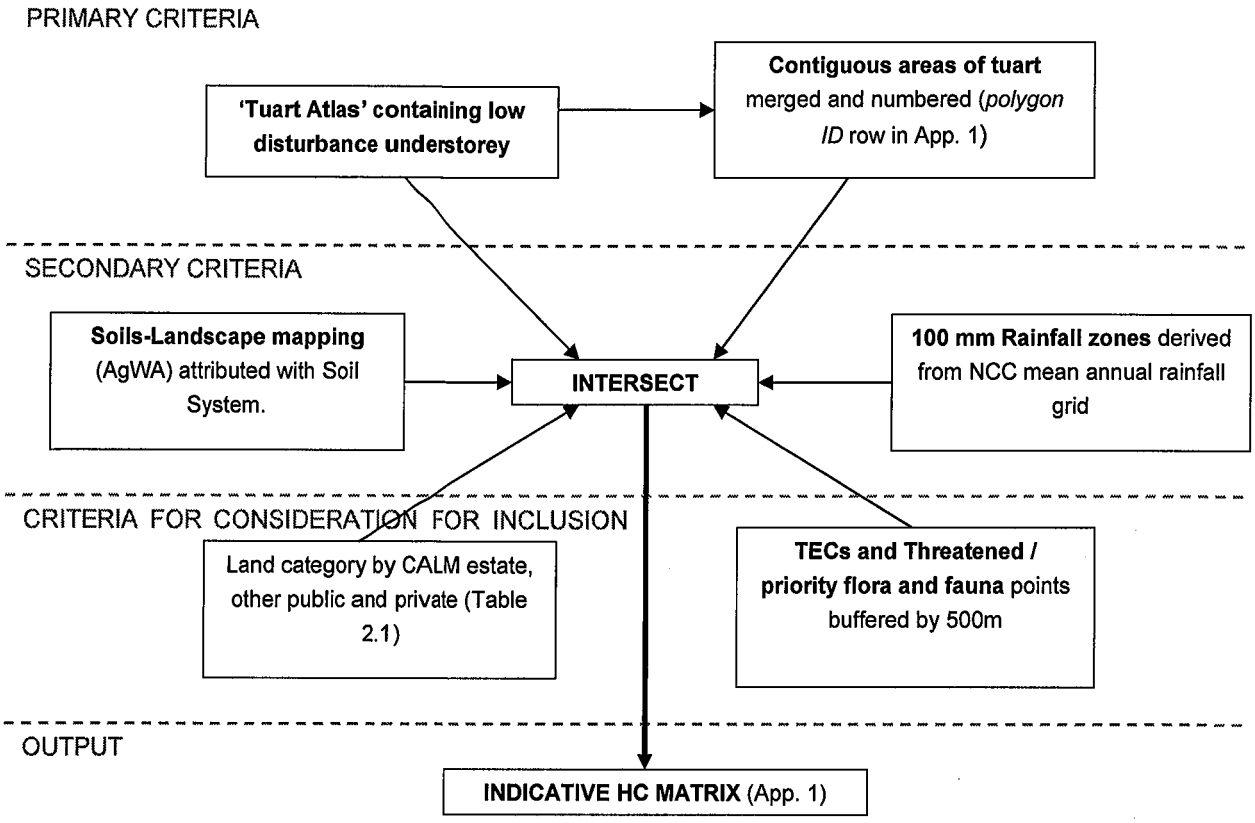
2.2.6 Threatened Ecological Communities

Threatened ecological communities have been derived from a floristic survey of the Swan Coastal Plain (Gibson *et al.* 1994) and have been assessed by the Threatened Ecological Communities Advisory Group using criteria to define conservation status (English and Blyth 1997). Threatened ecological communities fit one of the following categories (i) presumed totally destroyed, (ii) critically endangered, (iii) endangered, or (iv) vulnerable. The data for the threatened ecological communities criterion was sourced from CALM's Threatened Ecological Communities database. For the purpose of intersecting the dataset an arbitrary buffer of 500 metres was placed around point locations.

2.3 Criteria Evaluation

'Indicative high conservation' tuart areas were evaluated by intersecting polygons containing low visible disturbance understorey tuart woodlands, with datasets relevant to the above criteria. The results of this analysis have been summarised in a matrix table (Appendix 1) that can be used as a tool to assess the status of tuart (i) for possible inclusion in conservation reserves, (ii) for special protection on private lands, and (iii) for the development of wildlife linkages between conserved and protected lands. Figure 5 depicts the basic methodology used in carrying out the intersections.

Figure 5: Model for identifying 'Indicative high conservation' tuart woodlands



3.0 Results

Tools for Identifying 'Indicative High Conservation' Tuart Woodlands

3.1 Intersection Results

Table 2 shows a summary of the intersection results of low visible disturbance understorey tuart woodlands with soil systems, rainfall zones and land category.

Table 2: Intersection results summary of 'Indicative high conservation' tuart. The data shows areas of low visible disturbance understorey tuart woodlands by soil system, rainfall zone and land category

Soil System	Rainfall	Land Category				
		CALM-managed	Public	Private	Other	Total
	(mm)	(hectares)				
Abba	700 – 799	5.9	0.0	0.3	0.0	6.2
Bassendean	800 – 899	156.9	55.0	34.9	4.5	251.3
Moore River	600 – 699	0.3	6.2	10.5	1.5	18.5
	700 – 799	0.0	2.1	31.4	1.4	35.0
Pinjarra	800 – 899	0.0	0.0	6.3	0.1	6.4
Quindalup	500 – 599	1.7	0.0	0.0	0.0	1.7
	600 – 699	0.0	10.4	25.4	27.9	63.7
	700 – 799	24.3	11.1	88.5	10.8	134.7
	800 – 899	27.2	33.7	155.0	3.1	219.1
Spearwood	500 – 599	3.4	0.00	0.0	0.0	3.4
	600 – 699	51.7	1.0	47.8	0.3	100.9
	700 – 799	2,824.9	223.8	995.1	62.2	4,106.1
	800 – 899	3,680.4	163.2	1,461.5	100.6	5,405.7
	900 – 999	77.1	0.0	59.2	3.4	139.7
Vasse	800 – 899	261.1	57.8	42.5	9.7	371.1
Total		**7,114.9**	**564.4**	**2,959.5**	**225.5**	**10,864.3**

Tuart woodlands with low visible disturbance understorey are most commonly found on Spearwood Soil Systems. They can also be found on the Quindalup, Bassendean and Vasse Soil Systems, but are much less extensive. Tuart woodlands in these latter soil systems are assumed to (i) be at the extremes of their natural range and are likely to have unique understorey vegetation associations, or (ii) have been extensively cleared. They rate highly for conservation management consideration. Representation on Abba, Pinjarra and Moore River Soil Systems is also very low but is likely to be a result of inaccuracies of the data sets and the scale at which the data was acquired.

