# II VEGETATION OF BILLYACATTING HILL NATURE RESERVE

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## General

Billyacatting Hill Nature Reserve falls within the Coolgardie district of the Eremaean Botanical Province (cf. Grieve and Blackall 1975 modification of Gardner and Bennetts 1956). However, the vegetation of the reserve conforms to that of the Avon district which lies nearby to the west.

No documented plant collections have been made prior to this survey, which was carried out on 2-4 September 1977.

Vegetation descriptions are presented in **Appendix 1** and shown on **Map 1**. Species lists for selected locations are given in **Appendix 2.**

## Methodology

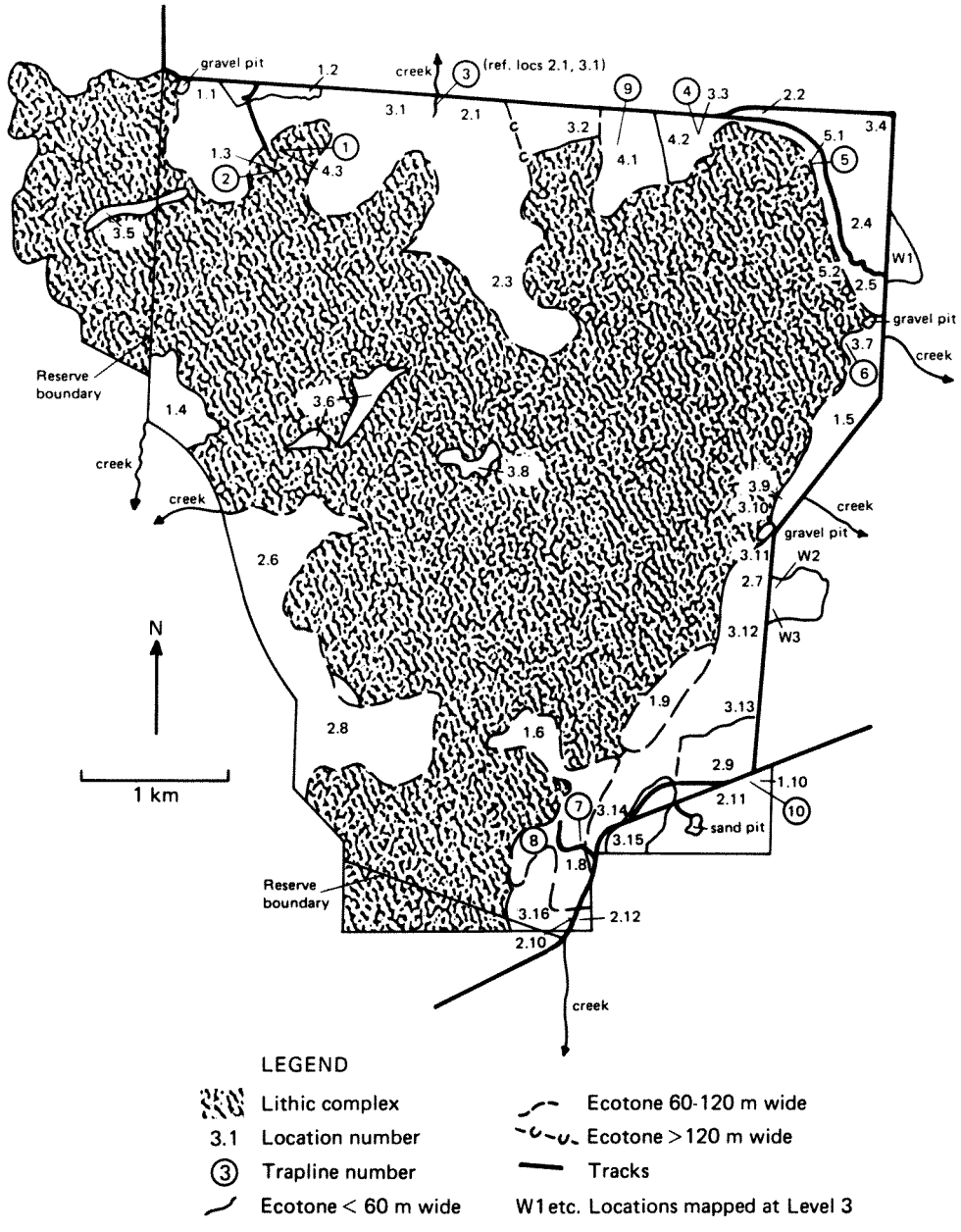
The vegetation of Billyacatting Hill Nature Reserve was mapped at Level 1 of the reliability scale set out in Muir (1977a). Each vegetation formation discernible on the air photographs was examined on the ground; at least one location was described in detail within each major association using the classification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

Level 1 locations shown on **Map 1** 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
5 = lithic complex

The methods used in classifying formations, coding vegetation, preparing plant lists, classifying litter and describing soils are those of Muir (1977a). 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. Conductivity readings were taken on a Phillips PW 9504 Conductivity Meter fitted with a PW 9510 electrode. Readings were then converted to total soluble salts by comparison to a standard seawater curve.




