

II VEGETATION OF BADJALING NATURE RESERVE, SOUTH BADJALING NATURE RESERVE, YOTING TOWN RESERVE AND YOTING WATER RESERVE

B.G. MUIR

General

The Badjaling-Yoting series of reserves falls within the Avon district of the South-Western Botanical Province of Gardner and Bennetts (1956) and the vegetation largely conforms to that generally found throughout this region.

No documented plant collections have been made prior to this survey, which was carried out on 5-7 September 1977.

Vegetation descriptions for Badjaling Nature Reserve, South Badjaling Nature Reserve, Yoting Town Reserve and Yoting Water Reserve are given in **Appendices 1, 3, 5 and 7** respectively; species lists at selected locations are given in **Appendices 2, 4, 6 and 8** respectively. Vegetation locations are given on **Figs 2, 3, 4 and 5** respectively.

Methodology

The vegetation of the Badjaling-Yoting Reserves was mapped at Level 1 of the reliability scale set out in Muir (1977). Each vegetation formation discernible on the air photographs was examined on the ground; at least one location was described in detail within each major association using the classification shown in **Table 1** and discussed in detail in Muir (1977); and a soil profile was described for each major association.

Level 1 locations shown on **Fig. 2** represent 'sample areas' where the vegetation was examined in detail. The following prefix numbers of the locations represent basic formation types:

- 1 = Woodland formations
- 2 = Mallee formations
- 3 = Shrubland formations
- 4 = Heath formations
- 7 = Salt complex
- 8 = Other

The methods used in classifying formations, coding vegetation, preparing plant lists, classifying litter and describing soils are those of Muir (1977). In addition to the soil characteristics dealt with on other reserves, total soluble salts were also measured.

Samples were prepared by mixing 20 g of sieved soil (less than 2 mm) with 50 cc deionised water and shaking periodically for 30 mins. Conduct-

TABLE 1
Vegetation Classification to be used in Wheatbelt Survey

LIFE FORM/HEIGHT CLASS		CANOPY COVER			
		DENSE 70-100% d	MID-DENSE 30-70% c	SPARSE 10-30% i	VERY SPARSE 2-10% r
T	Trees > 30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
M	Trees 15-30m	Dense Forest	Forest	Woodland	Open Woodland
LA	Trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
LB	Trees < 5m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
KT	Mallee tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
KS	Mallee shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
S	Shrubs > 2m	Dense Thicket	Thicket	Scrub	Open Scrub
SA	Shrubs 1.5-2.0m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
SB	Shrubs 1.0-1.5m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
SC	Shrubs 0.5-1.0m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
SD	Shrubs 0.0-0.5m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
P	Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
H	Hummock Grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
GT	Bunch grass > 0.5m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
GL	Bunch grass < 0.5m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
J	Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
VT	Sedges > 0.5m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
VL	Sedges < 0.5m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
X	Ferns Mosses, liverwort	Dense Ferns Dense Mosses	Ferns Mosses	Open Ferns Open Mosses	Very Open Ferns Very Open Mosses

ivity readings were taken on a Philips PW9504 Conductivity Meter fitted with a PW9510 electrode. Readings were then converted to total soluble salts by comparison with a standard seawater curve.

Formations and Distribution

Woodlands and shrublands are represented on all the reserves; mallee on Yoting Town Reserve (YR) and Yoting Water Reserve (YWR); heaths on Badjaling Nature Reserve (BNR), South Badjaling Nature Reserve (SBR) and on YR; and salt complex on BNR and YR. The woodlands of BNR and SBR are composed of *Banksia* and *Xylomelum* associations and thus tend to be on deep sandy soils on the higher parts of the reserves. At lower elevations and with development of heavier soils shrublands occur and these give way to salt complex in the lowest portions of the reserves (particularly BNR). YR has a similar distribution of formations in relation to elevation. Higher areas where soils is developed above granite have woodlands; or where laterite occurs, shrublands. Slightly lower altitude areas where sands have accumulated carry heaths, then the lower clayey areas have *Eucalyptus loxophleba* sparse tree mallees which border on salt complex along the water course. YWR is relatively flat and has heavy soils developed above granite. *Eucalyptus salmonophloia* woodland is developed over the whole area except where a small creek has allowed *E. loxophleba* mallee to develop or where a small area of shrubland occurs as regrowth after clearing.

Formation area and proportion of the reserves are set out in the table below.

Formation	BNR		SBR		YR		YWR	
Woodland	87 ha	32%	34 ha	82.9%	11 ha	18%	29 ha	85.3%
Mallee	—	—	—	—	8	13.1	1	2.9
Shrubland	147	54	2	4.9	11	18	4	11.8
Heath	7	2.6	5	12.2	6	9.9	—	—
Salt complex	31	11.4	—	—	2	3.3	—	—
Other (grass)	—	—	—	—	6	9.8	—	—

It can be seen that on BNR, shrubland is most abundant. In addition, the woodland is mostly *Banksia* and *Xylomelum* associations and has many shrub-like characteristics although the life-form is that of a tree (cf. life-forms discussed in Muir, 1977). Thus, in terms of fauna that may require shrub-like vegetation structure, BNR may have as much as 86% of suitable habitat. On SBR the same comments apply, the woodland also being composed of *Banksia* and *Xylomelum* associations.

On YR, woodlands and shrubland are of equal areas and proportion of the reserve, with mallee less abundant. It must be remembered that about 28% of the area of YR is covered by the siding, roads, gravel pits or fire

