Map and description of the Warra vegetation

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Abstract

A simplified vegetation map of the Warra Long-Term Ecological Research Site is presented, together with detailed descriptions of the plant associations indicated by fine-scaled vegetation mapping and field surveys of the area. The region's vegetation ranges from alpine and lowland heaths and sedgelands to subalpine woodlands and lowland forests, including rainforest, wet forest and dry forest types. The most common vegetation in the area is Eucalyptus obliqua *wet forest and mixed forest. A preliminary plant census is also presented and includes 261 vascular taxa.*

Introduction

The objective of this paper is to describe the detailed 1:25 000 synusia-based vegetation map produced from colour aerial photographic interpretation for the Warra Long-Term Ecological Research (LTER) Site (Corbett 1997) and to provide a simplified vegetation map for the area. The plant communities are described in as much detail as limited field checking of the mapping allowed. Survey data and various literature sources also assisted in providing more detail for many of the plant associations present. A preliminary vascular plant census for the area is appended. The conservation status of these plant communities and species is also described.

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The Warra LTER Site is an area of 15 900 ha including the Weld Range and located within the Southern Forests of Tasmania. The research site was established at this particular locality principally because it provides an extensive area of *Eucalyptus obliqua* forest in a variety of successional stages. This forest species is the most widespread of the commercially harvested eucalypt species in Tasmania. The Warra LTER Site is representative of the range of environments in which these forests grow. The area is therefore well placed to meet its principal aim of facilitating the understanding of ecological processes in Tasmania's wet forests.

In addition to *Eucalyptus obliqua*, another eight eucalypt taxa dominate various forests and woodlands in the Warra LTER Site. There is also a diverse range of vegetation types from lowland moorlands through to alpine heathlands. The complex vegetation reflects the environmental heterogeneity at the Site. The altitudinal range is from less than 100 m to over 1300 m a.s.l. Rock types include Precambrian quartzites and dolomite, Jurassic dolerite, Permian sedimentary rock and Triassic sandstone. The natural prehistory of folding and block faulting, as well as erosion and deposition brought about by glaciation and fluvial action and other geomorphic processes, has provided the area with a varied topography and associated range of edaphic conditions and microclimates. A predominantly westerly weather system and the altitudinal range combine to produce a marked climatic gradient across the Site. Superimposed on this environmental mosaic is the effect of a

varied and patchy history of fires (Hickey *et al*. 1999). This rich tapestry of environments and vegetation that makes up the Warra LTER Site, although complex, is similar to that of other regions within the Southern Forests and south-eastern Tasmania in general.

The vegetation of the Warra LTER Site has not as yet been the subject of systematic survey or inventory aimed at cataloguing the plant species and communities for the entire region. Fortunately, however, the range and variation in vegetation is reasonably well understood and described by research at sites in neighbouring regions and by various surveys undertaken within the region itself for an assortment of other purposes including, for example, pre-logging surveys.

Several comparable mountain regions in the immediate vicinity of Mount Weld have been the subject of previous study. These include Mount Picton (Kirkpatrick 1980), the Snowy Range (Wells 1985), Mount Bobs (Kirkpatrick and Harwood 1983), Mount Wellington (Martin 1940; Ratkowsky and Ratkowsky 1976, 1977) and Mount Field (Ogden and Powell 1979; Smith 1981). The greater region has also been the subject of cataloguing and description. For example, Williams (1987) compiled *The Vegetation of the Southern Forests* and Duncan and Johnson (1995) compiled a forest botany manual for Nature Conservation Region 10b.

Most vegetation types within Warra have also been the subjects of systematic statewide and regional study. These include rainforest (Jarman *et al.* 1984.), mixed forests (Hickey 1994), wet eucalypt forests (Kirkpatrick *et al*. 1988; Hogg and Kirkpatrick 1974), buttongrass moorlands (Jarman *et al.* 1988), alpine vegetation (Kirkpatrick 1982, 1983, 1986; Kirkpatrick and Bridle 1999) and dry eucalypt forest (Duncan and Brown 1985). Some individual species and their associated communities have also been the subject of statewide surveys and ecological study; for example, King Billy pine (Cullen 1987; Brown 1988; Cullen and Kirkpatrick 1988) and Huon pine (Gibson 1986; Peterson 1990; Shapcott 1991). Studies of *Eucalyptus obliqua* and associated forest have been the focus of considerable research (Ashton 1981; West 1981; Wilkinson and Jennings 1993; Lindenmayer *et al.* 1996).

Various maps have been produced that have provided a vegetation map cover for the Warra Site. The *Atlas of Tasmania* (Davies 1965) provided one of the earliest statewide vegetation maps for Tasmania at 1:1 800 000 but had only six categories of vegetation, of which the Weld area was mapped entirely as rainforest. Kirkpatrick and Dickinson (1984) produced a more detailed statewide vegetation map at 1:500 000 but still showed little detail for the Warra Site. The South-West Resources Survey produced maps from black and white aerial photography of major vegetation types at 1:100 000. In this series, the Warra Site was mapped using 13 structural vegetation categories (SWRS 1979).

The first 1:25 000 vegetation map for the Warra Site was produced by Forestry Tasmania when it published the forestry PI-type maps for the *Weld* and *Picton* sheets in 1987. However, the forestry PI maps, while providing detailed and accurate representation of the structural variation in the vegetation, are of only limited value for the interpretation of floristic variation and community conservation assessment. The original synusia-based vegetation mapping upon which this paper is based is of a similar accuracy and detail as the PI-type maps but provides detailed floristic information and only limited structural information. These two mapping methods are therefore highly complementary.

The other statewide 1:25 000 map series are the complementary RFA (Regional Forest Agreement) forest vegetation maps produced by the Department of Primary Industries, Water and Environment (DPIWE) and Forestry Tasmania. DPIWE also produced the Tasveg maps of the non-forest

areas. These maps, whilst produced at the same scale and from the same aerial photographic coverage as the synusia-based Warra vegetation map, provide less detailed and less accurate information because of the differences in the methodology used. The classification-based methods adopted by the RFA and Tasveg are necessarily limited in the number of vegetation categories. The maps are produced quickly, using large polygons that typically show only the main structural and floristic variation of the vegetation, and minor vegetation components are often neglected. Information is not provided about the heterogeneity of the vegetation within a polygon—nor are variations in the understorey well represented in their classification, which is heavily biased to distinguish canopy dominants. For example, there is no distinction between *Eucalyptus obliqua* forest over a wet sclerophyll understorey and *E. obliqua* over a rainforest understorey, yet for fire management purposes these forests are likely to behave very differently, and for political reasons distinguishing between the oldgrowth and regrowth forests is also important. In the synusia-based system, not only is this distinguished but various types of these understoreys are also distinguished.

The synusia-based Warra vegetation map was produced as part of the 1:25 000 World Heritage Area vegetation mapping program (within DPIWE) and uses a methodology developed and described by Kirkpatrick (1990). Smaller polygons are identified and as much detail as can be detected from aerial photographic interpretation is coded into the tag which uses a system that distinguishes overstorey from understorey and enables minor vegetation components within vegetation mosaics to be mapped as well. About 50 vegetation codes in various combinations were used to describe the Warra vegetation. The raw map with its complex tags is not immediately useful. Computer manipulation of the data is necessary to produce purpose-made maps that display aspects of the vegetation of interest. In this manner, the map can be simplified into maps that, for example, display the RFA and Tasveg vegetation categories or classify the vegetation into various fire-sensitivity classes or trampling-sensitivity classes. The detailed map has been manipulated for this paper into a very basic map of understorey categories and a map of the overstorey eucalypts and King Billy pine.

Methods

Vascular plant species lists were compiled from various survey data collected from within the Warra LTER Site and from species distribution data within the DPIWE GIS database 'GTSpot'. The GTSpot data are derived from a variety of sources including the Tasmanian Herbarium database. Records from the Herbarium are marked as such in the plant census (Appendix 1) since they provide voucher evidence of the species' existence in the area. The greatest quantity of data for the Warra LTER Site was derived from Forestry Tasmania's database 'Botany'. Taxonomic nomenclature follows Buchanan (1999).

The map is based on interpretation of 1:25 000 colour photography (M744 1989) for the World Heritage Area portion of the maps and 1:20 000 colour photography (A086 SEforestry 1995 and M428 SEForesty 1984) for the State forest regions. Line work from the photos was manually photogrametrically corrected as it was transferred onto stable topographic transparencies. The Warra LTER Site is covered by parts of two *Tasmap* 1:25 000 topographic sheets—*Weld* 4623 (edn 1, 1987), and *Picton* 4622 (edn 1, 1987). Forestry PI mapping and the RFA map polygons were also incorporated as appropriate. The map sheets were then scanned and tagged for entry onto a Geographic Information System. The horizontal accuracy of the line work has not been calculated but given the subjectivity of assigning polygon boundaries in many instances and the general detailed

nature of the mapping sheets is probably accurate to within 50 m on average.

Ground checking was limited to about 10% of the map sheet and experience suggests that it is about 80% accurate for most vegetation types. Some overstorey species such as *Eucalyptus obliqua* and *E. delegatensis* are difficult to distinguish and may have a lower accuracy than this.

The vegetation maps presented in Figures 1 and 2 are simplified from the original mapping not presented here but available on request. The original vegetation was mapped using a synusia-based mapping system which is described in more detail elsewhere (Kirkpatrick 1990). This method enables the detailed mapping of the vertical layers in the vegetation (i.e. the overstorey and the understorey). It also enables the mapping of complex vegetation; for example, when a number of vegetation types are closely arranged within a mosaic or where a very small area of a vegetation type occurs within the polygon which is too small to map separately. Distinctive species within the vegetation may also be indicated within the tag to show their presence.

The complex polygon tags are then classified using a purpose-written computer program into vegetation types that meet the demands of the end user. For this paper, a map of the distribution of each of the eucalypts and King Billy pine has been produced (Figure 1). A second map (Figure 2) has categorised each polygon in terms of the main understorey vegetation (excluding the overstorey species information). An explanation of the original mapping codes is given in Appendix 1 and a list of the simplified vegetation groups mapped is shown in the legends of Figures 1 and 2.

Description of the flora

Appendix 2 contains a preliminary census of vascular plant species within the Warra LTER Site. At least 251 native vascular plant taxa have so far been recorded from the Warra LTER Site, of which 89 (35%) are endemic to Tasmania. In addition, 10 introduced species have been observed within the Site. The diversity so far recorded for the area is about half that of Mount Field with 449 vascular plant taxa (Parks and Wildlife Service 1999) and the Wellington Range with 487 (Ratkowsky and Ratkowsky 1976). However, both of these regions are larger and have been studied more intensively over many decades than the Warra LTER Site. The closer, Snowy Range area (also a larger region than the Warra area) has had about 300 native species listed (Wells 1985; GTSpot database 2001). There is therefore likely to be an increase to the Warra vascular plant census following surveys of the western side of the Weld Range, the alpine and subalpine areas of Mount Weld, and of the non-forest vegetation types such as moorlands and heaths.

Only five of the plants so far observed are listed as rare on the schedules of the *Threatened Species Protection Act 1995* (see Appendix 2).

