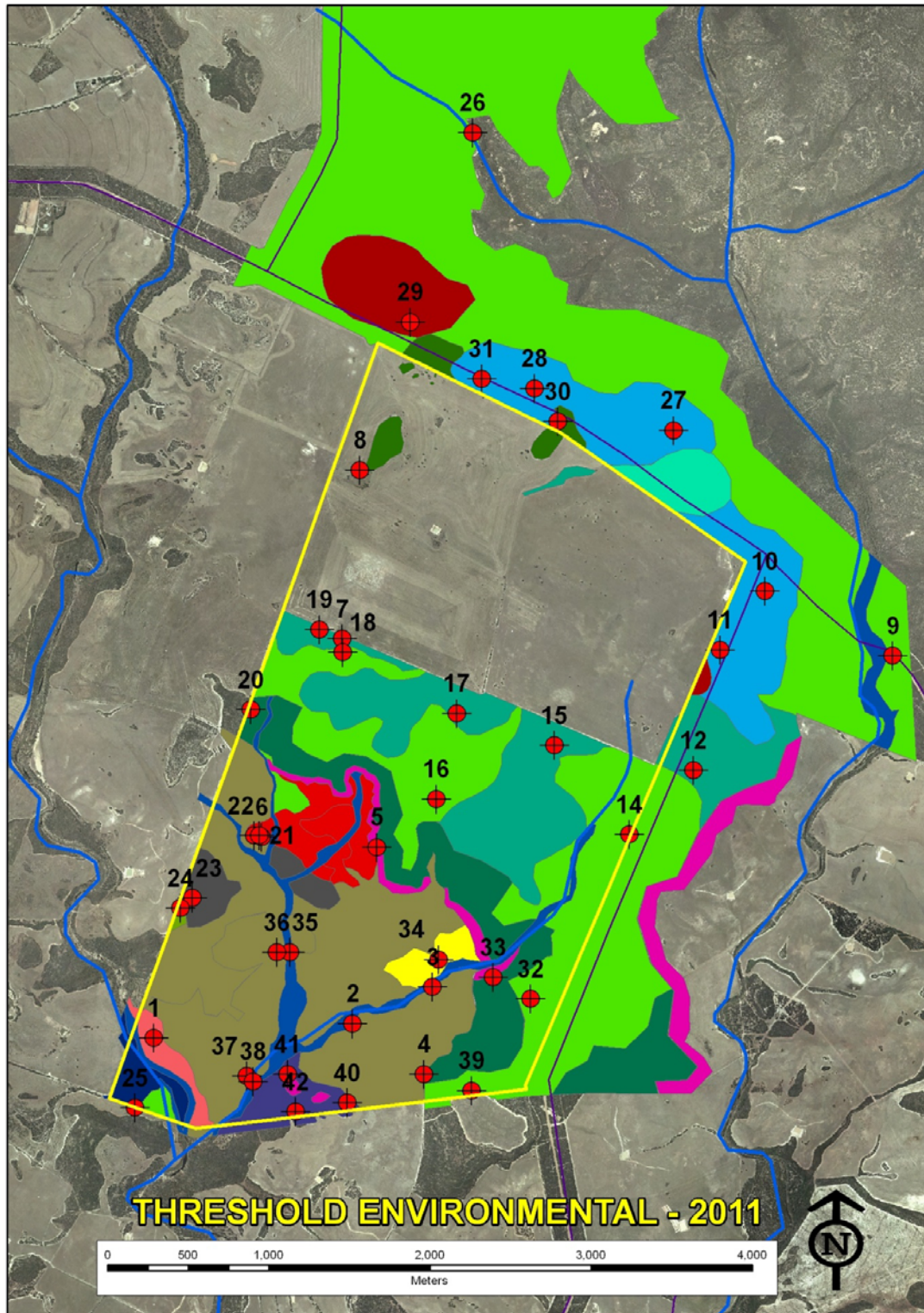
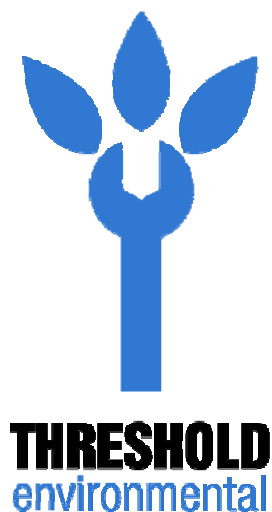


THE VEGETATION SYSTEMS OF MONJEBUP NORTH



Monjebup North Ecological Restoration Plan- **Vegetation Associations of Monjebup North**



Prepared by Justin Jonson

THRESHOLD ENVIRONMENTAL

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A project commissioned by Bush Heritage Australia

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SUMMARY OF VEGETATION SYSTEMS AT MONJEBUP NORTH

MN1: *Banksia media*, *Eucalyptus falcata*, & *Dryandra cirsioides* Mallee Scrub

MN2: *Banksia media*, *Eucalyptus pleurocarpa*, & *Eucalyptus pluricaulis* Mallee Scrub

MN3: *Eucalyptus annulata*, *Eucalyptus vergrandis* & *Eucalyptus conglobata*

MN4: *Eucalyptus platypus* / *Eucalyptus vesiculosa* Woodlands

MN5: *Eucalyptus astringens* / *Eucalyptus melanophitra* Mallet Breakaways

MN6: *Calothamnus quadrifidus* Granitic Scrub

MN7: *Calistemon phoeniceus*, *Melaleuca accuminata* & mixed species Drainage

MN8: *Melaleuca pentagona* Mallee Scrub

MN9: *Nutsya floribunda* / *Lambertia inermis* Mallee Scrub

MN10: *Eucalyptus occidentalis* / *Banksia media* Riparian Woodland Scrub

MN1: *Banksia media*, *Eucalyptus falcata*, & *Dryandra cirsioides* MalleeScrub

Associated Monjebup North Veg Survey Sites:

10; 11; 18; 26; 27; 28; 30; 31; 39

Total Number of Species recorded in this system:

74

Veg Survey Site: 10



Veg Survey Site: 11



Description: This unit is likely one of the most dominant vegetation associations observed within the greater 'Mallee Mosaic' that dominates the Fitz-Stirling landscape. Variations in the extent and distribution of subsurface soil types are reflected in the diverse mix of associated flora that persist within the greater extent of this association. It is also the most dominant unit represented on and around the Monjebup North property. While *Banksia media* is generally a ubiquitous species across the Fitz-Stirling landscape and beyond, the additional presence of both *Eucalyptus falcata* and *Dryandra cirsioides* clearly define this association from other similar vegetation units. Elements of this system make up zones of what would be defined as one type of what is termed 'Proteaceous heaths' in the Fitz-Stirling Functional Landscape Plan. A similar vegetation unit at Monjebup North, with a spongentic parent material is also present and has been segregated into its own category. Development of similar vegetation units from a vegetation mapping project in Ravensthorpe (Craig et al., 2007) illustrate the challenge of defining individual vegetation units from within a broader mosaic of ever changing mallee ecosystems.

Veg Survey Site: 18



Veg Survey Site: 26



Soil info: This unit is generally affiliated with a shallow compact sandy ironstone gravel duplex over a compact yellow clay hardpan. It is likely these soils have generally little fertility and poor water holding capacity. Two soil pits (Pit 46, Pit 44) were sampled in proximity to Vegetation Survey Sites for this association.

Landscape position: A defining element of this vegetation association is its occupancy of the large broad 'flats' with little topographical relief. This landscape element is a key feature of the Monjebup North property. The cleared portion of land slated for restoration at Monjebup North is centrally located within this landscape feature.

Veg Survey Site: 27



Veg Survey Site: 28



Hydrology: Water storage capacity is believed to be low due to a generally shallow soil profile. Much of the vegetation in this system is restricted in height, and significant areas are occupied with an understory of low Melaleuca heath. Due to a lack of topographical relief and broad catchment area, precipitation may be shed slowly. The abiotic characteristics of this system of shallow soil profiles, broad flat expanses, and little topographical relief, suggest the area may be subject to water logging at times. The presence of a Melaleuca heath understory may also support this hypothesis as this genus demonstrates increased tolerance to water logging.