Tuart woodlands with low visible disturbance understorey are most commonly found within the 800-900 mm rainfall zone and to a lesser extent in the 700-800 mm rainfall zone. They are also present within the 600-700 mm and the 900-1,000 mm rainfall zone but are much less extensive. Tuart woodlands in these latter rainfall zones are assumed to (i) be at the extremes of their natural range and are likely to have unique understorey vegetation associations, or (ii) have been extensively cleared. Again they rate highly for conservation management consideration.

Most tuart woodlands with low visible disturbance understorey (65.4%) occur in lands vested in the Conservation Commission and are managed by CALM. A total of 27.2% is found on private lands, 5.2% is found on public lands and 2.1% is found on other lands. Land category relates to the security of tenure and conservation management purpose. Lands managed by CALM provide the highest protection levels, and may be upgraded (eg. State forest to national park) through *Conservation and Land Management Act 1984* management planning processes. Reasonably high protection levels are also provided on other public lands such as unallocated Crown land and unmanaged reserves as CALM is now responsible for providing fire prevention services and controls declared plants and animals on these areas[4].

The security of tenure and conservation management purpose is least assured on private lands. This is significant as nearly one third of tuart woodlands with low visible disturbance understorey occur on private lands. The conservation management of tuart woodlands outside protected areas therefore needs to be considered in terms of consistent approaches across all freehold and other Crown lands where tuart occurs (Commonwealth of Australia 1996). Particular emphasis is necessary for the rural and urban conservation of tuart trees, vegetation communities, and ecosystems by (i) integrating tuart conservation into structure planning processes and development programs, (ii) encouraging local governments to retain and improve natural tuart ecosystems and to use tuart and associated understorey species for plantings in urban areas, and by (iii) promoting community tuart conservation partnerships, stewardship schemes, and other incentives.

3.2 'Indicative high conservation' matrix

The 'indicative high conservation' matrix (Appendix 1) forms part of a set of tools for assessing the suitability of tuart woodland areas for conservation management consideration. The matrix is derived from the intersection of tuart with low visible disturbance understorey with spatial layers depicting (i) soil systems, (ii) rainfall zones, (iii) land category, (iv) declared rare and priority flora, (v) threatened and priority fauna and (vi) threatened ecological communities.

The 'indicative high conservation' matrix splits each polygon (numbered across the top) into component areas based on intersections with soil system, rainfall and land category datasets. The polygons are ordered so that the polygon with the largest area (ie. *ID* 134) is first and the polygon with the smallest area (ie. *ID* 65) is last. This ranking assists the determination of tuart patch size for consideration relative to the "area of tuart" selection criteria.

[4] On 01 July 2003 the Government approved the transfer of funded management responsibilities on unallocated Crown land and unmanaged reserves from the Department of Planning and Infrastructure to CALM.

Tuart woodlands with low visible disturbance understorey occurring on the Bassendean, Moore river, Quindalup and Vasse Soil Systems, and within the 600-690 and 900-999 mm rainfall zones, are assessed as ***priority one*** for future conservation management because they occur at the limits of tuart's natural range (Appendix 1). Tuart woodlands with low visible disturbance understorey occurring on the Spearwood Soil System, and within the 700-900 mm rainfall zone, occur within tuart's normal range and are assessed as ***priority two*** for future conservation management (Appendix 1: red bordered stipple).

3.2.1 Process for identifying 'indicative high conservation tuart areas

Phase 1 (completed)

Tuart woodlands, except those on the Spearwood soil system and in the 700-800 mm and the 800-900 mm rainfall zone score for both primary and secondary criteria and are rated as ***priority one*** 'indicative high conservation' areas. Tuart woodlands on the Spearwood Soil System in the 700-800 mm and the 800-900 mm rainfall zone do not score for the secondary criteria and are rated as ***priority two*** 'indicative high conservation' areas (red stipple shade).

Phase 2

Priority one and priority two areas may be further merit assessed based on the:

- area of polygon components;
- land category of polygon component;
- recorded presence of declared rare and priority flora;
- recorded presence of threatened and priority fauna; and
- recorded presence of threatened ecological communities.