Description of the plant communities and their conservation status

The key to each of the map units (Corbett 2001) used at Warra is presented in Appendix 1.

Appendix 1 provides details of the area occupied by the major vegetation classes within the Warra LTER Site. Eucalypts are dominant over much of the region. The most common species is *E. obliqua,* which covers 43% of the Warra LTER Site (6806 ha). Nearly half (48%) of this *E. obliqua* forest dominates over a rainforest understorey (3248 ha). Of the remainder, most has a wet sclerophyll forest understorey (35% or 2411 ha) and a much smaller amount occurs over scrub, heath and dry forest types (17% or 1144 ha).

Appendix 1 also shows the relationship of the synusia-based mapping codes with the

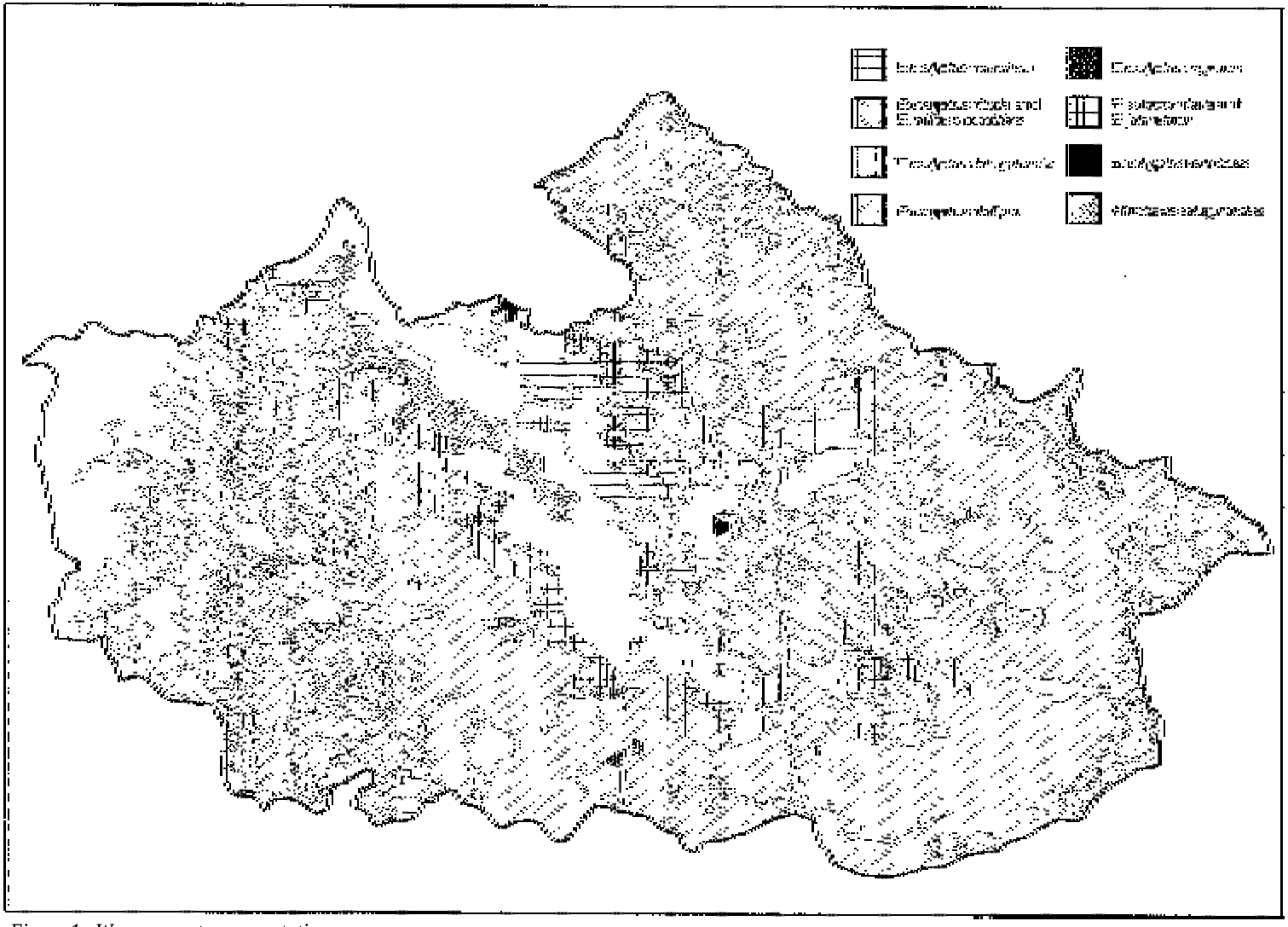

Figure 1. Warra overstorey vegetation.

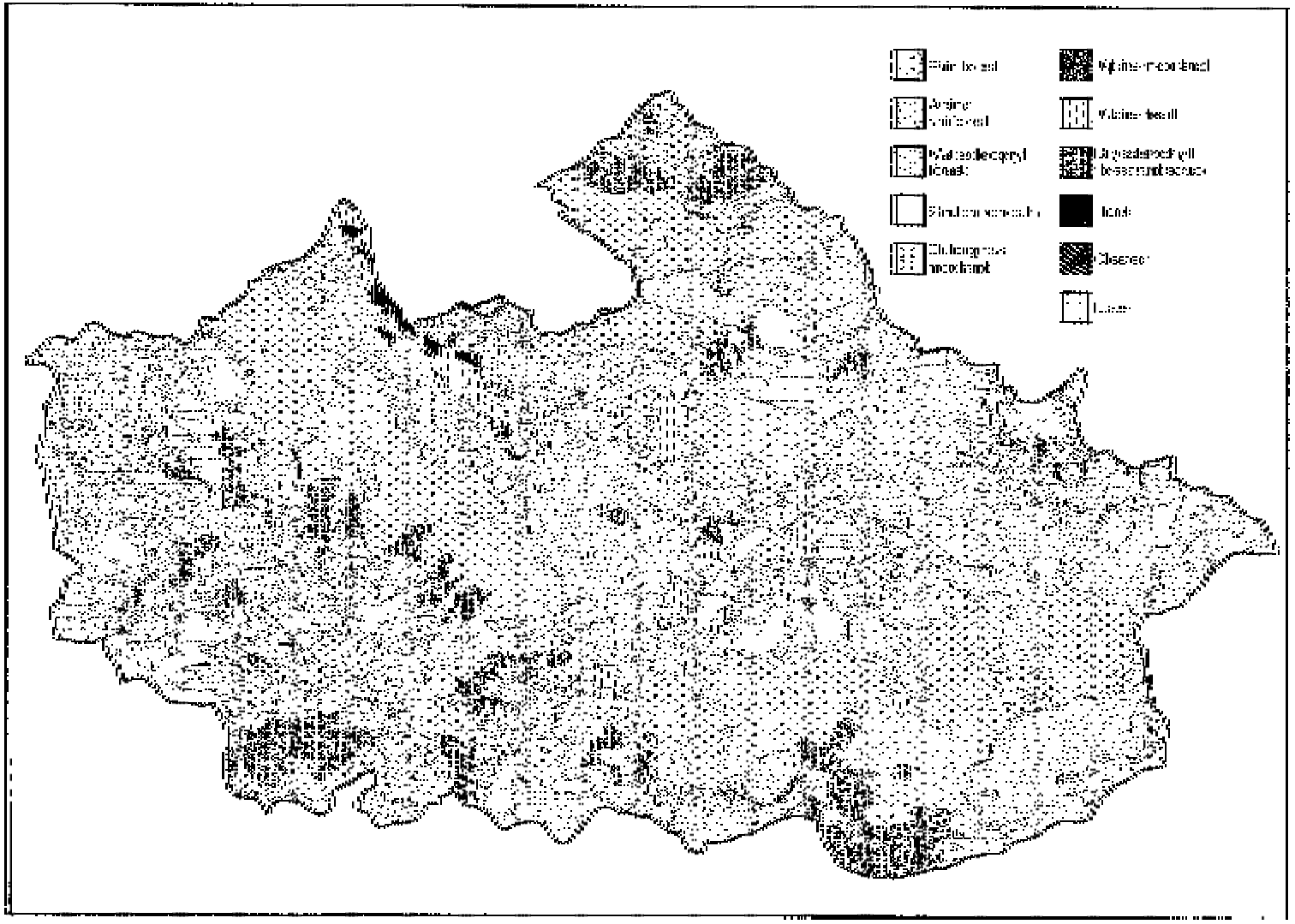

Figure 2. Warra understorey vegetation.

RFA and Tasveg mapping category where possible (Tasveg2000 2001). In addition, the most closely matching community or association described previously in the published literature is included in the last column of Appendix 1. Most communities that could be matched to the published literature are considered well reserved on a statewide and regional basis. It is not possible from photo-interpretation to be certain of the communities present and further on-ground survey work is required to confirm the presence of some of these communities. The mapping suggests the possibility of the presence of several communities within the Warra LTER Site that have been identified as warranting conservation priority. These communities are: *Eucalyptus johnstonii* wet sclerophyll forest (John1), *Eucalyptus obliqua – Phebalium squameum – Bauera rubioides* (OB3) (Duncan and Johnson 1995), *E. regnans – Acacia dealbata – Pomaderris apetala* wet sclerophyll forest (Reg1001) and *E. regnans – Atherosperma moschatum* mixed forest (REG111) (Kirkpatrick *et al.* 1988).

Post RFA data analysis (DPIWE files) suggests that the reservation targets of most broad forest types known to occur within the Warra Site have been secured for the Southern Ranges Bioregion. However, further evaluation of conservation and reservation status of some communities is warranted as more refined mapping becomes available. For example, *Eucalyptus johnstonii* has been grouped with *E. subcrenulata* in the RFA analysis because of the difficulties with distinguishing these species. *Eucalyptus subcrenulata* is widespread and well reserved within the Southern Ranges Bioregion and no further reservation is being targeted for this species group. Some closed canopy forests in which eucalypts and acacias are absent or sparse warrant attention for conservation management (Tasmanian Vegetation Management Strategy 1988). An example of such a community is the *Pomaderris elliptica* forests on dolomite below Lulworth Spur and the Crystal Caves at Warra.

The floristics of each of the mapped communities is described in detail below. These descriptions are broken into a number of sections. The first covers the alpine and subalpine zone, which includes a range of woodland and treeless plant communities. This section is divided into the subsections: heaths (where shrub species are a prominent component of the vegetation), moorlands (where shrubs are less important) and rainforest (in which rainforest species, *sensu* Jarman and Brown 1983, are prominent). The remainder of the description covers the range of vegetation structural types below the subalpine zone within the Warra LTER Site. These include the forest assemblages grouped into rainforests, wet forest and dry forest sections but for convenience the overstoreys and understoreys are described separately. The lowland, non-forest communities typical of frequently burnt sites on siliceous soils are divided into sections on scrub and heaths and buttongrass moorlands.