**Map 1: Billyacatting Hill Nature Reserve and adjacent uncleared land showing positions of vegetation locations, traplines and roads at 1977.**

**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 | Dense Ferns | Ferns | Open Ferns | Very Open Ferns |
| | Mosses, liverwort | Dense Mosses | Mosses | Open Mosses | Very Open Mosses |

## Formations and Distribution

Woodlands, mallee, shrublands, heath and lithic complex are all represented on Billyacatting Hill Nature Reserve. The distribution of the formations is related to the rainfall runoff from the granite outcrops, the soils developed on or adjacent to it, and fire. Woodlands are all developed on clayey soils which have formed *in situ* over granite, or as colluvials in watercourses, or resulting from sheet erosion. Mallee formations tend to be on the same soil as woodlands, but where it is shallower and with granitic or quartz pebbles abundant. Shrublands are commonest at the base of the granite where there is excessive runoff or on shallow or deep pockets of soil formed on the slopes or top of the outcrop. Heaths were present as regrowth following burning of shrubland or in areas where the soil was so shallow that full development of shrubland species was inhibited.

Formation area and proportion of the reserve are set out below:

| Formation | Area | % of reserve |
|---|---|---|
| Woodland | 162 ha | 7.8 |
| Mallee | 312 | 15.0 |
| Shrubland | 187 | 9.0 |
| Heath | 44 | 2.1 |
| Lithic complex | 1370 | 66.1 |

Clearly the lithic complex dominates the reserve, all the other formations being poorly represented, except perhaps mallee which is fairly abundant, but still less than one-quarter the area of the granite.

## Associations

'Associations' as used here include associations, associes and consociations according to the definitions of Beadle and Costin (1952) and Polunin (1960):

WOODLAND

*Eucalyptus salmonophloia*
*E. salubris*
*E. salubris-E. gracilis*
*E. wandoo*
*Hakea petiolaris-Acacia lasiocalyx*

MALLEE

*Eucalyptus loxophleba*
*E. redunca*
*E. sheathiana-E. foecunda*

SHRUBLAND

*Acacia acuminata-Dodonaea inequifolia*
*Calothamnus asper-Calycopeplus helmsii*
*Calycopeplus helmsii*
*Casuarina campestris*
*C. campestris-Melaleuca uncinata*
*D. inequifolia-Calycopeplus helmsii*
*Melaleuca eleutherostachya*
*M. eleutherostachya-M. uncinata*
*M. lateriflora*
*M. uncinata*
Mixed with variable dominants

HEATH

*Casuarina campestris*
*C. campestris-Melaleuca uncinata*
*C. campestris-M. uncinata-Acacia stereophylla*

LITHIC COMPLEX

All associations are represented in previous lists:

| Formations | No. of associations |
|---|---|
| Woodland | 5 |
| Mallee | 3 |
| Shrubland | 11 |
| Heath | 3 |
| Total | 22 |

Compared with many other reserves in the wheatbelt, Billyacatting Hill has an average number of associations. In terms of number of associations per area of reserve, however, Billyacatting Hill is of low diversity, having 1.06 associations per $km^2$.

**Senescent Trees**

The artificially contrived index of abundance of senescent trees discussed in Muir (1977b) can be calculated for Billyacatting Hill Reserve. The reserve has about 162 ha of woodland averaging about 22% canopy cover, and thus having about 36 ha of actual canopy. About 10% of all the trees on the reserve are senescent with hollow limbs and trunks, and thus the senescence index for the reserve is 3.6.

## Floristics

There is access to the reserve only on its northern and western edges, the rest of the reserve only being accessible on foot. This, together with its large size (2975 ha) makes it very difficult to collect even the large perennials with any certainty that most are recorded. However, the repeating mosaic nature of the granite area, which constitutes 66% of the reserve, probably means that most species were encountered. Based on previous experience, it is estimated that there are probably about 200 species of perennials and large annuals present.

A total of 132 species were collected, about 119 of which were perennials or large annuals, the remainder being ephemerals which were recorded only because the survey was in spring. Number of species per area of reserve is probably about 9.6 per $km^2$.

The table below compares floristic richness between formations:

| Formation | Number of species | Spp./ha |
|---|---|---|
| Woodland | 60 | 0.37 |
| Mallee | 40 | 0.13 |
| Shrubland | 58 | 0.31 |
| Heath | 13 | 0.30 |
| Lithic complex | 36 | 0.03 |

The table shows a very similar richness in all the formations except mallee and lithic complex. The slightly lower richness in mallee formations is probably due to fewer species in the understory as compared to woodlands. The low richness in lithic complex reflects the repeating mosaic nature of the vegetation on the granite, the same few species being found over its whole area.

