Natural Area and Biodiversity Assessment – Vegetation

with examples from the Swan Coastal Plain

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Government of Western Australia

Thanks to the following people for the use of images they have composed -

Greg Keighery, Karen Clarke, Sally Madden and Mark Brundrett

AND to the hundreds of people who have contributed to the understanding of the natural areas in our state.

NATURAL AREA

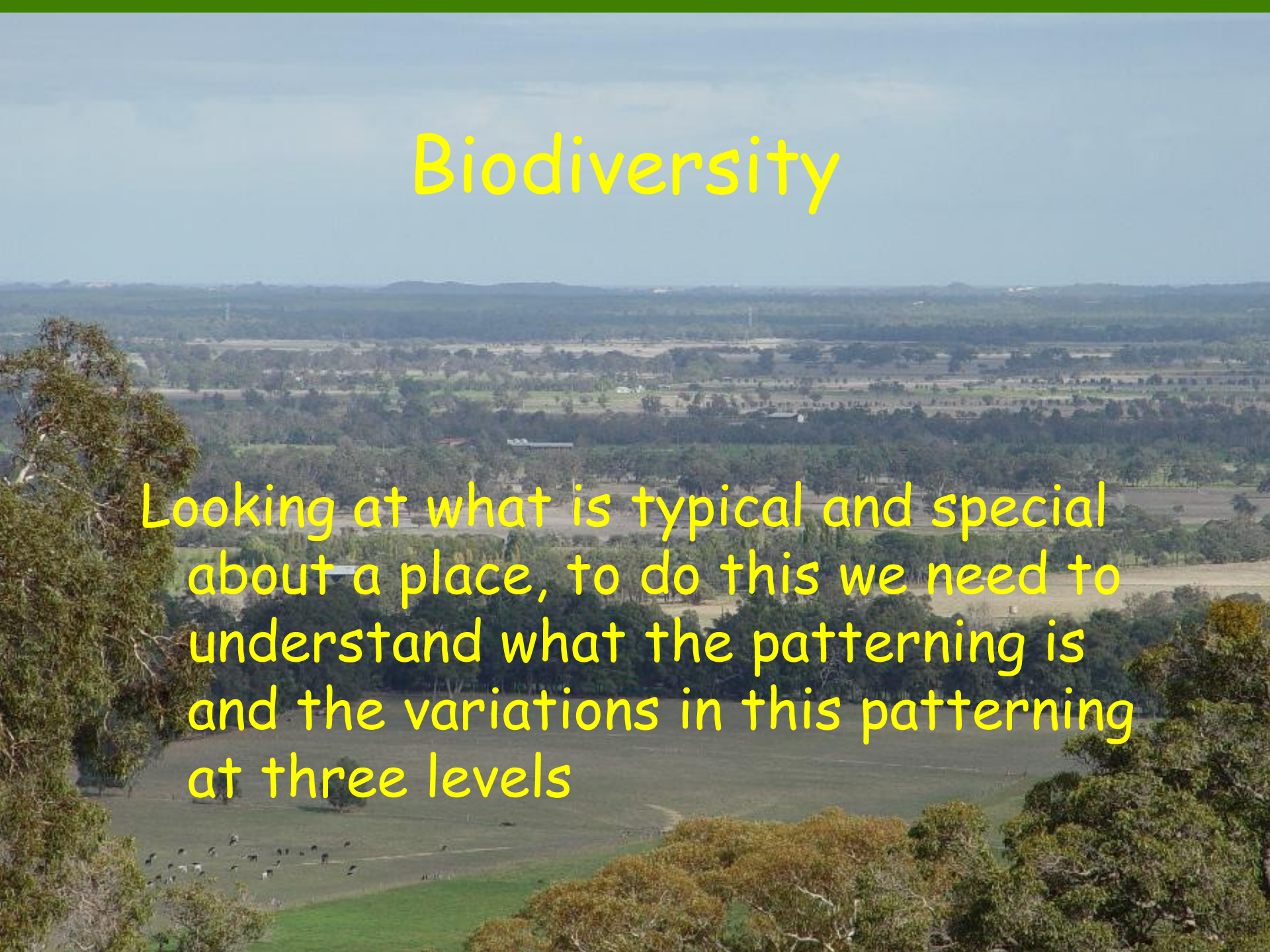
Naturally vegetated area or non-vegetated areas such as water bodies bare ground and rock outcrops.

NATURAL AREAS

Natural areas can be identified through mapping of the:

- total extent and location of naturally vegetated areas remaining (remnant native vegetation) and
- non-vegetated natural areas such as:
  - water bodies - rivers, lakes and estuaries
  - bare areas - sand, mud, rock etc

Biodiversity



Looking at what is typical and special about a place, to do this we need to understand what the patterning is and the variations in this patterning at three levels

Genetic variation - populations of species vary

Kunzea

Banksia menziesii

Biodiversity: Species

Jacksonia sericea

Jacksonia gracillima

Biodiversity: Communities

Ecological Community

'naturally occurring biological assemblages that occur in a a particular type of habitat'

English and Blyth 1997

REPRESENTATION OF ECOLOGICAL COMMUNITIES

A number of areas selected to represent the range of ecological communities and the places in which these communities merge.

REPRESENTATION OF ECOLOGICAL COMMUNITIES

- Comprehensive and adequate representation of each regional vegetation 'unit'.
- Areas contributing to at least 30 percent of each mapped regional unit in at least ten separate areas. In the defined constrained area this may be modified to at least 10%.

Other criteria related to vegetation – Diversity and Rarity


Surrogates
Banksia grandis
Photo: Bronwen Keighery

Interim Biogeographic Regionalisation for Australia

Interim Biogeographic Regionalisation for Australia — 5.1

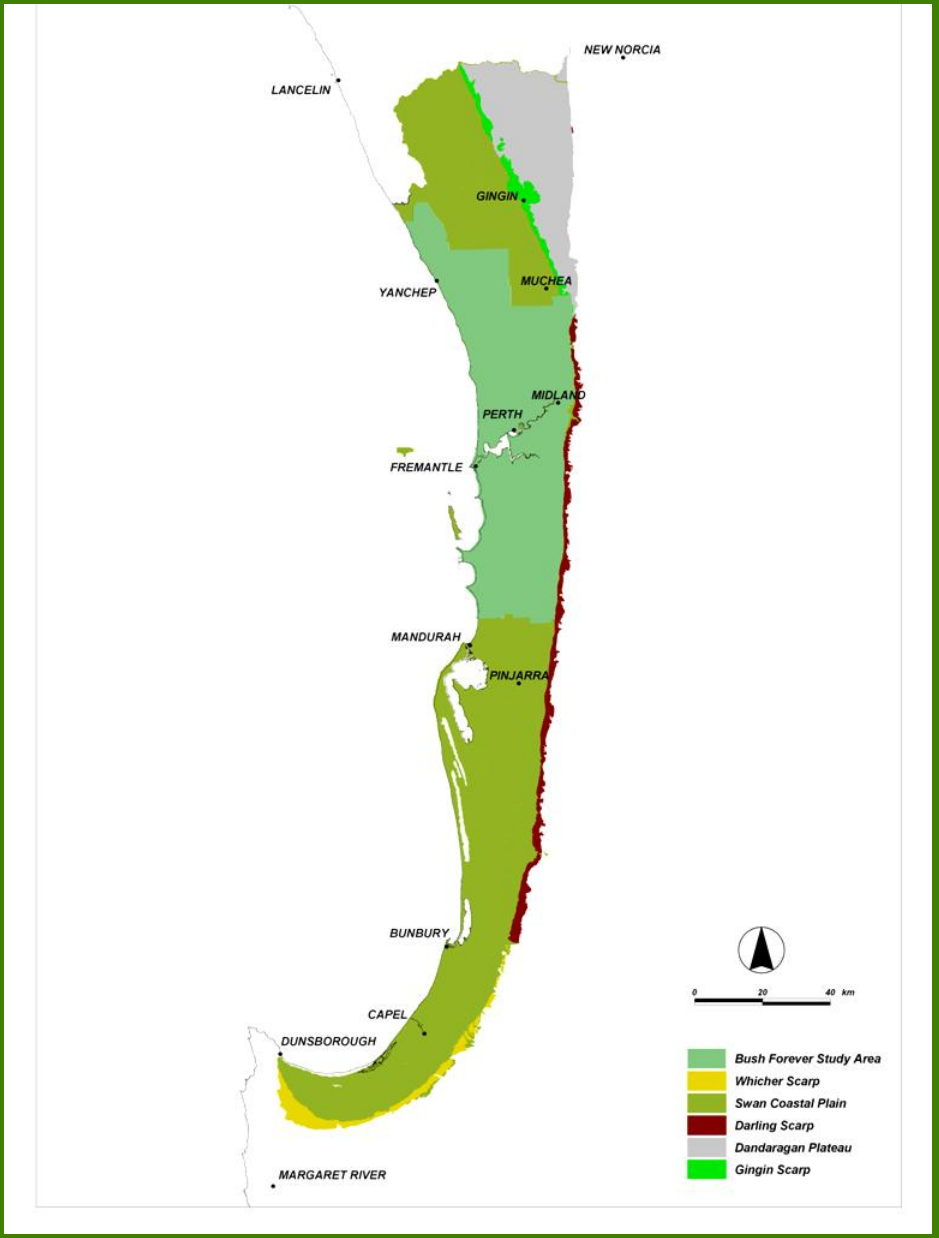
SWA Swan Coastal Plain

Low lying coastal plain, mainly covered with woodlands. It is dominated by *Banksia* or Tuart on sandy soils, *Allocasuarina obesa* on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah woodland. Warm Mediterranean. Three phases of marine sand dune development provide relief. The outwash plains, once dominated by *A. obesa*-marri woodlands and Melal extensive only in the south.

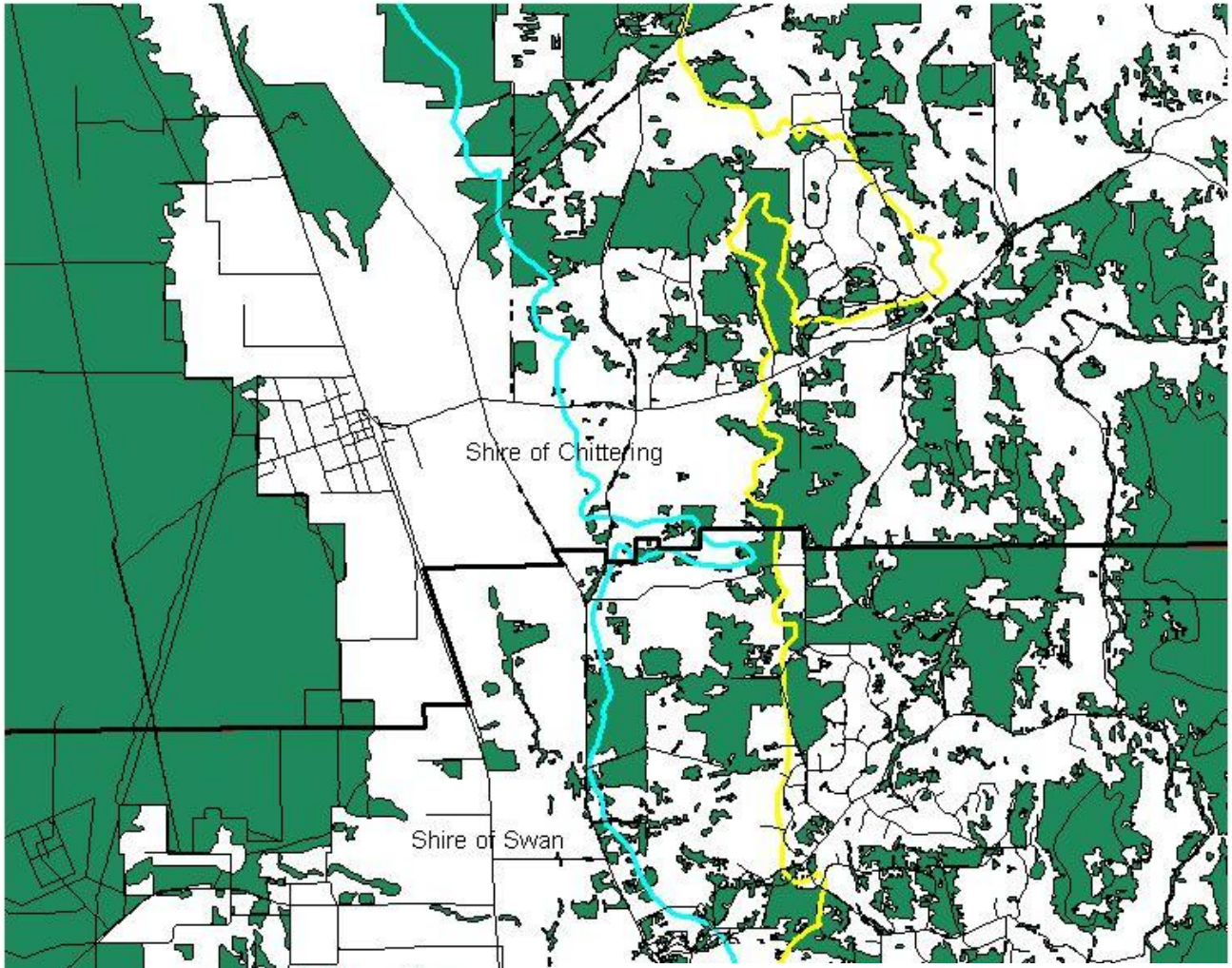
modified from DEC NatureBase 06.08 by BJ Keighery