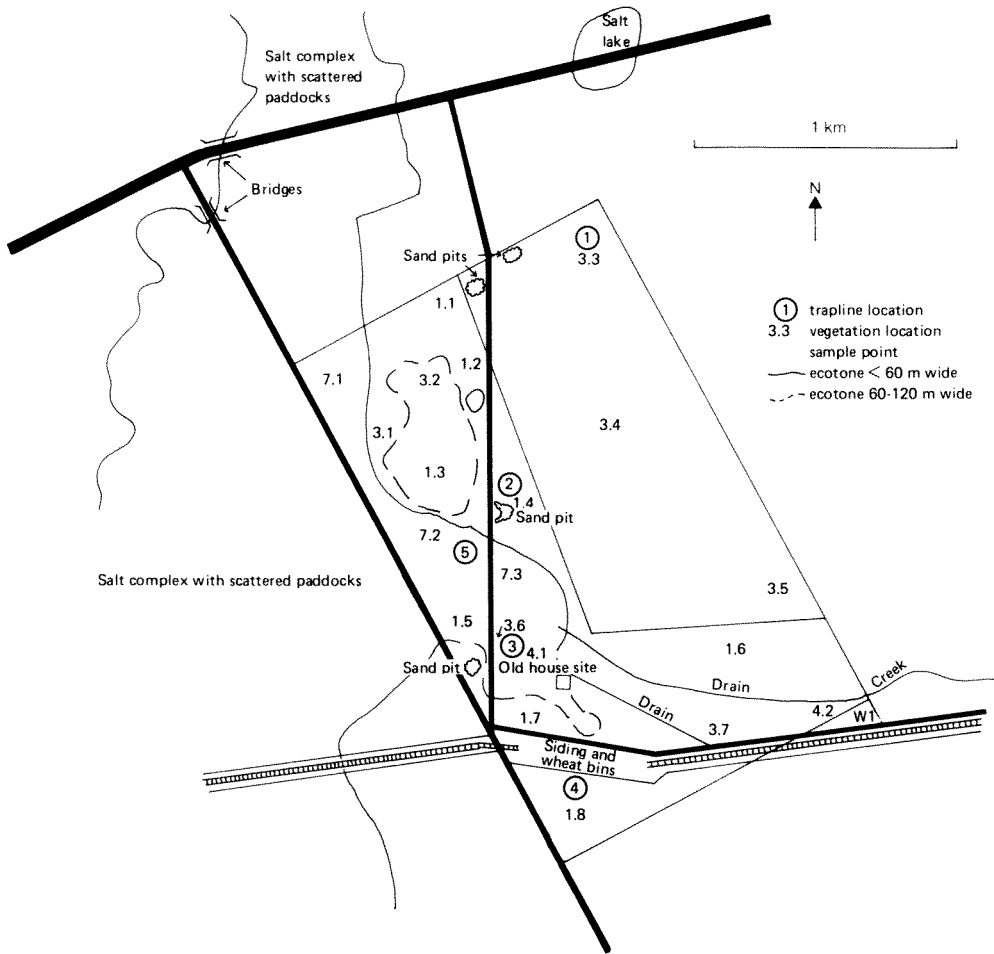


Fig. 2: Map of Badjaling Nature Reserve showing vegetation location numbers, ecotones and location of traplines.

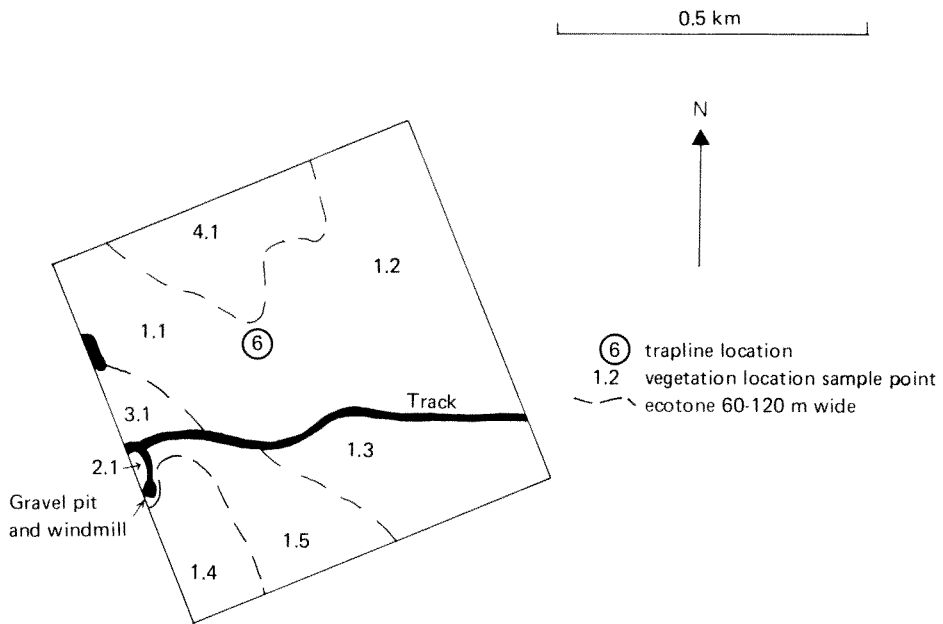


Fig. 3: Map of South Badjaling Nature Reserve showing vegetation location numbers, ecotones and location of traplines.

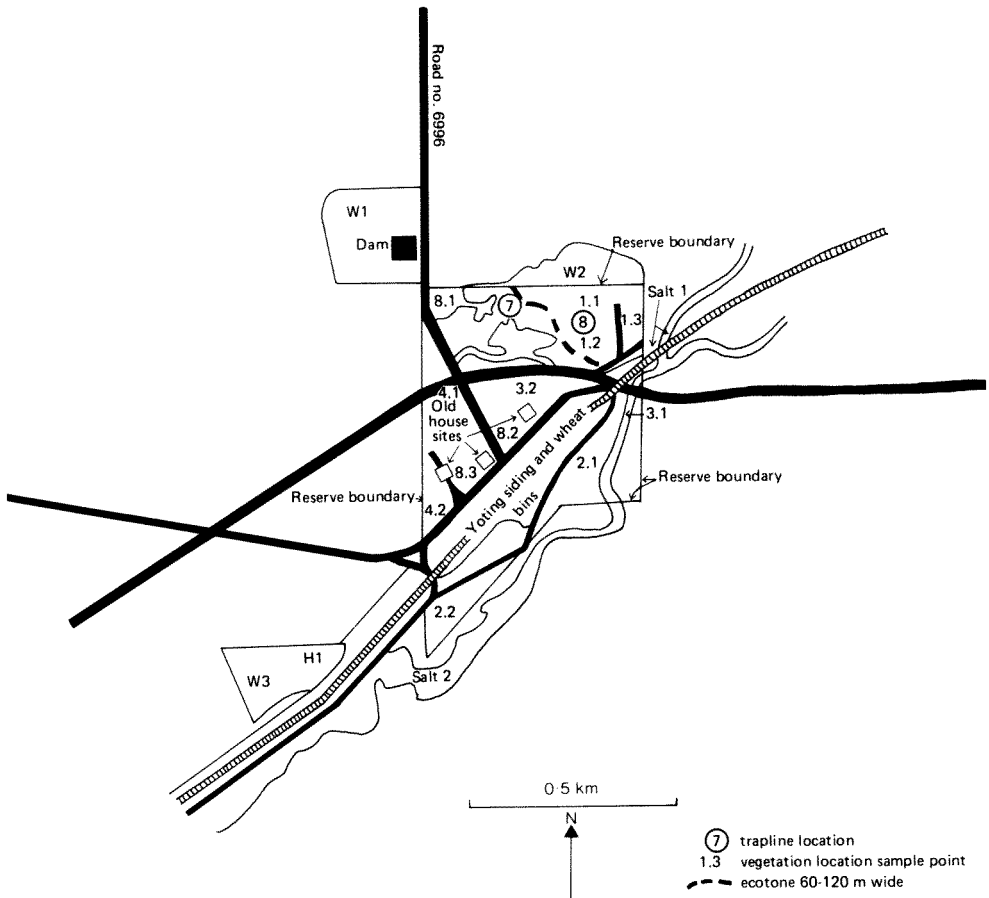


Fig. 4: Map of Yoting Town Reserve showing vegetation location numbers, ecotones and locations of traplines.