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

| Formation | Number of species | Spp./ha |
|---|---|---|
| Woodland | 27 | 0.17 |
| Mallee | 14 | 0.44 |
| Shrubland | 22 | 1.22 |
| Heath | 4 | 0.09 |
| Lithic complex | 11 | 0.01 |

Clearly the greatest number of restricted species per area of formation is in shrubland, the high richness probably being due in part to the species restricted to the extremely wet runoff areas. By far the lowest number of

restricted species per area is in lithic complex, suggesting that much of the complex consists of a few restricted species, e.g. *Thryptomene australis*, *Pleurosorus rutifolius* and *Cheilanthes tenuifolia* which occur consistently over the whole area of granite.

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

## APPENDIX 1

## VEGETATION DESCRIPTIONS
## BILLYACATTING HILL

N.B. All vegetation older than 20 years unless otherwise specified.

WOODLAND FORMATIONS

- **Loc. 1.1**

**Key Description**

Low Woodland A *on* heavy clay.

**Code** eLAi/HC

**Loc. Details**

Unstratified, *Eucalyptus salubris* and *E. gracilis* trees, mature, 8-11 m tall, 10-30% canopy cover.

**Comments**

No understory but scattered shrubs are present. No evidence of fire. Gravel pit is 5-15 years old.

**Litter**

Abundant, broad leaves, bark and twigs with some large debris. Layer continuous to 2 cm deep.

**Soil**

30 cm sample highly pedal, sandy, very coherent, unbleached, non-calcareous, pH 6.2, yellowish-red, 5 YR 4/6, heavy clay. Soluble salts 210 ppm. Poorly drained.

- **Loc. 1.2**

*Eucalyptus salmonophloia* and scattered *E. salubris* trees, mature to senescent, 12-17 m tall, 2-10% canopy cover over *Atriplex paludosa*, *Rhagodia spinescens* and numerous other shrubs, 0.5 m tall, 10-30% canopy cover.

Between this loc. and the granite are narrow bands of *Acacia acuminata*, *Casuarina campestris*, or *Calycopeplus helmsii*. The *A. acuminata* forms some stands 2-5 m tall and 70-100% cover.

- **Loc. 1.3 (Trapline 2)**

Key Description

Open Low Woodland A *over* Scrub *over* Low Sedges *on* sandy clay loam.

Code xLAr.xSi.$n_1$VLc/SCL $n_1$ = *Lepidosperma* affin. *tenue*

Loc. Details

Stratum 1. *Hakea petiolaris* and *Acacia lasiocalyx* trees, mature to senescent, 3-9 m tall, 2-10% canopy cover.

Stratum 2. *Calycopeplus helmsii* or *Gastrolobium spinosum grandiflorum* shrubs mature to senescent, 1-3 m tall, 10-30% canopy cover.

Stratum 3. *Lepidosperma* affin. *tenue* sedge, mature, 0.5 m tall, 30-70% canopy cover.

Comments

Some areas with *Casuarina campestris* shrubs 2-4 m tall, 70-100% canopy cover with scattered emergent *A. lasiocalyx* to 12 m tall. Also areas of *Spartochloa scirpoidea* grass to 70% canopy cover. Whole association is thickly covered with *Cassytha* affin. *melantha.* No evidence of fire.

Litter

Very abundant, mostly *Hakea petiolaris* leaves, layer continuous to 20 cm deep. Fallen branches and logs are very abundant and cover the ground in a network up to 0.5 m deep.

Soil

50 cm sample (there was a deep $0_2$ horizon) highly pedal, sandy, coherent, pH 4.8, reddish-brown, 5 YR 4/4, sandy clay loam. Well drained but much runoff from large granite sheet nearby.

- **Loc. 1.4**

*Eucalyptus salubris* and scattered *E. salmonophloia* trees, 10-12 m tall, 10-30% canopy cover.

- **Loc. 1.5**

As for loc. 1.8.

- **Loc. 1.6**

*Eucalyptus salubris* and scattered *E. gracilis* and *E. salmonophloia* trees, 12-18 m tall, 30-70% canopy cover. Some emergent *E. salmonophloia* to 22 m tall. Northern edge of loc. becomes pure *E. salmonophloia* with *Olearia muelleri* and *Santalum spicatum* in the understory. The rest of the area has no understory. Litter is sparse to moderate with some large debris. Soil is very stony, well drained.

- **Loc. 1.7 (Trapline 8)**

Near track are *Eucalyptus wandoo* trees, senescent 10-16 m tall, 10-30% canopy cover over mixed shrubs, mature to senescent, 1.0-2.5 m tall, 2-10% canopy cover. Soil here is well to poorly drained and very stony and with abundant quartz pebbles. The extreme western edge is a pure quartz ridge with *Calycopeplus helmsii* shrubs.