Structural Attributes: With the variations of the percent of gravel and/or depth of the soil profile, a diverse suite of associated flora is expressed across this system, reflected in an ever changing mix of structural diversity. In areas of shallow compact ironstone gravel, this unit is often dominated by small thickets of *Dryandra circioides*, while deeper profiles are often occupied by tall mallees *Eucalyptus falcata*, *E. pleurocarpa*, and *E. captiosa*. A good representation of species from the Proteaceous family are also present in this association including: *Banksia caleyi*, *Dryandra nervosa*, *Hakea corymbosa*, *Hakea marginata*, *Hakea pandanicarpa*, and *Hakea commutata*, *Hakea prostrata*, and *Hakea cygna ssp cygna*. Variations in the subsurface soil profile are likely to correlate with variations in vegetative structure above ground, and the association is therefore encompasses a full range of structural classifications including: Open Shrub Mallee, Open Scrub, Heath, Dwarf Scrub C, and Open Dwarf Scrub D.

Veg Survey Site: 30



Veg Survey Site: 31



Plant Community Structural Summary:

Small to Medium Trees: *Banksia media*, *Ecocarpos sparteus*, *Hakea laurina*, *Hakea pandanicarpa*, *Santalum accuminatum*, *Callitris roeii*

Mallees: *Eucalyptus capitosa*, *Eucalyptus falcata*, *Eucalyptus phaenophylla*, *Eucalyptus pleurocarpa*, *Eucalyptus thamnoides*, *Eucalyptus uncinata*

Tall Shrubs: *Banksia caleyi*, *Dryandra cirsioides*, *Hakea corymbosa*, *Kunzea recurva*, *Lambertia inermis*, *Melaleuca pentagona*, *Callitris sp.*

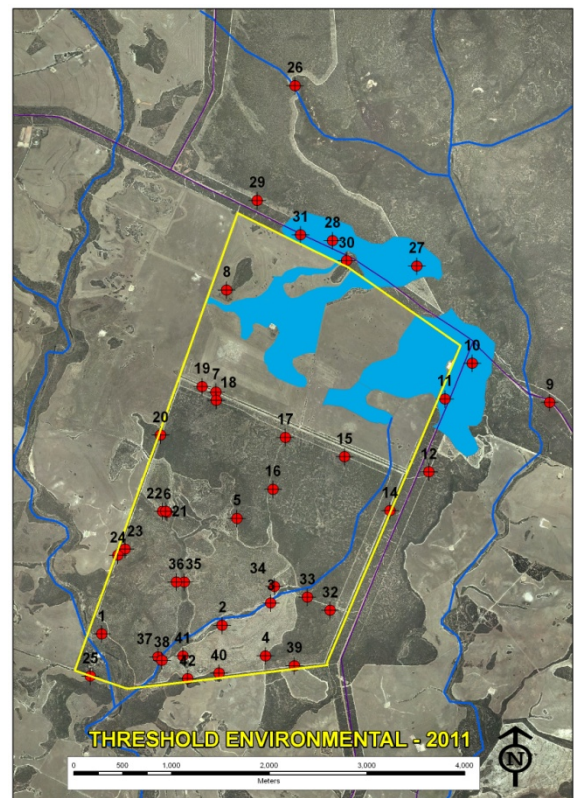
Mid Shrubs: *Acacia littorea*, *Acacia mimica var. mimica*, *Allocasuarina thyoides*, *Beaufortia micrantha*, *Beaufortia schaueri*, *Dryandra nervosa*, *Gastrolobium spinosum*, *Hakea commutata*, *Hakea marginata*, *Hakea trifurcata*, *Isopogon buxifolius*, *Isopogon seminuda*, *Isopogon trilobus*, *Kunzea affinis*, *Leptospermum sp.*, *Melaleuca bracteosa*, *Melaleuca carrii*, *Melaleuca hamata*, *Melaleuca scabra*, *Melaleuca spathulata*, *Melaleuca spathulata x pentagona*, *Melaleuca sp.*, *Melaleuca tuberculata*, *Petrophile seminuda*, *Petrophile sp.*, *Taxandria spathulata*

Low shrubs: *Acrotriche ramiflora*, *Agonis spathulata*, *Baeckea sp.*, *Beaufortia sp.*, *Bossiaea spinescens*, *Boronia octandra*, *Calothamnus gibbosus*, *Calothamnus gracilis*, *Chamelaucium ciliatum*, *Davesia incrassata*, *Davesia lancifolia*, *Davesia sp.*, *Epacrid sp.*, *Gompholobium confertum*, *Gompholobium scabra*, *Grevillea dolichopoda*, *Hakea prostrata*, *Leucopogon sp.*, *Lysinema sp.*, *Melaleuca violacea*, *Rinzia sp.*, *Tetrapora verrucosa*

Ground layer: *Xanthorrhoea sp.*

Grasses and Sedges: *Caustis dioica*, *Lepidosperma sp.*, *Desmocladus sp.*, *Gahnia ancistrophylla*, *Neurachne allopecuroidea*, *Schenous sp.*

MAP: Distribution and areas proposed for restoration for the ***Banksia media*, *Eucalyptus falcata*, and *Dryandra cirsioides* Mallee Scrub** vegetation association at Monjebup North.



**MN2: Banksia media, Eucalyptus pleurocarpa, & Eucalyptus pluricaulis
Mallee Scrub**

Associated Monjebup North Veg Survey Sites:
12; 14; 15; 16; 32; 36

Total Number of Species recorded in this system:
63

Veg Survey Site: 12 (1)



Veg Survey Site: 12 (2)



Description: This vegetation association is the twin sister of the *Banksia media*, *E. falacata*, & *Dryandra circioides* system, only the abiotic soil influence is spongelitic instead of sandy gravels. It is another dominant sub system within the greater 'Mallee Mosaic' of the Fitz-Stirling landscape. Together with its gravel associated companion, it is the most common unit represented on and around Monjebup Reserve. Key characteristics defining this vegetation association are *Banksia media* and *Banksia calyei*, with the most prominent mallees being *Eucalyptus pluricaulis*, *Eucalyptus pleurocarpa*, *Eucalyptus thamnoides* and *Eucalyptus uncinata*. Patches of *Verticordia fastigiata* are found on bare areas (see Veg Survey Site 12 (2) above) interspersed throughout this vegetation unit. Another key element of this association is the large expanses of low growing plants from the *Melaleuca* genus, resulting in areas with a heath like dense understory. Key species of this structural element are *Melaleuca violacea*, *Melaleuca spathulata*, *Melaleuca bracteosa*, and *Melaleuca tuberculata*. While this system may not be excessively rich species diversity from the Proteaceous family, there is a generally good representation, including *Banksia media*, *Banksia calyei*, *Hakea laurina*, and *Grevillea oligantha*.

Veg Survey Site: 14



Veg Survey Site: 15

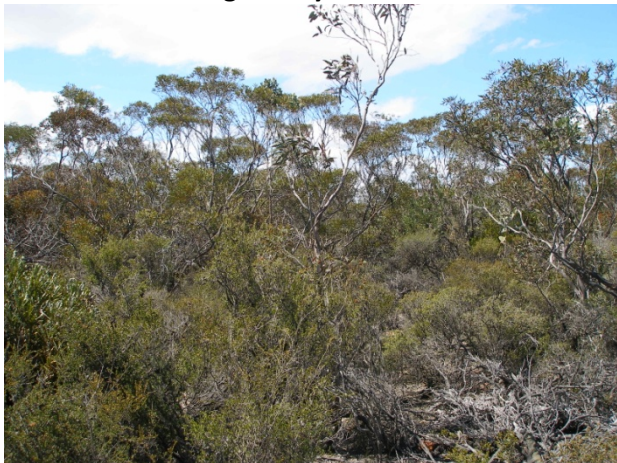


Soil info: This unit is generally affiliated with a shallow compact duplex, with a spongelitic or yellow clay hardpan not far from the surface. These soils are generally believed to have low fertility, with the upper

profile having poor water holding capacity. Five soil pits (Pit 48, Pit 56, Pit 115, Pit 117, Pit 118) were sampled in proximity to Vegetation Survey Sites for this association. For each pit, impermeable layers were found within approximately 25 cm from the surface. It is assumed this is the spongellitic hardpan.

Landscape position: This vegetation association is also defined by its occurrence on the large broad 'flats' with little topographical relief, common to the upper landscape unit of Monjebup North.