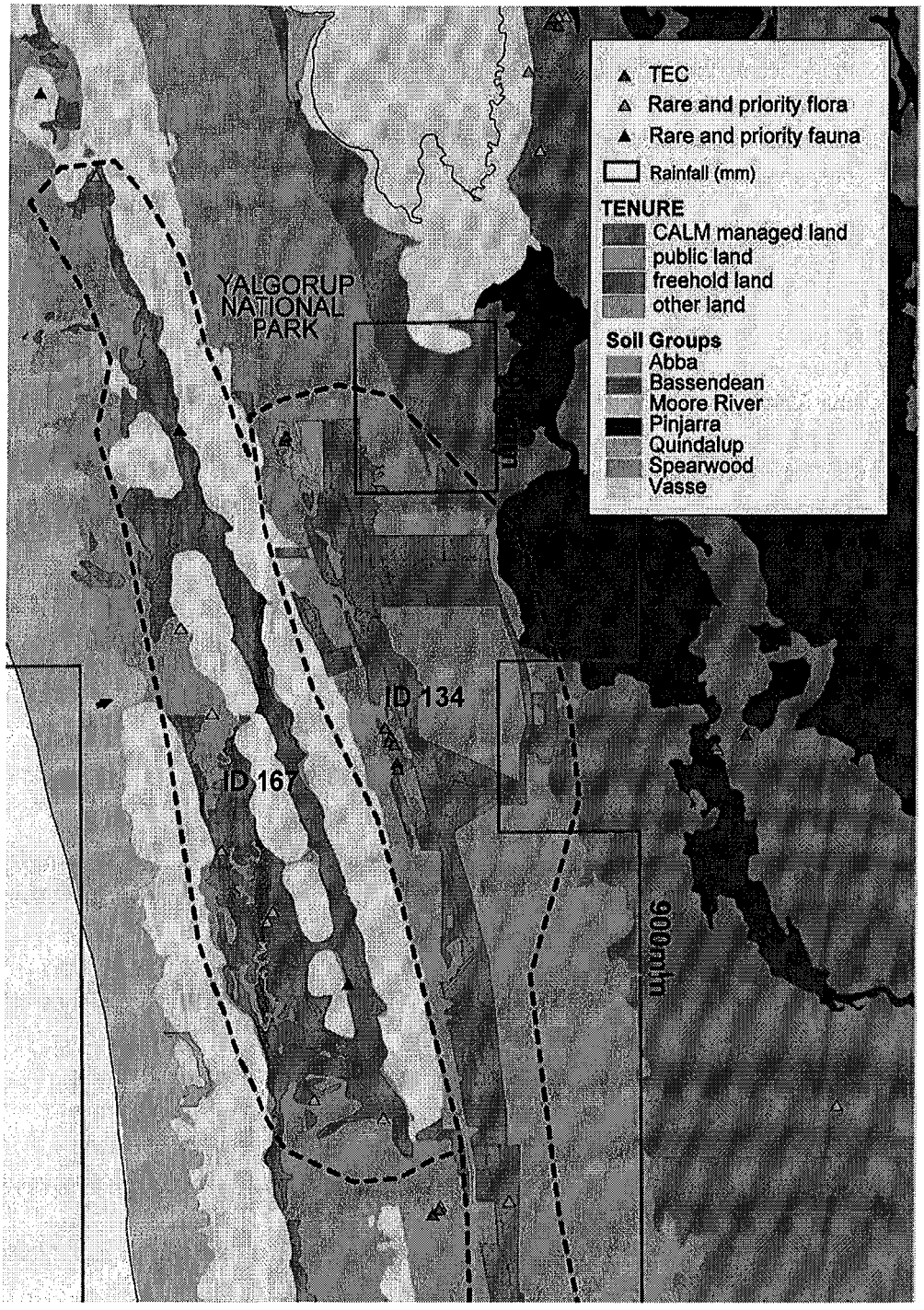
This assessment should be undertaken using the spatial data created by Ecoscape Pty Ltd's 'indicative high conservation' matrix . An example of spatial dataset representation is shown in Figure 6. Spatial datasets used are:

- polygons depicting extent of tuart woodlands with low visible disturbance understorey (polygon *ID* sourced from the 'indicative high conservation' matrix);
- intersection of low visible disturbance understorey tuart with soil systems;
- intersection of low visible disturbance understorey tuart with rainfall zones;
- intersection of low visible disturbance understorey tuart with land category;
- intersection of low visible disturbance understorey tuart with recorded declared rare and priority flora locations;
- intersection of low visible disturbance understorey tuart with recorded threatened and priority fauna locations; and
- intersection of low visible disturbance understorey tuart with recorded threatened ecological community locations.

Phase 3

Tuart areas resulting from Phase 1 and Phase 2 processes should then be ground-truthed to validate the accuracy of the spatial datasets and the suitability of areas for conservation management based on natural-cultural heritage and socio-economic values.

Figure 6: Example of spatial datasets used to determine areas of 'indicative high conservation' tuart woodlands.



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Appendix 1:
Indicative 'High Conservation' Tuart Matrix

Tools for Identifying 'Indicative High Conservation' Tuart Woodlands

Tuart HVC Matrix			Polygon ID													
Tenure	**Soil System**	**Rainfall**	**134**	**167**	**170**	**68**	**171**	**198**	**59**	**203**	**199**	**76**	**78**	**24**	**133**	**132**
CALM managed land	Ab	700 - 799				2.7						3.1				
	Ba	600 - 699	16.0													
	Mo	600 - 699														
	Qu	500 - 599														
		700 - 799														
		800 - 899										2.6				
	Sp	500 - 599								1.1						
		600 - 699														
		700 - 799				469.0	97.8	202.4	242.3		137.0	222.2	189.5			
		800 - 899	1183.8	1209.7	499.2					74.6			0.9		190.3	181.5
		900 - 999	49.1													
	Va	800 - 899	20.7	184.1						0.0						
CALM managed land Total			**1268.6**	**1393.8**	**499.2**	**471.8**	**97.8**	**202.4**	**242.3**	**75.7**	**139.6**	**225.3**	**190.5**		**190.3**	**181.5**
public land	Ba	800 - 899														
	Mo	600 - 699														
		700 - 799														
	Pj	800 - 899														
	Qu	600 - 699														
		700 - 799														
		800 - 899								0.5						
	Sp	600 - 699														
		700 - 799					22.4									
		800 - 899	61.7							0.8						
	Va	800 - 899								15.3						
public land Total			**61.7**				**22.4**			**16.6**						
private land	Ab	700 - 799										0.2				
	Ba	600 - 699														
		800 - 899														
		900 - 999	0.8													
	Mo	600 - 699														
		700 - 799														
	Pj	800 - 899														
	Qu	600 - 699														
		700 - 799														
		800 - 899								0.8						
	Sp	600 - 699														
		700 - 799				6.5	284.8	52.4			89.8	0.1	23.7			
		800 - 899	90.9	44.1	118.4					120.8			0.1	205.5		0.0
		900 - 999	54.5													
	Va	800 - 899	13.1	4.4						23.2						
private land Total			**159.4**	**48.5**	**118.4**	**6.5**	**284.8**	**52.4**		**144.7**	**89.8**	**0.4**	**23.7**	**205.5**		**0.0**
other land	Ba	800 - 899	0.0													
		900 - 999	0.0													
	Mo	600 - 699														
		700 - 799														
	Pj	800 - 899	0.0													
	Qu	600 - 699														
		700 - 799														
		800 - 899								0.1						
	Sp	600 - 699														
		700 - 799					8.6				3.0	5.1	0.2			
		800 - 899	25.9	31.0	6.9					3.4				1.6	7.5	2.5
		900 - 999	3.4													
	Va	800 - 899	0.7	4.1						0.3						
other land Total			**30.0**	**35.1**	**6.9**		**8.6**			**3.8**	**3.0**	**5.1**	**0.2**	**1.6**	**7.5**	**2.5**
Grand Total			**1519.6**	**1477.4**	**626.5**	**478.3**	**413.6**	**254.8**	**242.3**	**240.8**	**232.3**	**230.8**	**214.4**	**207.2**	**197.8**	**184.0**
Additional Criteria		TEC	8	0	0	0	0	3	0	0	7	0	0	0	0	0
		Priority & rare Fauna	0	4	3	4	3	0	0	0	4	0	0	0	2	0
		Priority & rare Flora	1	8	2	0	0	1	1	3	0	4	0	0	1	0
			Yalgorup NP	Yalgorup NP	Yalgorup NP	Tuart Forest NP	Adjacent to Neerabup NP	Yanchep NP		adjacent to Yalgorup NP	Yanchep NP	Tuart Forest NP	Tuart Forest NP	surrounded by quarries	Yalgorup NP	Yalgorup NP

