Mapping the vegetation of Hobart:

The application of synusiae-based analysis for the purpose of conservation management

by

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Statement

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university, and to the best of the author's knowledge and belief this thesis contains no copy or paraphrase of material previously published or written by other persons except when due reference is made in the text of the thesis.

Abstract

The utility of synusiae-based mapping has been demonstrated for conservation management in the Tasmanian World Heritage Area. To test its usefulness in a peri-urban environment, the Municipality of Hobart was chosen. Hobart contains substantial areas of remnant bushland. In total 4100 ha or 53% of the city is remnant bushland. The bushland areas are owned by government or quasi-government authorities or are privately held. Management of these areas is largely restricted to fuel-reduction burning with the aim of protecting lives and property from major bushfires.

The vegetation of Hobart was mapped using this synusiae-based approach with the aid of a Geographic Information System. Plant communities, identified using aerial photographs and ground surveys, were divided into one to four layers. Each layer corresponds to one or an association of two synusiae. Maps were created using a system of notation which readily identifies the communities present on the basis of the synusiae present. The dominant or tallest stratum/synusia(e) was always included. Synusiae present in other strata were only identified if their cover was significant. A total of twenty-three synusiae for the dominant layer were identified based on structural tree/shrub forms, growth forms or according to their situation (that is, environmental parameters or species associations). The second stratum was seldom significant and was simply coded according to the tree species. The understorey (third stratum) was identified according to either a synusiae based on a growth forms or their situation. Six of these were identified. The ground layer (forth stratum) was coded according to synusiae based on growth form and/or an additional code describing the surface features.

A total of 600 communities were distinguished using this system of notation. For analysis, communities were grouped according to the dominant synusiae and if appropriate either the understorey or ground layer synusiae. This resulting 84 'mapping units' were then grouped again according to their dominant strata synusia(e) and/or their location in Hobart. Each group formed a separate map. Mapping units were then analysed according to environmental parameters (aspect, slope, altitude and geological substrate), fire history and land tenure. This information was used to make recommendations for future conservation management, with particular emphasis on fire management practices. Each mapping unit was also classified according to pre-existing vegetation classifications. The conservation status of some of these communities was upgraded as a result of this work. Nine communities of high conservation value were identified, mapped and described. Recommendations are made for their future management and preservation.

In addition to the synusiae-based analysis mentioned above a list of 59 rare or threatened species was tabulated and mapped from existing sources. Of these 16 are also unreserved (that is, not known to exist in a secure reserve in Tasmania). These are included only to further highlight the significance of bushland areas in Hobart.

General recommendations for future management of the bushland areas include the establishing of buffer zones and vegetation corridors to protect areas of high conservation value and areas of bushland where rare or threatened plants are present. Other recommendations include the preservation of bushland areas with centres more than 400 m from the nearest urban development. Amendments to the Hobart Planning Scheme or State Government legislation and greater cooperation between various authorities may be necessary to implement these recommendations. The maps prepared are an important database which can be used by both managers and planners to preserve the integrity of the bushland in Hobart.

Acknowledgments

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Chapter 1 Introduction

1.1 Importance of mapped data for vegetation management

Vegetation maps are widely recognised as an important means to record the geographic distribution of vegetation types (eg. Mueller-Dombois and Ellenberg 1974, Muir 1983, Orchard 1988, Zonneveld 1988a). When used in conjunction with floristic surveys they can represent "the meeting ground of ... systemic classification (of the vegetation)[1] and the mosaic arrangement of plants in the field" (Neldner 1993:1). Maps not only describe vegetation types, but also illustrate the spatial form of individual units or the overall patterns they create (Zonneveld 1988a). Vegetation maps are also an important means to compile information in a resource inventory which can be is used by land managers and planners (Muir 1983, Park 1983, Kirkpatrick and Dickinson 1986, Zonneveld 1988a, Neldner 1993). Applications include land-use planning, research and teaching, recreational planning and nature conservation (Neldner 1993, Zonneveld 1988a).

The scale and required resolution of a map are generally determined after considering the needs of the user, technical feasibility and economic factors Small-scale vegetation maps (1:250000 or smaller) are used for national or regional resource inventories. A large proportion of Australian vegetation has been mapped at this scale (Kirkpatrick and Dickinson 1986). Large-scale vegetation maps (1:100000 or larger) are used for a variety of purposes including municipal planning, forestry and conservation management. The complexity of vegetation patterning often requires sighting large-scale maps since variations in the vegetation would not be detected at smaller scales (Kirkpatrick and Dickinson 1986).

Vegetation maps when used in conjunction with other land attributes are good indicators of the resource potential of the land, past land-use and changes in the environment on a macro and micro scale (Neldner 1993). Vegetation maps are also important tools for strategic and regional planning, property planning, infrastructure planning and development control (Zonneveld 1988a, Neldner 1993).

Schools and centres of higher learning use land resource information as a basis for field studies and research. Vegetation maps are useful not only for systemic studies but also in the understanding of the relationship between the vegetation and its surrounding environment (Neldner 1993).

Vegetation maps, used alone or in conjunction with other forms of land information are useful for identifying and managing important plant communities, habitats and natural

[1] Punctuation added by author

landscapes (Park 1983, Pressey and Bedward 1991), including the location of significant plant species and communities. They are an essential first step in the formation of a management plan for conservation reserves and provide a basis for the planning of any disturbance within a reserve such as visitor access, tracks, fire breaks and burning strategies. Short and long-term fire planning is aided greatly by large-scale vegetation maps (Kirkpatrick 1990).

1.2 Place of GIS in vegetation management

Geographic information can be defined as "information about the state of affairs (conditions, circumstances) the properties and the mutual relations of factors relating to a geographic area" (Berg 1985 cited in van der Zee and Huizing 1988:163). A geographic information system (GIS) is a system which allows the processing of this information, including compilation, storage, retrieval, transformation, integration, analysis and display of the information (Zee and Huizing 1988). Information can be assembled in an infinite number of layers and the subsequent maps produced are a compilation of a selection of these layers. The main advantage of GIS is that it allows easy manipulation of graphic and non-graphic (attributes) information. It is also easy to merge or extract information from various layers. The main disadvantage is that unless one repeatedly needs the features a GIS offers, the initial digitising process can be overly time-consuming. Thus, in the case where one only needs a simple or single one-off map, conventional methods still have merit.

GIS technology has greatly increased the interpretive use of vegetation maps, since these maps can easily be overlain on other environmental parameters such as topography, geology and soil (Neldner 1993). Further, once an area is digitised changes in vegetation patterns and composition can be easily observed over time (Gullan 1991).

Geographic Information Systems are an important tool for land managers and planners. This technology has been adopted by many government and quasi-government authorities including those in Tasmania. Their role in natural resource management is primarily to aid in the making of spatial decisions, such as the location of new roads. They can also be used to aid in the collection of data or attributes for resource inventories. This role later includes:

- Aid in the design and selection of sampling strategies
- The modelling and mapping of species distributions in terms of known or surveyed environmental variables
- The systemic use of information for decision making purposes

(Cocks and Baird 1991:74)

1.3 Synusiae mapping

The term synusia (plural being synusiae) was introduced by Gams in 1918. He defined it as "a group of plants of one or several related life forms[2], growing under similar environmental conditions" (cited in Küchler 1988:17). Plant communities may be considered in layers and the synusiae often correspond to these layers. The terms synusia and stratum (layer) are often synonymous, since the various vegetation layers can often be distinguished with the help of life forms (Zonneveld 1988b).

Plant communities can be divided into a number of synusiae, depending on the criteria which define each synusia. Criteria may be based on structure, morphology, function or situation (Kirkpatrick 1990). The synusia concept has some distinct advantages over other methods or systems of plant classification, since the combination of synusiae can portray a clear picture of the community including its habitat preferences (Mueller-Dombois and Ellenberg 1974).

Large-scale vegetation mapping based on synusiae can be useful for the conservation management of native vegetation. This approach has been used to map part of the Tasmanian World Heritage Area (Kirkpatrick 1990), highlighting vegetation patterns which in turn reflect past disturbances including management practices. Synusiae-based mapping lends itself to easy computation and manipulation with the features inherent in a GIS.

1.4 Purpose and overview of thesis

This thesis has sought to test the usefulness of synusiae-based mapping in an peri-urban environment. The Municipality of Hobart was chosen since it contains both urban areas and substantial areas of remnant bushland. The bushland areas reflect both past and present disturbances, including effects from urban encroachment and fires. Many of these fires are a result of a deliberate policy to reduce fuel loads with the aim of protecting people and property from severe bushfires. The effects of these fires on the vegetation and species diversity has only been a minor consideration in most areas.

A synusiae-based approach to mapping these bushland areas highlights vegetation patterns attributable to these disturbances and allows them to be analysed easily. This approach can also identify areas of high conservation value. The resulting maps and accompanying attributes, aided by the features of a GIS, form an important database

[2] Life form: "growth form which displays an obvious relationship to important environmental factors" (Mueller-Dumbois and Ellenberg 1974:142)

which can be used for the future research and management of this area. This includes appropriate fire regimes and recommending areas which should be conserved. To further highlight the significance of bushland areas in Hobart the location(s) of rare or threatened plant species have also been mapped.

The thesis has the following components:

1) Review of the study area (Hobart) (Chapter 2)

2) The design of a notation system which can best represent the vegetation structure and form (Chapter 3)

3) Map individual vegetation types using this notational system
Compile a spreadsheet of attributes and describe the highlights in a paragraph form (Chapter 4)

4) Recommend fire regimes and other management options for the various vegetation types (Chapter 5)

5) Identify communities of high conservation value and map their location(s) (Chapter 6)

6) Identify and map rare or threatened plant species which are known, or were known to occur in Hobart (Chapter 7)

7) Discuss the implications of the above with regard to future management and planning in Hobart, and how the maps can be used to aid in these processes (Chapter 8).

Chapter 2 The study area

2.1 Physical description

2.1.1 Overview

The Municipality of Hobart (hereafter referred to as Hobart) is located on the western shore of the Derwent River in southern Tasmania and occupies a total area of 7700 ha (Bureau of Statistics 1991). It includes the City of Hobart (capital of Tasmania), some of the surrounding suburbs and a large area of remnant bush on the summit and eastern slopes of Mt. Wellington (Figure 2.1).

The elevation ranges from sea level to 1271 m on Mt. Wellington, which dominates the visual landscape of the entire region. The summit is only 8 km from the River Derwent. Houses are situated on the slopes and ridgetops of some of the foothills which surround the central business district, and extend to Fern Tree at an altitude of 500 m. As there remain no significant areas of cleared land, any future urban development within Hobart will almost inevitably be at the expense of bushland.

2.1.2 Land tenure of bushland

A large proportion of Hobart, approximately 4100 ha, or 53%, is remnant bushland. Of this 2600 ha is owned and managed by a number of government and quasi- government agencies (see Figure 2.2) and the remaining 1500 ha is private land. The Hobart City Council's (HCC) land includes a number of reserves - Mountain Park, Ridgeway Park and Knocklofty Park, the land set aside for the Hobart water supply[1] and the Queens Domain (2200 ha). Until recently this land was administered and managed either by the City Engineer's Department (eg. Mountain Park) or the Parks and Recreation Department (eg. Queens Domain). Since restructuring in early 1994, the Parks and Community Services Division have assumed responsibility for all HCC reserves.. The State Government is responsible for the Crown Reserves - Truganini Reserve and the adjacent Mt. Nelson Signal Station Reserve, some land adjacent to Hobart College and the areas set aside for the Hydro-Electric Commission. The University of Tasmania owns and manages the University Reserve. A large portion of the private land is held by corporate

[1] Mountain Park and the land set aside for the Hobart water supply are part of the larger Wellington Park (see Section 2.4.2)

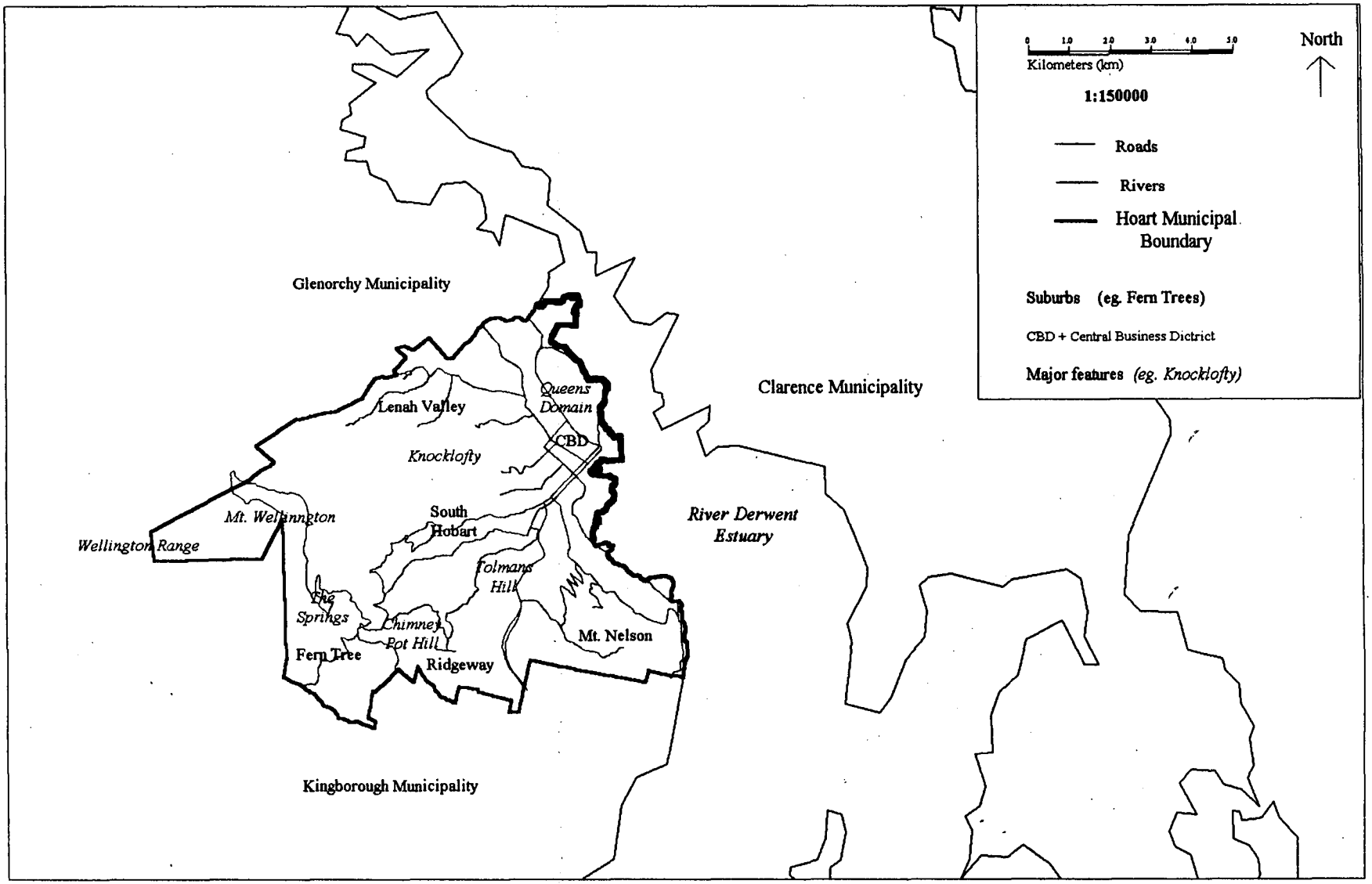

Figure 2.1: Locality map of Hobart Municipality, including some suburbs and major land features

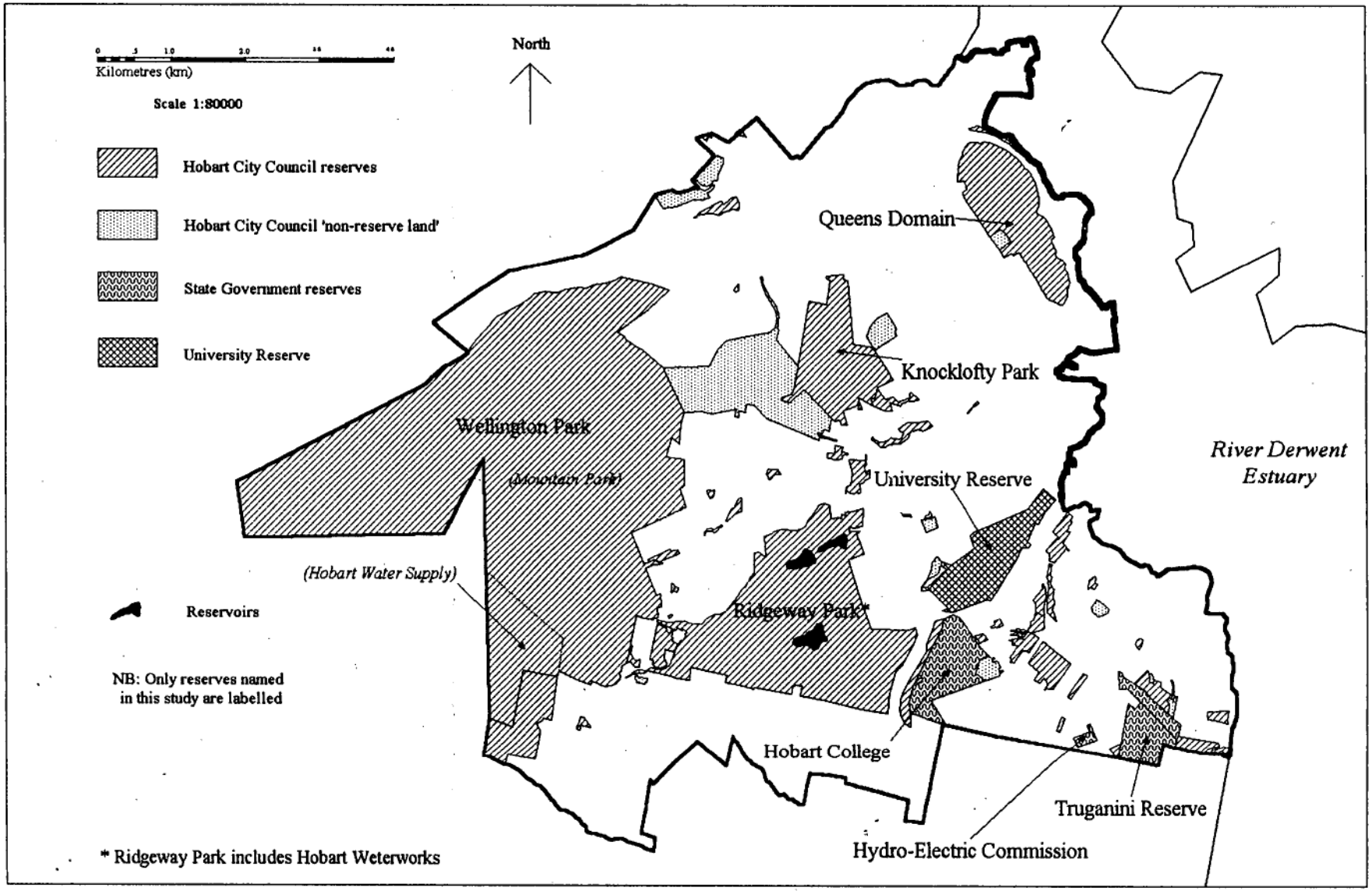

Figure 2.2: Location of major reserves in Hobart

interests. Cascades Brewery owns large tracts of bushland adjacent or near to its brewery in South Hobart. Prior to the establishment of Mountain Park, this company owned most of the land from South Hobart to the Mt. Wellington summit plateau.

2.1.3 Climate

Tasmania has a temperate maritime climate with cool winters and mild to warm summers. The climate of Hobart is not uniform, being determined by its altitude, aspect and its proximity to Mt. Wellington. According to the Thornthwaite classification, Hobart has three climatic zones: moist subhumid cool (foothills); humid cool (lower slopes of Mt. Wellington); and perhumid (alpine areas) (Gentilli 1972).

The mean monthly maximum and minimum temperatures vary greatly from sea level to the summit of Mt. Wellington (Table 2.1). At the Hobart Regional Forecasting Centre (RFC) the mean monthly minimum ranges from 5°C to 12°C and the mean monthly maximum from 11°C to 22°C. By contrast on the summit of Mt. Wellington the mean monthly minimum ranges from -2°C to 5°C and mean monthly maximum ranges from 2°C to 13°C. The lapse rate for the maximum temperature on Mt Wellington is 0.75°C/100 m and 0.50°C/100 m for the minimum temperature, yielding a daily mean lapse rate of 0.63°C/100 m (Nunez and Colhoun 1986:12).

Table 2.1: Comparison of the mean monthly Max/Min temperatures (°C) for central Hobart and the Mt. Wellington summit

Station (Period)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hobart RFC (1883 to 1993)	21/12	22/12	20/11	17/9	14/7	12/5	11/5	13/5	15/6	17/8	19/9	20/11
Mt Wellington summit (1961 to 1972)	13/4	13/5	11/4	8/2	5/0	3/-1	2/-2	2/-2	4/-2	7/0	8/1	11/3

(Bureau of Meteorology unpublished data)

Precipitation in Hobart is largely associated with south-west to south-easterly winds (Bureau of Meteorology 1979:45). The average yearly rainfall varies from 574 mm at the Queens Domain (near the River Derwent) to 1371 mm at The Springs a site on the upper slopes of Mt. Wellington. The wettest month is generally October when a average of 132 mm falls at The Springs and 56 mm on the Queens Domain. February is the driest month with an average of 39 mm recorded at the Queens Domain, and 85 mm recorded at The Springs. Table 2.2 lists the rainfall for all rainfall stations in and around Hobart and Figure 2.3 shows the general rainfall pattern around Hobart.

Table 2.2: Mean monthly and annual rainfall readings for Hobart rainfall stations

Station (period)	Elevation (m)	Mean Rainfall (mm)												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Queens Domain (1841 to 1993)	27	44	39	44	47	44	51	50	46	48	56	55	52	574
Hobart RFC (1882 to 1993)	55	48	39	46	52	48	56	54	52	52	63	55	58	624
Lenah Valley (1891 to 1993)	100	48	41	49	56	51	58	58	55	54	66	54	62	653
Mt Nelson (1871 to 1975)	335	52	46	52	57	55	61	52	49	49	66	64	62	666
Waterworks (1897 to 1993)	160	59	52	59	72	66	72	76	69	73	88	73	78	838
Strickland Ave.[2] (1961 to 1993)	280	63	55	67	70	72	70	105	95	86	87	83	88	949
Fern Tree (1967 to 1993)	457	84	72	90	81	95	80	114	109	94	113	117	116	1166
The Springs (1891 to 1993)	720	99	85	105	114	110	124	117	108	111	132	123	126	1371
Mt. Wellington summit[3]	1271													
Glenorchy Res* (1898 to 1993)	93	47	43	50	61	55	63	69	65	64	75	61	63	716
Taroona** (1961 to 1993)	37	48	47	52	47	49	42	61	61	51	60	61	68	655

* Glenorchy Municipality (northerly adjacent)

** Kingborough Municipality (southerly adjacent)

(Bureau of Meteorology unpublished data)

Snow is common on the summit and upper slopes of Mt. Wellington (above 1000 m), settling in winter for lengthy periods of time. Occasional flurries extending to the lower slopes and in rare instances snow falls at sea level. In the 20 year period from 1952 to 1971, snow settled below 500 m for a total of 125 days. For this same period of time, snow was recorded only 10 times at 150 m, settling close to sea level only 3 times (Bureau of Meteorology 1979). Table 2.3 indicates the average number of snow days for the summit of Mt. Wellington.

2 in South Hobart

3 Rainfall figures available for the summit of Mt. Wellington are known to be inaccurate (Bureau of Meteorology Staff pers comm.) and therefore have not been considered. The automatic weather station on the summit can not adequately record the weather conditions encounter, especially when the precipitation is in the form of snow or freezing rain. Trials using different rain gauges have demonstrated that the standard rain gauge has significantly underestimated the rainfall (Morris 1990).

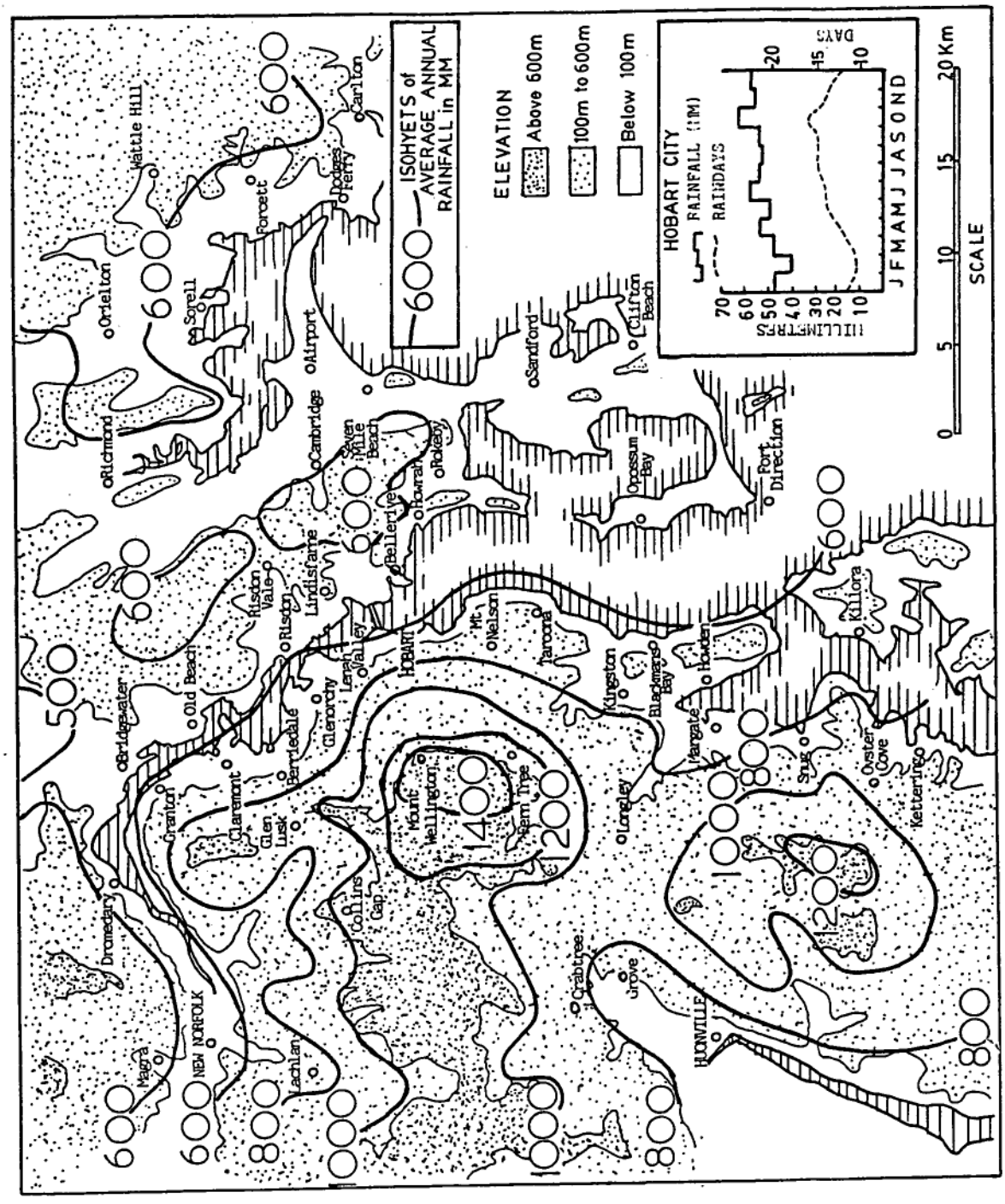

Figure 2.3: General rainfall pattern around Hobart (Bureau of Meteorology 1986)

Table 2.3: Average number of snow days per month on Mt. Wellington summit for a period 1967 to 1972

Station (period)	Snow days												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mt. Wellington summit (1961 to 1972)	2	1	2	3	6	6	8	9	9	7	6	3	62

(Gilfedder 1985:9)

At the Hobart RFC frosts occur generally between May and September, with heavy frosts concentrated in June. The frost period at The Springs is longer, usually in the period between February and December, with heavy frosts between April and November (Bureau of Meteorology 1979:21). Table 2.4 shows the estimated number of frost days on Mt. Wellington and the average number of frost days in central Hobart. In urban Hobart, frosts tend to be more common in valleys which funnel cold air down from the mountain at night.

Table 2.4: Average number of frost days per month on Mt. Wellington summit for a period 1961 to 1972

Station (period)	Frost days												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mt. Wellington summit (1961 to 1972)	3	2	2	5	10	13	12	13	13	10	7	7	97

(Gilfedder 1985:9)

The wind direction in Hobart is predominantly from the north-west with sea breezes from October to April (Bureau of Meteorology 1979:67). On the summit of Mt. Wellington, the deformation of *Eucalyptus coccifera*[4] indicates that the strong winds are predominantly from the south-west (Gilfedder 1985).

North to north-west aspects are the driest and warmest due to the combined effects of the drier north west winds and solar radiation (Nunez 1980). Martin (1940:100) has adequately summarised the 'exposure' of Mt. Wellington as follows:

> "The top and west sides of the summit of Mt. Wellington ... and its foothills receive maximum sunlight and experience maximum evaporation. The summit ridges experience also lowest temperature and maximum wind. The steep eastern face loses direst sunlight before mid-day in winter, while the shadow of the mountain covers most of the S.E. slope early in the afternoon."

[4] Species nomenclature in this thesis follows Buchanan *et al.* (1989)

Table 2.5 shows the variation in maximum solar radiation on Mt. Wellington, estimated along the horizontal (from Nunez 1983).

Table 2.5: Maximum solar radiation on Mt. Wellington in December and June

Slope	Max. solar radiation on a horizontal surface (M J m^{-2} day^{-1}) December	June
North facing slope	22.0	9.0
South-facing slope	9.0	2.3

(Nunez 1983)

2.1.3 Geology and soils

The geology of Hobart has been mapped by Leaman (1972) and described by Leaman (1976). Major rock types include Jurassic dolerite, Triassic quartz sandstones and Permian mudstones and siltstones. Other substrata include Tertiary basalt and Quaternary deposits such as dolerite talus and alluvial deposits. The geology and geomorphology of Mt. Wellington has most recently been summarised by Two Hundred and Eight Network (1994a).

The soils of Hobart have been mapped and described by Loveday (1955) and Davies (1987), and summarised by Martin (1940) and Two Hundred and Eight Network (1994a). In general, podzols and podzolic soils are found on the sandstone substrates, including the sandstone benches below Mt. Wellington, such as The Springs, and parts of the Waterworks Reserve and Knocklofty Park. Podzolic soils occur on dolerite and the lower mudstone slopes of Mt. Wellington . On dolerite these soils are generally limited to areas of high rainfall (greater than 625 mm) such as the summit and upper slopes of Mt. Wellington and the south facing or protected slopes and gullies of Mt. Nelson and Ridgeway. Black soils are found on dolerite where the annual rainfall is typically less than 625 mm. These include the exposed slopes and ridges of Mt. Nelson, Knocklofty and Ridgeway (Loveday 1955). Peat occurs on the alluvial deposits in the drainage depressions of the Mt. Wellington plateau, such as the headwaters of North West Bay River (Davies 1987).

A detailed summary of some of the physical and biological characteristics, including the rainfall, geology, topography, soils and vegetation, can be found in Davies (1987).

2.2 The vegetation of Hobart

2.2.1 Introduction

Historically the vegetation of Hobart attracted both botanists and timber millers. When Hobart Town was founded by Collins in 1804, a member of the party was the eminent botanist Robert Brown. During his nine month stay in Hobart, Brown collected a number of specimens mostly from Mt. Wellington (Stearn 1960). This collection is described in *Prodromus Florae Novae Hollandiae et insulae Van Diemen* (Brown 1960). Many other botanists and naturalists were subsequently attracted to Hobart and Mt. Wellington, including Joseph Hooker who published *Flora Tasmaniae* in 1860 (de Quincey 1987).

The timber industry was very productive in the nineteenth century. Land close to Hobart was cleared and buildings constructed. The mountain was a major source of timber. In 1855, it was estimated that timber collected from the slopes of Mt. Wellington made a profit of £30,000 for the owners of a timber mill at Cascades[5] (Aves 1955:42). By 1906, when Mountain Park was proclaimed (see Section 2.4.2) all the millable timber had been removed from the lower slopes (Martin 1940).

2.2.2 Species

The flora of Hobart is well documented. Following the initial surveys by botanists such as Brown and Hooker, floristic surveys in twentieth century tended to concentrate on specific areas. For example, Gibbs (1920) studied the phytogeography and flora of various summit plateaus including Mt. Wellington. The first complete survey of the Wellington Range was by Martin (1940) who published a list of the vascular species and their abundance in various 'zones' on the mountain. Ratkowsky and Ratkowsky (1976) repeated Martin's study and extended the study area to include the foothills of Mt. Wellington such as Chimney Pot Hill, Knocklofty and Tolmans Hill. This study, between 1973 and 1975, was initiated to determine what effect (if any) the 1967 bushfires had on the flora of this region. A summary of this study concluded that of the 487 species found by Martin only 6.0% showed a significant change in their abundance 6 to 8 years after the fire (Ratkowsky and Ratkowsky 1982a). However, it should not be concluded that the huge fires of 1967 have had little effect on the structure of the vegetation.

Field guides of Mt. Wellington, such as Curtis (1966) and Collier (1988) also illustrate the common species of this region. A list of some Tasmanian endemic species found on Mt. Wellington and its foothills can be found in Brown *et al.* (1983) and Kirkpatrick and Brown (1984).

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5 Cascades is now part of South Hobart

The non-vascular flora of Mt. Wellington has also been described. Ratkowsky and Ratkowsky (1982b) studied the bryophytes and Ratkowsky *et al.* (1989) studied the macrolichens.

The genecology of two eucalypt species found in Hobart have been the topic of past studies. Variations in the *Eucalyptus urnigera* populations on Mt. Wellington are well documented (Barber and Jackson 1957, Thomas and Barber 1974a, 1974b, Savva *et al.* 1988) and the *E. cordata* [6] population on Chimney Pot Hill has been compared to other populations in Tasmania (Potts 1989).

The conservation status of the nationally rare species *Carex tasmanica*[7] has also been studied (Gilfedder 1991, Wells 1994). One population of this species is found on the Queens Domain.

Many recent studies of the vegetation of the Hobart region have included floristic surveys, notably studies on Knocklofty (Brown 1982), the Hobart Waterworks[8] and the University Reserve (Kirkpatrick and Marks 1985), Mt. Wellington (Gilfedder 1985, Whinam 1985, Askey-Doran 1990, Whinam and Kirkpatrick 1994) and the Queens Domain (Kirkpatrick 1986a).

2.2.3 Communities

Many plant communities in Hobart have been described and mapped by several authors. However, the focus of most prior studies has been the botanical identification and description of the communities rather than the production of a comprehensive vegetation map covering the entire Hobart Municipality. The Wellington Range vegetation was first mapped in 1940 by Martin. He divided the Wellington Range into seven vegetation zones (Table 2.6) based on the three plant formations he identified, eucalypt forest, microthermal rain forest and austral-montane.

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6 *Eucalyptus cordata* is rare in Tasmania (see Section 3.8)

7 see Section 7.3 for the location of *Carex tasmanica* populations in Hobart and Section 3.8 for definition of 'rare'

8 Hobart Waterworks (or Waterworks Reserve) is included in Ridgeway Park

Table 2.6: Martin's (1940) vegetation zones of the Wellington Range

Zone	Community	Approx elevation (m)*
Zone 1	Austral-montane formation of the summit plateau	1220 - 1270
Zone 2	*E. coccifera* consociation	1100 - 1220
Zone 3	*E. coccifera* - *E. urnigera* association	760 - 1100
Zone 4	*E. obliqua* - *E. regnans* association	240 -670
Zone 5	Sandstone communities	600 - 750
Zone 6	Gully communities	< 600
Zone 7	Open forest associations	not stated

* from Ratkowsky and Ratkowsky (1976)

The next major study of the Wellington Range was by Ratkowsky and Ratkowsky (1977). They largely adopted the methodology of Martin (1940). They extended the study area and split a number of Martin's original zones, resulting in a total of 12 vegetation zones (Table 2.7).

Table 2.7: Ratkowsky and Ratkowsky's (1977) vegetation zones of the Wellington Range

Zone	Description	Approx. elevation (m)
Zone 1R	Montane shrubberies on dolerite, treeless	1220-1270
Zone 1M	Montane grasslands and wetlands on dolerite, treeless and shrubless	1220-1270
Zone 2R	Montane woodlands on dolerite, containing pure stands of *Eucalyptus coccifera*	1100-1220
Zone 3M	Montane Quaternary swamp and marsh deposits on dolerite within montane woodlands, treeless	1100-1180
Zone 3aR	Submontane woodlands on dolerite or dolerite talus, containing *E. urnigera* plus lesser amounts of *E. coccifera* and *E. johnstonii*	800-1100
Zone 3aM	Submontane Quaternary swamp and marsh deposits on dolerite with submontane woodlands, treeless	900-1000
Zone 5	Triassic sandstone communities on Snake Plains	600-700
Zone 3b	Wet sclerophyll forests on dolerite and dolerite talus, dominated by *E. delegatensis*	600-800
Zone 4P	Wet sclerophyll forests on Permian deposits, dominated by *E. obliqua*	240-670
Zone 6	Gully communities, permanently wet, with thick undergrowth	240-600
Zone 7P	Dry sclerophyll open forest on Permian deposits, light undergrowth, grasses generally absent, dominant eucalypt *E. tenuiramis*	240-400
Zone 7D	Dry sclerophyll open forest on dolerite, light to medium undergrowth, dominant eucalypts *E. pulchella* and *E. viminalis*	240-500

The only other study to describe and map a large area of Hobart was by Fensham (1992) whose study area included the lower slopes of Mt. Wellington, the surrounding foothills and the Queens Domain. His community analysis and accompanying map was more detailed than of Ratkowsky and Ratkowsky (1977). He divided four of their lower four vegetation zones (Zones 4P to 7D) into 8 vegetation types (Table 2.8).

Table 2.8: Fensham's (1992) vegetation types of Hobart

Vegetation type	Description
Allocasuarina verticillata shrubland	Dominate by *A. verticillata* (on dolerite)
Grassy woodland	Dominated by *Eucalyptus viminalis* and *A. verticillata* over native grasses (*Themeda triandra* and *Poa rodwayi*)
Grassy forest	Dominated by *E. pulchella* with *E. viminalis* and *E. ovata* as subdominants over native grasses (*Themeda triandra* and *Poa rodwayi*)
E. *pulchella* heathy forest	*E. pulchella* dominant with *E. globulus* subdominant over a shrub layer
E. tenuiramis heathy forest	*E. tenuiramis* dominant over shrubs
E. amygdalina heathy forest	Dominated by *E. amygdalina* with *E. viminalis* as sub-dominant over sclerophyllous shrubs
Sclerophyllous wet forest	Dominated by *E. obliqua* over small leaved sclerophyllous shrubs
Broadleaved wet forest	Dominated by *E. obliqua, E. globulus* or *E. regnans* over tall broadleaved shrubs

Other studies have been on smaller areas with more specific ends. Brown (1982) divided Knocklofty Park into 13 vegetation types for a management plan and Gilfedder (1985) divided the vegetation at the headwaters of North West Bay River (Mt. Wellington plateau) into 8 communities in her study of the inverted treeline on Mt. Wellington. A general description of the forest vegetation of the Wellington Range was submitted to the Australian Heritage Commission by Kirkpatrick *et al.* (1990).

2.2.4 Community ecological studies

The ecology of Mt. Wellington was first studied by Beadle (1935 in Martin (1940)). Other ecological studies include an examination of the subalpine fen (Whinam 1985), the occurrence of mixed stands of eucalypts (Duff *et al.* 1983), the ecology of an inverted treeline (Gilfedder 1988), growth rate of eucalypts on Mt. Wellington (Pyrke 1989 and Pyrke and Kirkpatrick 1994) and the environment and primary productivity of the cushion species on Mt. Wellington (Gibson 1990).

Ecological studies have also been undertaken elsewhere in Hobart, including the effects of insect predation on eucalypts at Ridgeway (Marks 1985), the drought damage of some plants in the Waterworks and University Reserves (Kirkpatrick and Marks 1985), the nature conservation value of the Queens Domain (Kirkpatrick 1986a) and the dynamics of gully scrub communities (Woolward 1983). Other studies have looked at the effects of introduced species such as boneseed (Paterson and Volframs 1976) and *Cotoneaster* spp. (Zacharek 1990).

2.3 Bushfires in Hobart

Bushfires are not uncommon in the Hobart region. Early Europeans documented the burning of Mt. Wellington by the indigenous Tasmanians (de Quincey 1987) and in the last 100 years severe fires have occurred in 1897-8, 1914, 1934 and 1967, with many smaller fires in the intervening years. The 1967 bushfires are thought to have been the most devastating fires in southern Tasmania's recorded history. These fires affected 14 municipalities, burning 264,000 ha of farm, forest and bushland. Stock losses were estimated at 80,000 animals. In Hobart, 20 people and 408 premises were destroyed (Bureau of Meteorology 1979, de Quincey 1987).

In 1967 a Royal Commission was set up as a result of the bushfires. It recommended among other things a large increase in the funding of fire prevention and the introduction of a fire permit system. It also recommended transferring greater responsibility for fire management to local government authorities (Sutton 1985). The creation of the Hobart Special Fire Area, which includes all of Hobart, was a direct result of these recommendations.

The HCC is responsible for the reduction of fuel (generally by burning) on council land, including some of the lower slopes of Mt. Wellington, Ridgeway Park, Knocklofty and the Queens Domain. Most of Mountain Park is not included in this fuel reduction program. Fuel reduction on private land is the responsibility of the land owner. In the drier months a fire season is declared (usually late Spring to early Autumn) during which the land owner must obtain permission from the Tasmanian Fire Service prior to burning. Between 1967 and 1985 most of the native vegetation of Hobart (except the slopes and alpine areas of Mt. Wellington) was burnt at regular intervals. However, responding to a number of reports suggesting the adverse effects of the particular control burns undertaken (for example, Page and Smith 1976, Corbett 1981 and Sutton 1985) and rising public scrutiny, the scale of the fuel reduction program has declined noticeably (Fensham 1992).

Despite current efforts, arson and the occasional escaped control burn continue to be a threat to property, public safety and some vegetation types. In 1983 a bushfire burnt a large area of Mountain Park and other large fires have occurred in adjoining Municipalities. Figure 2.4 shows the total area burnt by fires (both control burns and bushfires) from 1980/81 to 1992/3 (as recorded by the HCC Officers). The dates and areas burnt by each fire are documented in Appendix A.

Fire management in Tasmania is currently under review by the Tasmanian Parliament, with a new fire services bill to be debated shortly (J. Hickie pers. comm.).

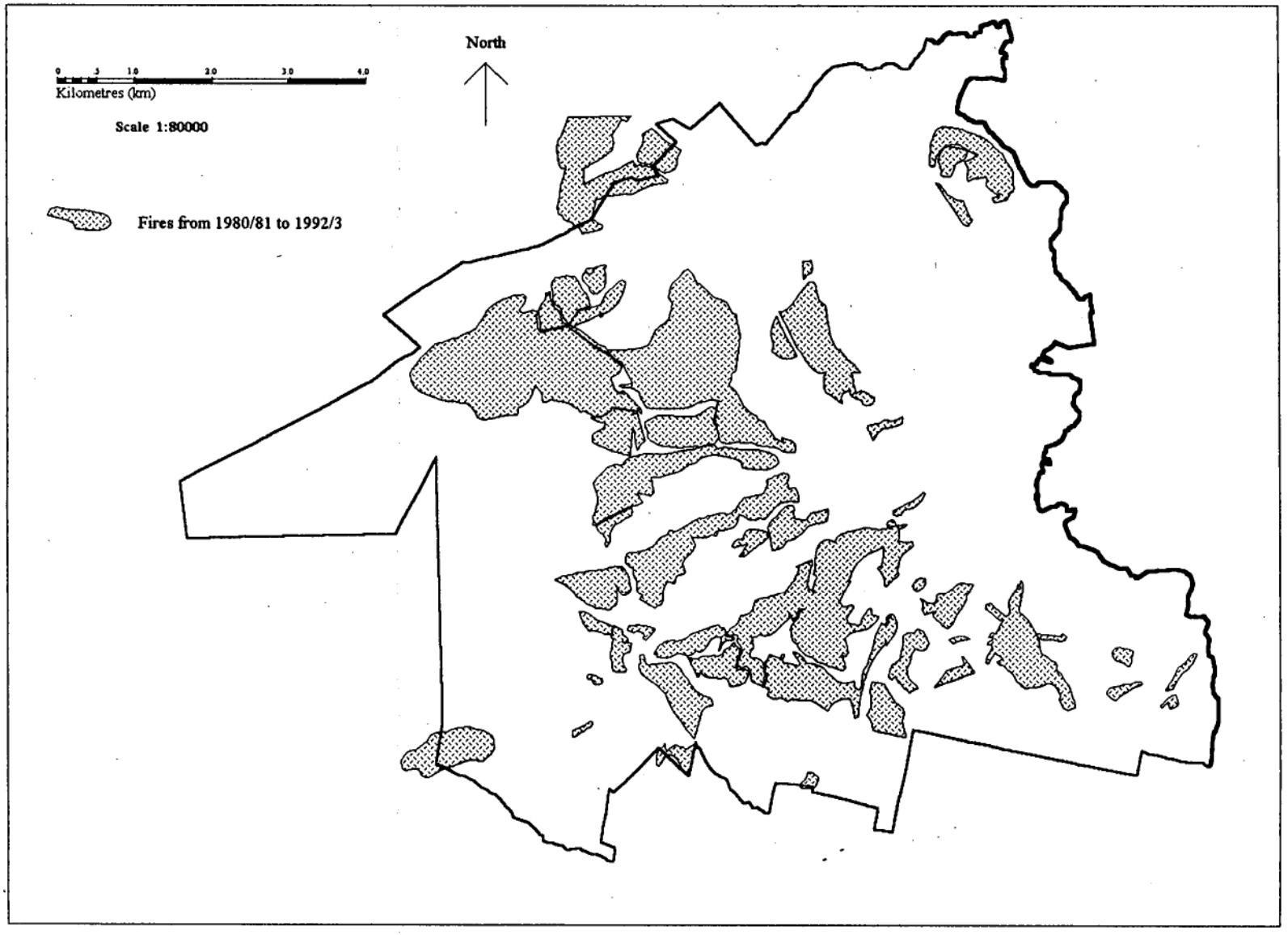

Figure 2.4: Total area burnt (both control burns and wildfires) in Hobart from 1980/81 to 1992/93, as recorded by Hobart City Council Officers

2.4 Planning schemes, reports and management plans

2.4.1 City of Hobart Planning Scheme

The City of Hobart Planning Scheme (1982) approved in 1991 and further amended in 1992, divides Hobart into 21 Zones. Six of these zones contain most of the native bushland of Hobart. Table 2.9 lists the Zones, Precincts and Density Zones of these areas.

Subdivisions have been approved by the HCC in some of these Precincts, affecting substantial areas of bushland on Tolmans Hill in the Waterworks Precinct and some of the bushland areas in the Fern Tree and Albion Heights Precincts (N. Noye pers. comm.).

The Hills Face Zone has been set aside in order to

> "...minimise the potential for development in sensitive landscape areas which also possess severe constraints in the provision of access and reticulate services, or land identified as being topographically difficult to develop."
> (Corporation of the City of Hobart 1982:38)

Table 2.9: Zones and Precincts of Hobart which contain significant stands of remnant vegetation

Zone	Precinct	Density Zone
The Residential 2 Zone	Cascades	34A
	Waterworks	35C
	Porter Hill	39
The Special Use Zone 2	University	29
	College	30
The Rural 'B' Zone	Old Farm Road	41
	Ridgeway	44A
The Rural 'C' Zone	Brushy Creek	40
	Fern Tree	43D, 43E
	Ridgeway	44B, 44C
	Albion Heights	45
The Hills Face Zone	see below	
The Recreation Zone	see below	

Corporation of the City of Hobart (1982)

The Recreation Zone includes the reserves Queens Domain, Knocklofty Park, Ridgeway Park, Mountain Park, Lambert Gully, Truganini Gully. According to the Planning Scheme, it is expected that this District will

> "...continue to provide areas of natural bushland and facilities for the passive and visual recreation and enjoyment of the residents, workforce and visitors to Hobart, and to accommodate various utility services where necessary, by eventual public ownership."
> (Corporation of the City of Hobart 1982:35)

2.4.2 The Wellington Range and Mountain Park

Wellington Range, located to the west of Hobart, includes Mt. Wellington and its foothills and extends 25 km westwards to the State Forest and low hills near White Timber Mountain. It occupies 19,000 ha, the majority of which is owned and/or managed by government or quasi-government bodies. Some freehold land exists on the lower slopes and foothills (Tasmanian Lands Department 1981:1).

The Wellington Range is administered under the *Wellington Park Act 1993*. This Act sets aside Wellington Park as a reserve with an expressed purpose which includes the "preservation or protection of the fauna and flora contained in or on the land" (*Wellington Park Act 1993*:5). It also states that

> "It is the duty of all land owners or occupiers of land in Wellington Park to exercise their function and powers and to use and manage the land in a manner that is consistent with the purposes for which it is set aside and with any management plan"
>
> (*Wellington Park Act 1993*:18).

Included in 'Wellington Park' is Mountain Park, a municipal reserve owned and managed by the Corporation of the City of Hobart. This park was established in 1906 by an Act of Parliament (*Mountain Park Act 1906*) and covers an area of some 1600 ha on the western side of Hobart. This is the only reserve in Hobart which has a 'high security of tenure', requiring the approval of both Tasmanian Houses of Parliament for revocation of its status as a park.

The Wellington Range is a significant area in terms of conservation value. It contains over 80 endemic plants (over 40% of Tasmania's endemic flora) (Kirkpatrick *et al* 1990:137), including *Abrotanella forsteroides, Cyathodes parvifolia, Orites acicularis, Richea dracophylla* and *Telopea truncata*. This area has been identified Kirkpatrick and Brown (1984) as containing part of one of the "centres of local higher plant endemism" in Tasmania. The Wellington Range also contains a number of dicotyledonous angiosperms not found in other secure reserves in Tasmania (Kirkpatrick *et al*. 1991a). The Wellington Range also contains one Tasmanian endangered species, *Euphrasia scabra*, and 17 rare species. The distribution of three of these rare species, *Australina pusilla ssp. muelleri* and the endemics *Brachyglottis brunonis* and *Euphrasia gibbsiae ssp. wellingtonensis*, does not exceed 10000 square kilometres (FAC 1994). *Australina pusilla ssp. muelleri* has not been recorded in Hobart. A number of significant communities also occur on the Wellington Range including *Helichrysum ledifolium* dominated heathland, *Eucalyptus urnigera* subalpine mixed forest and *E. johnstonii* wet sclerophyll forest (Kirkpatrick 1986c and Kirkpatrick *et al*. 1988b). Recognising the significance of the above, the Wellington Range was nominated for National Estate listing in 1981 and is currently under consideration (L. Wall pers. comm.).

The significance of the Wellington Range has also been highlighted in a number of recent reports, including a report to the Australian Heritage Commission (Kirkpatrick *et al.* 1990) and one to the Resource Assessment Commission's Forest and Timber Inquiry (Kirkpatrick and Brown 1991).

2.4.3 Management plans

A number of management plans and reports have made proposals regarding the future use of bushland areas in Hobart. Most of these plans have considered the entire Wellington Range (and Mountain Park) not confining themselves to HCC land. Mt. Wellington is of great significance to Hobartians (Barns 1992). Commonly called "the mountain", it was formally seen as a provider of resources, especially timber. It is now valued in a myriad of ways by the residents of Hobart, private industry and government authorities.

In 1980, the Tasmanian Conservation Trust (a non-government agency) proposed a number of guidelines for future development of the Wellington Range. This was followed in 1981 by a "Report and Recommendations on the Management Plan for the Wellington Range" (Tasmanian Lands Department). This draft included a report of the vegetation types, fire behaviour and fire protection measures in the Fern Tree, Knocklofty and Mt. Wellington area (Corbett 1981).

In 1991, the Mount Wellington Management Working Party commissioned a report on Mountain Park (Carpenter 1991). This was followed in early 1993 by the allocation of funds for a master and a management plan of Mountain Park. The subsequent proposal includes a number of recommendations including management strategies for the conservation of physical, biological and cultural values. It also recommends the creation of 3 sub-zones within the Recreation Zone in Mountain Park: alpine, mountain face and lower slopes, it is acknowledged that this would involve some additions and amendments to the City of Hobart Planning Scheme (Two Hundred and Eight Network 1994b).

The debate between its passive use, such as recreation, and active use such as tourist development has marred some community relations in the recent years (Phair 1993). The fear that potential developments could become stalled in endless debate, incited the government to pass legislation, the *Wellington Park Act 1993*, enabling them to 'fast-track' chosen projects. This Act allows the government to curtail the usual mechanisms of appeal in the normal approval process. The instigation for this legislation was the current Skyway project, a cable car and ski field proposal, but it by no means restricted to this project.

To date, only some recommendations of the various proposed management plans have been implemented. The Mount Wellington Management Trust, a body established by the

Wellington Park Act 1993, has recently assumed responsibility for the management and maintenance of Mountain Park. Any management plan(s) for this area must now be approved by the Trust.

Management plans have also been proposed for other municipal reserves in Hobart. Green (1982) prepared a plan for the Queens Domain and a plan for Knocklofty Park was prepared by Brown (1982). The Queens Domain is an important site for a number of rare and threatened plant species and communities (Kirkpatrick *et al.* 1988a) and unreserved dicotyledonous angiosperms (Kirkpatrick *et al.* 1991a). It has been recommended that this reserve be adopted in State legislation, thereby further securing its tenure (Kirkpatrick *et al.* 1991a). The bushland areas of Fern Tree have also been the subject of a study in which guidelines for its retention were proposed (McRae 1980). In 1993 a study of open space in Hobart was undertaken to address a number of needs identified by the Council. One such need was for the establishment of corridors between areas for the benefit of wildlife.