Veg Survey Site: 16



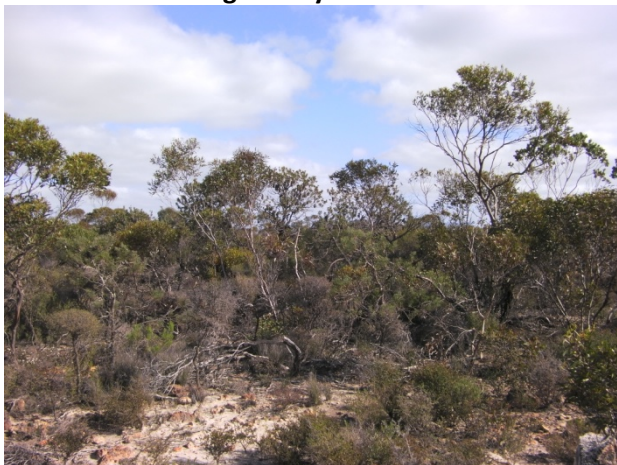
Veg Survey Site: 18



Hydrology: Water storage capacity is believed to be low due to a very shallow soil profile and subsurface hardpan. Much of the vegetation in this system is restricted in height, with taller vegetation generally sparsely distributed. Large areas are occupied with a low dense heath-like understory composed primarily of species from the *Melaleuca* genera. Water logging is likely following large rainfall events, or in accordance with seasonal precipitation patterns.

Structural Attributes: The main defining structural characteristic for this vegetation association would be the large expanses of *Melaleuca* understory heath, interspersed with generally widely spaced open distributions of *Eucalypt* and *Banksia* overstory trees. Bare ground with *Verticordia fastigiata* are also prevalent suggesting areas very shallow soil profiles, or areas of ephemeral water ponding. Taller plants in this land unit are often low and compact in their form, with *Eucalyptus pluricaulis*, *Banksia media* and *Banksia calyei* being excellent examples of this. Structural classifications for this unit range from Open Shrub Mallee, Open Scrub, Heath, Dwarf Scrub C, and Open Dwarf Scrub D.

Veg Survey Site: 32



Veg Survey Site:36 (cleared regrowth)



Plant Community Structural Summary:

Small to Medium Trees: *Banksia media*, *Hakea laurina*, *Hakea pandanica*, *Santalum murrayanum*, *Callitris roeii*, *Calitris glaucophylla*

Mallees: *Eucalyptus capitosa*, *Eucalyptus globata*, *Eucalyptus falcata*, *Eucalyptus phaenophylla*, *Eucalyptus pleurocarpa*, *Eucalyptus pluricaulis*, *Eucalyptus thamnoides*, *Eucalyptus uncinata*, *Eucalyptus vergrandis*, *Eucalyptus xanthonema*

Tall Shrubs: *Banksia caleyi*, *Hakea corymbosa*, *Kunzea recurva*

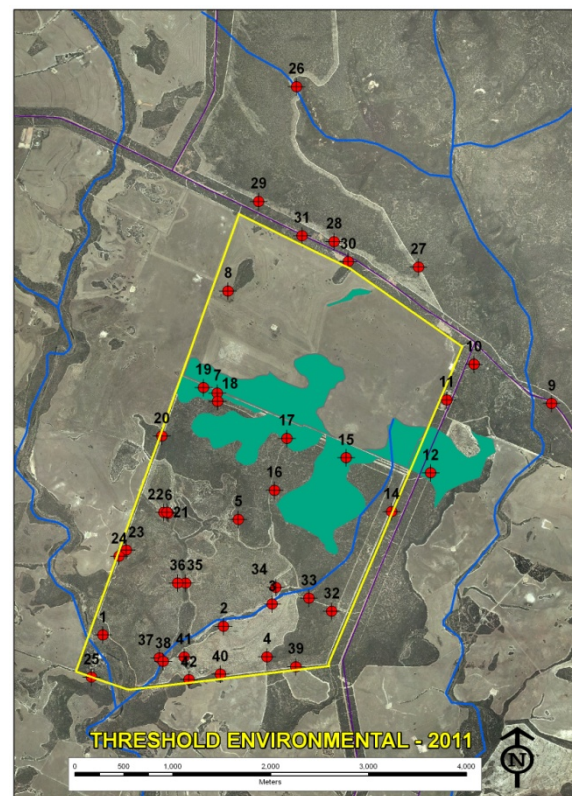
Mid Shrubs: *Acacia sphacelata*, *Beaufortia micrantha*, *Beaufortia schaueri*, *Dryandra cirsioides*, *Dryandra tenuifolia*, *Dryandra nervosa*, *Hakea marginata*, *Isopogon buxifolius*, *Kunzea affinis*, *Leucopogon sp.*, *Melaleuca bracteosa*, *Melaleuca hamata*, *Melaleuca haplantha*, *Melaleuca scabra*, *Melaleuca sp.*, *Melaleuca spathulata*, *Melaleuca tuberculata*, *Tetrapora verrucosa*

Low shrubs: *Acrotriche ramiflora*, *Acrotriche sp.*, *Baekkea sp.*, *Boronia sp.*, *Calothamnus gibbosus*, *Chamelaucium ciliatum*, *Darwinia sp.*, *Davesia lancifolia*, *Davesia sp.*, *Epacrid sp.*, *Grevillea oligantha*, *Melaleuca violacea*

Ground layer:

Grasses and Sedges: *Caustis dioica*, *Lepidosperma sp.*, *Gahnia ancistrophylla*, *Schenous sp.*

MAP: Distribution and areas proposed for restoration for the *Banksia media*, *Eucalyptus pleurocarpa*, & *Eucalyptus pluricaulis* Spongelitic Mallee Scrub vegetation association at Monjebup North.



MN3: *Eucalyptus annulata*, *Eucalyptus vergrandis* & *Eucalyptus conglobata*

Monjebup North Veg Survey Sites:
29; 37; 40; 41

Total Number of Species recorded in this system:
66

Veg Survey Site: 29 (1)



Veg Survey Site: 29 (2)



Description: This unit is not characteristic of vegetation at Monjebup North, but is more widely represented in the surrounding landscape. Only a few Vegetation Survey Sites were recorded, and this has resulted in an incomplete assessment for this land unit system. It is also likely several of the sites surveyed included may be more accurately characterised as ecotones, as they were located at interfaces between two soil types (i.e. Granitic Clay/Loam & Doleritic Dyke). However, for the purpose of this project, this Vegetation Association is defined to represent the Tall Mallee Scrub type community that is found on soils with heavy subsurface clays. The mix of dominant species for these heavy clay soils vary across the Fitz-Stirling, but a few consistently represented species recur. In the redder clays (i.e. Dolerite Dykes) *Eucalyptus annulata* is found; when these clays are still dark but more brown in colour, *Eucalyptus platypus* is often found; pallid grey heavy clays are generally also occupied by *E. platypus*, but may support *E. annulata* as well (as found at 'Peniup'). Those two species should be identified as their own Vegetation Associations, however for the purpose of this project it is good to reflect on how they interact with the 'Mallee Mosaic' across the greater landscape. Building on that theme, several 'clay loving' mallees, *Eucalyptus flocktoniae*, *Eucalyptus conglobata* and *Eucalyptus vergrandis*, are often found adjacent to (and at times lightly interspersed with) the *E. platypus* and *E. annulata* systems. A suite of additional clay associated species are also commonly found for these vegetation associations including *Melaleuca cucullata*, *Melaleuca pauperiflora*, *Acacia glaucopter*, *Acacia cyclops*, and *Acacia harveyii*.

Veg Survey Site: 37 (1) - Regrowth



Veg Survey Site: 37 (2) - Regrowth



While species from the *Hakea* and *Banksia* genus are not as widely common as in other vegetation associations, *Hakea verrucosa* is an exception. *Grevillea pectinata* was also commonly found on the heavier soils at Monjebup North, as was *Grevillea oligantha*.

Soil info: As indicated in the description above, the soils associated with this vegetation unit are the heavier clay dominant soil types. These clays originate from various origins and therefore have varying levels of fertility and friability. One soil pit in the remnant vegetation (Pit 41) and a suite from within the cleared area () were identified as being associated with this vegetation unit.

Landscape position: No definitive landscape position has been identified for this vegetation association.

Hydrology: Water storage capacity is high in this association due to its high water holding capacity. This is especially the case in very wet years, a directly contrasting condition in dry years. Variations in precipitation patterns from year to year are likely to express significantly different hydrological influence on these systems. It is likely that vegetation found in these landscape units can vary from a dormant hibernation like state to a highly productive state depending on the quantum of available moisture.