Southern Swan Coastal Plain

- between Moore River and Dunsborough
- including the Gingin, Darling and Whicher Scarps
- excluding the Perth Metropolitan Region



What is remaining:
remnant native vegetation



NLWRA Native Vegetation Extent

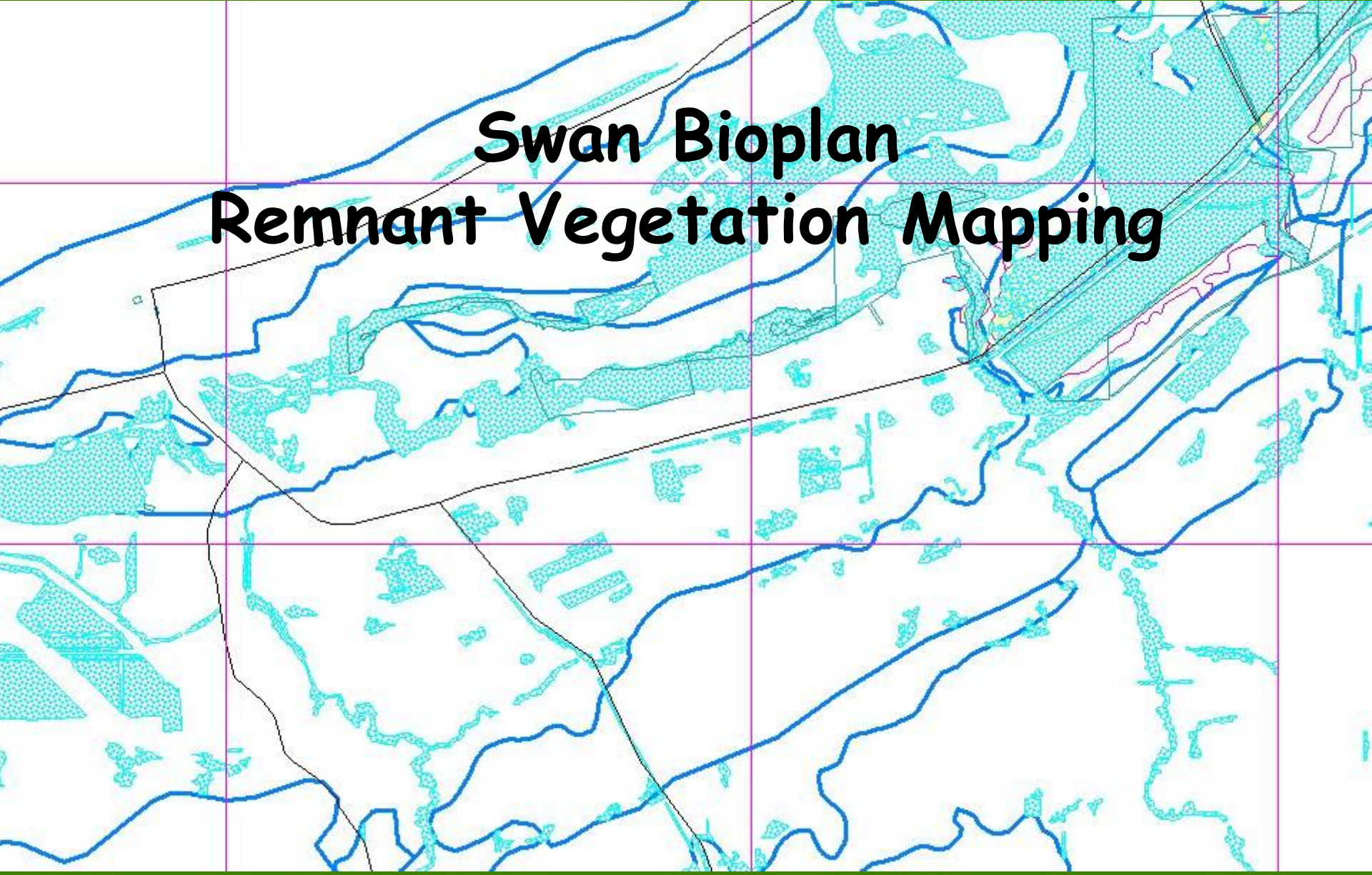
Roads Centrelines DLI 2004
Perth Metropolitan Boundary
Local Government Authority Boundaries
Biogeographic Sub-Regions 5.1 (IBRA 5.1)
Jarrah Forest
Swan Coastal Plain
Remveg (NLWRA)

0 2.5 5 Kilometers

Scale: 1:100,000

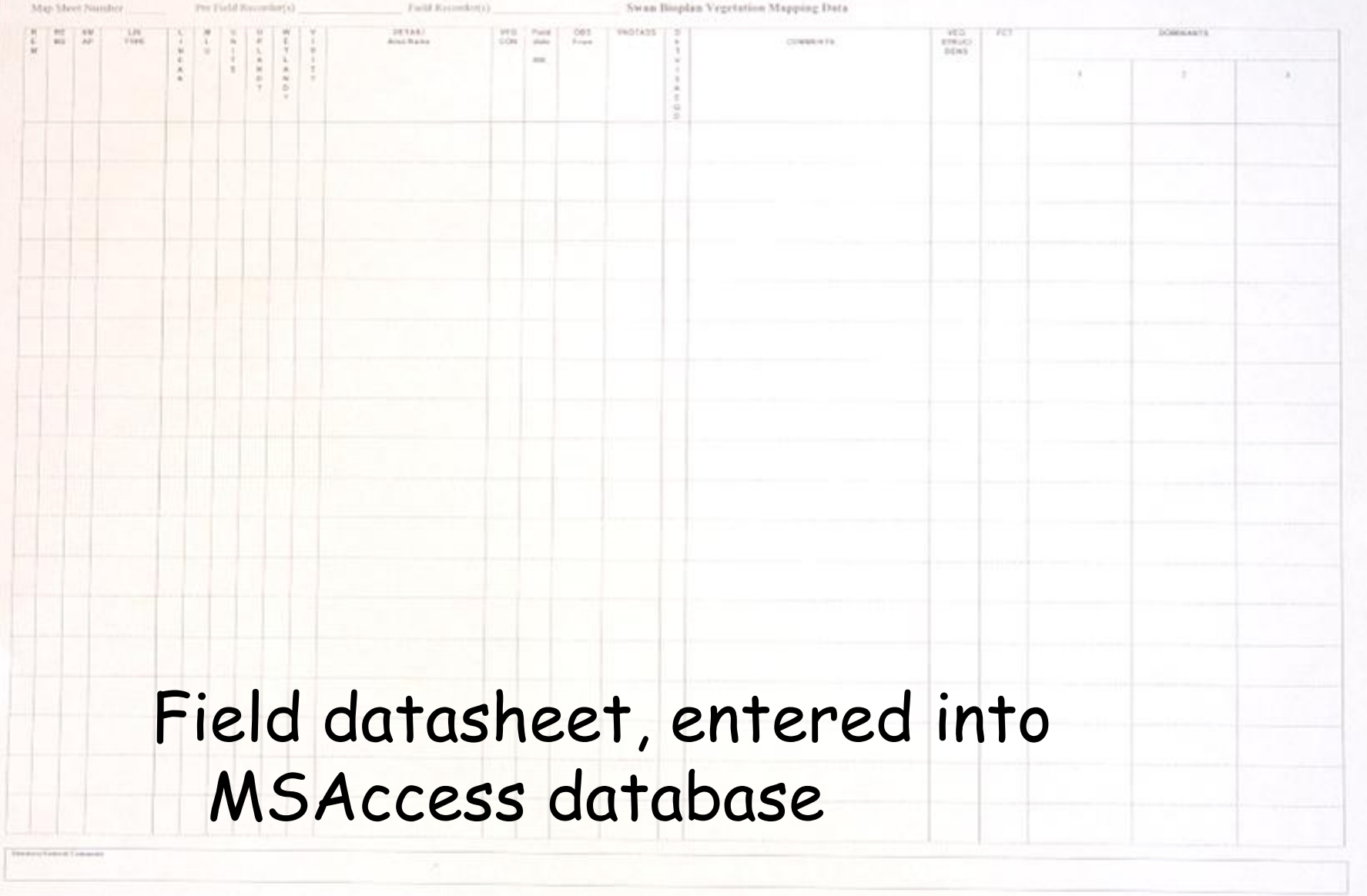
N

Swan Bioplan
Remnant Vegetation Mapping



Swan Bioplan tile boundary

Swan Bioplan remnant



Field datasheet, entered into MSAccess database

What condition is the vegetation in?

Bushland

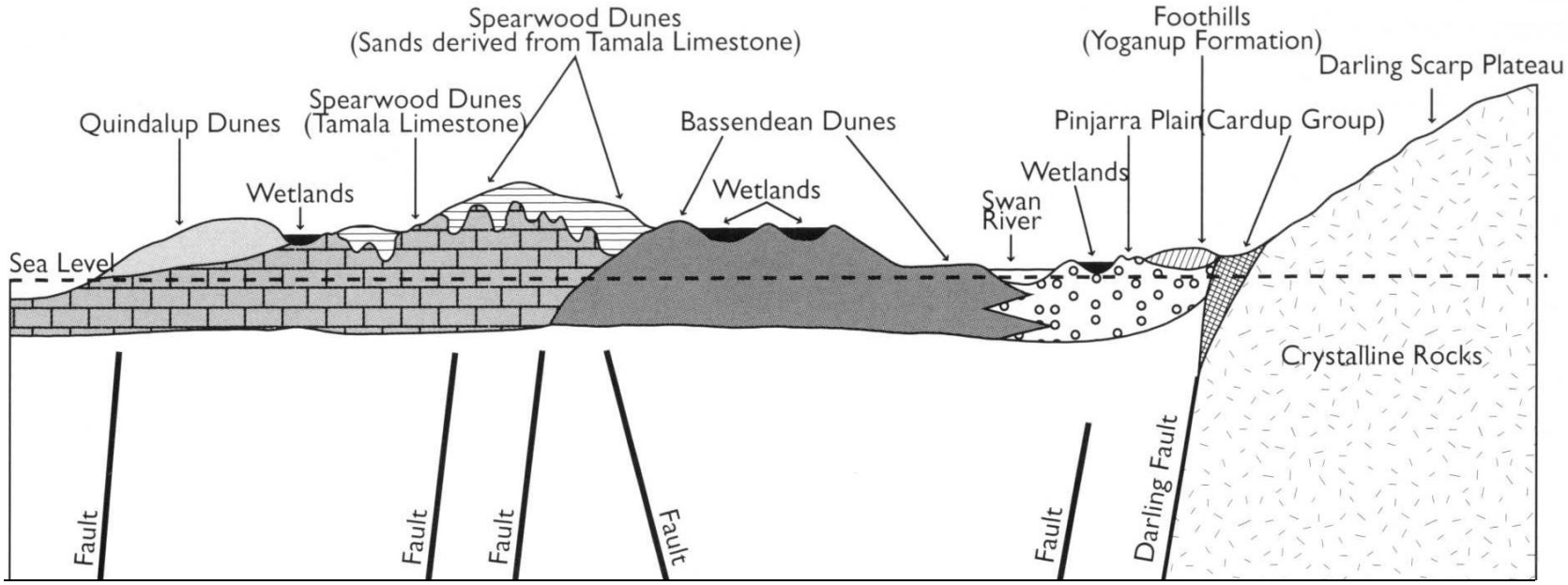
'land on which there is vegetation which is either a remainder of the natural vegetation of the land or, if altered, is still representative of the structure and floristics of the natural vegetation, and provides the necessary habitat for fauna'

Vegetation condition rating Good or better


Bushland


Bushland

Landforms



Foothills (Ridge Hill Shelf)

Yoganup Formation

Cardup Group

Spearwood Dunes

Tamala Limestones

Sands derived from Tamala Limestones

Pinjarra Plain

Guildford Formation

Bassendean Dunes

Bassendean Sand

Quindalup Dunes

Safety Bay Sands

Adapted with permission from Fact Sheet 15. The Geology of Perth. Department of Mineral Sands and Energy, WA.