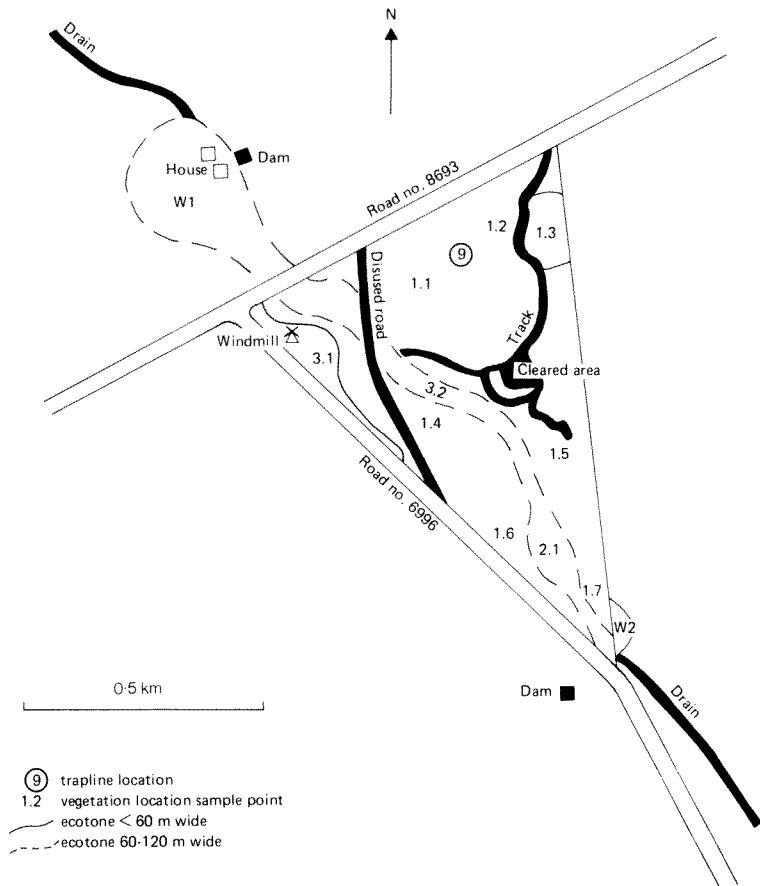


Fig. 5: Map of Yoting Water Reserve showing vegetation location numbers, ecotones and locations of traplines.

breaks and thus excluding the grassland area, the area of remaining relatively undisturbed bushland is probably only about 38 ha.

YWR is almost entirely dominated by woodland, the majority of the remainder (11.8%) being covered with a shrubland which results from regrowth following clearing. This shrubland will regrow into either mallee or woodland.

Uncleared land adjacent to BNR is all salt complex, being part of Salt River, a saline watercourse and salt marsh complex which flows past Badjal-ing Siding, arising north and east of the reserve and flowing to the south-west. There is no uncleared land adjacent to BNR.

At YR the majority of uncleared land is woodland with some salt complex and at YWR are woodland extensions of the associations on the reserve.

Associations

'Associations' as used here include associations, associates and consociations according to the definitions of Beadle & Costin (1952) and Polunin (1960). Formation prefix numbers in the columns below represent the formation types represented by each association, e.g. *Casuarina campestris* associations are found on BNR, SBR and YR in shrubland and also as a heath on YR.

Association	BNR	SBR	YR	YWR
<i>Acacia acuminata</i>			1	
<i>Arthrocnemum halocnemoides</i>	7		7	
<i>Banksia prionotes</i>		1		
<i>Casuarina campestris</i>	3	3	3, 4	
<i>C. huegeliana</i>	1			
<i>Eremaea pauciflora-C. campestris</i>	4			
<i>Eucalyptus loxophleba</i>	1		1	2
<i>E. loxophleba-A. saligna</i>				3
<i>E. salmonophloia</i>				1
<i>E. salubris</i>				1
<i>Leptospermum erubescens</i>	3			
<i>Melaleuca lateriflora-M. uncinata</i>	3			
<i>M. seriata</i>		4		
<i>M. uncinata</i>	3			
Mixed grasses (variable dominance)			8	
Mixed shrubs (variable dominance)	4			
<i>Xylomelum angustifolium</i>	1, 3			
<i>X. angustifolium-B. prionotes</i>	1	1		

Below are the numbers of different associations found in each formation on each reserve.

Woodland	4	2	2	2
Mallee	—	—	—	1
Shrubland	5	1	1	1
Heath	2	1	1	—
Salt complex	1	—	1	—
Grassland	—	—	1	—
Total	12	4	6	4

The 4 reserves are low in number of associations compared to some other wheatbelt reserves. In terms of number of associations per area, however, they are very diverse, having an average number of associations per square km of 8.94 compared to the highest previously recorded of 6.63 at Wilroy Reserve (Muir 1979).

Senescent Trees

The artificially contrived index of abundance of senescent trees discussed in Muir (1977b) can be calculated for the reserves.

	BNR	SBR	YR	YWR
Area of woodland	87 ha	34 ha	11 ha	29 ha
Average % canopy cover	12.3	17.2	15.3	29.3
% senescent trees	10	0	1	2
Index	1.07	—	0.02	0.17

On BNR the index is larger than it should be, owing to the large area of woodland involved. Most of the woodland is *Banksia* and *Xylomelum* dominated, and these species rarely form hollow limbs or trunks. The indices are low compared to most other reserves examined in the wheatbelt.

Floristics

A total of 186 species of plants were recorded on the 4 reserves, 111 on BNR, 37 on SBR, 72 on YR and 50 on YWR. Based on previous experience, the total number of common perennials and ephemerals is probably about 180, 60, 120 and 60 respectively.

The table below compares floristic diversity between formations.

Formation	BNR		SBR		YR		YWR	
Woodland	56	0.21/ha	17	0.41/ha	30	0.49/ha	38	1.12/ha
Mallee	—	—	—	—	7	0.11	15	0.44
Shrubland	42	0.15	6	0.15	16	0.26	15	0.44
Heath	36	0.13	24	0.59	44	0.72	—	—
Salt complex	19	0.07	—	—	7	0.11	—	—

A comparison of number of species per ha of formation shows that heaths and woodlands have the greatest floristic diversity on SBR and YR and woodlands on BNR and YWR. Salt complex, where it occurred, was least diverse. The mallee on YR which also had low diversity was *E. loxophleba* tree mallee scattered over a salt complex/grassland mosaic containing very few species.

The number of species recorded *only* in a single formation (restricted species) are shown below.

Formation	BNR		SBR		YR		YWR	
Woodland	32	0.12/ha	9	0.22/ha	19	0.31/ha	31	0.91/ha
Mallee	—	—	—	—	1	0.02	2	0.06
Shrubland	21	0.08	2	0.05	7	0.11	5	0.15
Heath	19	0.07	15	0.37	34	0.56	—	—
Salt complex	9	0.03	—	—	1	0.02	—	—

The figures for number of restricted species and for species per area reflect those for total species shown above.

A synthesis of all ecological and floristic data for the reserves will be included in the final wheatbelt study to be presented later.

APPENDIX 1

VEGETATION DESCRIPTIONS — BADJALING NATURE RESERVE

N.B. All vegetation is older than 20 years but locations 3.3, 3.4 and 3.5 have been cleared and have regrown.

WOODLAND FORMATIONS

● Loc. 1.1

As loc. 1.6 with small patches of *Acacia acuminata* and *Eucalyptus gracilis* trees along fence line.

● Loc. 1.2

Key Description

Open Low Woodland B over Dwarf Scrub C on fine sandy loam.