Structural Attributes: Like other vegetation associations in the Fitz-Stirling Mallee Mosaic, above ground biomass is strongly correlated to the depth of the soil profile and associated water storage capacity. For those areas that have sufficient depth before an impermeable layer, above ground vegetation is generally dense and stem densities of all species are high. In those areas where the profile is shallower, above ground growth is limited and significant areas of bare ground are present.

Plant Community Structural Summary:

Small to Medium Trees: *Acacia cyclops*, *Exocarpos aphyllus*, *Exocarpos sparteus*, *Hakea laurina*, *Santalum murrayanum*

Mallees: *Eucalyptus annulata*, *Eucalyptus conglobata*, *Eucalyptus flocktoniae*, *Eucalyptus platypus*, *Eucalyptus uncinata*, *Eucalyptus vergrandis*, *Eucalyptus xanthonema*

Tall Shrubs: *Acacia harveyii*, *Hakea verrucosa*, *Melaleuca cucculata*

Mid Shrubs: *Acacia cupularis*, *Acacia sphacelata*, *Acacia trulliformis*, *Dodonaea sp.*, *Gastrolobium parviflorum*, *Gastrolobium tetragonophyllum*, *Leptospermum maxwellii*, *Melaleuca calycina*, *Melaleuca carrii*, *Melaleuca hamata*, *Melaleuca haplantha*, *Melaleuca lateralis*, *Melaleuca lateriflora*, *Melaleuca scabra*, *Melaleuca sp.*, *Melaleuca spathulata*, *Melaleuca undulate*, *Microcorys glabra*

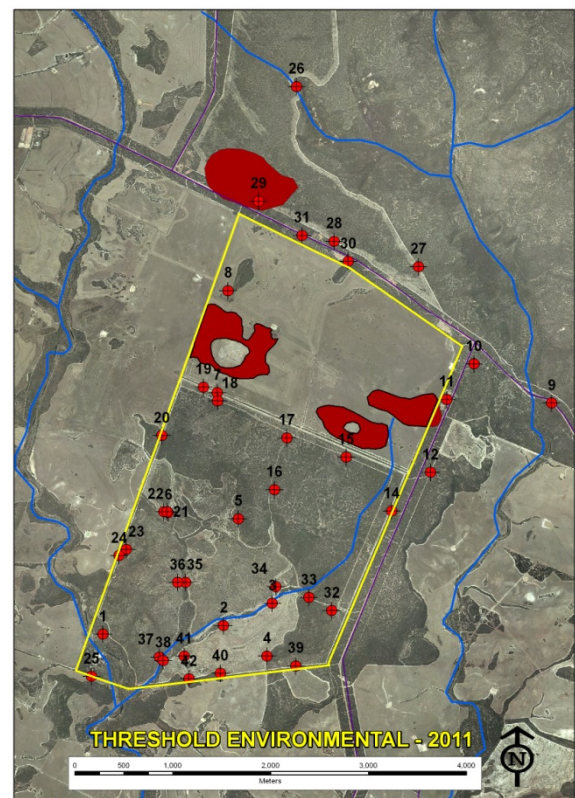
Low shrubs: *Acacia glaucoptera*, *Acacia lasiocarpa*, *Acrotriche sp.*, *Alygoine sp.*, *Astroloma sp.*, *Baeckea sp.*, *Boronia sp.*, *Calothamnus gibbosus*, *Chamelaucium ciliatum*, *Conospermum sp.*, *Coopernookia polygalacea*, *Davesia sp.*, *Dryandra tenuifolia*, *Grevillea oligantha*, *Grevillea pectinata*, *Guichenotia sp.*, *Hemigenia sp.*, *Leucopogon gibbosus*, *Melaleuca violacea*, *Opercularia sp.*, *Ozothamnus lepidophyllus*, *Ozothamnus sp.*, *Phebaleum reversifolia*, *Phebalium sp.*, *Pimelia sp.*

Ground layer: *Acacia ferocior*

Vines/Climbers: *Billedaria sp.*, *Cassytha sp.*

Grasses and Sedges: *Austrostipa sp.*, *Dianella sp.*, *Ghania ancistrophylla*, *Ghania frifida*, *Lepidosperma sp.1*, *Lepidosperma sp.2*

MAP: Distribution and areas proposed for restoration for the *Eucalyptus annulata*, *Eucalyptus vergrandis* & *Eucalyptus conglobata* vegetation association at Monjebup North.



MN4: *Eucalyptus platypus* / *Eucalyptus vesiculosa* Woodlands

Monjebup North Veg Survey Sites:
6, 9; 13; 22

Total Number of Species recorded in this system:
26

Veg Survey Site: Downslope from 6



Veg Survey Site: 6 (1)



Description: One of the most charismatic vegetation associations observed within the Fitz-Stirling ‘Mallee Mosaic’, often referred to as ‘Moort’. At maturity, this association demonstrates a strong trend to a monoculture type stand formation, with *Eucalyptus platypus* forming stands of either dense high stem densities, or very old open woodland formations. *Eucalyptus vesiculosa* (‘Red Flowering Moort’) is here grouped with *E. platypus* however it is a different system with a trend of occupancy in water gaining locations. Both *E. platypus* and *E. vesiculosa* are obligate seeders killed by fire. There is also a common mix of associated species that grow with, and around, these vegetation units. *Eucalyptus annulata*, and the suite of other mallees with a clay soil type affiliation are often found adjacent to Moort. Similarly, other clay soil species are also found, including *Acacia harveyii* and *A. cyclops*, *Melaleuca accuminata*, *M. pauperiflora* and *M. cucullata*, and *Gastrolobium spinosum*. At Monjebup North, *Acacia trulliformis* (see photo: Near 22 & 6 (3)) is also seen in proximity to this vegetation association.

Veg Survey Site: Near 22 & 6 (1)



Veg Survey Site: Near 22 & 6 (2)



Soil info: This unit is strongly affiliated with heavy clays, generally red/brown, but sometimes a sticky tight grey. *Eucalyptus platypus* produces substantial litter, which through time are likely to build substantial resources for soil biota. Two soil pits (Pit 49, Pit 62) were sampled in proximity to Vegetation Survey Sites for

this association. It should also be noted that this association is found in areas where spongelite fragments are found within the soil profile.

Landscape position: The association is found in association with heavy clays. In the local landscape, as also the case at Monjebup North, it is found on the flat foot-slopes below the mallet breakaway systems. While the cleared portion of land slated for restoration at Monjebup North does not have any specific landform units for this system, several large areas of heavy sticky clay are recommended to support this system.

Veg Survey Site: 6 (2)



Veg Survey Site: Near 22 & 6 (3)



Hydrology: The clay soils associated with this system are likely to hold, and slowly release, substantial quantities of water in wet years, yet are very dry and hard in drier years. Moort systems are another example of extremely hardy vegetation with the capacity to go into a general locked up state of dormancy. Older remnant stands in the Fitz-Stirling landscape have maintained very high stem densities and demonstrate this trend. This dynamic has been quantified (Jonson et al., 2007).

Structural Attributes: This vegetation association is unique in its structural element, and its contrast with the thicker understory dominant Mallee Mosaic of the Fitz-Stirling landscape. Moort systems can demonstrate elements of both openness and obstruction through their high density, equal aged stands with little understory vegetation.

Veg Survey Site: 22 (1)



Veg Survey Site: 22 (2)



Plant Community Structural Summary:

Small to Medium Trees: *Eucalyptus platypus*, *Eucalyptus vesiculosa*, *Acacia cyclops*, *Santalum accuminatum*

Mallees: *Eucalyptus annulata*, *Eucalyptus flocktoniae*, *Eucalyptus conglobata*, *Eucalyptus pluricaulis*, *Eucalyptus vergrandis*, *Eucalyptus xanthonema*

Tall Shrubs: *Melaleuca accuminata*, *Melaleuca cucullata*, *Melaleuca pauperiflora*, *Acacia harveyii*, *McDryandra cirsioides*, *Hakea corymbosa*, *Kunzea montana*, *Lambertia inermis*, *Melaleuca pentagona*, *Callitris* sp.