The vegetation

A. Alpine and subalpine vegetation

The true alpine zone is defined by a mean summer temperature of less than 10°C. On Mount Weld, the climatic tree-line is at about 1200 m above sea level so the area of true alpine vegetation is restricted to the very narrow ridge top and peaks along the range. The map indicates this region is largely composed of dolerite scree and is inhabited by plant species adapted to tolerate extreme insolation stress, minimal soil depth and periodic drought stresses. Hence, the vascular vegetation in this area is essentially heath or shrubland. However, heath and other treeless plant communities extend well below the climatic tree-line in situations where factors other than mean summer temperature prevent tree growth. These factors include frost and edaphic factors. Treeless vegetation covers much of the landscape on Mount Weld above 1000 m elevation.

The subalpine region as defined here includes woodlands and scrub as well as the treeless plant communities. For this paper, it is bounded by the lower limit of *Eucalyptus coccifera,* a tree species generally restricted to high altitudes and a common emergent over heathlands that are otherwise very similar to the heathlands above the tree-line. At Warra, the lower limit of *E. coccifera* can be as low as 700 m altitude in places.

The communities occurring within the alpine and subalpine zone are divided here into three subsections: heathland, moorland and rainforest. The communities described may have overstoreys of *Eucalyptus coccifera* and, at the lower limit of the subalpine zone, the *E. coccifera* x *nitida* hybrid. Present also but far less common are shrubs or trees of *E. vernicosa* found between 700 and 1100 m. This species typically occurs on peaty soils on quartzite, mudstone or sandstone geology but on the eastern slopes of Mount Weld it occurs on peat over dolerite. This species forms an altitudinal cline with the other lower altitude yellow gums *E. subcrenulata* and *E. johnstonii* (Williams and Potts 1996).

The presence of eucalypts in the subalpine zone is associated with an infrequent fire history and relative protection from extreme frost events. For this reason, areas with severe cold air drainage may have inverted tree-lines. Low-lying flats may have the compounding problem of poor drainage to further inhibit tree growth (Gilfedder 1988). Large areas of dead eucalypts across the Weld Range and other nearby mountains are thought to be associated with severe frosts at the turn of the century but may also be associated with past fires or a combination of these events (Wells 1985). Areas with long fire-free intervals are associated with the development of rainforest shrubberies and coniferous communities.

A1. HEATHLAND

Heaths are dominated by shrub species less than 2 m tall and have an overall cover in the dominant shrub stratum of greater than 30%. Heathland vegetation is favoured by rocky exposed conditions within the alpine and subalpine zone. It is a widespread component of the alpine and subalpine vegetation in the Warra LTER Site (3% of Warra).

Alpine heaths (As)

The species that dominate the highest of the alpine heathlands (mapped as As) include *Richea scoparia, Podocarpus lawrencei, Diselma archeri* and *Epacris serpyllifolia.* Other more sparsely distributed but characteristic shrub species include *Tasmannia lanceolata, Orites revoluta, O. acicularis, Ozothamnus rodwayi, Pimelea sericea, Richea sprengelioides, Archeria serpyllifolia* and *Trochocarpa cunninghamii.* Herbs are sparsely distributed beneath the shrub canopy or form denser patches (described below) in a mosaic with the heath.

At slightly lower altitudes, the heaths (still mapped as As) diversify on the eastern slopes of the Weld Range and include additional species such as *Leptospermum rupestre, Bauera rubioides, Exocarpos humifusus* and *Gonocarpus montanus.*

Graminoid heath (Aw)

In more exposed, poorly drained situations at or just below the tree-line, the heaths have a higher proportion of graminoids. These heaths (mapped as Aw) include *Dracophyllum milliganii, Carpha alpina, Oreobolus pumilio, Sprengelia incarnata, Epacris serpyllifolia, Leucopogon milliganii, Astelia alpina, Gleichenia alpina, Helichrysum pumilum, Drosera arcturi, Bauera rubioides, Ewartia meredithiae* and sometimes *Microcachrys tetragona.* The apparent absence of bolster shrubs in this vegetation is anomalous with other mountain regions. Elsewhere, cushion species are usually the dominant plants in otherwise similar species associations. This vegetation is not matched well by previously described communities since the cushions *Donatia novae-zelandiae* and *Dracophyllum minimum* are the usual dominants of communities such as this and

they are rare on Mount Weld. Elsewhere, this assemblage is typical on exposed areas of peaty soil developed on siliceous substrates. On the north-eastern face of Mount Weld, there is no evidence of rocks other than dolerite underlying the moors.

Subalpine heath (H)

At lower altitudes within the subalpine zone, the heaths (mapped as H) become taller and scrubbier and may have affinities with lowland vegetation, including species such as *Oxylobium ellipticum, Pultenaea juniperina, Cyathodes juniperina*, and *Lomatia polymorpha.*

Western subalpine heath (Hw)

Below 900 m altitude, the infertile, waterlogged situations are occupied by a tall heathy scrub (mapped as Hw). This vegetation is dominated alternately by emergent *Leptospermum nitidum* (L) and / or *Melaleuca squamea* (M) and may also contain *Agastachys odorata, Persoonia gunnii, Baeckea gunniana* and *Bauera rubioides. Gleichenia alpina* and various monocots including *Empodisma minus* and *Eurychorda complanata* dominate openings between the shrubs. As the drainage improves, *Eucalyptus coccifera* is present as an emergent over the *Melaleuca* moorland and *Banksia marginata* is also more common. This vegetation is particularly extensive on the sedimentary rocks making up the crest of Mount Frederick. This vegetation does not fit well within the existing communities described by Kirkpatrick *et al.* (1995). Scrub vegetation is the most poorly described of the vegetation types and hence this association is difficult to place. However, it correlates best with layered eastern moor described by Jarman *et al.* (1988), although it lacks the identifier species *Gymnoschoenus sphaerocephalus.*

A2. ALPINE MOORLAND

Alpine moorland is the term here used to collectively describe a variety of vegetation types, including alpine herbfields, low closed graminoid heaths and sedgelands in which the shrubs are a much less prominent component of the community. These alpine moorlands are found interspersed through the widespread heaths as small patches that are often too small to map. In some situations, the moorland associations form an understorey beneath the heathland. The moorlands are characteristic of poor drainage, severe frost, or prolonged snow-lie in less rocky terrain than that favoured by the heaths. The herbfields and other alpine moorlands occupy a negligible area of the Warra Site.

Milligania/Astelia beds (Tm)

The alpine heaths above the tree-line and just below are interspersed with a herbfield or sedgeland that is largely dominated by *Astelia alpina* and / or *Milligania densiflora* (mapped as Tm). This tall alpine herbfield also includes a number of sparsely distributed herbs and graminoids of which *Chionogentias* sp., *Hierochloe fraseri, Uncinia compacta, Erigeron stellata, Poa gunnii* and *Aciphylla procumbens* are the most consistently present. The mat shrub *Pentachondra pumila* also dominates smaller vegetation patches within the mosaic. The *Milligania* herbfield vegetation is likely to be associated with areas with prolonged snow-lie but is a relatively minor component of the alpine and treeless subalpine vegetation on Mount Weld.

The *Astelia alpina – Milligania* herbfield is a very extensive and widely distributed community on dolerite in alpine areas of Tasmania (Kirkpatrick 1997).

Alpine herbfield (Ah)

Deeper peat soils, frosty conditions or situations with prolonged snow-lie favour alpine herbfields or moorlands. In the poorly drained, exposed saddles at high altitude, the moorland (mapped as Ah) is dominated by *Carpha alpina, Dracophyllum milliganii, Astelia alpina, Milligania densiflora* and commonly includes the small shrub *Sprengelia montana.* Also present is the

cushion graminoid *Oreobolus oligocephalus*, herbs such as *Drosera arcturi*, *Schizacme montana* and occasionally the cushion plant, *Abrotanella forsteroides.* Communities such as this, although considerably more restricted than heaths, are well reserved and reach their best development within the Cradle Mountain-Lake St Clair National Park.

Alpine sedgeland (Tg)

In especially waterlogged areas on frost-prone flats and gentle slopes down to altitudes of about 900 m, the coral fern *Gleichenia alpina* dominates a moorland community (Tg) which includes *Astelia alpina, Empodisma minus, Epacris serpyllifolia, Baeckea gunniana* and *Sprengelia incarnata*.

A3. ALPINE RAINFOREST

In the situations of improved drainage and shelter from frost or wind exposure, the vegetation below the tree-line often has an emergent canopy of *Eucalyptus coccifera* (Ec) and a rainforest floristic element (*sensu* Jarman and Brown 1983). Even at the highest elevations, rocky outcrops create a warmer microclimate with improved drainage that enables shrubby copses to develop. The alpine rainforest communities can be described generally as having *E. coccifera* emergent over a diverse range of shrubs, including *Nothofagus cunninghamii, Eucryphia milliganii, Orites diversifolia, Richea scoparia, R. pandanifolia, Cenarrhenes nitida* and *Telopea truncata,* with *Tetracarpaea tasmanica, Cyathodes juniperina, Leucopogon milliganii* and *Empodisma minus* beneath. The alpine rainforests are reasonably extensive in the subalpine zone and make up 7% of the Warra LTER Site.

Coniferous heath (Ac)

Small areas of coniferous heaths (mapped as Ac) dominated by *Diselma archeri* occur in small, fire-protected patches on sheltered lake shores and streamlines and boulder-streams. They are placed in this alpine rainforest group rather than the alpine heath group because some areas of coniferous heath may have been mapped as Arf due to its similarity in texture and species association with the alpine rainforest shrubbery (Arf). However, the decision was rather arbitrary and other coniferous heath associations such as the prostrate coniferous heaths are mapped as part of As (alpine heath) because of their similarity in texture and species association.

Alpine shrubbery (Arf)

On the steep, well-drained rocky slopes below the tree-line, a diverse subalpine rainforest heath (mapped as Arf) is dominated by *Nothofagus cunninghamii* and *Eucryphia milliganii,* while *Eucalyptus coccifera* and/or *E. vernicosa* are occasionally emergent. This shrubbery has a diverse range of heath species, including many elements from the alpine heaths such as *Richea scoparia, Tasmannia lanceolata* and *Coprosma nitida* but particularly *Richea pandanifolia* and *Bauera rubioides.*

Alpine rainforest (Rfa)

With a decline in elevation, the rainforest heath increases in height to form denser and taller krumholz (mapped as Rfa) or rainforest scrub and becomes more widespread. In addition to the dominant plants *Nothofagus cunninghamii* and *Eucryphia milliganii,* other consistent species include the trees *Phyllocladus aspleniifolius* and *Richea pandanifolia,* with *Eucalyptus coccifera* as an occasional emergent. *Athrotaxis selaginoides* (mapped as K) occurs in some patches that have escaped fires on the western slopes and in creek-lines and on lake shores to the east of Mount Weld. Typical shrubs include *Coprosma nitida, Bauera rubioides, Trochocarpa cunninghamii* and *Cyathodes juniperina,* while the graminoid *Astelia alpina* is persistent but sparse.