Code n₁ LBr.n₂ SCi/FSL

n₁ = *Xylomelum angustifolium*

n₂ = *Grevillea pritzellii*

Loc. Details

Stratum 1. *Xylomelum angustifolium* trees mature to senescent, 1.5-3.5 m tall, 2-10% canopy cover.

Stratum 2. *Grevillea pritzellii* shrubs, mature, 1.0 m tall, 10-30% canopy cover.

Comments

Scattered *Casuarina huegeliana* present. No evidence of fire.

Litter

Moderate, narrow leaves and large debris. Some logs and standing dead trees.

Soil

Deeper than 1 m. 50 cm sample moderately pedal, sandy, poorly coherent, unbleached, non-calcareous, pH 5.9, yellow, 10 YR 7/8, fine sandy loam. Excessively drained.

● Loc. 1.3

Key Description

Low Woodland A over Open Dwarf Scrub C on fine sandy loam.

Code cLAI.xSCr/FSL

Loc. Details

Stratum 1. *Casuarina huegeliana* trees, immature, stratum 6-11 m tall, 10-30% canopy cover.

Stratum 2. *Eremaea pauciflora* and *Grevillea pritzellii* shrubs, senescent, stratum 1.0 m tall, 2-10% canopy cover.

Comments

Evidence of very old fire scars.

Litter

Abundant, terete leaves, twigs and some large debris. Layer continuous to 2 cm deep.

Soil

Friable soil deeper than 1 m. 50 cm sample slightly pedal, sandy, poorly coherent, unbleached, non-calcareous, pH 4.7, yellow 10 YR 7/8, fine sandy loam, well drained.

● Loc. 1.4 (Trapline 2)

As for loc. 1.6.

● Loc. 1.5

Eucalyptus loxophleba trees, senescent, 12-16 m tall, 2-10% canopy cover over *Arthrocnemum halocnemoides* and *Atriplex paludosa* shrubs, mature, 0.5 m tall, 10-30% canopy cover. Dead trees are scattered throughout the area and are more abundant closer to locs 7.2 and 7.3.

● Loc. 1.6

Key Description

Low Woodland B over Low Scrub B on fine sandy loam.

Code xLBi.xSBI/FSL

Loc. Details

Stratum 1. *Xylomelum angustifolium* and *Banksia prionotes* trees and some shrubs, senescent, 0.5 m tall, 10-30% canopy cover (some areas only 2-10%).

Stratum 2. *Eremaea pauciflora* and several other species of shrubs, senescent, stratum 0-1.5 m tall, 10-30% canopy cover.

Comments

No evidence of fire.

Litter

Moderately abundant, broad leaves, twigs and large debris. Litter clumped to 2 cm deep, clumps 2-4 m apart. Some standing dead trees.

Soil

Friable soil deeper than 1 m. 50 cm sample moderately pedal, sandy, virtually non-coherent, unbleached, non-calcareous, pH 5.9, yellow, 10 YR 7/8, fine sandy loam. Well to excessively drained.

● Loc. 1.7

As for loc. 1.8.

● Loc. 1.8 (Trapline 4)

Key Description

Open Woodland over Dense Low Grass on sandy clay loam.

Code eMr.xGLd/SCL

Loc. Details

Stratum 1. *Eucalyptus loxophleba* trees and scattered tree mallee, mature to senescent, stratum 12-16 m tall, ca 10% canopy cover.

Stratum 2. *Hordeum marinum*, *Ehrharta longiflora* and numerous other grasses and some weeds, 0.2-0.4 m tall, 70-100% canopy cover.

Comments

Scattered shrubs present. No evidence of fire other than grass fires. The area is probably burnt often to reduce fire hazard and remove snakes from near the wheat bins.

Litter

Sparse, scattered broad leaves, twigs and some large debris. Abundant grass cover in winter. Abundant rubbish including sheets of iron, drums and bottles.

Soil

Friable soil ca 0.5 m deep over clays. 30 cm sample moderately pedal, sandy, coherent, unbleached, non-calcareous, pH 6.0, light yellowish brown, 10 YR 6/4, sandy clay loam. Well drained, may be some pooling after heavy rain.

SHRUBLAND FORMATIONS

• Loc. 3.1

Casuarina campestris or *Melaleuca uncinata* shrubs with numerous other species present, mature to senescent, stratum 1-2.5 m tall, 30-70% canopy cover (some areas only 2-10% cover). Area has been disturbed, possibly partly cleared. Gravel pits with regrowth of *Arthrocnemum halocnemoides* present. There is a small area of *Eucalyptus gracilis* trees 8-13 m tall, 2-10% canopy cover over *Atriplex paludosa* 0.5 m tall, 10-30% cover present within the shrubland. The shrubland area had slightly pedal, sandy, poorly coherent, pH 5.1, light yellowish brown, 10 YR 6/4, fine sandy loam soil. There is ca 30% laterite pebbles present in the top 30 cm.

• Loc. 3.2

Key Description

Scrub over Open Low Scrub B on fine sandy loam.

Code cSi.xSBr/FSL

Loc. Details

Stratum 1. *Casuarina campestris* shrubs, immature to mature, 1.5-2.5 m tall, 10-30% canopy cover.

Stratum 2. *Eremaea pauciflora* and *Grevillea pritzellii* shrubs, the *E. pauciflora* immature to mature, the *G. pritzellii* mature to senescent. Stratum 0.5-1.5 m tall, 2-10% canopy cover.

Comments

Evidence of old fire scars.

Litter

Moderately abundant, mostly terete leaves and twigs. Abundant dead standing shrubs. Litter layer continuous, 2 cm deep.

Soil

30 cm sample non-pedal, sandy, non-coherent, pH 4.7, brownish yellow, 10 YR 6/6, fine sandy loam.

• Loc. 3.3 (Trapline 1)

Key Description

Open Scrub over Open Low Scrub A on fine sandy loam.

Code n₁Sr.n₂SAr/FSL

n₁ = *Xylomelum angustifolium*

n₂ = *Eremaea pauciflora*

Loc. Details

Stratum 1. *Xylomelum angustifolium* shrubs, mature, stratum 1-4.5 m tall, 2-3% canopy cover.

Stratum 2. *Eremaea pauciflora* shrubs, mature, stratum 0.5-2 m tall, 2-10% canopy cover.

Comments

Evidence of old fire scars, possibly following clearing.

Litter

Sparse, scattered under shrubs.

Soil

50 cm sample highly pedal, sandy, poorly coherent, pH 5.4, brownish yellow, 10 YR 6/8, fine sandy loam. Well drained.

● Loc. 3.4

Vague mosaic of *Xylomelum angustifolium* shrublands similar to locs 3.3 and 3.5 but with open areas where upper stratum drops below 2% canopy cover and heathy species become more abundant.

● Loc. 3.5

Basically as for loc. 3.3 but upper stratum is 1.5-3.5 m tall and canopy is ca 5% cover. Understory is a mixed heath with no particular dominant, 0.5 m tall, 10-30% canopy cover. Litter and soils as for loc. 3.3.

● Loc. 3.6

Small stand of *Melaleuca lateriflora* and *M. uncinata* shrubs, mature, stratum 2-3 m tall, 70-100% canopy cover.

● Loc. 3.7

Key Description

Scrub over Open Dwarf Scrub C on sandy loam.