Soil Systems Ab = Abba, Ba = Bassendean, Mo = Morre River, Pj = Pinjarra, Qu = Quindalup, Sp = Spearwood, Va = Vasse

Priority 2 Polygons

Tuart HVC Matrix

Tenure	Soil System	Rainfall	214	169	48	81	205	209	144	168	187	145	207	178	201	211	46	155	188	18
CALM managed land	Ab	700 - 799																		
	Ba	600 - 699			123.8															
	Mo	600 - 699																		
	Qu	500 - 599																		
		700 - 799																		
		800 - 899																		
	Sp	500 - 599																		
		600 - 699																		
		700 - 799	12.3				148.8		136.0			91.6	89.0				74.2	71.7		
		800 - 899																		
		900 - 999																		
	Va	800 - 899			38.6															
CALM managed land Total			**12.3**		**162.4**		**148.8**		**136.0**			**91.6**	**89.0**				**74.2**	**71.7**		
public land	Ba	800 - 899																		
	Mo	600 - 699																		
		700 - 799																		
	Pj	800 - 899																		
	Qu	600 - 699																		
		700 - 799		1.8																
		800 - 899																		
	Sp	600 - 699																		
		700 - 799		0.1			0.2							88.2	73.4					
		800 - 899									14.3									47.7
	Va	800 - 899																		0.1
public land Total				**1.9**			**0.2**				**14.3**			**88.2**	**73.4**					**47.9**
private land	Ab	700 - 799																		
	Ba	600 - 699																		
		800 - 899			6.4			0.9												
		900 - 999																		
	Mo	600 - 699																		
		700 - 799																		
	Pj	800 - 899						5.8											0.5	
	Qu	600 - 699																		
		700 - 799		28.6						3.1										
		800 - 899								117.4										
	Sp	600 - 699																		
		700 - 799	170.4	76.0			1.1			2.4				0.4	4.3			1.1		
		800 - 899		66.9		169.9		132.3		8.4	113.9					76.8			70.0	10.6
		900 - 999																		
	Va	800 - 899																		
private land Total			**170.4**	**171.5**	**6.4**	**169.9**	**1.1**	**139.0**		**131.3**	**113.9**			**0.4**	**4.3**	**76.8**		**1.1**	**70.5**	**10.6**
other land	Ba	800 - 899			3.9			0.1												
		900 - 999																		
	Mo	600 - 699																		
		700 - 799																		
	Pj	800 - 899						0.1												
	Qu	600 - 699																		
		700 - 799								0.0										
		800 - 899			3.1					1.6										
	Sp	600 - 699																		
		700 - 799		4.3									0.0	0.1	2.4					
		800 - 899		0.7		2.0		2.7			0.8					2.9				0.6
		900 - 999																		
	Va	800 - 899			0.8															0.6
other land Total				**5.0**	**4.0**	**2.0**		**2.8**		**1.6**	**0.8**		**0.0**	**0.1**	**2.4**	**2.9**				**1.2**
Grand Total			**182.7**	**178.4**	**172.9**	**171.9**	**150.1**	**141.8**	**136.0**	**133.0**	**129.0**	**91.6**	**89.0**	**88.8**	**80.1**	**79.7**	**74.2**	**72.8**	**70.5**	**59.7**
Additional Criteria	TEC		0	0	0	0	0	0	5	0	2	0	0	0	0	0	0	0	0	0
	Priority & rare Fauna		0	2	2	0	2	0	0	2	0	1	0	0	0	0	0	0	0	0
	Priority & rare Flora		1	0	3	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0
			adjacent to Granagara-Moore SF	adjacent to esperance aborig. Res.	Kooljerrenup NR		Tuart Forest NP		Yanchep NP		adjacent to lake Cooloongup									

Soil Systems Ab = Abba, Ba = Bassendean, Mo = Morre River, P = Pinjarra, Qu = Quindalup, Sp = Spearwood, Va = Vasse