Subalpine rainforest scrub (Rfas)

At the lower limits of the subalpine zone, *Eucalyptus subcrenulata, E. coccifera* and a

white gum-barked hybrid between *E. nitida* and *E. coccifera* occur over a heathy implicate rainforest scrub understorey (mapped as Rfas). *Nothofagus cunninghamii, Eucryphia milliganii* and *Phyllocladus aspleniifolius* codominate. Shrubs and small trees of *Cyathodes parvifolia, Orites diversifolia, Olearia persoonioides, Bauera rubioides, Telopea truncata* and *Tetracarpaea tasmanica* contribute to the lower strata of this vegetation. *Leptospermum lanigerum* and *Gahnia grandis* distinguish this community on the flats from the rainforests on the slopes. In particularly wet areas on siliceous substrates, the rainforest scrub can include *Richea milliganii, Blandfordia punicea, Agastachys odorata, Epacris heteronema, Persoonia gunnii* and *Sprengelia incarnata.*

King Billy pine (K)

Stands of rainforest dominated by the long-lived conifer King Billy pine (*Athrotaxis selaginoides*) are mapped as K or, where they have been killed by fire, as [K].

B. FOREST VEGETATION

Forests cover most of the Warra region (70%), from the lowest altitudes up to the subalpine zone, the lower boundary for which varies between 700 up to 900 m in places. These forests can be broadly divided into dry eucalypt forest, wet eucalypt forest, mixed forest and cool temperate rainforest. For the purposes of this description, the rainforests and mixed forest will be discussed together in one subsection. The eucalypt overstoreys, wet forest understoreys and the dry forest understoreys will each be covered in separate subsections. The type of forest developed is heavily dependent on fire history, soil fertility and other environmental factors. Hickey *et al. (*1999) provide detail on the known fire history for the area.

B1. RAINFOREST AND MIXED FOREST UNDERSTOREYS

In situations where there has been a particularly low frequency of fires, the climax vegetation for the region (cool temperate rainforest) occurs. Eucalypts are usually absent from forest only where the fire-free interval is more than 400 years. Where there has been a history of fires but no fire for more than 130 years, rainforest predominates beneath a eucalypt canopy.

Several rainforest communities have so far been identified for the Warra LTER Site. They occur as both pure rainforest in which no eucalypts are present (or present with less than a 5% canopy) or as mixed forest in which a rainforest understorey occurs beneath a eucalypt overstorey.

Callidendrous and intermediate rainforest (Rf)

On lowland sites of high fertility, small patches of pure rainforest tend towards a callidendrous rainforest structure but have closer floristic affinities with thamnic forest (*sensu* Jarman *et al.* 1984). This *Nothofagus cunninghamii* rainforest (mapped as Rf) is codominated by *Eucryphia lucida* and other species, including *Phyllocladus aspleniifolius, Atherosperma moschatum, Anopterus glandulosus* and *Cenarrhenes nitida.* The ground layer may include some tree ferns and other smaller ferns such as *Polystichum proliferum, Blechnum wattsii* and *Histiopteris incisa* but is dominated by rich carpets of moss. Epiphytic ferns include *Grammitis billardierei, Hymenophyllum flabellatum, H. cupressiforme* and *H. rarum.* Such rainforests are rather restricted to protected regions adjacent to watercourses. In riparian situations, this forest can have an understorey of ferns (mapped as Rf-F) or broad-leafed shrubs, including species such as *Bedfordia salicina* and *Olearia argophylla* (mapped as Rf-Po).

Thamnic rainforest (Rft)

Away from the fire protection and added fertility of watercourses, both pure rainforest and the understorey of mixed forest are typically thamnic in structure (mapped as Rft). This *Nothofagus cunninghamii* rainforest is distinguished by the abundant presence of the tree *Anodopetalum biglandulosum* in the

understorey. Otherwise it has essentially the same subdominant tree species: *Phyllocladus aspleniifolius, Atherosperma moschatum, Anopterus glandulosus* and *Cenarrhenes nitida. Orites diversifolia* is also a component of this forest, which may also include *Dicksonia antarctica* in the ground layer, with *Blechnum wattsii* and mosses. The epiphytic ferns *Grammitis billardierei, Hymenophyllum rarum,* and *Grammitis magellanica* subsp. *nothofageti* are also common.

Rainforest regrowth (Rfr)

In most situations where the thamnic rainforests have been logged, broad-leafed shrubs and the ubiquitous *Gahnia grandis* dominate the regrowth. In some situations, however, thamnic rainforest appears to regenerate in the absence of any intermediate successional stages (mapped as Rfr) and differs largely from its mature counterpart in its age structure and the characteristic presence of *Gahnia grandis*. There is also no evidence that there is a successional relationship between the different rainforest types. It would appear that the communities are relatively stable and are dependent for their occurrence on site characteristics rather than disturbance.

Implicate rainforest (Rfi)

On poorer fertility sites and/or at higher elevation (above 600 m), the rainforests (mapped as Rfi) and rainforest understoreys become floristically more diverse and develop a tangled, implicate rainforest structure. These *Nothofagus cunninghamii* forests may include *Atherosperma moschatum* and *Phyllocladus aspleniifolius* but also contain an abundance of *Anodopetalum biglandulosum, Eucryphia milliganii, Eucryphia lucida, Richea pandanifolia, Anopterus glandulosus* and *Orites diversifolia. Prionotes cerinthoides* climbs up the trunks of the eucalypts and other trees. The ground cover is *Blechnum wattsii* and mosses, with the epiphytic ferns, *Hymenophyllum* species and *Grammitis* species, being common on logs and on the base of tree trunks. Other species that may also occur include *Telopea truncata, Trochocarpa* species, *Leptospermum lanigerum, Lomatia polymorpha* and *Gleichenia microphylla.* Where these forests have a eucalypt overstorey, the dominant is likely to be *Eucalyptus nitida* or its hybrid form or *E. subcrenulata* as, for example, on the sandstone shelf on Mount Frederick between 500 and 640 m altitude.

Huon pine (La)

Huon pine, *Lagarostrobos franklinii* (mapped as La), is restricted at Warra to the riparian rainforest along the Huon River. It dominates this rainforest, in association with tree species such as *Nothofagus cunninghamii, Eucryphia lucida* and *Anopterus glandulosus.* Other species include *Lomatia polymorpha, Telopea truncata, Orites diversifolia, Pomaderris apetala* and *Acacia verticillata.*

The Huon pine along the Picton River and Huon River may well be at the climatic limit for the species, though climate modelling of the species by Gibson (1986) provided fairly inconclusive results. Regeneration of Huon pine along these rivers appears to be continuous, with large numbers of seedlings and small individuals arising from vegetative regeneration (Gibson 1986).

B2. WET SCLEROPHYLL FOREST AND MIXED FOREST OVERSTOREYS

In forests where there has been a history of repeated fires, tall eucalypts typically occur. In some instances, the wattles (blackwood or silver wattle) may also be present in the overstorey or may dominate in the absence of eucalypts. The tall forests cover most of the Warra region below the subalpine zone. The understoreys typical of these forests are described separately within the rainforest subsection above or the wet and dry forest understorey subsections below.

Silver wattle (Ad) and blackwood (Am)

Beneath or sometimes instead of a eucalypt canopy, tall trees of silver wattle (*Acacia*

dealbata) and / or blackwood (*A. melanoxylon*) sometimes dominate over rainforest or shorter, broad-leafed understoreys.

Eucalyptus obliqua (Eob)

Below 450 m altitude, the most widespread and dominant eucalypt is messmate *(E. obliqua).* It is a tree species that copes with a wide range of fire frequencies and soil nutrient conditions and is very well adapted to the moderately fertile, high rainfall sites on the lower slopes to the east and south of the Weld Range.

Eucalyptus regnans (Erg)

The mountain ash or swamp gum *(E. regnans)* codominates with *E. obliqua* in small patches between 100 and 200 m altitude in frost-free situations of high fertility and good drainage.

Eucalyptus nitida (En) and (Enx)

In situations where the underlying rocks weather to produce poor soils (for example the hornfels at the northern end of the Warra Road), the dominant eucalypt tends to be the Smithton peppermint, *E. nitida,* over implicate rainforest scrub (dominated by *Phyllocladus aspleniifolius*) or *Leptospermum scoparium* scrub, depending on the fire history. On soils of low fertility and relatively poor drainage at higher altitudes, *E. nitida* and its hybrid form with *E. coccifera* become common.

Eucalyptus delegatensis (Ed)

As temperatures decrease with increasing altitudes or in association with cold-air drainage situations, the gum-top stringy bark (*Eucalyptus delegatensis*) replaces *E. obliqua* as the main dominant on soils of moderate to high fertility. The transition is gradual, with some *E. delegatensis* forests occurring at altitudes as low as 300 m and most forests being dominated by it by 600 m. *Eucalyptus delegatensis* forms pure stands only on sites of the highest fertility.

Between 700 and 900 m, *E. delegatensis* forests are gradually replaced by *E. coccifera* subalpine woodlands.

Yellow gums Eucalyptus johnstonii (Ej) and E. subcrenulata (Es)

On lower fertility sites, the forests are dominated or codominated by *E. johnstonii* between 400 and 450 m altitude and by *E. subcrenulata* above this. At about 700 m, the subalpine yellow gum *E. vernicosa* replaces *E. subcrenulata*. The eucalypts codominating with *E. johnstonii* and *E. subcrenulata* are *E. delegatensis* and, at the upper end of its altitudinal range, *E. coccifera, E. nitida* and the *E. nitida* x *coccifera* hybrid.

B3. WET SCLEROPHYLL FOREST UNDERSTOREYS

Most of the wet forests within the Warra area occur on dolerite, which weathers to red clay soils with fairly high fertility. In these situations, the forest understoreys are most often thamnic rainforest or broad-leafed wet forest. Where fires have occurred within the past 110 years and the fire interval is on average less than this, then the understorey is wet sclerophyll forest.

Pomaderris broad-leaf shrubbery (Po)

The most common wet scerophyll forest understorey type is between 6 and 8 m tall and is typically dominated by *Pomaderris apetala* (mapped as Po), together with species such as *Zieria arborescens, Bedfordia salicina, Olearia argophylla, Prostanthera lasianthos* and *Nematolepis squamea.* Transitional between the wet forest understorey – *Pomaderris* shrubbery and thamnic rainforest are the wet understoreys dominated by *Nematolepis squamea* that include species such as *Lomatia tinctoria, Eucryphia lucida, Zieria arborescens, Correa lawrenceana, Monotoca glauca, Cyathodes glauca, Acacia riceana* and *Melaleuca squarrosa,* often with a distinctive tangled ground cover of *Hibbertia empetrifolia.*

Melaleuca squarrosa, Banksia marginata, *Leptospermum* species and *Acacia verticillata*

are also sometimes codominants in the *Pomaderris* shrubbery, and in other situations form the main understorey species, particularly on drier or less fertile sites, and are transitional with dry forests. Where these species form dominants, they are mapped as Mt, Ba, Lt and Av respectively.

Wet forest shrubbery (Wf)

Wet forest shrubbery is a community type midway between wet sclerophyll forest and rainforest and may also be classified as wet scrub. The presence of sclerophyllous species such as *Leptospermum lanigerum, Monotoca glauca, Acacia mucronata* and *Melaleuca squarrosa* requires that it be placed in the wet forest category here. It also has a rainforest component, although the rainforest trees are usually young. Prominent rainforest species include *Anodopetalum biglandulosum, Nothofagus cunninghamii, Eucryphia lucida* (*E. milliganii* in the subalpine woodlands) and *Cenarrhenes nitida.* Smaller shrubs may include *Bauera rubioides, Pentachondra involucrata, Richea procera* and *Cyathodes juniperina. Blechnum wattsii* and *Gleichenia microphylla* are common ferns.