Code n₁Si.xSCr/SL

n₁ = *Leptospermum erubescens*

Loc. Details

Stratum 1. *Leptospermum erubescens* shrubs, mature, stratum 1-3.5 m tall, 10-30% canopy cover.

Stratum 2. Mixed shrubs, no particular dominant, 1.0 m tall, 2-10% canopy cover.

Comments

Area may be regrowth following clearing. Evidence of very old fire scars.

Litter

Absent.

Soil

Soil as for loc. 4.2. Well drained.

HEATH FORMATIONS

- Loc. 4.1 (Trapline 3)

Key Description

Dwarf Scrub C over Low Heath D on sandy loam.

Code xSCi.mSDc/SL

Loc. Details

Stratum 1. Numerous dominants in discrete patches as a mosaic over the area. Major dominants are *Melaleuca uncinata*, *Acacia* affin. *desertorum*, *Olearia revoluta* or *Grevillea paniculata* shrubs, immature to mature, 0.5-1.0 m tall, 10-30% canopy cover.

Stratum 2. *Melaleuca subtrigona* shrubs, senescent, 0.5 m tall, 30-70% canopy cover.

Comments

The canopy cover of stratum 1 averages 10-30% over the entire area but in some areas stratum 1 is absent. A cleared area near an old house site has *Pinus pinaster* trees and a single large *Eucalyptus calophylla* tree. The area also has abundant grass, particularly *Hordeum marinum* and *Ehrharta longiflora*. There are also cultivated *Freesia*. Several dead *E. loxophleba* trees are on the edge of the salt flat. Areas with poorest drainage have abundant *Rhagodia nutans* and *Cotula coronopifolia*.

Litter

Abundant where understory mostly senescent. Sparse elsewhere, consists almost entirely of twigs.

Soil

Friable soil deeper than 1 m. 50 cm sample is highly pedal, sandy, coherent, pH 4.8, very pale brown, 10 YR 8/4, sandy loam with coarse quartz grit. Poorly drained.

- Loc. 4.2

Eremaea pauciflora and *Casuarina campestris* shrubs, 1.5 m tall, 30-70% canopy cover. Scattered *Eucalyptus loxophleba* and *Acacia* affin. *saligna* trees to 7 m tall and *Leptospermum erubescens* shrubs to 3.5 m tall. Soil non-pedal, sandy, pH 4.2, very pale brown, 10 YR 7/3, sandy loam. Well drained.

SALT COMPLEX

- Loc. 7.1

Arthrocnemum halocnemoides shrubs, 0-0.5 m tall, unevenly distributed but overall canopy cover 30-70%. Raised areas and ecotone to loc. 3.1 have stands of *Melaleuca adnata* and scattered *Acacia merrallii*, *M. cymbifolia* etc. Soil in main *A. halocnemoides* area is waterlogged. In ecotone area soil is moderately or highly pedal, sandy, poorly coherent, pH 3.8, light yellowish brown, 10 YR 6/4, sandy loam with abundant grit and ca 5% laterite pebbles. Soluble salts 180 ppm. Poorly drained.

- Loc. 7.2 (Trapline 5)

As for loc. 7.1.

- Loc. 7.3

As for loc. 7.1.

UNCLEARED LAND ADJACENT TO
BADJALING NATURE RESERVE

- W1

Acacia affin. *saligna* trees, 2-4 m tall, 2-10% canopy cover over *Olearia revoluta* and numerous other species of shrubs 1.0 m tall 30-70% canopy cover. Abundant grasses.

APPENDIX 2

PLANT SPECIES LISTS FROM SELECTED LOCATIONS BADJALING NATURE RESERVE

(SC) denotes specimen lodged in Western Australian Museum Survey Collection.

Loc. 1.6

Actinostrobus arenarius
Baeckea crispiflora
Banksia prionotes
Calytrix fraseri
Carpobrotus edulis
Casuarina campestris
C. huegeliana
Comesperma scoparia
Daviesia juncea
Dianella revoluta
Dryandra sessilis
Enneapogon caeruleus
Eremaea pauciflora
Glischrocaryon flavescens
Grevillea integrifolia
G. pritzellii
Hakea incrassata

H. platysperma
Laxmannia squarrosa
Leptospermum erubescens
Leucopogon dielsianus
L. crassifolius
Melaleuca seriata
M. subtrigona
Mesomelaena uncinata
Mirbelia spinosa
Olearia revoluta
Pultenaea capitata
Rhagodia affin. *nutans*
Schoenus affin. *brevifolius*
Stipa elegantissima
Verticordia acerosa
V. picta
Xylomelum angustifolium

Loc. 1.8

Acacia acuminata
A. mackayana
Acanthocarpus sp. 1
Bassia diacantha
Carpobrotus edulis
Cheiranthra parviflora
Dampiera affin. *spicigera*
Dianella revoluta
Dodonaea bursariifolia
Ehrharta longiflora

Eremophila woolsiana var. *viridiflora*
Eucalyptus loxophleba
Hordeum marinum
Lomandra effusa
Loxocarya pubescens
Olearia revoluta
Oxalis pes-caprae
Ptilotus spathulatus
Rhagodia affin. *nutans*
R. preissii

Loc. 3.3

Baeckea affin. *floribunda*
Calytrix empetrioides
Choretrum pritzellii
Darwinia purpurea
Dianella revoluta
Eremaea pauciflora
Grevillea integrifolia

G. pritzellii
Harperia lateriflora
Laxmannia squarrosa
Lepidosperma gracile
Melaleuca seriata
Mesomelaena uncinata
Xylomelum angustifolium

Loc. 4.1

Acacia andrewsii
A. affin. desertorum
Arthrocnemum bidens
A. halocnemoides
Calothamnus sanguineus
Calytrix brachyphylla
C. fraseri
Carpobrotus edulis
Cassutha pubescens
Cotula coronopifolia
Daviesia brevifolia
Enchylaena tomentosa
Enneapogon caeruleus
Gastrolobium spinosum
Grevillea filifolia

G. paniculata
G. petrophiloides
Harperia lateriflora
Juncus maritimus
Lycium australe
Melaleuca lateriflora
M. subtrigona
M. uncinata
Mesomelaena uncinata
Muhlenbeckia adpressa
Olearia revoluta
Rhagodia affin. nutans
Santalum acuminatum
Scaevola arenaria

Loc. 7.1

Arthrocnemum halocnemoides
Cotula coronopifolia

Disphyma blackii
Polypogon monspeliensis

APPENDIX 3

VEGETATION DESCRIPTIONS --
SOUTH BADJALING NATURE RESERVE

WOODLAND FORMATIONS

● Loc. 1.1

As for loc. 1.2 but with an understory of *Eremaea pauciflora* shrubs 0.5-1.5 m tall, 30-70% canopy cover. *Petrophile ericifolia* and *Acacia assimilis* prominent. Vegetation older than 25 years.

● Loc. 1.2 (Trapline 6)

Key Description

Low Woodland A over Open Dwarf Scrub C on fine sandy loam.