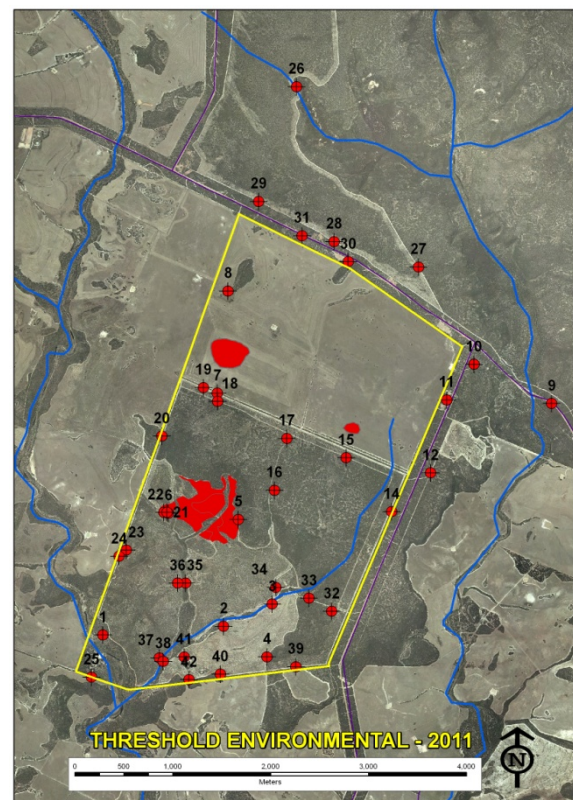
Mid Shrubs: *Acacia trulliformis*, *Alygoine* sp., *Gastrolobium parviflorum*, *Melaleuca bracteosa*, *Melaleuca calycina*, *Melaleuca hamata*, *Melaleuca pentagona*, *Melaleuca scabra*

Low shrubs:

Ground layer:

Grasses and Sedges: *Austrodanthonia* sp.

MAP: Distribution and areas proposed for restoration for the *Eucalyptus platypus* / *Eucalyptus vesiculosa* Woodlands vegetation association at Monjebup North.



MN5: *Eucalyptus astringens* / *Eucalyptus melanophitra* Mallet Breakaways

Monjebup North Veg Survey Sites:

5

Total Number of Species recorded in this system:

6

Veg Survey Site: 5 (1)



Veg Survey Site: 5 (2)



Description: Another charismatic vegetation association nested with the greater Mallee Mosaic of the Fitz-Stirling landscape. Perched on the spongelitic breakaway slopes, the Mallet system seems oddly out of place amongst the shorter statured mallee ecosystems. Most commonly occupied by *Eucalyptus astringens* subsp. *redacta*, but also populated with *Eucalyptus melanophitra* and *Eucalyptus clivicola*, these tall open woodlands are relatively low in species diversity. The mallets are all obligate seeders, and killed by fire.

Veg Survey Site: 5 (3)



Veg Survey Site: 5 (4)



Soil info: This unit is strongly associated with spongelitic breakaway landforms. Findings from an honors research project (Oxley, 2007) indicated a trend of high silt concentration in soils associated with Mallet systems.

Landscape position: Almost exclusively on spongelitic breakaways. At Monjebup North, areas of the drainage lines are also occupied by a mix of Mallet and drainage associated vegetation. As previously mentioned, a defining element of the landscape at Monjebup North are the large broad upland 'flats' that stretch from the Corackerup Nature Reserve right through the cleared land and beyond. Monjebup North is essentially split in major landform units. The Mallet breakaways on Monjebup North occur on an east-west

position and essentially define this transition. This breakaways unit also continues on the adjacent property to the east, however there its influence is expressed in a north-south landscape position. This landscape element is a key feature of the Monjebup North property and surrounds.

Veg Survey Site: 5 (5)



Veg Survey Site: 5 (6)



Hydrology: Due to the slopes associated with spongolitic breakaways, it is assumed that these landscape units shed large amounts of water following large precipitation events. The specific hydrology of these systems is not widely known.

Structural Attributes: Similar to the Moort association, this system provides a unique structural element to contrast the broader Mallee Mosaic vegetation of the Fitz-Striling landscape. Mallet systems are unique in their height, and provide an appealing open structure with little understory.

Plant Community Structural Summary:

Small to Medium Trees: *Eucalyptus platypus*

Mallets: *Eucalyptus astringens*, *Eucalyptus melanophitra*

Mallees:

Tall Shrubs:

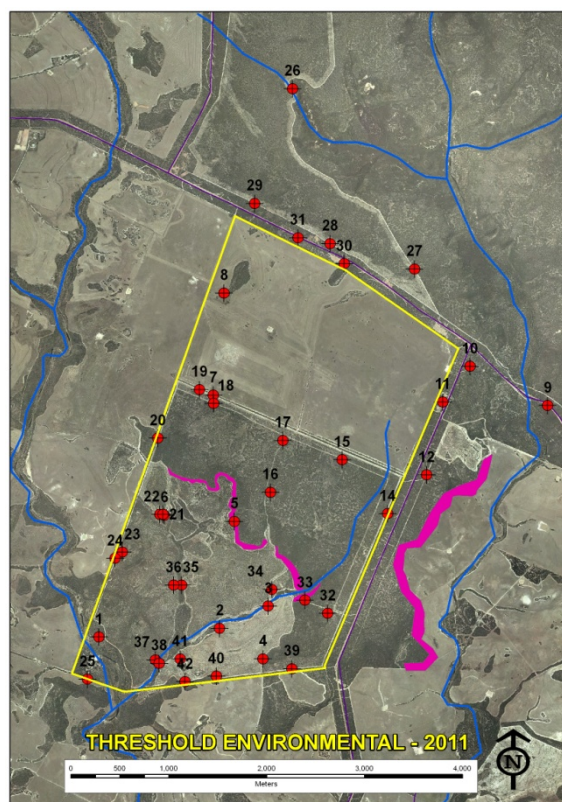
Mid Shrubs: *Dodonaea sp.*

Low shrubs: *Acacia spongolitica*, *Phebalium tuberculosum*

Ground layer:

Grasses and Sedges:

MAP: Distribution and areas proposed for restoration for the *Eucalyptus astringens* / *Eucalyptus melanophitra* Mallet Breakaways vegetation association at Monjebup North.



MN6: *Calothamnus quadrifidus* Granitic Scrub

Monjebup North Veg Survey Sites:
21; 23; 42

Total Number of Species recorded in this system:
42

Veg Survey Site: 21 (1)



Veg Survey Site: 21 (2)



Description: This vegetation association is variable due to position in the landscape and associated depth of soil profile. While there are no areas supporting this unit in the cleared lands at Monjebup North, it was surveyed prior to the soil survey, and was an element in the mosaic of vegetation located on the property south of the breakaways. The species diversity and composition of this system are generally different to that found in the greater Mallee Mosaic of the Fitz-Stirling. Fertility and ephemeral water availability are two abiotic influences that have shaped this system. *Calothamnus quadrifidus* is a defining species found in these systems in the Fitz-Stirling landscape. These systems also had good representation of species from the *Lepidosperma* genus, along with consistent representation by *Leptospermum erubescens* and *Santalum accuminatum*.

Veg Survey Site: 21 (3)



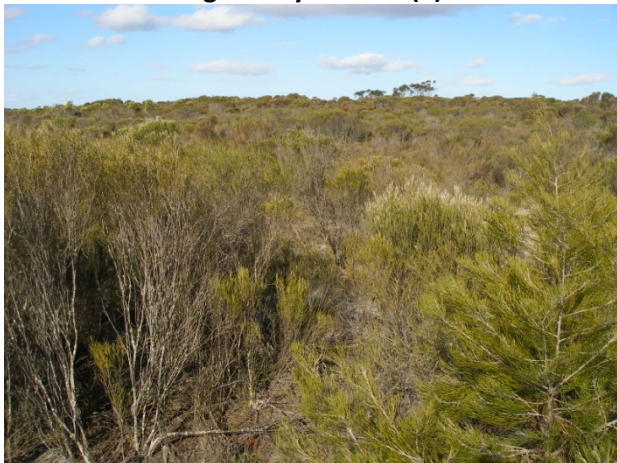
Veg Survey Site: 23 (1)



Soil info: This unit is associated with granitic outcrops. The specific vegetation supported at any given area varies due to soil depth, adjacent soil types, and level of decomposition of parent material. These soils are some of the more fertile soils of the Fitz-Stirling.

Landscape position: No specific landscape position, however granitic outcrops are generally positioned higher in the landscape at the patch scale due to a resistance to extensive erosion over time.

Veg Survey Site: 23 (2)



Veg Survey Site: Near 21



Hydrology: Soil water infiltration is good, but soil water storage capacity is not believed to be high as a lack of sufficient profile depth is usually present. A result of the shallow profile is likely shedding of water resources following large rainfall events.