Landforms

- Dandaragan Plateau/Gingin Scarp
- Foothills
- Pinjarra Plain
- Bassendean Dunes
- Bassendean Dunes/Pinjarra Plain
- Spearwood Dunes
- Quindalup Dunes
- Wetlands (within the Quindalup, Spearwood, Bassendean Dunes or Pinjarra Plain)
- Lagoonal and estuarine Deposits (within the Quindalup, Spearwood, Bassendean Dunes and Pinjarra Plain)

Soils

Photos: Bronwen Keighery


Foothills


Pinjarra Plain


Pinjarra Plain


Bassendean Dunes


Spearwood Dunes


Spearwood Dunes


Quindalup Dunes
Spearwood Dunes


Quindalup Dunes


Estuary


Upland
wetland

Wetlands

'areas of seasonally, intermittently or permanently waterlogged soils or inundated land whether natural or otherwise, fresh or saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries'

(Wetland Advisory Committee 1977).

Other wetland definitions

'areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed more than six metres'.

(State Wetland Conservation Policy, Government of Western Australia 1997)

Vegetation Types

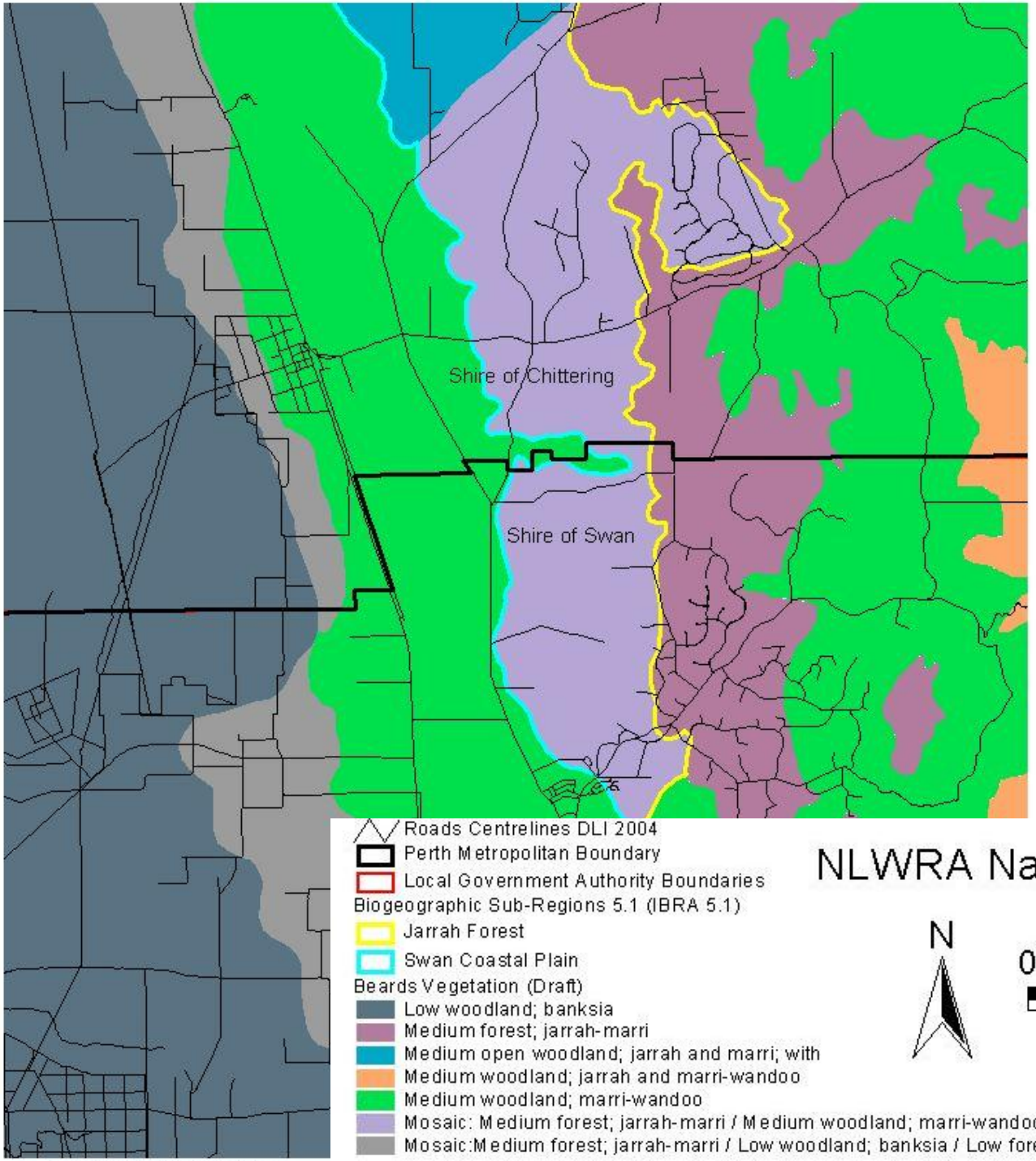
Vegetation units based on vegetation structure, cover and dominant species.

1960's and 70's Beard mapped the vegetation types of the Swan Coastal Plain, north of Pinjarra, at a 1 : 250 000 scale, based on the earlier mapping by Speck. The original extent of the vegetation types is mapped.

1981 Beard produced a map at a 1 : 1 000 000 scale for the entire area.

1996 Beard's 1 : 250 000 maps were digitised (Hopkins *et al.* 1996)

Vegetation Types



NLWRA Native Vegetation Types

N

0 2.5 5 Kilometers

Scale: 1:100,000

Roads Centrelines DLI 2004
Perth Metropolitan Boundary
Local Government Authority Boundaries
Biogeographic Sub-Regions 5.1 (IBRA 5.1)
Jarrah Forest
Swan Coastal Plain
Beards Vegetation (Draft)
Low woodland; banksia
Medium forest; jarrah-marri
Medium open woodland; jarrah and marri; with
Medium woodland; jarrah and marri-wandoo
Medium woodland; marri-wandoo
Mosaic: Medium forest; jarrah-marri / Medium woodland; marri-wandoo
Mosaic:Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree / Low woodland; Casuarina obesa

VEGETATION COMPLEXES

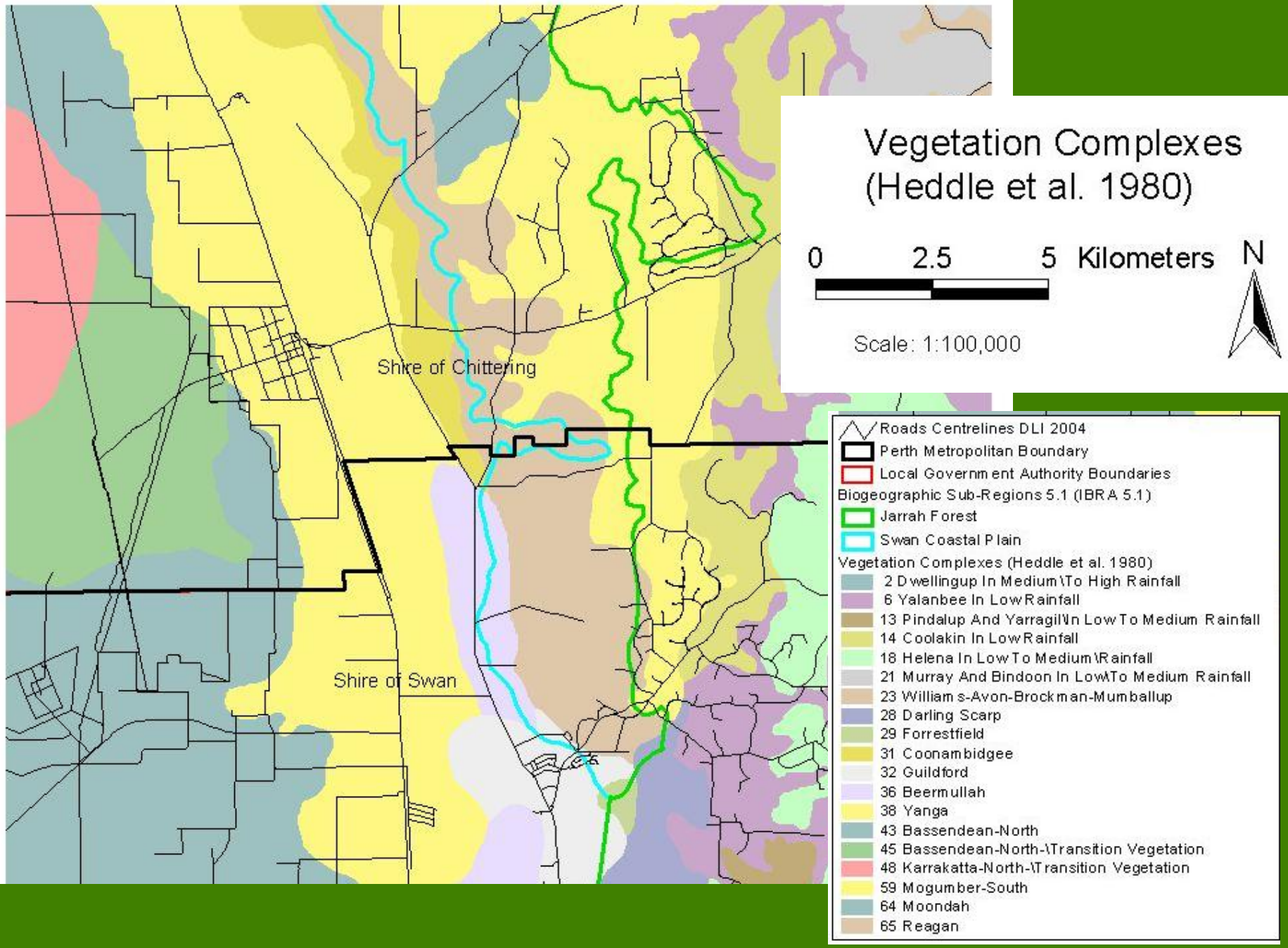
Vegetation complexes are a series of plant communities forming regularly repeating groups associated with a particular soil/landform units.

Heddle *et al.* 1980 and Mattiske and Havel 1998

Based on vegetation and floristic information from ground surveys (both plots and transects on small scale areas), road traverses, aerial photographs and from previous interpretations of the vegetation.

1 : 250 000 scale for the Swan Coastal Plain

1 : 50 000 the Jarrah Forest.