Code $n_1 n_2 LAi.n_3 SCr/FSL$

n_1 = *Banksia prionotes*
 n_2 = *Xylomelum angustifolium*
 n_3 = *Eremaea pauciflora*

Loc. Details

Stratum 1. *Banksia prionotes* trees and *Xylomelum angustifolium* shrubs and trees, mature to senescent, stratum 4-6 m tall, 10-30% canopy cover.

Stratum 2. *Eremaea pauciflora* shrubs, senescent, stratum 1.0 m tall, 2-10% canopy cover.

Comments

Melaleuca seriata and *Mesomelaena uncinata* 0.3 m tall, 1-2% canopy cover present. No evidence of fire. Vegetation older than 25 years.

Litter

Abundant, mostly narrow leaves and twigs. Some large debris. Layer continuous or slightly clumped, 2 cm deep.

Soil

Friable soil deeper than 1 m. 50 cm sample slightly pedal, sandy, poorly coherent, unbleached, non-calcareous, pH 5.7, yellow, 10 YR 7/8, fine sandy loam. Drainage excessive.

- Loc. 1.3

As for loc. 1.2.

- Loc. 1.4

As for loc. 1.2.

- Loc. 1.5

Banksia prionotes trees 4-6 m tall, 2-10% canopy cover over scattered shrubs to 0.5 m tall (mostly *Dryandra cirsioides* or *hewardiana*) and abundant grass. Some heathy species as found in loc. 1.2. Area is much disturbed and may be regrowth following heavy grazing or clearing in which the trees were not removed. Has not been burnt for ca 20 years.

MALLEE FORMATION

- Loc. 2.1

Very small area of *Eucalyptus comitae-vallis* tree mallee 4-8 m tall surrounded by cleared areas and gravel pit. A windmill is adjacent.

SHRUBLAND FORMATION

- Loc. 3.1

Area of transition between woodland loc. 1.5 and watercourse leading on to farmland to the west of the reserve. Association is *Casuarina campestris* shrubs, mature, stratum 1.5-3.5 m tall, 10-30% canopy cover over *Ecdeiocolea monostachya* sedge, 0.3 m tall, 30-70% canopy cover. Scattered *Grevillea excelsior* are emergent to 7 m tall. Soil is deeper than 1 m, moderately pedal, sandy, strongly coherent, pH 4.6, brownish yellow, 10 YR 6/6, sandy clay loam. Soluble salts less than 30 ppm. Vegetation is ca 20 years old.

HEATH FORMATION

- Loc. 4.1

Key Description

Low Heath C over Very Open Low Grass on light sandy clay loam.

Code mSCc.n₁GLr/LSCL

n₁ = *Amphipogon debilis*

Loc. Details

Stratum 1. *Melaleuca seriata* shrubs mature 0.8 m tall, 30-70% canopy cover.

Stratum 2. *Amphipogon debilis* grass, mature, 10 cm tall, 2-10% canopy cover.

Comments

Scattered *Dryandra cirsioides* and *Grevillea pritzellii* to 1.5 m tall. Vegetation is ca 20 years old.

Litter

Sparse, mostly terete leaves.

Soil

Friable soil deeper than 1 m. 50 cm sample highly pedal, sandy, coherent, unbleached, non-calcareous, pH 5.3, yellow, 10 YR 8/6, light sandy clay loam. Soluble salts less than 30 ppm. Drainage excessive.

APPENDIX 4

PLANT SPECIES LISTS FROM SELECTED LOCATIONS SOUTH BADJALING NATURE RESERVE

Loc. 1.2

Baeckea crispiflora
B. floribunda
Banksia attenuata
Borya nitida
Casuarina microstachya
Choretrum pritzellii
Cryptandra myriantha
Enneapogon caeruleus
Eremaea pauciflora

Grevillea excelsior
G. pritzellii
Hakea incrassata
Harperia lateriflora
Leptospermum erubescens
Melaleuca seriata
Mesomelaena uncinata
Schoenus compressus
Stipa hemipogon

Loc. 3.1

Casuarina campestris
Dryandra cirsioides
D. hewardiana

Ecdeiocolea monostachya
Grevillea excelsior
Mesomelaena uncinata

Loc. 4.1

Amphipogon debilis
Calytrix fraseri
Cassytha pubescens
Chamaexeros fimbriata
Choretrum pritzellii

Dampiera affin. dura
Dryandra cirsioides
D. hewardiana
Gahnia affin. polyphylla
Hakea incrassata

Harperia lateriflora
Hibbertia pungens
Laxmannia squarrosa
Leptospermum erubescens
Leucopogon blepharolepis
Loxocarya pubescens
Melaleuca seriata

Mesomelaena uncinata
Mirbelia spinosa
Pimelia brevifolia
Ursinia anthemoides
Verticordia acerosa
V. brownii
V. picta

APPENDIX 5

LOCATION DESCRIPTIONS — YOTING TOWN RESERVE

WOODLAND FORMATIONS

- Loc. 1.1 (Trapline 8)

Key Description

Low Woodland A over Open Low Scrub B over Herbs and Low Sedge on sandy clay loam.

Code eLAI.xSBr.xJVLc/SCL

Loc. Details

Stratum 1. *Eucalyptus loxophleba* trees and tree mallee, mature, stratum 10-15 m tall, 10-30% canopy cover.

Stratum 2. *Grevillea paniculata* and several other species of shrubs, mature, stratum 1-1.5 m tall, 2-10% canopy cover.

Stratum 3. *Borya nitida* herbs and *Harperia lateriflora* sedge, mature, stratum 0.1 m tall, 30-70% canopy cover.

Comments

Scattered *Acacia acuminata* 5-7 m tall. No evidence of fire. Vegetation is older than 15 years.

Litter

Moderately abundant, mostly broad leaves, twigs and large debris, clumped to 2 cm deep, clumps 1-2 m apart.

Soil

Friable soil deeper than 0.5 m. 30 cm sample slightly pedal, sandy, coherent, unbleached, non-calcareous, pH 4.3, pink, 7.5 YR 7/4, sandy clay loam. Soluble salts 40 ppm. Well drained.

- Loc. 1.2

As for loc. 1.1 but understory is almost entirely *Grevillea paniculata* 1.0 m tall, 30-70% canopy cover. Stratum 3 is virtually absent.

- Loc. 1.3

Key Description

Open Low Woodland A over Dense Herbs and Dense Low Grass on clay loam.

Code aLAr.xJGLd/CL

Loc. Details

Stratum 1. *Acacia acuminata* trees, immature, stratum 6-9 m tall, 2-10% canopy cover.

Stratum 2. *Dampiera spicigera* herbs and several species of herbs, grasses and shrubs, immature to mature, stratum 0.3 m tall, 70-100% canopy cover.

Comments

Scattered emergent *Eucalyptus wandoo* and *E. loxophleba* present. Area is very disturbed and weeds are abundant. Evidence of very old fire scars. Vegetation is older than 15 years.

Litter

Moderately abundant, mostly dead grass, layer continuous.

Soil

Friable soil deeper than 0.5 m. 30 cm sample slightly pedal, sandy, poorly coherent, unbleached, non-calcareous, pH 5.0, light yellowish brown, 10 YR 6/4, clay loam. Soluble salts less than 30 ppm. Poorly drained.