Structural Attributes: As indicated, vegetation for this system varies from patch to patch across the Fitz-Stirling landscape due to differences in soil profile depth, adjacent vegetation, and the relative extent of the given patch (vegetation association) within the local sub-landscape scale.

Plant Community Structural Summary:

Small to Medium Trees: *Santalum accuminatum*

Mallees: *Eucalyptus phaenophylla*, *Eucalyptus pleurocarpa*, *Eucalyptus uncinata*, *Eucalyptus xanthonema*

Tall Shrubs: *Grevillea tetragonoloba*, *Melaleuca accuminata*, *Melaleuca hamata*, *Melaleuca pentagona*, *Persoonia longifolia*

Mid Shrubs: *Acacia assimilis*, *Acacia harveyii*, *Allocasuarina campestris*, *Calothamnus quadrifidus*, *Dodonaea amblyophylla*, *Gastrolobium parviflorum*, *Hakea lisocarpa*, *Hakea verrucosa*, *Leptospermum erubescens*, *Melaleuca hamulosa*, *Melaleuca spathulata*, *Melaleuca tuberculata*

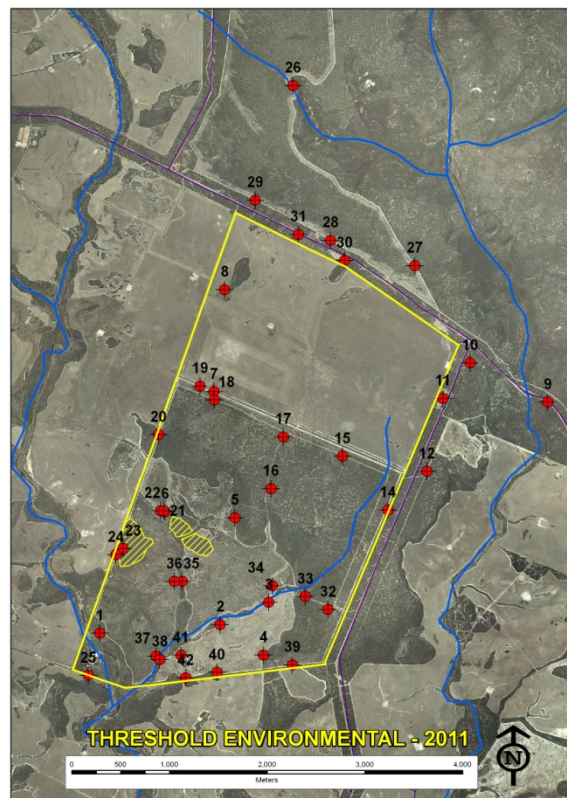
Low shrubs: *Acacia sulcata* var. *platyphylla*, *Chamelaucium* sp., *Cryptandra nutans*, *Hibbertia exasperate*, *Phebalium tuberosum*, *Thryptomene saxicola*, *Verticordia densiflora*

Ground layer: *Borya* sp., *Rinzia* sp., *Xanthorrhoea* sp.

Vines/Climbers: *Cassytha* sp.

Grasses and Sedges: *Ghania* sp.1, *Ghania* sp.2, *Lepidosperma* sp.1, *Lepidosperma* sp.2, *Lepidosperma* sp.3, *Lepidosperma* sp.4, *Neurachne allopecuroidea*

MAP: Distribution and areas proposed for restoration for the **Calothamnus quadrifidus Granitic Scrub** vegetation association at Monjebup North.



MN7: *Calistemon phoeniceus*, *Melaleuca accuminata* & Mixed sp. Drainage

Monjebup North Veg Survey Sites:
2; 35; 38

Total Number of Species recorded in this system:
27

Veg Survey Site: 2 (1)



Veg Survey Site: 2 (2)



Description: This vegetation association occupies the drainage lines of the landscape, with species composition strongly determined by adjacent, and especially up-slope, vegetation. As the topography of the Fitz-Stirling landscape is generally subtle in its relief, but large in its expanse, small drainage lines or ‘gullies’ are scattered across the landscape. At Monjebup North, these lines are less evident in the cleared area, but are well represented south of the breakaway land division. The most common species found in this system are *Calistemon phoeniceus* and *Melaleuca accuminata*, however these systems are usually a mixed community of those species that are common and robust in their recruitment and establishment potential. Interestingly to Monjebup North is relatively expansive presence of Mallets (*Eucalyptus astringens*; *Eucalyptus melanophytra*) however this may have been a common feature to the breakaway country prior to clearing. Another species of note is *Eucalyptus sporadica*, a mallee with a strong affiliation to drainage lines (Nathan McQuoid pers com). This vegetation unit also supports a range of sedges and grasses including species from the Lepidosperma, Neurachne, and Lomandra genera. Differences in species composition are likely across the site, however more extensive survey of this unit was not feasible.

Veg Survey Site: 2 (3)



Veg Survey Site: 35 (1)



Soil info: This unit is generally affiliated with a wide range of soil types as it traverses across the landscape following the path of least resistance. However consistent across the broader unit, is the presence of alluvial

fans of deposition, often sandy in nature. 'Sand slugs' are also a feature of this system, but were not extensively evident at Monjebup North. In addition, incised channels cut into these landscape units are present where water is focused and erosive powers have cut down to the impermeable soil layer. This is often a hard clay, rock, or other impermeable substrate.

Landscape position: The lowest points in the local patch. The drainage lines; gullies.

Veg Survey Site: 35 (2)



Veg Survey Site: 35 (3)



Hydrology: Areas of ephemeral, and sometimes perennial, water accumulation. These systems are essentially the hydrological pathways and filters from the upper landscape down to the coast. Variations in local topography and sub-surface soil parent material across the greater landscape result in a number of different hydrological systems including freshwater pools, broad water-logging flats, and narrow incised drainage pathways.

Structural Attributes: In general, this vegetation association and landscape unit is a source of both diverse and well represented structural elements. This system is likely the top area in the landscape for the provision of vegetative 'thickets'. As water availability is increased in these areas, stem densities are often higher than in the surrounding landscape. In addition, increased water availability and associated productivity have resulted in the accumulation of large quantities of coarse woody debris in these systems.

Veg Survey Site: 35 (4)



Veg Survey Site: 38



Plant Community Structural Summary:

Small to Medium Trees: *Eucalyptus platypus*, *Exocarpos aphyllus*, *Santalum accuminatum*

Mallets: *Eucalyptus astringens subsp. redacta*, *Eucalyptus melanophytra*

Mallees: *Eucalyptus flocktoniae*, *Eucalyptus sporadic*, *Eucalyptus thamnoides*, *Eucalyptus uncinata*
Eucalyptus xanthonema

Tall Shrubs: *Acacia harveyii*, *Melaleuca accuminata*, *Melaleuca hamata*

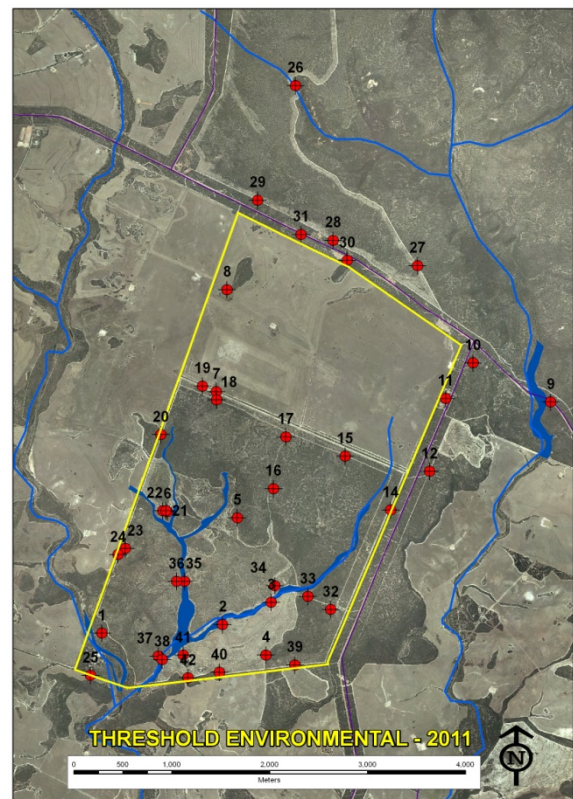
Mid Shrubs: *Calistemon phoeniceus*, *Grevillea sp.*, *Gastrolobium parviflorum*, *Melaleuca sp.*

Low shrubs: *Calothamnus gibbosus*, *Dodonaea amblyophylla*

Ground layer: *Astroloma sp.*, *Chamelaucium sp.*

Grasses and Sedges: *Desmocladus sp.*, *Lepidosperma sp.1*, *Lepidosperma sp.2*, *Lomandra caesia*, *Lomandra sp.*, *Neurachne sp.*

MAP: Distribution of the *Calistemon phoeniceus*, *Melaleuca accuminata* & *Mixed sp. Drainage* vegetation association at Monjebup North.