Priority 2 Polygons

Tuart HVC Matrix

Tenure	Soil System	Rainfall	27	120	54	45	194	79	174	26	173	7	183	67	130	166	165	57	135	131	9	4
CALM managed land	Ab	700 - 799																				
	Ba	800 - 899																				
	Mo	600 - 699													0.3							
	Qu	500 - 599																				
		700 - 799																				
		800 - 899	0.4																			
	Sp	500 - 599																				
		600 - 699													10.1					20.2		
		700 - 799		53.7		50.4	43.3		36.4		37.3			41.7							11.1	29.8
		800 - 899	57.4					49.7		47.8									29.4			
		900 - 999																				
	Va	800 - 899						0.2											0.4			
CALM managed land Total			57.8	53.7		50.4	43.3	49.8	36.4	47.8	37.3			41.7	10.3				29.8	20.2	11.1	29.8
public land	Ba	800 - 899			44.6																	
	Mo	600 - 699													4.4							
		700 - 799																				
	Pj	800 - 899																				
	Qu	600 - 699																				
		700 - 799																				
		800 - 899											12.9									
	Sp	600 - 699													1.0							
		700 - 799							1.8								20.7				0.1	
		800 - 899			1.6								28.9									
	Va	800 - 899			5.0																	
public land Total					51.2				1.8				41.9		5.4		20.7				0.1	
private land	Ab	700 - 799																0.1				
	Ba	600 - 699																				
		800 - 899			0.3											16.0						
		900 - 999																				
	Mo	600 - 699													5.9					1.3		
		700 - 799																				
	Pj	800 - 899																				
	Qu	600 - 699																				
		700 - 799																				
		800 - 899																				
	Sp	600 - 699													19.0					13.7		
		700 - 799							11.1		6.4	44.8					15.8	37.4			18.0	
		800 - 899			0.0											24.1						
		900 - 999																				
	Va	800 - 899			0.1																	
private land Total					0.5				11.1		6.4	44.8			24.9	40.1	15.8	37.4		15.0	19.0	
other land	Ba	600 - 699			0.5											0.0						
		900 - 999																				
	Mo	600 - 699																				
		700 - 799																				
	Pj	800 - 899																				
	Qu	600 - 699																				
		700 - 799																				
		800 - 899																				
	Sp	600 - 699																		0.2		
		700 - 799					7.0		0.2		2.0						1.0				0.5	
		800 - 899			0.9			0.2					1.2			0.0			5.7			
		900 - 999																				
	Va	800 - 899			0.1														0.0			
other land Total					0.9		7.0	0.2	0.2		2.0		1.2			0.0	1.0		5.7	0.2	0.5	
Grand Total			57.8	53.7	52.5	50.4	50.3	50.0	49.5	47.8	45.8	44.8	43.1	41.7	40.7	40.1	37.5	37.4	35.5	35.4	30.7	29.8
Additional Criteria		TEC	0	0	0	8	3	0	0	0	0	1	0	0	0	2	0	0	2	0	0	0
		Priority & rare Fauna	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0
		Priority & rare Flora	0	1	0	11	0	0	0	0	0	0	1	1	0	3	0	0	4	0	0	0

Soil Systems Ab = Abba, Ba = Bassendean, Mo = Morre River, P = Pinjarra, Qu = Quindalup, Sp = Spearwood, Va = Vasse

Priority 2 Polygons

Tuart HVC Matrix

Tenure	Soil System	Rainfall	98	80	161	19	213	115	104	172	3	177	157	49	189	150	210	66	87	51	86	137
CALM managed land	Ab	700 - 799																				
	Ba	600 - 699																				
	Mo	600 - 699																				
	Qu	500 - 599																				
		700 - 799											21.7									
		800 - 899												0.0			0.7			6.2		
	Sp	500 - 599																				
		600 - 699																				
		700 - 799					21.0	25.6							22.1			20.9				
		800 - 899												7.6			21.3			11.0	20.9	
		900 - 999																	21.8			
	Va	800 - 899												14.4						11.4		
CALM managed land Total							21.0	25.6					21.7	22.0	22.1		22.0	20.9	21.8	20.7	20.9	
public land	Ba	800 - 899																				
	Mo	600 - 699																				
		700 - 799																				0.6
	Pj	800 - 899								0.0												
	Qu	600 - 699							7.3													
		700 - 799				2.9							2.2									
		800 - 899		1.5								5.1										
	Sp	600 - 699																				
		700 - 799																				
		800 - 899								0.3												
	Va	800 - 899		24.0								13.2										
public land Total				25.5		2.9			7.3	0.4		18.4	2.2									0.6
private land	Ab	700 - 799																				
	Ba	600 - 699																				
		800 - 899																				
		900 - 999																				
	Mo	600 - 699																				
		700 - 799																				14.9
	Pj	800 - 899								0.0												
	Qu	600 - 699									25.4											
		700 - 799				24.0																0.1
		800 - 899		0.2								5.6										
	Sp	600 - 699																				
		700 - 799					4.8								0.0	22.4		1.0				4.2
		800 - 899	29.3		27.0					24.4											0.1	
		900 - 999																				
	Va	800 - 899		0.1																		
private land Total			29.3	0.3	27.0	24.0	4.8			24.4	25.4	5.6			0.0	22.4		1.0			0.1	19.1
other land	Ba	600 - 699																				
		900 - 999																				
	Mo	600 - 699																				
		700 - 799																				0.3
	Pj	800 - 899																				
	Qu	600 - 699							12.3													
		700 - 799																				
		800 - 899										0.0					0.0					
	Sp	600 - 699																				
		700 - 799													0.6							
		800 - 899								0.8				0.0			0.2			0.3		
		900 - 999																				
	Va	800 - 899		2.0										1.2						0.6		
other land Total				2.0					12.3	0.8		0.0		1.2	0.6		0.2			0.9		1.1
Grand Total			29.3	27.7	27.0	27.0	25.8	25.6	25.6	25.6	25.4	24.0	23.9	23.2	22.6	22.4	22.2	21.9	21.8	21.6	21.0	20.8
Additional Criteria	TEC		0	0	0	12	0	0	0	0	0	2	8	0	0	0	0	0	0	0	0	0
	Priority & rare Fauna		0	0	0	0	0	0	0	2	0	0	9	0	0	0	0	0	0	0	0	0
	Priority & rare Flora		0	0	0	0	0	0	0	0	0	0	5	1	2	1	0	0	0	1	0	0

Soil Systems Ab = Abba, Ba = Bassendean, Mo = Morre River, Pj = Pinjarra, Qu = Quindalup, Sp = Spearwood, Va = Vasse