Tall Melaleuca squarrosa swamp (Mt)

In poorly drained situations within wet forests, *Melaleuca squarrosa* swamp forests can occur with or without the eucalypt overstorey. This vegetation may be almost pure *Melaleuca squarrosa* or may be accompanied by *Banksia marginata,* with a bare understorey or with *Blechnum* species, sparse *Bauera rubioides* and / or *Gahnia grandis* (mapped as Gh) in the ground layer.

This mapping unit also includes the community described by Neyland (2001) as being dominated by *Melaleuca squarrosa* and *Leptospermum lanigerum* with an overstorey of *E. obliqua* and an understorey of *Nematolepis squamea, Acacia verticillata, Bauera rubioides, Blechnum wattsii, Gleichenia microphylla* and *Gahnia grandis.* He states that it is common on the lower slopes and flats which form part of the Warra silvicultural systems trial.

Tall tea-tree (Lt)

Tall tea-tree (particularly *L. nitidum* and *L. lanigerum*) are dominants in scrub with or without a eucalypt overstorey, particularly at higher altitudes. It can occur in almost pure form or in association with other wet forest and rainforest species.

Acacia verticillata scrub (Av)

Prickly mimosa (*Acacia verticillata*) sometimes forms the dominant within a scrubby wet forest understorey with other wet forest species. It is particularly dense along road-sides and recently logged and burnt areas. Cutting grass (*Gahnia grandis*) is typically associated with this *A. verticillata* scrub.

Riverine shrubbery (R)

In riparian situations, the wet forest shrubberies (mapped as R) include a diverse range of species. These include *Westringia angustifolia, Callistemon pallidus, Leptospermum riparium, L. lanigerum, Lomatia tinctoria, Telopea truncata, Acacia melanoxylon, A. verticillata, A. riceana* and *Pomaderris apetala* over *Baeckea ramosissima, Hibbertia empetrifolia, Lepidosperma laterale* and *Dianella tasmanica*.

B4. DRY FORESTS

The dry forests are usually dominated by *E. obliqua* (Eob) or, in particularly nutrient poor situations, *E. nitida* (En). They are defined by the presence of an understorey dominated by small, prickly leafed species. Because the overstoreys are fairly simple and lack the diversity that occurs over the wet forests, they are not described in more detail in a separate subsection. The dry forests are only common where the geology is siliceous and/or a history of frequent fires has removed the rainforest and wet forest species that would otherwise occur in this high rainfall region. Reduced rainfall on the lower eastern slopes of the Weld Range and the dry soils of the

dolomite outcrops also contribute to the development of the dry forests in the region.

Dry forests can also occur on dolerite in situations where frequent fires, poor drainage and/or shallow soils favour the hardier dry forest species. Dry forest types occupy about 5% of the Site.

Tea-tree scrub (Tl)

Even within the generally dolerite regions of Warra, there are a few remnants of Permo-Triassic sedimentary rocks, usually on the ridge crests. At altitudes below 500 m, these rocks weather to produce soils of only moderate fertility. In these situations, the canopy species often remain the same as for the surrounding dolerite areas but the understoreys tend to be small-leafed 'dry forests'. These dry forest understoreys (mapped as Tl) are generally dominated by *Leptospermum scoparium* in better drained situations with poor fertility. They are sometimes codominated by *Banksia marginata* (mapped as Ba) and *Leptospermum lanigerum* (L). Other associated species include *Pultenaea daphnoides, P. juniperina, Cyathodes juniperina, C. glauca, Tasmannia lanceolata, Acacia verticillata* and *Monotoca glauca.* However, *Leptospermum lanigerum* (mapped as L) dominates scrubs in creek-lines and wet soaks where *Bauera rubioides* is usually abundant in the ground layer and *Nematolepis squamea* may also be an important component. *Gahnia grandis* is ubiquitous in areas subject to any frequent disturbance whether it is from flooding, frost, fire or logging.

On the Precambrian dolomite ridges below Lulworth Spur and the Crystal Caves, a dry forest understorey has developed in response to the increased drainage and drought associated with the dolomite soils. *Pomaderris elliptica, Leptospermum scoparium,* and *Monotoca glauca* dominate this tea-tree scrub community, with few species in the ground layer. This forest type is unusual in the Warra LTER Site but is developed in a similar situation on the northern slopes of Mount Picton (Red Rag Scarp).

Monotoca shrubbery (Wm)

In some dry forests, *Monotoca glauca* becomes an important component of the community (mapped as Wm), co-occurring with species such as *Oxylobium ellipticum* and *Richea procera*. This community occurs on the boundary between *Eucalyptus obliqua* wet forest on dolerite and heathy *E. nitida* woodlands on Cambrian siliceous sediments near Glovers Bluff. It probably also occurs elsewhere in the western part of the Warra region on quartzite. It can form a transition with the *Aotus ericoides* heath (Ht).

C. LOWLAND NON-FOREST VEGETATION

Lowland scrub, heaths and sedgelands are described within this section of lowland non-forest vegetation. Such vegetation is restricted within the Warra LTER Site to the areas with soils that have both high organic contents and are highly siliceous. Typically, fire frequency is high. This group of communities occupies the smallest area of the Warra LTER Site. For convenience, this vegetation will be divided into two subsections. The heath and scrub communities are generally taller and located on freely drained sites. The sedgelands, or buttongrass moorlands as they are now known, are distinguished from heaths by the greater abundance of sedges and other graminoids, including buttongrass, and are generally located on the soils with the highest organic content and most impeded drainage.

C1. HEATH AND SCRUB

Heaths are dominated by shrub species less than 2 m tall, whilst scrub is defined as dense vegetation (greater than 30% canopy cover) dominated by trees or shrubs between 2 m and 8 m tall (Specht 1972). A sparse cover of some taller emergent trees may be present. About 11% (1676 ha) of the Warra Site is covered by these lowland vegetation types.

Aotus heath (Ht)

The shrub *Aotus ericoides* dominates this heath community (Ht). Other associated species include *Leptospermum scoparium, L. glaucescens, Boronia citriodora, Oxylobium ellipticum* and often *Amperea xiphoclada*. The community has an affinity with one mapped on the western slopes of the Tiger Range. It is located in situations of free drainage on the siliceous soils often on very steep slopes where fire frequency is high near Glovers Bluff. *Eucalyptus nitida* may occur as a sparse emergent over this heath. This association best matches the description of 'dry eastern heathy' (Jarman *et al.* 1988).

Short tea-tree scrub (L)

Where *Leptospermum nitidum* reaches heights of up to 3 m in association with other scrub species such as *L. glaucescens, Monotoca submutica, M. glauca* and *Pimelea linifolia*, the vegetation is mapped as short tea-tree (L). Scrub vegetation has still not been the subject of any systematic statewide surveys or classifications and so no matches for this association or those that follow can be made to the published literature. However, this association is likely to be widespread within the World Heritage Area.

Acacia wet scrub (Aws)

Wet scrub copses in which *Acacia mucronata* appears prominent are classified as Aws. These include additional species such as *Melaleuca squarrosa, Leptospermum glaucescens, Banksia marginata* and *Monotoca submutica* and, in the tangled ground layer, *Gleichenia microphylla, Bauera rubioides* and *Empodisma minus*. These copses may also have some rainforest elements such as *Agastachys odorata* and *Cenarrhenes nitida*.

Banksia wet scrub (Bws)

Wet scrub thickets surrounding small trees of *Banksia marginata* are classified as *Banksia* wet scrub. This scrub vegetation generally contains *Leptospermum scoparium, Melaleuca squarrosa, Bauera rubioides, Gahnia grandis, Agastachys odorata* and *Boronia citriodora*.

Melaleuca swamp (Ma)

Melaleuca squarrosa swamp forests occur south-east of Glovers Bluff and in other places along the Weld and Picton Rivers. This vegetation is often devoid of *Gymnoschoenus* but instead is dominated by dense thickets of *Melaleuca squarrosa, Leptospermum lanigerum* and *Gahnia grandis*. In the swamps north-west of Tahune Bridge, other species include *Leptospermum scoparium, L. glaucescens, Acacia verticillata, Monotoca glauca* and *Banksia marginata*, with *Bauera rubioides* and *Calorophus elongatus* in the ground layer.

C2. BUTTONGRASS MOORLAND

Buttongrass moorlands here include a range of vegetation types less than 2 m in height and typical of wet, poorly drained situations. Typically, sedges and graminoid species such as buttongrass are prominent components of the vegetation but some shrub-dominated associations form part of this vegetation continuum. This vegetation occupies 5% (865 ha) of Warra.

Banksia marginata (Ba)

Banksia marginata trees are mapped as 'Ba' where they occur as a distinctive emergent layer over buttongrass moorland. The species is also mapped when it is a significant component of wet scrub or wet forest.

Buttongrass (B)

There is very little or none of the community 'pure buttongrass' within the Warra region but, where buttongrass tussocks occur as a significant component within other moorland associations or scrub, the presence of this species is indicated with the mapping code B.

Wet buttongrass moorland (Bsq)

Where *Gymnoschoenus sphaerocephalus* occurs in association with *Leptospermum scoparium*,

Sprengelia incarnata, *Melaleuca squamea* and *Epacris obtusifolia*, the community is mapped as wet buttongrass moorland (Bsq). This community is restricted to the flats on Glovers Bluff and Glovers Plains. It also occurs up a few steep ridges onto the Bluff.

Sporodanthus wet moorland (Bl)

Within the wet buttongrass moorlands, slightly wetter situations give rise to the dominance of *Sporadanthus tasmanicus* in association with species such as *Sprengelia incarnata* and *Epacris lanuginosa*. This community has been mapped in the Warra Site only at Glovers Plain and in the south-east of the Site on the plains west of Piners Eddy.

Leptocarpus swamp (Ls)

Leptocarpus tenax swamps occur on the very wettest areas of Glovers Plain. This is an association dominated by *Leptocarpus tenax*, with *Sprengelia incarnata, Gleichenia dicarpa, Baloskion tetraphyllum* and occasionally *Epacris lanuginosa*.

Southwest blanket moorland (Bs)

This occurs in the disturbed moorlands on Glovers Bluff where it is poorly developed but contains the distinguishing species *Gymnoschoenus sphaerocephalus, Leptospermum nitidum, Boronia pilosa, Eurychorda complanata* and *Acion hookeri*. In addition to these species, the community generally contains *Melaleuca squamea, Sprengelia incarnata* and *Baeckea leptocaulis*. It is a common community in western Tasmania and is interpreted as dominating the western edge of the Warra LTER Site on quartzite near Manuka Creek.