MALLEE FORMATIONS

● Loc. 2.1

This area borders a salt creek (loc. 7.1) and is separated from the salt complex because it lies on higher ground. The understory is dominated by grasses rather than by halophytes and living *Eucalyptus loxophleba* trees are of sufficient abundance to constitute a distinct stand. The grasses are burned regularly.

The stand is *E. loxophleba* tree mallee mature to senescent, 6-12 m tall, 2-10% canopy cover over *Hordeum marinum* bunch grass and some *Arthrocnemum halocnemoides* 0.4 m tall, 90-100% canopy cover. Slightly higher ground within the stand has *E. salmonophloia* to 15 m tall. There is some large debris present but very little litter of other types. Soil is highly pedal, earthy, extremely coherent, pH 6.2, dark yellowish brown, 10 YR 4/4, medium clay. Soluble salts 1650 ppm. Poorly drained.

● Loc. 2.2

Eucalyptus loxophleba tree mallee and scattered *E. wandoo* trees 8-15 m tall, varying from 2-30% canopy cover.

Abundant *Acacia acuminata* in some areas 1.5-3 m tall. Grass covers the entire area. Some large debris present. Soil as for loc. 2.1 but is higher above creek level and is better drained. *Arctotheca calendula* common. No evidence of major fires but some grass has been burnt in small patches near the roads.

SHRUBLAND FORMATIONS

● Loc. 3.1 (Trapline 7)

Key Description

Dense Thicket on sandy loam.

Code cSd/SL

Loc. Details

Unstratified, *Casuarina campestris* shrubs, mature to senescent, 1-2.5 m tall, 70-100% canopy cover.

Comments

No understory present, but *Borya nitida* is abundant in open areas between the shrubs. North-east boundary of this loc. adjacent to loc. 1.1 has a small area of *Eucalyptus cylindriflora* tree mallees 2-10 m tall over *Acacia graffiana*. Evidence of old fire scars and burnt stumps.

Litter

Whole area is degraded and has piles of rubbish including sheets of corrugated iron, empty drums, bottles and car bodies. Natural litter comprises terete leaves to 0.5 cm deep in a continuous layer. Area was partly cleared 15-20 years ago.

Soil

Friable soil ca 20 cm deep over laterite. 15 cm sample pedal, earthy, moderately coherent, unbleached, non-calcareous, pH 6.6, pale brown, 10 YR 6/3, sandy loam with ca 80% laterite pebbles. Well drained but may have localised pooling.

● Loc. 3.2

As for loc. 3.1 but upper stratum is 30-70% canopy cover and there is a lower stratum of *Herperia lateriflora* sedge, *Borya nitida* herbs and grasses with variable canopy cover from absent to almost 100%. Litter and soil is as for loc. 3.1 but there is less man-made rubbish. Eastern portions of this loc. become similar to loc. 4.1. Vegetation is ca 20 years old.

HEATH FORMATIONS

● Loc. 4.1

Key Description

Open Dwarf Scrub C over Low Heath D on sandy clay loam.

Code cSCr.xSDc/SCL

Loc. Details

Stratum 1. *Casuarina campestris* shrubs, immature, 1.0 m tall, 2-10% canopy cover.

Stratum 2. Mixed heath, no particular dominant, 0.4 m tall, 30-70% canopy cover.

Comments

Shows evidence of old fire scars but current stand is regrowth following clearing rather than fire. In some areas stratum 1 is absent. Area cleared and possibly burnt ca 20 years ago.

Litter

Virtually absent.

Soil

Friable soil deeper than 1 m. 50 cm sample is non-pedal, sandy, virtually non-coherent, unbleached, non-calcareous, pH 4.4, very pale brown, 10 YR 7/4, sandy clay loam. Soluble salts virtually absent. Well drained.

- Loc. 4.2

As for loc. 4.1 but *Casuarina campestris* absent. Scattered *Banksia prionotes* present.

SALT COMPLEX

- Loc. 7.1

Creek and banks on ground slightly lower than loc. 2.1.

Creek is mostly 6-10 m wide at this point with vertical banks to 1 m high. Along the banks and extending back into the grassy *Eucalyptus loxophleba* areas is dense stands of *Arthrocnemum halocnemoides* 0.5 m tall, 70-100% canopy cover and abundant *Enchylaena tomentosa*. Water-logged areas have *Cotula coronopifolia* herbs and *Puccinellia stricta* and *Hordeum marinum* grass.

OTHER (GRASSLAND)

- Loc. 8.1

Cleared area with dense grass cover and scattered trees.

- Loc. 8.2

Cleared, 100% canopy cover of grass and weeds.

- Loc. 8.3

As for loc. 8.2 with scattered introduced trees and shrubs including *Eucalyptus* sp., *Nerium oleander* (Oleander) and *Shinus molle* (Pepper Tree). Closer to loc. 8.2 is a small stand of *Pinus pinaster* trees.

UNCLEARED LAND CONTINGUOUS WITH YOTING TOWN RESERVE

- W1

Extension of locs 1.1 and W2.

- W2

As for loc. 1.1 and 1.3.

- W3

Casuarina huegeliana trees and some *Actinostrobus arenarius* and *Xylomelum angustifolium* over heath 1 m tall.

- H1

Eremaea pauciflora shrubs 0.5-2 m tall, 90-100% canopy cover. There is a stand of *Pinus pinaster* trees adjacent to the railway line.

● Salt 1

Arthrocnemum halocnemoides and abundant *Hordeum marinum* in narrow band surrounded by farm land.

● Salt 2

As for loc. 7.1.

APPENDIX 6

PLANT SPECIES LISTS FROM SELECTED LOCATIONS YOTING TOWN RESERVE

Loc. 1.1

Acacia acuminata
A. pulchella var. *glaberrima*
Amphipogon debilis
Borya nitida
Caesia parviflora
Casuarina campestris
Cheiranthra parviflora
Chorizema aciculare
Dampiera affin. *spicigera*
Dianella revoluta
Enchylaena tomentosa

Grevillea paniculata
Hakea scoparia
Helichrysum lindleyi
Lepidosperma effusum
Lomandra effusa
Loxocarya pubescens
Mesomelaena uncinata
Olearia revoluta
Opercularia vaginata
Santalum spicatum
Westringia affin. *rigidula*
var. *brachyphylla*

Loc. 2.1

Arthrocnemum halocnemoides
Cotula coronopifolia
Enchylaena tomentosa
Eucalyptus loxophleba

E. salmonophloia
Hordeum marinum
Puccinellia stricta

Loc. 3.1

Borya nitida
Casuarina campestris
Cryptandra myriantha

Helichrysum lindleyi
Laxmannia squarrosa
Lepidosperma tenue

Loc. 4.1

Acacia andrewsii
A. beauverdiana
A. lasiocarpa var. *bracteolata*
A. nigripilosa
Anigozanthos humilis
Baeckea floribunda
Caladenia flava
Calectasia cyanea
Calytrix fraseri

Cassytha pubescens
Casuarina microstachya
Chamaexeros fimbriata
Comesperma scoparia
Dampiera spicigera
Daviesia brevifolia
D. preissii
Dianella revoluta
Dodonaea caespitosa

Eremaea pauciflora
Gastrolobium crassifolium
Grevillea paniculata
G. petrophiloides
G. pilulifera
Guichenotia sarotes
Hakea circumalata
H. incrassata
Harperia lateriflora
Hibbertia pungens
Laxmannia squarrosa
Lepidosperma tenue
Leptospermum erubescens
Leucopogon blepharolepis

Lysinema ciliatum
Melaleuca seriata
Mesomelaena uncinata
Mirbelia spinosa
Osteospermum clandestinum
Pimelia affin. *imbricata*
Podolepis clandestinum
Synaphaea polymorpha
Thomasia rugosa
Trymalium ledifolium
Verticordia acerosa
V. brownii
V. picta

Loc. 7.1

Arctotheca calendula
Arthrocnemum halocnemoides
Cotula coronopifolia
Enchylaena tomentosa

Eucalyptus loxophleba
Hordeum marinum
Puccinellia stricta

APPENDIX 7

VEGETATION DESCRIPTIONS — YOTING WATER RESERVE

N.B. All vegetation is older than 25 years unless specified otherwise.