Vegetation Complexes
(Heddle et al. 1980)
0
2.5
5 Kilometers
N
Scale: 1:100,000
Shire of Chittering
Shire of Swan
Roads Centrelines DLI 2004
Perth Metropolitan Boundary
Local Government Authority Boundaries
Biogeographic Sub-Regions 5.1 (IBRA 5.1)
Jarrah Forest
Swan Coastal Plain
Vegetation Complexes (Heddle et al. 1980)
2 Dwellingup In Medium\To High Rainfall
6 Yalanbee In Low Rainfall
13 Pindalup And Yarragil\In Low To Medium Rainfall
14 Coolakin In Low Rainfall
18 Helena In Low To Medium\Rainfall
21 Murray And Bindoon In Low\To Medium Rainfall
23 Williams-Avon-Brockman-Mumballup
28 Darling Scarp
29 Forrestfield
31 Coonambidgee
32 Guildford
36 Beermullah
38 Yanga
43 Bassendean-North
45 Bassendean-North-\Transition Vegetation
48 Karrakatta-North-\Transition Vegetation
59 Mogumber-South
64 Moondah
65 Reagan

Foothills

FORRESTFIELD COMPLEX : Vegetation ranges from open forest of *E. calophylla - E. wandoo - E. marginata* to open forest of *E. marginata - E. calophylla - C. fraseriana - Banksia* species. Fringing woodland of *E. rudis* in the gullies that dissect this landform.


Pinjarra Plain
SERPENTINE RIVER COMPLEX : Closed scrub of *Melaleuca* species and fringing woodland of *E. rudis - M. rhaphiophylla* along streams.

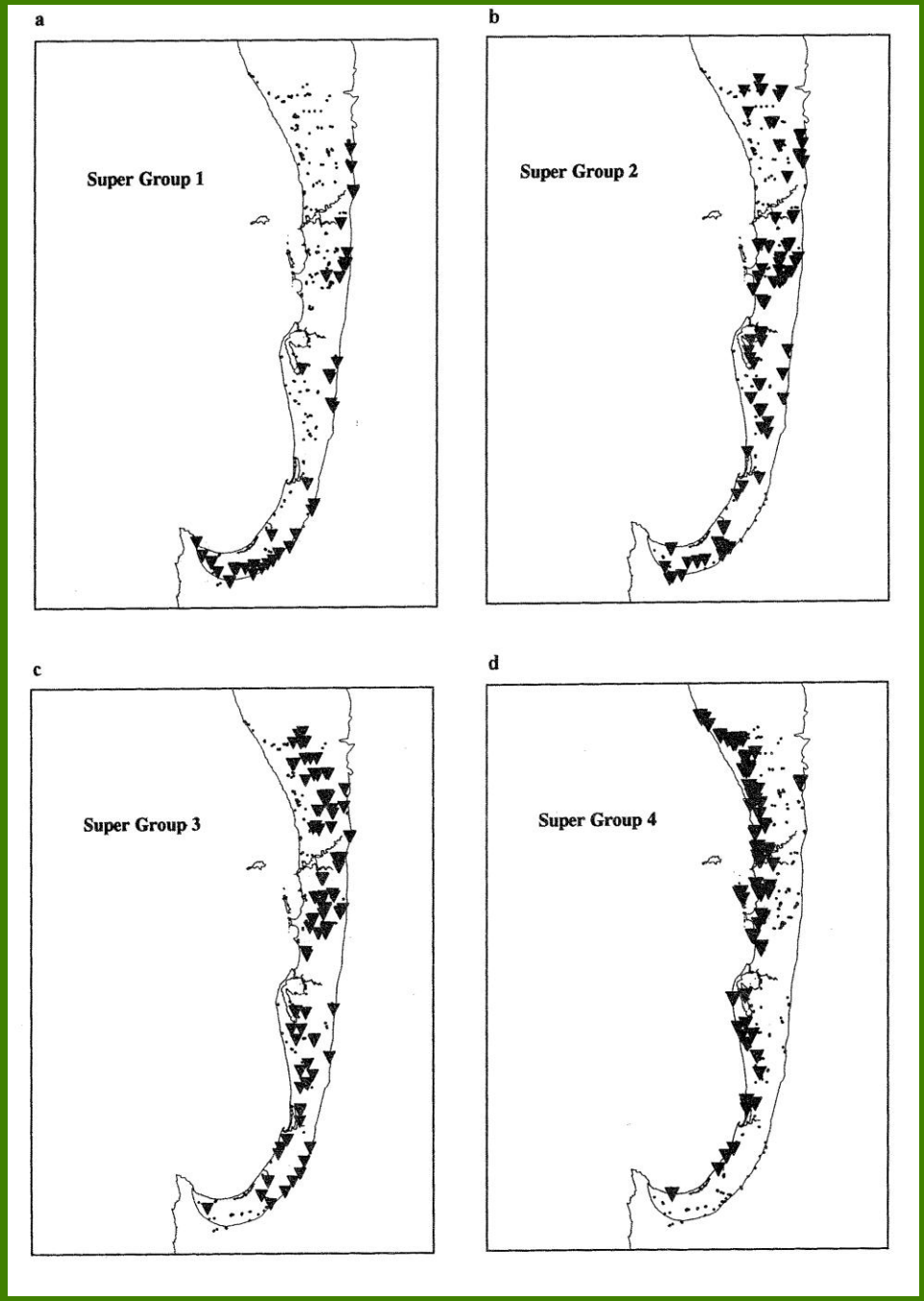
Spearwood Dunes

Quindalup Dunes

FLORISTIC COMMUNITY TYPES

- Distinctive floristic assemblages identified on the southern Swan Coastal Plain in Gibson *et al.* (1994) and DEP (1996).
- The presence or absence of individual taxa in standard areas (plots) is used to define floristic groupings based on shared species.
- Gibson *et al.* 44 FCT's, DEP 66 FCT's (additioal wetlands, Quindalup Dunes)

Foothills/
Pinjarra
Plain

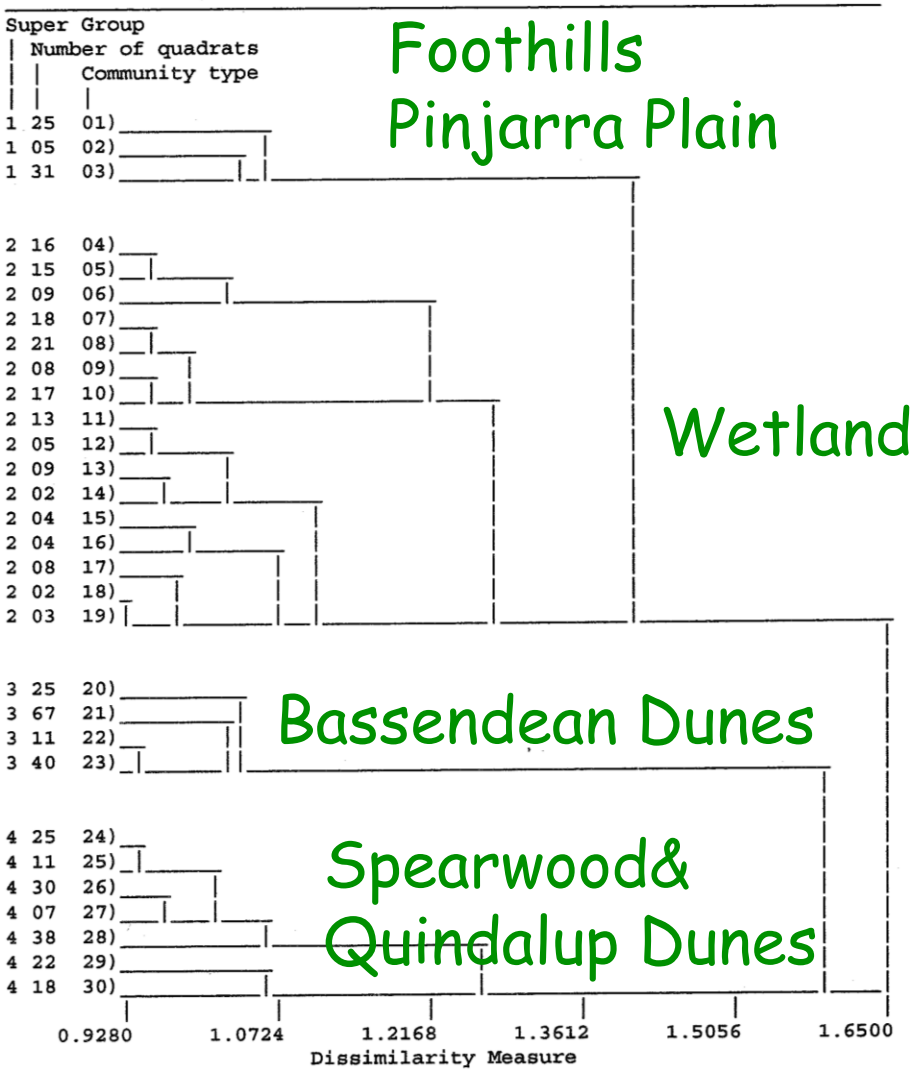


Wetlands

Bassendean
Dunes

Spearwood&
Quindalup
Dunes

Figure 6. Dendrogram showing the four super groups and the 30 community types defined from the floristic presence / absence data set.



Foothills
Pinjarra Plain

Wetlands

Bassendean Dunes

Spearwood&
Quindalup Dunes

Supergroups

Pinjarra Plain/Bassendean Dunes


Bassendean Dunes
23a Central Banksia attenuata - Banksia menziesii woodlands


Spearwood Dunes
26a *Melaleuca huegelii - Melaleuca acerosa* shrublands on Limestone ridges

Quindalup Dunes

S13 Northern *Olearia axillaris - Scaevola crassifolia* shrublands

THREATENED OR POORLY RESERVED PLANT COMMUNITIES

- Communities that have been recognised and mapped by the Environmental Protection Authority (1994).
- Majority of these areas are on the eastern side of the Swan Coastal Plain, with several from the west of the Plain. Keighery and Trudgen (1992) and Gibson *et al.* (1994) were used to identify these areas

THREATENED ECOLOGICAL COMMUNITIES

Categories related to the status of the threat to the community.

Reduced range and/or the total area occupied and/or the number of discrete occurrences

- "Presumed Totally Destroyed"
- "Critically Endangered" ≤ 10%
- "Endangered" ≤ 30%
- "Vulnerable" (English and Blyth 1997,1999).
- *Commonwealth Environment Protection and Biodiversity Act* 1999