The bushland remnants of Hobart have also been the subject of reports to State Government authorities. One report on the dry sclerophyll forests of Tasmania recommended two areas in Hobart receive greater protection - Truganini Reserve and the area south of the New Town Rivulet (in Mountain Park) between 300 and 600 m (Williams 1989). This report also recommended the *Eucalyptus cordata* population on HCC reserve at Chimney Pot Hill be managed according to the recommendations of Potts (1989).

The management of bushfires and the fuel reduction program have been highlighted in two reports to the Hobart City Council. Sutton (1985) investigated the risk of bushfires in the Hobart Municipality and Fensham (1991) assessed the fuel loads of various vegetation types with a view to their management implications.

Chapter 3 Methods

3.1 General survey

A vegetation survey of bush remnants in the Hobart Municipality was conducted from April to November 1993. This survey and the resulting map involved the following:

1. Interpreting aerial photographs to determine the mapping units;
2. Verification of the above by ground truthing;
3. Recording amendments to (1) as a result of ground truthing; and
4. Recording the details of each mapping unit on to a spreadsheet and a Geographic Information System (GIS).

3.1.1 Aerial photographs

Colour and black and white aerial photographs were the primary means for identifying the vegetation and determining mapping unit boundaries. In Tasmania, this method of remote sensing is recognised for its effectiveness (Kirkpatrick 1990) especially for large-scale vegetation maps. Table 3.1 lists the aerial photographs used. All aerial photographs were produced by TASMAP (Department of Environment and Land Management).

Table 3.1: Aerial photographs used in ground survey and location of mapping unit boundaries

Date	Film #	Run #	Photograph #'s	Height ASL (feet)	Scale (nominal)	Type
16-2-92	1183	2	192-197	12800'	1:12500	Colour
16-2-92	1184	3N	1-6	12800	1:12500	Colour
16-2-92	1184	4	40-49	12800	1:12500	Colour
16-2-92	1184	5	75-84	12800	1:12500	Colour
16-2-92	1184	6	106-113	12800	1:12500	Colour
16-2-92	1184	7	45-47	12800	1:12500	Colour
11-1-84	974	1	43	22500	1:20000	Colour
6-2-84	983	9	82-83	21000	1:20000	B&W

The most recent colour aerial photographs (1992) were the preferred choice, it was, however, necessary for areas such as the Mt Wellington plateau to use a 1984 colour aerial photograph, and for the area south and south-west of Fern Tree to use 1984 black and white aerial photographs.

The overlap specified for the 1992 aerial photographs is 60% forward overlap and 30% side overlap. The 1984 black and white photographs also have a forward overlap of 60%, the side overlap was not relevant since no side adjacent photographs were used.

Vegetation changes appear on aerial photographs as colour (grey-scale) and structural variations representing the dominant and understorey species. For example, *Eucalyptus* and *Acacia* species can be determined by the shape and colour of their crown. Due to the sparse nature of eucalypt crowns, some understorey life forms can be distinguished in photographs of this scale. Changes were determined by naked eye or with the use of a magnifying glass and/or stereoscope.

To record the mapping unit boundaries a clear transparency was placed over the central portion of each photograph and the boundaries traced. Density and aspect were not used as a criteria for distinguishing boundaries at this stage.

3.1.2 Ground truthing

In order to verify the vegetation regions identified on the aerial photograph an extensive study of the bush remnants was undertaken (see Figure 3.1). The study involved the collection of vegetation data from selected locations. Each location, or ground reference point, was selected by either of the following criteria:

1. at least one point within each mapping unit determined from the aerial photograph or
2. when ground truthing, where a noticeable vegetation change occurred on the ground which was not perceived on the aerial photograph, further points were recorded as needed to establish a boundary or the existence of a mapping unit not initially recognised.

Access to the mapping units identified on the aerial photographs was largely along established roads, formed tracks and creek beds. Fortunately there is an extensive network of walking/fire tracks in the study area. The units not accessible via these means were surveyed by walking through the bush from a known point.

The location of each ground reference point was established/confirmed by using aerial photographs in conjunction with the relevant 1:25000 topographic map and a compass. Features such as roads and tracks were clearly visible on most photographs. Table 3.2 lists the Tasmanian 1:25000 series topographic maps (TASMAP 1986 and 1988) used.

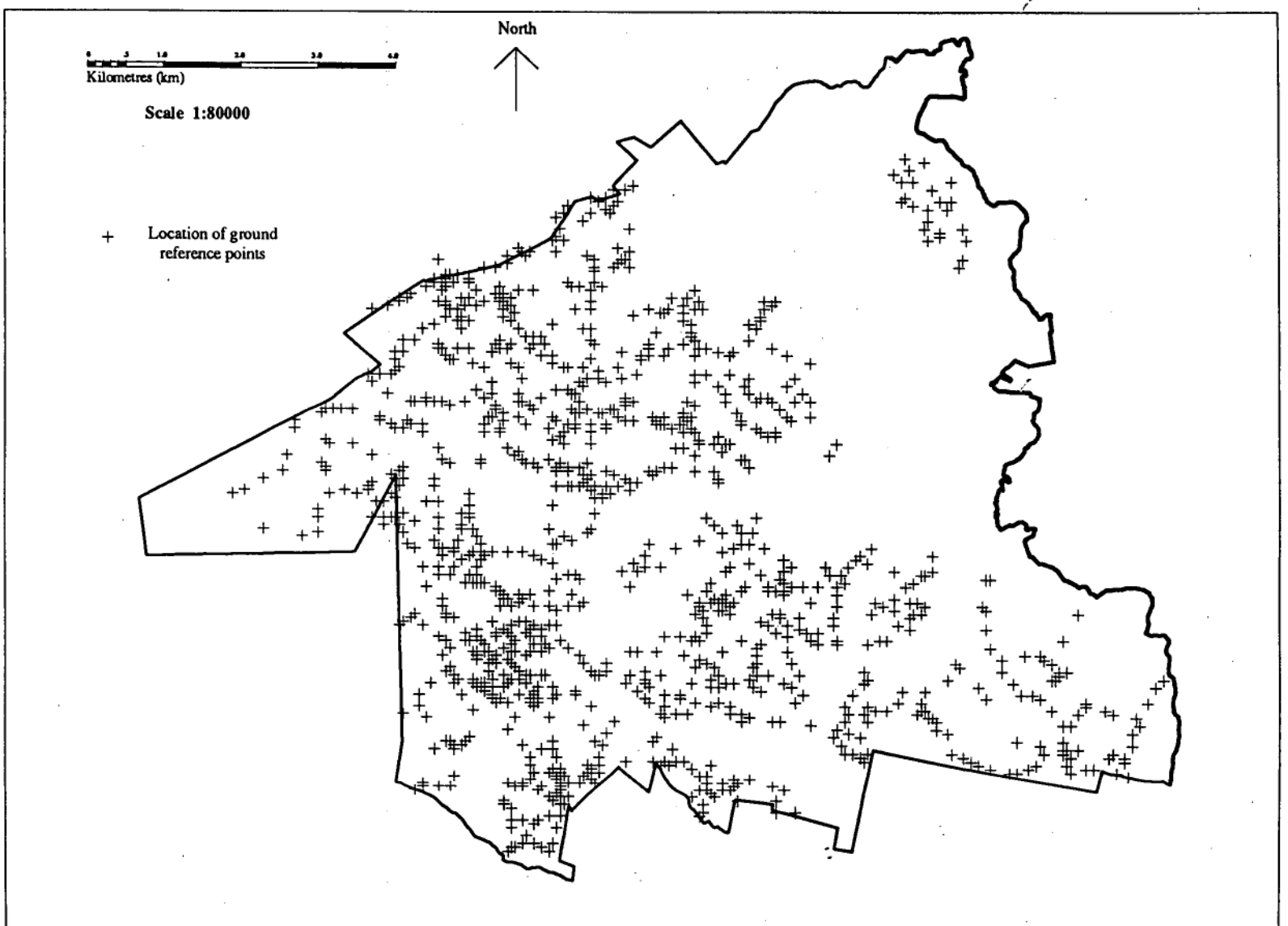

Figure 3.1: Location of ground reference points used to establish mapping unit nomenclature and boundaries

Table 3.2: Tasmanian 1:25000 series topographic maps used in survey

Map name	Sheet	Edition/date
Longley	5024	Edition 2, 1988
Collinsvale	5025	Edition 2, 1986
Taroona	5224	Edition 2, 1988
Hobart	5225	Edition 3, 1988

Australian Map Grid (AMG) coordinates were chosen to locate each point. The Easting (X coordinate) were in 5 figure numbers and the Northing (Y coordinate) were in 6 figures. The accuracy of each location varies greatly according to visible features. If points were located near roads or tracks (most points) the error is estimated to be ±50 m. If no clear landmarks were available the error is estimated to be ±100 m, however, in some remote cases the error may be greater.

At each reference point recent fire evidence, geology, dominant vegetation and any other significant factors were noted. The geology was determined by surface observation supported by the 1:50000 Geological Survey Map of Hobart (Leaman 1972).

Up to four vegetation strata (layers) were identified:

1. Tallest stratum (overstorey)
   - including a codominant species if its' apparent cover was > 50% of the dominant species

2. Second stratum
   - this stratum was only noted if it was significant (that is, an apparent cover > 50% of the tallest stratum

3. Third stratum (understorey)
   - included only those species which were abundant

4. Ground cover
   - in general only the dominant life form(s) (>25% of total ground cover) were noted
   - if there were no dominant life forms either rock or bare ground were noted

This approach to vegetation description was chosen as this study did not require a comprehensive floristic analysis only a recognition of understorey and ground layer of dominant life forms.

Reference point information was placed on an Microsoft® Excel spreadsheet according to the following format:

- Site name - Full name
  - Code
- AMG references - Easting
  - Northing
- Geology
- Vegetation - 1st Strata (dominant)
  - 2nd Strata
  - 3rd Strata (understorey)
  - 4th Strata (ground cover)
- Recent fires

As a result of the vegetation ground truthing, the mapping unit boundaries on the transparencies were added, deleted or modified as needed.

Mapping unit boundaries represent vegetation changes which may be either sharp or diffuse. Sharp boundaries tend to follow abrupt environmental changes or are due to direct human interference such as roads, power lines and land clearing. Diffuse boundaries are more typical of gradual environmental changes. In such cases the line must be put within a transition zone between the communities, usually the midpoint. Environmental parameters which may cause both sharp and diffuse boundaries are changes in the topography (relief), soil, geology, ground water availability and climate. The accuracy with which the sharp boundaries was determined is logically much greater than that for the diffuse boundaries, especially if they follow abrupt environmental changes in topography or are due to human interference.

3.2 Nomenclature of mapping units

3.2.1 Synusiae

Classification of vegetation mapping units followed the synusia-based descriptions first introduced by Gams in 1918 (see Section 1.3). Plant communities may be divided into layers and the synusiae often correspond to these layers. In order to identify each mapping unit one to four layers were chosen. The tallest stratum was always included, while the second stratum, understorey and ground layer were included only if their cover was significant (see Section 3.1.2). The various layers have been classified according to their structural or situation synusiae. Structural synusiae for the tallest stratum are based on Specht's (1970)[1] structural form classification. This classification uses the life form of

[1] Structural forms of vegetation (from Specht 1970:46)

the tallest stratum in combination with its projective foliage cover (Table 3.3). Growth forms, similar to those used by Walker and Hopkins (1990) were the basis for determining understorey synusiae (Table 3.4). These growth forms are generally equivalent to the 'life forms' of Specht (1970). Additional codes were added to some understorey synusiae to reflect some unique situations.(see Table 3.5).

Situation synusiae, based on environmental parameters and species associations were also used (Table 3.6). In addition to environmental parameters, a further code was added to dry alpine mapping units which escaped the 1967 bushfires.

Table 3.3: Codes for dominant/structural tree forms (based on Specht (1970))

Code	Perceptible synusiae (tallest stratum)
Ea	*Eucalyptus amygdalina* woodland/open forest
Ec	*Eucalyptus coccifera* subalpine low open woodland/woodland
Ecd	*Eucalyptus cordata* open scrub
Ed	*Eucalyptus delegatensis* tall woodland/open forest/tall open forest
Eg	*Eucalyptus globulus* tall open woodland/open forest/tall open forest
Ej	*Eucalyptus johnstonii* subalpine low open-woodland/low woodland/low open forest
Eo	*Eucalyptus obliqua* tall woodland/open forest/tall open forest
Eov	*Eucalyptus ovata* open woodland/woodland/open forest
Ep	*Eucalyptus pulchella* open woodland/woodland/open forest
Er	*Eucalyptus regnans* tall open woodland/tall open forest
Et	*Eucalyptus tenuiramis* open forest
Eu	*Eucalyptus urnigera* subalpine low open woodland/woodland/open forest
Ev	*Eucalyptus viminalis* open woodland/woodland/open forest
Ad	*Acacia dealbata* low open forest/open forest
Al	*Allocasuarina verticillata* closed-scrub
Nc	*Nothofagus cunninghamii* subalpine low scrubland

Where the tallest stratum is very sparse (< 10%) the notation "(sp)" follows the synusiae code.

Life Form and Height of Tallest Stratum	Projective Foliage Cover of Tallest Stratum			
	Dense (70-100%)	Mid Dense (30-70%)	Sparse (10-30%)	Very Sparse (< 10%)
Trees > 30m	Tall closed-forest	Tall open-forest	Tall woodland	Tall open-woodland
Trees 10-30m	Closed-forest	Open-forest	Woodland	Open-woodland
Trees 5-10m	Low closed-forest	Low open-forest	Low woodland	Low open-woodland
Shrubs 2-8m	Closed-scrub	Open-scrub	Tall shrubland	Tall open-shrubland
Shrubs 0-2m	Closed-heath	Open-heath	Low shrubland	Low open-shrubland

Table 3.4: Codes for perceptible synusiae based on Specht (1970) structural forms and Walker and Hopkins (1990) growth forms

Code	Perceptible synusiae
AS	Alpine heath (0-2m)
S	Shrub (2-8m)
H	Heath (0-2m)
BS	Broad-leaved (>1 cm wide) shrubs (2-8m)
G	Grass (Poaceae)
SD	Sedge (Cyperaceae)
F*	Fern (Pteridophyta)

* In the mapping units where bracken (*Pteridium esculentum*) was the dominant fern, the code Pe replaced the synusia 'F'.

Table 3.5: Additional codes used to pertaining to the understorey

Code	To describe
*	subalpine
(s)	sandstone

Table 3.6: Codes for situation synusiae

Code	Situation synusiae
DA(ub)	Dry alpine vegetation: unburnt in 1967 bushfires - *Orites acicularis* prominent
DA	Dry alpine vegetation: burnt in 1967 bushfires - *Helichrysum ledifolium* prominent
WA	Wet alpine vegetation
RF	Rainforest (evergreen closed forest) - *Atherosperma moschatum/Nothofagus cunninghamii* predominant
GS	Gully scrub Type 1 (inland gully vegetation)
GS(2)	Gully scrub: Type 2 - *Pomaderris apetala/Beyeria viscosa* prominent

Where it is suspected the original vegetation has changed in recent years due to fire or other disturbances square brackets "[ ]" were placed around the synusiae. For example possible areas which may have been rainforest - [RF] - or areas which may have had a shrubby understorey [S].

Synusia were not used for all layers. When a second stratum was present (significant) a code was adopted for each 'dominant' species (Table 3.7).

Table 3.7: Code for plants in second stratum

Code	Plant species
Ad	*Acacia dealbata*
Al	*Allocasuarina verticillata*
Am	*Acacia melanoxylon*
Ar	*Acacia mearnsii*
Av	*Acacia verniciflua*

When the ground layer was not dominated by a particular growth form(s) a code was adopted for protruding boulders (rocks) or for bare ground (Table 3.8).

Table 3.8: Code for non-vegetative ground cover

Code	Cover of ground layer
R	Rock (>50% cover)
B	Bare ground (>50% cover)

3.2.2 Notations

The notation used to label each mapping unit is a combination of the synusiae noted. This notation follows Kirkpatrick (1990). For example, a *Eucalyptus regnans* open forest with a broad-leaved shrub understorey would be notated as Er/BS. The slash (/) is used to describe the arrangement of vertical strata. Where two species or life forms are dominant in the same strata the notation used is a dash[2] (-), as in Eo-Er/BS-S. This notation describes a community where *E. obliqua* is the dominant species and *E. regnans* is codominant. A reversal of their order would indicate *E. regnans* as the dominant and *E. obliqua* as the codominant (Er-Eo). A synusiae which was probably dominant in the past but due to recent human practices such as fire and possibly land clearing and is no longer present is denoted in brackets, for example Er/BS(RF) or Ev/(S)/G.

3.3 Mapping/Geographic Information Systems (GIS)

Geographic information systems (GIS) as described in Section 1.2, are a means by which the geographical distribution of land attributes, such as vegetation, can be stored, manipulated and presented (van der Zee and Huizing 1988:163). Generally three types of notations are used in GIS to represent the spatial location of geographic phenomena: points; straight and curved lines (polylines); and closed loops (polygons). The program

[2] These notations contrast with some of the literature referred to later in this thesis, that is a dash represents a vertical arrangement and a dash a horizontal arrangement (eg. Kirkpatrick *et al.* 1988a and b; Askey-Doran 1993).

used in this case was MapInfo®, which is a vector based program where points, polylines, and polygons are defined by coordinates or sets of coordinates in a system chosen by the user. Options include Australian Map Grid (AMG) and longitude/latitude. In turn these are linked to given attributes.

This program was chosen primarily due to its compatibility with the program used by the HCC, and because the features of more complex programs were not needed.

3.4 Transfer of information onto GIS

Two forms of information are associated with each mapping unit: geographic data which define it, and its associated attributes. Geographic data may be entered manually on the screen, transferred from a compatible program such as Microsoft® Excel or entered electronically (eg. digitised, scanned). Attributes may either be entered manually or transferred with the geographic data from a compatible program. This section describes how the geographic information and associated attributes were transferred into the system.

3.4.1 Digitising and base maps

Prior to digitising the vegetation data, a base map of the study area was digitised. This consisted of several layers which represented information obtained from commercial maps, private maps and only in the case of obtaining the contours was any existing digital information used (Table 3.9). Attributes were associated with some of the graphic data. For all digitising the map scale on the computer screen was set at 1:12500 and AMG coordinates were chosen.

The accuracy of the maps produced by combining the above mentioned sources is largely dependent on three factors:

1. the quality of the source material;
2. the accuracy of entry; and
3. the resolution of the digitiser.

For purposes of this study errors in the resolution of the digitiser are assumed to be negligible. Where printed/digitised information was used, the source material was deemed to be relatively accurate. However, when the source material came from a hand drawn map, as in the fire and Hobart City Council (HCC) land tenure information, the copy digitised is only as accurate as the source. The accuracy of this material is not known.

Table 3.9: The various layers used to compose a base map on the GIS

Layer	Geographic data used	Attributes	Source(s)
Roads	Major roads in Hobart	None	Tasmanian 1:25000 series topographic maps: Longley, Collinsvale, Taroona and Hobart (TASMAP 1986 and 1988)
Rivers	Hydrological features (including reservoirs)	None	" "
HCC boundary	Hobart Municipal boundary	None	" "
Land tenure	University Reserve boundary	Name	" "
" "	Crown Reserves boundaries	Name	" "
" "	HEC managed land boundaries	Name	" "
" "	HCC Reserve - land acquired for reserve (includes purchases by agreement, gifts and bequests)	Name	City of Hobart property maps (1:10000)
" "	HCC Non-reserve land - land acquired for other than reserve (includes purchases by agreement, gifts and bequests)	Name	" "
Contours	Contours - 10m contour intervals	Height (m)	Digital Tasmanian 1:25000 series topographic maps: (Longley, Collinsvale, Taroona and Hobart)
Control burns	Control burns by the HCC (Engineering Dept.) from 1980 to 1993	Date	HCC fire maps (1:25000)
Wildfires	Wildfires from 1980 to 1993	Date	" "
Geology	Major geological substrates	Rock type	Geological Survey 1:50000 map of Hobart

3.4.2 Digitising for the vegetation map

Digitising the information from the aerial photographs was not as straightforward as digitising from the topographic maps. The main problem was that the scale of the aerial photographs varied greatly as the elevation changed from sea level to over 1200 m in a relatively short distance (~ 8 km). All of the 1992 aerial photographs were photographed from 12800' above sea level (ASL) for a nominal scale of 1:12500 valid only at sea level. On the summit of Mt. Wellington the scale was calculated to be 1:8500. Other problems were increased distortion away from the centre of the photographs and errors due to sudden changes in height or angle of the aircraft.

Prior to digitising it was necessary to transform the information from the aerial photographs into a scale which could be easily digitised. This could have been done digitally, optically or manually. Digital and optical means were not available. It was decided to manually interpret the boundaries onto a set of topographic maps with a scale of 1:12500 (with the exception of Mt. Wellington summit plateau). Transparent enlargements (200%) of the Tasmanian 1:25000 series maps were made using a photocopier. This brought the information to a scale near that of the aerial photographs. Boundaries were then drawn on the enlarged commercial map relative to visible landmarks on each. For flat regions this

process was fairly simple, however with increasing slope more landmarks were needed. The vegetation boundaries on the summit plateau were transferred onto a map of 1:9000, closely matching the 1:8500 scale of the aerial photographs at this elevation. As a map at this scale could not be accurately enlarged from Tasmanian 1:25000 series maps, I chose to use the digitised map (Section 3.4.1) and print out a copy at a 1:9000 scale on a transparency. This map was composed of contours, rivers, roads and the HCC boundary.

This transformation procedure is potentially the greatest source of error. Errors arising from enlarging the maps with the photocopier (lens distortion) are considered to be negligible. To overcome distortions on the edges of the aerial photographs, where possible only the central third of the photograph was used.

The vegetation regions were digitised with the screen map scale set to 1:8000 (5 pixel snap tolerance) to ensure the regions were accurately drawn. With this vector based program, it was necessary to carefully mark on each of the vegetation boundaries the points which would make up the region or polygon. This was necessary to ensure adjacent boundaries 'snapped' together.

The attributes associated with each mapping unit were entered manually. Attributes were used for locating, labelling and shading each mapping unit.

3.4.3 Ground references

The ground reference data, including the coordinates were transferred directly from the Microsoft® Excel spreadsheets (Section 3.1.2) into respective MapInfo® tables. It was then possible to use the coordinates to create points on a layer above the base map. Figure 3.2 shows these points with respect to the Hobart Municipal boundary. As this involved only transferring files within the computer no further errors were introduced.

3.5 Vegetation mapping units

3.5.1 Vegetation maps

Once the information had been entered onto the GIS it was then possible to extract all or sections of the data to produce a variety of maps. Initially a map was produced of all the vegetation mapping units (Attachment 1). This map is at a scale of 1:16000 and is colour coded according to the tallest stratum. Labels correspond to the full notation ascribed to each mapping unit (see Appendix II). Rivers, roads and HCC boundary are included as layers overlaying the vegetation data.

To describe and clearly map each vegetation (or mapping) unit, the above map was simplified into either one or two layers. These layers corresponded to the tallest stratum

synusia(e) and where appropriate either the understorey or ground layer synusia(e). These mapping units were then grouped together initially by their location in Hobart and secondarily according to the tallest stratum (Table 3.10). Since the primary purpose of the subsequent maps were to show the location(s) of each unit in Hobart, they included the HCC boundary, rivers and roads. These maps are shaded (black and white) according to their notation. The scale of these maps depended on the distribution of the mapping units. Where possible scales of 1:25000 or 1:50000 were chosen. However, other scales (1:35000, 1:40000 and 1:60000) were used in some circumstances.

Table 3.10: Plant communities (mapping units) which comprise each subgroup (map)

Groups	Subgroup	Plant communities
Alpine communities		DA(ub); DA; WA; DA-WA; Nc-AS
Subalpine communities	*E. coccifera* communities/associations	Ec/AS; Ec/H*; Ec/S-H*; Ec/R; Ec-Ed/S*
	E. urnigera communities/associations	Eu/S-H*; Eu/R; Ec-Eu/S-H*; Ed-Eu/S*; Ed-Eu/R
Upper slopes communities	*E. delegatensis* communities/shrub community	Ed/S-H; Ed/S; Ed/BS-S; Ed/BS
	Sandstone communities on Mt. Wellington	Ej/S; Ej/H; Ed-Ej/S; H/SD
	E. delegatensis associations	Ed-Eo/BS-S; Ed-Eo/S; Er-Er/BS-S
Lower slopes communities	*E. obliqua* communities	Eo/BS; Eo/BS-S; Eo/S; Eo/S-H; Eo/H
	E. tenuiramis communities/associations	Et/H; Eo-Et/H; Eo-Et/S-H
Mountain gully communities	Eucalypt-dominated mountain gully communities	Er/BS; Eo-Er/BS; Eo-Er/BS-S
	Rainforest/wet gully communities	RF; BS; Ad/BS; Ad/BS-S
Foothill gully communities	Foothill gullies (1) communities	Eg/GS; Eg-Eo/BS-S; Eg-Eo/S
	Foothill gullies (2) communities	Eg/GS(2); GS(2)
Foothill communities	Foothill 1 communities	Eo-Ep/S-H; Ecd/H
	Foothill 2 communities	Eo-Ev/S; Eo-Ev/S-H; Eo-Ev/H; Eo-Ev/G
	Foothill 3 communities	Ea/S-H; Ea/S-H(s); Ea/H; Ea-Ev/H; Ea-Eo/S-H; Ea-Eo/H
	Foothill 4 communities	Ea-Et/S-H; Et-Ev/S; Ea-Eg/S-H
	Foothill 5 communities	Ep/S; Ep/S-H; Ep/H; Ep/G
	Foothill 6 communities	Al/G; Ep-Ev/S; Ep-Ev/S-H; Ep-Ev/H; Ep-Ev/G
	Foothill 7 communities	Eg-Ep/S; Eg-Ep/S-H; Eg-Ep/H; Eg-Ep/G
	Foothill 8 communities	Ev/S; Ev/G; ; Eg-Ev/G; Eg-Ev/G; Eg-Ev/H
	Foothill 9 communities	Eov/H; Eov-Ep/H; Eov-Ep/S-H; Eg-Eov/S-H; Eg-Eov/S

3.5.2 Vegetation descriptions

Each mapping unit was described according to a number of environmental parameters: elevation; slope; aspect; area; geology; land tenure and fire history. To describe the elevation, slope and aspect the contour layer was overlaid on each mapping unit. These contours were at intervals of 10 m and were used to calculate the slope (nearest 5°) and aspect (nearest 45°). 50 m intervals were deemed sufficient for the elevation.

The total area each mapping unit occupied was calculated by merging the various regions which make up the mapping unit. These merged units could then be used to calculate

other areas, such as those discussed below. Where roads traverse mapping units the area occupied by the road was not omitted.

The geology and land tenure of each mapping unit was described by overlaying the layers and then calculating the area of overlap. The geology consisted of six geological substrates:

- Alluvial deposits (Quaternary)
- Jurassic dolerite
- Dolerite talus (Quaternary)
- Permian mudstone - all Permian substrates
- Triassic sandstone - all Triassic substrates
- Tertiary basalt - all Tertiary substrates

The land tenure was initially divided according to ownership which was then subdivided according to the management status of the land:

- Hobart City Council
  - reserve (land acquired for reserve)
    - Wellington Park[3]
  - non-reserve (land acquired for other purposes than a reserve)
- State Government
  - Crown Reserves (Truganini Reserve and the Mt. Nelson Signal Station Reserve)
  - Hydro-Electric Commission land
  - Hobart College
- University of Tasmania
- Private (freehold)

Private land was calculated by subtracting the government and quasi-government land, marked on the City of Hobart property maps (see Subsection 3.4.1) from the total area of each mapping unit.

The above information was recorded in a number of tables, each table corresponding to a vegetation subgroup. Only the significant features of these tables are highlighted in the discussion.

The descriptions of each mapping unit often included dominant understorey and ground layer plant species. These species were noted during ground truthing (Section 3.1.2) and are included in the full notation of each mapping unit (see Attachment A: Vegetation of the Hobart Municipality).

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[3] In the vegetation descriptions, the term Wellington Park will generally refer only to the section of Wellington Park which are found in Hobart, that is, Mountain Park and the adjacent land set aside for the Hobart water supply.

The fire history of each mapping unit was described in two ways:

- units burnt during the 1967 bushfires; and
- areas burnt since 1980 by either fuel reduction burns (control fires) or bushfires (wildfires).

The 1967 fire history was obtained from fire maps and aerial photographs. The fire maps created shortly after the fire were draw on Southern Metropolitan topographic maps (1:12000). Although these maps showed the general movement of the fires, they generally did not show the intensity of the burn or small pockets which escaped burning. The aerial photographs were useful for discerning which areas were not burnt. Unfortunately the summit and plateau of Mt. Wellington were not photographed at the time and a complete set of existing photographs was unavailable to the author. The photographs used are listed in Table 3.11.

Table 3.11: Aerial photographs used to discern areas burnt in the 1967 bushfires

Date	Project #	Run #	Photograph #'s	Height ASL (feet)	Type
Feb 1967	1674	9	T488-50 to T488-54	12000'	B&W
Feb 1967	1674	9	T488-57 to T488-59	12000'	B&W
Feb 1967	1674	9	T488-61	12000'	B&W
Feb 1967	1674	11	T488-105 to T488-108	12000'	B&W
Feb 1967	1674	12	T488-137 to T488-142	12000'	B&W
Feb 1967	1674	15	T487-84 to T487-85	12000'	B&W
Feb 1967	1674	16	T487-106 to T487-110	12000'	B&W

The locations of control burns and wildfires from 1980/81 to 1992/93 were obtained from the (then) HCC City Engineer's Department. This was in the form of transparencies they had placed over a 1:25000 topographic map. Control burns and wildfires were drawn on separate transparencies and colour coded according to the fire season. Most fire areas were labelled with the date of burning. No further information, such as the intensity of the burn or any areas within the fire boundary which were not burnt, were noted on the map. This fire information generally only applied to those fires on HCC land either managed or attended by officers of this Department. No information was otherwise available for private land and no information was available for any land prior to 1980/81 fire season (with the exception of the 1967 wildfires). These fire boundaries were not checked, however, during the initial survey areas recently burnt were noted.

For each mapping unit the area burnt was calculated for wildfires, control fires and the total area burnt.

3.5.3 Vegetation classification

Tasmanian plant communities that occur in Hobart have been described by a number of authors (Table 3.12). These communities are based on floristic composition and are generally named according to the dominant species. In order to determine the reservation status of each mapping unit it was first necessary to compare the description of each mapping unit to these communities. Since mapping units are based on a synusiae approach, often they could not be described as one community type but roughly corresponded to two or three communities. All community types were recorded, however the first community is the most probable or best represents the mapping unit. Some mapping units did not correspond to any community and were subsequently accorded the title 'undescribed'.

Table 3.12: The various vegetation types of Tasmania found in Hobart

Vegetation type	Classificatory studies
Alpine	Kirkpatrick (1983, 1986b)
Rainforest	Jarman, Brown and Kantvilas (1984)
Wet sclerophyll forests	Kirkpatrick *et al.* (1988b)
Riparian communities	Askey-Doran (1992)
Dry sclerophyll forests	Duncan and Brown (1985)
Grassy woodlands	Kirkpatrick *et al.* (1988a)

3.5.4 Community reservation status

Tasmanian plant communities (Section 3.5.3) have been assigned a reservation status by Kirkpatrick *et al.* (1994). This reservation status was determined by an analysis of the frequency and location of each community. The term 'reserve' is used loosely by a variety of government and quasi-government agencies to refer to land set aside for a variety of reasons ranging from recreation to conservation. With regard to the conservation of a community, it is essential to recognise both the reason a reserve exists and the degree of protection afforded in each type of reserve. Kirkpatrick *et al.* (1994) have used the notion of "security of tenure" as a means to define the degree of protection afforded in each type of reserve. Reserves with a high security of tenure are those which can be altered only with the consent of both Tasmanian Houses of Parliament or are protected under an international convention. Reserves which have this security of tenure include the World Heritage Area, National Parks, State Reserves, Nature Reserves and some Conservation Reserves, all are managed by the Department of Environment and Land Management (DELM) and Forestry Reserves managed by Forestry Tasmania. Other state reserves, such as State Recreation Areas and Protected Areas, do not have this security of tenure.

To calculate the reservation status of each community, Tasmania was divided into 10 x 10 km quadrats. A community's status was then determined according to the following criteria:

1. Unreserved: not occurring in a reserve with high security of tenure
2. Poorly-reserved: occurring in a reserve(s) with high security of tenure, but only in one quadrat
3. Well-reserved: occurring in at least one reserve with a high security of tenure, and in at least two quadrats

When determining which reserves had a high security of tenure, Kirkpatrick *et al.* (1994) only used reserves located on Crown land and managed by the Tasmanian Government. Wellington Park, which includes Mountain Park (a municipal reserve owned and managed by the HCC) and land set aside for the Hobart water supply, was not used in these calculations. This park is now covered by the *Wellington Range Act 1993* (see Section 2.4.2). For revocation, approval must be obtained from both Houses of the Tasmanian Parliament.

Recognising Wellington Park has the same security of tenure as secure State managed reserves, it was possible to upgrade the reservation status of some of the communities solely on the basis of having been identified within this park (ie. poorly-reserved to well-reserved and unreserved to poorly-reserved).

3.6 Fire descriptions and management

Recommended fire management strategies for plant communities in Tasmania are generally based on vegetation types. Table 3.13 summarises these recommendations.

Table 3.13: Recommended fire frequencies for the various vegetation types found in Hobart

Vegetation type	Fire frequency	Source
Alpine	never	Balmer (1991)
Rainforest	> 350 years	Jackson (1968) and Cullen (1991)
Wet gully communities	> 350 years	Cullen (1991)
Mixed forests/ Wet sclerophyll forests	50 - 150 years	Wells (1991)
Dry sclerophyll forests - heathy/sedgy	8 to 10 years	Fensham (1992) and Williams (1991)
Dry sclerophyll forests - shrubby	>20 to 25 but < 80 years	Williams (1991)
Grassy woodlands	~ 5 years	Fensham (1992) and Kirkpatrick (1991a)

In order to recommend a fire regime for each vegetation mapping unit, it was first necessary to place each unit into one of these vegetation types (Table 3.13). Where one mapping unit corresponded with two or more vegetation types a judgement was made on the basis of which community it most closely represented.

Table 3.14: The most probable vegetation type of each mapping unit

Vegetation type	Mapping units
Alpine	DA(ub); DA, WA, DA/WA, Nc/AS
Rainforest	RF
Wet gully communities	BS, Ad/BS, Ad/BS-S, GS(2); S/SD
Mixed forests/ Wet sclerophyll forests	Eu/S-H*, Ec-Eu/S-H*, Ed-Eu/S*, Ed/BS, Ed/BS-S, Ej/S*, Ej/H*, Ed-Ej/S*, Ed-Eo/BS-S, Eo-Er/BS-S, Eo/BS, Eo/BS-S, Er/BS, Ed-Er/BS-S, Eo-Er/BS, Eg/GS, Eg/S, Eg-Eo/BS-S, Eg-Eo/S, Eg/GS(2), Eg-Ep/S, Eg-Ev/S, Eg-Eov/S
Dry sclerophyll forests - shrubby	Ec/AS, Ec/H*; Ec/S-H*, Ec/R, Ec-Ed/S*, Eu/R, Ed-Eu/R, Ed/S, Ed/R, Ed-Eo/S, Eo/S, Eo/S-H, Eo/H, Eo-Et/S-H; Eo-Et/H, Eo-Ep/S-H, Ecd/H, Eo-Ev/S, Eo-Ev/S-H, Eo-Ev/H, Eo-Ev/G, Ea-Eo/S-H, Ea-Eo/H, Al/G
Dry sclerophyll forests - heathy/sedgy	Ea/S-H(s), Ea-Et/S-H, Et-Ev/S-H, Eov/H, Eov-Ep/H; (H*/SD)[4]
Grassy woodlands	Et/H; Ea-S-H; Ea/H; Ea-Ev/H, Ea-Eg/S-H, Ep/S, Ep/S-H, Ep/H, Ep/G, Ep-Ev/S, Ep-Ev/S-H, Ep-Ev/H, Ep-Ev/G, Eg-Ep/S-H, Eg-Ep/H, Eg-Ep/G, Ev/S, Ev/G, Eg-Ev/G, Eg-Ev/H, Eov-Ep/S-H

The fire history of the various mapping units was generally obtained from 1967 aerial photographs and HCC fire maps, including the total area burnt by fires from the 1980/81 to 1992/3 fire seasons (see Subsection 3.5.2). Since the literature suggests heathy and sedgy dry sclerophyll forests require burning approximately every 8 to 10 years, the total area burnt in the last 10 years (1983/4 to 1992/3 fire seasons) was calculated for these vegetation types. For grassy forests which require burning every 5 years, the total area burnt in this time (1987/8 to 1992/3) was also calculated. It should again be noted that no extensive survey was undertaken to verify this information and that the areas calculated only correspond to fires attended by HCC Officers and do not include many fuel reduction burns or wildfires on private land not attended or mapped by HCC officers.

3.7 Communities of high conservation value

Conservation significant communities are defined as those communities which are either unreserved or poorly-reserved in Tasmania. According to the criteria of Kirkpatrick *et al.* (1994) twenty communities in Hobart fit these criteria. However, seven of these communities have been upgraded to well-reserved due to their presence in Wellington Park (see Subsection 3.5.4).

[4] Note, the mapping unit H/SD is not a dry sclerophyll forest. It has been included in this 'vegetation type' only because it contains a heathy layer.

Conservation significant communities were deemed to be those mapping units judged to correspond to communities described by other authors (see Table 3.12). For wet sclerophyll forests it was possible to use Kirkpatrick *et al.* (1988b). However, for grassy woodlands it was not generally possible to accurately classify each unit according to Kirkpatrick *et al.* (1988a) without further floristic analysis. The more generalised dry sclerophyll classification of Duncan and Brown (1985) in combination with the grassy woodland classification of Kirkpatrick (1991a) was chosen for all except the *Eucalyptus pulchella* communities (Table 3.15).

Table 3.15: Grassy woodland vegetation types of Kirkpatrick *et al.* (1988a) and the corresponding type according to Duncan and Brown (1988) or Kirkpatrick *et al.* (1991a)

DSF classification (Duncan and Brown 1985 and Kirkpatrick *et al.* 1991b)	Grassy Woodland Classification (Kirkpatrick *et al.* 1988a)	Code
Grassy *E. viminalis* woodland	*E. viminalis/Allocasuarina stricta-Acacia mearnsii* grassy woodland	Evam
	E. viminalis/E. ovata/E. pauciflora-Convolvulus erubescens grassy woodland	Evc
	E. viminalis-Plantago varia grassy woodland	Evpv
	E. viminalis-Acaena ovina grassy woodland	Eva
Grassy *E. amygdalina/E. viminalis* woodland	*E. viminalis/E. amygdalina-Dianella revoluta* grassy woodland (mudstone)	Evd
	E. viminalis-Poa sieberana grassy woodland (mudstone)	Evp
	E. viminalis/E. amygdalina-Acaena echinata/Dichondra repens grassy woodland (dolerite)	Evaa

E. pulchella communities have been divided by Kirkpatrick *et al.* (1988a) into *E. pulchella/E. globulus - Acrotriche serrulata* grassy woodland, which is poorly-reserved in Tasmania and *E. pulchella-Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland, which is well-reserved in Tasmania. However, since only 5% of all *E. pulchella-E. globulus-E. viminalis* grassy/shrubby dry sclerophyll forests in Tasmania are found on reserved land, both these communities are considered to be of high conservation value, especially in southeastern Tasmania (Kirkpatrick *et al.* 1994). The mapping units which can be described as *E. pulchella-Bossiaea prostrata/Gonocarpus tetragynus* grassy woodlands have therefore been included in this section.

Inland *E. tenuiramis* dry sclerophyll forests have been urgently recommended for further reservation in Tasmania (Kirkpatrick *et al.* 1994). This community includes the heathy and grassy dry sclerophyll forests of Duncan and Brown (1985) found largely on sandstone and mudstone. Despite grassy *E. tenuiramis* forests being well-reserved in Tasmania, only 1% of the more generalised classification, Inland *E. tenuiramis* dry sclerophyll forest, is reserved. For this reason, I have chosen to use the more generalised classification for this section.

According to the above criteria nine communities of high conservation value were identified. Table 3.16 summarises the mapping units which correspond to each conservation significant community.

Table 3.16: Mapping units which correspond to significant plant communities

Conservation significant communities in Hobart	Source	Mapping unit(s)
E. globulus-Poa labillardieri-Hypochoeris radicata wet sclerophyll forest	Kirkpatrick *et al.* (1988b)	Eg/S Eg-Eov/S Eg-Ep/S
E. globulus-Bedfordia salicina-Beyeria viscosa wet sclerophyll forest	Kirkpatrick *et al.* (1988b)	Eg/GS(2)
Pomaderris apetala-Beyeria viscosa-Asterotrichion discolour closed forest scrub	Kirkpatrick (1991b)	GS(2)
Inland *E. tenuiramis* dry sclerophyll forest	Kirkpatrick *et al.* (1994) and Duncan and Brown (1985)	Et-Ev/S-H Et/H
E. pulchella/E. globulus - Acrotriche serrulata grassy woodland	Kirkpatrick *et al.* (1988a)	Eg-Ep/S-H Eg-Ep/H Eg-Ep/G Eov-Ep/S-H
E. pulchella-Bossiaea prostrata/Gonocarpus tetragynus grassy woodland	Kirkpatrick *et al.* (1988a)	Ep/S Ep/S-H Ep/H Ep/G Ep-Ev/S Ep-Ev/S-H Ep-Ev/H Ep-Ev/G
Grassy *E. viminalis* woodland	Duncan and Brown (1985)	Ev/S Ev/G
Grassy *E. amygdalina/E. viminalis* woodland	Kirkpatrick (1991a)	Ea-Ev/H Ea-Eg/S-H Ea/S-H Ea/H
Undescribed		H*/SD

Map(s) were compiled for each conservation significant community in Hobart. These maps are at a scale of 1:25000, 1:30000 or 1:35000, and highlight the location of each community by including contours, rivers, roads and the Hobart Municipal boundary. Some communities which are widely distributed in Hobart could not fit on a single A4 sheet and thus required two maps.

For each of the above conservation significant communities the following was calculated:

- The total area (ha) of the community in the study area
- The land tenure, area (ha) and percentage (%) held by each of the following[5]

- Hobart City Council	- reserve (land acquired for reserve) - Wellington Park - non-reserve (land acquired for other than reserve)
- State Government	Crown Reserves (Truganini Reserve and the Mt. Nelson Signal Station Reserve) - Hydro-Electric Commission land - Hobart College
- University of Tasmania	
- Private land (freehold)	

When land tenure was considered a relevant issue it was included in a description of each conservation significant community. Where appropriate, the recent fire history was also included in these descriptions. This information was derived from the HCC fire maps (see Subsection 3.5.2 and Section 3.6).

3.8 Rare or threatened species

Rare or threatened species which occur in the Hobart area were largely identified using a current database lodged in the Department of Geography and Environmental Studies of the University of Tasmania. This database divides Tasmania into 10 x 10 km quadrats which correspond to grid references (AMG). In order to obtain a more precise location(s) for each species the original data sheets were obtained. Information on the data sheets usually included the general name of the collection/recording site, a reference point (Latitude/Longitude or AMG coordinates) and the source of the information. Much of this information was on record at the Tasmanian Herbarium. These records were inspected for any additional or new information or collections. Additional recordings were also sought from other records such as floristic surveys and the personal records of a number of botanists. Surveys used were Martin (1940), Ratkowsky and Ratkowsky (1976, 1982a), Morris (1991), Two Hundred and Eight Network (1994a) and Wells (1994). Additional information and consultation was obtained from: F. Duncan, L. Gilfedder, J. Hickie, J. Kirkpatrick, A. Pyrke and D. Ziegeler.

[5] Land tenure is based on the City of Hobart property maps (1:10000) and Tasmanian 1:25000 series topographic maps (see subsection 3.4.1)

Prior to producing a list of the rare and threatened species from the above information it was first necessary to delete any species which did not occur within the Hobart Municipality as the original database included information relating to other municipalities. It was also necessary to update the risk codes since the National and Tasmania risk codes have been revised recently by ANZECC Endangered Flora Network (1993) and FAC (1994). National codes are in upper case and Tasmanian codes are in lower case. Nationally threatened risk codes follow ANZECC Endangered Flora Network (1993) and national rarity codes follow Briggs and Leigh (1988). Tasmanian risk codes follow the definitions of Kirkpatrick *et al.* (1991b) and FAC (1994).
Threatened species has been ascribed the following risk codes:

X or x for presumed extinct
E or e for endangered
V or v for vulnerable

Rare species (R) have been divided into two groups according to their distribution:

r1 - not x, e or v and the distribution does not exceed 100 x 100 km
r2 - not x, e, v or r1 and occurs in 20 or less 10 x 10 km AMG squares

The term 'K' or 'k' is used for species which are probably rare or threatened but cannot be allocated a specific risk code because there are insufficient data (Kirkpatrick *et al.* 1991b).

Some species on the original database were no longer classified as rare or threatened and thus were deleted from the list.

The reservation status of each species in Tasmania was obtained from FAC (1994). Note, the criteria for assigning a reservation status to a species are not to be confused with assigning a reservation status to a community (see Section 3.7).

Unreserved
- taxa not known to occur in a secure reserve (World Heritage Area and reserves requiring the approval of both Houses of Parliament for revocation - this includes Wellington Park)

Reserved
- taxa known to occur in a secure reserve

Unreserved species were assigned the code 'u', reserved species were not assigned a reservation code.

In addition to the above codes, species endemic to Tasmania were also assigned the code:

1. Endemic to Tasmania
0. Non-endemic to Tasmania

A list of these species was obtained from FAC (1994).

The species nomenclature generally follows Buchanan *et al.* (1989), however, where a species has been renamed recently, both the old and new names are given. Sources of the new names are given in the text. Names of undescribed orchids were obtained from FAC (1994).

Prior to mapping the location(s) of the rare and threatened species in Hobart, it was necessary to chose a uniform reference system. Latitude/longitude was chosen since most locations were referenced in this manner. However, as a few were referenced in AMG it was necessary to convert these points. A number of locations were only referenced by description (for example one mile east of Pinnacle Rd or Queens Domain). For these the latitude/longitude was determined. It was also noticed that many of the given locations did not appear to correspond to the site descriptions. In such cases the reference point was altered to correspond to the site description.

After converting the Hobart Municipal boundary (originally in AGM) to latitude/longitude, maps of the rare and threatened species were created at a scale of 1:80000. Note, these are the only maps in this thesis not to use AGM references, the use of latitude/longitude references allows easy comparison and verification with the source documents.

Chapter 4 Vegetation mapping units

4.1 Alpine Communities

In Tasmania, the term 'alpine' refers to vegetation of both the true alpine zone and to zones of treeless vegetation of alpine character (Kirkpatrick 1983; Balmer 1991). In Hobart, vegetation of this type is restricted to the plateau of Mt. Wellington and to some of its upper doleritic slopes above 950 m. The absence of trees in these communities below the treeline is attributed to soil infertility, frequent frosts, waterlogging and/or repeated firing (Balmer 1991).

Alpine communities in Tasmania have been classified into ten major vegetation types: bolster heath, deciduous heath, coniferous heath, heath, fjaeldmark, bog, fen, short alpine herbfield, tall alpine herfield and tussock grassland (Kirkpatrick 1983). Gilfedder (1985, 1988) identified three of these types on Mt Wellington (bolster heath, tall alpine herbfield and heath) and further divided them according to dominant species. Tall alpine herbfield has subsequently been renamed alpine sedgeland (Kirkpatrick 1989a).

Four mapping units on Mt. Wellington have been identified: dry alpine; wet alpine; dry to wet alpine; and *Nothofagus cunninghamii* alpine heath. Dry alpine has been further divided in fire history to make a total of five mapping units (Figure 4.1). Table 4.1 summarises the various environmental parameters and the land tenure of each mapping unit. In Hobart, this vegetation is found solely in Wellington Park.

Alpine vegetation in Hobart has been burnt by wildfires at least three times in the last century: 1898; 1914; and the latest fire in 1967. This vegetation has been described and mapped by Martin (1940) and Ratkowsky and Ratkowsky (1976 and 1977). Ratkowsky and Ratkowsky (1976) found the species composition had not changed due to the 1967 fire. However, they did modify the 'alpine' associations of Martin (1940) and identified three distinct zones - Zone 1R: montane shrubberies on dolerite, treeless; Zone 1M: montane grasslands and wetlands on dolerite, treeless and shrubless and Zone 2M: montane Quaternary swamp and marsh deposits on dolerite with montane woodlands, treeless (Ratkowsky and Ratkowsky 1977).

Dry alpine vegetation (DA and DA(ub))

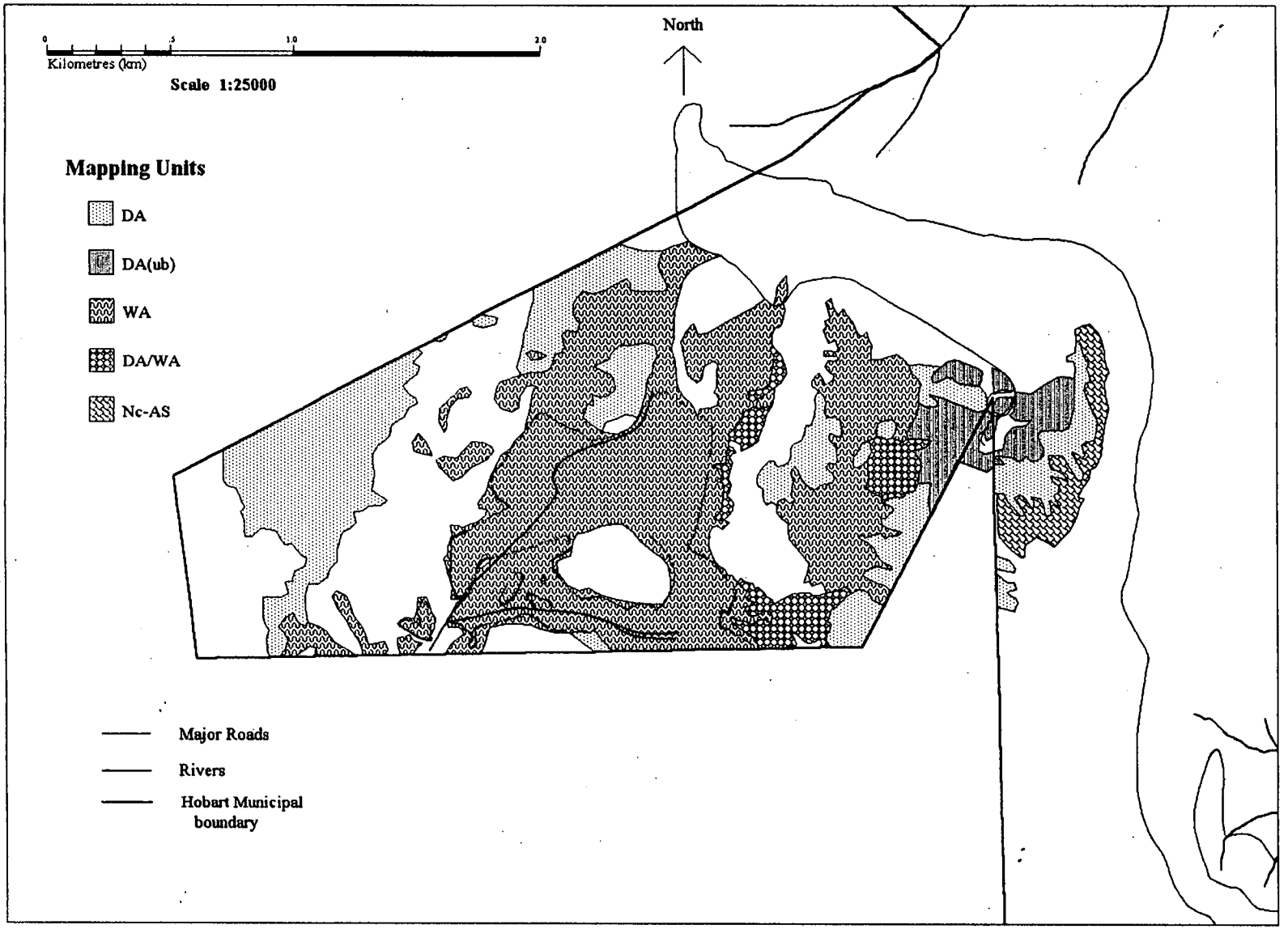
These synusiae contain species which are rarely over 1 m high and represent alpine plant communities which occur on very rocky well drained substrates. Vegetation not burnt or not severely burnt in the 1967 bushfires can be easily distinguished on aerial photographs by its colour - greener areas represent unburnt vegetation and burnt vegetation is brown in

Table 4.1: Alpine communities (as described in text)

		DA	DA(ub)	WA	DA/WA	Nc-AS
Altitude (m)		> 1000	> 1150	>1150	> 1150	950-1150
Slope (degrees)		5 to 35	5 to 25	0 to 5	0 to 20	25 to 30
Aspect		SE, W/SW	E-SE, W	E-S-SW	Summit/W	E-SE
Total Area (ha)		88.1	16.1	129.7	11.0	11.0
Substrate:	Alluvial deposits (ha)	6.0 (7%)		65.4 (50%)		
	Jurassic dolerite (ha)	82.1 (93%)	16.1 (100%)	64.3 (50%)	11.0 (100%)	11.0 (100%)
Land tenure:	HCC reserve (ha)	88.1 (100%)	16.1 (100%)	129.7 (100%)	11.0 (100%)	11.0 (100%)
	Wellington Park (ha)	88.1 (100%)	16.1 (100%)	129.7 (100%)	11.0 (100%)	11.0 (100%)
Fires*	Total area burnt (ha)	0	0	0	0	0
Community description(s)** and respective Reservation Status ** From Kirkpatrick (1983, 1986a)		Heath[1]	Heath[1]	Tall alpine herbfield[1]/ Bolster heath[1]	Heath[1]/ Tall alpine herbfield[1]/ Bolster heath[1]	Heath[1]/ (*Nothofagus cunninghamii-Eucryphia milliganii* heath[1])

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania



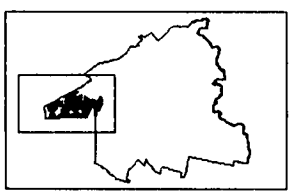


Figure 4.1: Alpine communities

appearance. Some plant species are typically dominant in either the burnt or unburnt areas. For example, *Orites acicularis* is generally more prominent in unburnt areas whereas *Helichrysum ledifolium* which requires fire for long term abundance, dominates many burnt areas (Balmer 1991).