Middle of loc. 1.7 has the quartz ridge developed in the woodland and the *E. wandoo* is immature to mature and 8-12 m tall. The extreme southern edge of loc. has an ecotone of *E. redunca* shrub mallees 3-6 m tall, 10-30% canopy cover with no understory.

Litter and soil as for loc. 2.10.

- **Loc. 1.8 (Trapline 7)**

*Eucalyptus salubris* and *E. salmonophloia* trees, mature, 12-16 m tall, 10-30% canopy cover. No understory but scattered *Olearia muelleri, Rhagodia preissii* and *Acacia graffiana.* Litter and soil as for loc. 2.10.

- **Loc. 1.9**

*Eucalyptus salmonophloia* trees, 12-18 m tall, 30-70% canopy cover. Rest as for loc. 1.6.

- **Loc. 1.10 (Trapline 10)**

*Eucalyptus salmonophloia* and scattered *E. loxophleba* trees, structually similar to loc. 2.9.

MALLEE FORMATIONS

- **Loc. 2.1 (includes Trapline 3)**

**Key Description**

Open Shrub Mallee *over* Very Open Low Sedges *over* Very Open Herbs *on* clayey sand.

Code eKSi.xVLr.$n_1$Jr/CLS $n_1$ = *Borya nitida*

**Loc. Details**

Stratum 1. *Eucalyptus sheathiana* and *E. foecunda* shrub mallee, mature, stratum 6-8 m tall, 10-30% canopy cover.

Stratum 2. *Loxocarya* affin. *pubescens* and *Harperia lateriflora* sedge 0.3 m tall. 2-10% canopy cover.

Stratum 3. *Borya nitida* herbs, 0.1 m tall, 2-10% canopy cover.

**Comments**

Scattered thickets of *Melaleuca eleutherostachya* present. Trapline was set along a creek with a distinct association of *Acacia acuminata* trees 6-7 m tall, 10-30% canopy cover over *Spartochloa scirpoidea* grass 0.5 m tall, *ca* 1-2% canopy cover. The creek association varies from 2-8 m wide and has a total area of about 0.5 ha. The association passes abruptly into loc. 2.1 to the east and loc. 3.1 to the west. No evidence of fire.

**Litter**

Moderately abundant, broad leaves, bark and twigs, clumped to 1 cm deep, clumps 1-3 m apart.

**Soil**

30 cm sample is moderately pedal, sandy, poorly coherent, unbleached non-calcareous, pH 5.5, pink, 7.5 YR 8/8, clayey sand. Well drained.

- **Loc. 2.2**

Clumps or scattered *Eucalyptus loxophleba* shrub mallee together with clumps of *Casuarina campestris* to 3 m tall. There are also scattered clumps of *Acacia acuminata* woodland.

- **Loc. 2.3**

Clumps of *Eucalyptus loxophleba* or *E. redunca* mallee with patches of *Casuarina campestris, Calycopeplus helmsii* or *Acacia acuminata* associaton.

- **Loc. 2.4**

*Eucalyptus redunca* shrub mallee 6-10 m tall, 10-30% canopy cover with scattered shrubs of *Acacia graffiana, Melaleuca eleutherostachya* and *Olearia muelleri.* Scattered *E. salmonophloia* trees emergent to 24 m.

- **Loc. 2.5**

*Eucalyptus loxophleba* tree mallee as for loc. 2.10. Some areas dominated by *E. redunca* but structurally similar to loc. 2.10.

- **Loc. 2.6**

*Eucalyptus loxophleba* tree mallee with patches of *E. salmonophloia* and small areas of *Acacia acuminata.*

- **Loc. 2.7**

*Eucalyptus loxophleba* tree mallee, mature 6-8 m tall, 2-10% canopy cover over *Acacia acuminata* trees, immature, 4-5 m tall, 2-10% canopy cover. Understory absent except annual herbs. Mostly as for loc. 2.10.

- **Loc. 2.8**

As for loc. 2.6 with some areas of woodland similar to loc. 1.6 and 1.7.

- **Loc. 2.9**

Basically as for loc. 2.10. *Eucalyptus loxophleba* tree mallee, 5-8 m tall, 2-10% canopy cover with clumps up to 30% cover. Understory of variable height from 0.5 to 3 m tall, 2-10% canopy cover. *Olearia revoluta* and *Stylobasium australe* prominent in understory. Small patches of *Borya nitida* present. Soil is highly pedal, sandy, coherent, unbleached, non-calcareous, pH 5.7, yellowish-red, 5 YR 4/8, sandy clay loam, Well drained.

- **Loc. 2.10**

**Key Description**

Very open Tree Mallee *over* Open Scrub *on* fine sandy loam.

**Code** eKTr.aSr/FSL

**Loc. Details**

Stratum 1. *Eucalyptus loxophleba* tree mallee, mature to senescent, 7-9 m tall, 2-10% canopy cover.