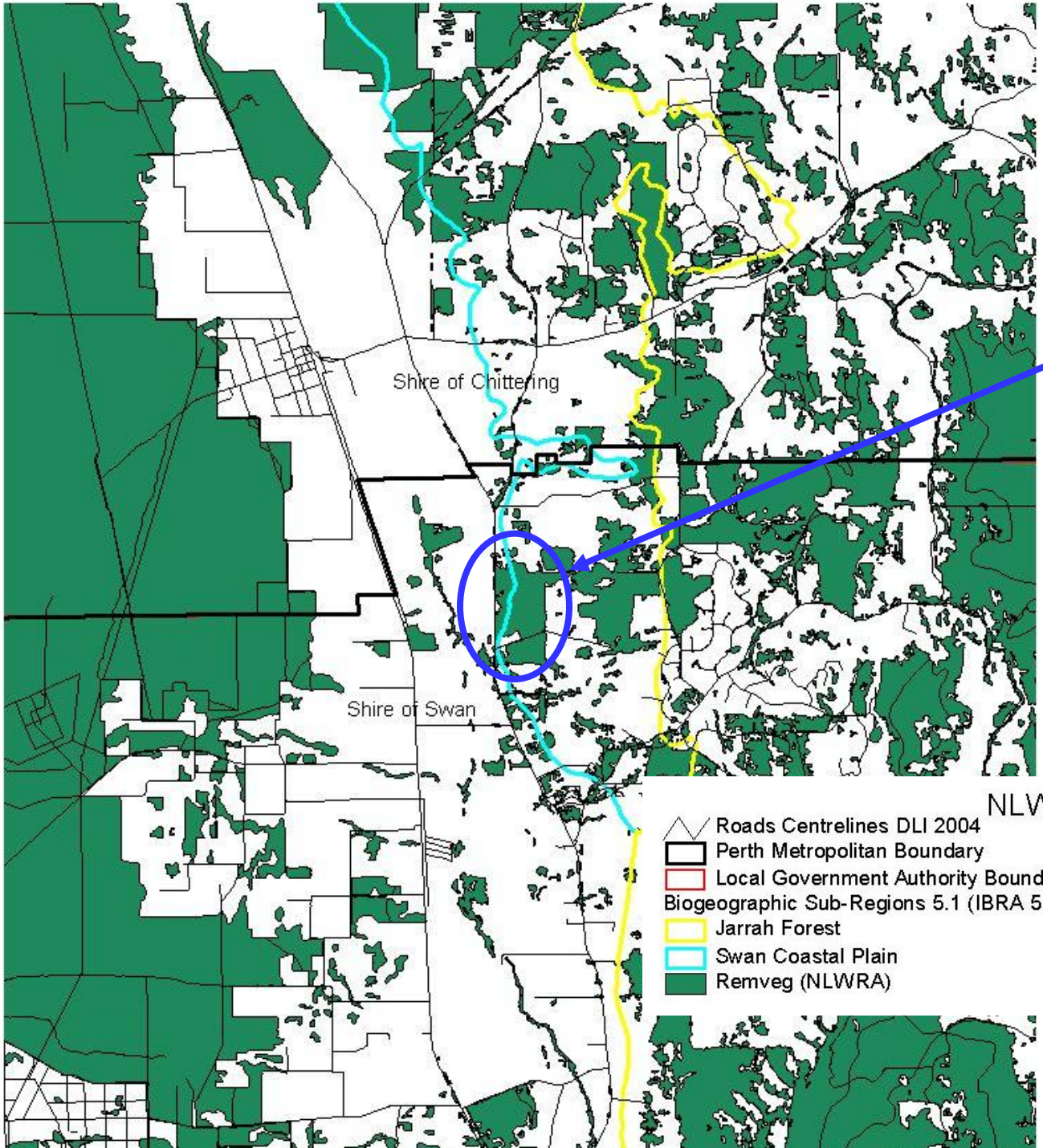

Foothills
20c Eastern shrublands and woodlands


Pinjarra Plain
8 Herb rich shrublands in clay pans

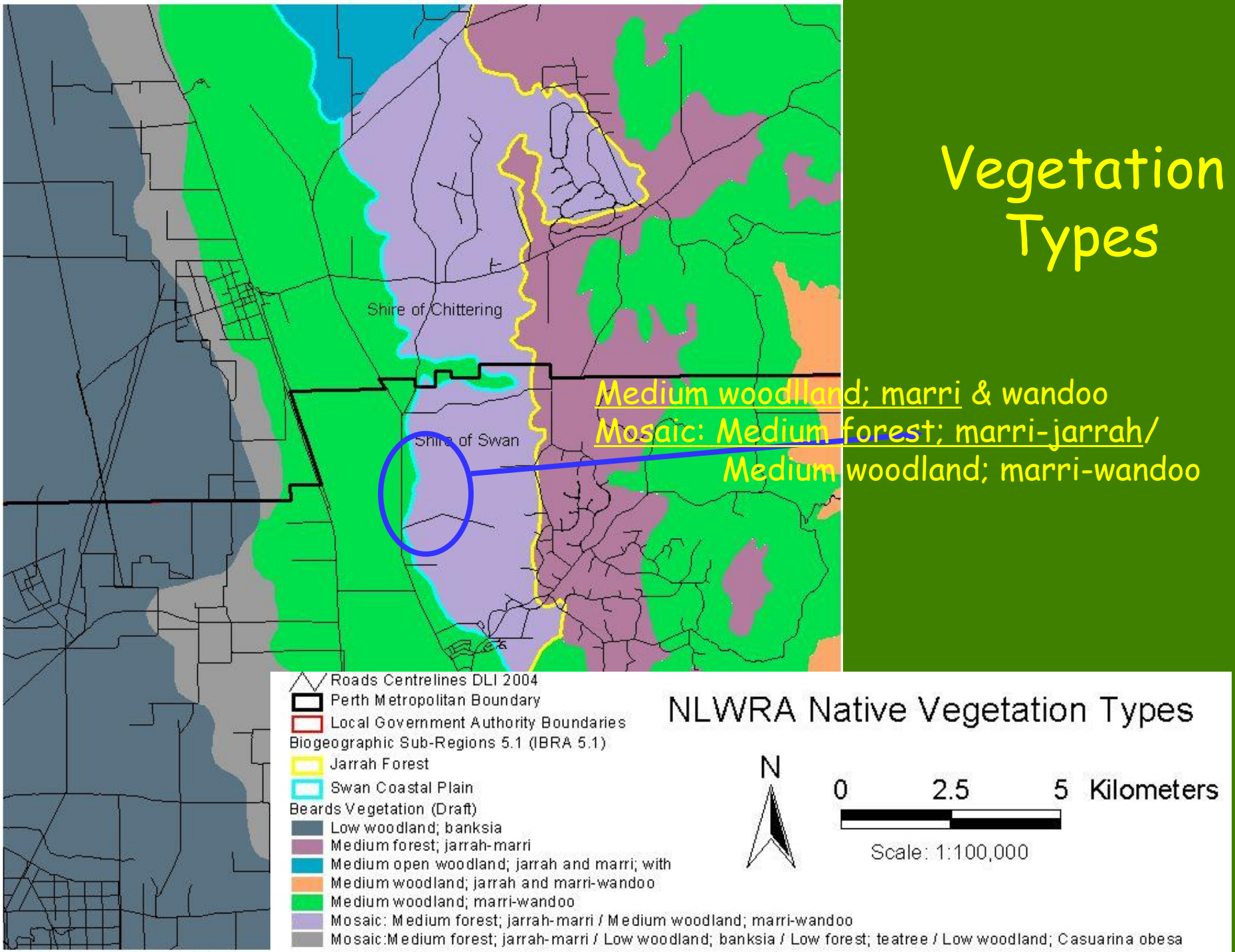
26a *Melaleuca huegelii - Melaleuca acerosa* shrublands on Limestone ridges