Priority 2 Polygons

Tuart HVC Matrix

Tenure	Soil System	Rainfall	50	5	138	92	191	62	212	146	88	22	164	190	23	126	181	17	217	113	75	47	139
CALM managed land	Ab	700 - 799																					
	Ba	800 - 899						18.1															
	Mo	600 - 699																					
	Qu	500 - 599																					
		700 - 799																					
		800 - 899																					
	Sp	500 - 599																					
		600 - 699														13.4							
		700 - 799		20.3									0.0						8.4	13.0			
		800 - 899								17.1	12.6										12.6		
		900 - 999									3.6												
	Va	800 - 899																					
CALM managed land Total				20.3				18.1		17.1	16.2		0.0			13.4			8.4	13.0	12.6		
public land	Ba	800 - 899																					
	Mo	600 - 699																					
		700 - 799																					
	Pj	800 - 899																					
	Qu	600 - 699																					
		700 - 799										0.1										1.0	
		800 - 899															2.7						
	Sp	600 - 699																					
		700 - 799										3.0		5.4					3.4			0.0	
		800 - 899																					
	Va	800 - 899																					
public land Total												3.1		5.4			2.7		3.4			1.0	
private land	Ab	700 - 799																					
	Ba	600 - 699																					
		800 - 899							4.3														
		900 - 999																					
	Mo	600 - 699																					
		700 - 799			12.0																		
	Pj	800 - 899																					
	Qu	600 - 699																					
		700 - 799										1.9										11.2	
		800 - 899															11.6	14.0					
	Sp	600 - 699														1.0							
		700 - 799			7.9		18.6					10.9	14.5	3.8					0.6			0.2	
		800 - 899	19.8			18.9			13.0						14.4								
		900 - 999																					
	Va	800 - 899	0.6																				
private land Total			20.4		19.9	18.9	18.6		17.2			12.8	14.5	3.8	14.4	1.0	11.6	14.0	0.6			11.4	
other land	Ba	800 - 899																					
		900 - 999																					
	Mo	600 - 699																					
		700 - 799			0.4																		
	Pj	800 - 899																					
	Qu	600 - 699																					
		700 - 799																					
		800 - 899																					
	Sp	600 - 699																					
		700 - 799											0.7	5.2					1.2				12.3
		800 - 899	0.0																				
		900 - 999																					
	Va	800 - 899																					
other land Total			0.0		0.4								0.7	5.2					1.2				12.3
Grand Total			20.4	20.3	20.2	18.9	18.6	18.1	17.2	17.1	16.2	15.9	15.3	14.5	14.4	14.4	14.4	14.0	13.6	13.0	12.6	12.4	12.3
Additional Criteria	TEC		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Priority & rare Fauna		1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0
	Priority & rare Flora		0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

Soil Systems Ab = Abba, Ba = Bassendean, Mo = Morre River, P = Pinjarra, Qu = Quindalup, Sp = Spearwood, Va = Vasse

Priority 2 Polygons

Tuart HVC Matrix

Tenure	Soil System	Rainfall	109	195	15	52	114	97	8	55	184	43	215	41	96	91	21	200	124	196	95	142	122	175
CALM managed land	Ab	700 - 799																						
	Ba	600 - 699																						
	Mo	600 - 699																						
	Qu	500 - 599																						
		700 - 799																						
		800 - 899				10.5																		
	Sp	500 - 599																						
		600 - 699																						
		700 - 799	12.1	4.6			11.6		10.6			9.9		9.5						8.6		8.3	8.3	
		800 - 899				0.4										6.7								
		900 - 999														2.5								
	Va	800 - 899																						
CALM managed land Total			12.1	4.6		10.9	11.6		10.6			9.9		9.5		9.2				8.6		8.3	8.3	
public land	Ba	800 - 899								10.4														
	Mo	600 - 699											1.8											
		700 - 799																						
	Pj	800 - 899																						
	Qu	600 - 699																						
		700 - 799																						
		800 - 899									8.7													
	Sp	600 - 699																						
		700 - 799																						
		800 - 899									0.0							7.8						
	Va	800 - 899																						
public land Total										10.4	8.7		1.8					7.8						
private land	Ab	700 - 799																						
	Ba	600 - 699																			0.1			
		800 - 899																						
		900 - 999																						
	Mo	600 - 699											3.3											
		700 - 799																						
	Pj	800 - 899																						
	Qu	600 - 699																						
		700 - 799																						6.2
		800 - 899									0.6													
	Sp	600 - 699											2.8								8.2			
		700 - 799		6.1															8.6					
		800 - 899			11.7						0.1						9.1	1.0						
		900 - 999																						
	Va	800 - 899																						
private land Total				6.1	11.7						0.8		6.1				9.1	1.0	8.6		8.3			6.2
other land	Ba	800 - 899																						
		900 - 999																						
	Mo	600 - 699											1.5											
		700 - 799																						
	Pj	800 - 899																						
	Qu	600 - 699						0.2							9.2									
		700 - 799						10.9																
		800 - 899				0.6					0.4													
	Sp	600 - 699											0.1											
		700 - 799		1.1																				
		800 - 899				0.1					0.0													
		900 - 999																						
	Va	800 - 899																						
other land Total				1.1		0.8		11.2			0.5		1.6		9.2									
Grand Total			12.1	11.7	11.7	11.6	11.6	11.2	10.6	10.4	10.0	9.9	9.5	9.5	9.2	9.2	9.1	8.8	8.6	8.6	8.3	8.3	8.3	8.2
Additional Criteria	TEC		0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	0	0	0	1	2	0
	Priority & rare Fauna		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Priority & rare Flora		0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	1	0	0	0

Soil Systems Ab = Abba, Ba = Bassendean, Mo = Morre River, Pj = Pinjarra, Qu = Quindalup, Sp = Spearwood, Va = Vasse

Priority 2 Polygons

Tuart HVC Matrix

Tenure	Soil System	Rainfall	42	16	197	10	40	74	159	117	34	186	123	118	58	44	101	208	202	179	206	83	99	31	119
CALM managed land	Ab	700 - 799																							
	Ba	800 - 899																							
	Mo	600 - 699																							
	Qu	500 - 599																							
		700 - 799																							
		800 - 899																							
	Sp	500 - 599																				0.5			
		600 - 699																							
		700 - 799	8.1		7.3	7.0	7.2			6.9			6.7	6.2	6.1	6.1			5.0		5.5				5.2
		800 - 899						6.8			6.9							5.6				1.7			
		900 - 999																							
	Va	800 - 899						0.1																	
CALM managed land Total			8.1		7.3	7.0	7.2	7.0		6.9	6.9		6.7	6.2	6.1	6.1		5.6	5.0		5.5	2.5			5.2
public land	Ba	800 - 899																							
	Mo	600 - 699																							
		700 - 799																							
	Pj	800 - 899																							
	Qu	600 - 699																							
		700 - 799															2.9			0.2					
		800 - 899																							
	Sp	600 - 699																							
		700 - 799															0.0							0.7	
		800 - 899																							
	Va	800 - 899																							
public land Total																	2.9			0.2				0.7	
private land	Ab	700 - 799																							
	Ba	600 - 699																							
		800 - 899																							
		900 - 999																					5.2		
	Mo	600 - 699																							
		700 - 799																							
	Pj	800 - 899																							
	Qu	600 - 699																							
		700 - 799															3.1			5.5					
		800 - 899																				2.7			
	Sp	600 - 699																							
		700 - 799			0.3				6.9								0.4		0.0					4.6	
		800 - 899		8.0				0.2				6.6						0.2				0.1	0.2		
		900 - 999																							
	Va	800 - 899																							
private land Total				8.0	0.3			0.2	6.9			6.6					3.1	0.2	0.0	5.5		2.8	5.4	4.6	
other land	Ba	800 - 899																							
		900 - 999																							
	Mo	600 - 699																							
		700 - 799																							
	Pj	800 - 899																							
	Qu	600 - 699																							
		700 - 799																							
		800 - 899																							
	Sp	600 - 699																							
		700 - 799				0.6																			
		800 - 899										0.1							0.2					0.1	
		900 - 999																							
	Va	800 - 899																							
other land Total						0.6						0.1							0.2					0.1	
Grand Total			8.1	8.0	7.6	7.6	7.2	7.1	6.9	6.9	6.9	6.7	6.7	6.2	6.1	6.1	6.0	5.8	5.7	5.6	5.5	5.4	5.4	5.3	5.2
Additional Criteria	TEC		1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0
	Priority & rare Fauna		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Priority & rare Flora		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