Melaleuca squamea shrubbery (M)

Where *Melaleuca squamea* provides more than 20% cover, the moorland is categorised as *Melaleuca* shrubbery. It is likely to contain a similar species assemblage to that in southwest buttongrass moorland but with greater dominance by *Melaleuca squamea* and a reduced dominance by *Gymnoschoenus* and other sedges. This vegetation appears to be common on the poorly drained flats of the western plateau region of the Warra LTER Site on quartzite. It may have emergent *Agastachys odorata*, straggling *Sprengelia incarnata*, *Epacris lanuginosa, Calorophus elongatus, Lepidosperma filiforme* and *Hibbertia procumbens*. At the scrub ecotones, it is likely to have *Pimelea linifolia, Leptospermum scoparium* and *L. glaucescens*.

Conclusions

The preliminary list of species available for the Warra LTER Site is likely to increase with further survey work. It is likely to have a floristic diversity similar to that of the nearby Snowy Range with which it shares a similar geology, topography and climate. Although the diversity of environments represented is slightly more limited than that of the larger regions represented by Mount Field National Park and the Wellington Range, the *Eucalyptus obliqua* wet forests and mixed forests are well represented. This forest vegetation is also accessible across a diversity of fire histories, and topographic and geological environments, making it relevant for studies of these ecosystems. Lack of access is a practical limitation to the study of the alpine and western regions of the Site.

The vegetation map described here will be a useful tool in the planning of future experimental research and monitoring work.

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Appendix1. Key to synusia-based mapping codes used on the original vegetation map together with an approximate translation to RFA and VMS mapping codes and previously described communities. Areas occupied by main overstorey trees and main understorey types are also provided. (Explantory notes: / as in A/B = A more abundant than B; - as in A-B = A taller than B; ~ as in A~B = a vegetation mosaic of A and B where A is equal to or more common than B)

OVERSTOREY TREES

		Area (%)	Equivalent RFA/VMS categories
Eucalypts			
Eob	*E. obliqua*	6806 ha (43%)	OT
Ed	*E. delegatensis*	1518 ha (10%)	DT (when present as dominant)
Erg	*E. regnans*	8 ha (< 1%)	R (" " " ")
Ej	*E. johnstonii*	509 ha (3%)	SU (" " " ")
Es	*E. subcrenulata*	(mapped with Ej)	SU (" " " ")
Ev	*E. vernicosa*	8 ha (< 1%)	SU (" " " ")
Ec	*E. coccifera*	834 ha (5%)	C (" " " ")
En	*E. nitida*	2814 ha (18%)	NT (" " " ")
Enx	*E. nitida* x *E. coccifera* hybrid	mapped with En	NT (" " " ")
Other tree species			
Ad	*Acacia dealbata*		SI when sole dominant
Am	*Acacia melanoxylon*		no equivalent
Ba	*Banksia marginata*		no equivalent
K	*Athrotaxis selaginoides*	229 ha (1%)	X
Nc	*Nothofagus cunninghamii*		M+ or M- (height dependent)

UNDERSTOREY VEGETATION TYPES

Code	Name of unit	Equivalent RFA/VMS categories	Equivalent described communities
ALPINE AND SUBALPINE VEGETATION			
***Alpine heath*—457 ha (3%)**			
As	alpine heath	Ae	*Richea scoparia – Orites acicularis* heath; also *Podocarpus lawrencei – Ozothamnus rodwayi* coniferous heath (Kirkpatrick 1991)
Aw	graminoid heath	Hs	*Isophysis tasmanica – Dracophyllum milliganii* alpine sedgeland and / or *Dracophyllum minimum – Empodisma minus* bolster heath (Kirkpatrick *et al.* 1995)
H	subalpine heath	C	Dry *Eucalyptus coccifera* shrubby woodland community 5g (Duncan and Brown 1985)
Hw	western subalpine heath	Hs	Layered eastern moor (Jarman *et al.* 1988)
***Alpine moorland*—11 ha (< 0.1%)**			
Tm	*Milligania* sedgeland	Hs	*Astelia alpina – Milligania* herbfield (Kirkpatrick 1997)
Ah	alpine herbfield	Hs	
Tg	alpine sedgeland (*Astelia* and / or *Gleichenia* dominant)	Hs	*Gleichenia alpina – Empodisma minus* fernland (Kirkpatrick *et al.* 1995)

***Alpine rainforest*—1186 (7%)**

Ac	coniferous heath	Ae	*Diselma archeri – Richea sprengelioides* coniferous heath (Kirkpatrick *et al.* 1995)
Arf	alpine rainforest heath / shrubbery	Sr	*Nothofagus cunninghamii – Eucryphia milliganii* heath and *N. cunninghamii – Prionotes* heath (Kirkpatrick *et al.* 1995)
Rfa	krumholz rainforest	Sr	Where mapped in association with 'K' may be related to community I1.4 (Jarman *et al.* 1984).
Rfas	subalpine rainforest scrub	Sr	I1.1 (Jarman *et al.* 1984)

FOREST VEGETATION

***Rainforest /mixed forest understoreys*—6561 (41%)**

Rf	callidendrous or intermediate rainforest	M+	When beneath a *Eucalyptus obliqua* canopy the community correlates with OB1000, if below Erg equivalent to REG111 (Kirkpatrick *et al.* 1988), otherwise it is intermediate between C3 and T1 (Jarman *et al.* 1984).
Rft	thamnic rainforest	M-	Mapped with 'Eob' it correlates with OB1001 (Kirkpatrick *et al.* 1988), otherwise it fits T1.2 (Jarman *et al.* 1984).
Rfr	regrowth rainforest	M-	
Rfi	implicate rainforest	M-	I1.1 (Jarman *et al.* 1984), when in with 'En', 'Es', or 'Ej' it best fits NIT 0 or SUB1001. Mapped with 'Ed' it correlates with DEL1010, DEL 1011 or DEL1111 (Kirkpatrick *et al.* 1988).
La	riparian Huon pine forest	H	T3.2 (Jarman *et al.* 1984)

***Wet sclerophyll forest understoreys*—4189 ha (26%)**

Po	*Pomaderris apetala* wet forest	NP when no eucalypt overstorey	Mapped with 'Erg' it is REG101, or REG1001. Mapped with 'Eob' may be OB0110 with *Olearia argophylla* and / or *Bedfordia salicina,* or 'Eob' without daisies may be OB1110 or OB0111
Wf	Wet forest shrubbery	no eq.	Mapped with 'Eob' it may be OB101 or OB0111 or *'Eucalyptus obliqua – Phebalium squameum – Bauera rubioides* wet sclerophyll forest' (OB3), or with Ej may be John1 (Duncan and Johnson 1995).
Mt	*Melaleuca squarrosa* wet forest	L when no eucalypt overstorey	F1, depauperate tea-tree scrub (Pannel 1992)
Lt	*Leptospermum lanigerum* wet forest	L when no eucalypt overstorey	F1, depauperate tea-tree scrub (Pannel 1992)
Av	*Acacia verticillata* wet forest	no eq.	Mapped with 'Eob' it is OB1110.
R	riverine shrubbery	no eq.	Not described elsewhere.

***Dry sclerophyll forest understoreys*—895 ha (5%)**

Tl	Tea-tree scrub (*Leptospermum scoparium*)	no eq.	5a Shrubby *E. obliqua* forest (Duncan and Brown 1985)
Wm	*Monotoca* shrubbery	no eq.	No equivalent previously described.

LOWLAND NON-FOREST VEGETATION

***Heath/scrub*—1676 ha (11%)**

Ht	*Aotus* heath	Hh	'Dry eastern heathy' (Jarman *et al.* 1988)
Aws	Acacia wet scrub	Sn	'Dry copses' (Jarman *et al.* 1988)
Bws	*Banksia* wet scrub and copses	Sn	'Wet copses' (Jarman *et al.* 1988)
Ma	*Melaleuca squarrosa* swamp / scrub	Sw	'Eastern woolly tea-tree' (Jarman *et al.* 1988)
L	short tea-tree scrub	Sw	'Layered blanket moor' (Jarman *et al.* 1988)

***Buttongrass moorland*—865 ha (5%)**

Bsq	buttongrass wet moorland	Bb	'Wet standard' (Jarman *et al.* 1988)
Bl	*Sporadanthus* wet moorland	Br	'Southwestern sedgey' (Jarman *et al.* 1988)
Ls	*Leptocarpus* swamp	Br	'Southwestern sedgey' (Jarman *et al.* 1988)
M	*Melaleuca squamea* shrubbery	Bm	'Layered blanket moor' (Jarman *et al.* 1988)
Bs	southwest blanket moorland	Bb	'Standard peat' (Jarman *et al.* 1988)

MISCELLANEOUS VEGETATION ATTRIBUTES—71 ha (< 1%)

B	buttongrass prominent in moorland
F	ferns prominent in the ground layer
Gh	cutting grass (*Gahnia grandis*) prominent
Ro	rocky or gravelly area
Z	cleared area
c'o	recently cut over
reg	regrowth, generally more than five years old
Z	man-made bare ground
F'd	fire damaged, some trees dead
[A]	A is dead

Appendix 2. Warra LTER Site plant census. (Abbreviations: e = endemic to Tasmania; r = listed on the schedules of the Threatened Species Protection Act 1995 *as rare; t = within Australia, occurs only in Tasmania; i = introduced weed species; H = a voucher specimen of this species is lodged at the Tasmanian Herbarium)*

Family and species	Status		Common name
DICOTYLEDONAE			
APIACEAE			
Aciphylla procumbens (F.Muell.) Benth.	e	H	Procumbent Aciphylla
Diplaspis cordifolia (Hook.) Hook.f.	e		Heart-leafed Diplaspis
Hydrocotyle hirta R.Br. ex A.Rich.			Hairy Pennywort
Hydrocotyle sibthorpioides Lamk.			Entire-leaf Pennywort
ARALIACEAE			
Pseudopanax gunnii (Hook.f.) Philipson	e	H	Native Ivy-bush
ASTERACEAE			
Abrotanella forsteroides (Hook.f.) Benth	e		Cushion Plant
Abrotanella scapigera (F.Muell.) Benth.	e		Cushion Plant
Bedfordia salicina (Labill.) DC.	e		Tasmanian Blanket Leaf
Celmisia asteliifolia Hook.f.	e		Silver Daisy
Cirsium vulgare (Savi) Ten.	i		Scotch Thistle
Erigeron stellatus (Hook.f.) W.M.Curtis	e		Star Fleabane
Ewartia catipes (DC.) P.Beauv.	e		Ewartia
Helichrysum pumilum Hook.f. var. *pumilum*		H	Tiny Alpine Everlasting
Hypochoeris radicata L.	i		Flat-weed
Olearia argophylla (Labill.) Benth.			Musk
Olearia ledifolia (DC.) Benth.	e		Orites Mountain Daisy Bush
Olearia persoonioides (DC.) Benth.	e		Geebung Daisy Bush
Olearia phlogopappa (Labill.) DC.			Dusty Daisy Bush
Olearia stellulata (Labill.) DC.			Daisy Bush
Ozothamnus ledifolius (DC.) Hook.f.	e		Mountain Everlasting
Ozothamnus rodwayi Orch. var. *rodwayi*	e		Rodway's Everlasting
Senecio biserratus Belcher			Groundsel
Senecio pectinatus DC.			Alpine Groundsel
BRASSICACEAE			
Cheesemania radicata (Hook.f.) O.E. Schulz	e	H	Mountain Cress
CARYOPHYLLACEAE			
Sagina procumbens L.	i		Procumbent Pearlwort
CUNONIACEAE			
Anodopetalum biglandulosum A.Cunn. ex Hook.f.	e	H	Horizontal
Bauera rubioides Andrews			Bauera; Wiry Bauera
DILLENIACEAE			
Hibbertia empetrifolia (DC.) Hoogl.			Scrambling Guinea-flower
DROSERACEAE			
Drosera arcturi Hook.			Alpine Sundew
ELAEOCARPACEAE			
Aristotelia peduncularis (Labill.) Hook.f.	e		Heart Berry