Dry alpine vegetation (burnt and unburnt) can be placed in Ratkowsky and Ratkowsky's (1977) Zone 1R. According to the classification of Kirkpatrick (1983) this vegetation is best described as 'heath'. Gilfedder (1985) divided these heath communities into: *Helichrysum hookeri-Olearia algida* heath, *Epacris serpyllifolia-Baeckea gunniana* heath and *Olearia pinifolia* heath. Recent studies have divided the 'dry' communities into *Helichrysum ledifolium* heath, *Richea scoparia-Orites acicularis* heath, *Epacris serpyllifolia-Helichrysum backhousei* heath and *Leptospermum rupestre* heath (Two Hundred and Eight Network 1994a). Heath communities are well-reserved in Tasmania, although *Helichrysum ledifolium* dominated heathland which is largely restricted to Mt Wellington, is poorly-reserved[1] in Tasmania (Kirkpatrick 1986b).

Wet alpine vegetation (WA)

Wet alpine vegetation occurs in poorly drained areas with few rocks protruding the surface. Ratkowsky and Ratkowsky (1977) have divided this community into two according to the underlying sediment, Zone 1M (dolerite) and Zone 2M (Quaternary swamp and marsh deposits on dolerite). This synusia, comprising both tall alpine herbfield and bolster heath communities (Kirkpatrick 1983) is further divided by Gilfedder (1985) into *Helichrysum scorpioides* tall alpine herbfield, *Astelia alpina* tall alpine herbfield, *Carex appressa* tall alpine herbfield and *Abrotanella forsteroides* bolster heath communities. A more recent study divided 'wet' vegetation into *Astelia alpina* tall alpine herfield, *Abrotanella forsteroides* bolster heath, *Helichrysum hookeri* heath and *Gleichenia alpina-Empodisma minus* fernland, the last community is restricted to Quaternary swamp and marsh deposits on dolerite (Two Hundred and Eight Network 1994a). These wet alpine communities are all well-reserved in Tasmania.

Dry to Wet alpine vegetation (DA/WA)

This mapping unit represents areas where dry and wet alpine vegetation are interspersed and could be considered as a transition zone between the two. Small pools surrounded by protruding rocks/boulders (dolerite) and gravelly surfaces typify the environment of this unit. Plant species common to both dry and wet alpine synusiae are present.

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[1] Kirkpatrick (1986a) lists this community as unreserved, however, as Wellington Park is noted as a secure reserve, its status can be upgraded to poorly-reserved.

Nothofagus cunninghamii-alpine heathland (Nc-AS)

This mapping unit is found on protected slopes below and adjacent to the Organ Pipes on Mt Wellington. It is easily distinguished from other alpine heath mapping units (DA and DA(ub)) by the presence/dominance of dwarf (<2 m) *Nothofagus cunninghamii* shrubs and occurs in very rocky areas (often >50% rock). It is distinguished by its blue-green colouration on aerial photographs. This community, described as *Nothofagus cunninghamii-Eucryphia milliganii* heath (Kirkpatrick 1986b), is well-reserved in Tasmania.

4.2 Subalpine communities

Subalpine mapping units on Mt. Wellington are strongly associated with Jurassic dolerite or dolerite talus. In Hobart, these units are entirely located within Wellington Park (Mountain Park and the adjacent land reserved for City of Hobart water supply). Most of this area was burnt in the bushfires of 1967.

Subalpine plant communities on Mt Wellington are dominated by *Eucalyptus coccifera* and/or *E. urnigera*. Occasionally *E. delegatensis* is present as a codominant or a subdominant species. These mixed eucalypt stands are present at the upper altitudinal limit of *E. delegatensis*. Pyrke and Kirkpatrick (1994) have suggested that *E. delegatensis* will out compete *E. coccifera* and *E. urnigera* on sunny slopes (to its altitudinal limit). However, on shady slopes the inability of its seedlings to survive the freeze-thaw at the snow surface may limit its range. Subalpine communities are generally located between 800 and 1250 m and may extend down to 600 m on more sheltered[2] and colder slopes.

Major fires have occurred in subalpine communities at least three times in the last century: 1898; 1914 and the latest 1967. This vegetation, like alpine vegetation has been described and mapped by Martin (1940) and Ratkowsky and Ratkowsky (1976 and 1977). Ratkowsky and Ratkowsky (1976) found the species composition had not changed due to the 1967 fire. However, they did modify the 'subalpine' associations of Martin (1940) and identified two distinct zones - Zone 2R: montane woodlands on dolerite, containing pure stands of *E. coccifera,* and Zone 3aR: sub-montane woodlands on dolerite or dolerite talus, containing *E. urnigera* plus lesser amounts of *E. coccifera* and *E. johnstonii*. A

[2] The term 'sheltered' is used here to described slopes or ridges which are either south-facing or a protected from the dominating NW winds (see Subsection 2.1.2)

further zone - Zone 3b: wet sclerophyll forests on dolerite or dolerite talus, dominated by *E. delegatensis*, applies to sites where *E. delegatensis* codominates with *E. coccifera* or *E. urnigera.*

4.2.1 *Eucalyptus coccifera* communities/associations

E. coccifera is found in both shrub and tree form on Mt. Wellington. The ground is typically very rocky, with lichens and mosses abundant. *E. coccifera* communities can be divided into four mapping units: over alpine scrub, subalpine heath, subalpine shrubs-heath and rock (where the understorey is sparse). These units occur between 900 and 1200 m. *E. delegatensis* forms an association with *E. coccifera* on an single exposed site between 800 and 950 m (Figure 4.2; Table 4.2).

Eucalyptus coccifera low open-woodland over alpine scrub (Ec/AS)

This mapping unit, characterised by multi-stemmed eucalypts over an understorey of alpine heath, is closely associated with DA and Nc-AH. This unit can be described as an *E. coccifera-Helichrysum ledifolium* low open-woodland (Gilfedder 1985). In her study of the vegetation on the Mt. Wellington summit plateau, Gilfedder concluded that in the subalpine valleys waterlogging prevents the establishment of *E. coccifera,* frost is not the determining factor. This unit occurs in Ratkowsky and Ratkowsky's (1977) Zone 2R.

According to the classification of Duncan and Brown (1985) this unit can also be described as a shrubby subalpine *E. coccifera* woodland, which is well-reserved in Tasmania.

Eucalyptus coccifera low open-woodland over subalpine heath (Ec/H*)

This mapping unit is characterised by the sparseness and often the absence of *E. coccifera* over an heathy understorey. *E. coccifera* has been demonstrated to decline with increased waterlogging (Davidson *et al.* 1981; Pyrke and Kirkpatrick 1994) and its absence in some patches within this unit can be attributed to this environmental stress factor. *Leptospermum lanigerum*, which is better adapted to waterlogging, dominates in these areas. Although only one site is large enough to warrant mapping, small patches were found within the boundaries of some Ec/AS units. This unit which forms part of Ratkowsky and Ratkowsky's (1977) Zone 2R, is best described as a shrubby subalpine *E. coccifera* woodland (Duncan and Brown 1985), which is well-reserved in Tasmania.

Table 4.2 ***Eucalyptus coccifera*** **communities/associations (as described in text)**

		Ec/AS	Ec/H*	Ec/S-H*	Ec/R	Ec-Ed/S*
Altitude (m)		1050-1250	1050-1150	900-1200	900-1100	800-950
Slope (degrees)		5 to 35	10 to 15	25 to 35	25 to 35	30
Aspect		various	N	NE-E-SE	SE-E-NE	NE
Total Area (ha)		116.2	1.9	33.0	14.0	6.1
Substrate:	**Alluvial deposits (ha)**	3.0 (3%)				
	Jurassic dolerite (ha)	113.2 (97%)	1.9 (100%)	31.7 (96%)	14.0 (100%)	0.1 (2%)
	Dolerite talus (ha)			1.3 (4%)		6.0 (98%)
Land tenure:	**HCC reserve (ha)**	116.2 (100%)	1.9 (100%)	33.0 (100%)	14.0 (100%)	6.1 (100%)
	Wellington Park (ha)	116.2 (100%)	1.9 (100%)	33.0 (100%)	14.0 (100%)	6.1 (100%)
Fires*	**Total area burnt (ha)**	0	0	0	0	0
Community description(s) and respective Reservation Status** ** From Duncan and Brown (1985) or Kirkpatrick *et al* (1988b)		Shrubby subalpine *E. coccifera* woodland[1]	Shrubby subalpine *E. coccifera* woodland[1]	Shrubby *E. coccifera* woodland[1]/ *E. coccifera - Orites revoluta - Olearia phlogopappa* subalpine mixed forest (COC 00)[1]	Shrubby subalpine *E. coccifera* woodland[1]/ Shrubby *E. coccifera* woodland[1]	Shrubby *E. delegatensis* forest[1]/ *E. delegatensis - Olearia phlogopappa - O. viscosa* subalpine wet sclerophyll forest (DEL 0010)[1]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania

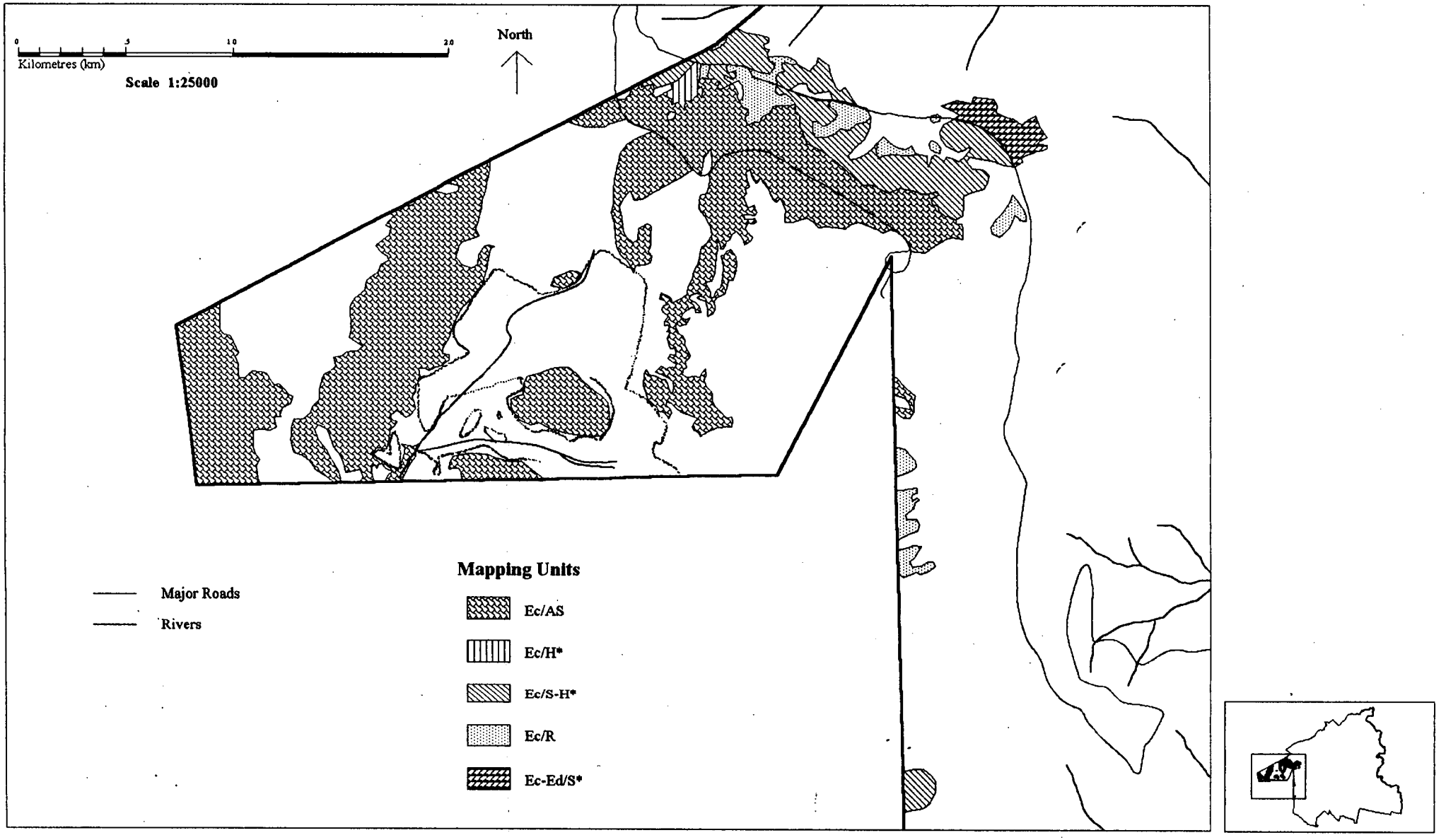


Figure 4.2: Eucalyptus coccifera communities/associations

Eucalyptus coccifera open-woodland over subalpine shrub-heath (Ec/S-H*)

This mapping unit can be distinguished from the two previous units by its floristic composition (absence of xeromorphic alpine flora) and location (lower altitudes and generally more sheltered sites). It forms part of Ratkowsky and Ratkowsky's (1977) Zone 3aR. This unit can be described as a shrubby *E. coccifera* woodland (Duncan and Brown 1985). However, on more sheltered sites where *Nothofagus cunninghamii* is present, this unit is better described as an *E. coccifera-Orites revoluta-Olearia phlogopappa* subalpine mixed forest (COC 00) (Kirkpatrick *et al.* 1988b). Shrubby *E. coccifera* woodland due to its presence in Wellington Park is well-reserved in Tasmania (see Table 4.3). COC 00 is well-reserved in Tasmania. The rare Tasmanian endemic *Brachyglottis brunonis*, is occasionally present in this mapping unit (see Section 7. 3).

Eucalyptus coccifera low open-/open-woodland over rock (Ec/R)

This final *E. coccifera* mapping unit is distinguished by the sparseness or absence of shrubs/heaths in the understorey. An understorey synusia has therefore been omitted. *E. coccifera* is distributed between rocks which are covered with a variety of lichens and mosses. As with the previous unit it forms part of Ratkowsky and Ratkowsky's (1977) Zone 3aR. This unit is placed in shrubby *E. coccifera* woodland, although on sites adjacent to alpine vegetation it is better described as shrubby subalpine *E. coccifera* woodland (Duncan and Brown 1985). As these communities are present in Wellington Park and other secure reserves in Tasmania (see Table 4.3), both are deemed to be well-reserved.

Eucalyptus coccifera-E. delegatensis open-forest over subalpine shrubs (Ec-Ed/S*)

This mapping unit represents the transition zone between *E. coccifera* and *E. delegatensis* at the upper altitudinal range of *E. delegatensis*. The dominant understorey species are similar to those occurring in Ec/S-H*, but are taller and therefore classified as shrubs. This unit is included in Ratkowsky and Ratkowsky's (1977) Zone 3b. Although *E. coccifera* is codominant, this unit is best described as a shrubby *E. delegatensis* forest (*E. delegatensis-E. coccifera* (low) open-forest) (Duncan and Brown 1985), which is well-reserved in Tasmania. This unit only occurs on one small rocky, well-insolated slope on Mt. Wellington.

Table 4.3: Modified Reservation status of various communities due to their presence in Wellington Park

Community	Reservation status (Kirkpatrick *et al.* 1994))	Mapping units	Area in Well. Park (ha)	Probable area occupied by community[1] (ha)	Reservation status (includes Wellington Park)
Shrubby *E. coccifera* woodland	Poorly reserved	Ec/S-H*	33.0	33.0	Well-reserved
		Ec/R	14.0		
		Eu/R	10.8		
E. urnigera subalpine mixed forest	Poorly reserved	Eu/S-H*	48.0	101.1	Well-reserved
		Ec-Eu/S-H*	92.6		
		Ed-Eu/S*	53.1		
Undescribed	Poorly reserved[2]	S/SD	5.0	5.0	Well-reserved
E. johnstonii wet sclerophyll forest	Poorly reserved	Ej/S*	4.2	39.7	Well-reserved
		Ej/H*	2.5		
		Ed-Ej/S*	33.0		
Not described	Unreserved	H/SD	2.5		Poorly-reserved
E. regnans - Acacia dealbata - Pomaderris apetala wet sclerophyll forest	Poorly Reserved	Ed-Er/BS-S	7.9	57.9	Well-reserved
		Er/BS	32.9		
		Eo-Er/BS	17.1		
		Eo-Er/BS-S	32.4		
E. obliqua - Olearia lirata - Pultenaea juniperina wet sclerophyll forest	Poorly reserved	Eo/BS-S	55.7	0.0	Poorly-reserved
		Eo/S	136.1		
E. regnans - E. obliqua - Pomaderris apetala - Olearia lirata wet sclerophyll forest	Poorly Reserved	Eo-Er/BS	17.1	32.4	Well-reserved
		Eo-Er/BS-S	32.4		

[1] Area calculated using the first choice description of each mapping unit

[2] This community is also found in the Maria Island National Park

4.2.2 *Eucalyptus urnigera* communities/associations

This group consists of communities where *E. urnigera* dominates or codominates with either *E. coccifera* or *E. delegatensis*. These communities generally occur on lower or cooler/moist sites than *E. coccifera* communities and although the ground is still rocky, sedges such as *Gahnia grandis*, dominate the wetter sites. For example, on easterly/south-easterly slopes *E. urnigera* dominant communities are present down to 750 m and where they form an association with *E. delegatensis* they are found as low as 600 m (Figure 4.3; Table 4.4). *Brachyglottis brunonis*, a rare Tasmanian endemic, is occasionally present in these mapping units (see Section 7.3).

Eucalyptus urnigera woodland/open-forest over subalpine shrub-heath (Eu/S-H*)

The understorey of this mapping unit is similar to Ec/S-H* (Section 4.2.1) in floristic composition. However, it occurs at lower altitudes and sites tend to be more sheltered and wetter. *E. johnstonii* and *Nothofagus cunninghamii* are occasionally present. *E. urnigera* prefers the warm lower sites and can withstand a higher degree of waterlogging (Pyrke and Kirkpatrick 1994). This community is included in Ratkowsky and Ratkowsky's

Table 4.4 ***Eucalyptus urnigera*** **communities/associations (as described in text)**

		Eu/S-H*	Eu/R	Ec-Eu/S-H*	Ed-Eu/S*	Ed-Eu/R
Altitude (m)		750-1050	750-900	800-1150	650-1000	600-900
Slope (degrees)		20 to 25	20 to 30	20 to 35	20 to 30	20 to 30
Aspect		E-SE	E	SE-NE	E, N	E
Total Area (ha)		48.0	10.8	92.6	53.9	9.2
Substrate:	**Jurassic dolerite (ha)**	12.5 (26%)	0.7 (6%)	44.8 (48%)	2.9 (5%)	
	Dolerite talus (ha)	35.5 (74%)	10.1 (94%)	47.8 (52%)	46.8 (87%)	9.2 (100%)
	Triassic sandstone (ha)				4.2 (8%)	
Land tenure:	**HCC reserve (ha)**	48.0 (100%)	10.8 (100%)	92.6 (100%)	53.9 (100%)	9.2 (100%)
	Wellington Park (ha)	48.0 (100%)	10.8 (100%)	92.6 (100%)	53.1 (98%)	9.2 (100%)
Fires*	**Wildfires (ha)**				12.8 (24%)	
	Control burns (ha)					
	Total area burnt (ha)	0	0	0	12.8 (24%)	0
Community description(s) and respective Reservation Status**		*E. urnigera* subalpine mixed forest[1]	Shrubby subalpine *E. coccifera* woodland[1]	*E. coccifera - Orites revoluta - Olearia phlogopappa* subalpine mixed forest (COC 00)[1]/ *E. urnigera* subalpine mixed forest[1]	*E. delegatensis - Olearia phlogopappa - O. viscosa* subalpine wet sclerophyll forest (DEL 0010)[1]	Shrubby *E. delegatensis* forest[1]

** From Duncan and Brown (1985) or Kirkpatrick *et al* (1988b)

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania

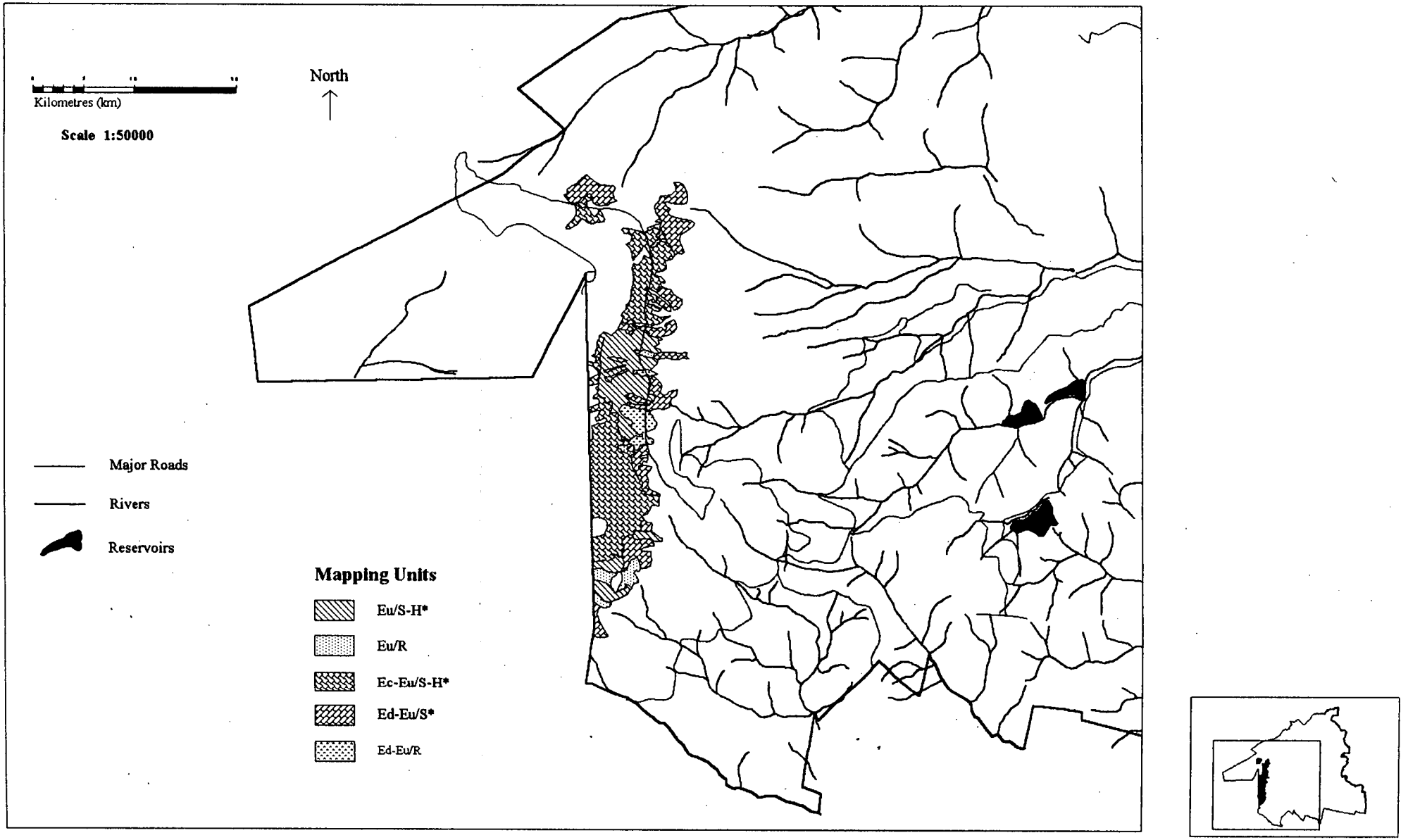


Figure 4.3: Eucalyptus urnigera communities/associations

(1977) Zone 3aR. Kirkpatrick *et al.* (1988b) does not floristically describe this type of vegetation, although they preliminary describe it as an *E. urnigera* subalpine mixed forest. This community is well-reserved in Tasmania (see Table 4.3).

***Eucalyptus urnigera* woodland/open-forest over rock (Eu/R)**

This mapping unit is characterised by the sparseness or the absence of a shrub/heath understorey. Rocks or boulders covered in lichens and mosses dominate the ground layer, with ferns present in the cracks. As with the previous unit, this unit forms part of Ratkowsky and Ratkowsky's (1977) Zone 3aR. This unit is similar to the mapping unit Ec/R and us best described according to the dry sclerophyll classification of Duncan and Brown (1985) as a shrubby *E. coccifera* woodland. *E. coccifera* is often codominant in this woodland and the sites on Mt. Wellington may represent the lower end of its altitudinal range. Shrubby *E. coccifera* woodland is well-reserved in Tasmania (see Table 4.3).

***Eucalyptus coccifera-E. urnigera* low open-/open-woodland over subalpine shrubs-heath (Ec-Eu/S-H*)**

E. coccifera forms an association with *E. urnigera* between 700 and 1150 m over an understorey of subalpine shrubs-heath. The understorey is floristically similar to Ec/S-H and Eu/S-H* and it occurs where environmental parameters allow these two mapping units to coexist. This unit forms part of Ratkowsky and Ratkowsky's (1977) Zone 3aR. It is best described as a transition zone between an *E. coccifera-Orites revoluta-Olearia phlogopappa* subalpine mixed forest (COC 00) and an *E. urnigera* subalpine mixed forest (Kirkpatrick *et al.* 1988b). Both communities are well-reserved in Tasmania.

***Eucalyptus delegatensis - Eucalyptus urnigera* open-forest over subalpine shrubs (Ed-Eu/S*)**

E. delegatensis commonly codominates with *E. urnigera* in subalpine regions of Mt Wellington, especially on the easterly dolerite talus slopes. *E. urnigera* tends to dominate the upper altitudinal limits of this unit and *E. delegatensis* toward the lower limits. *E. coccifera* is also present as a subdominant species. The understorey species are similar to the shrub-heath synusiae found below *E. urnigera*, but are taller and therefore classified as shrubs. This unit represents a transition between *E. urnigera* subalpine mixed forest (Kirkpatrick *et al.* 1988b) and shrubby *E. delegatensis* forest (Duncan and Brown 1985). Both communities are well-reserved in Tasmania. This unit was partially burnt by a bushfire in early 1983.

***Eucalyptus delegatensis-E. urnigera* tall open-woodland over rock (Ed-Eu/R)**

This vegetation type occurs over exposed boulders with understorey species composition similar to the previous mapping unit. Although *E. urnigera* is present, this unit is best described as a shrubby *E. delegatensis* forest (Duncan and Brown 1985), which is well-reserved in Tasmania.

4.3 Upper slope communities

The upper slopes of Mt. Wellington are dominated by *Eucalyptus delegatensis,* often in association with other species of eucalypt. Associations with *E. coccifera* and *E. urnigera* occur at the upper altitudes (see Section 4.2) and *E. obliqua* and *E. regnans* at the lower altitudes. On sandstone *E. delegatensis* may form an association with *E. johnstonii* in which the latter species may be dominant. There are two mapping units which lack a eucalypt overstorey. Most of this area was burnt in the bushfires of 1967.

Three subgroups have been identified on the upper slopes of Mt. Wellington: *E. delegatensis* communities/shrub community; the sandstone communities of Mt. Wellington ; and the associations at the lower altitudinal range of *E. delegatensis* (with either *E. obliqua* or *E. regnans).*

4.3.1 *Eucalyptus delegatensis* communities/shrub community

E. delegatensis dominates the dolerite talus slopes of Mt. Wellington. To a minor degree on the sandstone sites it also codominates with *E. johnstonii*, this mapping unit (Ed-Ej/S*) will be discussed in Subsection 4.3.2. Where *E. delegatensis* is the sole dominant it occurs over a variety of understorey synusiae. Other species of eucalypt are also present. For example, *E. urnigera* may be present at the upper altitudinal limits of these mapping units and *E. obliqua* at the lower limits. The ground is generally less rocky than in *E. coccifera* and *E. urnigera* units, with ferns and sedges often dominating the ground layer. Included also in this group is a mapping unit which lacks a dominant eucalypt stratum.

With the exception of two units, Ed/BS and Ed/S, all the following units are found entirely in Hobart City Council (HCC) reserves. Figure 4.4 shows the locations of these mapping units. Table 4.5 shows the total area, some environmental parameters and the land tenure of each unit.

The communities found on these doleritic slopes are included in Ratkowsky and Ratkowsky's (1977) Zone 3b: wet sclerophyll forests on dolerite or dolerite talus, dominated by *E. delegatensis.*

Table 4.5 ***Eucalyptus delegatensis*** **communities/shrub community (as described in text)**

		Ed/S	Ed/BS-S	Ed/BS	Ed/R	S/SD
Altitude (m)		500-950	500-750	550-750	600-1000	700-950
Slope (degrees)		20 to 30	15 to 30	15 to 25	25 to 30	15 to 25
Aspect		NE-E	SE-NE	E	SE-NE	N
Total Area (ha)		125.4	49.7	12.7	10.6	5.0
Substrate:	**Jurassic dolerite (ha)**	0.8 (1%)			0.4 (3%)	
	Dolerite talus (ha)	105.6 (84%)	27.4 (55%)	4.5 (35%)	9.9 (94%)	5.0 (100%)
	Triassic sandstone (ha)	14.2 (11%)	20.7 (42%)	8.2 (65%)	0.3 (3%)	
	Permian mudstone (ha)	4.8 (4%)	1.6 (3%)			
Land tenure:	**HCC reserve (ha)**	114.7 (91%)	49.7 (100%)		10.6 (100%)	5.0 (100%)
	Wellington Park (ha)	101.2 (81%)	42.9 (86%)		10.6 (100%)	5.0 (100%)
	Private (ha)	10.7 (9%)		12.7 (100%)		
Fires*	**Wildfires (ha)**	59.8 (43%)	6.8 (14%)		2.3 (21%)	4.7 (95%)
	Control burns (ha)					
	Total area burnt (ha)	59.8 (43%)	6.8 (14%)		2.3 (21%)	4.7 (95%)
Community description(s) and respective Reservation Status**		Shrubby *E. delegatensis* (tall) forest/[1] *E. delegatensis Olearia phlogopappa O. viscosa* subalpine wet sclerophyll forest (DEL 0010)[1]	Shrubby *E. delegatensis* (tall) forest[1]/ *E. delegatensis -Atherosperma moschatum -Olearia argophylla* wet sclerophyll forest (DEL 0110)[1]/ *E. delegatensis- Zieria arborescens- Hydrocotyle sibthorpioides* wet sclerophyll forest (DEL 0111)[1]	*E. delegatensis- Atherosperma moschatum- Olearia argophylla* wet sclerophyll forest (DEL 0110)[1]	Shrubby *E. delegatensis* (tall) forest[1]	undescribed, though occurs on Maria Is.***[2]

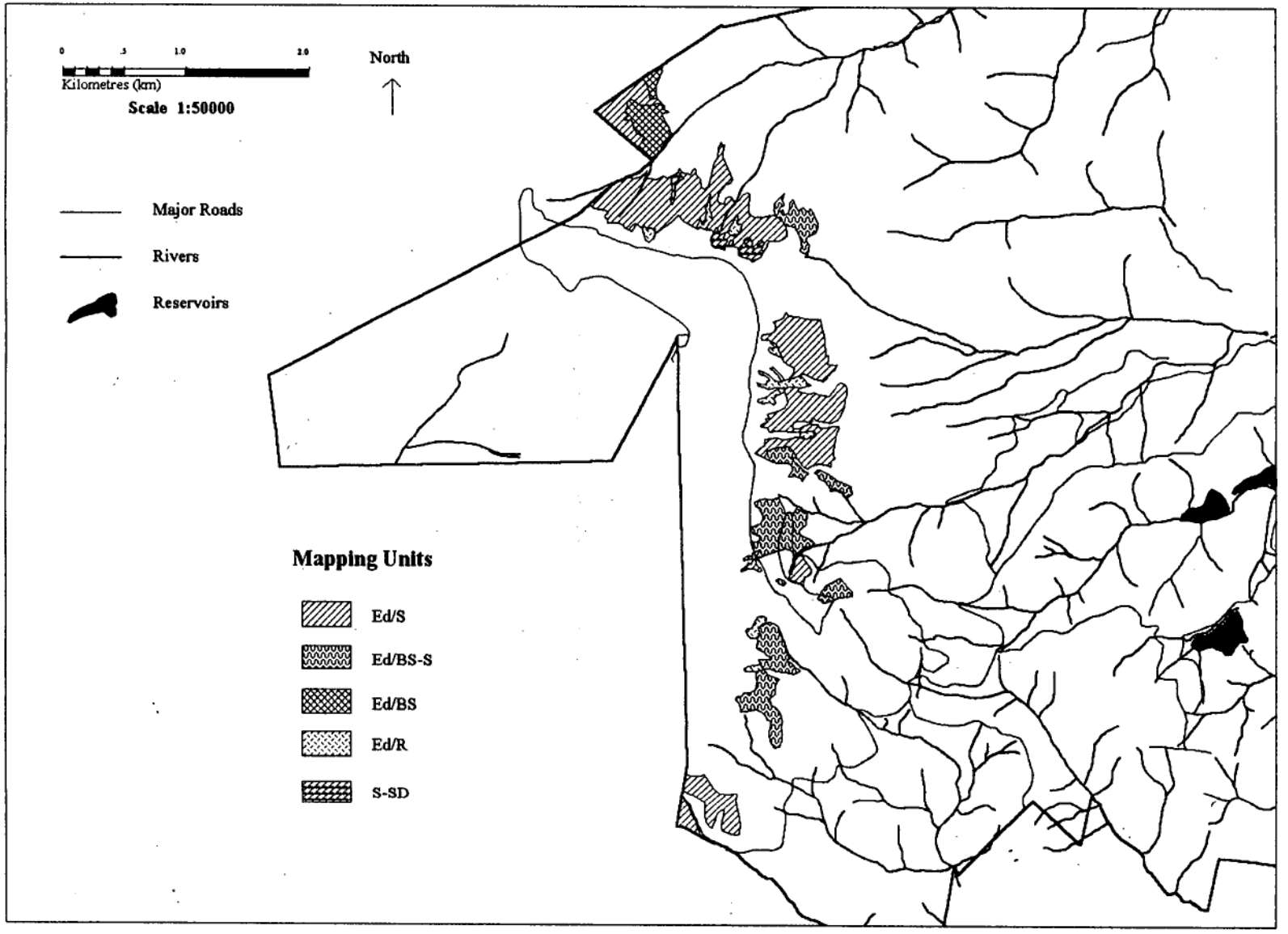
** From Duncan and Brown (1985) or Kirkpatrick *et al* (1988b)

*** J. Kirkpatrick pers comm

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania

[2] Poorly-reserved in Tasmania



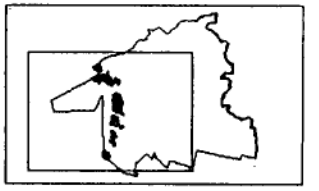


Figure 4.4: Eucalyptus delegatensis communities/shrub community

Eucalyptus delegatensis open-/tall open-forest over narrow-leaved shrubs (Ed/S)

This vegetation type, characterised by *E. delegatensis* over an understorey dominated by narrow-leaved shrubs, is predominantly located in Wellington Park. Found generally on the drier north-facing slopes, many sites were burnt in the wildfire in early 1983. This unit can be described by as a shrubby *E. delegatensis* (tall) forest (Duncan and Brown 1985), although in areas where broad-leaved shrubs are present it can be described as an *E. delegatensis-Olearia phlogopappa-O. viscosa* wet sclerophyll forest (DEL 0010) (Kirkpatrick *et al.* 1988b). By either classification this community is well-reserved in Tasmania.

Eucalyptus delegatensis open-/tall open-forest over broad-leaved - narrow-leaved shrubs (Ed/BS-S)

This *E. delegatensis* mapping unit shows elements common to both wet and dry sclerophyll forests containing both broad-leaved and narrow-leaved species. The wildfire in early 1983 burnt some sites, however, since these sites are slightly wetter than those associated with the previous mapping unit Ed/S, the burning was probably not as severe. Ed/BS-S occurs on either Jurassic dolerite or Triassic sandstone substrates. *E. johnstonii* is often present on the latter substrate. This unit can generally be described as a shrubby *E. delegatensis* (tall) forest (Duncan and Brown 1985), however, on dolerite talus it is better be described as an *E. delegatensis-Atherosperma moschatum-Olearia argophylla* wet sclerophyll forest (DEL 0110) and on sandstone sites as *E. delegatensis-Zieria arborescens-Hydrocotyle sibthorpioides* wet sclerophyll forest (DEL 0111) (Kirkpatrick *et al.* 1988b). Shrubby *E. delegatensis* (tall) forests, DEL 0110 and DEL 0111 are all well-reserved in Tasmania.

Eucalyptus delegatensis tall open-forest over broad-leaved shrubs (Ed/BS)

This wet sclerophyll forest community occurs in two privately owned areas north of New Town Rivulet. These sites are on southerly aspects and the vegetation indicates that these sites have not been burnt since 1967. *E. delegatensis* is often sparsely distributed with *Acacia dealbata* forming a second stratum. The understorey vegetation is often dense, attaining heights of over 3m. Sites are predominantly Triassic sandstone and to a lesser degree dolerite talus. Although this mapping unit is best described as an *E. delegatensis-Atherosperma moschatum-Olearia argophylla* wet sclerophyll forest (DEL 0110) (Kirkpatrick *et al.* 1988b) it lacks the mixed forest species. This community is well-reserved in Tasmania.

Eucalyptus delegatensis tall open-woodland over rock (Ed/R)

E. delegatensis occurs sparely in areas of dolerite scree between 600 and 1000m on NE-SE facing slopes (25 to 30°). Other than the occasional shrub no understorey is present. This mapping unit was partially burnt in a 1983 wildfire on Mt. Wellington. This unit is best described as a shrubby *E. delegatensis* (tall) forest (Duncan and Brown 1985), which is well-reserved in Tasmania.

Shrubland over sedges (S/SD)

This mapping unit is dominated by *Bedfordia salicina* and *Gahnia grandis*. *E. delegatensis* is an occasional emergent. It occurs on the wetter north-facing upper slopes of Mt. Wellington and may represent a transitional stage towards a *E. delegatensis* forest. The establishment of *E. delegatensis* seedlings may be restricted by the semi-waterlogged ground. Fire records indicate this unit was last burnt in a wildfire in 1983. Although not described, this unit also occurs in Maria Island National Park (J. Kirkpatrick pers. comm.). Due to its presence in both in Wellington Park and Maria Is., this community can be considered well-reserved in Tasmania (see Table 4.3).

4.3.2 Sandstone communities on Mt Wellington

E. johnstonii dominates or codominates with *E. delegatensis* on the Triassic sandstone benches of Mt Wellington. These benches which include The Springs and Sphinx Rock are found at altitudes between 600 and 750 m. *E. urnigera* is often subdominates in these communities. A further community which lacks eucalypts is also included in this group due to its presence on a sandstone bench.

These mapping units are also characterised by the dominance of ferns or sedges including *Gahnia grandis*. The communities are all located in Wellington Park. Figure 4.5 shows the locations of the mapping units found on these sandstone outcrops. Table 4.6 shows the total area, some environmental parameters and the land tenure of each unit.

Sandstone communities in Hobart included in Martin's (1940) Zone 5: sandstone communities were omitted from Ratkowsky and Ratkowsky's (1977) study as they were not found on acid, peaty soil. This latter study only included the communities on Snake Plains (Kingborough Municipality).

Table 4.6 **Sandstone communities on Mt. Wellington (as described in text)**

		Ej/S*	Ej/H*	Ed-Ej/S*	H*/SD
Altitude (m)		650-701	650-700	600-750	650-700
Slope (degrees)		5 to 15	0	15-30	5
Aspect		S		NE-E-S	N-NE
Total Area (ha)		4.2	2.5	33.0	2.5
Substrate:	**Dolerite talus (ha)**	0.5 (12%)		10.3 (31%)	
	Triassic sandstone (ha)	3.7 (88%)	2.5 (100%)	20.2 (61%)	2.5 (100%)
	Permian mudstone (ha)			2.5 (8%)	
Land tenure:	**HCC reserve (ha)**	4.2 (100%)	2.5 (100%)	33.0 (100%)	2.5 (100%)
	Wellington Park (ha)	4.2 (100%)	2.5 (100%)	33.0 (100%)	2.5 (100%)
Fires*	**Wildfires (ha)**				2.5 (100%)
	Control burns (ha)				
	Total area burnt (ha)	0	0	0	2.5 (100%)
Community description(s) and respective Reservation Status** * From Kirkpatrick *et al* (1988b)		*E. johnstonii* wet sclerophyll forest[1]	*E. johnstonii* wet sclerophyll forest[1]	*E. johnstonii* wet sclerophyll forest[1]/ *E. delegatensis - Olearia phlogopappa - O. viscosa* subalpine wet sclerophyll forest (DEL 0010)[1]	Not described[2]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania

[2] Poorly-reserved in Tasmania

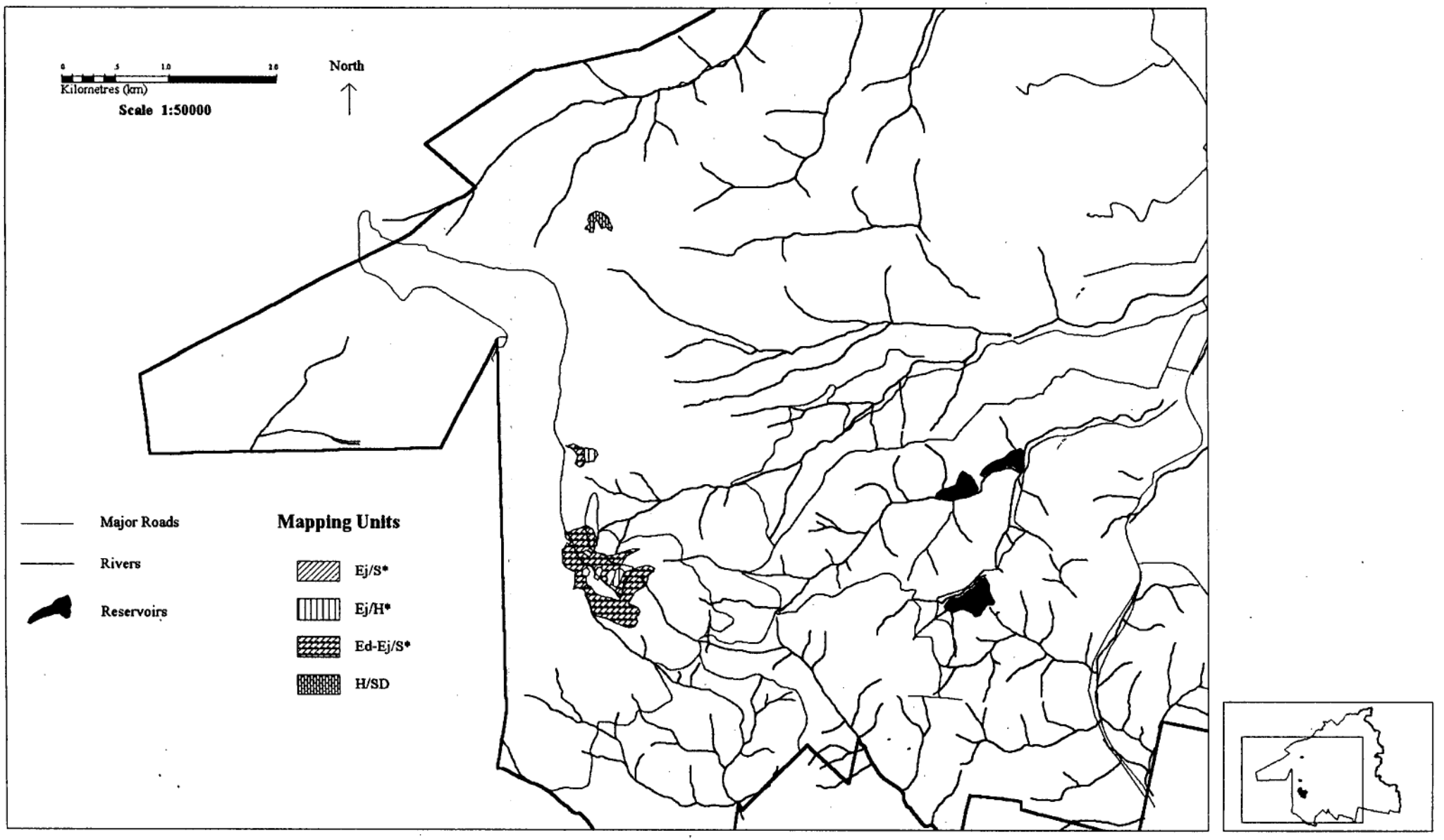


Figure 4.5: Sandstone outcrop communities on Mt. Wellington

Eucalyptus johnstonii low woodland/low open-forest over subalpine shrubs (Ej/S*)

This mapping unit occurs on one sheltered slope at The Springs. Moist conditions and the absence of fire (since 1967) have allowed a tall shrub layer to develop. This unit is best described an a *E. johnstonii* wet sclerophyll forest (Kirkpatrick *et al.* 1988b), and due to its presence in Wellington Park and the Cape Pillar State Reserve, is well-reserved in Tasmania (see Table 4.3).

Eucalyptus johnstonii low open-/open-woodland over subalpine heath (Ej/H*)

This mapping unit is restricted to the flat, more exposed and moderately drained sandstone outcrops at The Springs and Sphinx Rock. Although floristically similar to the above unit, the harsher environmental conditions have probably restricted the development of understorey species. This area may have been cleared in the past. It is again described as a *E. johnstonii* wet sclerophyll forest community (Kirkpatrick *et al.* 1988b), which is well-reserved in Tasmania .

Eucalyptus delegatensis-E. johnstonii open-forest over subalpine shrubs (Ed-Ej/S*)

E. delegatensis and *E. johnstonii* codominate in a mapping unit which is floristically similar to the unit Ej/S*. *E. urnigera* is present occasionally as a subdominant. This unit represents a transition between a *E. johnstonii* wet sclerophyll forest and an *E. delegatensis-Olearia phlogopappa-O. viscosa* subalpine wet sclerophyll forest (DEL 0010) community (Kirkpatrick *et al.* 1988b). Both communities are well-reserved in Tasmania.

Heathland over sedges (H/SD)

This mapping unit occurs on a moderately drained sandstone outcrop. This unit is dominated by heath species with the occasional *Eucalyptus delegatensis* seedling emerging through this layer. The absence of a dominant eucalyptus layer may be attributed to the drainage. The heath species are similar to those occurring in the understorey of Ej/H*, however, some species common to lower altitudes are present probably due to this sites warmer northerly-facing aspect. Fire records show that this site has a history of fires, including the 1967 and more recently the 1983 wildfire. This community may be a transition to a shrubby dry sclerophyll forest, however, as such it is not described in the literature (see Subsection 3.5.3). Due to its presence in Wellington Park can be considered poorly-reserved in Tasmania (see Table 4.3).

4.3.3 *Eucalyptus delegatensis* associations

E. delegatensis forms an association with either *E. obliqua* or *E. regnans* at its lower altitudinal limits. This boundary roughly corresponds to the 700 m contour. Ferns and sedges generally dominate the ground layer. Figure 4.6 shows the locations of these mapping units. Table 4.7 shows the total area, some environmental parameters and the land tenure of each unit.

These communities are incorporated in both Zone 3b: wet sclerophyll forests on dolerite or dolerite talus, dominated by *E. delegatensis* and Zone 4P: wet sclerophyll forests on Permian deposits, dominated by *E. obliqua* (Ratkowsky and Ratkowsky 1977).

Eucalyptus delegatensis-E. obliqua broad-leaved - narrow-leaved shrub open-forest (Ed-Eo/BS-S)

On the wet and sheltered sites where these two species codominate, the understorey is dominated by both broad-leaved and narrow-leaved shrubs. *Acacia dealbata* often forms a second stratum. This unit which occurs on a variety of substrates is entirely located in Wellington Park. It can be described as either an *E. delegatensis/E. obliqua-Acaena novae-zelandiae* wet sclerophyll forest (DEL 0101) or an *E. delegatensis/E. viminalis-Acacia melanoxylon* wet sclerophyll forest (DEL 0100) (Kirkpatrick *et al.* 1988b). By either description this community is well-reserved in Tasmania.

Eucalyptus delegatensis-E. obliqua narrow-leaved shrub open-forest (Ed-Eo/S)

This mapping unit, when compared to the previous unit, is found on drier and/or more frequently and recently fired sites. It represents a transition between a dry sclerophyll and wet sclerophyll forest. However, it is best described as a shrubby *E. delegatensis-E. obliqua* forest (Duncan and Brown 1985). This community is well-reserved in Tasmania. Most of this mapping unit occurs in Wellington Park.

Eucalyptus delegatensis-E. regnans broad-leaved - narrow-leaved shrubs tall open-forest (Ed-Er/BS-S)

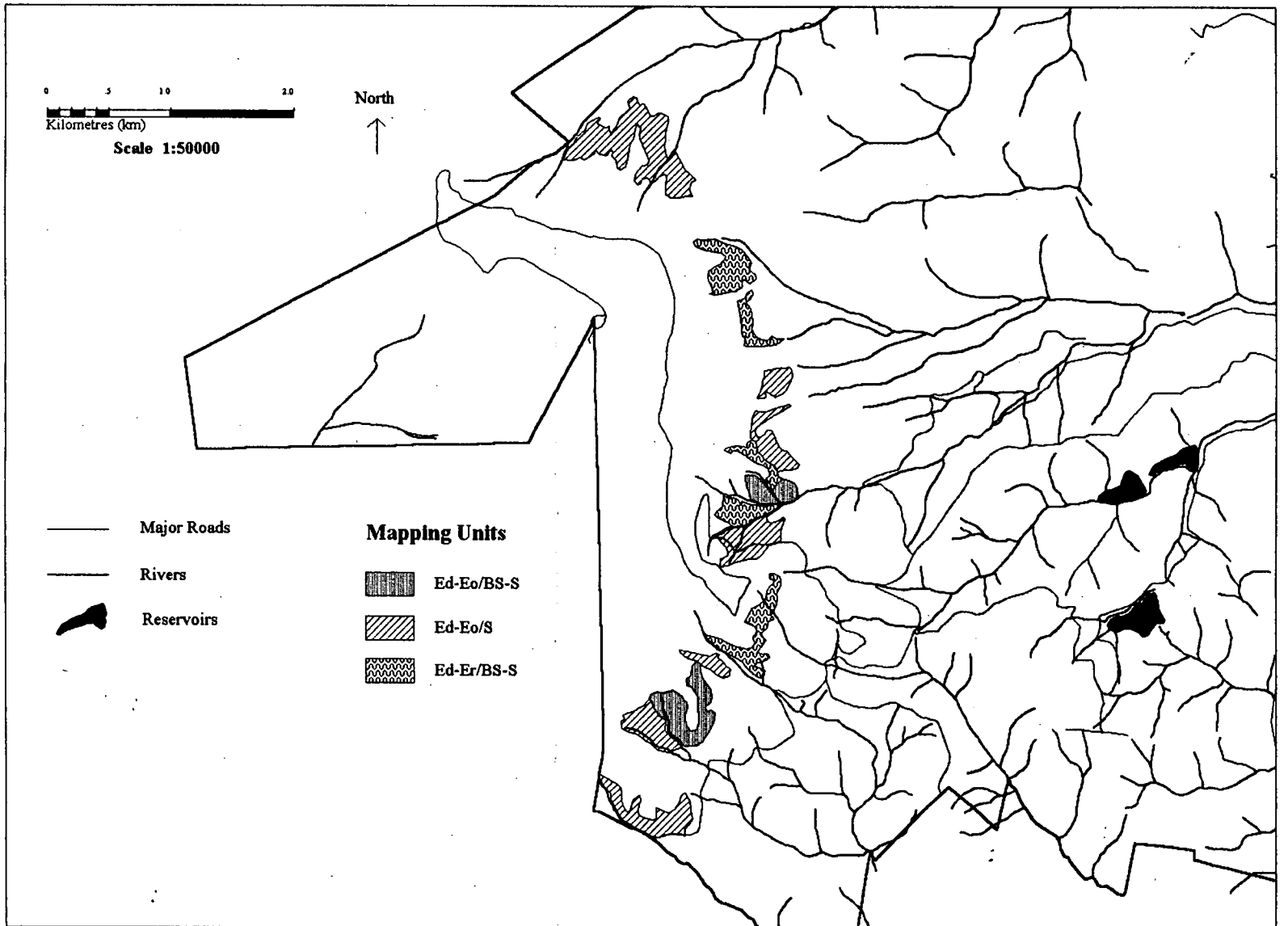
This mapping unit is found on sheltered or moist slopes at the lower limits of *E. delegatensis*'s altitudinal range. *E. obliqua* is occasionally subdominant. The understorey consists of a combination of broad- and narrow-leaved shrubs, ferns and sedges dominate the ground layer. This understorey indicates that this unit has probably not been burnt

Table 4.7 *Eucalyptus delegatensis* associations (as described in text)

		Ed-Eo/BS-S	Ed-Eo/S	Ed-Er/BS-S
Altitude (m)		450-750	400-700	400-600
Slope (degrees)		15 to 25	10 to 25	15 to 25
Aspect		E-S	S, NE-E	W-SW
Total Area (ha)		28.3	86.1	22.3
Substrate:	Jurassic dolerite (ha)			
	Dolerite talus (ha)	15.0 (53%)	48.4 (56%)	10.7 (48%)
	Triassic sandstone (ha)	5.1 (18%)	10.9 (13%)	6.4 (29%)
	Permian mudstone (ha)	8.2 (29%)	26.8 (31%)	5.2 (23%)
Land tenure:	HCC reserve (ha)	28.3 (100%)	77.8 (90%)	22.1 (99%)
	Wellington Park (ha)	28.3 (100%)	67.3 (78%)	7.9 (35%)
	Private (ha)		8.3 (10%)	0.2 (1%)
Fires*	Wildfires (ha)	2.0 (7%)	27.9 (32%)	
	Control burns (ha)			
	Total area burnt (ha)	2.0 (7%)	27.9 (32%)	0
Community description(s)** and respective Reservation Status ** From Duncan and Brown (1985) or Kirkpatrick *et al* (1988b)		*E. delegatensis/E. viminalis-Acacia melanoxylon* wet sclerophyll forest (DEL 0100)[1]/ *E. delegatensis/E. obliqua - Acaena novae-zelandiae* wet sclerophyll forest (DEL 0101)[1]	Shrubby *E. delegatensis-E. obliqua* forest[1]	*E. regnans - Acacia dealbata - Pomaderris apetala* wet sclerophyll forest (REG 1001)[1]/ *E. delegatensis - Atherosperma moschatum - Olearia argophylla* wet sclerophyll forest (DEL 0110)[1]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania



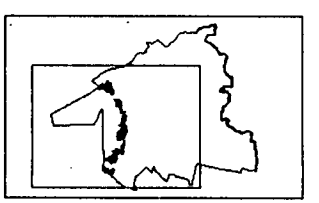


Figure 4.6: Eucalyptus delegatensis associations

since the bushfires of 1967. These sites probably represent a transition between *E. delegatensis-Atherosperma moschatum-Olearia argophylla* wet sclerophyll forest (DEL 0110) and an *E. regnans-Acacia dealbata-Pomaderris apetala* wet sclerophyll forest (REG 1001) (Kirkpatrick *et al.* 1988b). DEL 0110 is well-reserved in Tasmania and due to REG 1001's presence in Wellington Park it can also be deemed well-reserved (see Table 4.3).