Soil Systems Ab = Abba, Ba = Bassendean, Mo = Morre River, P = Pinjarra, Qu = Quindalup, Sp = Spearwood, Va = Vasse

Priority 2 Polygons

Tuart HVC Matrix

Tenure	Soil System	Rainfall	37	2	85	216	111	30	90	185	204	84	192	154	143	53	77	116	25	128	112	107	20	105	163
CALM managed land	Ab	700 - 799																							
	Ba	600 - 699																							
	Mo	600 - 699																							
	Qu	500 - 599		5.7																					
		700 - 799																							
		800 - 899															2.6								
	Sp	500 - 599		3.4																					
		600 - 699																		4.1					
		700 - 799					4.9						3.3		4.3			4.2			4.0	4.0			3.1
		800 - 899			5.0							4.6				4.0			4.1						
		900 - 999																							
	Va	800 - 899															3.1								
CALM managed land Total				5.1	5.0		4.9					4.6	3.3		4.3	4.0	3.7	4.2	4.1	4.1	4.0	4.0			3.1
public land	Ba	800 - 899																							
	Mo	600 - 699																							
		700 - 799				0.4																			
	Pj	800 - 899																							
	Qu	600 - 699																							
		700 - 799																					0.1		
		800 - 899																					0.2		
	Sp	600 - 699																							
		700 - 799																						3.3	
		800 - 899																							
	Va	800 - 899																					0.1		
public land Total						0.4																	0.4	3.4	
private land	Ab	700 - 799																							
	Ba	600 - 699																							
		800 - 899																							
		900 - 999							0.1																
	Mo	600 - 699																							
		700 - 799				4.6																			
	Pj	800 - 899																							
	Qu	600 - 699																							
		700 - 799												0.1											
		800 - 899																					2.1		
	Sp	600 - 699																		0.0					
		700 - 799	5.1										0.3	4.4											
		800 - 899						4.6	0.0	4.6	4.6														
		900 - 999							4.7																
	Va	800 - 899																					1.0		
private land Total			5.1			4.6		4.6	4.8	4.6	4.6		0.3	4.5						0.0			3.1		
other land	Ba	800 - 899																							
		900 - 999																							
	Mo	600 - 699																							
		700 - 799				0.0																			
	Pj	800 - 899																							
	Qu	600 - 699																							
		700 - 799																							
		800 - 899															0.3								
	Sp	600 - 699																							
		700 - 799											0.6												0.1
		800 - 899						0.2		0.0						0.2									
		900 - 999																							
	Va	800 - 899															0.2								
other land Total						0.0		0.2		0.0			0.9			0.2	0.5								0.1
Grand Total			5.1	5.1	5.0	5.0	4.9	4.8	4.8	4.7	4.6	4.6	4.5	4.5	4.3	4.2	4.2	4.2	4.1	4.1	4.0	4.0	3.5	3.4	3.2
Additional Criteria	TEC		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	1
	Priority & rare Fauna		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
	Priority & rare Flora		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Soil Systems Ab = Abba, Ba = Bassendean, Mo = Morre River, P = Pinjarra, Qu = Quindalup, Sp = Spearwood, Va = Vasse

Priority 2 Polygons

Tuart HVC Matrix

Tenure	Soil System	Rainfall	127	100	39	162	180	147	38	110	193	121	94	73	149	32	72	182	108	141	36	1	148	106	93
CALM managed land	Ab	700 - 799																							
	Ba	600 - 699																							
	Mo	600 - 699																							
	Qu	500 - 599																							
		700 - 799																							
		800 - 899															2.1								
	Sp	500 - 599																							
		600 - 699	2.5																						
		700 - 799			3.0		3.0		2.9	2.7	1.9								2.0					1.7	
		800 - 899												2.5			0.2								
		900 - 999																							
	Va	800 - 899																							
CALM managed land Total			2.5		3.0		3.0		2.9	2.7	1.9			2.5			2.3		2.0					1.7	
public land	Ba	800 - 899																							
	Mo	600 - 699																							
		700 - 799																							
	Pj	800 - 899																							
	Qu	600 - 699		3.1																					
		700 - 799																							
		800 - 899																2.0							
	Sp	600 - 699																							
		700 - 799														1.0									
		800 - 899																							
	Va	800 - 899																							
public land Total				3.1												1.0		2.0							
private land	Ab	700 - 799																							
	Ba	600 - 699																							
		800 - 899																							1.7
		900 - 999																							
	Mo	600 - 699																							
		700 - 799																							
	Pj	800 - 899																							
	Qu	600 - 699																							
		700 - 799										0.5													
		800 - 899																							
	Sp	600 - 699	0.6										2.5												
		700 - 799					0.0					2.2			2.5	1.4					1.9		1.8		
		800 - 899				3.0		3.0														1.8			
		900 - 999																							
	Va	800 - 899																							
private land Total			0.6			3.0	0.0	3.0				2.7	2.5		2.5	1.4					1.9	1.8	1.8		1.7
other land	Ba	800 - 899																							
		900 - 999																							
	Mo	600 - 699																							
		700 - 799																							
	Pj	800 - 899																							
	Qu	600 - 699																							
		700 - 799																							
		800 - 899																							
	Sp	600 - 699																							
		700 - 799									0.5					0.1									
		800 - 899						0.0																	
		900 - 999																							
	Va	800 - 899																							
other land Total								0.0			0.5					0.1					1.9				
Grand Total			3.1	3.1	3.0	3.0	3.0	3.0	2.9	2.7	2.7	2.7	2.5	2.5	2.5	2.4	2.3	2.0	2.0	1.9	1.9	1.8	1.8	1.7	1.7
Additional Criteria	TEC		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Priority & rare Fauna		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Priority & rare Flora		0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0