EPACRIDACEAE			
Archeria serpyllifolia Hook.f.	e		Stout Archeria
Cyathodes dealbata R.Br.	e		Prostrate Cheeseberry
Cyathodes glauca Labill.	e		Cheeseberry
Cyathodes juniperina (Forst.f.) Druce		H	Pink or Crimson Berry
Cyathodes parvifolia R.Br.	e		Pink Mountain Berry
Cyathodes straminea R.Br.	e		False-whorled Cheeseberry
Dracophyllum minimum F.Muell.	e		Heath Cushion Plant
Epacris impressa Labill.			Common Heath
Epacris lanuginosa Labill.			Swamp Heath
Epacris obtusifolia Smith			Blunt-leafed Heath
Epacris serpyllifolia R.Br.	e	H	Sinuous or Snake Heath
Leucopogon milliganii (F.Muell.) Rodway	e		Milligan's Beard-heath
Monotoca elliptica (Smith) R.Br.			Tree Broom-heath
Monotoca glauca (Labill.) Druce		H	Golden Wood
Monotoca linifolia (Rodway) W.M.Curtis	e	H	Nodding Monotoca
Monotoca submutica (Benth.) Jarman	e	H	Round-leaf Monotoca
Monotoca submutica var. *autumnalis* Jarman	e, r		Round-leaf Monotoca
Pentachondra involucrata R.Br.	e		Southern Endemic Pentachondra
Pentachondra pumila (Forst. & Forst.f.) R.Br.			Carpet Heath
Planocarpa petiolaris Weiller			Diode
Prionotes cerinthoides (Labill.) R.Br.	e	H	Climbing Heath
Richea dracophylla R.Br.	e		Dragon Heath
Richea milliganii (Hook.f.) F.Muell.	e		Milligan's Richea
Richea pandanifolia Hook.f.	e		Pandani; Giant Grass Tree
Richea pandanifolia x scoparia			
Richea procera (F.Muell.) F.Muell.	e		Lowland Richea
Richea scoparia Hook.f.	e		Scoparia
Richea sprengelioides (R.Br.) F.Muell.	e		Mountain-top Richea
Sprengelia incarnata Smith		H	Pink Swamp Heath
Sprengelia montana R.Br.			Mountain Sprengelia
Trochocarpa cunninghamii (DC.) W.M.Curtis	e		Straggling Trochocarpa
Trochocarpa disticha (R.Br.) Sprengel	e		Lune River Trochocarpa
Trochocarpa gunnii (Hook.f.) Benth.	e		Sweet-scented Trochocarpa
ERICACEAE			
Gaultheria hispida R.Br.			Snow Berry
ESCALLONIACEAE			
Anopterus glandulosus Labill.	e		Tasman Laurel
Tetracarpaea tasmanica Hook.f.	e	H	Tetracarpa
EUCRYPHIACEAE			
Eucryphia lucida (Labill.) Baill.	e	H	Leatherwood
Eucryphia milliganii Hook.f.	e		Dwarf Leatherwood
EUPHORBIACEAE			
Amperea xiphoclada (Sieber ex Sprengel) Druce			Broom Spurge
Beyeria viscosa (Labill.) Miq.			Pinkwood
FABACEAE			
Aotus ericoides (Vent.) G.Don			Golden Pea; Common Aotus
Daviesia ulicifolia Andrews			Native Gorse

Oxylobium ellipticum (Labill.) R.Br.		Golden Rosemary
Pultenaea daphnoides J.Wendl. var. *obcordata* (Andrews) Benth.		Native Daphne
Pultenaea juniperina Labill.		Prickly Beauty
Trifolium repens L.	i	White Clover
FAGACEAE		
Nothofagus cunninghamii (Hook.) Oersted		Myrtle Beech
GENTIANACEAE		
Centaurium erythraea Rafn	i	Common Centaury
Chionogentias sp.		Alpine Gentian
GERANIACEAE		
Geranium sp.		Native Geranium
Pelargonium australe Willd.		Wild Geranium
HALORAGACEAE		
Gonocarpus montanus (Hook.f.) Orch.		Common Alpine Raspwort
Gonocarpus teucrioides DC.		Raspwort
LAMIACEAE		
Prostanthera lasianthos Labill.		Christmas Bush
Prunella vulgaris L.	i	Self-heal
Westringia angustifolia R.Br.	e	Scabrous Westringia
LAURACEAE		
Cassytha pubescens R.Br.		Hairy Dodder-laurel
LOGANIACEAE		
Schizacme montana (Hook.f. ex Benth.) Dunlop		Mountain-herb
MIMOSACEAE		
Acacia dealbata Link		Silver Wattle
Acacia melanoxylon R.Br.		Blackwood
Acacia mucronata Willd. ex Wendl.f.		Variable Sallow Wattle
Acacia mucronata Willd. ex Wendl.f. var. *dependens* (A.Cunn. Ex Benth.) Hook.f.	e, r	Variable Sallow Wattle
Acacia riceana Henslow	e	Rice's Wattle
Acacia verniciflua A.Cunn.		Varnish Wattle
Acacia verticillata (L'Hérit.) Willd. var. *latifolia* DC.		Prickly mimosa
Acacia verticillata (L'Hérit.) Willd. var. *verticillata*		Prickly mimosa
MONIMIACEAE		
Atherosperma moschatum Labill.		Sassafras
MYRTACEAE		
Baeckea ramosissima A.Cunn.		Rosy Heath-myrtle
Callistemon pallidus (Bonpl.) DC.		Lemon Bottlebrush
Eucalyptus coccifera Hook.f.	e	Tasmanian Snow Gum
Eucalyptus delegatensis R.Baker subsp. *tasmaniensis* Boland	e	White-topped Stringy Bark

Eucalyptus delegatensis x obliqua			
Eucalyptus johnstonii Maiden	e		Tasmanian Yellow Gum
Eucalyptus nitida Hook.f.	e		Smithton Peppermint
Eucalyptus nitida x coccifera			
Eucalyptus obliqua L'Hérit.			Brown-top or Messmate Stringybark
Eucalyptus pulchella Desf.	e		White Peppermint
Eucalyptus regnans F.Muell.			Swamp Gum, Mountain Ash (Vic)
Eucalyptus subcrenulata Maiden & Blakely	e		Tasmanian Alpine Yellow Gum
Eucalyptus vernicosa Hook.f.	e		Varnished Gum
Leptospermum glaucescens S.Schauer	e	H	Semi-glaucous Tea-tree
Leptospermum lanigerum (Aiton) Smith		H	Woolly Tea-tree
Leptospermum nitidum Hook.f.	e		Shiny Tea-tree
Leptospermum riparium D.I.Morris	e	H	Riverine Tea-tree
Leptospermum rupestre Hook.f.	e		Mountain Tea-tree
Leptospermum scoparium Forst. & Forst.f.		H	Large Manuka
Melaleuca squamea Labill.			Swamp Melaleuca
Melaleuca squarrosa Donn ex Smith			Scented Paperbark
OLEACEAE			
Notelaea ligustrina Vent.			Native Olive
OXALIDACEAE			
Oxalis magellanica Forst.f.			White Wood Sorrel
PITTOSPORACEAE			
Billardiera longiflora Labill.			Climbing Blueberry
Pittosporum bicolor Hook.			Cheesewood
PRIMULACEAE			
Anagallis arvensis L.	i		Pimpernel
PROTEACEAE			
Agastachys odorata R.Br.	e		White Waratah
Banksia marginata Cav.			Silver Banksia
Bellendena montana R.Br.	e		Mountain Rocket
Cenarrhenes nitida Labill.	e		Native Plum; Port Arthur Plum
Hakea epiglottis Labill.	e	H	Beaked Hakea
Hakea lissosperma R.Br.			Needle Bush; Mountain Needlewood
Lomatia polymorpha R.Br.	e		Variable Guitar Plant
Lomatia tinctoria (Labill.) R.Br.	e		Guitar Plant
Orites acicularis (R.Br.) Roemer & Schultes	e		Yellow Bush
Orites diversifolia R.Br.	e	H	Variable Orites
Orites revoluta R.Br.	e		Narrow-leaf Orites
Persoonia gunnii Hook.f.	e		Gunn's Geebung
Persoonia gunnii Hook.f. var. *oblanceolata* Orch.	e, r	H	Gunn's Geebung
Persoonia muelleri (P.Parm.) Orch. var. *muelleri*	e		Mueller's Geebung
Telopea truncata (Labill.) R.Br.	e		Waratah
RANUNCULACEAE			
Clematis aristata R.Br. ex Ker Gawler			Australian Clematis
RHAMNACEAE			
Pomaderris apetala Labill.			Dogwood
Pomaderris elliptica Labill.			Yellow Dogwood

Appendix 2. Continued.

ROSACEAE			
Acaena novae-zelandiae Kirk			Buzzy; Biddy-widdy
Geum talbotianum W.M.Curtis	e, r		Mountain Geum
Rubus gunnianus Hook.	e		Alpine Raspberry
RUBIACEAE			
Asperula gunnii Hook.f.			Mountain Woodruff
Coprosma hirtella Labill.			Coffee-berry
Coprosma nitida Hook.f.			Mountain Currant Bush
Coprosma quadrifida (Labill.) Robinson			Native Currant
Galium australe DC.		H	Tangled Bedstraw
Nertera depressa Banks & Soland. ex Gaertner	?t		Cushion Nertera
RUTACEAE			
Boronia citriodora Gunn ex Hook.f.			Lemon-scented Boronia
Correa lawrenceana Hook. var. *lawrenceana*			Mountain Correa
Nematolepis squamea (Labill.) Paul G.Wilson subsp. *retusa* (Hook.) Paul. G.Wilson	e		Satinwood
Nematolepis squamea (Labill.) Paul G.Wilson subsp. *squamea*			Satinwood
Zieria arborescens Sims			Stinkwood
SANTALACEAE			
Exocarpos humifusus R.Br.	e		Mountain Native Cherry
SCROPHULARIACEAE			
Euphrasia gibbsiae subsp. *kingii* (W.M.Curtis) W.R.Barker	e	H	King's Eyebright
STYLIDIACEAE			
Stylidium graminifolium Swartz			Grass Trigger Plant
THYMELAEACEAE			
Pimelea cinerea R.Br.	e		Grey Pimelea
Pimelea drupacea Labill.		H	Cherry Rice-flower
Pimelea ligustrina Labill. subsp. *ligustrina*			Tall Rice-flower
Pimelea linifolia Smith subsp. *linifolia*			Slender Rice-flower
Pimelea sericea R.Br.	e		Silky Pimelea
URTICACEAE			
Urtica incisa Poiret			Nettle
VIOLACEAE			
Viola cleistogamoides (L.G.Adams) Seppelt			Cryptic Violet
Viola hederacea Labill.			Ivy-leaf Violet
WINTERACEAE			
Tasmannia lanceolata (Poiret) A.C.Smith			Mountain Pepper