4.4 Lower slope communities

The lower slopes of Mt. Wellington are generally dominated by *Eucalyptus obliqua* or *E. tenuiramis*, or an association between these species. The underlying rock is predominantly Permian mudstone. However, dolerite talus and Triassic sandstone sites are present. Although part of the lower slopes are in Wellington Park much of the remaining land is privately held. Vegetation on these slopes is subject to destruction by urban expansion or is affected by the neighbouring urbanisation.

4.4.1 *Eucalyptus obliqua* communities

E. obliqua is commonly found in a variety of environmental conditions such as wet and dry sclerophyll forests and woodlands. This adaptation is thought to be largely due to a variety of ecotypes Ashton (1981). In Hobart, this species dominates the lower slopes of Mt. Wellington and is present on some of the foothills surrounding the urban centre. Ranging from 100 to 700 m in altitude the underlying rock is predominantly Permian mudstone. *E. obliqua* also codominates with many other eucalypt species in Hobart. These associations are discussed in Sections 4.3, 4.5, 4.6 and 4.7. *E. cordata,* is present in the understorey of some *E. obliqua* communities near Chimney Pot Hill/Summerleas Road, this species is 'rare' in Tasmania (FAC 1994) - see Section 7.3. Five *E. obliqua* mapping units have been identified: over broad-leaved shrubs, broad-leaved/narrow-leaved shrubs, narrow-leaved shrubs, narrow-leaved shrubs-heath and heath.

Figure 4.7 shows the locations of these mapping units. Table 4.8 shows the total area, some environmental parameters and the land tenure of each unit.

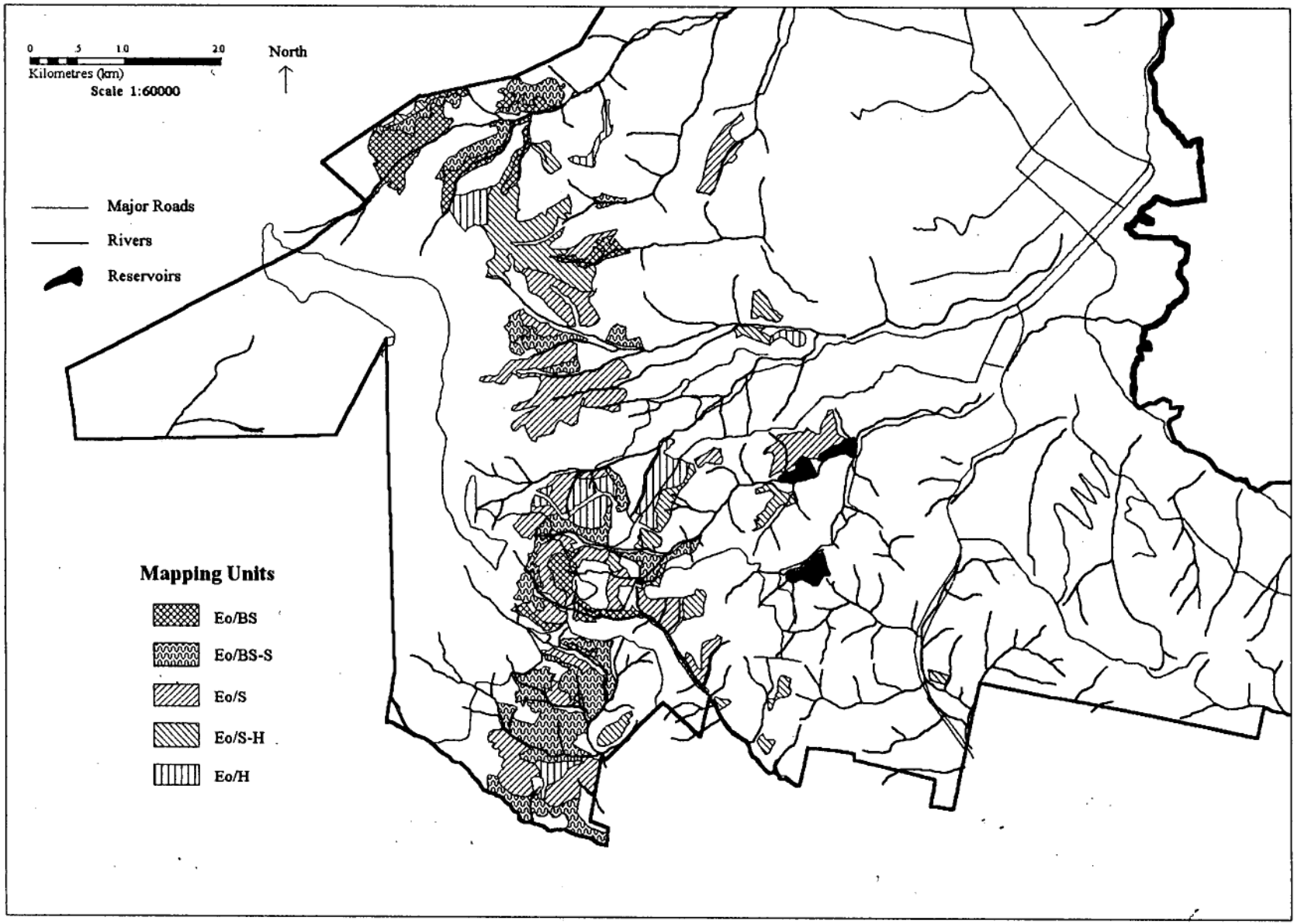
These communities are described by Ratkowsky and Ratkowsky (1977) as Zone 4P: wet sclerophyll forests on Permian deposits, dominated by *E. obliqua*.

Table 4.8 *Eucalyptus obliqua* communities (as described in text)

		Eo/BS	Eo/BS-S	Eo/S	Eo/S-H	Eo/H
Altitude (m)		150-700	200-600	300-600	100-650	200-600
Slope (degrees)		10 to 30, gully	10 to 25, gully	5 to 25	5 to 30	10 to 25
Aspect		NE-E-SE-S	NE-E-SE-S	S-NE	SW-SE-NE-N	N-E
Total Area (ha)		87.8	195.8	257.4	127.7	73.9
Substrate:	Jurassic dolerite (ha)	2.1 (2%)		5.5 (2%)	17.3 (14%)	
	Dolerite talus (ha)	4.2 (5%)	16.1 (8%)	60.5 (24%)		1.7 (2%)
	Triassic sandstone (ha)	5.7 (6%)	3.0 (2%)	29.2 (11%)	18.0 (14%)	3.6 (5%)
	Permian mudstone (ha)	76.0 (87%)	176.7 (90%)	163.2 (63%)	92.4 (72%)	68.6 (93%)
Land tenure:	HCC reserve (ha)	44.5 (51%)	67.1 (34%)	174.7 (68%)	86.5 (68%)	34.7 (47%)
	Wellington Park (ha)	39.8 (45%)	55.7 (28%)	136.1 (53%)	68.4 (54%)	34.7 (47%)
	HCC non-reserve (ha)	0.8 (1%)		1.4 (1%)		
	Private (ha)	42.5 (48%)	128.7 (66%)	81.3 (32%)	41.2 (32%)	39.2 (53%)
Fires*	Wildfires (ha)			35.3 (14%)	67.9 (53%)	26.0 (35%)
	Control burns (ha)		11.3 (6%)	57.1 (22%)	19.3 (15%)	37.0 (50%)
	Total area burnt (ha)		11.3 (6%)	88.3 (34%)	86.8 (68%)	46.9 (63%)
Community description(s)** and respective Reservation Status ** From Duncan and Brown (1985) or Kirkpatrick *et al* (1988b)		*E. obliqua - Acacia dealbata - Olearia argophylla* wet sclerophyll forest (OB 0110)[1]/ *E. obliqua - Nothofagus cunninghamii - Polystichum proliferum - Hymenophyllum flabellatum* mixed forest (OB 1000)[1]	*E. obliqua - Acacia dealbata - Olearia argophylla* wet sclerophyll forest (OB 0110)[1]/ *E. obliqua - Olearia lirata - Pultenaea juniperina* wet sclerophyll forest (OB 010)[1]	Shrubby *E. obliqua* forest/ *E. obliqua - Olearia lirata - Pultenaea juniperina* wet sclerophyll forest (OB 010)[1]	Shrubby *E. obliqua* forest[1]	Shrubby E. *obliqua* forest (argillaceous)[1]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania



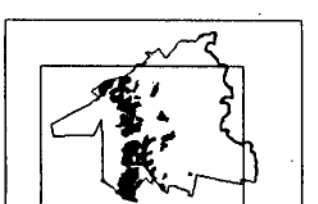


Figure 4.7: Eucalyptus obliqua communities

Eucalyptus obliqua tall woodland/tall open-forest over broad-leaved shrubs (Eo/BS)

This *E. obliqua* mapping unit is characterised by the dominance of broad-leaved shrubs, such as *Olearia argophylla, Bedfordia salicina* and *Pomaderris apetala,* in the understorey. This unit is found either in gullies or on sheltered, moist slopes. *Acacia dealbata* is often emergent above the understorey, and the ground layer is dominated by ferns, including *Dicksonia antarctica.* Callidendrous rainforest species (eg *Atherosperma moschatum*) are occasionally present. However, these sites are too small to warrant a mixed forest mapping unit. This unit is best described as an *E. obliqua-Acacia dealbata-Olearia argophylla* wet sclerophyll forest (OB 0110) containing pockets of *E. obliqua-Nothofagus cunninghamii-Polystichum proliferum-Hymenophyllum flabellatum* mixed forest (OB 1000) (Kirkpatrick *et al.* 1988b). OB 0110 and OB 1000 are well-reserved in Tasmania. Although 45% is found in Wellington Park, a further 48% occurs on private land.

Eucalyptus obliqua tall open-forest over broad-leaved - narrow-leaved shrubs (Eo/BS-S)

This mapping unit is found on slightly drier sites (though in similar locations) to the previous unit. This is reflected in the understorey which is comprised of a combination of broad- and narrow-leaved shrubs. *Acacia dealbata* or *A. verniciflua* commonly form a second stratum. The ground layer is dominated by ferns and sedges. It is best described as an *E. obliqua-Acacia dealbata-Olearia argophylla* wet sclerophyll forest (OB 0110), which is well-reserved in Tasmania. However, on drier sites it is better described as an *E. obliqua-Olearia lirata-Pultenaea juniperina* wet sclerophyll forest (OB 010) (Kirkpatrick *et al.* 1988b), which is poorly-reserved in Tasmania. As OB 0110 is not the preferred option, the reservation status of this community has not been amended (see Table 4.3). Two-thirds of this unit is found on private land.

Eucalyptus obliqua open-forest/tall open-forest over narrow-leaved shrubs (Eo/S)

This *E. obliqua* mapping unit is similar to the previous mapping unit except it lacks broad-leaved shrubs as dominants in the understorey. It occurs on two types of sites, the first on dry or exposed slopes at the upper (altitudinal) range of *E. obliqua* and the second on lower more sheltered or moist sites. The latter sites have a history of recent and frequent fires in the last 12 years. Sedges or bracken (*Pteridium esculentum*) commonly dominate the ground layer. This unit represents a transition zone between dry and wet sclerophyll forest and can be described either as a shrubby *Eucalyptus obliqua*

forest (Duncan and Brown 1985), which is well-reserved in Tasmania or an *E. obliqua-Olearia lirata-Pultenaea juniperina* wet sclerophyll forest (OB 010) (Kirkpatrick *et al.* 1988b), which is poorly-reserved in Tasmania. One-third of this unit is found on private land.

Eucalyptus obliqua open-forest over shrubs-heath (Eo/S-H)

This mapping unit occurs in slightly drier locations than the above unit. This may be a factor which has contributed to wildfires burning over 50% of this unit in the last 13 years, including the 1983 wildfire on Mt Wellington. The understorey is a combination of taller (> 2 m) narrow-leaved shrubs and lower (< 2 m) heath species. The ground layer is dominated by sedges and *Pteridium esculentum*, although some bare areas are present. It can be described as a shrubby *Eucalyptus obliqua* forest (Duncan and Brown 1985), which is well-reserved in Tasmania. Over two-thirds of this unit is found in HCC reserves, including 54% in Wellington Park..

Eucalyptus obliqua open-forest over heath (Eo/H)

This mapping unit consists of *E. obliqua* forests over an understorey dominated by shrubs less than 2 m tall (heath). The ground is commonly bare or covered with *Pteridium esculentum*. This understorey is a result of its location (dry or exposed sites) coupled with recent, frequent fires. Found entirely on Permian mudstone, this unit can be described as an argillaceous *E. obliqua* (shrubby) forest (Duncan and Brown 1985), which is well-reserved in Tasmania. This unit either occurs in Wellington Park or on private land.

4.4.2 *Eucalyptus tenuiramis* communities/associations

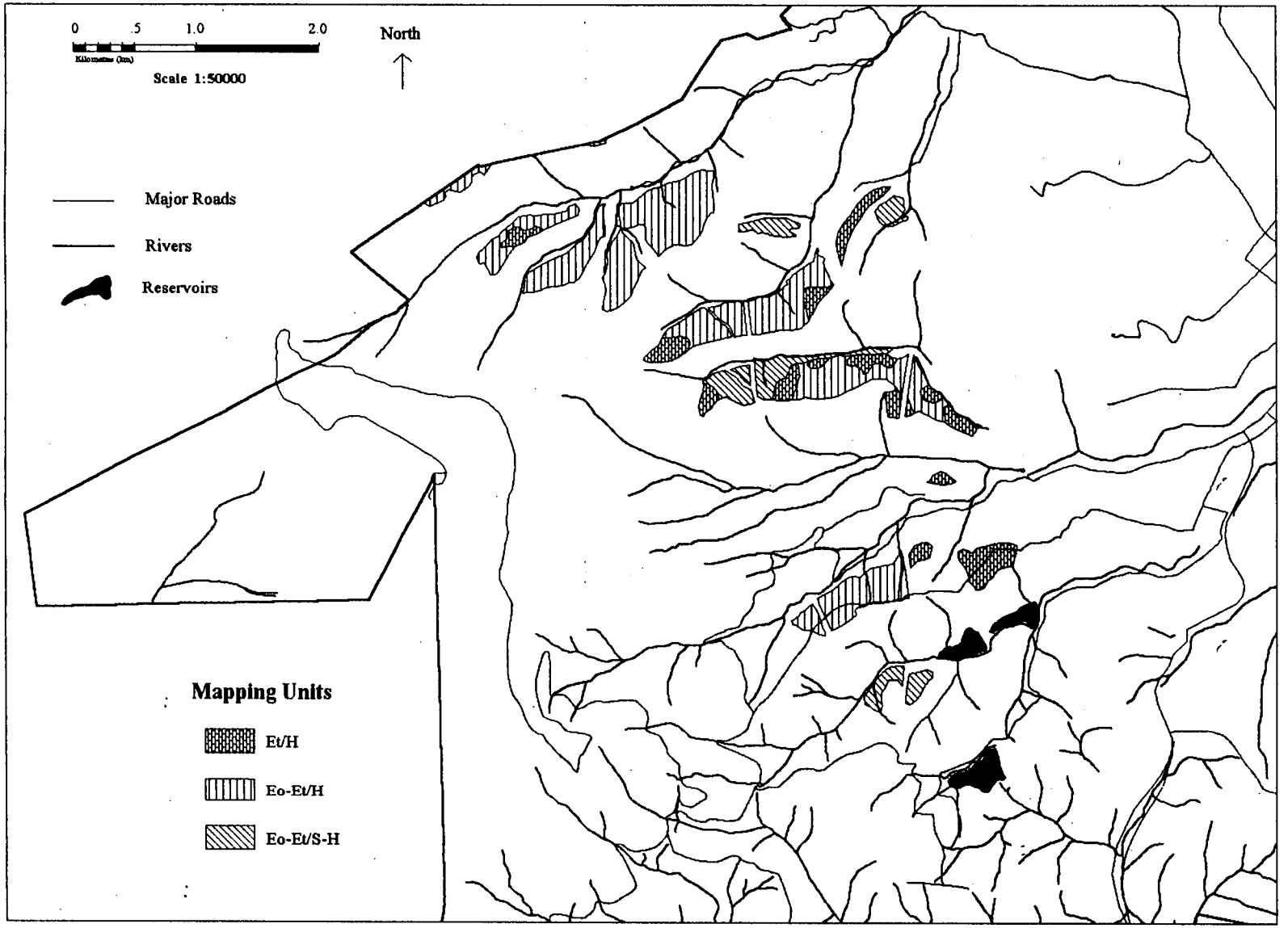
Eucalyptus tenuiramis occurs as the sole dominant or forms an association with *E. obliqua* on well-insolated lower slopes of Mt. Wellington and some its foothills. Found predominantly on Permian mudstone, these communities are categorised generally by Ratkowsky and Ratkowsky (1977) as Zone 7P: wet sclerophyll forests on Permian deposits, dominated by *E. obliqua*. Figure 4.8 shows the locations of these mapping units. Table 4.9 shows the total area, some environmental parameters and the land tenure of each unit.

Figure 4.9 ***Eucalyptus tenuiramis*** **communities/associations (as described in text)**

		Et/H	Eo-Et/H	Eo-Et/S-H
Altitude (m)		100-500	200-500	150-450
Slope (degrees)		0 to 20	0 to 25	0 to 20
Aspect		NW-NE	NW-NE	N-NE
Total Area (ha)		51.2	133.2	37.3
Substrate:	Jurassic dolerite (ha)			2.3 (6%)
	Triassic sandstone (ha)	1.6 (3%)	7.1 (5%)	6.2 (17%)
	Permian mudstone (ha)	49.6 (97%)	126.1 (95%)	28.8 (77%)
Land tenure:	HCC reserve (ha)	15.1 (29%)	51.7 (39%)	16.6 (45%)
	Wellington Park (ha)	10.8 (21%)	51.5 (39%)	8.3 (22%)
	HCC non-reserve (ha)	15.2 (30%)	28.9 (22%)	10.6 (28%)
	Private (ha)	20.9 (41%)	52.6 (39%)	10.1 (27%)
Fires*	Wildfires (ha)	7.7 (15%)	52.4 (39%)	5.7 (15%)
	Control burns (ha)	30.4(59%)	72.7 (55%)	12.4 (33%)
	Total area burnt (ha)	38.2 (75%)	119.4 (90%)	16.0 (43%)
Community description(s)** and respective Reservation Status ** From Duncan and Brown (1985)		Grassy *E. tenuiramis* forest[1]	Shrubby *E. obliqua* forest (argillaceous *E. obliqua* - *E. tenuiramis*)[1]/ Grassy *E. tenuiramis* forest[1]	Shrubby *E. obliqua* forest (*E. obliqua* - *E. tenuiramis*)[1]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania



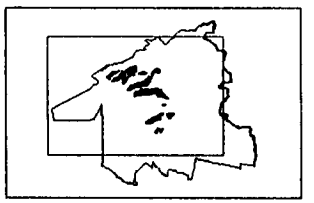


Figure 4.8: Eucalyptus tenuiramis communities/associations

***Eucalyptus tenuiramis* open-forest over heath (Et/H)**

In Hobart this is the only mapping unit where *E. tenuiramis* occurs as the sole dominant. Understorey species are typically of a 'heath' form and the ground layer is either covered very sparsely in grasses or devoid of vegetation. This vegetation is probably a result of the exposed/dry northerly aspect coupled with frequent, recent fires. Although this unit predominantly occurs on mudstone it is best described as a grassy *E. tenuiramis* forest (Duncan and Brown 1985), which is well-reserved in Tasmania. This unit is found either in HCC land (including 21% in Wellington Park) or on private land.

***Eucalyptus obliqua-E. tenuiramis* open-forest over heath (Eo-Et/H)**

This mapping unit is an association between *E. tenuiramis* and *E. obliqua* over a heath understorey. Dry, northerly-facing sites and frequent, recent fires are responsible for the understorey species. Ninety percent of this unit has been burnt in the last 13 years. This unit represents a transition from an *E. tenuiramis* forest over heath (Et/H) to an *E. obliqua* forest over heath (Eo/H). It can be described as a grassy *E. tenuiramis* forest/argillaceous shrubby *E. obliqua* (*E. obliqua-E. tenuiramis*) forest (Duncan and Brown 1985). These communities are well-reserved in Tasmania. Just under 40% of this unit occurs in Wellington Park.

***Eucalyptus obliqua-E. tenuiramis* open-forest over shrubs-heath (Eo-Et/S-H)**

This mapping unit is similar to the above, however, the understorey is more developed. This may be a result of fewer or less recent fires. *Pteridium esculentum* often dominates the ground layer, however many sites are bare. It can generally be described as a shrubby *E. obliqua* (*E. obliqua-E. tenuiramis*) forest (Duncan and Brown 1985), which is well-reserved in Tasmania. Forty-five percent of this unit is found in HCC reserves (22% in Wellington Park) the remainder is found on either 'non-reserved' HCC or private land.

4.5 Mountain gully communities

Mountain gully communities are grouped here by the presence (Subsection 4.5.1) or absence (Subsection 4.5.2) of a dominant eucalypt overstorey. These groups include communities which are found on moist slopes adjacent to gullies. *Acacia dealbata* often forms a second stratum and ferns, including *Dicksonia antarctica,* dominate the ground layer.

4.5.1 Eucalypt-dominated mountain gully communities

Members of the ash group (*Eucalyptus regnans, E. obliqua*) are the dominant eucalypts in mountain gullies and are found at altitudes from 200 to 700 m. The underlying rock is predominantly Permian mudstone with occasional sites on dolerite talus and Triassic sandstone. Figure 4.9 shows the locations of these mapping units. Table 4.10 shows the total area, some environmental parameters and the land tenure of each unit.

The fire history indicates in some instances that these mapping units have been burnt since the 1967 wildfires. However, visual evidence indicates that these control or wild fires did not penetrate these units.

Although in the early study Martin (1940) described these communities as part of Zone 4: *E. obliqua-E. regnans* association, only the *E. obliqua* communities on Permian deposits (Zone 4P) were mapped by Ratkowsky and Ratkowsky (1977).

Eucalyptus regnans broad-leaved shrubs tall open-forest (Er/BS)

E. regnans dominates in gullies and on adjacent slopes over an understorey composed predominantly of broad-leaved shrubs (including *Olearia argophylla, Pomaderris apetala* and *Bedfordia salicina). Acacia dealbata* emerges occasionally from this understorey, and ferns such as *Dicksonia antarctica* dominate the ground layer. Callidendrous rainforest species such as *Atherosperma moschatum* are often present, however, these mixed forests are too small to map. Er/BS can be described as either an *E. regnans-Acacia dealbata-Pomaderris apetala* wet sclerophyll forest (REG 1001) or an *E. regnans-Atherosperma moschatum-Acacia dealbata-Olearia argophylla* wet sclerophyll/mixed forest (REG 101) (Kirkpatrick *et al.* 1988b). Due to its presence in Wellington Park, REG 1001 like REG 1001 is well-reserved in Tasmania (see Table 4.3). Almost half of this unit is found in Wellington Park, with 50% on private land.

Eucalyptus obliqua-E. regnans tall open-forest over broad-leaved shrubs (Eo-Er/BS)

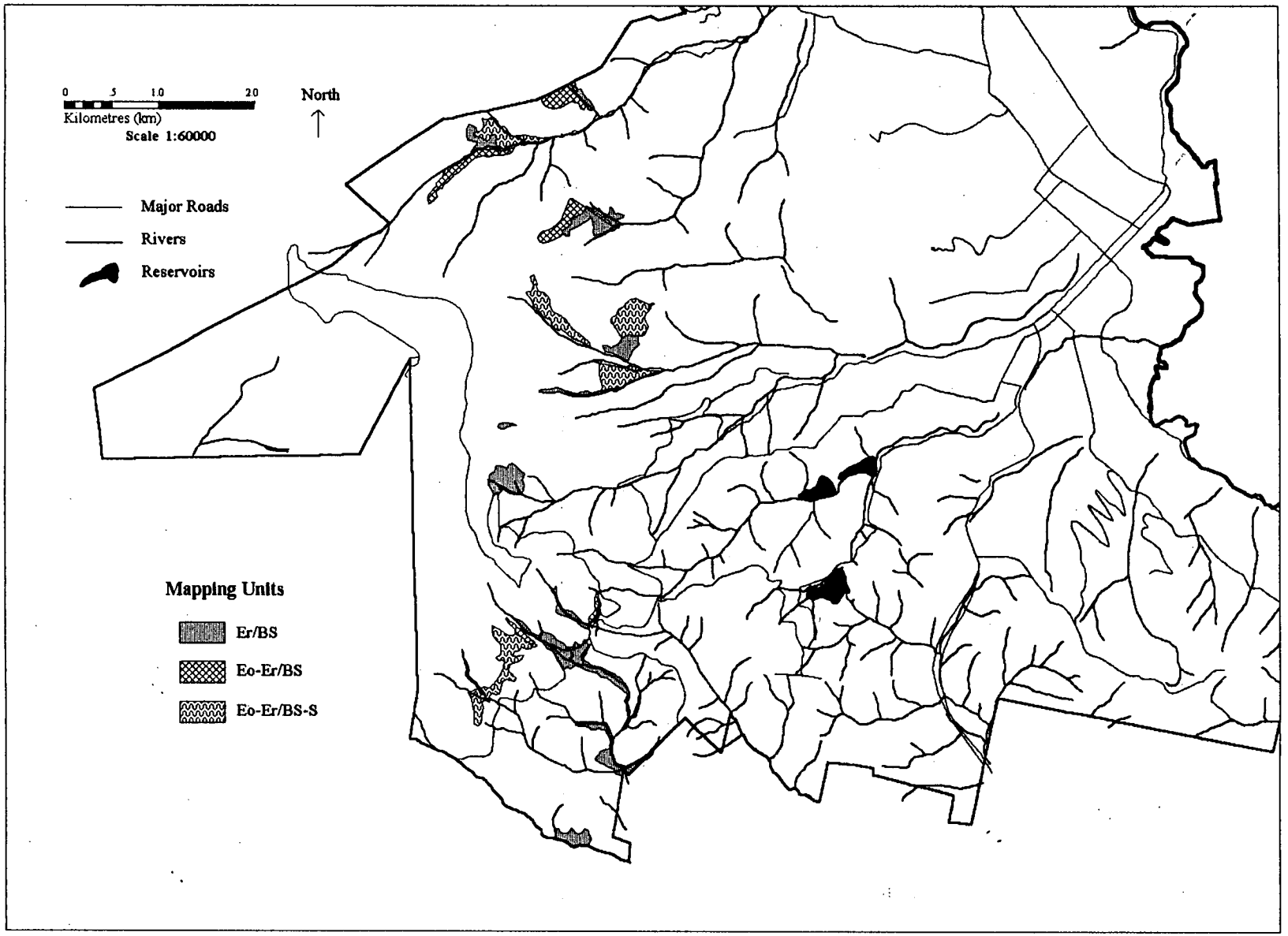
This mapping unit is similar to the above except *E. obliqua* codominates with *E. regnans* over an understorey of broad-leaved shrubs. It is best described as either an *E. regnans-Acacia dealbata-Pomaderris apetala* wet sclerophyll forest (REG 1001) or an *E. regnans-E. obliqua-Pomaderris apetala-Olearia lirata* wet sclerophyll forest (REG 1000) (Kirkpatrick *et al.* 1988b). Due to the presence of these communities in Wellington Park (over 70% of this unit) they can be considered well-reserved in Tasmania (see Table 4.3).

Figure 4.10 **Eucalypt-dominated mountain gully communities (as described in text)**

		Er/BS	Eo-Er/BS	Eo-Er/BS-S
Altitude (m)		200-700	250-600	250-350
Slope (degrees)		15-30, gully	10 to 30, gully	10 to 20
Aspect		S-SE-E, W	S-E-NE	SE-E
Total Area (ha)		67.2	25.1	58.0
Substrate:	**Dolerite talus (ha)**	13.5 (20%)		8.3 (14%)
	Triassic sandstone (ha)	3.3 (5%)		8.7 (15%)
	Permian mudstone (ha)	50.4 (75%)	25.1 (100%)	41.0 (71%)
Land tenure:	**HCC reserve (ha)**	33.9 (50%)	17.8 (71%)	39.6 (68%)
	Wellington Park (ha)	32.9 (49%)	17.1 (68%)	33.3 (57%)
	Private (ha)	33.3 (50%)	7.3 (29%)	18.4 (32%)
Fires*	**Wildfires (ha)**			7.2 (12%)
	Control burns (ha)			16.5 (28%)
	Total area burnt (ha)			18.3 (32%)
Community description(s) and respective Reservation Status ** From Kirkpatrick *et al* (1988b)		*E. regnans - Acacia dealbata - Pomaderris apetala* wet sclerophyll forest (REG 1001)[1]/ *E. regnans - Atherosperma moschatum - Acacia dealbata - Olearia argophylla* wet sclerophyll/mixed forest (REG 101)[1]	*E. regnans - Acacia dealbata - Pomaderris apetala* wet sclerophyll forest (REG 1001)[1]/ *E. regnans - E. obliqua - Pomaderris apetala - Olearia lirata* wet sclerophyll forest (REG 1000)[1]	*E. regnans - E. obliqua - Pomaderris apetala - Olearia lirata* wet sclerophyll forest (REG 1000)[1]/ *E. regnans - Acacia dealbata - Pomaderris apetala* wet sclerophyll forest (REG 1001)[1]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania



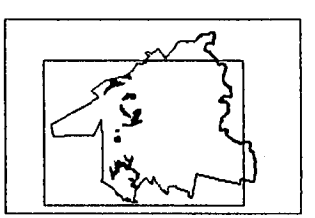


Figure 4.9: Eucalypt-dominated mountain gully communities

Eucalyptus obliqua-E. regnans broad-leaved - narrow-leaved shrubs tall open-forest (Eo-Er/BS-S)

This mapping unit consists of a mixed eucalypt stand over a combination of broad- and narrow-leaved shrubs. Although absent from gullies, it is found on the adjacent sheltered or moist slopes. It can be described as an *E. regnans-E. obliqua-Pomaderris apetala-Olearia lirata* wet sclerophyll forest (REG 1000) or an *E. regnans-Acacia dealbata-Pomaderris apetala* wet sclerophyll forest (REG 1001) (Kirkpatrick *et al.* 1988b). Both communities are well-reserved in Tasmania.

4.5.2 Rainforest/wet gully communities

This group represents the mountain gullies where eucalypts are absent from the dominant overstorey. Occasionally they have a limited presence on the edges of these mapping units, or are present as emergents (ie. up to 5% of the total cover). Found from 200 to 700 m in elevation, these units generally occur either on dolerite talus or Permian mudstone. Figure 4.10 shows the locations of these units. Table 4.11 shows the total area, some environmental parameters and the land tenure of each unit.

Ratkowsky and Ratkowsky (1977) classified these communities into Zone 6: gully communities, permanently wet, thick undergrowth.

Rainforest (RF)

Two rainforest sites totalling only 8 ha have been identified in Hobart. Significantly, these represent areas which escaped severe burning for a least 80 years. This mapping unit can be described as a callidendrous sassafras-musk rainforest - *Atherosperma moschatum* over *Olearia argophylla-Dicksonia antarctica-Polystichum proliferum* (Jarman *et al.* 1984) and is well-reserved in Tasmania. These remnants are popular recreational destinations. Although over 90% is found in Wellington Park, the proximity of suburbia to one site makes it vulnerable to disturbances.

Broad-leaved closed-scrub (BS)

This mapping unit is found in mountain gullies similar to the above mapping unit, though the absence of rainforest species indicate these sites have probably been burnt in the last 80 years. *Acacia dealbata* is an occasional emergent. Small pockets of callidendrous sassafras-musk rainforest remain within some sites (eg Myrtle Gully) but are too small to be mapped. This unit, entirely located in Mountain Park, can be described as a *Bedfordia salicina-Olearia argophylla* closed-scrub community (BSOA) (Kirkpatrick 1991b), which is well-reserved in Tasmania.

Figure 4.11 **Rainforest/wet gully communities (as described in text)**

		RF	BS	Ad/BS	AD/BS-S
Altitude (m)		350-700	450-600	200-650	200-400
Slope (degrees)		gully	15 to 20, gully	gully	gully
Aspect		SE-E	N, W-SW	N-E-S	S, W
Total Area (ha)		7.9	3.7	40.1	9.1
Substrate:	**Jurassic dolerite (ha)**				0.2 (2%)
	Dolerite talus (ha)	4.1 (52%)	1.6 (42%)	10.4 (26%)	
	Triassic sandstone (ha)	0.4 (5%)	0.1 (3%)	1.5 (4%)	2.4 (26%)
	Permian mudstone (ha)	3.4 (43%)	2.0 (55%)	28.2 (70%)	6.5 (72%)
Land tenure:	**HCC reserve (ha)**	7.2 (91%)	3.7 (100%)	37.3 (93%)	2.3 (25%)
	Wellington Park (ha)	7.2 (91%)	3.7 (100%)	34.4 (86%)	
	Private (ha)	0.7 (9%)		2.8 (7%)	6.8 (75%)
Fires*	**Wildfires (ha)**				
	Control burns (ha)			2.3 (6%)	
	Total area burnt (ha)			2.3 (6%)	
Community description(s) and respective Reservation Status** ** From Jarman *et al* (1984); Kirkpatrick *et al* (1988b); Kirkpatrick (1991c) or Askey-Doran (1993)		Callidendrous sassafras-musk rainforest[1] (*Atherosperma moschatum over Olearia argophylla - Dicksonia antarctica - Polystichum proliferum*)	*Bedfordia salicina - Olearia argophylla* closed scrub/[1] Callidendrous sassafras-musk rainforest pockets[1]	*Bedfordia salicina - Olearia argophylla* closed scrub[1]	*Eucalyptus obliqua-Acacia dealbata-Olearia argophylla* wet sclerophyll forest [1](OB 0110)/ *Acacia dealbata - Beyeria viscosa - Geranium potentilloides* low closed riparian forest[1]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania

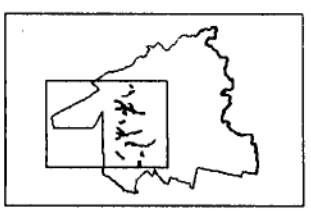


Figure 4.10: Rainforest/Wet Gully Communities

Acacia dealbata woodland/open-forest over broad-leaved shrubs (Ad/BS)

This mapping unit is similar to the above, except that *Acacia dealbata* forms the tallest stratum rather than the occasional emergent. As with the previous unit it represents sites which were probably burnt in the last 80 years. The dominance of *A. dealbata* might be explained by the intensity of the fire and or a shift towards a mudstone substrate. Although this mapping unit has not bee described in the literature (see Table 3.12) it probably represents a successional stage towards a *Bedfordia salicina-Olearia argophylla* closed-scrub community (BSOA) as described by Kirkpatrick (1991b). BSOA is well-reserved in Tasmania. Over 90% of this unit is found in HCC reserves, including 34 ha in Wellington Park.

Acacia dealbata woodland/open-forest over broad-leaved shrubs (Ad/BS-S)

This mapping unit although occurring in similar environments to the two preceding units has an the understorey dominated by both broad- and narrow-leaved shrubs, including many exotic species. *Eucalyptus obliqua* and/or *E. globulus* may be present but rarely forming a canopy above this community. This is probably a result of past human practices such as clearing or burning (75% is found on private land) rather than a natural successional phase. This community may develop into a eucalypt forest such as Eo/BS-S (Section 4.4.1) Eg-Eo/BS-S or Eg/GS(1) (Section 4.6.1). It is best described as a *Eucalyptus obliqua-Acacia dealbata-Olearia argophylla* wet sclerophyll forest (OB 0110) (Kirkpatrick *et al.* 1988b), however, it could also be described as an *Acacia dealbata-Beyeria viscosa-Geranium potentilloides* low closed riparian forest (Askey-Doran 1993:15). Both communities are well-reserved in Tasmania.

4.6 Foothill gully communities

Foothill gullies are distinguished from Mountain Gullies (Section 4.6) primarily by their location, that is, on the foothills away from the slopes of Mt. Wellington and closer to the coast. Urban development often intrudes in these mapping units. These gullies have been split into two groups. The first (Subsection 4.6.1) is on the eastern and north-eastern slopes of Mt. Nelson and the second (Subsection 4.6.2) comprises all the remaining gullies and some of the adjacent slopes which supports similar synusiae.

4.6.1 Foothill gullies (1) communities

The following two mapping units are found in the gullies of the eastern and north-eastern slopes of Mt Nelson (Figure 4.11). They are distinguished by the dominance of *Pomaderris apetala and Beyeria viscosa* either as the tallest stratum or as dominants in the understorey. The substrate is predominantly Jurassic dolerite. Table 4.12 shows the total area, some environmental parameters and the land tenure of each unit.

Coastal gully closed-scrub (GS(2))

This mapping unit differs from other foothill gully mapping units by the absence of a dominant eucalypt overstorey. *E. globulus* and *Acacia melanoxylon* are occasional emergents through this scrub layer. This unit is found on one site partly located in Truganini Reserve, with the majority (63%) occurring on the adjacent private land. This area has probably not burnt for at least 80 years. This unit is best described as a *Pomaderris apetala-Beyeria viscosa-Asterotrichion discolor* closed-forest/scrub (Kirkpatrick 1991b), which is poorly-reserved in Tasmania.

Eucalyptus globulus tall woodland/tall open-forest coastal gully shrub (Eg/GS(2))

This mapping unit is similar to the above except *E. globulus* is dominant rather than an occasional emergent. Sites are located on drier/more exposed gullies. This unit was not burnt in the 1967 fire and although the HCC fire maps (see Figure 2.4) indicate it has been burnt since then, these fires probably did not penetrate the gully. This unit is best described as an *E. globulus-Bedfordia salicina-Beyeria viscosa* wet sclerophyll forest (GLOB 0100) (Kirkpatrick *et al.* 1988b), which is poorly-reserved in Tasmania. Nearly 80% of this unit is found in government or quasi-government reserves.

4.6.2 Foothill gullies (2) communities

Eucalyptus globulus dominates or codominates with *E. obliqua* in many gullies (and adjacent slopes) on the foothills surrounding urban Hobart (Figure 4.12). This group includes all but one of these mapping units (Eg/GS(2)) which is described in the previous subsection. These units occur on a variety of substrates generally between 150 and 300 m. Table 4.14 shows the total area, some environmental parameters and the land tenure of each unit.

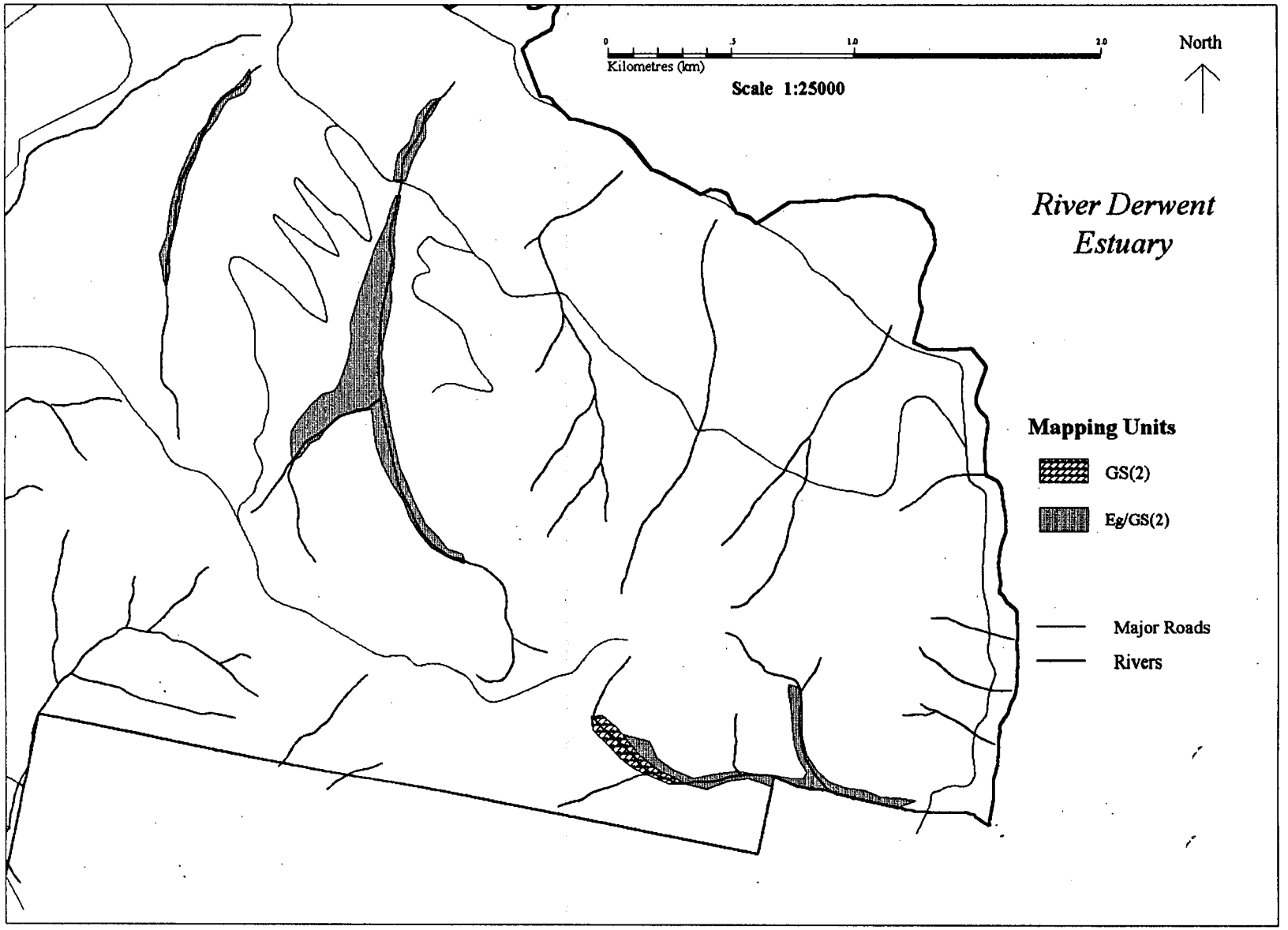
Martin (1940) included the area occupied by these communities under the umbrella of Zone 7: Other forest communities. They are not included in Ratkowsky and Ratkowsky's (1977) study.

Figure 4.12 Foothill gullies (1) communities (as described in text)

		GS(2)	Eg/GS(2)
Altitude (m)		150-300	0-250
Slope (degrees)		gully	gully
Aspect		SE	N-NE-E
Total Area (ha)		2.4	28.0
Substrate:	**Jurassic dolerite (ha)**	2.4 (100%)	24.2 (87%)
	Permian mudstone (ha)		3.8 (13%)
Land tenure:	**HCC reserve (ha)**		12.0 (43%)
	Crown Reserves (ha)	0.9 (37%)	4.5 (16%)
	University Reserve (ha)		2.9 (10%)
	Private (ha)	1.5 (63%)	8.6 (31%)
Fires*	**Wildfires (ha)**		
	Control burns (ha)	5.0 (18%)	
	Total area burnt (ha)	5.0 (18%)	
Community description(s) and respective Reservation Status** ** From Kirkpatrick *et al* (1988b) or Kirkpatrick (1991c)		*Pomaderris apetala - Beyeria viscosa - Asterotrichion discolor* closed-forest/scrub[1]	*E. globulus - Bedfordia salicina - Beyeria viscosa* wet sclerophyll forest (GLOB 0100)[1]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Poorly-reserved in Tasmania



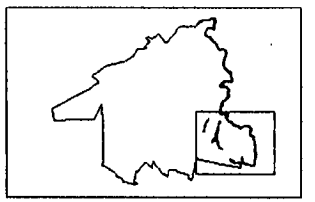


Figure 4.11: Foothills gullies (1) communities

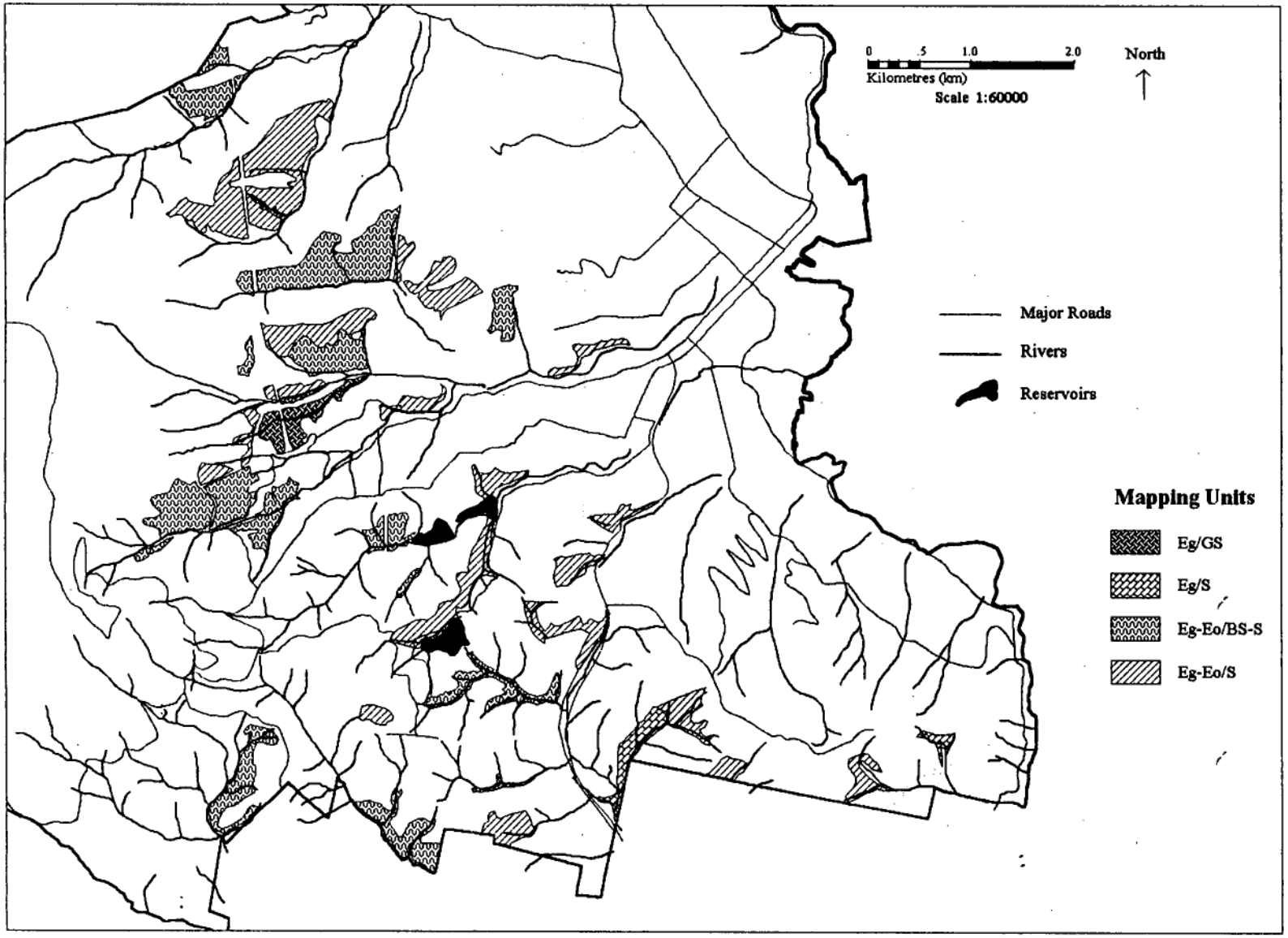
Figure 4.13 Foothill gullies (2) communities (as described in text)

		Eg/GS	Eg/S	Eg-Eo/BS-S	Eg-Eo/S
Altitude (m)		150 -300	100-250	150-500	50 -400
Slope (degrees)		5 to 10, gully	15 to 25	10 to 25	5 to 25
Aspect		N-NE-SE	SE-E	NE-SE-SW	SW-SE-NE
Total Area (ha)		25.1	19.9	237.2	254.8
Substrate:	Jurassic dolerite (ha)	2.2 (9%)	19.9 (100%)	58.5 (25%)	117.8 (46%)
	Dolerite talus (ha)			41.8 (18%)	5.3 (2%)
	Triassic sandstone (ha)			21.9 (9%)	14.4 (6%)
	Permian mudstone (ha)	22.9 (91%)		115.0 (48%)	117.3 (46%)
Land tenure:	HCC reserve (ha)	1.9 (8%)	0.8 (4%)	68.4 (29%)	76.3 (30%)
	Wellington Park (ha)	1.9 (7%)		29.0 (12%)	13.4 (5%)
	HCC non-reserve (ha)		1.1 (6%)	49.9 (21%)	13.6 (5%)
	Crown Reserves (ha)		1.6 (8%)		
	Hobart College (ha)		1.6 (8%)		1.3 (1%)
	University Reserve (ha)				
	Private (ha)	23.2 (92%)	14.8 (74%)	117.9 (50%)	163.6 (64%)
Fires*	Wildfires (ha)			21.3 (9%)	39.1 (15%)
	Control burns (ha)	5.0 (20%)		84.6 (36%)	40.8 (16%)
	Total area burnt (ha)	5.0 (20%)		105.7 (45%)	75.5 (30%)
Community description(s)** and respective Reservation Status ** From Duncan and Brown (1985) or Kirkpatrick *et al* (1988b)		*E. globulus - Acacia dealbata-A. melanoxylon - Cassinia aculeata* wet sclerophyll forest (GLOB 0101)[1]	*E. globulus - Poa labillardieri - Hypochaeris radicata* wet sclerophyll forest (GLOB 1)[2]	*E. globulus - Acacia dealbata-A. melanoxylon - Cassinia aculeata* wet sclerophyll forest (GLOB 0101)[1]	*E. globulus - Acacia dealbata-A. melanoxylon - Cassinia aculeata* wet sclerophyll forest (GLOB 0101)[1]/ Shrubby *E. obliqua* forest[1]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania

[1] Poorly-reserved in Tasmania



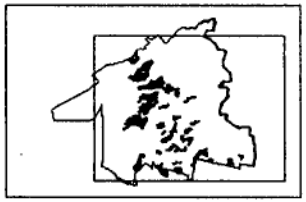


Figure 4.12: Foothill gullies (2) communities

Eucalyptus globulus open-/tall open-forest over gully shrub (Eg/GS)

This *E. globulus* mapping unit is found in gullies and on sheltered or moist slopes at the base of Mt. Wellington and on foothills inland from the River Derwent. *Acacia dealbata* commonly forms a second stratum, with ferns and sedges dominating the ground layer. Although this unit contains many broad-leaved shrubs, the different species mix and the abundance of species such as *A. verticillata* and *Coprosma quadrifida* warrant a different synusia than either GS(2) or the combination BS-S. The fire history indicates that some of this unit has been burnt in recent years. This unit can be described as an *E. globulus-Acacia dealbata-A. melanoxylon-Cassinia aculeata* wet sclerophyll forest (GLOB 0101) (Kirkpatrick *et al.* 1988b), which is well-reserved in Tasmania. Over 90% of this unit is located on private land.

Eucalyptus globulus open-/tall open-forest over shrubs (Eg/S)

This mapping unit occurs on sheltered or moist slopes adjacent to 'foothill gullies'. Although these sites are similar to the above, this unit lacks most of the broad-leaved shrubs and ferns characteristic of Eg/GS. This unit is best described as an *E. globulus-Poa labillardieri-Hypochaeris radicata* wet sclerophyll forest (GLOB 1) (Kirkpatrick *et al.* (1988b). This community is poorly-reserved in Tasmania. Over 70% occurs on private land in Hobart.

Eucalyptus globulus-E. obliqua open-/tall open-forest over broad-narrow leaved shrubs (Eg-Eo/BS-S)

This *E. globulus-E. obliqua* association occurs in similar, though slightly drier locations than the above two mapping units. The understorey closely resembles the synusia GS, however, many more narrow-leaved shrubs are present. This may be due to more frequent or recent burning. Ferns and sedges dominate the ground layer. This unit is best described as an *E. globulus-Acacia dealbata-A. melanoxylon-Cassinia aculeata* wet sclerophyll forest (GLOB 0101) (Kirkpatrick *et al.* 1988b) and is well-reserved in Tasmania. Private land accounts for half of the area in which this unit occurs in Hobart.