Stratum 2. *Acacia tetragonophylla, A. graffiana* and *A. acuminata* shrubs, mature, 2-3 m tall, varying from 1 to *ca* 5% canopy cover.

**Comments**

*Rhagodia preissii* and *Scaevola spinescens* common on tumbled granite hillocks. Where *E. loxophleba* canopy thins out *E. salmonophloia* comes in and a clumped understory of *Acacia acuaria* and *A. graffiana* 0.5-1.5 m tall develops. There are also small dense clumps of *Melaleuca eleutherostachya* and *Templetonia sulcata* shrubs 2-2.5 m tall.

The *E. salmonophloia* are 10-20 m tall. No evidence of fire.

**Litter**

Abundant, broad leaves, bark and twigs, some large debris, clumped to 5 cm deep, clumps 2-6 m apart.

Soil

30 cm sample slightly pedal, sandy, poorly coherent, unbleached, non-calcareous, pH 5.5, red, 2.5 YR 4/6, fine sandy loam. Soil colluvial; small watercourse present. Probably well drained but waterlogs after heavy rain.

- **Loc. 2.11**

As for loc. 2.9.

- **Loc. 2.12**

As for loc. 2.10 with scattered *Eucalyptus salmonophloia.*

SHRUBLAND FORMATIONS

- **Loc. 3.1**

*Melaleuca lateriflora* shrubs mature, 3-5 m tall, 2-10% canopy cover with scattered *Eucalyptus salmonophloia* trees 10-15 m tall and scattered *E. loxophleba* shrub mallee. Western edge of the loc. is *M. eleutherostachya* and *M. lateriflora* shrubs 3-5 m tall, 30-70% canopy cover. These associations are immediately west of the creek and mallee association described in loc. 2.1 and containing trapline 3.

Between eastern end of loc. 1.2 and loc. 3.1 is a mosaic of *Acacia acuminata, Melaleuca lateriflora* and *M. uncinata* shrublands with patches of *E. loxophleba* shrub mallee.

- **Loc. 3.2**

**Key Description**

Thicket *over* Open Dwarf Scrub C *on* sandy loam.

**Code** xSc.xSCr/SL

**Loc. Details**

Stratum 1. *Melaleuca eleutherostachya, M. uncinata* and some *Acacia acuminata* shrubs, immature to mature, stratum 2-3.5 m tall, 30-70% canopy cover.

Stratum 2. Clumped, mostly *A. graffiana, Eremophila* affin. *caerulea* and several other species of shrubs, 1.0 m tall, 2-10% canopy cover.

**Comments**

Eastern parts of loc. with *Casuarina campestris* and *Ecdeiocolea monostachya* or *Spartochloa scirpoidea* as an understory.

**Litter**

Moderately abundant, terete leaves and twigs, continuous to 0.5 cm deep.

**Soil**

30 cm sample is slightly pedal, sandy, poorly coherent, unbleached, non-calcareous, pH 4.9, pink, 7.5 YR 8/4, sandy loam. Soluble salts 220 ppm. Well drained with some pooling.

- **Loc. 3.3 (Trapline 4)**

Mosaic of *Acacia acuminata* or *Casuarina campestris* or *Calycopeplus helmsii* or *Melaleuca radula* shrubland with scattered *Eucalyptus loxophleba* shrub mallee and clumps of *Acacia lasiocalyx* trees to 6 m tall. In some areas the *A. lasiocalyx* clumps

become discrete and are mostly 2-7 m tall with *Grevillea paniculata* and *Casuarina campestris* understory.

- Loc. 3.4

Mosaic of shrubland with patches of heath. Mostly *Melaleuca uncinata* dominated on low lying areas, and *Casuarina campestris* and *M. uncinata* on higher ground.

- Loc. 3.5

*Calothamnus asper* and *Calycopeplus helmsii* shrubs 1-3 m tall, 70-100% canopy cover. Occasional small patches of *Acacia lasiocalyx* over *Melaleuca radula* and *Calycopeplus helmsii.* Formed on area of accumulated soil in cleft between granite exposures. Granite nearby has *Kunzea pulchella* shrubs 1.0 m tall.

- Loc. 3.6

As for loc. 3.5, some parts with *Casuarina campestris* dominant.

- Loc. 3.7 (Trapline 6)

Creek with trapline placed along its length. Immediately adjacent to road are *Melaleuca eleutherostachya* shrubs 2-4 m tall, 70-100% canopy cover over *Lepidosperma* affin. *costale* 0.5 m tall, *ca* 1% canopy cover.

Middle of trapline is *Acacia lasiocalyx* trees and shrubs, 4-7 m tall, 10-30% canopy cover over *Casuarina campestris* shrubs 1-2.5 m tall, 70-100% canopy cover.