MN8: *Melaleuca pentagona* Mallee Scrub

Monjebup North Veg Survey Sites:
20; 33

Total Number of Species recorded in this system:
25

Veg Survey Site: 20 (1)



Veg Survey Site: 20 (2)



Description: This vegetation association is found in a broad band located just upslope of the breakaway land division at Monjebup North. The most defining characteristic of this system is the tall *Melaleuca pentagona* shrubs, which are quite mature and have developed robust paperbark stems. Other species identified within this association are *Acacia myrtyfolia*, *Eucalyptus falcata*, *Beaufortia schaueri*, and *Phebalium rude*. This system is not well understood and should be explored further.

Veg Survey Site: 33 (1)



Veg Survey Site: 33 (2)



Soil info: This vegetation association seems to be affiliated with the zone in the landscape where the spongellitic hard pan comes to the soil surface. Large spongellitic boulders and rocks were evident on the soil surface in this system.

Landscape position: This vegetation association seems to be closely affiliated with a zone just upslope from the spongellitic breakaway at Monjebup North. Further investigations are required to determine if this is a consistent trend across the greater Fitz-Stirling landscape.

Veg Survey Site: 33 (3)



Veg Survey Site: 33 (4)



Hydrology: The specific hydrology of this system is unknown, however it is possible that this is an area of high infiltration as stem densities are high and spongelitic surface materials suggest it may be the location of a broken hard pan located just upslope from the breakaway.

Structural Attributes: This vegetation association is dense and difficult to walk through. A low canopy is provided by the high stocking density of *Melaleuca pentagona* tall shrubs. A Malleefowl was observed near survey site 33. The height of the scrub indicates good growth productivity and suggests the site may be relatively long unburnt.

Plant Community Structural Summary:

Small to Medium Trees: *Hakea laurina*, *Santalum accuminatum*

Mallees: *Eucalyptus falcata*, *Eucalyptus lehmannii* subsp *parallela*, *Eucalyptus phaenophylla*

Tall Shrubs: *Dryandra cirsioides*, *Hakea strumosa*, *Kunzea recurva*, *Melaleuca pentagona*

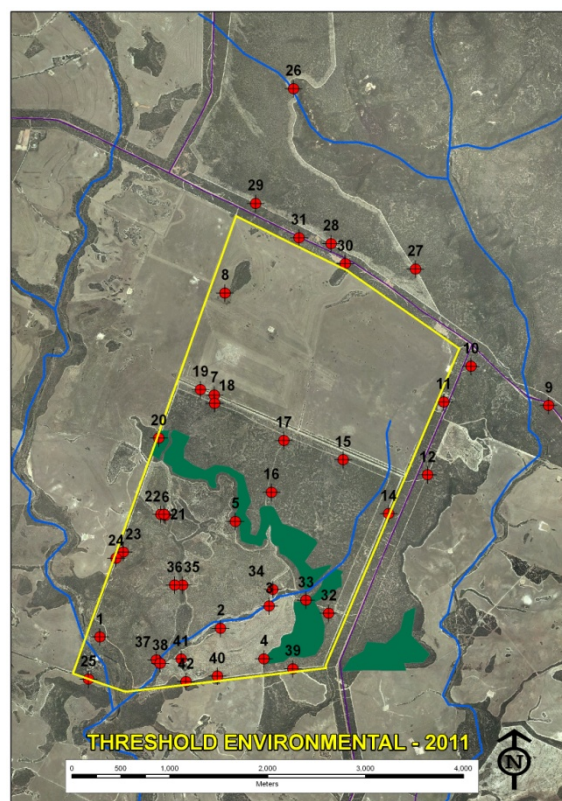
Mid Shrubs: *Acacia myrtifolia*, *Gastrolobium parviflorum*, *Gastrolobium spinosum*

Low shrubs: *Beaufortia schaueri*, *Boronia crassifolia*, *Epacrid* sp., *Guichenotia ledifolia*, *Isopogon buxifolius*, *Phebalium rude*, *Leucopogon gibbosus*, *Leucopogon* sp., *Hibbertia mucronata*, *Thomasia angustifolia*

Ground layer: *Chamelaucium ciliatum*

Grasses and Sedges: *Lepidosperma* sp.1, *Lepidosperma* sp.2 sp.

MAP: Distribution of the *Melaleuca pentagona* Mallee Scrub vegetation association at Monjebup North.



MN9: *Nutsya floribunda* / *Lambertia inermis* Mallee Scrub

Monjebup North Veg Survey Sites:

34

Total Number of Species recorded in this system:

28

Veg Survey Site: 34 (1)



Veg Survey Site: 34 (2)



Description: This vegetation association is commonly defined in association with deep sands. *Nutsya floribunda*, or WA Christmas tree is very well represented in such areas. Interestingly, the image that comes to mind of a deep gut-less sand may not be fully appropriate. A more accurate visual representation would confine this sandy profile to the upper horizon of the soil, and not be carried on to the next profile depth, which can be surprising close to the soil surface. However, it is evident that gutless pale surface sands are associated with this system. Other species commonly found with this vegetation association are *Lambertia inermis*, *Calothamnus gracilis*, *Dryandra sessilis*, and *Isopogon trilobus*. Picturesque species such as *Conospermum coerulescens*, and *Lechenaultia tubiflora* were also identified at the vegetation survey site for this vegetation association. *Eucalyptus pleurocarpa* is commonly found both within and surrounding these vegetation units. This system is one of the representative vegetation associations of what is termed 'Proteaceous heaths' in the Fitz-Stirling Functional Landscape Plan (FLP).

Veg Survey Site: 34 (3)



Veg Survey Site: 34 (4)



Soil info: As indicated in the description above of this vegetation association, a general affiliation with deep sands is often used to identify this system. The upper soil profile is a gutless white sand, however subsurface

soils have been found at Monjebup North and other sites to be composed of tightly packed ironstone gravels. Soil pits number 67 was sampled in proximity to the vegetation survey sites for this association.

Landscape position: No specific landscape position has been identified for this vegetation association, aside from its presence on dune like perched gut-less white sands.

Veg Survey Site: 34 (5)



Hydrology: Water infiltration is believed to be generally good once any hydrophobic thresholds are passed and the soil is sufficiently hydrated as a result of steady rainfall. Water holding capacity in the upper soil surface profile is not believed to be good, but available water resources at depth are unknown.

Structural Attributes: This type of vegetation association is generally referred to as a Proteaceous rich Mallee scrub, or heath. Eucalypt mallees generally do not dominate these systems, but where present are represented by *Eucalyptus pleurocarpa* and *E. falcata*. As a result the upper stratum of vegetative structure is generally reduced in stature. Banksias, Dryandras, *Nutsya floribunda* and *Lambertia inermis* generally represent the upper stratum. While the mid and low story vegetation for this vegetation association generally provide substantial structural attributes, the survey site at Monjebup North has been cleared and is therefore does not represent a fully appropriate analogue site for this system.