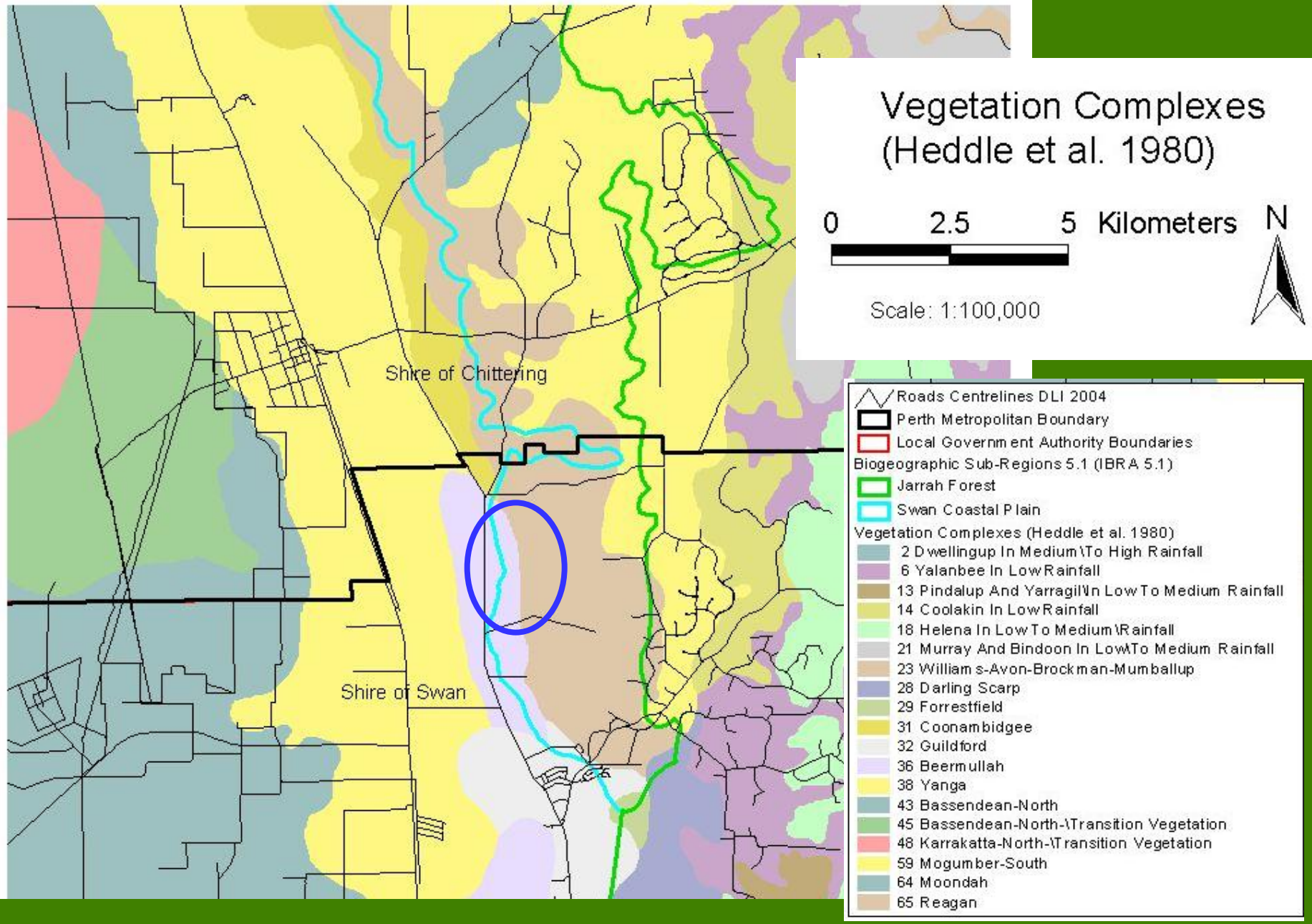
Remnant native vegetation

Bullsbrook Nature Reserve



Vegetation Types




Vegetation Complexes
(Heddle et al. 1980)
0
2.5
5 Kilometers
N
Scale: 1:100,000
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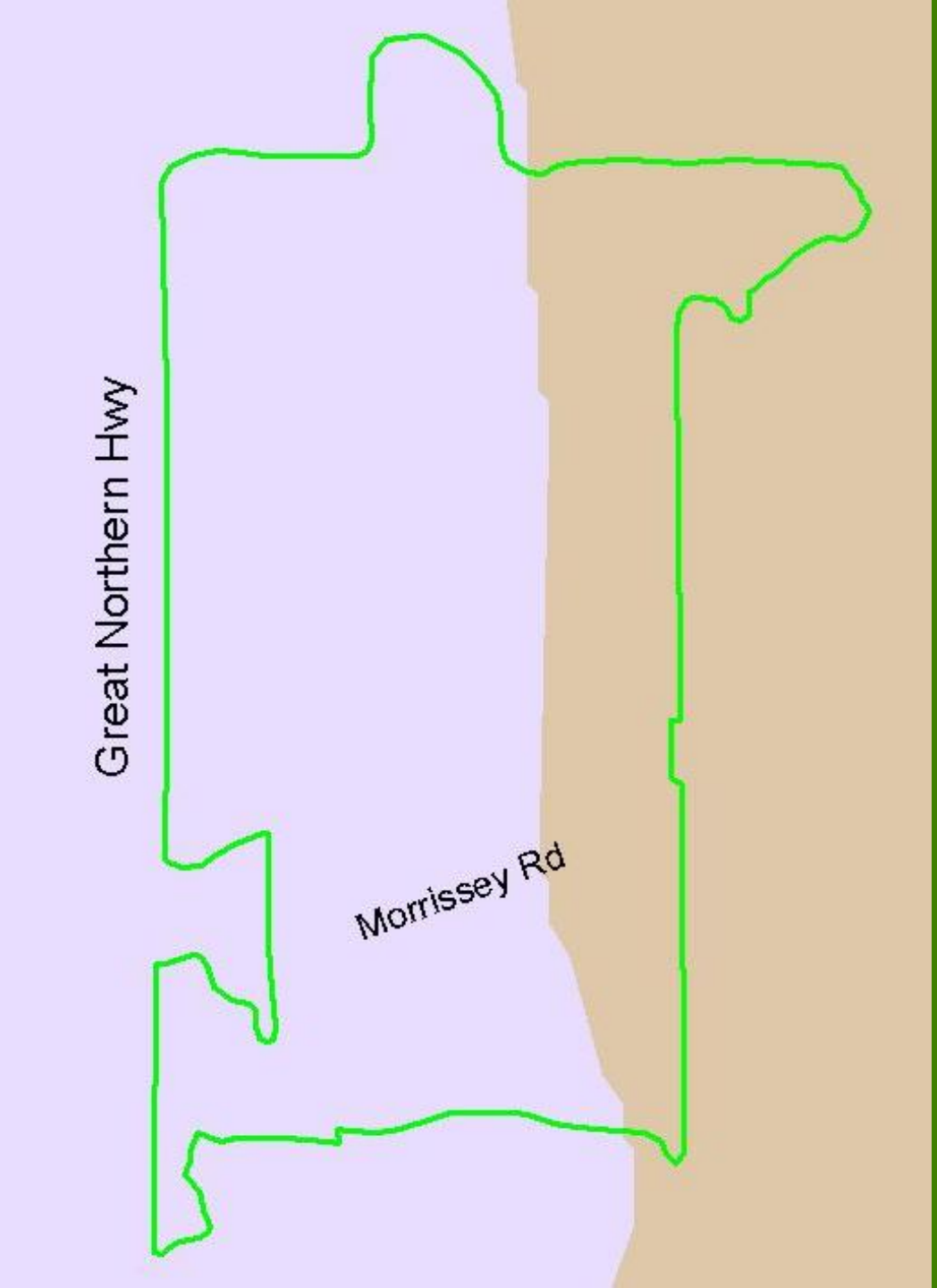
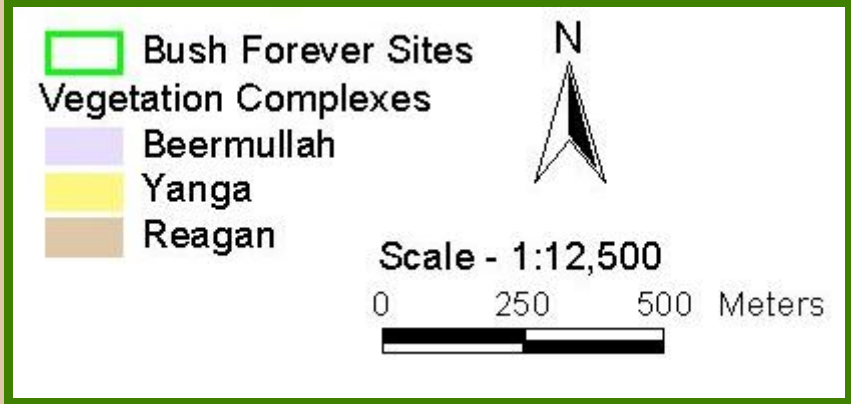


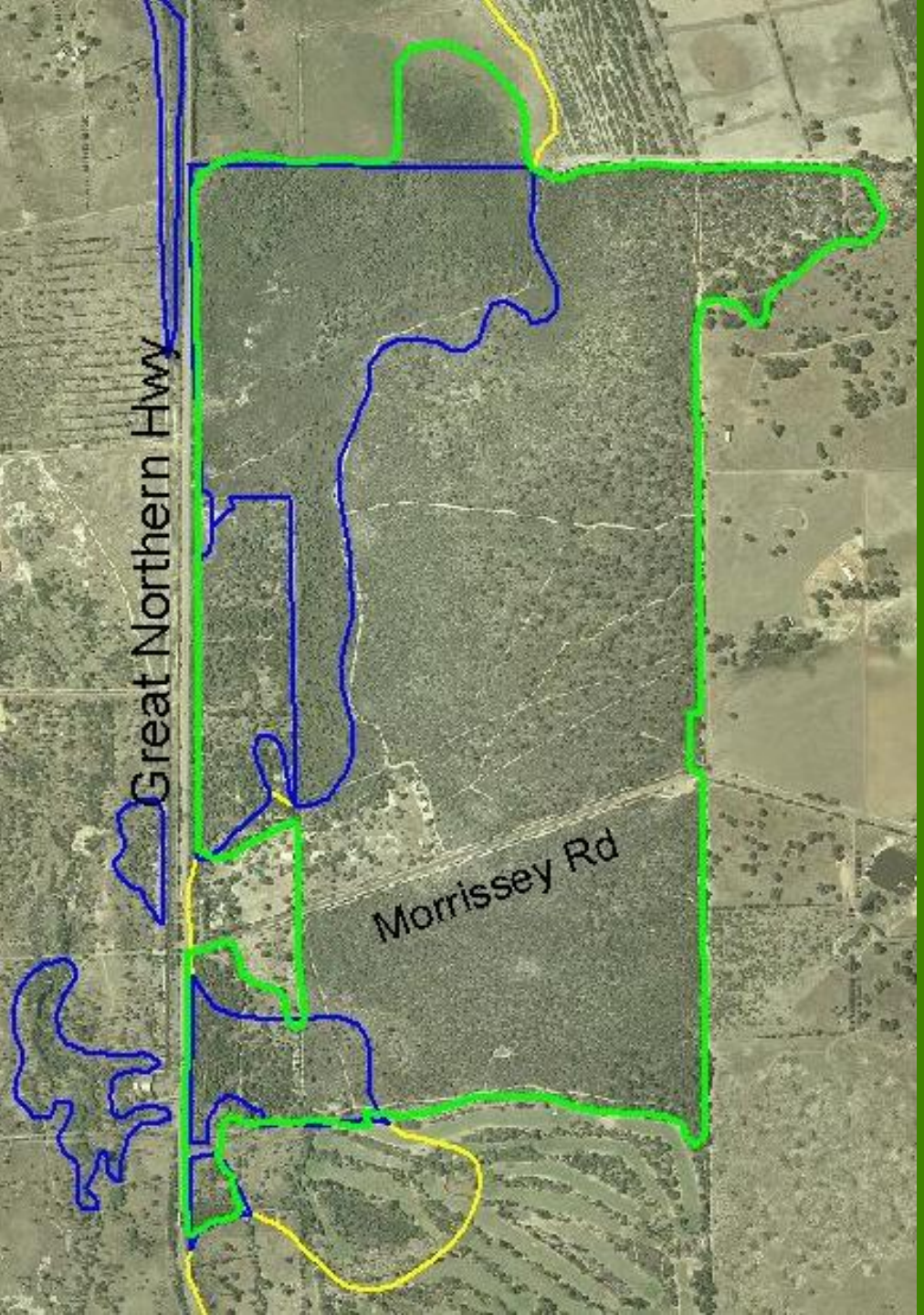
Vegetation Complexes

Beermullah: Low open forest of *Casuarina obesa* with *marri* - *wandoo* and *jarrah.* Minor components include closed scrub *Melaleuca* spp. and occurrence *Actinostrobus pyramidalis*

Reagan: Mixture of low open woodland of *Banksia* spp.-*E. todtiana* to closed heath Myrtaceae-Proteaceae spp.



Wetlands



Bush Forever Sites
Geomorphic Wetland Evaluation Categories Nov04
Conservation Category
Geomorphic Wetland Classifications Nov04
Palusplain

Scale - 1: 15,000
0 300 600 Meters

N

2004 SkyView Aerial Photography, DLI

Vegetation Map
(Keighery *et al* 1996)

8 mapped units from 17 sites

Key

- Nature Reserve boundary
- plant community boundary
- tracks
- (4) Site location (see Appendix 1)