Upper end of trapline adjacent to granite outcrop is similar to loc. 5.2 (bottom end). Southern edge of creek has a narrow band of *Eucalyptus loxophleba* shrub mallee 4-6 m tall, 30-70% canopy cover with scattered *A. acuminata* and *Rhagodia preissii.*

- Loc. 3.8

As for loc. 3.5.

- Loc. 3.9

Mosaic of *Melaleuca uncinata* and *Casuarina campestris* associations, the *C. campestris* on slightly higher ground. Association is mostly 1.5-2.5 m tall with a few small areas 0.5-1.5 m tall, 30-70% canopy cover.

- Loc. 3.10

*Casuarina campestris* shrubs 2-3 m tall, 30-70% canopy cover. Gravel pit has *Calycopeplus helmsii* regrowth to 1.5 m.

- Loc. 3.11

*Calycopoplus helmsii* shrubs, immature, 2-3 m tall, 70-100% canopy cover. Gravel pit is 5-15 years old.

- Loc. 3.12

Area of *Melaleuca uncinata, M. eleutherostachya* or *M. lateriflora* shrubs, 2-3.5 m tall, 30-70% canopy cover surrounded by *Casuarina campestris* shrubland similar to loc. 3.13. Scattered *Eucalyptus loxophleba* shrub mallee between this loc. and loc. 2.7.

- Loc. 3.13

Key Description

Scrub or Open Scrub *over* Open Low Grass or Very Open Low Grass *over* Herbs *on* sandy clay loam.

Code cSr-i.xGLr-i.$n_1$ Jc/SCL $n_1$ = *Borya nitida*

**Loc. Details**

Stratum 1. *Casuarina campestris* shrubs, mature, 2-3 m tall, varying from 2-30% canopy cover.

Stratum 2. *Spartochloa scirpoidea* grass and *Verticordia chrysantha* and *Baeckea crispiflora* shrubs, mature, 1.0 m tall, varying from 2-30% canopy cover.

Stratum 3. *Borya nitida* herbs, mature, 0.2 m tall, 30-70% canopy cover.

**Comments**

Small patches of *Melaleuca uncinata* shrubs, 2-3 m tall, 70-100% canopy cover and scattered *Eucalyptus loxophleba* present. No evidence of fire.

**Litter**

Moderately abundant, mostly twigs and large debris, clumped to 2 cm deep, clumps 1-3 m apart.

**Soil**

30 cm sample moderately pedal, sandy, extremely coherent, unbleached, non-calcareous, pH 4.4, strong brown, 7.5 YR 5/8, sandy clay loam. Poorly drained. Flat granite sheets a few metres in diameter outcrop occasionally.

- **Loc. 3.14**

*Dodonaea inequifolia* and *Calycopeplus helmsii* shrubs 1.5-3.0 m tall, 30-70% canopy cover. Scattered *Acacia tetragonophylla* present. Exposures of granite within this association have *Casuarina campestris* shrubs up to 5 m tall and *Melaleuca radula* and *Acacia* affin. *beauverdiana.* Some parts have *Spartochloa scirpoidea* 1.0 m tall as an understory, 2-10% canopy cover. *Acacia acuminata* trees and *Eucalyptus loxophleba* tree mallee are abundant where runoff from the granite is greatest. One of the narrow *E. loxophleba* belts appears to closely follow a dolerite dyke. Soil over most of area as for loc. 2.9.

- **Loc. 3.15**

*Calycopeplus helmsii* shrubs, immature, 2-3 m tall, 10-30% canopy cover. Area appears to be regrowth following clearing or fire.

- **Loc. 3.16**

*Acacia acuminata* and *Dodonaea inequifolia* shrubs, 1-3.5 m tall, 2-10% canopy cover. No understory but abundant growth of annuals in the wet season. Where granite outcrops are steep and form tumbled boulder slopes there are scattered *Eucalyptus salmonophloia* to 24 m tall. This area is higher than that of loc. 2.10. Soil is highly pedal, sandy, coherent, unbleached, non-calcareous, pH 4.8, reddish-brown, 5 YR 4/4, sandy clay loam. Well drained. Coarse quartz grit and granite pebbles are common.

## HEATH FORMATIONS

- **Loc. 4.1 (Trapline 9)**

**Key Description**

Dense Heath B *on* sandy clay loam.

Code xSBd/SCL

Loc. Details

Unstratified *Casuarina campestris, Melaleuca uncinata,* and *Acacia stereophylla* shrubs, immature, 0.5-1.5 m tall, 70-100% canopy cover.

Comments

No understory, some *Ecdeiocolea monostachya* around open areas of flat granite exposure. Small unburnt patches within this association are mostly *C. campestris* shrubs 2-2.5 m tall. Old fire scars present. Stand 15-20 years old.

Litter

Sparse, mostly terete leaves, no clumping. Dead sticks to 2 m tall indicate height of original bush.