Eucalyptus globulus-E. obliqua open-/tall open-forest over shrubs (Eg-Eo/S)

This mapping unit is found on the edge of gullies in drier locations. Narrow-leaved shrubs predominate though some broad-leaved shrubs are present. The dominance of *Pteridium esculentum* in many of the sites indicates either recent or frequent fires. Eg-Eo/S represents either shrubby *E. obliqua* forest (Duncan and Brown 1985) or a

transition zone between this forest and an *E. globulus-Acacia dealbata-A. melanoxylon-Cassinia aculeata* wet sclerophyll forest (GLOB 0101) (Kirkpatrick *et al.* 1988b). Both communities are well-reserved in Tasmania. Over 60% of this unit occurs on private land.

4.7 Foothill communities

This section describes the various mapping units which are generally found on the hills within urban Hobart. These include the Queens Domain, Knocklofty, Waterworks Reserve/Ridgeway Park, Chimney Pot Hill (all HCC reserves) and Mt. Nelson. These units have been grouped into 9 subgroups (subsections) based generally on the dominant stratum or/or an association between two eucalypt species.

Most of these communities were burnt in the bushfires of 1967, and many, especially those on HCC land have subsequently been burnt in fuel reduction programs. Many wildfires have also occurred and private land owners also regularly burn their land.

Ratkowsky and Ratkowsky's (1977) included only part of this area in their study - Zone 7D: dry sclerophyll open-forest on dolerite, light to medium undergrowth, dominant eucalypts *E. pulchella* and *E. viminalis*. Jurassic dolerite areas such as the Queens Domain, and sites over Permian mudstones or Triassic sandstone substrates were not included in their study.

4.7.1 Foothill 1 communities

This group consists of two mapping units, one dominated by *E. cordata* and one an association between *Eucalyptus obliqua* and *E. pulchella*. Both units are located on moist, sheltered slopes. Figure 4.13 shows the locations of these mapping units. Table 4.14 shows the total area, some environmental parameters and the land tenure of each unit. Predominantly on Jurassic dolerite, they form part of Ratkowsky and Ratkowsky's (1977) Zone 7D.

Eucalyptus cordata open-heath (Ecd-H)

This mapping unit on Chimney Pot Hill is characterised by shrub form *E. cordata* in association with heath species such as *Banksia marginata* and *Leptospermum scoparium*. *Gahnia grandis* is also common on this poorly drained ground. This unit was burnt in 1967 and part of it was burnt again in late 1982. This unit is best described as a shrubby *E. cordata* forest (Duncan and Brown 1985), which is well-reserved in Tasmania. However, *E. cordata* is a Tasmanian endemic and is considered rare both on a national and state level (FAC 1994). Over 90% of this unit is found in Ridgeway Park, a HCC reserve.

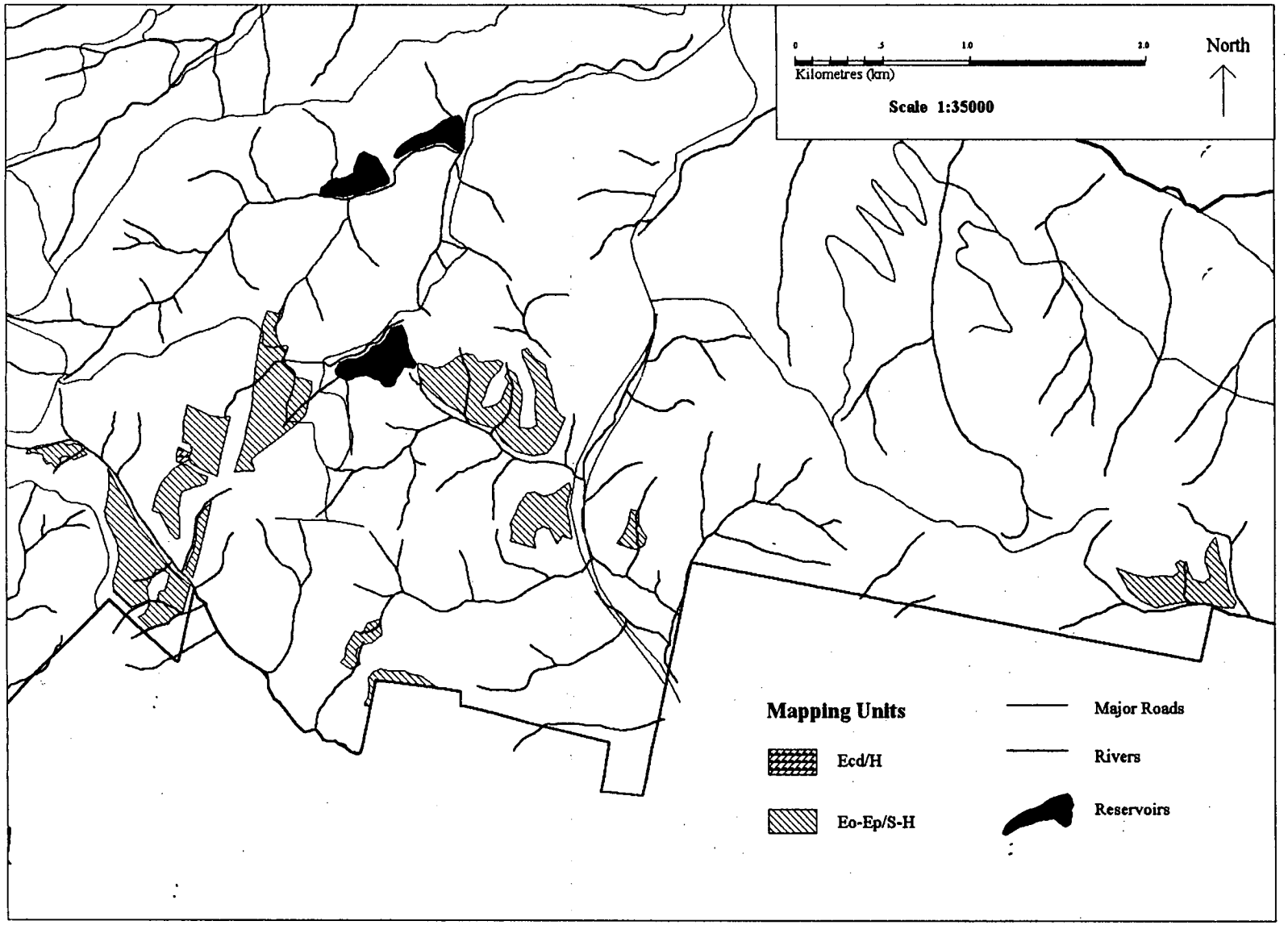
Figure 4.14 Foothill 1 communities (as described in text)

		Ecd/H	Eo-Ep/S-H
Altitude (m)		400-450	200-450
Slope (degrees)		0 to 5	10 to 20
Aspect		S	E-S-SW
Total Area (ha)		0.5	101.7
Substrate:	**Jurassic dolerite (ha)**	0.5 (100%)	97.5 (96%)
	Triassic sandstone (ha)		2.9 (3%)
	Permian mudstone (ha)		1.3 (1%)
Land tenure:	**HCC reserve (ha)**	0.5 (94%)	55.6 (55%)
	Crown Reserves (ha)		11.3 (11%)
	Private (ha)	0.03 (6%)	34.8 (34%)
Fires*	**Wildfires (ha)**	0.2 (32%)	29.3 (29%)
	Control burns (ha)		13.2 (13%)
	Total area burnt (ha)	0.2 (32%)	42.0(41%)
Community description(s) and respective Reservation Status**		Shrubby *E. cordata* forest[1]	Shrubby *E. obliqua* forest (doleritic)[1]

** From Duncan and Brown (1985)

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania



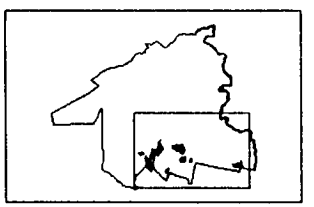


Figure 4.13: Foothill 1 communities

***Eucalyptus obliqua-E. pulchella* open-forest over shrubs-heath (Eo-Ep/S-H)**

This association between *E. obliqua* and *E. pulchella* is characterised by an understorey comprised of both tall and low shrubs over a ground layer dominated by sedges. *E. globulus* is subdominant on the more sheltered sites. Many sites have been burnt in the last 13 years. On sites located on the south and south-east slopes of Chimney Pot Hill, *E. cordata* is present as a shrub in the understorey. This unit can be described as a doleritic *E. obliqua* forest (Duncan and Brown 1985), which is well-reserved in Tasmania.

4.7.2 Foothill 2 communities

Eucalyptus obliqua also codominates with *E. viminalis* in Hobart. Four mapping units have been identified: over shrubs; shrubs-heath; heath; and grass-*Pteridium esculentum*. Figure 4.14 shows the locations of these mapping units. Table 4.15 shows the total area, some environmental parameters and the land tenure of each unit. Only the Jurassic dolerite sites were included in Zone 7D of Ratkowsky and Ratkowsky (1977) other sites were omitted from their study.

***Eucalyptus obliqua-E. viminalis* open-forest over shrubs (Eo-Ev/S)**

This mapping unit is characterised by an understorey of shrubs over a ground layer dominated by bracken (*Pteridium esculentum*) or sedges. It occurs on moist or sheltered sites without regard to the underlying rock. No major fires have been recorded on these sites in the last 13 years. This unit is best described as a shrubby *E. obliqua* forest (Duncan and Brown 1985), which is well-reserved in Tasmania.

***Eucalyptus obliqua-E. viminalis* open-forest over shrubs-heath (Eo-Ev/S-H)**

This mapping unit occurs on either slightly drier sites and/or more recently burnt sites than the previous unit (40% burnt in the last 13 years). It is characterised by both tall and low shrubs in the understorey and a ground layer of bracken or sedges. This unit is associated either with Jurassic dolerite or Permian mudstone. This unit is best described as a shrubby *E. obliqua* forest (Duncan and Brown 1985), which is well-reserved in Tasmania. Nearly 70% occurs on private land.

***Eucalyptus obliqua-E. viminalis* open-forest over heath (Eo-Ev/H)**

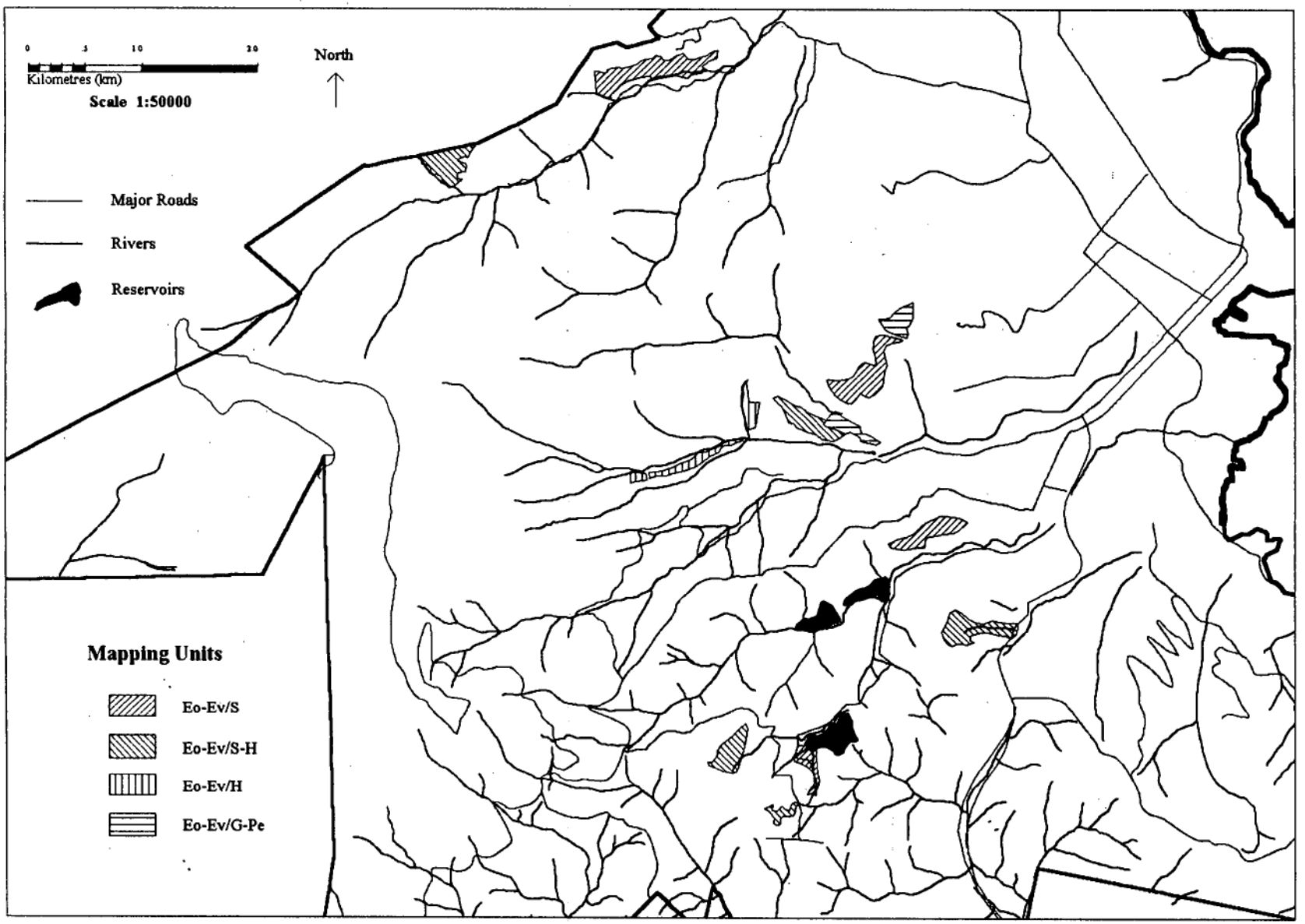
This mapping unit occurs entirely on Permian mudstone and is characterised by an understorey of low, heath-like shrubs. The ground layer is often bare, especially on the exposed sites. Nearly all sites have been burnt in the last 13 years. This unit is best described as a argillaceous *E. obliqua* forest (Duncan and Brown 1985), which is well-reserved in Tasmania. Only 5% of this unit occurs in HCC reserves.

Figure 4.15 **Foothill 2 communities (as described in text)**

		Eo-Ev/S	Eo-Ev/S-H	Eo-Ev/H	Eo-Ev/G-Pe
Altitude (m)		100-300	100-500	150-250	150-300
Slope (degrees)		10 to 20, gully	5 to 20	5 to 20	10.0
Aspect		SE-SW	NE-SE, SW	NE, S	N-E
Total Area (ha)		42.8	36.9	8.9	9.3
Substrate:	**Jurassic dolerite (ha)**	18.1 (42%)	19.8 (54%)		4.7 (50%)
	Dolerite talus (ha)	1.1 (3%)			
	Triassic sandstone (ha)	7.1 (17%)			2.8 (30%)
	Permian mudstone (ha)	16.5 (39%)	17.1 (46%)	8.9 (100%)	1.8 (20%)
Land tenure:	**HCC reserve (ha)**	19.1 (45%)	8.8 (24%)	0.5 (5%)	5.1 (55%)
	HCC non-reserve (ha)	4.4 (10%)	1.6 (4%)		1.9 (21%)
	Private (ha)	19.5 (45%)	26.5 (72%)	8.4 (95%)	2.3 (24%)
Fires*	**Wildfires (ha)**		6.9 (19%)	0.7 (8%)	4.3 (46%)
	Control burns (ha)	1.9 (4%)	8.0 (22%)	8.7 (98%)	
	Total area burnt (ha)	1.9 (4%)	14.9 (40%)	8.7 (98%)	4.3 (46%)
Community description(s) and respective Reservation Status** From Duncan and Brown (1985)		Shrubby *E. obliqua* forest[1]	Shrubby *E. obliqua* forest[1]	Shrubby *E. obliqua* forest (argillaceous)[1]	Shrubby *E. obliqua* forest[1]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania



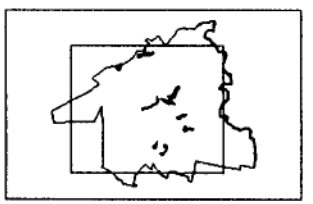


Figure 4.14: Foothill 2 communities

***Eucalyptus obliqua-E. viminalis* woodland/open-forest over grasses-*Pteridium esculentum* (Eo-Ev/G-Pe)**

This mapping unit is on two sites in Hobart. Both these sites show evidence of recent fires (HCC fire records and/or visual evidence). Shrubs are generally absent in the understorey, although the ground is covered by native grasses and/or bracken. This unit occurs on exposed slopes over various substrates. One of the sites is found on the HCC reserve Knocklofty Park, and the other occurs overlaps HCC 'unreserved' land and private land adjacent to the McRobies Gully Municipal Tip west of Knocklofty. This unit is best described as a shrubby *E. obliqua* forest (Duncan and Brown 1985), which is well-reserved in Tasmania.

4.7.3 Foothill 3 communities

This subsection is comprised of mapping units where *Eucalyptus amygdalina* dominates or is found in associations with *E. viminalis* or *E. obliqua*. These units are generally found on the drier more exposed northerly-facing Permian mudstone or Triassic sandstone slopes. The sandstone communities on Knocklofty are described by Brown (1982). Figure 4.15 shows the locations of these mapping units. Table 4.16 shows the total area, some environmental parameters and the land tenure of each unit.

***Eucalyptus amygdalina* woodland/open-forest over shrubs-heath (Ea/S-H)**

This mapping unit is characterised by *E. amygdalina* over an understorey of shrubs and heath type species. The ground layer is dominated by native grasses. This unit is found over a substrate of Permian mudstone and has been burnt in the last 13 years. Only one site is present in Hobart. This unit can be described as an *E. viminalis/E. amygdalina-Dianella revoluta* grassy woodland (Evd) which is unreserved in Tasmania (Kirkpatrick *et al.* 1988a). This unit is predominantly found on HCC 'unreserved' land (86%).

***Eucalyptus amygdalina* woodland/open-forest over shrubs-heath (Ea/S-H(s))**

This mapping unit is similar to the above as it is characterised by *E. amygdalina* over an understorey of shrubs and heath type species. *E. obliqua* and *E. viminalis* subdominate. The ground layer is generally bare, although some native grasses are present. This unit differs from the above as it occurs over a substrate of Triassic sandstone. Only one site is present in Hobart. This site has been partially burnt in the last 13 years. This unit is best described as an heathy *E. amygdalina* open forest/woodland on sandstone (Duncan and Brown 1985), which is well-reserved in Tasmania. Forty-five percent occurs in HCC reserves with the remainder on private land.

Figure 4.16 Foothill 3 communities (as described in text)

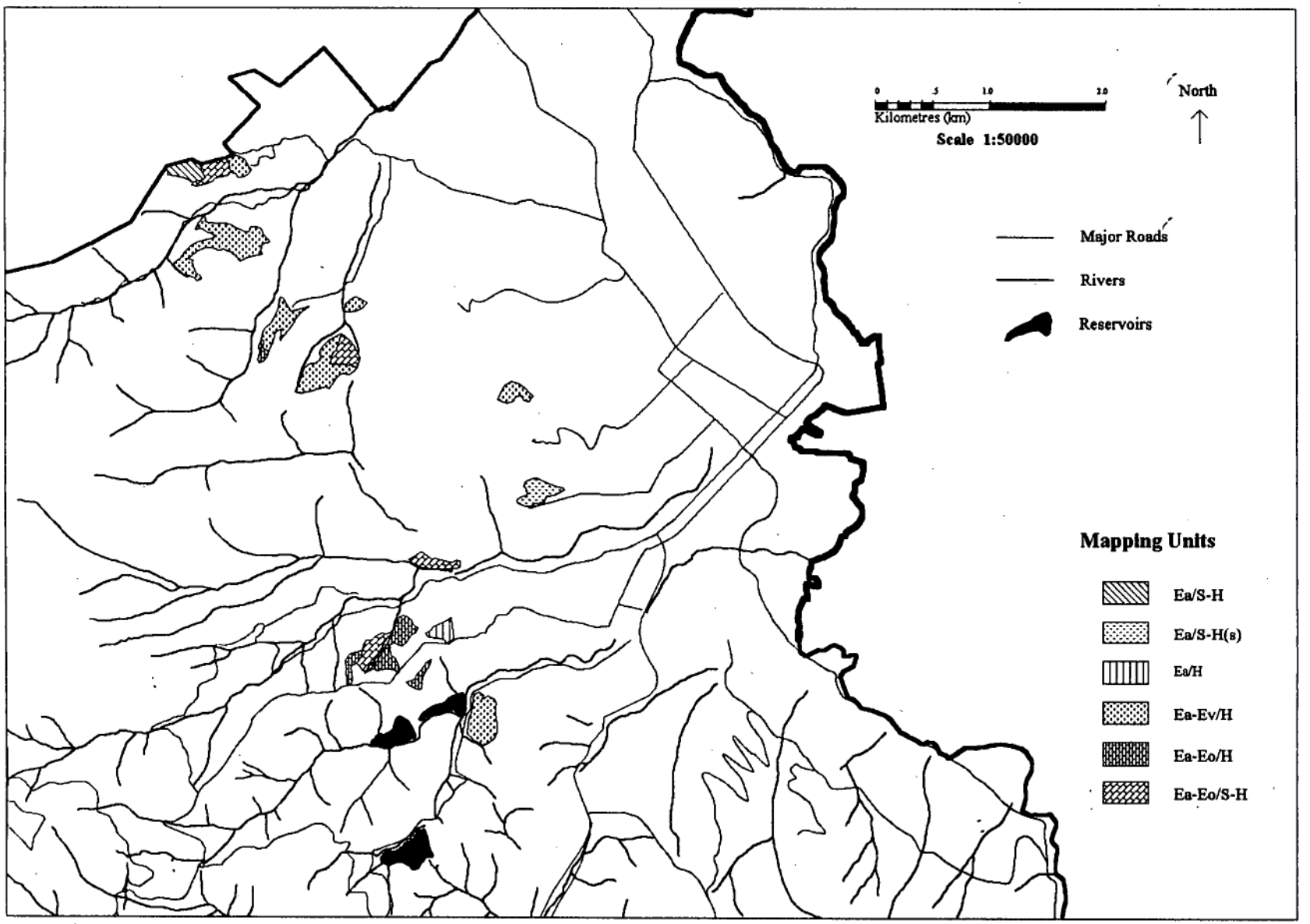
		Ea/S-H	Ea/S-H(s)	Ea/H	Ea-Ev/H	Ea-Eo/H	Ea-Eo/S-H
Altitude (m)		150-200	150-250		150-300	100-300	100-250
Slope (degrees)		0 to 15	15.0		5 to 25	10 to 15	10 to 20
Aspect		NW-W	N-NW		NW-NE	SE, N-NW	NE, S
Total Area (ha)		4.2	5.3	3.0	49.7	11.4	17.6
Substrate:	**Jurassic dolerite (ha)**				8.2 (17%)		
	Triassic sandstone (ha)		5.3 (100%)		10.0 (20%)	3.1 (27%)	4.7 (27%)
	Permian mudstone (ha)	4.2 (100%)		3.0 (100%)	31.5 (63%)	8.3 (73%)	12.9 (73%)
Land tenure:	**HCC reserve (ha)**		2.4 (45%)		4.4 (9%)	1.6 (14%)	0.8 (5%)
	HCC non-reserve (ha)	3.6 (86%)			6.8 (14%)		4.3 (25%)
	Private (ha)	0.6 (14%)	2.9 (55%)	3.0 (100%)	38.5 (77%)	9.8 (86%)	12.5 (71%)
Fires*	**Wildfires (ha)**				8.0 (16%)		
	Control burns (ha)	4.2 (100%)	2.8 (52%)	1.1 (36%)	16.2 (32%)	10.5 (92%)	10.6 (60%)
	Total area burnt (ha)	4.2 (100%)	2.8 (52%)	1.1 (36%)	24.1 (48%)	10.5 (92%)	10.6 (60%)
Community description(s) and respective Reservation Status** From Duncan and Brown (1985) or Kirkpatrick et al. (1988a)		E. *viminalis/E. amygdalina* - *Dianella revoluta* grassy woodland (Evd)[3]	Heathy *E. amygdalina* forest on sandstone[1]	*E. viminalis/E. amygdalina* - *Dianella revoluta* grassy woodland (Evd)[3]	*E. viminalis/E. amygdalina* - *Dianella revoluta* grassy woodland (Evd)[3]/ *E. viminalis* - *Poa sieberana* grassy woodland (Evp)[2]	Shrubby E. *obliqua* forest[1]	Shrubby *E. obliqua* forest[1]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania

[2] Poorly-reserved in Tasmania

[3] Unreserved in Tasmania



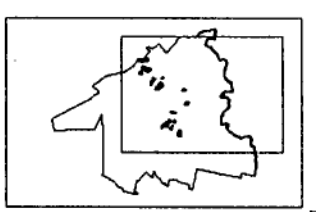


Figure 4.15: Foothill 3 communities

***Eucalyptus amygdalina* woodland/open-forest over heath (Ea/H)**

This mapping unit is characterised by *E. amygdalina* over a sparse understorey of heath. The ground layer is bare, although some native grasses are present. This unit is probably more frequently burnt than the previous two units, however, few fire records exist since it is only found on private land. Found predominantly on Permian mudstone, it is best described as an *E. viminalis/E. amygdalina-Dianella revoluta* grassy woodland (Evd) (Kirkpatrick *et al.* 1988a). This community is unreserved in Tasmania.

***Eucalyptus amygdalina-E. viminalis* woodland/open-forest over heath (Ea-Ev/H)**

This mapping unit is characterised by an association between *E. amygdalina* and *E. viminalis* over an understorey dominated by low shrubs. Native grasses commonly dominate the ground layer. This unit appears to be a result of recent and/or frequent fires. However, like the previous unit, its prevalence on private land (77%) makes this difficult to substantiate. It can be described generally as an *E. viminalis/E. amygdalina* grassy woodland open-forest (Kirkpatrick 1991b:97). With more floristic analysis it might be possible to further classify this unit into an *E. viminalis/E. amygdalina-Dianella revoluta* grassy woodland (Evd) which is unreserved in Tasmania, and/or an *E. viminalis-Poa sieberana* grassy woodland (Evp) (Kirkpatrick *et al.* 1988a), which is poorly-reserved in Tasmania.

***Eucalyptus amygdalina-E. obliqua* open-forest over heath (Ea-Eo/H)**

This mapping unit is characterised by an association between *E. amygdalina* and *E. obliqua* over an understorey of heath species. The ground layer is generally bare, a result of the frequent, recent firing. Located on Permian mudstone or Triassic sandstone, it can be described as a shrubby *E. obliqua* forest (Duncan and Brown 1985), which is well-reserved in Tasmania. Over 85% of its area is found on private land.

***Eucalyptus amygdalina-E. obliqua* open-forest over shrubs-heath (Ea-Eo/S-H)**

This mapping unit is similar to the above unit however the understorey is composed of both tall shrubs/trees and low shrubs (heath). Bracken (*Pteridium esculentum)* commonly dominates the ground layer. The vegetation suggests these sites have been burnt less than Ea-Eo/H. This unit can be described as shrubby *E. obliqua* forest (Duncan and Brown 1985), which is well-reserved in Tasmania. Over 70% is found on private land.

4.7.4 Foothill 4 communities

This group contains the associations between *Eucalyptus amygdalina* and *E. tenuiramis*, *E. tenuiramis* and *E. viminalis*, and *E. amygdalina* and *E. globulus*. These associations generally occur on the dry or exposed north-facing slopes in Hobart. Figure 4.16 shows the locations of these mapping units. Table 4.17 shows the total area, some environmental parameters and the land tenure of each unit.

***Eucalyptus amygdalina-E. tenuiramis* open-forest over shrubs-heath (Ea-Et/S-H)**

This *E. amygdalina-E. tenuiramis* association is found on only one site, Ridgeway Park. *E. obliqua* and *E. viminalis* are also present and may occasionally dominate/codominate some small areas. However, these areas are too small to map. The understorey is composed of tall and low shrubs, and native grasses dominate the ground layer. This unit predominantly occurs on Triassic sandstone and, to a lesser extent, on Permian mudstone. On sandstone this unit may be described as a heathy *E. amygdalina* open-forest/woodland on sandstone, which is well-reserved in Tasmania or a heathy *E. tenuiramis* forest (Duncan and Brown 1985), which is poorly-reserved in Tasmania. On mudstone it is best described as a grassy *E. tenuiramis* forest (Duncan and Brown 1985), which is poorly-reserved in Tasmania. This mapping unit most probably represents an area where these communities overlap.

***Eucalyptus tenuiramis-E. viminalis* open-forest over shrubs-heath (Et-Ev/S-H)**

E. tenuiramis co-dominates with *E. viminalis* on only two sites in Hobart. The understorey of this mapping unit is characterised by both tall and low shrubs, the ground layer is covered by native grasses and/or bracken (*Pteridium esculentum*). This unit occurs solely on Triassic sandstone and can be described as a heathy *E. tenuiramis* forest (Duncan and Brown 1985), which is poorly-reserved in Tasmania. This unit is found predominantly (95%) in HCC reserves.

***Eucalyptus amygdalina-E. globulus* open-forest over shrubs-heath (Ea-Eg/S-H)**

This mapping unit is an association between *E. amygdalina* and *E. globulus* over both tall and low shrubs with native grasses dominating the ground layer. It generally overlies Triassic sandstone and can be described as an *E. viminalis/E. amygdalina-Dianella revoluta* grassy woodland (Evd). This community is unreserved in Tasmania. Over 95% of this unit occurs in the HCC reserve Ridgeway Park.

Figure 4.17 **Foothill 4 communities (as described in text)**

		Ea-Et/S-H	Et-Ev/S-H	Ea-Eg/S-H
Altitude (m)		150-250	50-250	150-200
Slope (degrees)		5 to 15	10 to 25	5 to 20
Aspect		N	N-NW, SW	N-NW
Total Area (ha)		9.7	5.3	3.1
Substrate:	**Jurassic dolerite (ha)**			0.1 (4%)
	Triassic sandstone (ha)	8.5 (88%)	5.3 (100%)	2.6 (84%)
	Permian mudstone (ha)	1.2 (12%)		0.4 (12%)
Land tenure:	**HCC reserve (ha)**	9.7 (100%)	5.0 (95%)	3.0 (96%)
	Private (ha)		0.3 (5%)	0.1 (4%)
Fires*	**Wildfires (ha)**	0.6 (6%)		0.8 (25%)
	Control burns (ha)		0.8 (15%)	
	Total area burnt (ha)	0.6 (6%)	0.8 (15%)	0.8 (25%)
Community description(s) and respective Reservation Status** ** From Duncan and Brown (1985) or Kirkpatrick *et al.* (1988a)		Heathy *E. amygdalina* on sandstone/[1] Grassy *E. tenuiramis* forest[1]/ Heathy *E. tenuiramis* forest[2]	Heathy E. *tenuiramis* forest[2]	*E. viminalis*/*E. amygdalina* - *Dianella revoluta* grassy woodland (Evd)[3]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania

[2] Poorly-reserved in Tasmania

[3] Unreserved in Tasmania

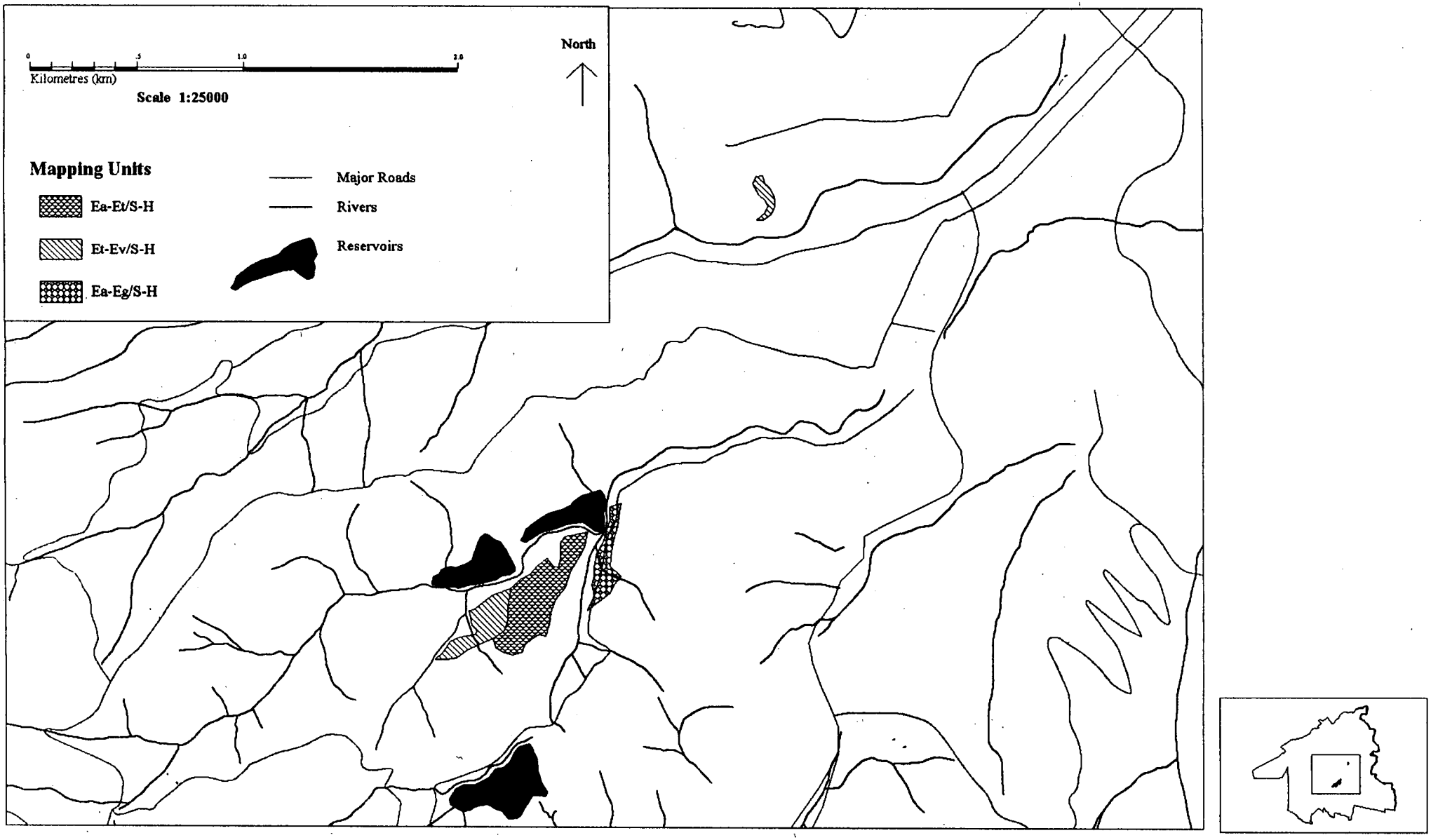


Figure 4.16: Foothill 4 communities

4.7.5 Foothill 5 communities

Eucalyptus pulchella either dominates or codominates with a variety of eucalypt species in the Hobart area (eg. *E. viminalis*. *E. ovata, E. globulus* and *E. obliqua*). This subsection is comprised of the mapping units where *E. pulchella* dominates. These units are probably due to the combination of fire regime and environmental parameters such as altitude, aspect and slope. Past studies have indicated a relatively high fire frequency will promote the establishment of grassy species at the expense of tree and shrub seedlings (Kirkpatrick 1991b). Four mapping units are described: over shrubs, shrubs-heath, heath; and grasses. Figure 4.17 shows the locations of these mapping units. Table 4.18 shows the total area, some environmental parameters and the land tenure of each unit. These communities are included in Ratkowsky and Ratkowsky's (1977) Zone 7D.

Eucalyptus pulchella woodland/open-forest over shrubs (Ep/S)

This mapping unit is characterised by tall shrubs/trees dominating the understorey and a ground layer dominated by grasses. *E. ovata* is often present as a subdominant. Found on the insolated Jurassic dolerite slopes of Mt. Nelson, this unit is most likely a result of a low fire frequency. However, this can not be verified since over 60% is found on private land. Kirkpatrick (1991b) found that in grasslands around Hobart which had not been burnt since 1967 has since turned into a *Allocasuarina verticillata* closed-scrub. Exotic species such as *Chrysanthemoides monilifera* (boneseed) are commonly present in the understorey. This unit is best described as *E. pulchella-Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb) (Kirkpatrick *et al.* 1988a), which is well-reserved in Tasmania.

Eucalyptus pulchella woodland/open-forest over shrubs-heath (Ep/S-H)

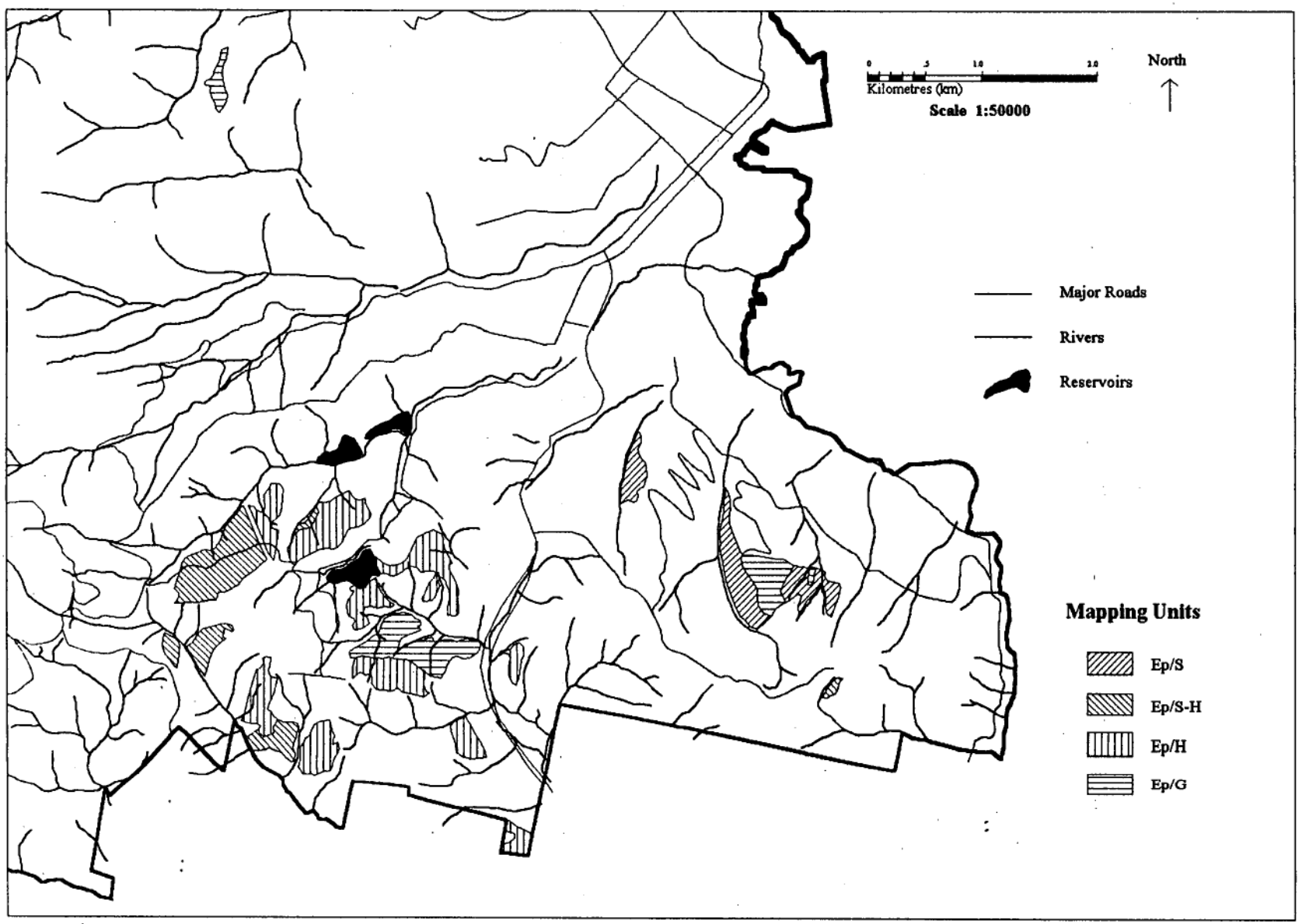
This mapping unit is similar to the previous unit, however it also contains a combination of tall shrubs and heath species, including a shrub form of *E. cordata*, in the understorey. The ground layer is dominated by sedges or native grasses, the latter are always present. This mapping unit occupies sites less exposed than the previous unit and is predominantly found on Jurassic dolerite substrates. The fire frequency is probably slightly greater than the above unit. This unit is best described as *E. pulchella-Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb) (Kirkpatrick *et al.* 1988a), which is well-reserved in Tasmania. Nearly 75% is contained within HCC 'reserved' land.

Figure 4.18 Foothill 5 communities (as described in text)

		Ep/S	Ep/S-H	Ep/H	Ep/G
Altitude (m)		50-250	250-500	150-500	100-300
Slope (degrees)		15 to 25	0 to 20	0 to 20	0 to 15
Aspect		W-N-NE	NW-W-S-SE	all ex W	W, NE-N
Total Area (ha)		37.2	46.3	109.3	47.1
Substrate:	Jurassic dolerite (ha)	37.2 (100%)	35.3 (76%)	95.9 (88%)	42.9 (91%)
	Triassic sandstone (ha)		8.6 (19%)	13.4 (12%)	
	Permian mudstone (ha)		2.4 (5%)		4.2 (9%)
Land tenure:	HCC reserve (ha)	5.9 (16%)	34.4 (74%)	61.7 (56%)	27.4 (58%)
	Hobart College (ha)			3.1 (3%)	
	University Reserve (ha)	8.2 (22%)			
	Private (ha)	23.1 (62%)	11.9 (26%)	44.5 (41%)	19.7 (42%)
Fires*	Wildfires (ha)	15.9 (43%)	23.5 (51%)	23.9 (22%)	4.8 (10%)
	Control burns (ha)	2.6 (7%)		21.6 (20%)	31.1 (66%)
	Total area burnt (ha)	17.3 (47%)	23.5 (51%)	43.6 (40%)	33.6 (71%)
Community description(s)** and respective Reservation Status ** From Kirkpatrick *et al.* (1988a)		*E. pulchella - Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb)[1]	*E. pulchella - Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb)[1]	*E. pulchella - Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb)[1]	*E. pulchella - Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb)[1]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania



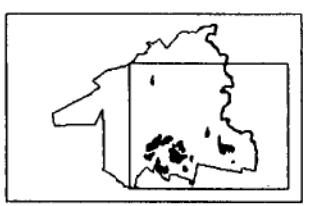


Figure 4.17: Foothill 5 communities

Eucalyptus pulchella woodland/open-forest over heath (Ep/H)

This *E. pulchella* mapping unit is characterised by an understorey of heath species over a ground layer dominated by native grasses. The lack of a tall shrub layer can probably be attributed to recent or frequent fires. *E. globulus, E. ovata* and *E. viminalis* are often present as subdominants. This unit occurs predominantly over Jurassic dolerite and can best described as *E. pulchella-Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb) (Kirkpatrick *et al.* 1988a), which is well-reserved in Tasmania. Over 40% is found on private land.

Eucalyptus pulchella open-woodland/woodland over grasses (Ep/G)

This mapping unit, which generally occurs on the drier north-facing slopes, is characterised by the absence of a shrub layer and the dominance of native grass species. Although over 40% is found on private land, HCC fire records indicate that a large proportion of this unit has been burnt in the last 13 years. These fires have probably prevented the establishment of shrub/tree seedlings (Kirkpatrick 1991b). This unit is best described as *E. pulchella-Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb) (Kirkpatrick *et al.* 1988a), which is well-reserved in Tasmania.

4.7.6 Foothill 6 communities

This group is composed of the mapping unit which is dominated by *Allocasuarina verticillata* and four mapping units where *Eucalyptus pulchella* codominates with *E. viminalis* (over shrubs, shrubs-heath, heath and grass). These units are all found on free-draining sites and the understorey/ground layer is dependent on the fire frequency. Figure 4.18 shows the locations of these mapping units. Table 4.19 shows the total area, some environmental parameters and the land tenure of each unit.

The underlying substrate is predominantly Jurassic dolerite and these sites, except those in the Queens Domain, are included in Ratkowsky and Ratkowsky's (1977) Zone 7D.

Allocasuarina verticillata over grass (Al/G)

This mapping unit is characterised by *Allocasuarina verticillata* over a ground layer of native grasses. *Eucalyptus viminalis, E. pulchella* and/or *E. globulus* are occasional emergents. The understorey is sparse. This unit occurs solely on the dry exposed doleritic slopes of Mt. Nelson and Tolmans Hill. Although fire records indicate that some sites were burnt over 7 years ago, the closed canopy indicates that these fires did not effect the crowns. This unit is described by Fensham (1992) as an *Allocasuarina verticillata*

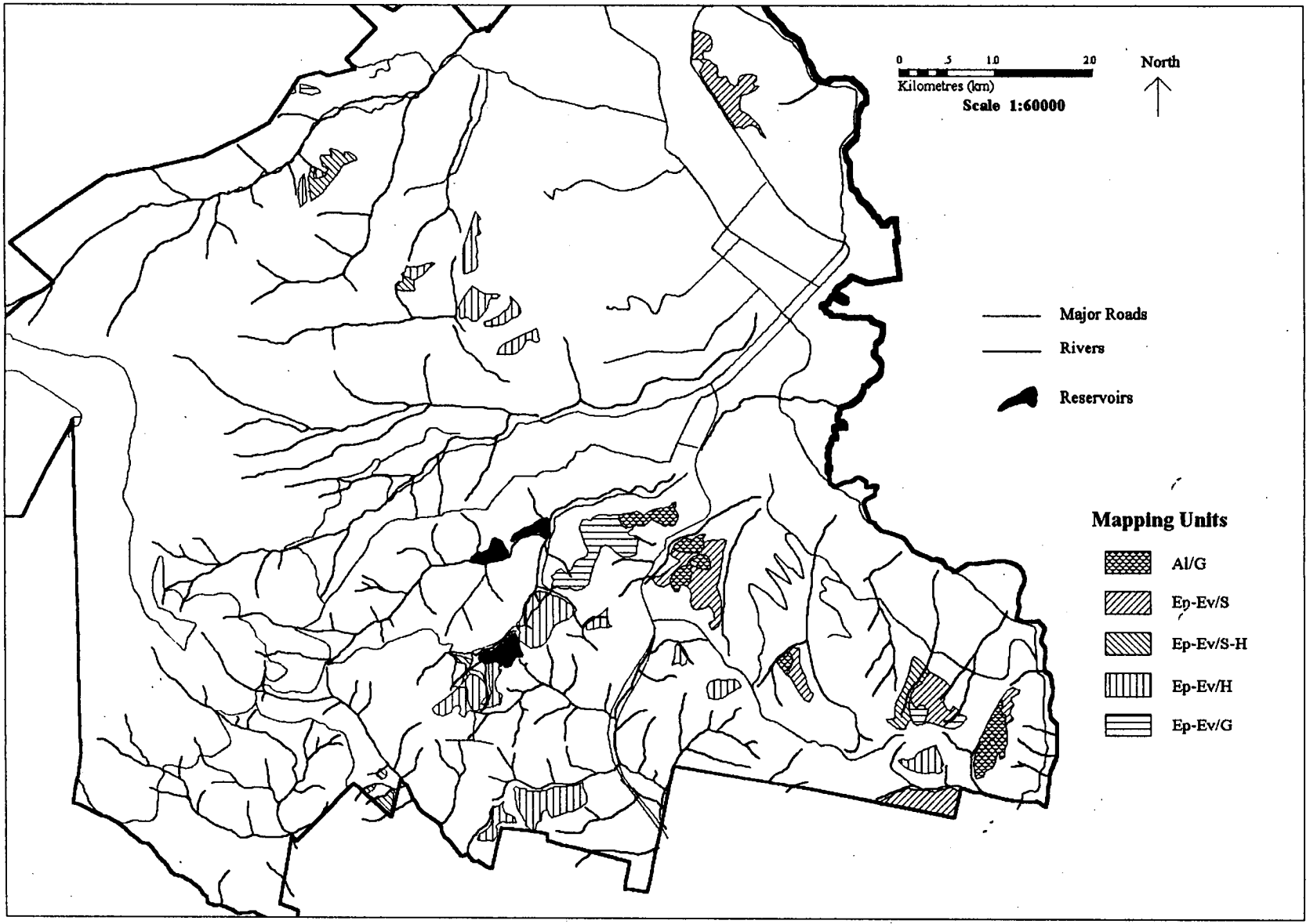
Figure 4.19 Foothill 6 communities (as described in text)

		Al/G	Ep-Ev/S	Ep-Ev/S-H	Ep-Ev/H	Ep-Ev/G
Altitude (m)		100-300	100-350	100-400	100-350	50-100
Slope (degrees)		5 to 20	0 to 25	5 to 20	5 to 20	20 to 25
Aspect		N	NE-NW	S-E-NE-NW	various	NW-SW
Total Area (ha)		35.4	91.5	29.7	113.2	36.1
Substrate:	Jurassic dolerite (ha)	35.4 (100%)	86.1 (94%)	17.5 (59%)	100.2 (89%)	36.1 (100%)
	Triassic sandstone (ha)		2.4 (3%)		0.8 (1%)	
	Permian mudstone (ha)		3.0 (3%)	12.2 (41%)	11.2 (10%)	
Land tenure:	HCC reserve (ha)	2.0 (6%)	34.6 (38%)	2.0 (7%)	48.3 (43%)	3.0 (8%)
	Wellington Park (ha)				0.6 (1%)	
	HCC non-reserve (ha)	0.5 (1%)		2.0 (7%)	13.5 (12%)	1.1 (3%)
	Crown Reserves (ha)	1.4 (4%)	14.0 (15%)	1.6 (5%)	7.3 (6%)	2.4 (7%)
	Hobart College (ha)				4.2 (4%)	
	University Reserve (ha)	6.5 (18%)	20.9 (23%)			
	Private (ha)	25.0 (71%)	22.0 (24%)	24.1 (81%)	39.9 (35%)	29.6 (82%)
Fires*	Wildfires (ha)	8.8 (25%)	7.6 (8%)	4.1 (14%)	26.0 (23%)	25.8 (72%)
	Control burns (ha)	3.3 (9%)	12.9 (14%)	2.5 (8%)	29.9 (26%)	1.6 (4%)
	Total area burnt (ha)	11.8 (33%)	16.4 (18%)	6.5 (22%)	41.1 (36%)	27.4 (76%)
Community description(s)** and respective Reservation Status ** From Duncan and Brown (1985) or Kirkpatrick *et al.* (1988a)		Inland Allocasuarina low forest[1]	*E. pulchella - Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb)[1] / *E. viminalis/Allocasuarina verticillata - Acacia mearnsii* grassy woodland (Evam)[2]	*E. pulchella - Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb)[1]	*E. pulchella - Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb)[1]	*E. pulchella - Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb)[1]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania

[2] Poorly-reserved in Tasmania



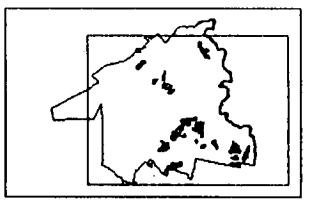


Figure 4.18: Foothills 6 communities

shrubland. Using the dry sclerophyll classification of Duncan and Brown (1985) it is best described as an inland *Allocasuarina verticillata* low forest, which is well-reserved in Tasmania. Over 70% of this unit is found on private land.

***Eucalyptus pulchella-E. viminalis* woodland/open-forest over shrubs (Ep-Ev/S)**

This mapping unit occurs on dry and exposed northerly-facing sites on Mt. Nelson and the Queens Domain. The understorey is typically composed of tall shrubs/trees and the ground is covered by both native grasses and sedges. *E. globulus* is often present as a subdominant. Some of these sites have been recently burnt. This unit can generally be described as an *E. pulchella-Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb) (Kirkpatrick *et al.* 1988a), which is well-reserved in Tasmania. However, sites on the Queens Domain are best described as an *E. viminalis/Allocasuarina verticillata-Acacia mearnsii* grassy woodland (Evam) (Kirkpatrick *et al.* 1988a), which is poorly-reserved in Tasmania. Most of this land (78%) is reserved by various government or quasi-government authorities.

***Eucalyptus pulchella-E. viminalis* woodland/open-forest over shrubs-heath (Ep-Ev/S-H)**

This mapping unit is characterised by the dominance of both tall shrubs and heath in the understorey. *E. obliqua* and *E. ovata* are often present as subdominants. On Jurassic dolerite substrates it generally occurs on slightly wetter or more sheltered sites than the previous unit, however, on Permian mudstone it occurs on drier more exposed slopes. This unit is best described as an *E. pulchella-Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb) (Kirkpatrick *et al.* 1988a), which is well-reserved in Tasmania. This unit is mainly found on private land (80%) and the fire history is generally unknown.

***Eucalyptus pulchella-E. viminalis* woodland/open-forest over heath (Ep-Ev/H)**

This mapping unit most closely resembles Ep/H (Subsection 4.7.5) and is characterised by an understorey dominated by heath over a ground layer of native grasses. *E. globulus* and *E. ovata* are often present as subdominants. This unit occurs predominantly on Jurassic dolerite. Sites appear to have been more recently or frequently burnt than the previous unit (Ep-Ev/S-H). It is best described as an *E. pulchella-Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb) (Kirkpatrick *et al.* 1988a), which is well-reserved in Tasmania. Over 40% occurs in HCC reserves, with a further 35% on private land.

***Eucalyptus pulchella-E. viminalis* open-woodland/woodland over grasses (Ep-Ev/G)**

This *E. pulchella-E. viminalis* association is characterised by the absence of a dominant shrub layer and a ground layer covered with native grasses. *E. globulus* is often present as a subdominant. The absence of shrubs may be due to recent or frequent fires. This fire regime is known to favour native grasses and prevent the establishment of shrub seedlings (Kirkpatrick 1991b:109). It is best described as an *E. pulchella-Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb) (Kirkpatrick *et al.* 1988a), which is well-reserved in Tasmania. This unit is found predominantly on private land (82%).

4.7.7 Foothill 7 communities

Eucalyptus pulchella codominates with *E. globulus* on some moist or protected slopes in Hobart. *E. globulus* tends to dominate as the moisture increases, whereas *E. pulchella* dominants where the site is more exposed. *E. ovata, E. obliqua* and/or *E. viminalis* may also be present. The ground layer is almost always grassy due to the interaction of dryness and fire on this substrate (J. Kirkpatrick pers. comm.). Where fires are not common, the ground layer is dominated by sedges. The most common substrate is Jurassic dolerite. Four mapping units are described: over shrubs; shrubs-heath; heath; and grasses. Figure 4.19 shows the locations of these mapping units. Table 4.20 shows the total area, some environmental parameters and the land tenure of each unit. These mapping units are included in Ratkowsky and Ratkowsky's (1977) Zone 7D.