Plant Community Structural Summary:

Small to Medium Trees: *Nutsya floribunda*

Mallees: *Eucalyptus pleurocarpa*, *Eucalyptus falcata*

Tall Shrubs: *Lambertia inermis*, *Dryandra sessilis*, *Taxandria spathulata*

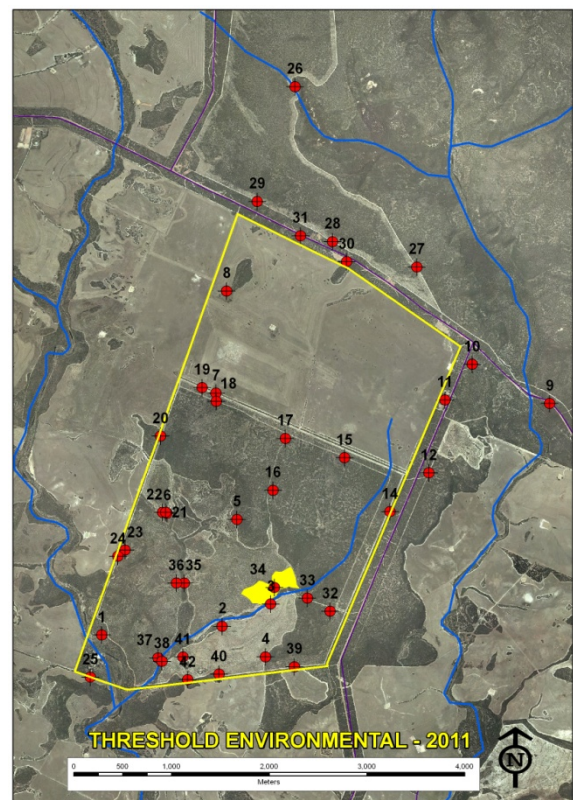
Mid Shrubs: *Acacia bidentata*, *Allocasuarina humilis*, *Calothamnus gracilis*, *Franklandia fucifolia*, *Isopogon trilobus*, *Lysinema ciliatum*, *Petrophile teretifolia*

Low shrubs: *Baeckea preissiana*, *Conospermum coerulescens*, *Davesia emarginata*, *Lechenaultia tubiflora*, *Melaleuca societalis*

Ground layer: *Banksia nutans*, *Brachysema sp.*, *Dampiera sp.*, *Gastrolobium latifolium*

Grasses and Sedges: *Anigozanthus rufa*, *Conothamnus aureus*, *Desmocladius aspa*, *Loxocaria sp.*, *Mesomelaena stygia*, *Schenous sp.*

MAP: Distribution of the *Nutsya floribunda* / *Lambertia inermis* Mallee Scrub vegetation association at Monjebup North.



MN10: *Eucalyptus occidentalis* / *Banksia media* Riparian Woodland Scrub

Monjebup North Veg Survey Sites:

1

Total Number of Species recorded in this system:

14

Veg Survey Site: 1 (1)



Veg Survey Site: 1 (2)



Description: This core foundation of this vegetation association is a Yate (*Eucalyptus occidentalis*) riparian system. This system represents another target identified by the Fitz-Stirling FLP. In this specific vegetation unit found in the south west corner of the Monjebup North property, the Yate has an understory of *Banksia media* (a species that generally is not associated with this landscape position, or found in affiliation with a Yate system). However the often disturbed nature of the riparian systems of the Fitz-Stirling, and diverse range of species found within them, illustrates the influential power of 'adjacency' for the dispersal limited flora of the south west of WA. In this way, the local abundance of *Banksia media* in the surrounding landscape provides the explanation for its presence in this system. Other common species to this riparian association are *Acacia saligna* and *Melaleuca accuminata*.

Veg Survey Site: 1 (3)



Veg Survey Site: 1 (4)



Soil info: This unit is generally defined as a riparian land unit with associated alluvial fans. However the presence of some plant species that are affiliated with clay soils such as *Melaleuca cucullata*, indicate that the soil for this location are heterogeneous at a relatively acute scale.

Landscape position: This vegetation association is associated with a riparian zone in the landscape.

Hydrology: The hydrological signature of this vegetation association is similar to that demonstrated by the drainage or gully systems; however these landscape positions are more strongly fed by draining water and therefore are likely to store greater levels of soil moisture over time. These landscape positions support both ephemeral and perennial water pools. They are the main hydrological pathways and filters from the upper landscape down to the coast. They house diverse hydrological features including freshwater pools, saline pools, broad water-logging flats, and large sandy alluvial depositions ('sand slugs').

Structural Attributes: This vegetation association is defined by a tall open woodland of *Eucalyptus occidentalis*, with a mix of both open and dense areas of mid and lower story vegetation. Vegetative growth is generally high and this is reflected through the presence of shrub 'thickets' and areas of high stem densities. High levels of natural attrition and recruitment are also present, with an associated accumulation of large quantities of coarse woody debris.

Plant Community Structural Summary:

Tall Trees: *Eucalyptus occidentalis*

Small to Medium Trees: *Acacia saligna*, *Banksia media*, *Melaleuca hamulosa*, *Santalum accuminatum*

Mallees:

Tall Shrubs: *Acacia assimilis*, *Melaleuca accuminata*, *Melaleuca cucullata*, *Dodonaea sp.*

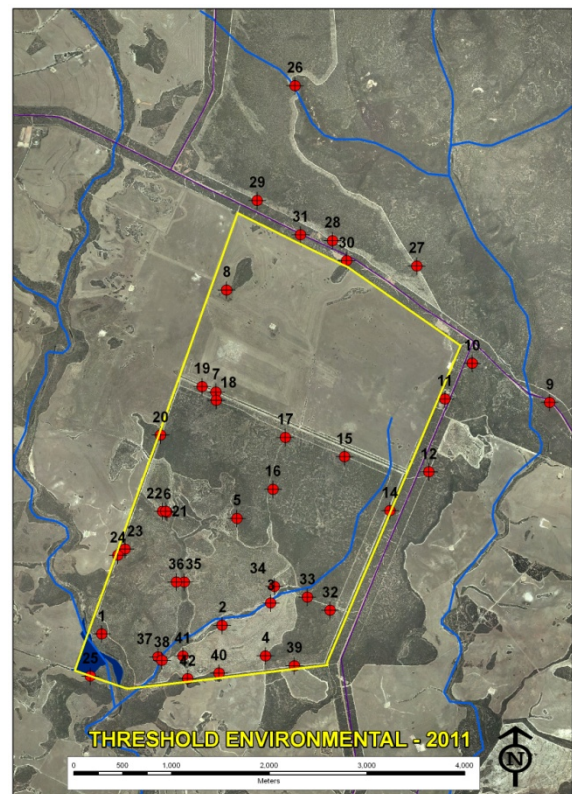
Mid Shrubs: *Acacia cupularis*, *Acacia sphacelata*, *Dryandra tenuifolia*, *Grevillea dolichopoda*

Low shrubs:

Ground layer:

Grasses and Sedges: *Lomandra sp.*

MAP: Distribution of the *Eucalyptus occidentalis* / *Banksia media* Riparian Woodland Scrub vegetation association at Monjebup North.



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Eucalyptus melanophytra						1		1				
Eucalyptus sporadica												
Eucalyptus vesiculosa						1	1					
Gompholobium confertum	1		1									
Gompholobium scabra			1		1							
Grevillea dolichopoda	1											1
Grevillea pectinata						1	1					
Hakea lisocarpa								1				1
Hakea prostrata		1	1									
Hakea strumosa						1					1	
Lepidosperma sp.3								1				1
Leptospermum erubescens								1	1			
Leucopogon gibbosus						1				1	1	
Leucopogon sp.					1					1		
Lomandra sp.									1			1
Melaleuca calycina						1		1				1
Melaleuca hamulosa								1				
Melaleuca tuberculata			1					1				
Neurachne allopecuroidea	1							1				
Ozothamnus lepidophyllus						1	1					
Persoonia longifolia								1				
Phebalium rude					1					1	1	
Pimelia sp.							1	1				
Rinzia sp.			1						1			
Santalum murrayanum					1							
Acacia bidentata											1	
Acacia densiflora												1
Acacia littorea												
Acacia mimica var. mimica			1									
Acacia saligna												
Acacia spongolitica								1				1
Acacia sulcata var. platyphylla									1			
Acacia trulliformis												
Acrotriche ramiflora		1						1				
Agonis spathulata											1	
Allocasuarina campestris										1		
Allocasuarina humilis											1	
Allocasuarina lehmanniana												1
Anigozanthus rufa											1	
Astatea sp.						1						
Austrodanthonia sp.								1				
Austrostipa sp.									1			
Baeckea preissiana											1	
Banksia nutans											1	
Beaufortia sp.	1											
Billardiera sp.							1					
Boronia crassifolia											1	
Boronia octandra												
Bossiaea spinescens											1	
Brachysema sp.											1	
Calitris glaucophylla						1						
Callitris sp.	1											
Caustis dioica			1									
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Conospermum sp.							1					
Conothamnus aureus											1	
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Dianella sp.											1	
Dryandra sessilis											1	
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Eucalyptus occidentalis												1
Franklandia fucifolia											1	
Gahnia ancistrophylla	1											
Gahnia frifida											1	
Gahnia sp.1											1	
Gahnia sp.2											1	
Gastrolobium latifolium											1	
Gastrolobium sp.								1				
Gastrolobium tetragonophyllum											1	
Grevillea sp.												
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Grevillia pectinata											1	
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Hibbertia recurvifolia											1	
Inapogon sp.												1
Isopogon seminuda											1	