Soil

30 cm sample is highly pedal, sandy, poorly coherent, unbleached, non-calcareous, pH 5.4, very pale brown, 10 YR 8/4, sandy clay loam. Well drained with some pooling around edge of granite exposures.

- Loc. 4.2

*Casuarina campestris* shrubs, 1.0-2,0 m tall, 70-100% canopy cover. No understory, soil as for loc. 4.1. This probably represents the association prior to the burn described in loc. 4.1.

- Loc. 4.3 (Trapline 1)

Key Description

Heath B *over* Herbs *on* sandy clay loam.

Code xSBc.$n_1$Jc/SCL $n_1$ = *Borya nitida*

Loc. Details

Stratum 1. *Casuarina campestris* and *Melaleuca uncinata* shrubs, immature to mature, stratum 1-1.5 m tall, 30-70% canopy cover.

Stratum 2. *Borya nitida* shrubs, mature, stratum 0.1 m tall, 30-70% canopy cover.

Comments

Small patches with *Verticordia chrysantha* shrubs abundant.

Litter

Absent to very sparse.

Soil

As for loc. 4.1.

LITHIC COMPLEX

The majority of the reserve is covered by lithic complex, and most of the associations show influences from the granite. The granite outcrop rises fairly abruptly from the surrounding country, particularly on the eastern side, and is relatively flat on top, but very dissected, and with a gentle increase in altitude from west to east. Soil pockets in depressions and joints carry mostly shrublands dominated by *Casuarina campestris* or *Calycopeplus helmsii.* Vegetation was examined at several points and the majority of it

was found to conform to associations described in detail elsewhere. The major part of the outcrop can therefore be considered to be vegetated by a complex mosaic (of varying scale) of associations similar to locs 1.3, 3.5, 3.10, 3.16, 4.3, 5.1 and 5.2.

- **Loc. 5.1 (Trapline 5)**

Granite slope less steep than that of loc. 5.2 and with few boulders; the majority of the soil development being in joints. The top and slopes of the outcrop have *Calycopeplus helmsii* shrubs, mature, 0-2.5 m tall, 70-100% canopy cover with no understory. Lower slopes have the same association but *Spartochloa scirpoidea* occurs scattered beneath the upper stratum.

All areas are much tangled by *Cassytha* affin. *glabella* and *Cheiranthera parviflora*. Open areas have *Muhlenbeckia adpressa* prostrate or climbing.

- **Loc. 5.2**

Located on a steep north-easterly facing slope. Top — mostly *Casuarina campestris*, *Acacia acuminata*, *Melaleuca radula*, and *M. uncinata* shrubs, mature, 0.5-1.0 m tall, up to 80-90% canopy cover with patches of *Verticordia chrysantha*, *Borya nitida* or *Darwinia*. There are occasional patches of *M. lateriflora* and *M. hamulosa* shrubs 2-3 m tall, 70-100% canopy cover.

Upper slope — tors and tumbled boulders with pockets of soil. *Calycopeplus helmsii* shrubs or *Spartochloa scirpoidea* grass growing opportunistically. Deeper soil pockets with excessive runoff have *Gastrolobium spinosum grandiflorum*, *Hakea petiolaris*, *Acacia lasiocalyx* or clumps of *Casuarina campestris*.

Lower slope — expanses of smooth, steeply sloping bare rock with scattered shrubs of *Calothamnus asper*, *Hakea petiolaris* or *Calycopeplus helmsii* varying from 1 to 2.5 m tall.

Base of rock where maximum runoff occurs — *Calycopeplus helmsii*, *Melaleuca radula*, *M. elliptica*, *Acacia acuminata*, *Hakea petiolaris* or *Casuarina campestris* mostly 0-3 m tall, 70-100% canopy cover over *Spartochloa scirpoidea* 1 m tall, 30-70% canopy cover. Scattered *H. petiolaris* and *Acacia lasiocalyx* to 9 m tall. Much tangled with *Cassytha* affin. *glabella*.

Flat area *ca* 10 m from edge of rock — *Calothamnus asper*, *Grevillea paniculata*, *Melaleuca radula*, *Casuarina campestris* shrubs, 2-3.5 m tall, 70-100% canopy cover over *Spartochloa scirpoidea* grass and *Olearia revoluta* shrubs 0.5 m tall, 2-10% canopy cover. Scattered *Acacia lasiocalyx* emergent to 5 m.

ADJACENT UNCLEARED LAND

- W1

*Eucalyptus salmonophloia* similar to loc. 1.10 with some *E. loxophleba* shrub mallee.

- W2

*Eucalyptus loxophleba* similar to loc. 2.10 but with trees rather than tree mallee.

- W3

*Eucalyptus salubris* similar to loc. 1.8.