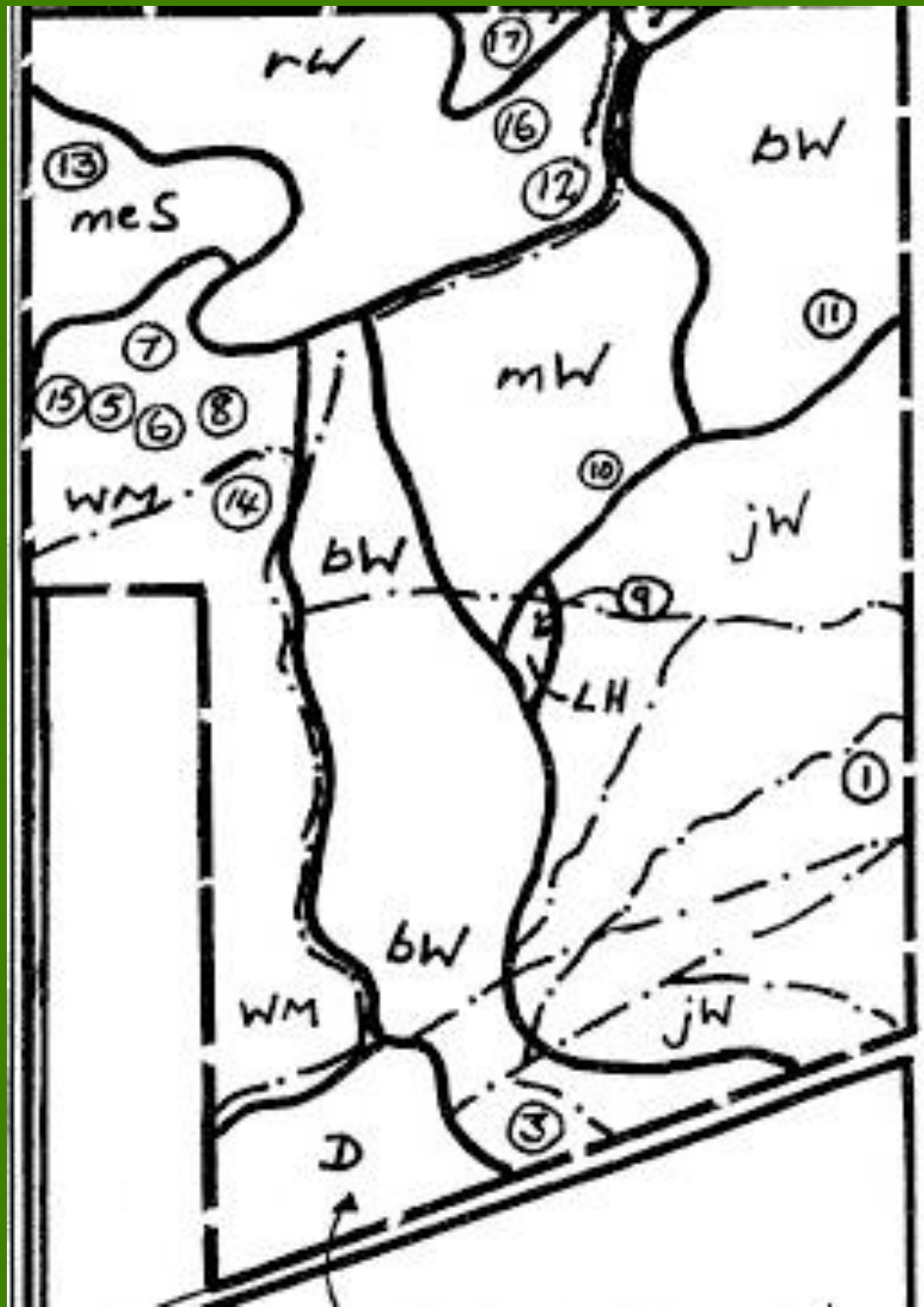
Woodlands and Shrublands

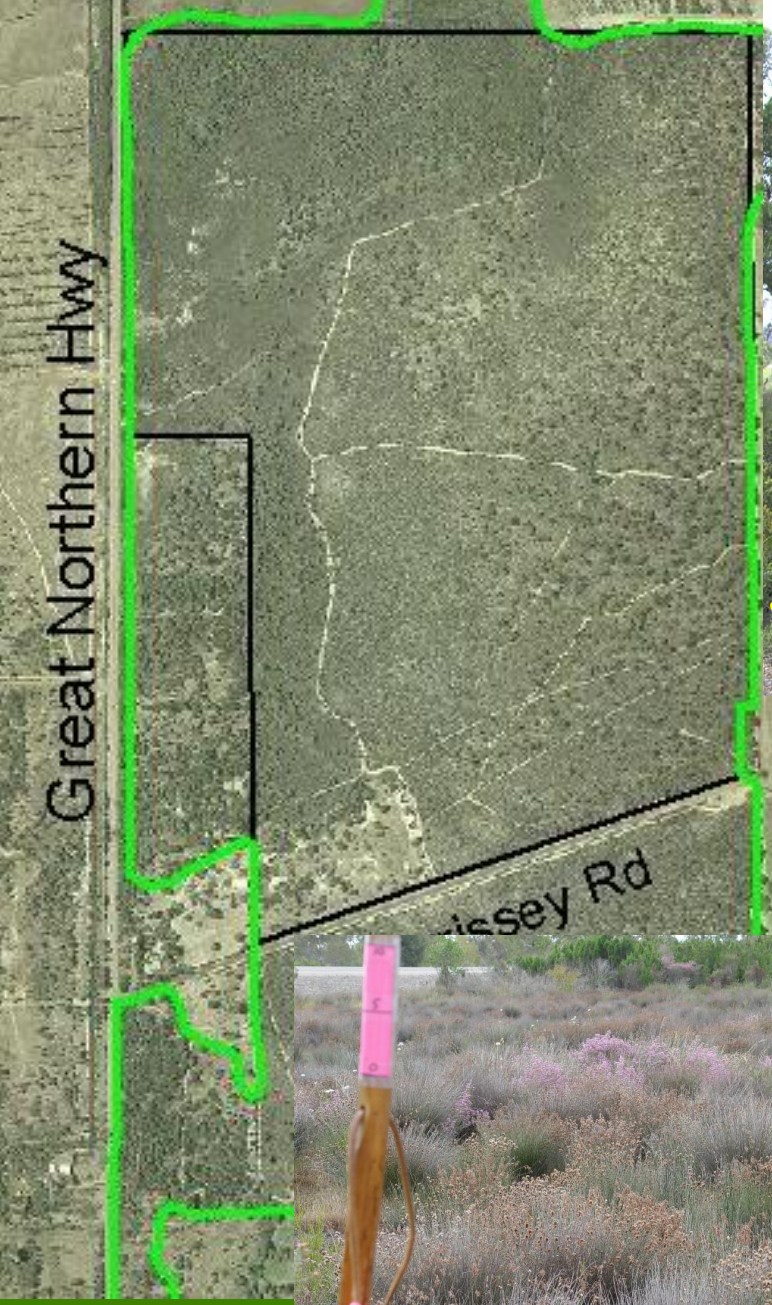
- mW = Marri Woodland
- jW = Jarrah Woodland
- bW = *Banksia* Woodland
- LH = Lateritic Heath

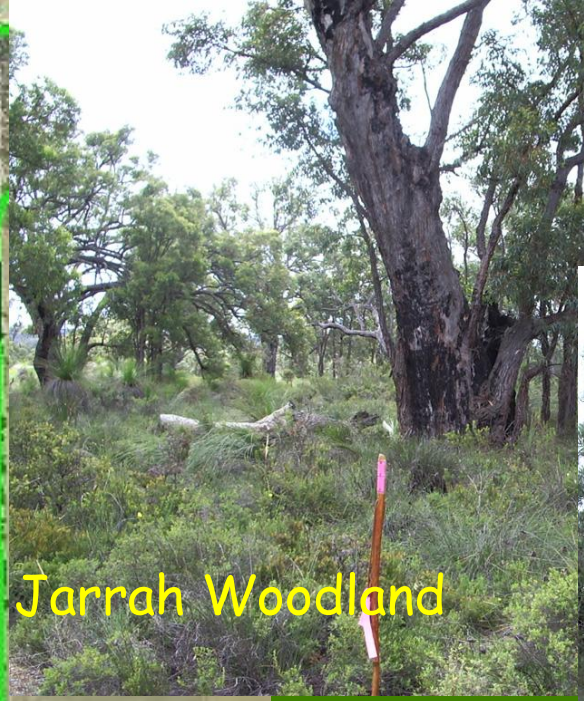
Wetlands

- rW = Flooded Gum Woodland
- mrLF = *Melaleuca rhaphiophylla* Low Forest
- meS = *Melaleuca* Shrubland
- WM = Wetland Mosaic

- D = Completely Degraded







Jarrah Woodland

Banksia Woodland

Wetland Mosaic

Bush Forever Site Description: BULLSBROOK NATURE RESERVE AND ADJACENT BUSHLAND

REGIONAL INFORMATION

LANDFORMS AND SOILS

VEGETATION

Vegetation Types

Mosaic: Medium forest; marri-jarrah/Medium woodland; marri-wandoo
Medium woodlland; marri & wandoo

Vegetation Complexes

Reagan Complex
Beermullah Complex

WETLANDS

Wetland Types: palusplain/**Natural Wetland Group:**Ellen Brook (R.3)/
Wetland Management Objectives: Conservation (56.3ha), Multiple Use

Bush Forever Site Description: BULLSBROOK NATURE RESERVE AND ADJACENT BUSHLAND

FIELD STUDIES

limited survey (part Site — Alford 1996a, DEP 1999, Chambers 1997 a&b, Gibson *et al.* 1994 (Bull 01–12), Gray 1994a, Keighery, BJ, and Trudgen 1992); detailed survey (part Site — Keighery, GJ, *et al.* 1997a (Bullsbrook Nature Reserve))

REGIONAL INFORMATION

Floristic Community Types

Supergroup 2: Seasonal Wetlands

5 Mixed shrub damplands

7 Herb-rich saline shrublands in clay pans

11 Wet forests and woodlands

Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau

23a Central *Banksia attenuata — B. menziesii* woodlands (most northerly occurrence)

Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes

28 Spearwood *Banksia attenuata* or *B. attenuata — Eucalyptus* woodlands (eastern representation of this community type)

SPECIFIC SITE DETAIL

Structural Units: mapping (Keighery, BJ, and Trudgen 1992, Keighery, GJ, *et al.* 1997a)

Uplands: *Eucalyptus marginata* Woodland to Forest; *Eucalyptus calophylla* Woodland; *Banksia attenuata* and *B. menziesii* Woodland with scattered *Eucalyptus todtiana*; *Banksia ilicifolia, B. attenuata* and *B. menziesii* Woodland; *Xanthorrhoea drummondii, Calothamnus sanguineus, Daviesia nudiflora* and *Hakea stenocarpa* Open Low Heath

Wetlands: *Eucalyptus rudis* Woodland; *Melaleuca preissii* Low Closed Forest; Shrublands dominated by *Melaleuca rhaphiophylla, M. viminea, M. uncinata* and *Actinostrobus pyramidalis* and combinations of these; *Melaleuca scabra* and *Verticordia densiflora* Open Low Heath; Mixed Open Heath; Mixed Herbland; Sedgeland dominated by *Meeboldinia cana, L. aristatus, Anarthria laevis, Dielsia stenostachya* and *Lepidosperma longitudinale* and combinations of these; *Lepidosperma longitudinale* and *Baumea vaginalis* Sedgelands; *Cyclosorus interruptus* and *Pteris vittata* Fernland

Vegetation Condition: >90% Excellent to Very Good, <10% Good, with areas of severe localised disturbance

brevifolia

Bush Forever Site Description: BULLSBROOK NATURE RESERVE AND ADJACENT BUSHLAND

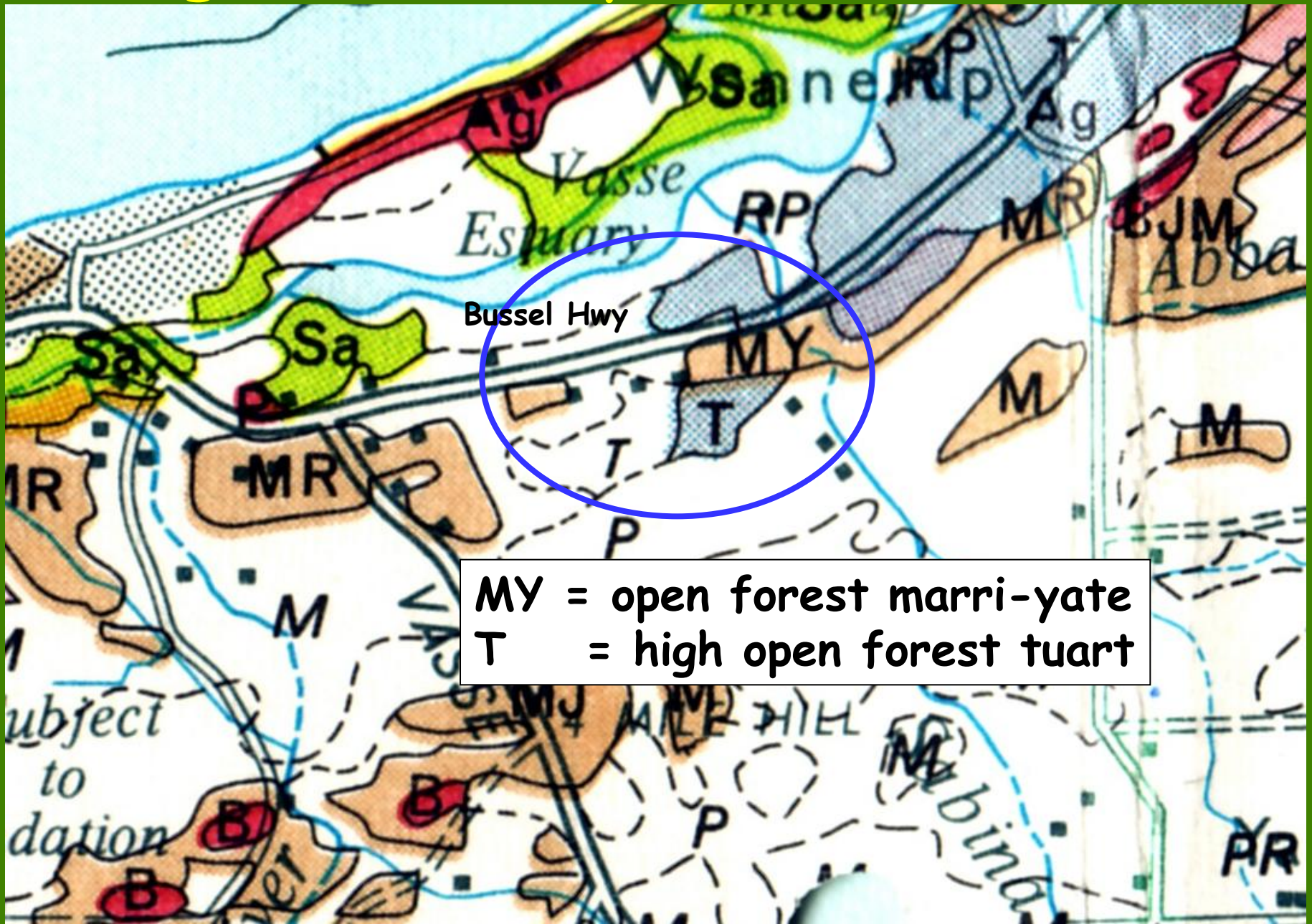
FIELD STUDIES

limited survey (part Site — Alford 1996a, DEP 1999, Chambers 1997 a&b, Gibson *et al.* 1994 (Bull 01-12), Gray 1994a, Keighery, BJ, and Trudgen 1992); detailed survey (part Site — Keighery, GJ, *et al.* 1997a (Bullsbrook Nature Reserve))