WOODLAND FORMATIONS

- Loc. 1.1 (part Trapline 9)

Key Description

Woodland on sandy clay.

Code eMi/SC

Loc. Details

Unstratified *Eucalyptus salmonophloia* trees, immature, the top of the canopy varying from 16-22 m tall, the bottom of the canopy varying from 4-16 m tall, 10-30% canopy cover.

Comments

No understory present but scattered shrubs and a seasonal patchy cover of grasses. No evidence of fire.

Litter

Abundant, mostly broad leaves, twigs and large debris clumped or continuous to 3 cm deep. Dense cover of grass present. Some domestic and farm rubbish.

Soil

Friable soil 30 cm deep. Horizon A is highly pedal, sandy, strongly coherent, unbleached, non-calcareous, pH 4.8, pinkish grey, 7.5 YR 6/2, sandy clay with coarse quartz grit. Poorly drained.

- **Loc. 1.2 (part Trapline 9)**

As for loc. 1.1. Farm and domestic rubbish very abundant and including rotting sheep carcasses.

- **Loc. 1.3**

Key Description

Dense Low Forest A on sandy clay.

Code eLAd/SC

Loc. Details

Unstratified *Eucalyptus salubris* trees, immature, canopy 4-13 m tall (mostly 8-10 m), 70-100% canopy cover.

Comments

Scattered *E. salmonophloia* to 15 m tall. Maximum diameter of *E. salubris* was 10 cm at breast height. No understory but scattered *Acacia graffiana* present, and there is evidence that the *A. graffiana* layer was once 30-70% canopy cover. Some *Acacia merrallii* shrubs present. Evidence of old fire scars. Stand is 5-15 years old.

Litter

Abundant, mostly broad leaves and twigs, layer continuous to 5 cm deep.

Soil

Friable soil 20 cm deep over heavy clay. 15 cm sample is highly pedal, sandy, very strongly coherent, unbleached, non-calcareous, pH 6.3, pinkish grey, 7.5 YR 6/2, sandy clay with some coarse quartz grit. Soluble salts 150 ppm. Poorly drained.

- **Loc. 1.4**

Basically as loc. 1.1 but bottom of canopy 13-19 m tall and only 2-10% canopy cover. There is a clumped understory of *Melaleuca uncinata* and *M. adnata* shrubs, senescent, 2-3 m tall, 10-30% canopy cover. Litter and soil as for loc. 1.1.

- **Loc. 1.5**

Key Description

Woodland over Open Scrub (clumped) on sandy clay.

Code eMi.mSr-d/SC

Loc. Details

Stratum 1. *Eucalyptus salmonophloia* trees, mature, stratum 20-26 m tall, 10-30% canopy cover.

Stratum 2. *Melaleuca acuminata* and *M. adnata* shrubs, 2-3.5 m tall, clumped into stands with 70-100% internal canopy cover. Canopy cover over the whole area is 2-3%.

Comments

No evidence of fire.

Litter

Abundant mostly large debris, broad leaves and twigs. Clumps 0.5 m apart, 3 cm deep. Much farm and domestic rubbish including sheets of tin, cans, bottles and paper.

Soil

As for loc. 1.1.

- **Loc. 1.6**

As for loc. 1.5.

- **Loc. 1.7**

Mostly as for loc. 1.5 with *Eucalyptus salmonophloia* trees 20-24 m tall and 2-10% canopy cover together with scattered *E. loxophleba* tree mallees. Dense cover of grass present. Scattered *Acacia microbotrya* and *A. acuminata* present, most of which are dead but standing.

MALLEE FORMATION

- **Loc. 2.1**

Key Description

Dense Tree Mallee on medium clay.

Code eKTd/MC

Loc. Details

Unstratified *Eucalyptus loxophleba* tree mallee, senescent, 13-15 m tall, 70-100% canopy cover.

Comments

Ground cover of grasses with 100% canopy cover. Occasional clumps of *Melaleuca acuminata* shrubs. No evidence of fire. Situated on creek.

Litter

Abundant, broad leaves, twigs, continuous to 10 cm deep.

Soil

Friable soil 30 cm deep over heavy clay. 20 cm sample highly pedal, earthy, strongly coherent, unbleached, non-calcareous, pH 6.0, pale brown, 10 YR 6/3, medium clay with abundant quartz grit. Soluble salts 140 ppm. Poorly drained, waterlogs after heavy rain.

SHRUBLAND FORMATION

- **Loc. 3.1**

Regrowth in cleared area. Regrowth is *Eucalyptus loxophleba* shrub mallee, 1.5-5 m tall and clumps of *Acacia* affin. *saligna* shrubs, 10-30% canopy cover. Total ground cover of grass present. Soil as for loc. 1.1. Mill in this location was erected in late 1947 but regrowth is younger, being 5-15 years old.

UNCLEARED LAND CONTIGUOUS WITH
YOTING WATER RESERVE

- W1
Eucalyptus loxophleba tree mallee mostly 2-10% canopy cover. Partially cleared.
- W2
As for loc. 1.7.

APPENDIX 8

PLANT SPECIES LIST FROM SELECTED LOCATIONS
YOTING WATER RESERVE

Loc. 1.1

Acacia acuarria
A. erinacea
A. graffiana
A. microbotrya
Eucalyptus salmonophloia

Lomandra effusa
Melaleuca acuminata
M. adnata
Olearia muelleri
Stipa hemipogon

Loc. 2.1

Acacia acuarria
A. acuminata
A. affin. saligna
*Ehrharta longiflora**
Eucalyptus loxophleba
*Hordeum marinum**

Lepidosperma tenue
*Lolium multiflorum**
Olearia revoluta
*Osteospermum clandestinum**
Stylobasium australe
*Ursinia anthemoides**

Loc. 3.1

Acacia affin. saligna
*Arctotheca calendula**
*Avena barbata**
*Brassica tournefortii**
*Ehrahta longiflora**
Eucalyptus loxophleba
*Freesia refracta**
Grevillea paniculata

*Hordeum marinum**
*Hypochaeris glabra**
*Lolium multiflorum**
*Osteospermum clandestinum**
*Raphanus raphanistrum**
Stylobasium australe
*Ursinia anthemoides**

* Introduced weed species