# APPENDIX 2

## PLANT SPECIES LISTS FROM SELECTED LOCATIONS

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

Loc. 1.3

*Acacia lasiocalyx*
*Beyeria lechenaultii*
*Calothamnus asper*
*Calycopeplus helmsii*
*Cassytha glabella*
*Casuarina campestris*
*Dodonaea attenuata* var. *linearis*
*Gastrolobium spinosum* var. *grandiflorum*
*Hakea petiolaris*
*Lepidosperma* affin. *tenue*
*Leptospermum erubescens*
*Melaleuca macronycha*
*Parietaria debilis*
*Podotheca gnaphalioides*
*Santalum acuminatum*
*Spartochloa scirpoidea*
*Stypandra imbricata*
*Ursinia anthemoides*

Loc. 1.7

*Acacia erinacea*
*A. graffiana*
*A. ligustrina*
*A. tetragonophylla*
*Alyxia buxifolia*
*Arthropodium preisii*
*Calycopeplus helmsii**
*Cassytha glabella**
*Cryptandra glabriflora*
*Daviesia nematophylla*
*Dodonaea inequifolia*†
*Enchylaena tomentosa*†
*Eremophila clarkii**
*E. decipiens**
*E. drummondii*
*E. oppositifolia*
*Eucalyptus redunca**
*E. wandoo*
*Exocarpus sparteus*
*Gastrolobium crassifolium*
*Hakea recurva*
*Maireana georgii*
*Melaleuca eleutherostachya*
*Olearia muelleri*
*Osteospermum clandestinum**
*Persoonia* affin. *coriacea*
*Rhagodia preisii*
*Santalum acuminatum*
*S. spicatum*
*Scaevola spinescens*
*Stypandra imbricata**

* Restricted to quartz ridge
† Quartz ridge and in woodland

Loc. 2.1

*Acacia acuminata*‡
*A. assimilis*
*A. graffiana*
*A. microbotrya*
*Amphigopon debilis*§
*Baeckea* affin. *behrii*‡
*Borya nitida*
*Eucalyptus foecunda*
*E. sheathiana*
*Grevillea nana*‡
*Harperia lateriflora*
*Lepidobolus preissianus*
*Lepidosperma costale*‡
*Loxocarya* affin. *pubescens*
*Melaleuca eleutherostachya*
*M. hamulosa*
*M. laxiflora*
*Olearia revoluta*
*Phebalium verrucosa*
*Santalum spicatum*
*Spartochloa scirpoidea*‡

‡ Restricted to creek
§ Creek and in mallee

Loc. 2.10

*Acacia acuaria*
*A. acuminata*
*A. erinacea*
*A. graffiana*
*A. microbotrya*
*A. tetragonophylla*
*Amphipogon debilis*
*Amyema miquellii*
*Eremophila drummondii*
*Eucalyptus loxophleba*
*E. salmonophloia*
*Juncus pauciflorus*
*Lomandra effusa*
*Maireana trichoptera*
*Melaleuca eleutherostachya*
*Olearia muelleri*
*Pittosporum phillyraeoides*
*Podolepis capillaris*
*Rhagodia preissii*
*R. spinescens*
*Santalum acuminatum*
*S. spicatum*
*Scaevola spinescens*
*Templetonia sulcata*

Loc. 3.3

*Acacia acuminata*
*A. lasiocalyx*
*Calothamnus asper*
*Calycopeplus helmsii*
*Casuarina campestris*
*Cheiranthera parviflora*
*Eucalyptus loxophleba*
*Grevillea paniculata*
*Melaleuca eleutherostachya*
*M. radula*
*M. uncinata*
*Phebalium tuberculosum*

Loc. 3.7

*Acacia acuminata* (in ecotone)
*A. dentifera*||
*A. lasiocalyx*¶
*A. stenoptera*¶
*Casuarina campestris*¶
*Chamaescilla corymbosa*||
*Grevillea paniculara*¶
*Hakea petiolaris*¶
*Lepidosperma* affin. *costale*||
*L. scabra*¶
*Leptospermum erubescens*¶
*Melaleuca eleutherostachya*||
*M. elliptica*¶
*M. hamulosa*||
*Petrophile seminuda* (in ecotone)
*Rhagodia preissii* (in ecotone)

|| Creek on road verge
¶ Middle part of trapline

Loc. 4.3

*Borya nitida*
*Casuarina campestris*
*Hibbertia* sp. 1 (SC)
*Melaleuca laxiflora*
*M. radula*
*M. uncinata*
*Verticordia chrysantha*

Loc. 5.1

*Acacia lasiocalyx*
*Amyema miquellii*
*Calycopeplus helmsii*
*Cassytha* affin. *glabella*
*Casuarina campestris*
*Cheiranthera parviflora*
*Comesperma integerrimum*
*Melaleuca laxiflora*
*Muhlenbeckia adpressa*
*Santalum acuminatum*
*Schoenus asperocarpus*
*Spartochloa scirpoidea*
*Thryptomene australis*