***Eucalyptus globulus-E. pulchella* open-forest over shrubs (Eg-Ep/S)**

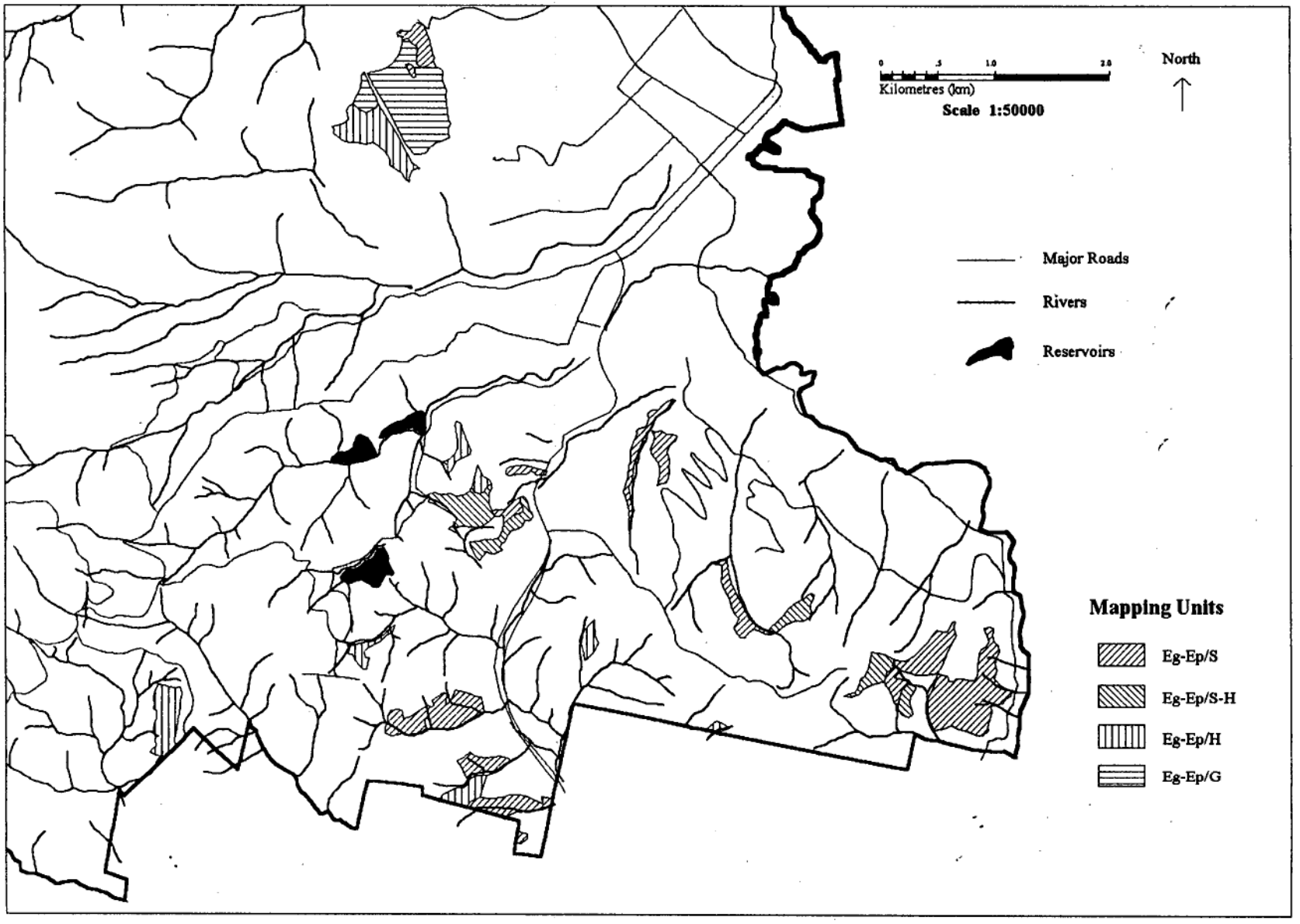
This *E. globulus-E. pulchella* mapping unit is characterised by an understorey comprised of narrow-leaved and to a minor extent broad-leaved shrubs with grasses dominating the ground layer. *E. obliqua* and *E. viminalis* are often present as subdominants. The underlying rock is predominantly Jurassic dolerite and it is located on moist, protected slopes. This unit can either be described as an *E. globulus-Poa labillardieri-Hypochaeris radicata* wet sclerophyll forest (GLOB 1) (Kirkpatrick *et al.* 1988b) or an *E. pulchella/E. globulus-Acrotriche serrulata* grassy woodland (Epa) (Kirkpatrick *et al.* 1988a), depending on which species are more dominant and the fire history. Sites which have been more recently burnt are best described as *E. pulchella/E. globulus-Acrotriche serrulata* grassy woodlands. Both of these communities are poorly-reserved in Tasmania. Over 60% of this unit is found on private land.

Figure 4.20 Foothill 7 communities (as described in text)

		Eg-Ep/S	Eg-Ep/S-H	Eg-Ep/H	Eg-Ep/G
Altitude (m)		50-300	200-350	150-400	200-350
Slope (degrees)		5 to 25	0 to 25	0 to 25	0 to 20
Aspect		N-SE, W	various	various	NW-E
Total Area (ha)		101.9	33.1	49.4	42.5
Substrate:	**Jurassic dolerite (ha)**	83.0 (81%)	32.6 (98%)	45.9 (93%)	41.9 (98%)
	Triassic sandstone (ha)			3.5 (7%)	0.6 (2%)
	Permian mudstone (ha)		0.5 (2%)		
	Sub-basalt (ha)	18.9 (19%)			
Land tenure:	**HCC reserve (ha)**	19.2 (19%)	1.6 (5%)	17.9 (36%)	36.1 (85%)
	HCC non-reserve (ha)	1.2 (1%)			
	Crown Reserves (ha)	5.7 (6%)	7.3 (22%)		
	Hobart College (ha)			3.0 (6%)	
	University Reserve (ha)	11.5 (11%)			
	Private (ha)	64.3 (63%)	24.2 (73%)	28.5 (58%)	6.4 (15%)
Fires*	**Wildfires (ha)**	12.3 (12%)	6.3 (19%)	4.1 (8%)	36.6 (86%)
	Control burns (ha)	6.2 (6%)	9.2 (28%)	9.1 (18%)	2.1 (5%)
	Total area burnt (ha)	12.8 (13%)	9.2 (28%)	13.2 (27%)	38.7 (91%)
Community description(s) and respective Reservation Status ** From Kirkpatrick *et al.* (1988a)or Kirkpatrick *et al.* (1988b)		*E. globulus - Poa labillardieri - Hypochaeris radicata* wet sclerophyll forest (GLOB 1)[1]/ *E. pulchella/E. globulus - Acrotriche serrulata* grassy woodland (Epa)[1]	*E. pulchella/E. globulus - Acrotriche serrulata* grassy woodland (Epa)[1]	*E. pulchella/E. globulus - Acrotriche serrulata* grassy woodland (Epa)[1]	*E. pulchella/E. globulus - Acrotriche serrulata* grassy woodland (Epa)[1]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Poorly-reserved in Tasmania



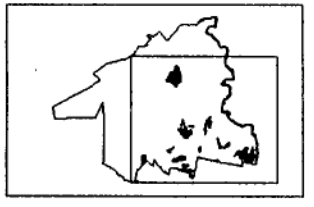


Figure 4.19: Foothill 7 communities

***Eucalyptus globulus-E. pulchella* open-forest over shrubs-heath (Eg-Ep/S-H)**

This mapping unit is characterised by both shrubs and heath in the understorey. *E. ovata* is often present as a subdominant. The understorey is either dominated by native grasses or sedges. It is best described as an *E. pulchella/E. globulus-Acrotriche serrulata* grassy woodland (Epa) (Kirkpatrick *et al.* 1988a), which is poorly-reserved in Tasmania. In the sites where sedges dominate the ground layer this community could also be described as a *E. pulchella* heathy forest (Fensham 1992). Over 70% of this unit occurs on private land.

***Eucalyptus globulus-E. pulchella* open-forest over shrubs-heath (Eg-Ep/H)**

This mapping unit is characterised by an understorey dominated by heath. These sites may have been more recently or frequently burnt. *E. ovata* and *E. viminalis* are often present as subdominants. Native grasses and/or sedges dominate the ground layer. Gorse (*Ulex europaeus*) is commonly found on these sites especially close to vehicle tracks. It is best described as an *E. pulchella/E. globulus-Acrotriche serrulata* grassy woodland (Epa) (Kirkpatrick *et al.* 1988a), which is poorly-reserved in Tasmania. Sedges tend to dominate the sites areas which have not been burnt for at least 10 years. These sites have been described by Fensham (1992) as a *E. pulchella* heathy forest. Nearly 60% of this unit occurs on private land.

***Eucalyptus globulus-E. pulchella* open-forest over grass (Eg-Ep/G)**

This mapping unit is characterised by a recently or frequently burnt shrub layer over a ground layer of native grasses. Prior to burning, at least one of these sites (on Knocklofty) contained a shrubby understorey. Brown (1982) described this site as an "Open-forest - grassy heath understorey" on the summit and an "Open-forest - shrubs greater than 1m tall" on the eastern slopes. This shrub layer will probably re-establish if this area is not burnt again for at least 10 years. This unit can be described as an *E. pulchella/E. globulus-Acrotriche serrulata* grassy woodland (Epa) (Kirkpatrick *et al.* 1988a), which is poorly-reserved in Tasmania. Nearly 90% of this unit is found in HCC reserves.

4.7.8 Foothill 8 communities

This group is composed of mapping units where *Eucalyptus viminalis* dominates or forms an association with *E. globulus*. Figure 4.20 shows the locations of these mapping units. Table 4.21 shows the total area, some environmental parameters and the land tenure of each unit. These mapping units, except for the units on the Queens Domain, are included in Zone 7D of Ratkowsky and Ratkowsky (1977).

Figure 4.21 Foothill 8 communities (as described in text)

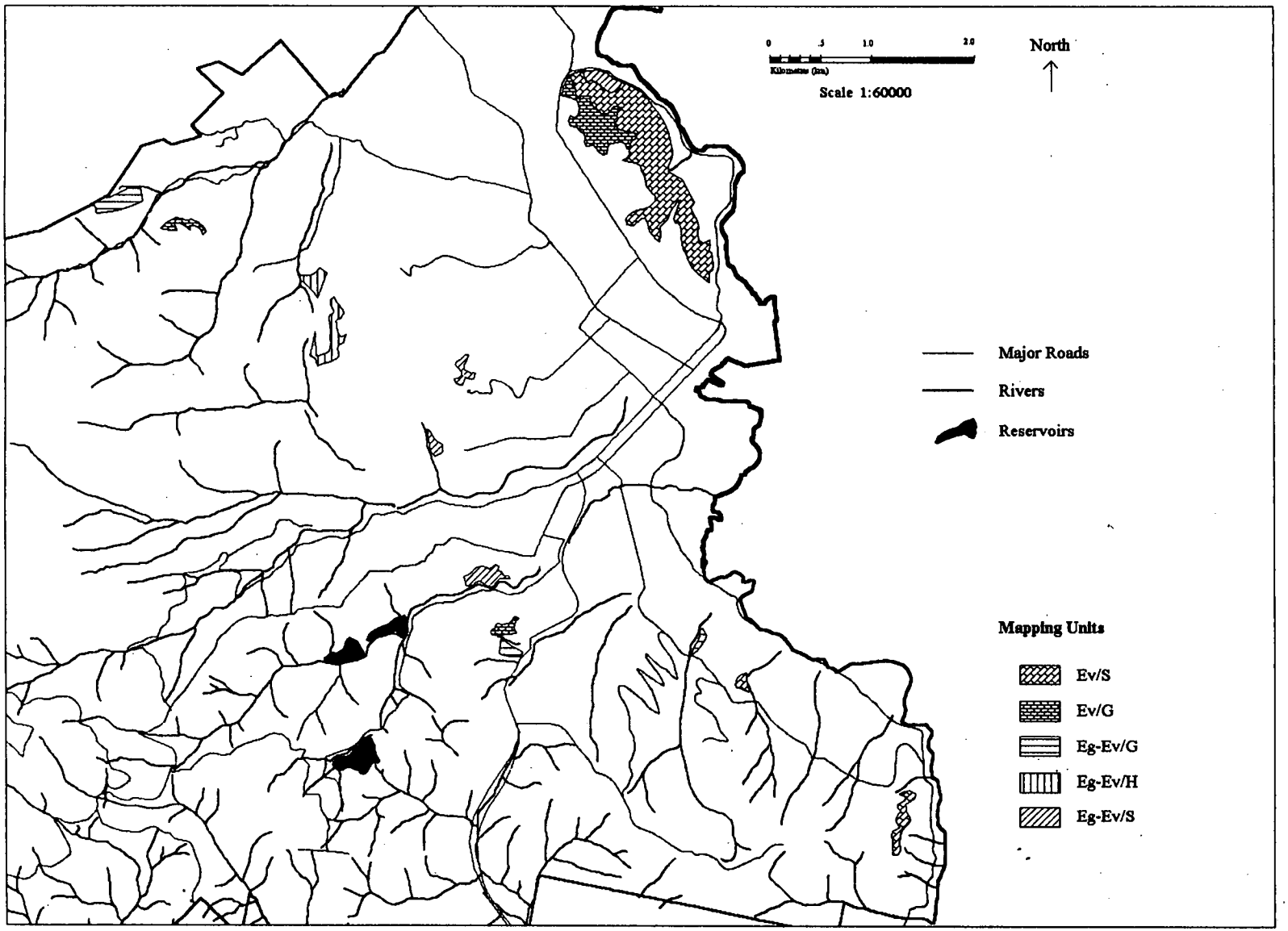
		Ev/S	Ev/G	Eg-Ev/G	Eg-Ev/H	Eg-Ev/S
Altitude (m)		0-300	0-250	0-300	200-300	100-250
Slope (degrees)		0 to 25	0 to 15	5 to 20	10 to 20	15 to 25
Aspect		N-E	NW-SE	N, SE	SW	S-W
Total Area (ha)		79.4	25.1	10.7	11.0	14.3
Substrate:	Jurassic dolerite (ha)	76.2 (96%)	22.4 (89%)	3.1 (29%)	6.1 (55%)	9.9 (69%)
	Triassic sandstone (ha)				3.1 (28%)	4.4 (31%)
	Permian mudstone (ha)	3.2 (4%)	2.7 (11%)	6.3 (59%)	1.8 (17%)	
	Sub-basalt (ha)			1.3 (12%)		
Land tenure:	HCC reserve (ha)	70.1 (88%)	19.2 (76%)	1.2 (11%)		3.5 (25%)
	HCC non-reserve (ha)				0.6 (5%)	
	Private (ha)	9.3 (12%)	5.9 (24%)	9.5 (89%)	10.4 (95%)	10.8 (75%)
Fires*	Wildfires (ha)	25.9 (33%)	12.2 (49%)	2.2 (21%)		
	Control burns (ha)	24.5 (31%)	2.3 (9%)	3.3 (31%)		3.4 (23%)
	Total area burnt (ha)	31.5 (40%)	14.5 (58%)	5.5 (52%)	0	3.4 (23%)
Community description(s)** and respective Reservation Status ** From Kirkpatrick *et al.* (1988a); Kirkpatrick *et al.* (1988b) or Duncan and Brown (1985)		E. *viminalis/Allocasuarina verticillata - Acacia mearnsii* grassy woodland (Evam)[2]/ E. *viminalis/E. ovata/E. pauciflora - Convolvulus erubescens* grassy woodland (Evc)[2]	*E. viminalis - Plantago varia* grassy woodland (Evpv)[3]/ *E. viminalis/Allocasuarina verticillata - Acacia mearnsii* grassy woodland (Evam)[2]/ *E. viminalis/E. ovata/E. pauciflora - Convolvulus erubescens* grassy woodland (Evc)[2]	Grassy *E. globulus/E. viminalis* forest[1] *E. viminalis/Allocasuarina verticillata - Acacia mearnsii* grassy woodland (Evam)[2]	Grassy *E. globulus/E. viminalis* forest[1]	Grassy *E. globulus/E. viminalis* forest[1] *E. globulus - Poa labillardieri - Hypochaeris radicata* wet sclerophyll forest (GLOB 1)[2]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania

[2] Poorly-reserved in Tasmania

[3] Unreserved in Tasmania



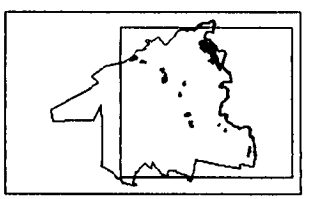


Figure 4.20: Foothill 8 communities

***Eucalyptus viminalis* woodland/open-forest over shrubs (Ev/S)**

This *E. viminalis* mapping unit is characterised by an understorey of tall shrubs/trees and a ground layer generally composed of native grasses. Some of these sites have been burnt in the last 13 years. This unit occurs predominantly on Jurassic dolerite and can be described as either an *E. viminalis/Allocasuarina verticillata-Acacia mearnsii* grassy woodland (Evam) or an *E. viminalis/E. ovata/E. pauciflora-Convolvulus erubescens* grassy woodland (Evc) (Kirkpatrick *et al.* 1988a). These grassy woodlands are poorly-reserved in Tasmania. Most of these sites are found on the HCC reserve the Queens Domain.

***Eucalyptus viminalis* low open-woodland/woodland over grasses (Ev/G)**

This mapping unit is characterised by the sparseness or absence of shrubs and a ground layer dominated by native grasses. Frequent or recent fires have occurred on all sites. The substrate is predominantly Jurassic dolerite. It is best described as an *E. viminalis-Plantago varia* grassy woodland (Evpv) (Kirkpatrick *et al.* 1988a), which is unreserved in Tasmania. However, with further floristic analysis it might be possible to assign a designation of an *E. viminalis/Allocasuarina verticillata-Acacia mearnsii* grassy woodland (Evam) or an *E. viminalis/E. ovata/E. pauciflora-Convolvulus erubescens* grassy woodland (Evc) (Kirkpatrick *et al.* 1988a). Both these communities are poorly-reserved in Tasmania. Over 75% of this unit is found in HCC reserves.

***Eucalyptus globulus-E. viminalis* open-woodland/woodland over grasses (Eg-Ev/G)**

This mapping unit represent areas where *E. viminalis* has formed an association with *E. globulus* over native grasses. Tall shrubs/trees are very sparsely distributed below the eucalypts. The understorey is possibly due to frequent fires or shrub clearing. The substrate is either Jurassic dolerite or Permian mudstone. This unit is best described using the dry sclerophyll classification of Duncan and Brown (1985) as a grassy *E. globulus/E. viminalis* forest which is well-reserved in Tasmania. However, where *E. viminalis* dominates it is better described as an *E. viminalis/Allocasuarina verticillata-Acacia mearnsii* grassy woodland (Evam) (Kirkpatrick *et al.* 1988a), which is poorly-reserved in Tasmania. Nearly 90% of this unit occurs on private land.

***Eucalyptus globulus-E. viminalis* woodland/open-forest over heath (Eg-Ev/H)**

This mapping unit is distinguished by an understorey of low shrubs over a ground layer dominated by native grasses. This unit is probably a result of frequent fires, though probably less frequent than the previous mapping unit. *E. ovata* may subdominate on

Jurassic dolerite substrates, and *E. amygdalina* or *E. tenuiramis* may subdominate on the Triassic sandstone. This unit is best described using the dry sclerophyll classification of Duncan and Brown (1985) as a grassy *E. globulus/E. viminalis* forest. This community is well-reserved in Tasmania. This unit is found predominantly on private land (95%).

***Eucalyptus globulus-E. viminalis* woodland/open-forest over shrubs (Eg-Ev/S)**

This mapping unit is found on the more sheltered aspects of the dry hills surrounding urban Hobart. The understorey differs from the above unit as taller shrubs are common and native grasses share the ground layer with sedges and bracken (*Pteridium esculentum*). *E. obliqua* is often present as a subdominant. The substrate is Jurassic dolerite or Triassic sandstone. This unit can either be described as a grassy *E. globulus/E. viminalis* forest (Duncan and Brown 1985), which is well-reserved in Tasmania or an *E. globulus-Poa labillardieri-Hypochaeris radicata* wet sclerophyll forest (GLOB 1) (Kirkpatrick *et al.* 1988), which is poorly-reserved in Tasmania. Seventy-five percent of this unit occurs on private land.

4.7.9 Foothill 9 communities

Eucalyptus ovata either dominates or codominates with *E. pulchella* or *E. globulus* in the Mt. Nelson area. The sites are generally moist and are often found in hollows on exposed slopes. Figure 4.21 shows the locations of these mapping units. Table 4.22 shows the total area, some environmental parameters and the land tenure of each unit. These communities are included in Ratkowsky and Ratkowsky's (1977) Zone 7D.

***Eucalyptus ovata* open-woodland/woodland over heath (Eov/H)**

This mapping unit occurs on two poorly drained sites on Mt Nelson. The substrate is entirely Jurassic dolerite. The understorey and ground layer are comprised of plant species, such as *Leptospermum scoparium* and *Gahnia grandis*, which are able to adapt to periodic waterlogging. This unit described as a sedgey *E. ovata* woodland (Duncan and Brown 1985), which is well-reserved in Tasmania. Over 30% of this unit occurs in HCC reserves, the remainder is managed by the Hydro-Electric Commission (HEC) or private land holders.

***Eucalyptus ovata-E. pulchella* open-woodland/woodland over heath (Eov-Ep/H)**

E. ovata commonly forms an association with *E. pulchella* on Jurassic dolerite, however, Permian mudstone is present on some sites. The understorey is characterised by low shrubs over a ground layer dominated by native grasses and/or sedges. *E. viminalis* is occasionally present as a subdominant. HCC fire records confirm recent burns on the public land, some sites on private land show evidence of recent firing but the dates could

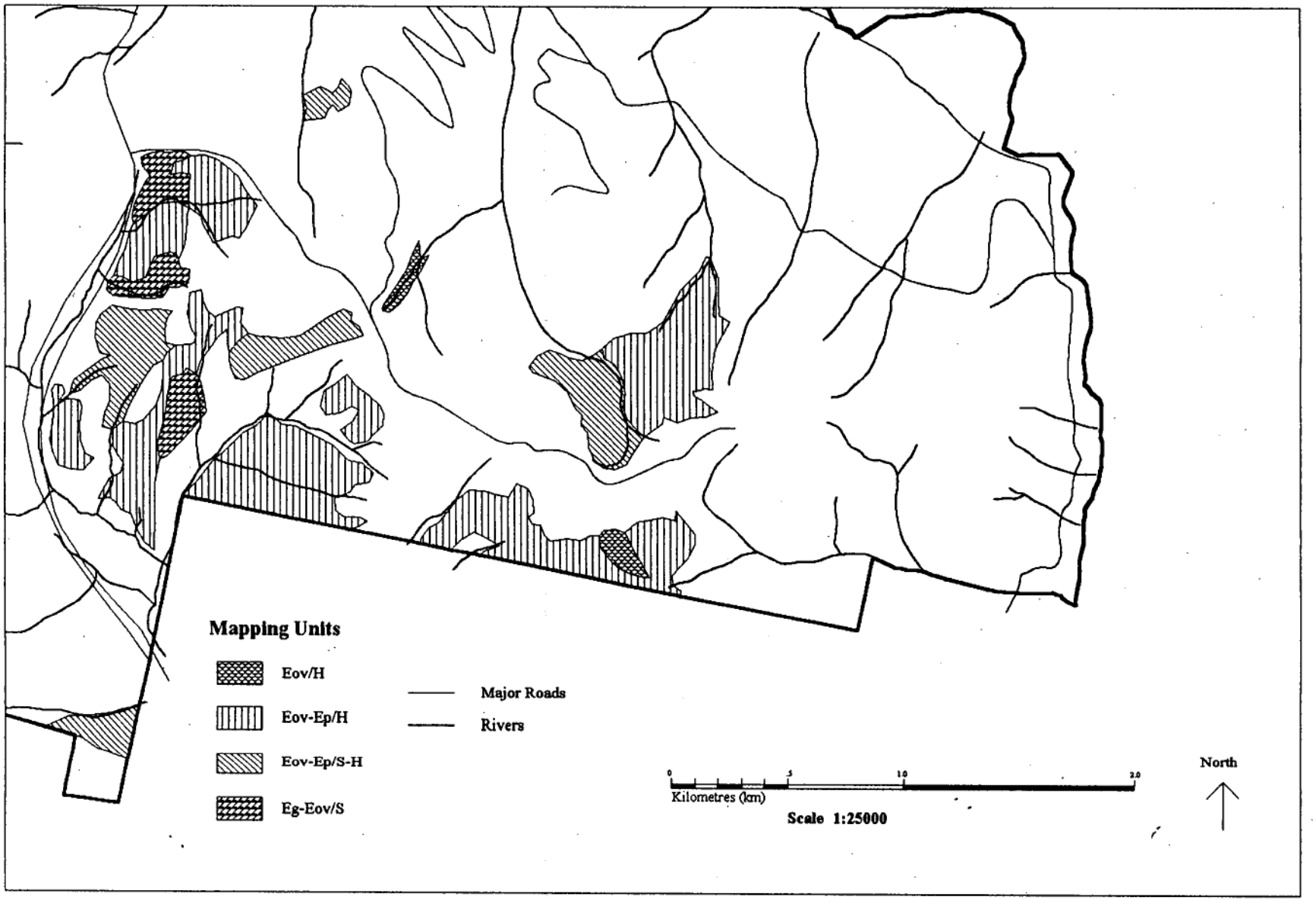
Figure 4.22 Foothill 9 communities (as described in text)

		Eov/H	Eov-Ep/H	Eov-Ep/S-H	Eg-Eov/S
Altitude (m)		200-350	100-350	150-350	200-250
Slope (degrees)		0 to 5	0 to 25	0 to 20	5 to 10
Aspect		NE, SE	various	All	W-SW-S
Total Area (ha)		4.0	103.6	29.8	13.1
Substrate:	Jurassic dolerite (ha)	4.0 (100%)	95.8 (92%)	23.8 (80%)	6.2 (47%)
	Triassic sandstone (ha)				
	Permian mudstone (ha)		7.8 (8%)	6.0 (20%)	6.9 (53%)
Land tenure:	HCC reserve (ha)	1.2 (30%)	6.9 (7%)	3.7 (13%)	1.8 (14%)
	HCC non-reserve (ha)			3.4 (11%)	
	Hydro-Electric Comm. land (ha)	1.6 (40%)	2.0 (2%)		
	Hobart College (ha)		20.2 (19%)	8.9 (30%)	5.8 (44%)
	University Reserve (ha)			1.5 (5%)	
	Private (ha)	1.2 (30%)	74.5 (72%)	12.3 (41%)	5.5 (42%)
Fires*	Wildfires (ha)		19.4 (19%)	7.0 (23%)	2.6 (19%)
	Control burns (ha)	0.8 (20%)		5.4 (18%)	
	Total area burnt (ha)	0.8 (20%)	19.4 (19%)	5.4 (18%)	2.6 (19%)
Community description(s)** and respective Reservation Status ** From Kirkpatrick *et al.* (1988a); Kirkpatrick *et al.* (1988b) or Duncan and Brown (1985)		Sedgy *E. ovata* woodland[1]	Sedgy *E. ovata* woodland[1]/ *E. pulchella - Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb)[1]	*E. pulchella/E. globulus - Acrotriche serrulata* grassy woodland (Epa)[2]/ Sedgy *E. ovata* woodland[1]	*E. globulus - Poa labillardieri - Hypochaeris radicata* wet sclerophyll forest (GLOB 1)[2]/ *E. pulchella/E. globulus - Acrotriche serrulata* grassy woodland (Epa)[2]

* Fires attended by HCC Officers only between 1980/81 and 1992/93 fire seasons

[1] Well-reserved in Tasmania

[2] Poorly-reserved in Tasmania



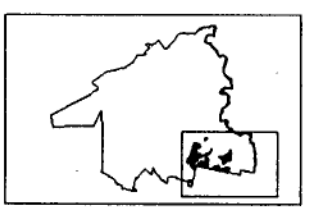


Figure 4.21 Foothills 9 communities

not be confirmed. On moist sites this mapping unit can be described as a sedgey *E. ovata* woodland (Duncan and Brown 1985), which is well-reserved in Tasmania. However, where the drainage is less impeded it is better described as an *E. pulchella-Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb) (Kirkpatrick *et al.* 1988a), which is well-reserved in Tasmania. Most of this unit is found on private land (72%).

***Eucalyptus ovata-E. pulchella* woodland/open-forest over shrubs-heath (Eov-Ep/S-H)**

This mapping unit is characterised by an understorey of both tall and low shrubs and a ground layer dominated by native grasses or sedges. *E. globulus* and *E. viminalis* are frequently present as subdominants. Sites tend to be similar in aspect, altitude and substrate to the previous unit, though the soil is probably better drained. On drier sites where *E. pulchella* dominates, this unit can be described as an *E. pulchella/E. globulus-Acrotriche serrulata* grassy woodland (Epa) (Kirkpatrick *et al.* 1988a), which is poorly-reserved in Tasmania. Where sedges dominate the ground layer this unit is better described as an *E. pulchella* heathy forest (Fensham 1992). This community is probably the result of lack of burning. On the more waterlogged sites where *E. ovata* is more dominant, this unit is better described as a sedgey *E. ovata* woodland (Duncan and Brown 1985), which is well-reserved in Tasmania. Over 40% of this unit is found on private land, the remainder is found on Hobart College and HCC land (both reserve and 'non-reserve')

***Eucalyptus globulus- E. ovata* woodland/open-forest over shrubs-heath (Eg-Eov/S)**

E. ovata codominates with *E. globulus* on moist, sheltered slopes. The understorey is composed of shrubs over a ground layer dominated by sedges, with some native grasses present. *E. pulchella* is common as a subdominant on Jurassic dolerite substrates. On the wetter sites this unit is best described as an *E. globulus-Acacia dealbata-A. melanoxylon-Cassinia aculeata* wet sclerophyll forest (GLOB 0101) (Kirkpatrick *et al.* 1988b), which is well-reserved in Tasmania. However, on drier sites it is better described as an *E. pulchella/E. globulus-Acrotriche serrulata* grassy woodland (Epa) (Kirkpatrick *et al.* 1988a), which is poorly-reserved in Tasmania. Over 40% of this unit is found on private land. The remainder is found either on Hobart College land or HCC reserves.

Chapter 5 Fire description and management

5.1 Alpine communities

Alpine vegetation as described in Section 4.1 includes both true alpine vegetation and the treeless vegetation which displays alpine characteristics. Figure 4.1 shows the location of these communities in Hobart.

Alpine plants typically have slow growth rates and generally do not recover quickly after fires. Some species such as conifers may take thousands of years to recover (Kirkpatrick and Dickinson 1984), while others by contrast, such as *Helichrysum ledifolium,* do require occasional burning for long-term abundance (Kirkpatrick 1986b).

Most of the alpine communities on Mt. Wellington were burnt in 1967, however, some areas such as the mapping unit DA(ub) escaped. This unit and other units found on the summit in the vicinity of the telecommunication towers were burnt in a small fire in 1962. Prior to the 1967 fire, Mt. Wellington was severely burnt in 1898 and 1914 (Ratkowsky and Ratkowsky 1976). This sequence of burning has probably lead to the elimination of conifers and the promotion of more fire resilient species such as *Helichrysum ledifolium.* This species dominates the mapping unit DA, Mt. Wellington being its stronghold in Tasmania (Kirkpatrick 1986b).

In order to preserve alpine communities, fire should be completely excluded (Balmer 1991). Management of these areas should include fire suppression and prevention policies to ensure that wildfires or escaped fuel reduction burns in adjacent areas do not touch this vegetation.

5.2 Rainforests

Cool temperate rainforests, such as those occurring in Tasmania, are defined as forest communities dominated by *Nothofagus, Atherosperma, Eucryphia, Athrotaxis, Lagarostrobos, Phyllocladus* and *Diselma* species (Jarman and Brown 1983). Accordingly only two small areas in Hobart, both on Mt. Wellington can be defined as rainforest (see Figure 4.10 - mapping unit RF). These rainforests are dominated by only two rainforest species -*Atherosperma moschatum* and *Nothofagus cunninghamii* .

Rainforest species, like alpine species do not regenerate readily after burning and even the most fire resistant species will be eliminated after repeated fires. The most sensitive species are the native pines and the deciduous beech *(N. gunnii).* By contrast, species such as *A. moschatum* and *N. cunninghamii* which have regular seed crops and good seed

dispersal mechanisms may readily regenerate from surviving seeds or by producing suckers after burning (Jarman *et al.* 1984; Cullen 1991). Rainforest species contain some physical attributes which protect them from fire. For example, *A. moschatum* leaves have a high ash content, a fire-resistant cuticle and non-flammable oils. Most species can withstand the initial heat and scorching from fire due to their relatively high moisture content. However, once a critical threshold of moisture is lost this vegetation burns rapidly (Dickinson and Kirkpatrick 1985).

Jackson (1968) suggests that in the absence of fires a eucalypt dominated wet sclerophyll forest will by succession become a mixed forest. If fires are absent for at least 350 years, the eucalypt species will die out resulting in a pure rainforest. To preserve the rainforest remnants it is important to implement management guidelines which ensure the exclusion of fires. This should include strict guidelines to contain control burns in areas adjacent to rainforests and to prevent encroachment of fire promoting species which may be promoted in adjacent areas (Cullen 1991).

5.3 Wet gully communities

These communities generally occur in slightly drier gullies than rainforests. However, like rainforests, the absence of fire has caused the eucalypts to be displaced by tall shrubs/trees which are able to regenerate without large scale disturbances such as fire. These communities described as containing 'dry rainforest trees' by Kirkpatrick (1989b) are comprised of species such as *Olearia argophylla, Pomaderris apetala, Bedfordia salicina* and *Beyeria viscosa. Acacia dealbata* is often an emergent and dominates one of these mapping units. These communities are probably the result of a fire almost a century ago (J. Kirkpatrick pers. comm.). The location of these communities in Hobart is shown in Figures 4.10 (mapping units BS, Ad/BS and Ad/BS-S) and 4.11 (mapping unit GS(2)).

Wet gully communities, like rainforests can be destroyed by fire (Cullen 1991). Although the moisture content of these species is generally quite high once their threshold is reached they will burn quickly (Dickinson and Kirkpatrick 1985). The management strategy therefore requires the complete exclusion of fire, including practices which prevent the encroachment of more fire promoting species (Cullen 1991).

5.4 Wet eucalypt forests

For the purposes of this study the term wet eucalypt forest incorporates both mixed forests, as described by Gilbert (1959) and wet sclerophyll forests, as described by Beadle and Costin (1952). These forests are generally located in the gullies and moist slopes of Mt. Wellington and the foothills surrounding urban Hobart where rainfall is typically high and reliable (see Section 2.1.3).

The intensity and frequency of fire determines the structure of wet forests. Less intense (surface) fires produce multi-aged forests as eucalypt seedlings are able to establish in the larger gaps, whereas fires which extend into the crown can potentially kill both the understorey and overstorey species (Wells 1991). Recurrent fires tend to promote the establishment of several age classes of eucalypts, whereas infrequent fires (greater than 100 year interval) result in a single age class of eucalypts (Wells 1991). In general, wet sclerophyll forests are maintained if the fire frequency is between 50 and 150 years. If the frequency is greater (ie. between 100 and 300 years) rainforest species may establish in the understorey and a mixed forest is formed (Jackson 1968).

Eucalypts in wet forests are shade intolerant and to regenerate require a disturbance such as fire to open the forest and allow sufficient light to reach their seeds and seedlings. Eucalypts contain many adaptations or features which appear to promote burning, the majority of viable seed is stored in the canopy and much of it may be released undamaged after the fire (Ashton 1981).

The structure of the understorey of wet eucalypt forests is also affected by fires. Broad-leaved shrubs such as *Pomaderris apetala* are removed if fire recurs in less than 5 to 8 years. Even species with lignotubers, such as *Olearia argophylla* and *Bedfordia salicina*, may eventually be eliminated by repeated surface or crown fires (Ashton 1981). Many plants in wet eucalypt forests do not encourage fires, especially the rainforest and broad-leaved species. Where the frequency of fire is high, fire tolerant species are promoted at the expense of broad and narrow-leaved shrubs not adapted to fire (Duncan 1985). Forests which lack the diversity and density of shrubs, and are often dominated by bracken (*Pteridium esculentum*) or cutting grass (*Gahnia grandis*) (Duncan 1985; Sutton 1985; Fensham 1992). Fire tolerant species are generally more flammable, further encouraging fire and reducing the likelihood of other less tolerant species re-establishing (Wells 1991).

Fires, especially if frequent can promote erosion by removing the ground layer. In areas of high rainfall, especially on steep slopes and/or sedimentary substrates, typical of the wet forests in Hobart, this erosion can be particularly severe (Fensham 1992).

In Hobart, most of the wet eucalypt forests have been burnt in bushfires at least once in the last century with major fires occurring in 1898, 1941 and 1967. Fuel reduction burns are generally limited to below 600 m (Sutton 1985), which excludes most of the lower slopes of Mt. Wellington and the foothill gullies. Wet forests do not benefit from fuel reduction burns because the fuel loads of these forests are known to increase sharply after a fire (Fensham 1992).

In order to conserve the ecological integrity of wet eucalypt forests the period between burning should be at least 80 years (J. Kirkpatrick pers. comm.). Safe, controlled and effective burning is difficult to achieve in wet forests (Sutton 1985, Fensham 1992). In the rare conditions when a forest is dry enough to burn, fires can easily get out of control. Due to this danger, control burning is not a recommended practice for wet forests. Where fuel loads may present a serious risk due to urban proximity alternative methods should be sought. These methods, outlined in Sutton (1985) and Webster (1986), range from better urban planning and public education to house and garden design.

5.5 Dry sclerophyll forests

Dry sclerophyll forests, described by Beadle and Costin (1952) incorporate the eucalypt woodlands and forests generally found on insolent slopes and/or areas which receive less than 1000 mm rainfall per annum. Four types of dry sclerophyll forests occur in Hobart. This section describes three types - shrubby, heathy and sedgy eucalypt forests/woodlands. The remaining type, grassy woodland, is discussed in the next section (Section 5.7).

In dry sclerophyll forests eucalypts are deemed 'fire tolerant' rather than 'fire-promoting' since their adaptations to fire relate to particular fire regimes rather than fire in general (Williams 1991). Specific fire regimes are determined by a combination of factors such as seasonality, intensity and frequency of burning. Fire regimes influence the species composition of the eucalypts and understorey. As with wet eucalypt forests, stands of unevenly aged eucalypts have groups of trees corresponding to the various fire years (Mount 1979).

Increased fire frequency reduces the diversity of xerophytic shrubs in the understorey and promotes more fire tolerant vegetative producers (Duncan 1985). Many shrubby dry forests may be a result of frequent fires occurring in what were originally wet forests. Heathy and sedgy understoreys are more adapted to fires than shrubby understoreys. However, if soil erosion occurs after a fire (particularly on steep slopes and/or sedimentary substrates) it becomes increasingly difficult for any plants to re-establish.

Soil erosion is visible on many mudstone and sandstone soils in Hobart. Exotic plants which are fire tolerant often invade these forests (Sutton 1985). For example, the germination of gorse (*Ulex europaeus*) is promoted by fire (Lee *et al.* 1986).

In general, shrubby dry sclerophyll forests should be burnt at intervals of greater than 20 or even 25 years, sedgy and heathy dry sclerophyll forest require a shorter time interval, Williams (1991) suggests less than 10 years. In his report to the HCC, Fensham (1992) recommended than fuel reduction burns should be at intervals of 8 to 10 years for *Eucalyptus pulchella* and *E. tenuiramis* heathy forests and 10 years for *E. amygdalina* heathy forests. In order to reduce ecological damage, he also recommended that this burning should be in a mosaic fashion, preferably occurring in late spring and summer (the driest months). This will allow the soil to consolidate and some ground cover to re-establish prior to being exposed to heavy rain.

Many of the shrubby dry sclerophyll forests, especially the *E. obliqua* forests have been burnt in the last 13 years. It is recommended that no dry forest be burnt and that the management of many of these forests, especially the subalpine shrubby forests, include measures to avoid fires. For the shrubby forests which surround residential housing, other methods should be used to reduce the fuel load.

In contrast, it is recommended that many of the heathy/sedgy forests be burnt. Fire records indicate that the heathy *E. tenuiramis* and some areas of heathy *E. amygdalina* and sedgy *E. ovata* forests/woodlands require burning (Table 5.1). However, since many of these communities are found on private land with an unknown fire history, these sites would require further assessment prior to recommending a fire regime. The undescribed heathy community requires a floristic survey before any fire plan can be drawn up.

Table 5.1: **Fires in heathy and sedgy dry sclerophyll forests recorded by HCC Officers in the last 10 years (1983/4 to 1992/3).**

		Total Area in Hobart (ha)	Wildfire in the last 10 years* (ha)	Control burns in the last 10 years* (ha)	Total Area of vegetation burnt in last 10 years* (ha)
Upper Slopes 2:	**H*/SD**	2.5	2.5 (100%)		2.5 (100%)
Foothills 3:	**Ea/S-H(s)**	5.3		2.8 (52%)	2.8 (52%)
Foothills 4:	**Ea-Et/S-H**	9.7			0.0 (0%)
	Et-Ev/S	5.3		0.8 (15%)	0.8 (15%)
Foothills 9:	**Eov/H**	4.0			0.0 (0%)
	Eov-Ep/H	103.6	15.7 (15%)		15.7 (15%)

* Only HCC records were used to calculate these areas
NB. Blank areas represent < 2% burnt

5.6 Grassy woodlands

Grassy vegetation in Tasmania incorporates grasslands, grassy sedgelands, grassy shrublands and grassy woodlands/forests. All these communities are characterised by the dominance of native grasses (Poaceae family) in at least one layer (Kirkpatrick 1991a). In Hobart, this vegetation is restricted to grassy woodland/forests.

Grassy woodlands/forests tend not to occur on nutrient poor soils in Tasmania (Kirkpatrick 1991a). In Hobart the substrate is commonly Jurassic dolerite. *Eucalyptus pulchella* and *E. viminalis* typically dominate these woodlands, however, *E. globulus* and *E. ovata* are often present and may dominate some communities. *E. amygdalina* dominates grassy woodlands which occur on Triassic sandstone and co-dominates with *E. viminalis* on Permian mudstone.

Shrub cover in grassy woodland is typically less than 20%, and between 20 and 50% for grassy forests (Fensham 1992). However, areas which have not been burnt since 1967 are often dominated by *Allocasuarina verticillata* (Kirkpatrick 1991a). Grass cover has been reduced on these sites, probably due to the increased shade preventing the development of grass seedlings (Sutton 1985, Fensham 1992).

Fire and/or grazing are necessary for the long term survival of grassy vegetation (see Kirkpatrick 1991a). In many areas of Hobart, grazing is limited or non-existent, especially grasslands on the urban fringe. These areas can only rely on regular burning. The intensity and seasonality of fire is not only important for grass species but also for the native herbs and woody species. On the Queens Domain, Kirkpatrick (1986a) found that frequent fires favour native herbs, including a number of rare and threatened species, and set back the development of exotic shrubs, such as boneseed (*Chrysanthemoides monilifera)* and gorse (*Ulex europaeus).* Woody species require longer intervals between fires (Fensham 1992). In order to maintain the diversity of plants, it is recommended by Fensham (1992) and Kirkpatrick (1991a) that grassy woodlands be burnt at regular intervals. On average, a 5 year interval is recommended, however, this time interval may vary from site to site depending on the vegetation and various environmental parameters. Further, it is recommended sites be burnt in a mosaic fashion to greatly increase the likelihood of maintaining plant diversity over the long-term.

Fire records indicate that very little of the grassy woodlands have been burnt in the last 5 years (Table 5.2). However, due to most of these woodlands occurring on private land, these sites need to be further analysed to determine an accurate fire history.

Table 5.2: Fires in grassy woodlands recorded by HCC Officers in the last 5 years (1988/89 to 1992/93)

		Total Area in Hobart (ha)	Wildfire in the last 5 years* (ha)	Control burns in the last 5 years* (ha)	Total Area of vegetation burnt in last 5 years* (ha)
Lower Slopes 2:	Et/H	51.2			0.0 (0%)
Foothills 3:	Ea/S-H	4.2			0.0 (0%)
	Ea/H	3.0			0.0 (0%)
	Ea-Ev/H	49.7		13.4 (27%)	13.4 (27%)
Foothills 4:	Ea-Eg/S-H	3.1			0.0 (0%)
Foothills 5:	Ep/S	37.2			0.0 (0%)
	Ep/S-H	46.3	0.5 (1%)		0.5 (1%)
	Ep/H	109.3	4.4 (4%)		4.4 (4%)
	Ep/G	47.1	2.8 (6%)	5.2 (11%)	7.9 (17%)
Foothills 6:	Ep-Ev/S	91.5	5.0 (5%)	6.6 (7%)	8.4 (9%)
	Ep-Ev/S-H	29.7		2.0 (7%)	2.0 (7%)
	Ep-Ev/H	113.2	2.3 (2%)	3.5 (3%)	5.8 (5%)
	Ep-Ev/G	36.1	1.1 (3%)		1.1 (3%)
Foothills 7:	Eg-Ep/S-H	33.1			0.0 (0%)
	Eg-Ep/H	49.4			0.0 (0%)
	Eg-Ep/G	42.5	36.6 (86%)	2.1 (5%)	38.7 (91%)
Foothills 8:	Ev/S	79.4		23.8 (30%)	23.8 (30%)
	Ev/G	25.1		2.0 (8%)	2.0 (8%)
	Eg-Ev/G	10.7			0.0 (0%)
	Eg-Ev/H	11.0			0.0 (0%)
Foothills 9:	Eov-Ep/S-H	29.8	1.8 (6%)		1.8 (6%)

* Only HCC records were used to calculate these areas
NB. Blank areas represent < 2% burnt

Chapter 6 Communities of high conservation value

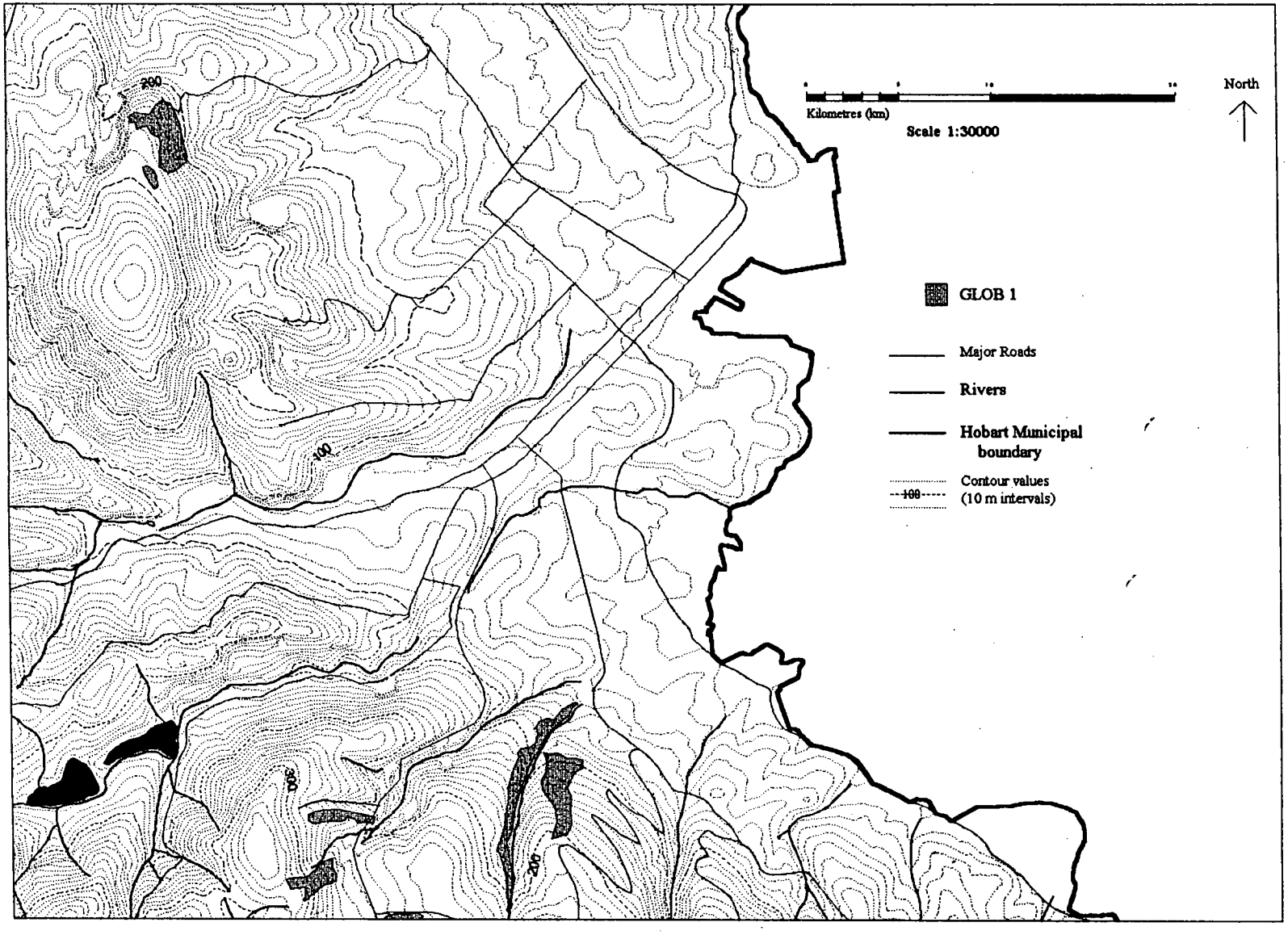
6.1 *Eucalyptus globulus - Poa labillardieri - Hypochoeris radicata* wet sclerophyll forests (GLOB 1)

This community is common on the moister aspects of the hills surrounding urban Hobart (Figures 6.1a and b). *E. pulchella* and *E. ovata* often co-dominant, however, they are more abundant uphill away from creeks. Although this community occupies 135 ha of land in Hobart, 63% of this occurs on private land and much of the remainder is surrounded by residential properties (Table 6.1). This community is very susceptible to weed invasion, usually by the dumping of garden refuse or seeds being dispersed from neighbouring gardens. Broom, gorse (*Ulex europaeus*) and herbs, such as *Hypochoeris radicata* are common exotic weeds.

As mentioned in Section 5.4, wet eucalypt forests should only be burnt every 50 to 150 years. Aerial photographs indicate that most of this community was burnt in the 1967 bushfires. It is therefore important that these sites be protected, especially as some sites have been burnt again in the last in the last 13 years. Further fires could modify this community by exposing the soil to erosion and/or promoting more fire resistant species (often exotics) to establish and/or dominate. It is also important to retain dead trees as they are important habitats for wildlife, including the swift parrot (*Lathamus discolor*). This vulnerable bird feeds on *E. globulus* nectar and nests in the hollows of trees above their feeding areas (Brown 1989).

6.2 *Eucalyptus globulus - Bedfordia salicina - Beyeria viscosa* wet sclerophyll forests (GLOB 0100)

This community occurs on Mt Nelson in some of the gullies which escaped the 1967 bushfires (Figure 6.2). Nearly 70% occurs in reserves either managed by the Hobart City Council (HCC), the State Government or the University of Tasmania (Table 6.1). However, much of this land, such as Lambert Gully, is adjacent to residential housing. This community is very susceptible to weed infestation from the adjacent properties or from garden refuse dumping. Exotic species include *Cotoneaster* spp., blackberry (*Rubus fruticosus* sp agg.) and hawthorn (*Crataegus monogyna*). *Cotoneaster* spp. are present on all sites preferring fertile dolerite/mudstone substrates and low altitudes gullies such as those occupied by this community (Zacharek 1990). Streams in the gullies tend to have a high nutrient loading due to runoff from residential properties. The presence of excess nutrients down stream often promotes exotic species to the detriment of many native species.