Soil Systems Ab = Abba, Ba = Bassendean, Mo = Morre River, P = Pinjarra, Qu = Quindalup, Sp = Spearwood, Va = Vasse

Priority 2 Polygons

Tuart HVC Matrix

Tenure	Soil System	Rainfall	89	6	156	71	125	35	28	140	136	56	33	103	158	129	152	14	13	82	151	69	153	70	176	11
CALM managed land	Ab	700 - 799																								
	Ba	800 - 899																								
	Mo	600 - 699																								
	Qu	500 - 599																								
		700 - 799																								
		800 - 899				0.2																		0.5		
	Sp	500 - 599																								
		600 - 699					1.4																			
		700 - 799																								
		800 - 899				1.3		1.4			0.6		1.1													
		900 - 999																								
	Va	800 - 899																								
CALM managed land Total						1.5	1.4	1.4			0.6		1.1											0.5		
public land	Ba	800 - 899																								
	Mo	600 - 699																								
		700 - 799														1.1										
	Pj	800 - 899																								
	Qu	600 - 699																								
		700 - 799																								
		800 - 899																								
	Sp	600 - 699																								
		700 - 799																								
		800 - 899																								
	Va	800 - 899																								
public land Total																1.1										
private land	Ab	700 - 799																								
	Ba	600 - 699																								
		800 - 899	0.0																							
		900 - 999																								
	Mo	600 - 699																								
		700 - 799														0.0										
	Pj	800 - 899																								
	Qu	600 - 699																								
		700 - 799												0.3	0.2		0.9				0.3				0.5	
		800 - 899							0.0																	
	Sp	600 - 699																								
		700 - 799		1.5	1.5							1.2		0.8	0.7		0.1	1.0	0.9	0.8	0.5	0.8	0.6			0.5
		800 - 899	1.5						1.4																	
		900 - 999																								
	Va	800 - 899																								
private land Total			1.5	1.5	1.5				1.4			1.2		1.1	1.0	0.0	1.0	1.0	0.9	0.8	0.8	0.8	0.6		0.5	0.5
other land	Ba	800 - 899																								
		900 - 999																								
	Mo	600 - 699																								
		700 - 799																								
	Pj	800 - 899																								
	Qu	600 - 699																								
		700 - 799																							0.0	
		800 - 899																								
	Sp	600 - 699																								
		700 - 799								1.2					0.1											
		800 - 899									0.6															
		900 - 999																								
	Va	800 - 899																								
other land Total										1.2	0.6				0.1										0.0	
Grand Total			1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.0	1.0	0.9	0.8	0.8	0.8	0.6	0.5	0.5	0.5
Additional Criteria	TEC		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Priority & rare Fauna		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Priority & rare Flora		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1

Soil Systems Ab = Abba, Ba = Bassendean, Mo = Morre River, P = Pinjarra, Qu = Quindalup, Sp = Spearwood, Va = Vasse

Priority 2 Polygons

Tuart HVC Matrix

Tenure	Soil System	Rainfall	102	12	60	160	29	64	61	63	65	Grand Total
CALM managed land	Ab	700 - 799										5.9
	Ba	800 - 899										156.9
	Mo	600 - 699										0.3
	Qu	500 - 599										11.7
		700 - 799										24.3
		800 - 899										27.2
	Sp	500 - 599										3.4
		600 - 699										51.7
		700 - 799							0.0			2824.9
		800 - 899										3680.4
		900 - 999										77.1
	Va	800 - 899										28.1
CALM managed land Total									0.0			**7114.9**
public land	Ba	800 - 899										55.0
	Mo	600 - 699										6.2
		700 - 799										2.1
	Pj	800 - 899										0.0
	Qu	600 - 699										10.4
		700 - 799										11.1
		800 - 899										33.7
	Sp	600 - 699										1.0
		700 - 799	0.0									223.8
		800 - 899										163.2
	Va	800 - 899										57.6
public land Total			0.0									**564.4**
private land	Ab	700 - 799										0.3
	Ba	600 - 699										0.1
		800 - 899										34.9
		900 - 999										0.8
	Mo	600 - 699										10.5
		700 - 799										31.4
	Pj	800 - 899										6.3
	Qu	600 - 699										25.4
		700 - 799										88.5
		800 - 899										155.0
	Sp	600 - 699										47.6
		700 - 799	0.5	0.4	0.4			0.1		0.0	0.0	995.1
		800 - 899					0.1					1461.5
		900 - 999										59.2
	Va	800 - 899										42.5
private land Total			0.5	0.4	0.4		0.1	0.1		0.0	0.0	**2959.5**
other land	Ba	800 - 899										4.5
		900 - 999										0.0
	Mo	600 - 699										1.8
		700 - 799										2.4
	Pj	800 - 899										0.1
	Qu	600 - 699										22.6
		700 - 799										11.9
		800 - 899										3.1
	Sp	600 - 699										0.3
		700 - 799				0.3						62.2
		800 - 899										100.8
		900 - 999										3.4
	Va	800 - 899										8.7
other land Total						0.3						**225.5**
Grand Total			0.5	0.4	0.4	0.3	0.1	0.1	0.0	0.0	0.0	**10864.3**
Additional Criteria		TEC	0	0	0	0	0	0	0	0	0	
		Priority & rare Fauna	0	0	0	0	0	0	0	0	2	
		Priority & rare Flora	0	1	0	0	0	1	0	0	0	

Soil Systems Ab = Abba, Ba = Bassendean, Mo = Morre River, P = Pinjarra, Qu = Quindalup, Sp = Spearwood, Va = Vasse

Priority 2 Polygons