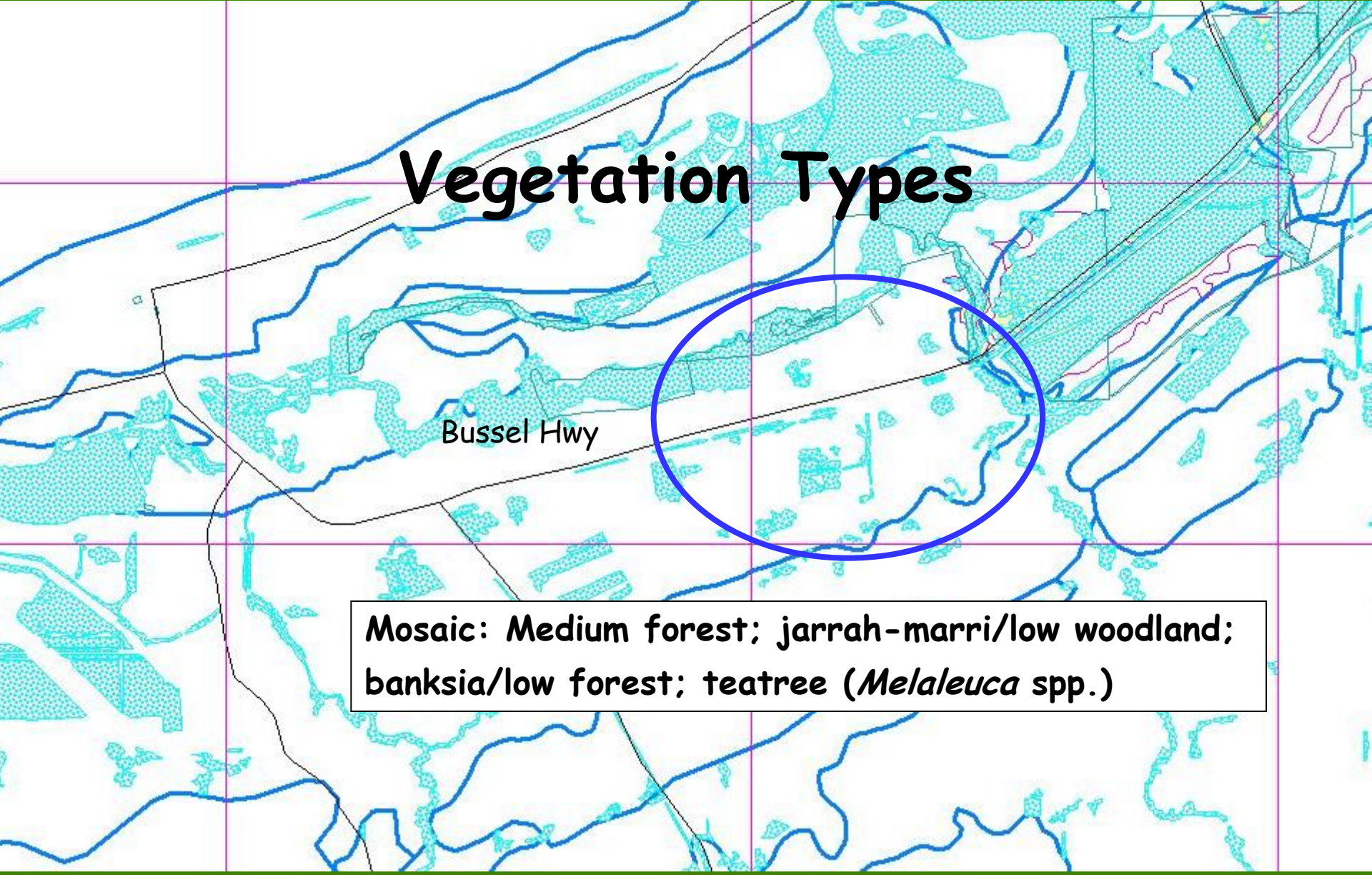
Total Flora: 440 native taxa, 63 weed taxa(Keighery, GJ, *et al.* 1997a) (estimated >90% of flora of entire Site)

Significant Flora: Keighery, GJ, *et al.* 1997a — *Grevillea althoferorum* (R) (southern limit of range, only secure population); *Tripterococcus paniculatus* ms (1), *Eryngium pinnatifidum* subsp. *palustre* ms (2) (northern limit of range), *Stylidium aceratum* (2) (only known population, Lowrie and Kennealy 1999), *Schoenus* sp. Bullsbrook (JJ Alford 915) (2) (only known location), *Haemodorum loratum* (3) (disjunct population), *Lambertia multiflora* var. *darlingensis* (3), *Platysace ramosissima* (3), *Conostephium minus* (4), *Anthotium junciforme* (4), *Myriocephalus appendiculatus* (3), *Stylidium longitubum* (3); *Persoonia angustiflora* and *Grevillea obtusifolia* (southern limit of ranges), *Hakea cristata*, *Cyathochaeta avenacea* and *Pultenaea ericifolia* (northern limit of ranges), *Pteris vittata* and *Cyclosorus interruptus* (disjunct populations), *Podolepis gracilis* (Swamp form), *Eucalyptus marginata* subsp. *thalassica* (only known population on the Swan Coastal Plain), co-occurrence of *Hovea trisperma* var. *grandiflora* and *Hovea trisperma* var. *trisperma*, *Hakea cristata* (only record on the Swan Coastal Plain), swamp and sand forms of *Stirlingia latifolia*, *Philotheca spicata* and *Stylidium brunonianum*, *Tetratheca nuda* (very uncommon on the Plain, confined to a few localities on the foothills of the Darling Range and Dandaragan Plateau), *Melaleuca ryeae*, *Melaleuca brevifolia*

Vegetation map (Smith 1973)



Vegetation Types



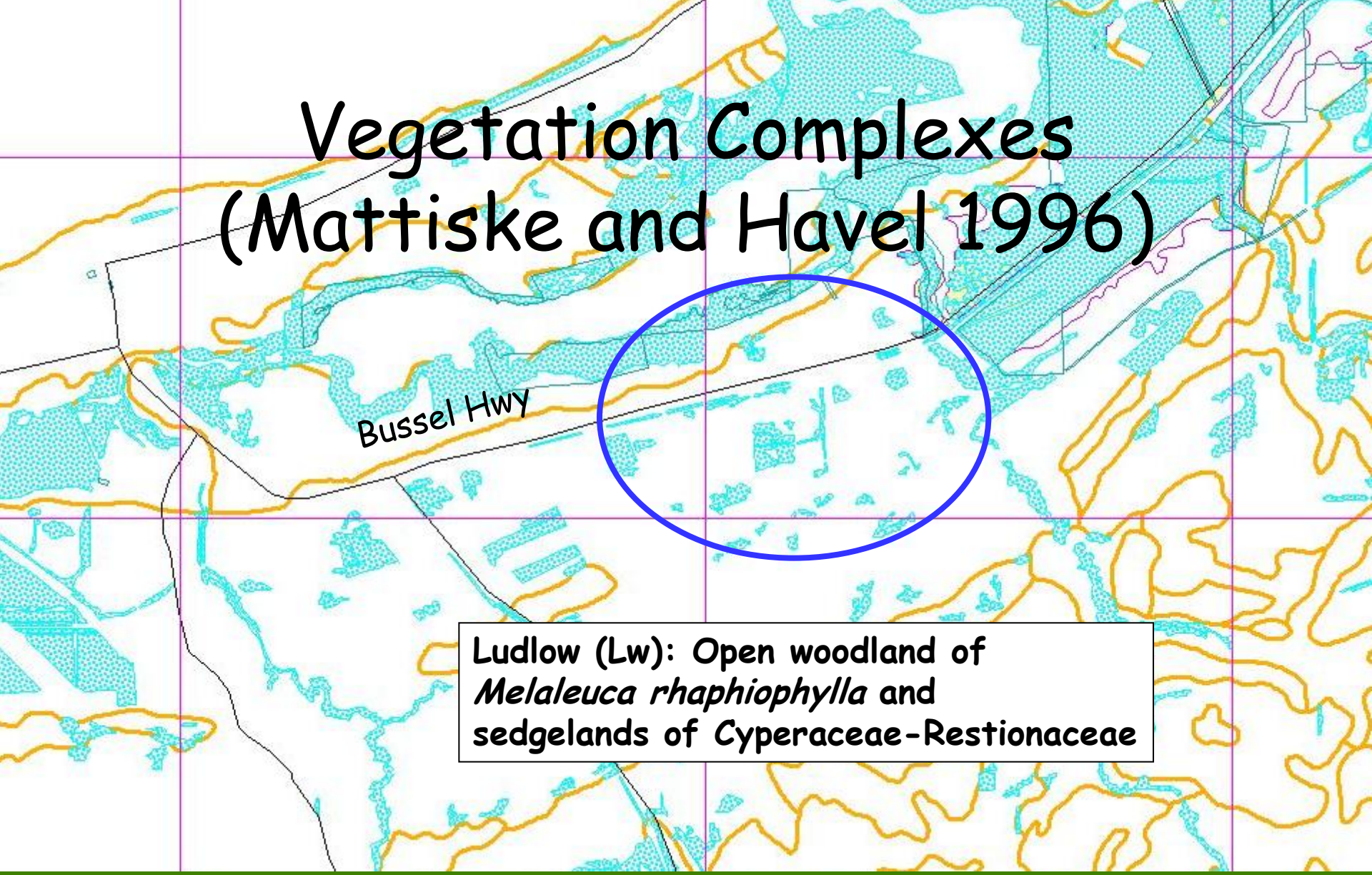
Mosaic: Medium forest; jarrah-marri/low woodland; banksia/low forest; teatree (*Melaleuca* spp.)

Vegetation type boundary

Swan Bioplan tile boundary

Swan Bioplan remnant

Vegetation Complexes (Mattiske and Havel 1996)



Ludlow (Lw): Open woodland of *Melaleuca rhaphiophylla* and sedgelands of Cyperaceae-Restionaceae

Vegetation complex boundary

Swan Bioplan tile boundary

Swan Bioplan remnant

SB Remnant 78/ 2-7 : dominants *E. decipiens,* Yate and Peppermint; condition: Very Good to Good).

Bussel Hwy

SB Remnant 78/ 5-1 :
dominants Tuart and Peppermint; condition: Degra

Swan Bioplan tile boundary

Swan Bioplan remnant

DIVERSITY

- *Areas with a high diversity of landforms, flora and/or fauna species or communities in close association*

- A wide variety of
  - landform units
  - flora and/or fauna species
  - concentrations of subspecies or varieties occurring together
  - floristic community types in close proximity
  - plant associations, assemblages or communities
- Species-rich examples of communities of their type

RARITY

- *Areas containing rare or threatened communities or species, or species of restricted distribution*

RARITY

- Threatened ecological communities.
- Habitats of rare, uncommon or restricted flora and/or fauna species and/or species outside of or at the limit of their range.
- Areas supporting rare, uncommon or restricted communities and/orcommunities outside of or at the limit of their normal range.

MAINTAINING ECOLOGICAL PROCESSES OR NATURAL SYSTEMS

- *Maintenance of ecological processes or natural systems at a regional or national scale*

MAINTAINING ECOLOGICAL PROCESSES OR NATURAL SYSTEMS

- Large areas in natural condition with natural processes intact or largely so.
- Fauna habitats providing specific requirements for feeding/breeding/ nursery functions.
- Substantive wildlife corridors connecting bushland areas.
- Habitats for significant populations of migratory birds.

SCIENTIFIC OR EVOLUTIONARY IMPORTANCE

- *Areas containing evidence of evolutionary processes either as fossilised material or as relict species*
- *Areas containing unusual or important geomorphological or geological sites*
- *Areas of recognised scientific and educational interest as reference sites or as examples of the important environmental processes at work*

GENERAL CRITERIA FOR PROTECTION OF WETLAND, STREAMLINE, AND ESTUARINE FRINGING VEGETATION AND COASTAL VEGETATION

- *Conservation Category Wetland areas including fringing vegetation and associated upland vegetation; coastal vegetation within the accepted coastal management zone*

Ecological Linkage

Regionally significant sequences of ecological communities within and between the major landform elements


Ocean
Qhsm
Qhs
Qts
Qha
Qpb/Qpa
Qhay
Qpa
Qpb
Qhw