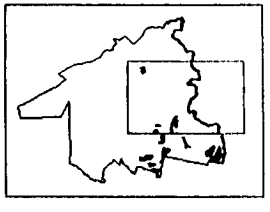


Figure 6.1a: Eucalyptus globulus-Poa labillardieri-Hypochoeris radicata wet sclerophyll forests (GLOB 1) in Hobart (Part 1 of 2)

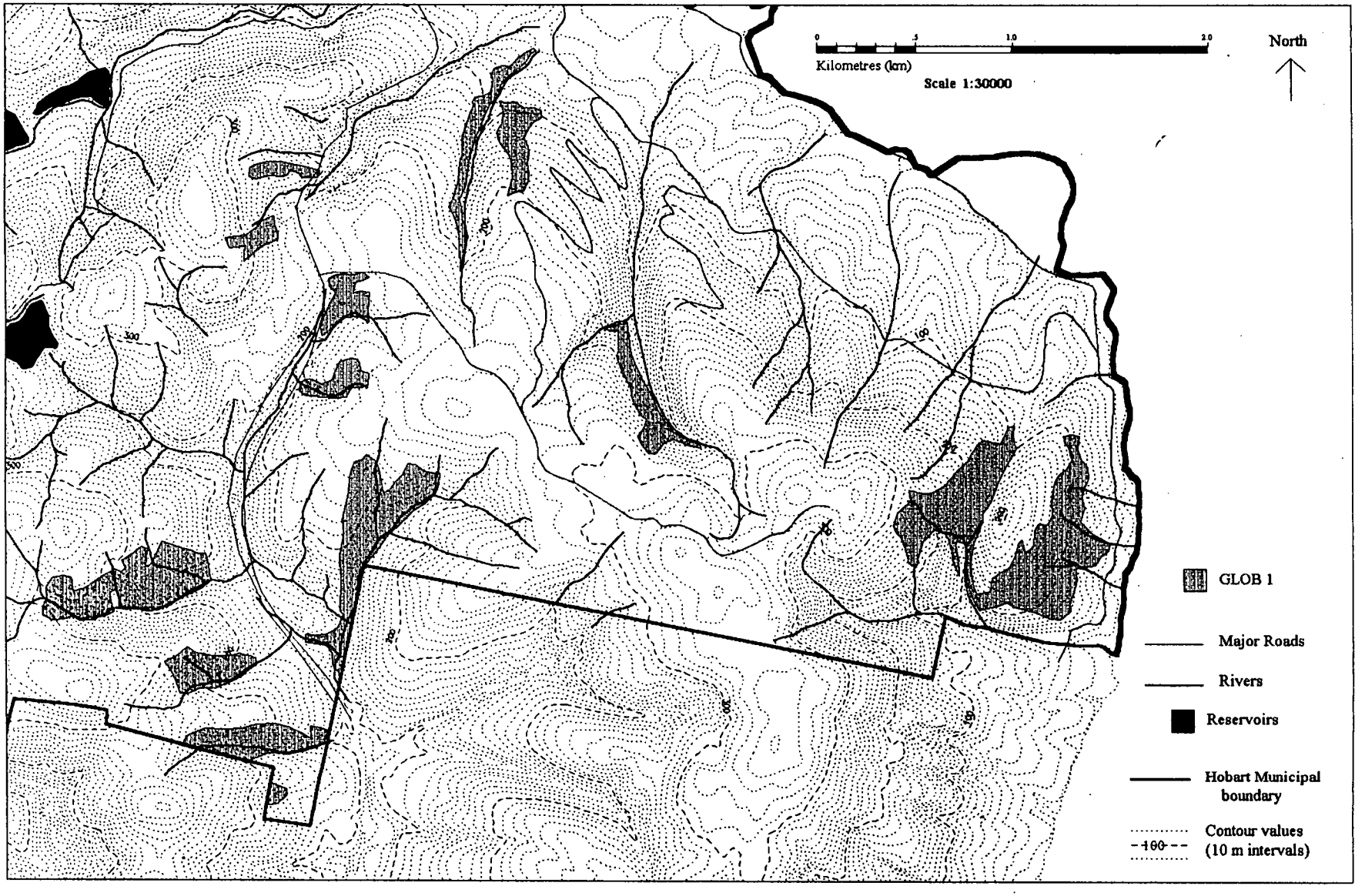


Figure 6.1b: Eucalyptus globulus-Poa labillardieri-Hypochoeris radicata wet sclerophyll forests (GLOB 1) in Hobart (Part 2 of 2)

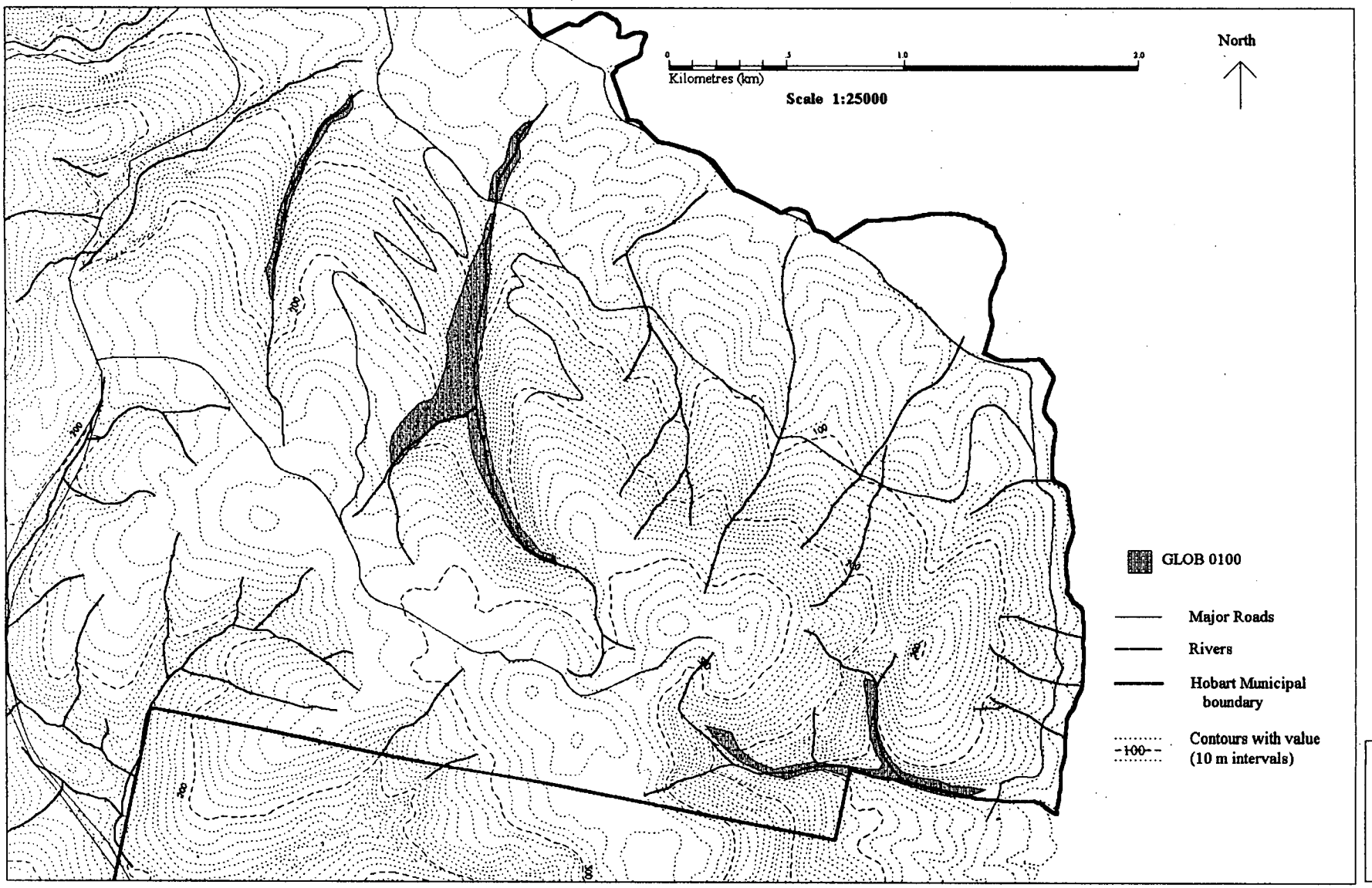


Figure 6.2: Eucalyptus globulus-Bedfordia salicina-Beyeria viscosa wet sclerophyll forests (GLOB 0100) in Hobart

Though not burnt in 1967, the edges of some of the sites have been recently burnt by fires which have probably originated in adjacent communities or residential properties. Although fire is important for the long-term survival of this community, it is necessary that the burning of this community be controlled and only occur at 50 to 150 year intervals (see Section 5.4). It is therefore necessary to ascertain when this community was last burnt prior to implementing any management plan for these forests.

Table 6.1: Land tenure of communities if high conservation in Hobart.

	Total Area (ha)	HCC reserve (ha)	Wellington Park (ha)	HCC non-reserve (ha)	Crown Reserves (ha)	Hobart College (ha)	University Reserve (ha)	Private (ha)
E. globulus-Poa labillardieri-Hypochoeris radicata wet sclerophyll forest	134.9	21.8 (16%)		2.3 (2%)	7.4 (5%)	7.3 (5%)	11.5 (9%)	84.5 (63%)
E. globulus-Bedfordia salicina-Beyeria viscosa wet sclerophyll forest	28.0	12.0 (43%)			4.5 (16%)		2.9 (10%)	8.6 (31%)
Pomaderris apetala-Beyeria viscosa-Asterotrichion discolour closed forest scrub	2.4				0.9 (37%)			1.5 (63%)
Inland *E. tenuiramis* forest dry sclerophyll forest	56.5	20.1 (36%)	10.8 (19%)	15.2 (27%)				21.2 (38%)
E. pulchella/E. globulus-Acrotriche serrulata grassy woodland	154.8	59.3 (38%)		3.4 (2%)	7.3 (5%)	12.0 (8%)	1.5 (1%)	71.4 (46%)
E. pulchella-Bossiaea prostrata/Gonocarpus tetragynus grassy woodland	510.3	217.4 (43%)		17.3 (3%)	25.3 (5%)	7.3 (1%)	29.1 (6%)	214.0 (42%)
Grassy *E. viminalis* woodland	104.5	89.3 (85%)						15.2 (15%)
Grassy *E. amygdalina/E. viminalis* woodland	60.1	7.4 (12%)		10.4 (17%)				42.4 (70%)
Undescribed	2.5	2.5 (100%)	2.5 (100%)					

As with the previous community (Section 6.1) this community is an important wildlife habitat, including the feeding ground for the swift parrot during its breeding season. To preserve the ecological integrity of this community, both dead and live trees should be preserved.

6.3 *Pomaderris apetala - Beyeria viscosa - Asterotrichion discolour* closed forest scrub (PABR)

This community occurs in one gully on the south-eastern side of Mt Nelson (Figure 6.3). Although 37% is found in the Truganini Reserve, the remainder occurs on private land higher up the gully (Table 6.1). As urban development surrounds the head of this gully and the ridgetop, this community is very susceptible to invasion by exotic plants. Runoff from these properties, in particular garden fertilisers, will likely increase the nutrient loading of the creek which in turn will favour the establishment of weeds within the reserve. Currently this gully appears free from the common invaders such as *Cotoneaster*

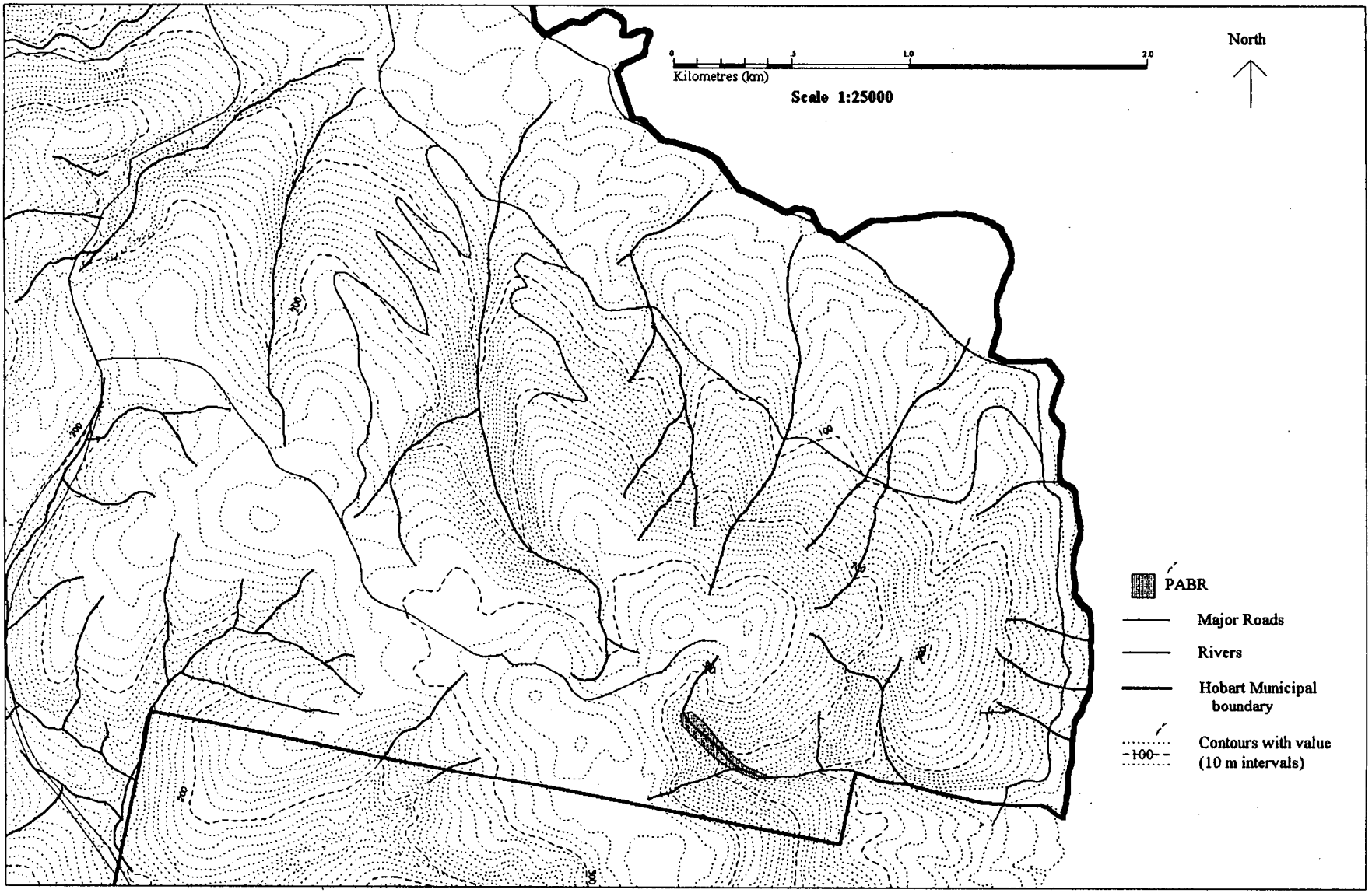


Figure 6.3: Pomaderris apetala-Beyeria viscosa-Asterotrichion discolor closed forest scrub in Hobart

spp.. This may be due to the denseness of the vegetation as *Cotoneaster* spp.can not bear fruit in shaded environments, and also the distance from the nearest seed source (Zacharek 1990).

The western edge of this community is bordered by an unmaintained track. This track is heavily eroded and needs to be either appropriately revegetated as it is a potential source for the introduction of weeds.

The management of this community should include the complete elimination of fire (see Section 5.3). Fuel reduction burns on neighbouring land should be regulated so that their is little chance that these fires might escape into this community.

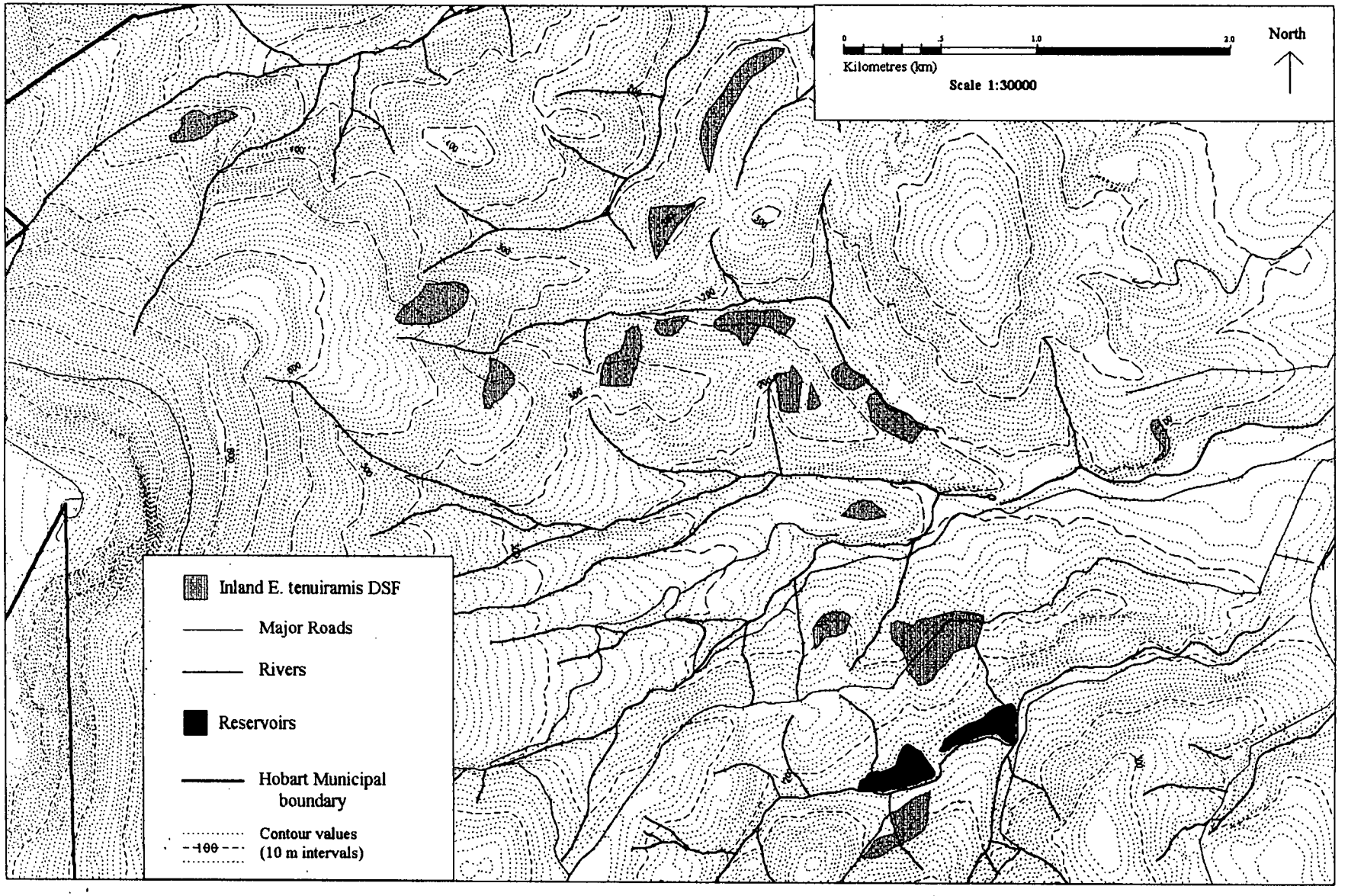
6.4 Inland *Eucalyptus tenuiramis* dry sclerophyll forest

Generally this community occurs on the drier north-facing slopes on mudstone and sandstone. Occupying over 50 ha in Hobart (Figure 6.4), the majority of sites are found on HCC land (both reserve and non-reserve land) including 11 ha in Wellington Park (Table 6.1). This community urgently requires further secure reservation (Kirkpatrick *et al.* 1994).

Management of this community will depend greatly on the composition of the understorey. Fire management guidelines call for heathy *E. tenuiramis* forests to be burnt on average every 8 to 10 years (see Section 5.5) and grassy forests to burn on average every 5 years (see Section 5.4). HCC fire records indicate that very little of the heathy forest has been burnt in the last 13 years (see Table 4.17 - mapping unit Et-Ev/S-H) and no sites have been burnt in the last 13 years (see Tables 5.1). This lack of burning has probably led to the development of the shrub layer. At least 75% of grassy *E. tenuiramis* forests have burnt in the last 13 years (Table 4.9 - mapping unit Et/H), however, no fires have been recorded in the last 5 years (Table 5.2).

For the long-term survival of this community, it is important that some sites be burnt in the near future. However, prior to burning, each site should be first assessed to determine an appropriate fire regimes.

Generally, this community is not adjacent to residential areas, and therefore is not greatly infested by exotic species. Gorse (*Ulex europaeus*), however, is present on some sites including those managed by the HCC.



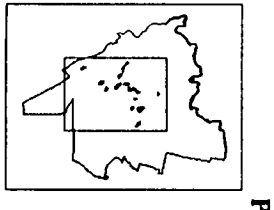


Figure 6.4: Inland Eucalyptus tenuiramis dry sclerophyll forests in Hobart

6.5 *Eucalyptus pulchella/E. globulus - Acrotriche serrulata* grassy woodland (Epa)

This *E. pulchella/E. globulus-Acrotriche serrulata* grassy woodland is found on the slightly moist dolerite slopes on Knocklofty, Mt. Nelson and Ridgeway (Figure 6.5a and b). The total area is 155 ha of which over 46% occurs on private land. The remaining sites are generally found on government and quasi-government reserves (Table 6.1).

In Hobart, this community can be split into two groups according to the ground layer - grassy and sedgy forests. Grassy forests occupy 77% and sedgy forests, which are associated with a heathy understorey, occupy 23% of the area (Table 6.2). The ground layer appears to be a direct result of the fire regime, grassy forests have been burnt regularly, whereas heathy/sedgy forests have either not been burnt, or at the least not severely burnt in recent years. Since most sites occur on private land the fire history of these sites is incomplete. However, records do indicate that 36% of grassy forests have been burnt in the last 5 years compared to 3% of heathy/sedgy forests. Most of the burnt areas are a result of wildfires rather than planning.

Table 6.2: Fire recorded in Epa communities by HCC Officers

	Total Area in Hobart (ha)	Percentage of Epa community (%)	Area burnt in last 5 years* (ha)	Area burnt in last 10 years* (ha)
Grassy *E. pulchella* forests	119.5	77%	35.5 (30%)	49.2 (41%)
Heathy/sedgy *E. pulchella* forests	35.3	23%	1.0 (3%)	7.9 (22%)
Total	154.8	-	36.5 (24%)	57.1 (37%)

* Only HCC records were used to calculate these areas

Most of this community is surrounded by some urban development. Exotic weeds, including gorse and *Erica* spp., are present on some sites. Measures need to be implemented to control the spread of these species. The proximity of these sites to residential areas has also made it susceptible to fire wood collection and rubbish dumping.

The future management of this community must take into account two fire regimes. Grassy forests should be burnt on average every 5 years, whereas the heathy/sedgy forest should be burnt every 8 to 10 years (see Sections 5.6 and 5.5). HCC fire records indicate that only the Knocklofty grassy communities have been burnt in the last 5 years. It is recommended that all sites be assessed to determine when they were last burnt and to use this information as a database for future fire management. Burning should closely follow the recommended frequencies, however, some variation are needed such as varying the intensity of the fire the season in which the burn takes place, and the period between fires. The resulting patterns should promote species diversity within these woodlands.

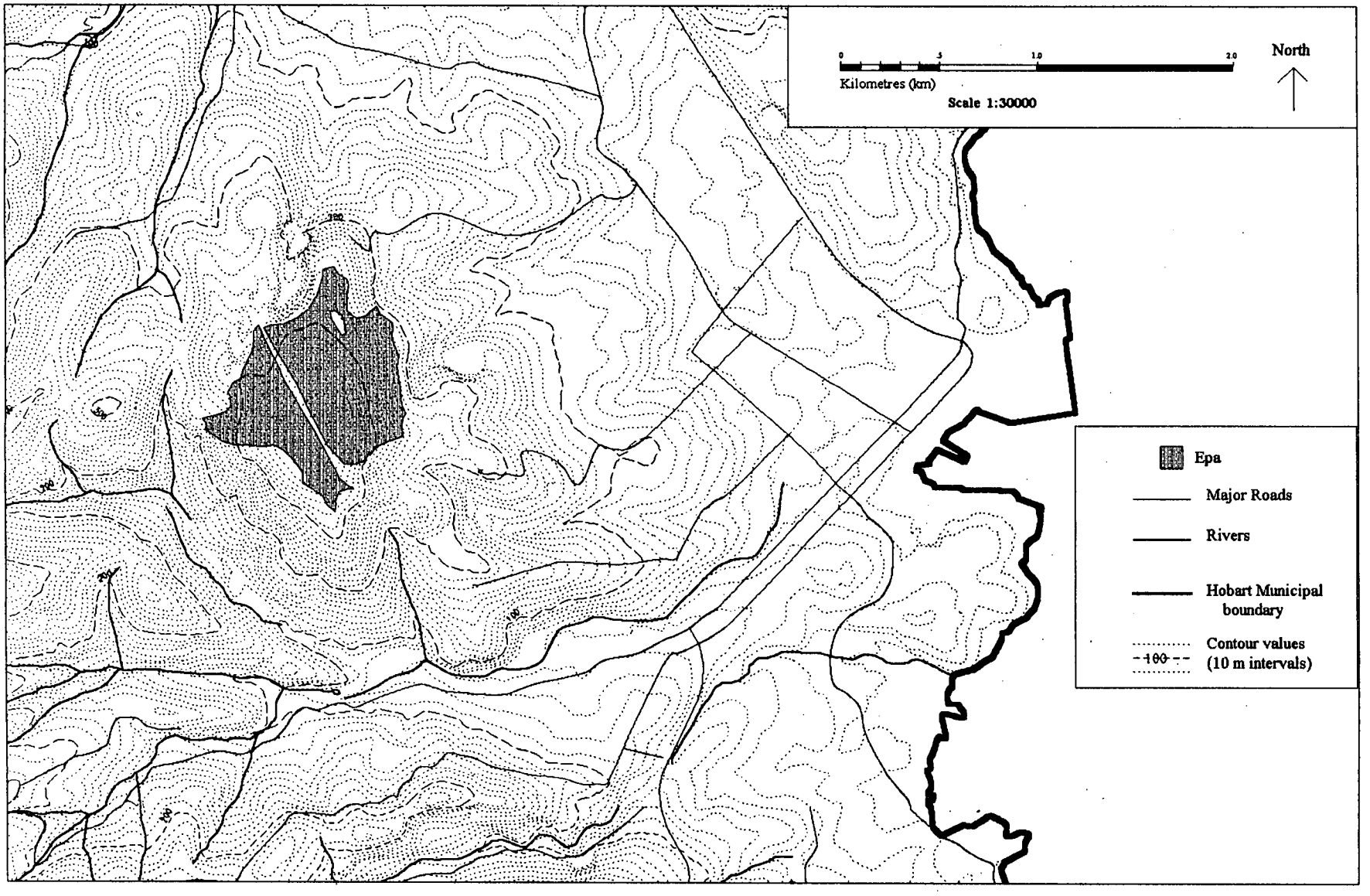


Figure 6.5a: Eucalyptus pulchella/E. globulus-Acrotriche serrulata grassy woodlands (Epa) in Hobart (Part 1 of 2)

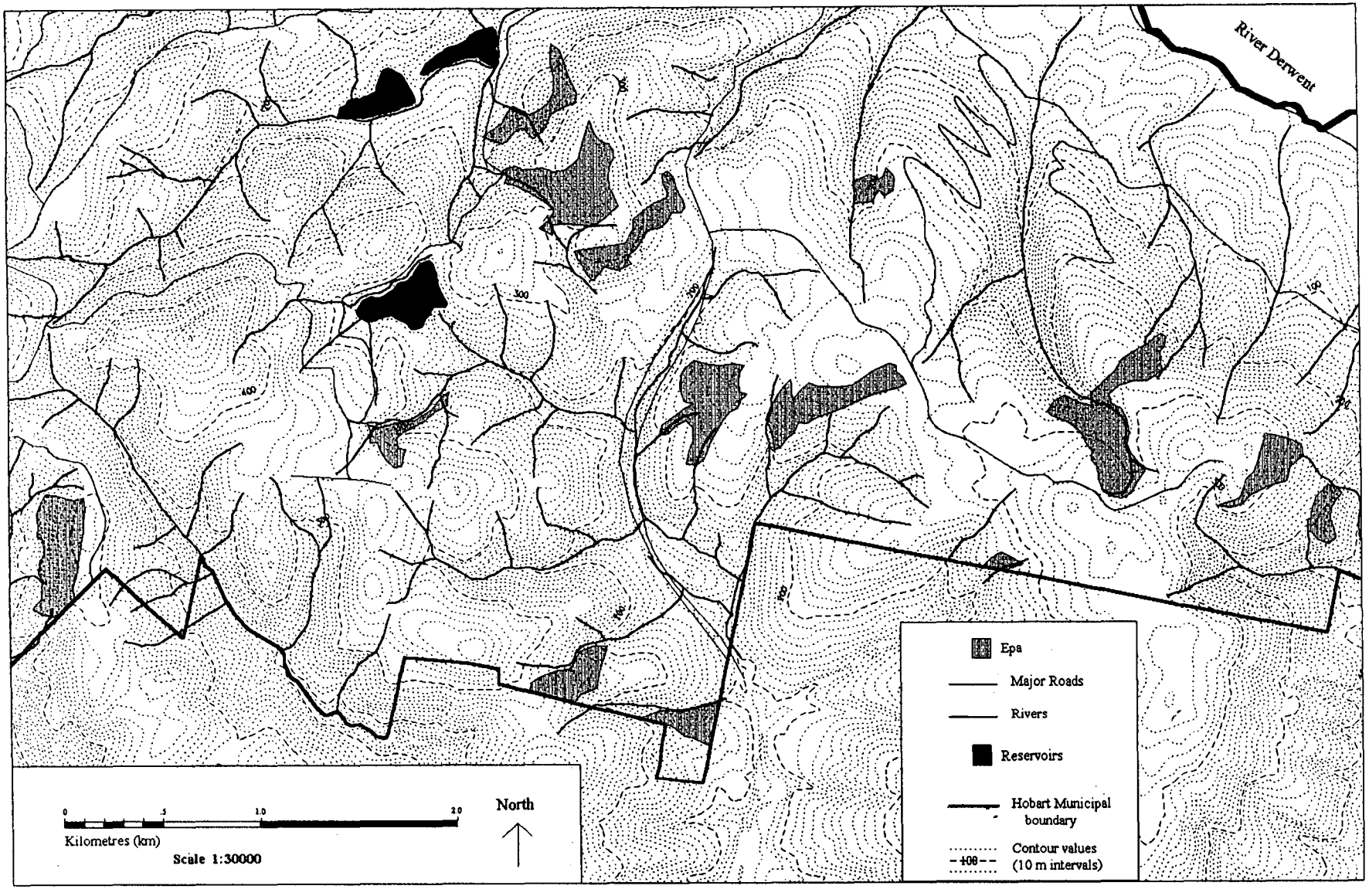


Figure 6.5b: Eucalyptus pulchella/E. globulus-Acrotriche serrulata grassy woodlands (Epa) in Hobart (Part 2 of 2)

The grassy *E. pulchella* (and grassy *E. globulus/E. viminalis*) forests found in the Truganini Reserve have been recommended as an areas for protection (RAP) by a report to the Forestry Commission's Working Group for Forest Conservation. This area is cited as an important remnant bushland in the urban area (Williams 1989).

6.6 *Eucalyptus pulchella - Bossiaea prostrata/Gonocarpus tetragynus* grassy woodland (Epb)

This community generally occurs on slightly drier sites than the above and dominates many of the north-facing dolerite slopes in Hobart, including the residential areas of Mt. Nelson (Figure 6.6a and b). This community occupies over 500 ha, 43% of these sites are on private land with a further 43% occurring in HCC reserves (Table 6.1).

As with the previous *E. pulchella* community, sites near residential areas are commonly invaded by exotic weeds such as gorse and are used to supplement household firewood supplies or discard unwanted items.

The ground layer of this community is predominantly native grasses, however, sedges and sag (*Lomandra longifolia*) are also common. This community should be managed in a manner which will ensure a high species diversity. Frequent burning is prescribed for all areas. On average every 5 years for grassy forests and slightly greater if a heathy/sedgy understorey is to be maintained. HCC records indicate that very little of this community has been burnt in the last 5 years and 41% in the last 13 years (Table 6.3). As with the previous community any future burning should be carried out in a mosaic fashion with will include a variable, but frequent fire regime (see previous section).

Table 6.3: Fire recorded in Epb communities by HCC Officers

	Total Area in Hobart (ha)	Area burnt in last 5 years* (ha)	Area burnt in last 13 years* (ha)
Total Area	510.3	30.1 (6%)	209.4 (41%)

* Only HCC records were used to calculate these areas

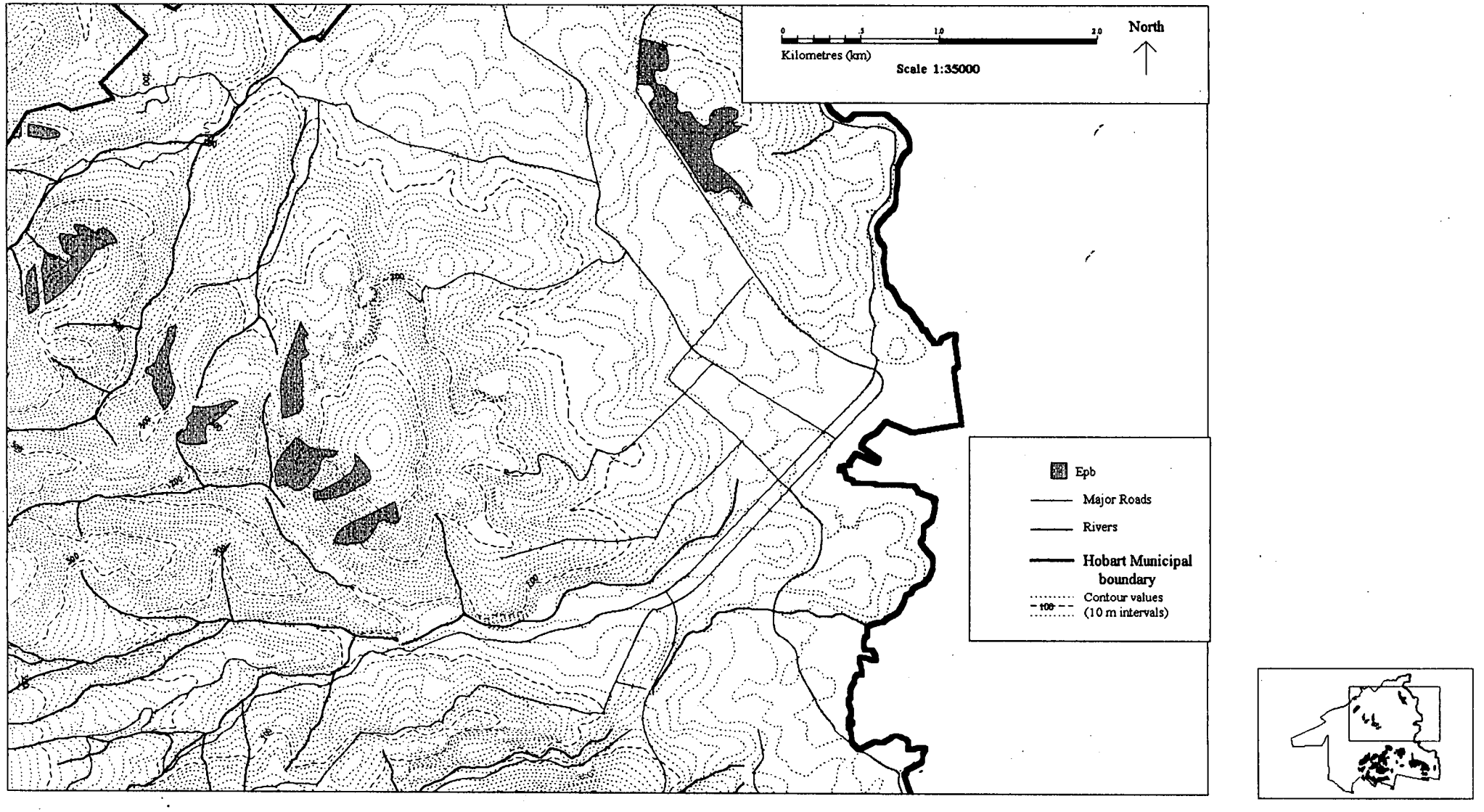


Figure 6.6a: Eucalyptus pulchella-Bossiaea prostrata/Gonocarpus tetragynus grassy woodlands (Epb) in Hobart (Part 1 of 2)

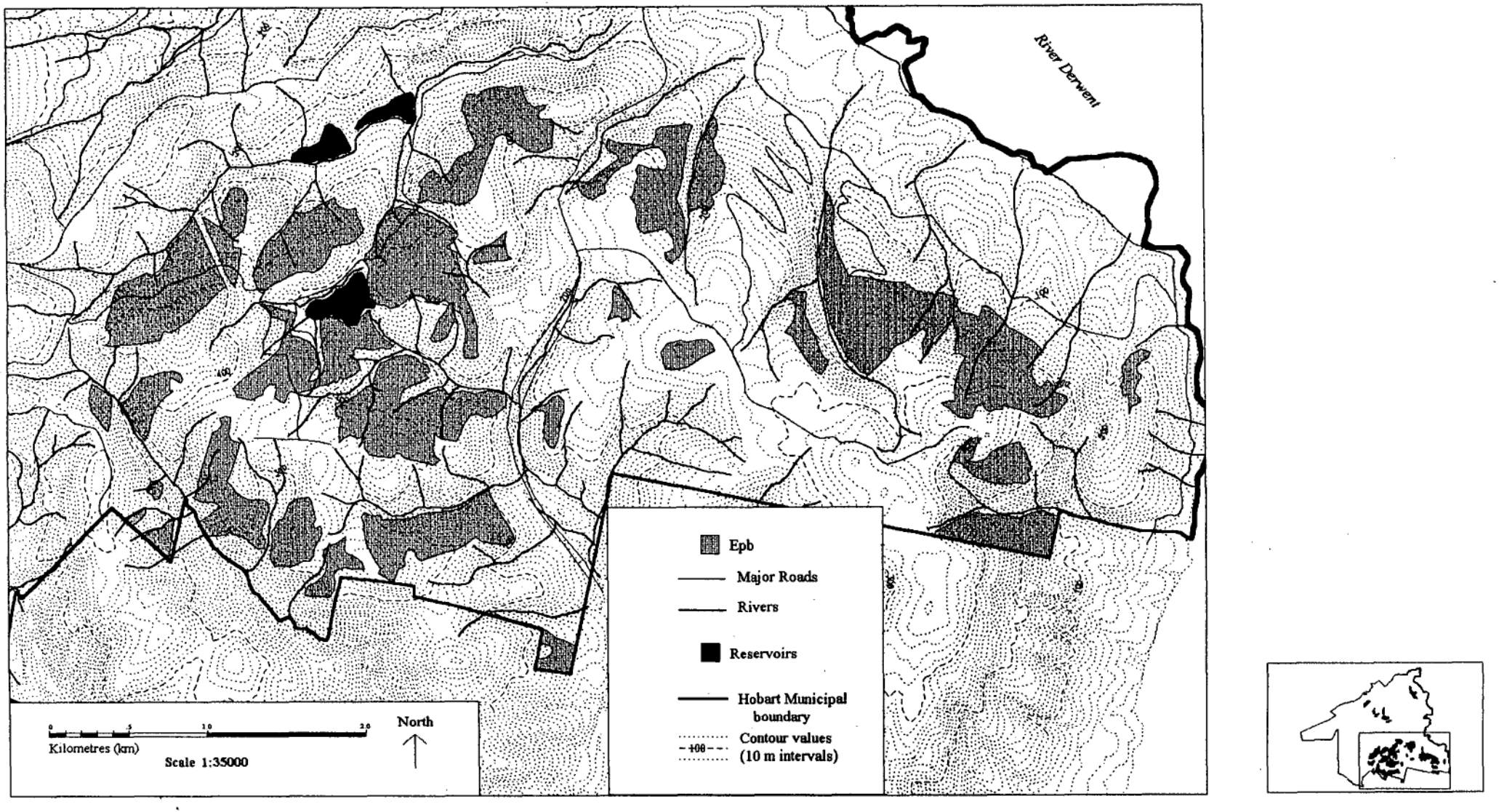


Figure 6.6b: Eucalyptus pulchella-Bossiaea prostrata/Gonocarpus tetragynus grassy woodlands (Epb) in Hobart (Part 2 of 2)

6.7 Grassy *Eucalyptus viminalis* woodland

This community occurs on the dry more exposed dolerite slopes on the Queens Domain, Tolmans Hill, Porters Hill (to the east of Mt. Nelson) and south of Lenah Valley Road, Lenah Valley (Figures 6.7a and b). The total is 105 ha of which 85% is found in the HCC reserve on the Queens Domain (Table 6.1). This community is very susceptible to invasion by exotic species such as gorse and boneseed. Some invaders have originated from the Royal Tasmanian Botanical Gardens on the south-eastern side of the Queens Domain (J. Hickie pers. comm.).

Fire is necessary for the long-term survival of this community. However, only the grassy *E. viminalis* sites on the Queens Domain have been burnt in the last 5 years (all fuel reduction burns and only 46% of all sites in the last 13 years.(Table 6.4) Other grassy *E. viminalis* woodlands in Hobart need to be managed in a similar fashion.

Table 6.4: Fire recorded in grassy *Eucalyptus viminalis* woodland communities by HCC Officers

	Total Area in Hobart (ha)	Area burnt in last 5 years* (ha)	Area burnt in last 13 years* (ha)
Grassy *E. viminalis* woodland	104.5	25.8 (25%)	46.0 (44%)

* Only HCC records were used to calculate these areas

This community is highlighted by Kirkpatrick *et al.* (1994) as one of three critically in need of reservation as it is presently unreserved in Tasmania. Fire management should follow similar guidelines as outlined in Section 6.5.

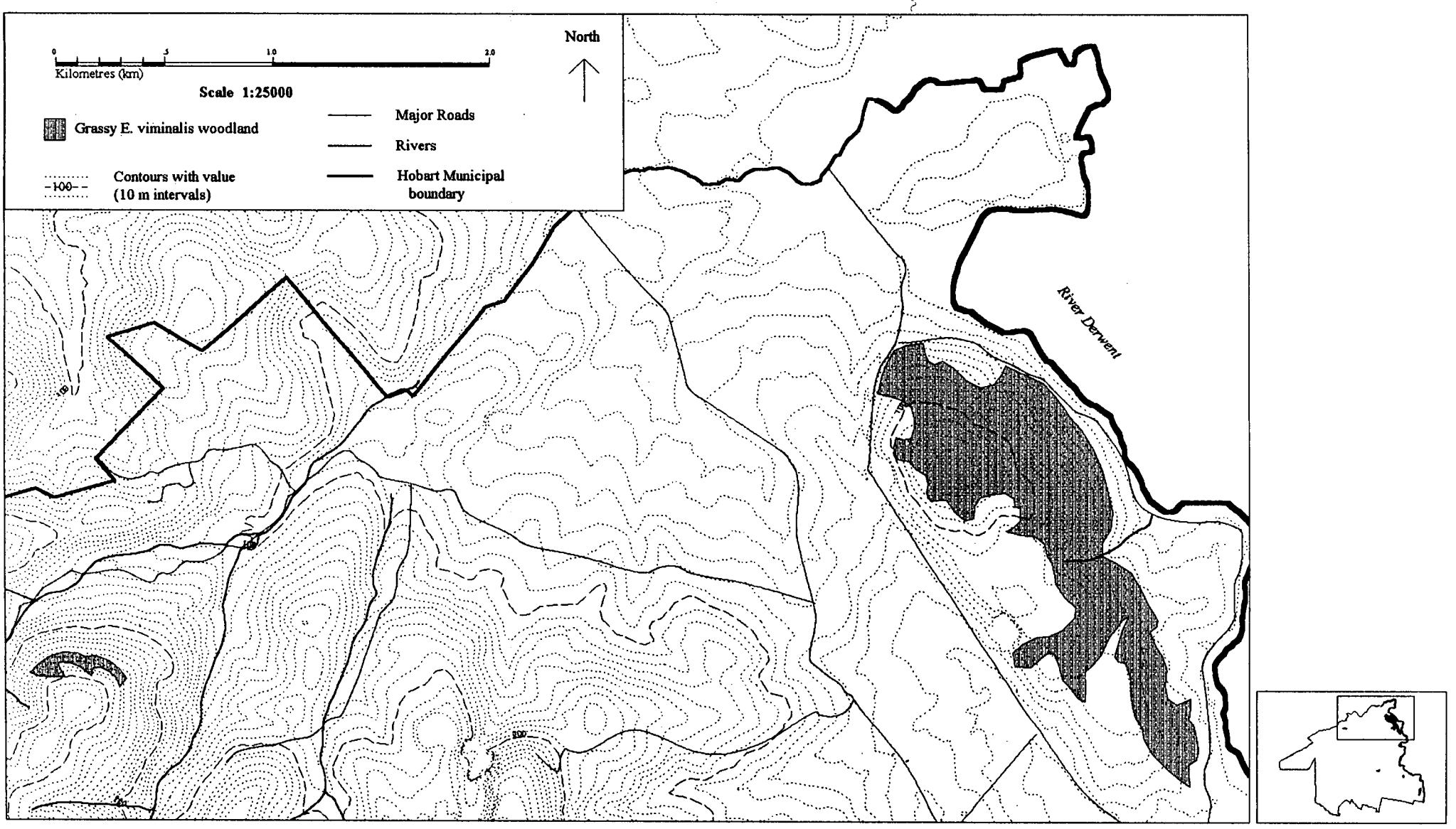


Figure 6.7a: Grassy Eucalyptus viminalis woodlands in Hobart (Part 1 of 2)

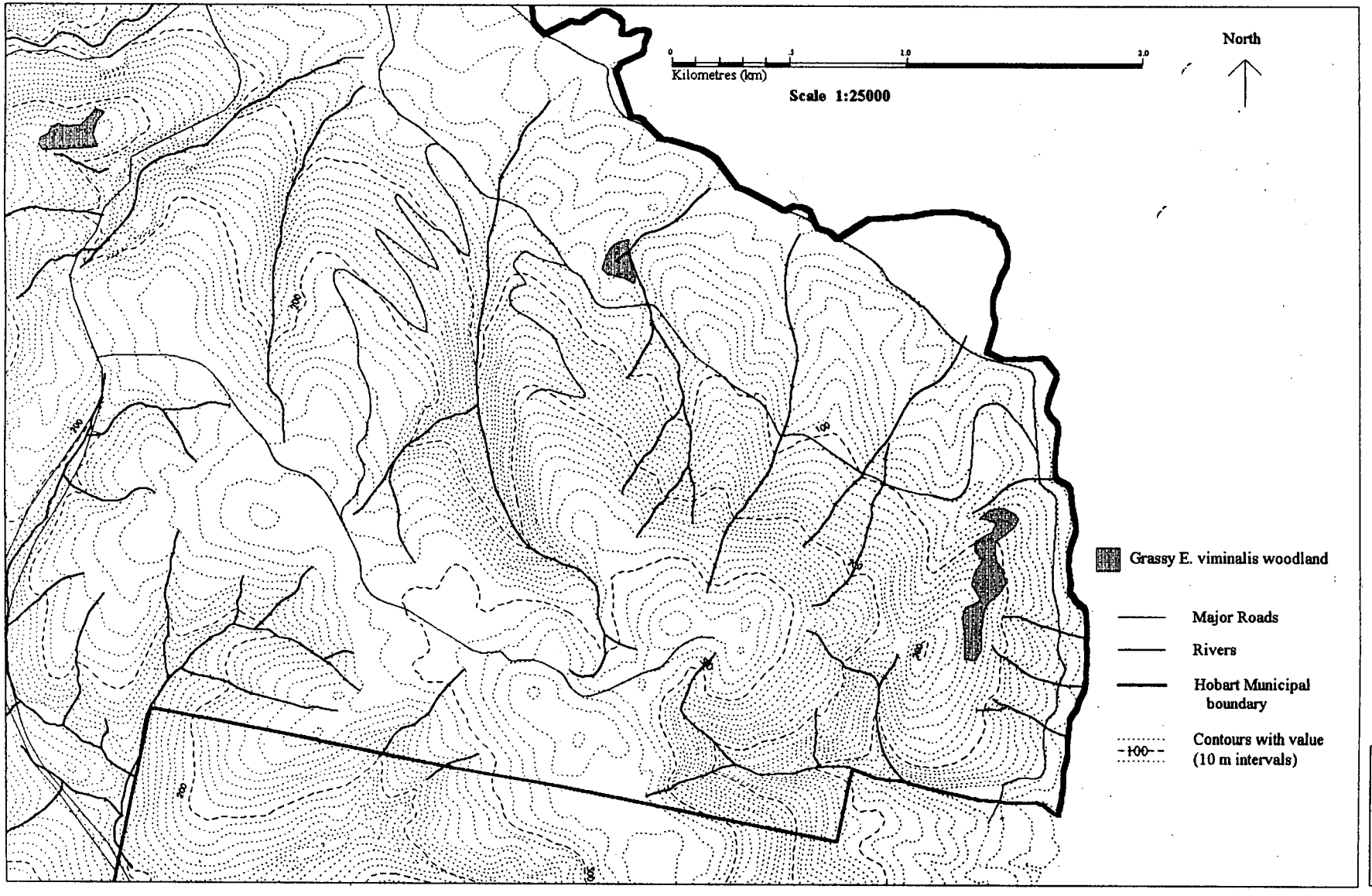


Figure 6.7b: Grassy Eucalyptus viminalis woodlands in Hobart (Part 2 of 2)

6.8 Grassy *Eucalyptus amygdalina/E. viminalis* woodland

This community is found predominantly on the dry northerly mudstone slopes around Hobart. These sites are on Knocklofty, in the Waterworks Reserve, and bushland areas in Lenah Valley (Figures 6.8a and b). Of a total of 60 ha, most of this community is found on private land (70%), with only 12% in HCC reserves. This community is often close to urban development and is susceptible to invasion by exotic weeds. Gorse is common on most sites.

As with the previous grassy communities, this community should be burnt on average every five years. Fire records indicate that only the Knocklofty sites have been burnt in this time, however, as these records represent mainly HCC land, it would be necessary to establish if any other sites have been burnt in this period. Records do indicate that at least 50% has been burnt in the last 13 years, that is, since 1980/81 fire season (Table 6.5). Fire management should follow similar guidelines as outlined in Section 6.5.

Table 6.5: Fire recorded in grassy *Eucalyptus amygdalina/E. viminalis* woodland communities by HCC Officers

	Total Area in Hobart (ha)	Area burnt in last 5 years* (ha)	Area burnt in last 13 years* (ha)
Grassy *E. amygdalina/E. viminalis* woodland	60.0	13.4 (22%)	30.2 (50%)

* Only HCC records were used to calculate these areas

6.9 Undescribed heath community on sandstone

This community occurs on one site in Wellington Park (Figure 6.9; Table 6.1). This site is on an isolated sandstone shelf with a northerly aspect. Since it is not described in any of the literature (see Subsection 3.5.3), though present in Wellington Park, this community must be classified as poorly-reserved. As indicated by the presence of eucalypt seedlings, this community may have the potential to develop into a shrubby dry sclerophyll forest. However, the poorly drained sandy soil probably favours the present heathy community. Further floristic analysis of this site might alter the classification and hence the status of this community.

Fire records indicate that this community has been burnt at least twice in the last 25 years - wildfires in 1983 and 1967. In order to preserve this community it should have a fire regime similar to that of heathy dry sclerophyll forests. However, prior to implementing a program the community should be assessed and the desired fire regime may need to involve a variety of fire frequencies, intensities and seasons of burning.