MONOCOTYLEDONAE

CENTROLEPIDACEAE			
Gaimardia fitzgeraldii F.Muell. & Rodway	e	H	Fitzgerald's Gaimard
CYPERACEAE			
Baumea tetragona (Labill.) S.T.Blake			Square Twig-rush
Carpha alpina R.Br.		H	Small Flower-rush
Gahnia grandis (Labill.) S.T.Blake			Cutting Grass
Gahnia rodwayi F.Muell. ex Rodway	e, r		Rodway's Saw-sedge
Gymnoschoenus sphaerocephalus (R.Br.) Hook.f.			Buttongrass
Isolepis wakefieldiana (S.T.Blake) K.L.Wilson			Club-rush
Lepidosperma concavum R.Br.			Sand or Hill Sword-sedge
Lepidosperma elatius Labill.			Tall Sword-sedge
Lepidosperma ensiforme (Rodway) D.I.Morris			Two Handed Sword
Lepidosperma inops F.Muell. ex Rodway	e	H	Fan Sedge
Lepidosperma laterale R.Br.			Broad Sword-sedge
Oreobolus sp.			Tuft-rush
Schoenus apogon Roemer & Schultes			Common or Fluke Bog-rush
Schoenus pygmaeus S.T.Blake	e	H	Pygmy Bog-rush
Tetraria capillaris (F.Muell.) J.Black			Hair-sedge; Bristle Twig-rush
Uncinia compacta R.Br.		H	Compact Hook-sedge
Uncinia flaccida S.T.Blake			Mountain Hook-sedge
Uncinia tenella R.Br.			Delicate Hook-sedge
IRIDACEAE			
Libertia pulchella Sprengel			Pretty Grass-flag
Patersonia fragilis (Labill.) Aschers & Graebner			Blue Iris; Short Purple-flag Iris
JUNCACEAE			
Juncus planifolius R.Br.			Broad-leaf Rush
LILIACEAE			
Astelia alpina R.Br. var. *alpina*	e		Pineapple Grass
Dianella tasmanica Hook.f.			Tasman Flax-lily
Drymophila cyanocarpa R.Br.			Turquoise Berry
Milligania densiflora Hook.f.	e		Cluster-leaf Milligania
ORCHIDACEAE			
Acianthus caudatus R.Br.			Mayfly Orchid
Acianthus pusillus D.L.Jones			Mosquito Orchid
Chiloglottis cornuta Hook.f.			Green Bird Orchid
Corybas aconitiflorus Salisb.			Spurred Helmet Orchid
Corybas diemenicus (Lindley) Reichb.f.			Stately Helmet Orchid
Gastrodia procera G.W.Carr			Tall Potato Orchid
Pterostylis melagramma D.L.Jones			Black-stripe Greenhood
Pterostylis nutans R.Br.			Nodding Greenhood
Pterostylis pedunculata R.Br.			Maroonhood
Townsonia viridis (Hook.f.) Schlechter	t		Beech Orchid
POACEAE			
Agrostis parviflora R.Br.			Hair Bent Grass

Deyeuxia sp.			Bent Grass
Ehrharta tasmanica (Hook.f.) Willemse	e	H	Tasmanian Wire-grass
Hierochloe fraseri Hook.f.	e		Fraser's Holy-grass
Holcus lanatus L.	i		Yorkshire Fog-grass
Poa annua L.	i		Wintergrass
Poa gunnii Vick.	e	H	Tussock Grass
Rytidosperma fortunae-hibernae (Renvoize) Connor & Edgar		H	Luck of the Irish

RESTIONACEAE

Baloskion tetraphyllum (Labill.) B.Briggs & L.Johnson			Tassel Cord-rush
Calorophus elongatus Labill.			Long Rope-rush
Empodisma minus (Hook.f.) L.Johnson & Cutler		H	Spreading Rope-rush
Eurychorda complanata (R.Br.) B.Briggs & L.Johnson			Flat Cord-rush
Sporadanthus tasmanicus (Hook.f.) B.Briggs & L.Johnson			Branching Scale-rush

GYMNOSPERMAE

CUPRESSACEAE

Athrotaxis selaginoides D.Don	e		King William (Billy) Pine
Diselma archeri Hook.f.	e	H	Cheshunt Pine

PINACEAE

Pinus sp.	i		

PODOCARPACEAE

Lagarostrobos franklinii (Hook.f.) Quinn	e	H	Huon Pine
Phyllocladus aspleniifolius (Labill.) Rich. ex Hook.f.	e	H	Celery-top Pine
Podocarpus lawrencei Hook.f.		H	Mountain Plum Pine; Plum Pine

PTERIDIOPHYTA

ASPLENIACEAE

Asplenium appendiculatum (Labill.) C.Presl. subsp. *appendiculatum*			Ground Spleenwort
Asplenium bulbiferum Forst.f.			Hen and Chicken Fern
Asplenium flabellifolium Cav.		H	Necklace Fern
Asplenium flaccidum Forst.f.			Weeping Spleenwort

BLECHNACEAE

Blechnum chambersii Tind.			Lance Water-fern
Blechnum fluviatile (R.Br.) E.J.Löwe ex Salomon			Ray Water-fern
Blechnum nudum (Labill.) Mett. ex Luerss.			Fishbone Water-fern; Black-stem
Blechnum vulcanicum (Blume) Kuhn			Wedge Water-fern
Blechnum wattsii Tind.			Hard Water-fern

CYATHEACEAE

Cyathea australis (R.Br.) Domin			Rough Tree-fern

DENNSTAEDTIACEAE			
Histiopteris incisa (Thunb.) J.Smith			Bat's Wing
Hypolepis rugosula (Labill.) J.Smith			Ruddy Ground-fern
Pteridium esculentum (Forst.f.) Cockayne			Bracken; Austral Bracken
DICKSONIACEAE			
Dicksonia antarctica Labill.			Tree-fern; Soft Tree-fern
DRYOPTERIDACEAE			
Polystichum proliferum (R.Br.) C.Presl			Mother Shield-fern
Rumohra adiantiformis (Forst.f.) Ching			Leathery Shield-fern; Shield Hare's-foot
GLEICHENIACEAE			
Gleichenia alpina R.Br.	t		Alpine Coral-fern
Gleichenia dicarpa R.Br.			Pouched Coral-fern
Gleichenia microphylla R.Br.			Scrambling Coral-fern
Sticherus lobatus Wakef.			Spreading Fan-fern
Sticherus tener (R.Br.) Ching			Silky Fan-fern
GRAMMITIDACEAE			
Ctenopteris heterophylla (Labill.) Tind.		H	Gipsy-fern
Grammitis billardierei Willd.		H	Finger-fern
Grammitis magellanica Desv. subsp. *nothofageti* Parris		H	Beech Finger-fern
Grammitis pseudociliata Parris	t	H	Hairy Finger-fern
HYMENOPHYLLACEAE			
Crepidomanes venosum (R.Br.) Copel.			Veined Bristle-fern
Hymenophyllum australe Willd.			Austral Filmy-fern
Hymenophyllum cupressiforme Labill.			Common Filmy-fern
Hymenophyllum flabellatum Labill.			Shiny Filmy-fern
Hymenophyllum marginatum Hook. & Grev.		H	Bordered Filmy-fern
Hymenophyllum peltatum (Poiret) Desv.			Alpine Filmy-fern
Hymenophyllum rarum R.Br.			Narrow Filmy-fern
Sphaerocionium applanatum (A.M.Gray & R.G.Williams) K.Iwats	e		Skeleton Filmy-fern
LYCOPODIACEAE			
Huperzia australiana (Herter) Holub			Fir Clubmoss
Lycopodiella diffusa (R.Br.) B.Øllg.	t	H	Buttongrass Clubmoss
POLYPODIACEAE			
Microsorum pustulatum (Forst.f.) Copel.			Kangaroo Fern
PSILOTACEAE			
Tmesipteris elongata Dangeard			Rounded Fork-fern
Tmesipteris obliqua Chinnock		H	Long Fork-fern
SCHIZAEACEAE			
Schizaea fistulosa Labill.			Narrow Comb-fern

Appendix 3. ANZLIC metadata for WHA vegetation maps.

Unique Id	ANZTA0015000015
Title	World Heritage Area Vegetation Mapping
Custodian	Resource Management and Conservation
Jurisdiction	Tasmania

Description

Abstract	The World Heritage Area dataset was created to map priority vegetation in the Tasmanian World Heritage Area. The coverage extends across the entire World Heritage Area. Polygon data are taken from aerial photograph interpretation and field checking for all vegetation types in the World Heritage Area. Combinations of understorey and canopy species are mapped, including mosaics between communities. It is a stand-alone dataset. Classification is based on structure as well as floristics of the vegetation.
Search Word(s)	VEGETATION
Geographic Extent	Tasmanian World Heritage Area

Dataset Currency

Beginning Date	1989-01-30
Anticipated End Date	June 30 2001
Dataset Status	In Progress
Maintenance and Update	As Required

Dataset Access

Stored Data Format(s)	Digital - ESRI shapefiles, Spatial Database Engine (SDE) Digital - MapInfo TAB files Digital - MapInfo TAB files
Available Format Type(s)	Digital - Genamap coverage Non-digital - Printed matter Digital - Arc view shape files
Access Constraints	Access to World Heritage Vegetation Mapping data is restricted. Maps are publicly available only on request and with permission may be accessed over the internet.

Data Quality

Lineage	Aerial photographic interpretation is the principal data-collection method. 1:25 000 scale aerial photographs taken in 1988 are used for interpretation. Aerial photograph interpretation is transcribed onto transparent sheets and transferred onto topographic base maps then scanned and converted into Genamap for labelling.
Positional Accuracy	15 metres

Appendix 3. Continued

Attribute Accuracy	Attribute accuracy is variable. Field verification leads to more detailed classification in some areas. No determination of the accuracy has been objectively undertaken.
Logical Consistency	World Heritage data are stored digitally and tests for logistical consistency are carried out automatically using geographic information system software (Genamap). The custom-made interface highlights where lines are not joined and where polygons are not tagged. A check of the whole map for logistical consistency is also run through the geographic information system software. Maps are checked so they meet across boundaries.
Completeness	Line work has been completed for the entire WHA. About 20 sheets in the Southwest National Park remain to be digitised and entered into the GIS. The completed areas include Cradle Mountain – Lake St Clair, Central Plateau, Frenchmans Cap, Mount Anne – Scotts Peak Road, Melaleuca / Cox Bight and the eastern boundary of the World Heritage Area including the Warra LTER Site. Attribute data are not available for the incomplete map sheets. The adopted classification method is not exhaustive due to the huge variation in available mapping units. The detailed classification method limits generalisations of represented features. There is no minimum area of width rule and all lakes are included. Lines are not smoothed for presentation. Field verification is extensive.

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