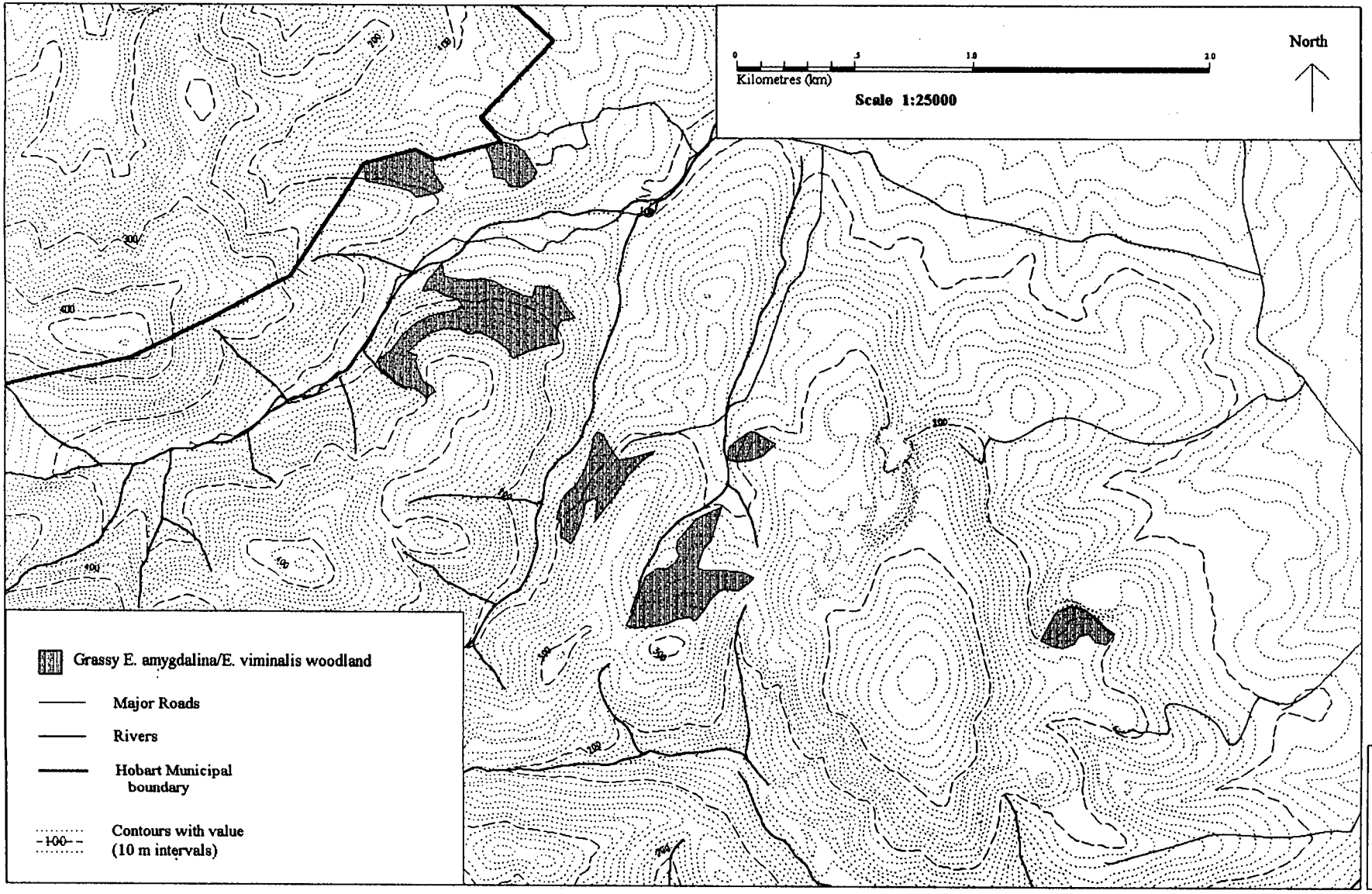
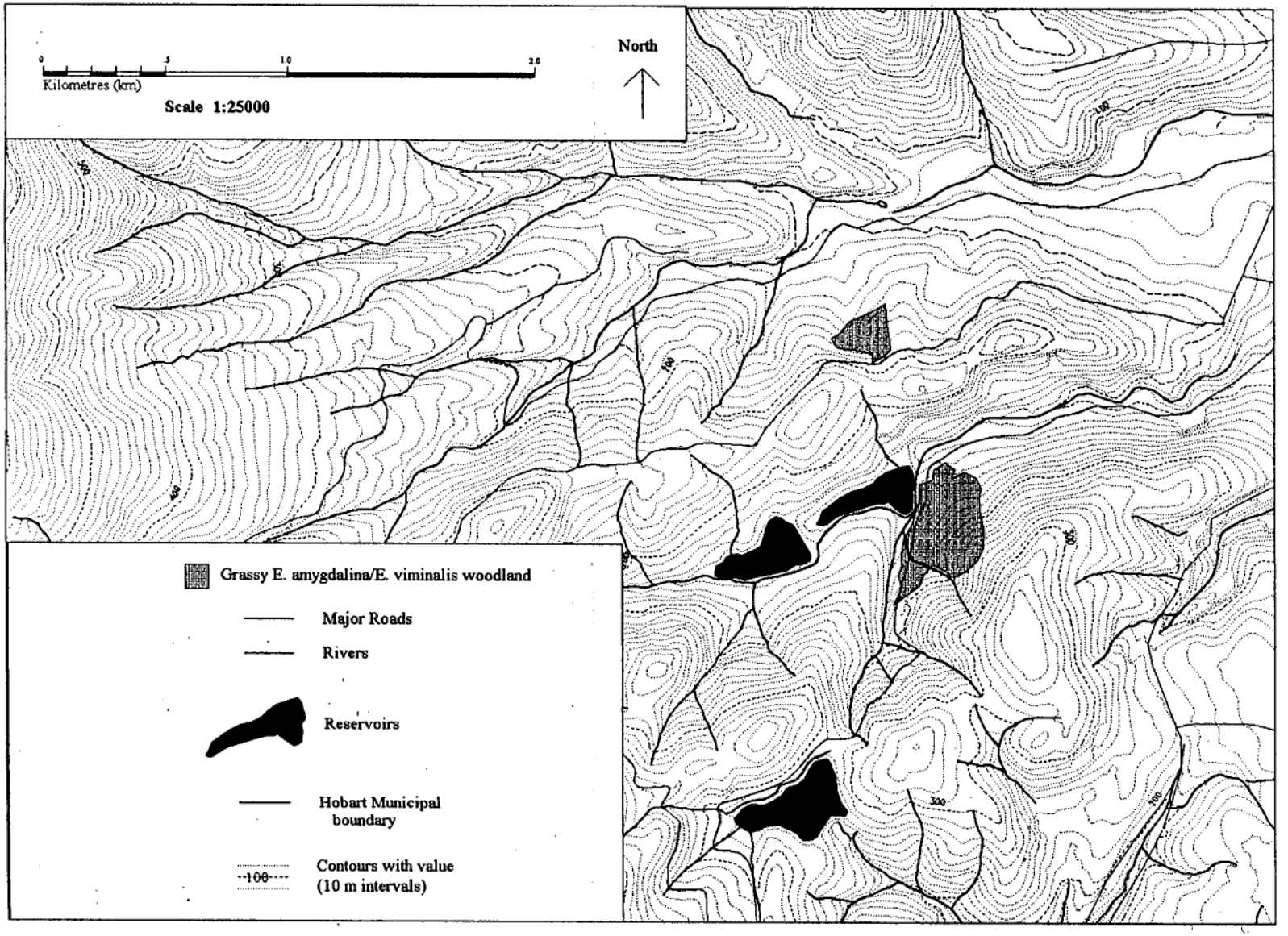


Figure 6.8a: Grassy Eucalyptus amygdalina/E. viminalis woodlands in Hobart (Part 1 of 2)



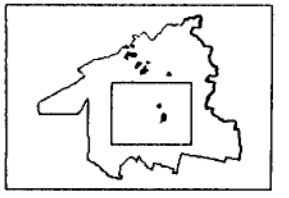
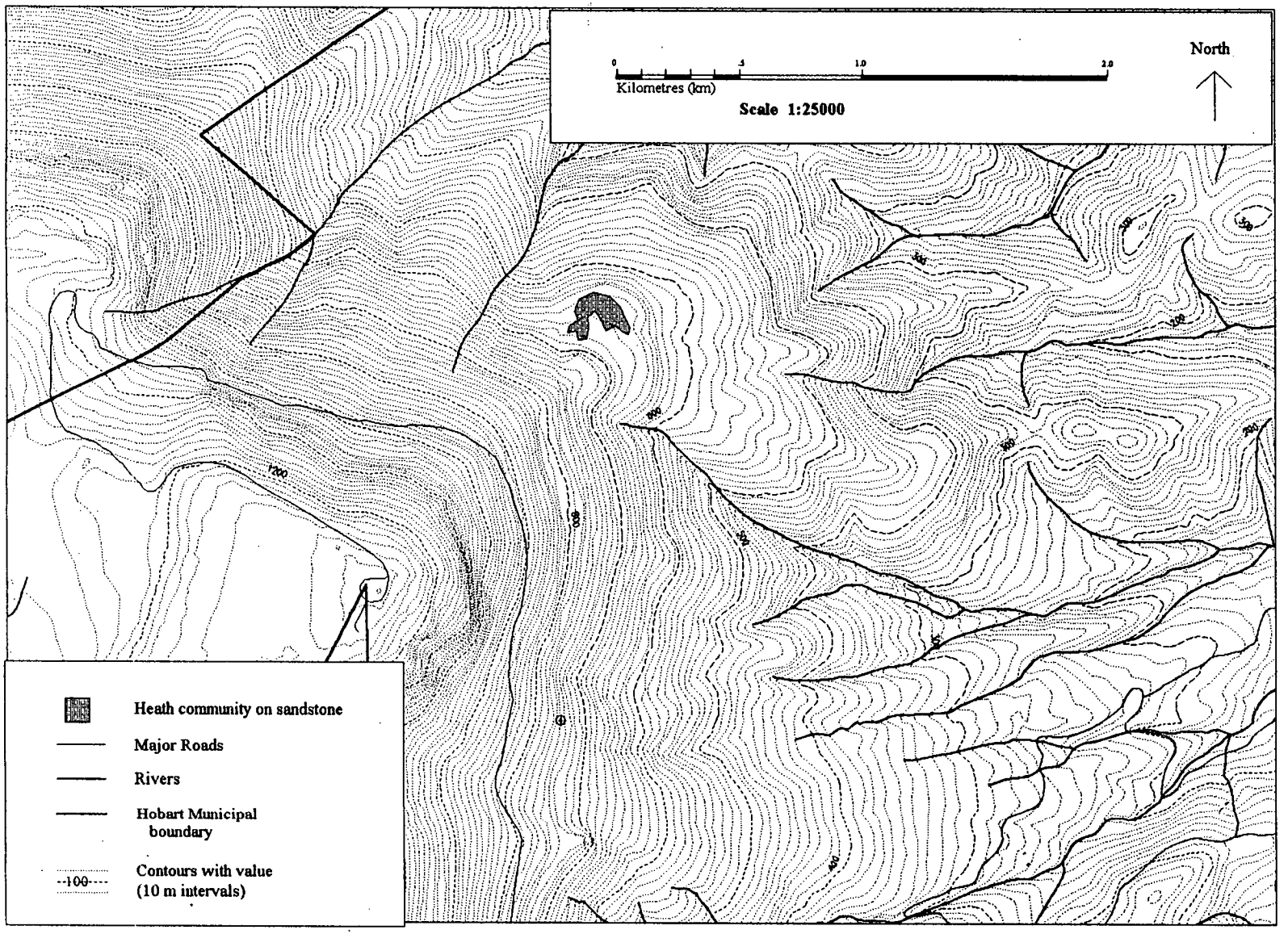


Figure 6.8b: Grassy Eucalyptus amygdalina/E. viminalis woodlands in Hobart (Part 2 of 2)



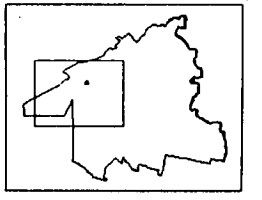


Figure 6.9: Undescribed heath community on sandstone in Hobart

Chapter 7 Rare or threatened species

7.1 Introduction

In Hobart, a total of 60 rare, threatened and/or unreserved species were identified using existing records, published papers and personal sightings. Many of these records are very old or unspecific (especially the Herbarium records) and it is possible that some of these species are now extinct in Hobart as a result of urban expansion.

7.2 Threatened species

A total of 9 threatened species were identified in the Hobart area (Table 7.1; Figure 7.1). Only one of these species is presumed extinct (x) - the orchid *Genoplesium nudiscarpum*. This species was last recorded by J. D. Hooker in 1840 on a hill east of Mt. Wellington (D. Ziegeler pers. comm).

Two species in Hobart are classified as endangered (e) - *Euphrasia scabra* and *Hyalosperma demissum*[1]. The only record of *E. scabra* in Hobart is from a survey of the Wellington Range by Ratkowsky and Ratkowsky (1976) who recorded only one population on Chimney Pot Hill. Subsequent surveys of this site have not located this species. Its disappearance has be attributed to urban expansion (Two Hundred and Eight Network 1994a). *H. demissum* was last collected from the Queens Domain in 1898, and since then it has not been recorded in Hobart.

The remaining 6 threatened species are classified as vulnerable (v). One of these species - *Doodia caudata* - is also nationally vulnerable (V). This species was last recorded by Martin (1940) but was not found in the subsequent study by Ratkowsky and Ratkowsky (1976). Since *D. caudata* normally occurs in the north of the state it is suspected that this species may have been wrongly identified by Martin, the sighting is now thought to have probably been *D. media* which is neither rare nor threatened (Two Hundred and Eight Network 1994a). *Prostanthera rotundifolia* may have also been wrongly identified as it's current distribution is also restricted to northern Tasmania (D. Ziegeler pers. comm.). However, since this species is restricted to riverine scrub or scrub communities and does not readily recover after burning, it may have been eliminated by urban expansion or fires (Kirkpatrick and Gilfedder 1991).

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[1] *Hyalosperma demissum* (syn = *Helipterum demissum*) - nomenclature follows Wilson (1989:85)

Key for Figure 7.1

Threatened Species	Code
Atriplex suberecta	As
Doodia caudata	Dc
Euphrasia scabra	Es
Genoplesium nudiscarpum	Gn
Hyalosperma demissum	Hd
Hydrocotyle laxiflora	Hl
Prostanthera rotundifolia	Pr
Pterostylis aff. mutica	Pm
Scleranthus fasciculatus	Sf

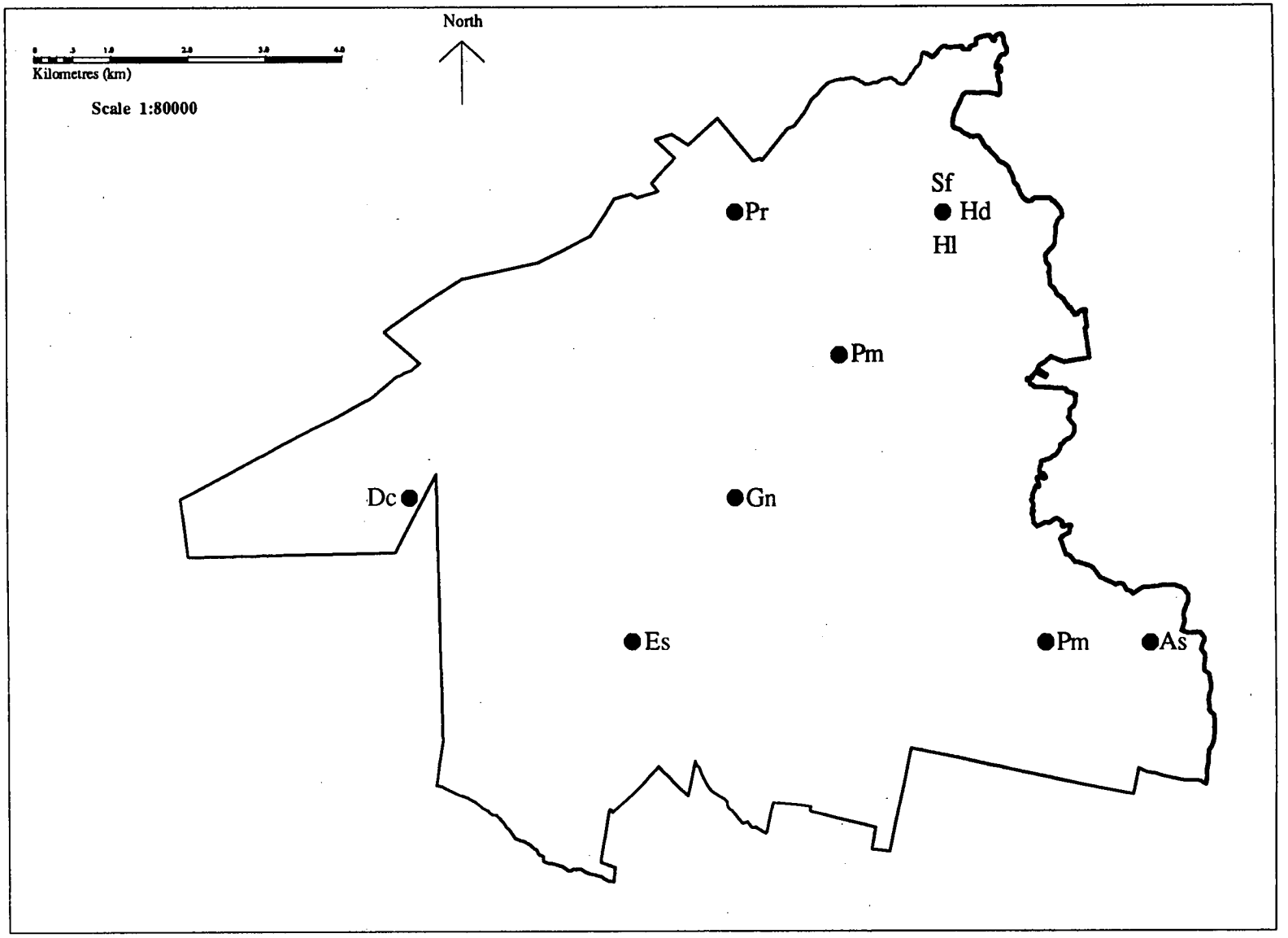

Figure 7.1: Threatened species located in the Hobart area

Table 7.1: Threatened species which occur or have occurred in Hobart

Species	End. code[1]	Cons. code[2]	Location	Lat/ Long	Date	Source
Pteridophytes						
Doodia caudata	0	V v	Organ Pipes, Mt Wellington	42°54' 147°14'	1901	L. Gilfedder pers. comm.
			Zones 2 & 3 *	?	1940	Martin (1940)
Angiosperms - Monocotyledons						
Genoplesium nudiscarpum	0	x	Hill east Mt Wellington	42°54' 147°17'	1840	D. Ziegeler pers. comm.
Pterostylis aff. mutica[2]	?	u v	Mt Stuart side of Knocklofty	42°53' 147°18'	1951	D. Ziegeler pers. comm.
			Mt Nelson	42°55' 147°20'	1955	D. Ziegeler pers. comm.
Angiosperms - Dicotyledons						
Euphrasia scabra	0	e	Zone 7**(Chimney Pot Hill)	42°55' 147°16'	1976	Ratkowsky & Ratkowsky (1976)
			(now extinct from this site)		1994	Two Hundred and Eight Network (1994)
Hyalosperma demissum (syn. = *Helipterum demissum*)	0	e	Domain	42°52' 147°19'	1898	Tasmanian Herbarium
Atriplex suberecta	0	u v	Sandy Bay (Long Pt.)	42°55' 147°21'	1900	Tasmanian Herbarium
Hydrocotyle laxiflora	0	u v	Domain - below summit	42°52' 147°19'	1958	Tasmanian Herbarium
			Domain-below summit on a dry slope under *Allocasuarina verticillata*	42°52' 147°19'	1985	Tasmanian Herbarium
			Domain - between Upper & Lower Domain Rds.	42°52' 147°19'	1988	Tasmanian Herbarium
			Domain	42°52' 147°19'	1992	J. Hickie pers. comm.
			Domain	42°52' 147°19'	1993	Centre for Environmental Studies
Prostanthera rotundifolia	0	u v	Lenah Valley	42°52' 147°17'	1929	Tasmanian Herbarium
Scleranthus fasciculatus	0	u v	Domain	42°52' 147°19'	1948	Tasmanian Herbarium
			Domain	42°52' 147°19'	1992	L. Gilfedder pers. comm.

[1] Endemic codes: 1 = Endemic to Tasmania
0 = Non-endemic

[2] Conservation codes: x = Extinct in Tasmania
e = Endangered in Tasmania
V/v = Vulnerable Nationally/Tasmania
u = Unreserved in Tasmania

* see Table 2.6 for definition of Martin's (1940) zones
** see Table 2.7 for definition of Ratkowsky and Ratkowsky's (1976) zones

Five of these six vulnerable species (*Atriplex suberecta, Hydrocotyle laxiflora, Prostanthera rotundifolia, Pterostylis aff. mutica*[2] and *Scleranthus fasciculatus*) are not found in secure reserves[3] in Tasmania. Two of these species have been recently sighted on the Queens Domain - *Hydrocotyle laxiflora* (only found on the Queens Domain) and *Scleranthus fasciculatus*. As no recent recordings exist for the other three species

[2] Nomenclature according to Ziegeler, D. *et al.* (in manuscript)

[3] Secure reserves: this term includes the World Heritage Area and other reserves which require both Tasmanian Houses of Parliament for revocation such as National Parks and Wellington Park.

(*Atriplex suberecta, Prostanthera rotundifolia* and *Pterostylis aff. mutica*) it is unknown if they are still present in Hobart. It is possible that *Prostanthera rotundifolia* and the saltbush *Atriplex suberecta* are locally extinct due to human interference.

Populations of these threatened species should be appropriately managed. For some species management plans or strategies, supported by legislation or regulations may be needed. If a species only occurs on non-reserved land, special attention may be needed including liaison with the land owner(s). To safeguard the species it may be necessary in some instances to acquire the land.

7.3 Rare species

A total of 44 species in Hobart are classified as rare. Five are classified as r1 (Table 7.2, Figure 7.2) and of these three are known to occur on Mt. Wellington (*Brachyglottis brunonis, Euphrasia gibbsiae spp. wellingtonensis* and *Pterostylis cucullata "var. viridis"*). *B. brunonis* is also nationally rare (R). The remaining two species are not found in any secure reserves in Tasmania. *Brachyscome perpusilla* was last collected from the Queens Domain in 1901 and the orchid - *Caladenia catenata* was recently found near Huon Rd. (D. Ziegeler pers comm).

Thirty-nine rare species in Hobart fall in the category r2 (Table 7.3; Figure 7.3). Of these, 9 species are also nationally rare and one (*Brachyscome radicata*) has the national classification of 'K'. *B. radicata* is currently under review and it's conservation status is likely to change (A. Wells pers. comm.). *Carex tasmanica* is classified as nationally rare, however, in Tasmania it is not considered rare despite not being found in any secure reserves. Six r2 species are also not found in any secure reserves. However, *Agrostis aemula var. aemula* and *Deyeuxia benthamiana* have been recorded in Wellington Park (see Table 7.3). It is therefore likely that upon review, only *Danthonia procera, Juncus amabilis, Prasophyllum fitzgeraldii* and *Typha orientalis* will be classified as 'unreserved'.

A significant population of *Eucalyptus cordata* (R r2) is found on Chimney Pot Hill. This site, primarily on HCC land has been noted for its significance by Potts (1989) who recommends that appropriate management policies be implemented to ensure the survival of this population. This recommendation has been supported in a report to the Forestry Commission's Working Group for Forest Conservation. This report by Williams (1989) recommends that this population be managed according to the recommendations of Potts (1989).

Key for Figure 7.2

Rare Species	Code
Agrostis aemula var. aemula	Aa
Austrofestuca hookeriana	Ah
Batrachium trichophyllus	Rt
Brachyglottis brunonis	Bb
Brachyscome perpusilla	Bp
Brachyscome radicata	Br
Caladenia catenata	Cc
Carex longebrachiata	Cl
Carex tasmanica	Ct
Cynoglossum australe	Ca
Danthonia procera	Dp
Deyeuxia benthamiana	Db
Eucalyptus cordata	Ec
Euphrasia gibbsiae ssp. wellingtonensis	Eg
Festuca plebeia	Fp
Gahnia rodwayi	Gr
Isolepis habra	Ih
Juncus amabilis	Ja
Lepidium pseudotasmanicum	Lp
Lepidosperma tortuosum	Lt
Millotia tenuifolia	Mt
Olearia ericoides	Oe
Pimelea flava	Pf
Prasophyllum aff. fitzgeraldii	Pg
Pterostylis aff. scabrida	Pb
Pterostylis squamata	Ps
Ranunculus pumilio	Rp
Senecio squarrosus	Ss
Stipa bigeniculata	Sb
Veronica serpyllifolia	Vs
Vittadinia cuneata	Vc
Vittadinia gracilis	Vg
Vittadinia muelleri	Vm

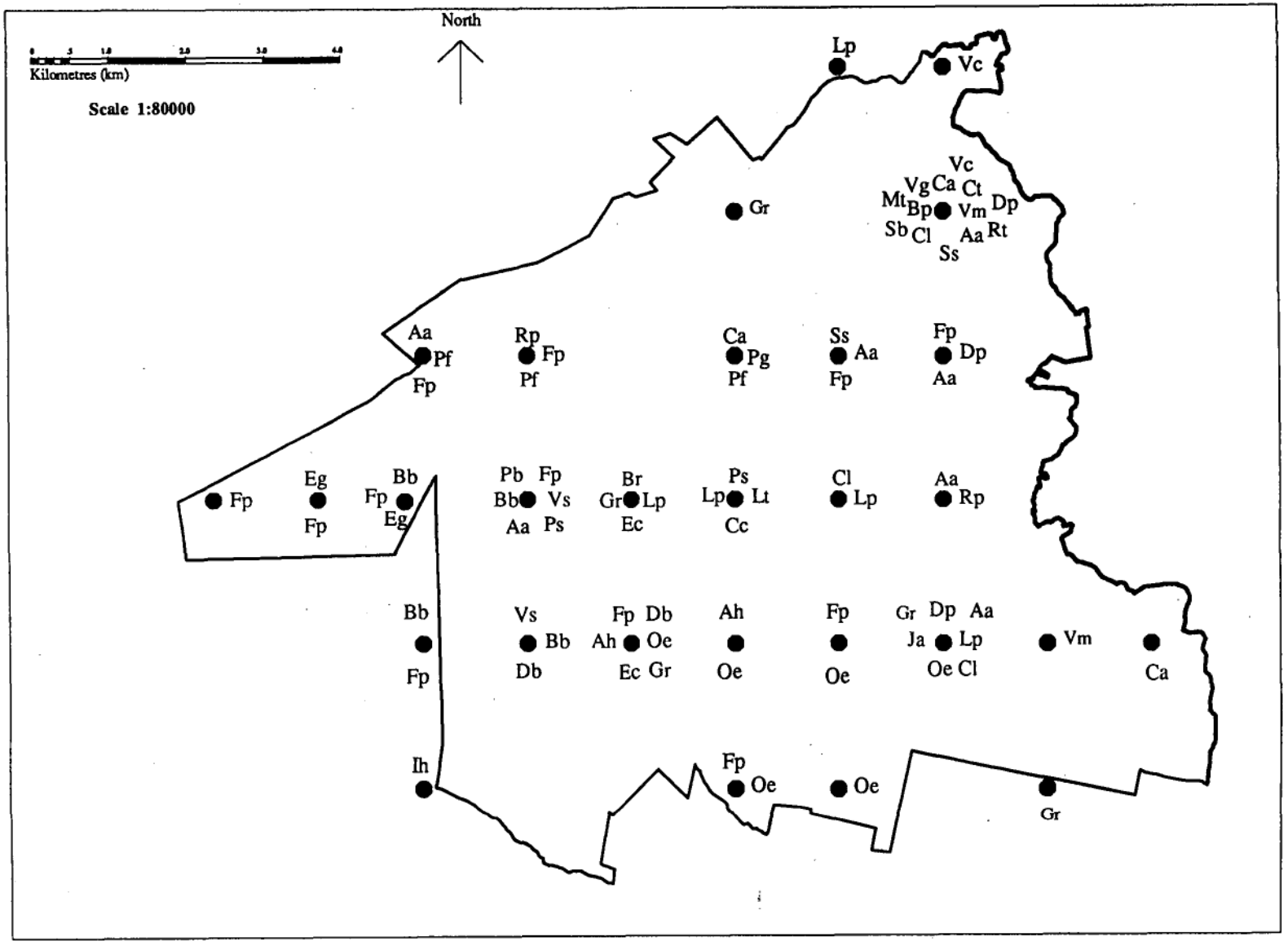

Figure 7.2: Rare species located in the Hobart area

Table 7.2: r1 species which occur or have occurred in Hobart**

Species	End. code*	Cons. code**	Location	Lat/ Long	Date	Source
Angiosperms - Monocotyledons						
Caladenia catenata	1	u r1	Huon Rd.	42°54' 147°17'	recent	D. Ziegeler pers. comm.
Pterostylis cucullata "var. viridis"[4]		r1	Mt Wellington	42°54' 147°15'		D. Ziegeler pers. comm.
Angiosperms - Dicotyledons						
Brachyglottis brunonis	1	R r1	Mt Wellington	42°54' 147°14'	1892; 1937	Tasmanian Herbarium
			Mt Wellington - altitude: 750 m	42°54' 147°14'	1926/8	
			Mt Wellington - altitude: 2900 m'; open hillside	42°54' 147°14'	1932	
			Zones 2; 3a; 3b & 5***		1976	Ratkowsky & Ratkowsky (1976)
			Mt Wellington - at Shelter Hut; altitude: 1000 m	42°54' 147°14'	1980	
			Mt Wellington -Shelter Hut/Organ Pipes Tracks; altitude: 1000 m	42°54' 147°14'	1989	
			Mt Wellington	42°54' 147°15'		A. Pyrke pers. comm.
			Mt Wellington	42°55' 147°14'		A. Pyrke pers. comm.
			Mt Wellington	42°55' 147°15'		A. Pyrke pers. comm.
			Organ Pipes Track, Mt Wellington	42°54' 147°14'	1992	L. Gilfedder pers. comm.
			Organ Pipes Track, Mt Wellington	42°54' 147°15'	1992	L. Gilfedder pers. comm.
Brachyscome perpusilla	0	r1 u	Queens Domain	42°52' 147°19'	1901	Tasmanian Herbarium
Euphrasia gibbsiae ssp. wellingtonensis	1	r1	Mt Wellington Summit	42°54' 147°14'	1947	Tasmanian Herbarium
			Mt Wellington	?		Tasmanian Herbarium
			Mt Wellington - moor near summit	42°54' 147°14'	1962	
			Mt Wellington - in Sphagnum bog	42°54' 147°13'	1965	
			Mt Wellington Plateau alt: 4100'	42°54' 147°14'	1967	Tasmanian Herbarium
			Zones 1; 2 & 3a***	?	1976	Ratkowsky & Ratkowsky (1976)
			Alpine and subalpine Mt Wellington	42°54' 147°14'	1994	J. Kirkpatrick pers. comm.

* Endemic codes: 1 = Endemic to Tasmania
0 = Non-endemic

** Conservation codes: R = Taxa is Nationally rare
r1 = Taxa that are not presumed extinct, endangered or vulnerable and have a distribution in Tasmania that does not exceed 100 X 100 km
u = Unreserved in Tasmania

*** see Table 2.7 for definition of Ratkowsky and Ratkowsky's (1977) zones

[4] Nomenclature according to Ziegeler, D. *et al.* (in manuscript)

Table 7.3: r2 species which occur or have occurred in Hobart**

Species	End. code*	Cons. code**	Location	Lat/ Long	Date	Source
Pteridophytes						
Anogramma leptophylla	0	r2	Zone 1*** (NB. not found in 1976)	?	1940	Martin (1940) Ratkowsky & Ratkowsky (1976)
Angiosperms - Monocotyledons						
Agrostis aemula var. aemula	0	u r2	Hobart	42°53' 147°19'	1929/30	Tasmanian Herbarium
			Domain	42°52' 147°19'	1943/9	Tasmanian Herbarium
			College Rd, Dynnyme	42°54' 147°19'	1964	
			Mt Nelson	42°55' 147°19'	1967	Tasmanian Herbarium
			Mt Nelson	?	1971	Tasmanian Herbarium
			1 mile east of Pinnacle Rd., Mt Wellington	42°54' 147°15'	1971	Tasmanian Herbarium
			Knocklofty (close to summit)	42°53' 147°18'	1984	Tasmanian Herbarium
			Hunter's Track, Mt Wellington	42°53' 147°14'	1986	Tasmanian Herbarium
			Mt Wellington	?	no date	Morris (1991)
Agrostis billardieri var. robusta	0	r2	Hobart	?	1929	Tasmanian Herbarium
Austrofestuca hookeriana	0	r2	Chimney Pot Hill Rd, Ridgeway (jct. Huon Hwy.)	42°55' 147°16'	1991	J. Hickie pers. comm.
			Ridgeway, Mt Wellington jct	42°55' 147°17'		Tasmanian Herbarium
Carex archeri	0	r2	Zones 1; 2 & 3a****		1976/82?	Ratkowsky & Ratkowsky (1976)
Carex longebrachiata	0	r2	Cascades	42°54' 147°18'	1893	
			Queens Domain: Moist hollow, altitude: 90 m	42°52' 147°19'	1985	Tasmanian Herbarium
			Queens Domain: above 'pond' parking area, altitude: 50 m	42°52' 147°19'		Tasmanian Herbarium
			(damp, open grassy patch, alt: 260m)	42°55' 147°19'	?	Tasmanian Herbarium
			Zone 4****		1976	Ratkowsky & Ratkowsky (1976)
Danthonia procera	0	u r2	Hobart	42°53' 147°19'	1930	Tasmanian Herbarium
			Mt Nelson	42o55' 147°19'	1930/47	Tasmanian Herbarium
			Zones 7****	?	?	Ratkowsky & Ratkowsky (1976)
			Queens Domain	42°52' 147°19'	1992	L. Gilfedder pers. comm.
			Noah's Saddle (east of Knocklofty)	42°53' 147°17'	1993	Two Hundred and Eight Network (1994b)
Deyeuxia benthamiana	0	R u r2	Huon Rd	42°55' 147°16'	1895	Tasmanian Herbarium
			Huon Rd	42°55' 147°16'	1912	Tasmanian Herbarium
			Path from Silver Falls to the Bower, Fern Tree	42°55' 147°15'	1962	Tasmanian Herbarium
			Mt Wellington	?	1974	Geography & Environmental Studies Database
			Zones 3b & 4****	?	1976	Ratkowsky & Ratkowsky (1976)

Continued next page

Table 7.3 *(cont.)*: r2 species which occur or have occurred in Hobart**

Festuca plebeia	1	R r2	Ridgeway	42°56' 147°17'	1909	Tasmanian Herbarium
			Hobart	42°53' 147°19'	1910	Tasmanian Herbarium
			Proctor's Rd	42°55' 147°18'	1946	Tasmanian Herbarium
			Summerleas Rd, Fern Tree - below housing roadside	42°55' 147°16'	1962	Tasmanian Herbarium
			Pinnacle Rd behind shelter shed, Mt Wellington	42°53' 147°14'	1977	Tasmanian Herbarium
			Pinnacle Rd behind shelter shed, Mt Wellington	42°53' 147°15'	1982	Tasmanian Herbarium
			Knocklofty (east facing grassy slope under power lines; altitude: 300 m)	42°53' 147°18'	1988	Tasmanian Herbarium
			Ridgeway Park	42°56' 147°17'	1989?	J. Kirkpatrick pers. comm.
			Unidentified	42°53' 147°14'		J. Kirkpatrick pers. comm.
			Unidentified	42°54' 147°14'		J. Kirkpatrick pers. comm.
			Unidentified	42°54' 147°15'		J. Kirkpatrick pers. comm.
			Unidentified	42°55' 147°14'		J. Kirkpatrick pers. comm.
			Unidentified	42°54' 147°12'	1985	L. Gilfedder pers. comm.
			Unidentified	42°54' 147°13'	1985	L. Gilfedder pers. comm.
Gahnia rodwayi	1	R r2	Pottery Rd, New Town	42°52' 147°17'	1925	Tasmanian Herbarium
			Mt Nelson	42°56' 147°20'	1958/60	Tasmanian Herbarium
			Zone 7****	?	1976	Ratkowsky & Ratkowsky (1976)
			Bend 3, Nelson Rd., Mt Nelson	42°55' 147°19'	1985	Tasmanian Herbarium
			Rare database:	?	recent	Geography % Environmental Studies Database
			Chimney Pot Hill Rd, on roadside	42°55' 147°16'	?	J. Hickie pers. comm.
			Walking track beside Strickland Ave	42°54' 147°16'	?	J. Hickie pers. comm.
Isolepis habra	0	r2	Pipeline Track near Fern Tree - altitude: 450 m	42°56' 147°14'	1974	Tasmanian Herbarium
Juncus amabilis	0	u r2	Hobart College, Mt Nelson (low eucalypt woodland amongst grasses)	42°55' 147°19'	1978	Geography % Environmental Studies Database
Lepidosperma tortuosum	0	r2	Brickfields (Turnip Fields Rd?), Huon Rd.	42°54' 147°17'	1894	Tasmanian Herbarium
Prasophyllum aff. fitzgeraldii[5]	0	u r2	Knocklofty (1200'; dolerite, grassy open forest, rock outcrop)	42°53' 147°17'	1936	D. Ziegeler pers. comm.
Pterostylis aff. scabrida[5]		r2	Mt Wellington (needs work)	42°54' 147°15'	?	D. Ziegeler pers. comm.
Pterostylis squamata		r2	Waterworks	42°54' 147°17'	1907	D. Ziegeler pers comm
			Mt Wellington	42°54' 147°15'	?	D. Ziegeler pers. comm.
Stipa bigeniculata	0	r2	Domain summit (open grassland with *Stipa stuposa & Themeda triandra)*	42°52' 147°19'	1986	Tasmanian Herbarium
Thismia rodwayi		R r2	?	?	?	Two Hundred and Eight Network (1994)
Typha orientalis		u r2	Zones 4 & 7****	?	1976	Ratkowsky & Ratkowsky (1976)

Continued next page

5 Nomenclature according to Ziegeler, D. *et al.* (in manuscript)

Table 7.3 *(cont.)*: r2 species which occur or have occurred in Hobart**

Carex tasmanica	0	R u	Queens Domain (altitude: 60 m - above 'pond' parking lot (1985);altitude 50 m (1987))	42°52' 147°19'	1985/6/7	Tasmanian Herbarium
			Queens Domain	42°52' 147°19'	1994	Wells (1994)
Angiosperms - Dicotyledons						
Batrachium trichophyllum [6] (syn. = *Ranunculus trichophyllus)*	0	r2	Queens Domain	42°52' 147°19'	1930	Herb?
Brachyscome radicata	0	K r2	Mt Wellington "Sawpits", Lenah Valley	42°54' 147°16'	1894, 1913	Tasmanian Herbarium
		(this may change)	Zone 7?****	?	1976	Ratkowsky & Ratkowsky (1976)
Cynoglossum australe	0	r2	Lower Sandy Bay - sand dunes	42°55' 147°21'	1901	Tasmanian Herbarium
			Knocklofty	42°53' 147°17'	1937	Tasmanian Herbarium
			Zone 7****	?	1976	Ratkowsky & Ratkowsky (1976)
			Queens Domain	52°52' 147°19'	1981	Tasmanian Herbarium
Derwentia nivea [7] (syn. = *Veronica nivea)*		r2	Zones 2; 3a & 4****	?	1976	Ratkowsky & Ratkowsky (1976)
Epacris acuminata	1	R r2	Zones 2; 3a & 4****	?	1976	Ratkowsky & Ratkowsky (1976)
Eucalyptus cordata	1	R r2	Huon Rd, 6.5 km from Hobart	42°54' 147°16'	1910	Tasmanian Herbarium
			Zone 7****	?	1976	Ratkowsky & Ratkowsky (1976)
			Chimney Pot Hill (Telecom access Rd.)	42°55' 147°16'	1993	Tasmanian Herbarium
Helichrysum expansifolium		R r2	Zones 1; 2 & 3a****	?	1976	Ratkowsky & Ratkowsky (1976)
Lepidium pseudotasmanicum	0	r2	Sandy Bay	42°54' 147°18'	1840	Tasmanian Herbarium
			Strickland Ave	42°54' 147°17'	1961	Tasmanian Herbarium
			Mt Nelson	42°55' 147°19'	1973	Tasmanian Herbarium
			St John's Rd, New Town	41°51' 147°18'	1978	Tasmanian Herbarium
			Strickland Ave, near Marlyn Rd	42°54' 147°16'	1992	L. Gilfedder pers. comm.
			Sandy Bay Rd. (east of Porter's Hill	42°56' 147°21'	1994	J. Kirkpatrick pers. comm.
Millotia tenuifolia	0	r2	Queens Domain	42°52' 147°19'	1893	Tasmanian Herbarium
			Procters Rd.	?	1946	Tasmanian Herbarium
Monotoca linifolia	0	R r2	Zones 3b & 5****	?	1976	Ratkowsky & Ratkowsky (1976)
Myosotis australis	0	r2	Zones 2; 3a; 3b & 6**	?	1976	Ratkowsky & Ratkowsky (1976)

Continued next page

6 *Batrachium trichophyllum* - Nomenclature follows Black (1986)

7 *Derwentia nivea* - Nomenclature follows Briggs and Ehrendorfer (1992:260)

Table 7.3 *(cont.)*: r2 species which occur or have occurred in Hobart**

Olearia ericoides	1	R r2	Ridgeway	42°56' 147°17'	1945	Tasmanian Herbarium
			Zone 7****	?	1976	Ratkowsky & Ratkowsky (1976)
			Chimney Pot Hill	42°55' 147°17'	?	J. Kirkpatrick pers. comm.
			University Reserve	42°55' 147°19'	?	J. Kirkpatrick pers. comm.
				42°55' 147°16'	?	J. Kirkpatrick pers. comm.
				42°55' 147°17'	?	J. Kirkpatrick pers. comm.
				42°55' 147°18'	?	J. Kirkpatrick pers. comm.
				42°56' 147°18'	?	J. Kirkpatrick pers. comm.
Pimelea flava	0	r2	Kangaroo Valley (Lenah Valley)	42°53' 147°17'	1929	Tasmanian Herbarium
			Pottery Rd, Lenah Valley	42°53' 147°17'	1938	D. Ziegeler pers. comm.
			Knocklofty	42°53' 147°17'	1978??	Tasmanian Herbarium
			New Town Falls (Mt Wellington)	42°53' 147°15'	no date	Tasmanian Herbarium
Ranunculus pumilio	0	r2	Proctor's Rd (generally dry hillside, except after rain when site is waterlogged)	42°54' 147°19'	1946	Tasmanian Herbarium
			Creek below waterhole at Junction Cabin (Mt Wellington)	42°53' 147°15'	1984	Tasmanian Herbarium
Senecio squarrosus	0	r2	Queens Domain	42°52' 147°19'	1958	Tasmanian Herbarium
			Knocklofty (altitude: 250 m; slope on northern side, though east facing; grassy u/s)	42°53' 147°18'	1984	
			Zones 4 & 7****	?	1976	Ratkowsky and Ratkowsky (1976)
Senecio velleioides		r2	Zone 4***	?	1940	Martin (1940)
Veronica serpyllifolia	0	r2	Mt Wellington altitude: 2700'	42°54' 147°15'	1939	Tasmanian Herbarium
			The Springs, Mt Wellington	42°55' 147°15'	1943	Tasmanian Herbarium
			Cascades	?	1937	Tasmanian Herbarium
			Zones 2; 3a; 3b; 4; 5 &6****	?	1976	Ratkowsky & Ratkowsky (1976)
Vittadinia cuneata	0	r2	Cornelian Bay	42°51' 147°19'	1922	Geography & Environmental Studies Database
			Queens Domain	42°52' 147°19'	1939/43	Geography & Environmental Studies Database
			Grasslands Gully, Queens Domain	42°52' 147°19'	1992	J. Hickie pers. comm.
			Queens Domain (Rare Data Base)	42°52' 147°19'	recent	Geography & Environmental Studies Database
Vittadinia gracilis	0	r2	Queens Domain	42°52' 147°19'	1939/43	Tasmanian Herbarium
Vittadinia muelleri	0	r2	Mt Nelson	42°55' 147°20'	1930/3	Tasmanian Herbarium
			Queens Domain	42°52' 147°19'	1938/52/ 92	Tasmanian Herbarium

* Endemic codes: 1 = Endemic to Tasmania
0 = Non-endemic

** Conservation codes: R = Taxa is Nationally rare
r2 = Taxa that are not presumed extinct, endangered or vulnerable and occur in 20 or less 10 X 10 km Australian Grid Squares in Tasmania
u = Unreserved in Tasmania

*** see Table 2.6 for definition of Martin's (1940) zones

*** see Table 2.7 for definition of Ratkowsky and Ratkowsky's (1976) zones

7.4 Unclassified (rare or threatened) species

Due to insufficient data, 6 species could not be placed in any of the above categories although they are known to be either rare or threatened in Tasmania. Table 7.4 lists these species and Figure 7.3 shows their distribution in Hobart. Of these species three are also not officially recognised in a secure reserve - *Acaena echinata var. tylacantha, Agrostis aff. scabra* and *Pelargonium littorale.* However, since Herbarium records indicate *Agrostis aff. scabra* was collected from Wellington Park in 1986, it could thus be accorded the status 'reserved' subject to confirmation of this record and recognition by the Flora Advisory Commission (FAC) of the Parks and Wildlife Service (Department of Environment and Land Management).

Table 7.4: Unclassified and unreserved species which occur or have occurred in Hobart

Species	End. code*	Cons. code**	Location	Lat/ Long	Date	Source
Angiosperms - Monocotyledons						
Agrostis aff. scabra	0	k u	Hunter's Track, Mt Wellington altitude: 900 m; amongst *Gahnia grandis*)	42°53' 147°14'	1986	Tasmanian Herbarium
Carex demissa	0	k	Pinnacle Rd, Mt Wellington (dominated by *E. urnigera*)	42°53' 147°14'	1981	Tasmanian Herbarium
Deyeuxia frigida	0	k	Saw Pits, Mt Wellington	42°54' 147°16	1894	L. Gilfedder pers. comm.
			Sandy Bay	42°54' 147°18'	1965	Tasmanian Herbarium
			1.6 km E of Pinnacle Rd., Mt Wellington (altitude: 600 m)	42°54' 147°15'	1971	Tasmanian Herbarium
			Lenah Valley Track, Mt Wellington	42°53' 147°15'	1973	Tasmanian Herbarium
			Mt Wellington	?	1973/4	Tasmanian Herbarium
			Zones 2; 3a; 3b; 4 & 6***	?	1976	Ratkowsky and Ratkowsky (1976)
			Hunter's Track, Mt Wellington (amongst *Gahnia grandis*)	42°53' 147°14'	1986	Tasmanian Herbarium
			Pinnacle Rd/Hunter's Track, Mt Wellington	42°53' 147°14'	1986?	Tasmanian Herbarium
Angiosperms - Dicotyledons						
Acaena echinata var. tylacantha	0	k u	Queens Domain	42°52' 147°19'	1952	Tasmanian Herbarium
			(NB. this variety could not be distinguish in 1992)			J. Hickie per comm.
Atriplex australasica	0	k	Hobart	42°53' 147°20'	1903	Tasmanian Herbarium
Pelargonium littorale	0	k u	Lenah Valley - altitude: 500'	?	1933	Tasmanian Herbarium
Goodia pubescens	0	u	Cascades	42°54' 147°17'	no date	L. Gilfedder pers. comm.
			Myrtle Gully Rd., near Cascades	?	1937	Tasmanian Herbarium

*Endemic codes: 1 = Endemic to Tasmania
0 = Non-endemic

**Conservation codes: k = Taxa is probably rare or threatened in Tasmania, however there is insufficient data to place it in any one category with any certainty
u = Unreserved in Tasmania

*** see Table 2.7 for definition of Ratkowsky and Ratkowsky's (1976) zones

Key for Figure 7.3

Unknown (rare or threatened) species	Code
Agrostis aff. scabra	Ac
Carex demissa	Cd
Deyeuxia frigida	Df
Acaena echinata var. tylacantha	Ae
Atriplex australasica	Au

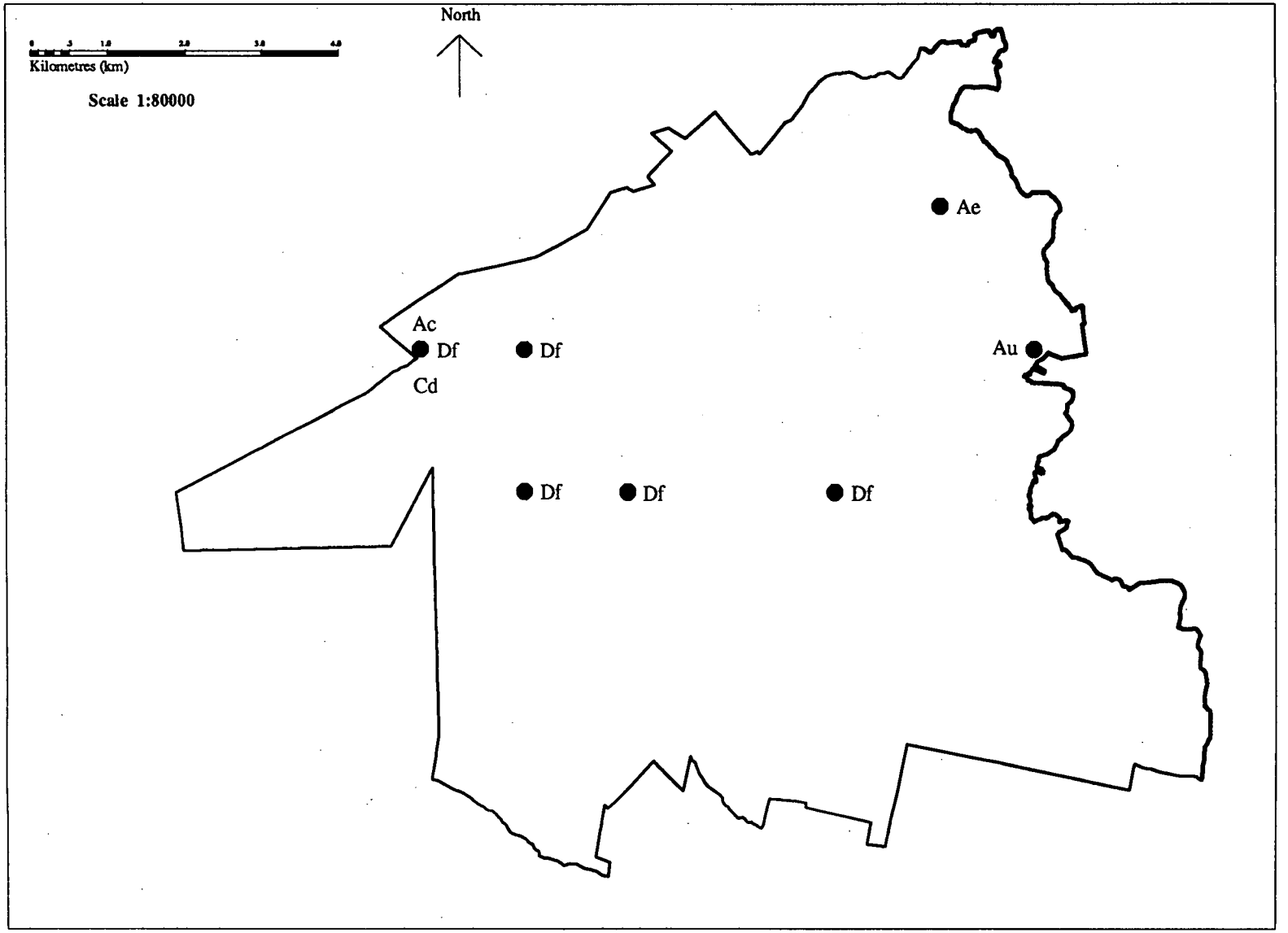

Figure 7.3: Unclassified (rare or threatened) species located in the Hobart area

7.5 Unreserved species

In Hobart, 17 rare or threatened species are not found in any secure reserves (see Sections 7.2, 7.3 and 7.4). Another species - *Goodia pubescens* - is also unreserved, though uncommon in Tasmania it is neither rare or threatened (see Table 7.5).

Many of these unreserved species could be under threat in Hobart due to urban expansion or may be now extinct. Only 10 species have been collected or recorded since 1970, and of these only 6 have been found since 1980 (Table 7.4). It is therefore important to locate these unreserved species, especially those which have not been recorded since 1970. If they are not found in a reserve which is managed for species conservation it may be necessary to establish management plans for each species or area. This may involve new legislation or regulations. If a species is only found on private land it may be necessary to acquire the land.

Table 7.5: Unreserved species collected/recorded since 1970/1980

Species	Conservation Code	Post 1970	Post 1980
Euphrasia scabra	e	Y	N[1]
Hydrocotyle laxiflora	v	Y	Y[2]
Scleranthus fasciculatus	v	Y	Y[2]
Caladenia catenata	r1	Y	Y
Agrostis aemula var. aemula	r2	Y	Y[2]
Danthonia procera	r2	Y	Y[2]
Deyeuxia benthamiana	r2	Y	N
Juncus amabilis	r2	Y	N
Typha orientalis	r2	Y	N
Carex tasmanica	R	Y	Y[2]
Agrostis aff. scabra	k	Y	Y[3]

[1] Presumed extinct (L. Gilfedder pers. comm.)

[2] Found on the Queens Domain

[3] Recorded from Wellington Park

Chapter 8 General discussion

The Hobart City Council is responsible for a variety of environmental management issues. Nature conservation[1] has only arisen as a public issue in the last 25 years and has yet to be seen as a priority in the face of more immediate and pressing issues. However, this is likely to change as nature conservation is being increasingly recognised as an integral component in the issues of water quality, waste management, and the aesthetic quality of the environment.

Local government has distinct advantages in issues of environmental management owing to its local base, flexibility and the ability to act quickly. Unfortunately, it can only act within existing legislation and its planning scheme, and does not have resource capacity of State and Federal Governments to effectively manage and control private land. In the past, other limitations arose from the segmented and compartmentalised nature of Local Government (TASQUE 1992). For example, prior to 1994 two Hobart City Council departments were largely responsible for its bushland areas (City Engineer's and Parks and Recreation Departments). Recent restructuring of the council has altered this with one division - the Parks and Community Services Division - assuming responsibility for all HCC reserves.

The preservation and management of remnant vegetation in Hobart, especially communities of high conservation value and those containing rare or threatened species should be a major priority for the Hobart City Council and the State Government. Many of these communities urgently require some form of management strategy. Apart from the obvious clearing of vegetation for housing and other development, potential threats arise from the spread of exotic weeds, deliberate or accidental burning, urban runoff and firewood collection (even of dead wood). The outer edge (or edge zone) of each vegetation community is under more pressure than its interior as it experiences higher levels of stress and more frequent disturbances (Taylor 1987). To reduce the likelihood of these threats it is recommended that vegetation buffer zones be maintained around each significant remnant community. Buffer zones would need to be wide enough to prevent or minimise the above threats. The width of the zone would greatly depend on the location and nature of the community. For example, if the community is located in a gully

[1] The terms conservation and preservation are sometimes used interchangeably and in practice they may appear indistinguishable. However, the subtle distinction often points out an underlying philosophical difference. In strict terms conservation has the connotation of something being conserved for future use, whereas preservation has the more altruistic connotation of keeping something for its own sake, in addition to or regardless of any use value it may have.

or below urban development, this zone will need to be quite wide to stop the 'downhill' migration of weeds and urban runoff. Where possible, the inclusion of surrounding ridges in the buffer zone would best protect the community.

If possible a community with significant conservation value, or containing rare or threatened species should be amalgamated with an existing reserve(s). This may require a larger buffer zone or at least a vegetation corridor. Vegetation corridors are often thought to be important for the maintenance of species diversity. However, if they are too narrow the corridor may be completely degraded by fertiliser drift and weed invasion (Dendy 1987).

Regardless of the significance of the community, there is an urgent need to retain viable areas of bushland throughout Hobart. A number of criteria can be used to assess which areas would benefit from remedial action. From an ecological point of view, those areas of bush with centres more than 400 m from developed areas should a priority. These bush areas are often less disturbed and are secure habitats for a variety of plant and animal species. Some areas should also be retained for more anthropocentric reasons, such as recreation, research and teaching and their aesthetic value to the community.

Without changes to the Hobart Planning Scheme or State Legislation, a policy for bushland conservation or preservation in Hobart will be difficult to implement. The Planning Scheme could be amended to include zones of conservation significance. An alternative would be to designate certain areas as Conservation Reserves, or larger areas as National Parks. Unfortunately, many of bushland areas have already been approved (under the Planning Scheme) for future residential development.

Statutory backing does not necessarily ensure the preservation of natural areas. Although an expressed purpose of the *Wellington Park Act 1993* is for the preservation or protection of fauna and flora, 'major developments' as designated within this Act, may override this purpose. The proposed Skyway project proposes to build a dam at the headwaters of North West Bay River and a ski-field on the adjacent Thark Ridge (to the west of the summit of Mt. Wellington). This proposal would destroy some alpine areas, including some sites of the poorly-reserved *Helichrysum ledifolium* dominated heathland. It is therefore imperative that the needs of nature preservation be afforded greater recognition if any such legislation is to function as purported.

Planning for nature conservation is only the first, and theoretically the easiest step. In the short and long-term management of conservation areas requires both human and financial resources. Local governments often does not have these resources or expertise, and rely heavily State and Federal budgets. For the long-term preservation of remnant bush,

ongoing funding and complete cooperation between all levels of government is essential. The alternative is for areas of high conservation value to be managed by the State Government authorities which have greater resources and expertise in this field.

An important aspect of bushland management is fire management. To preserve a variety of vegetation types and maintain species diversity it is crucial that appropriate fire regimes be implemented. When this conflicts with the safety of people or property, alternatives must be sought. It is unfortunate that many people opt for a semi-rural lifestyle without taking responsibility for the very thing which makes that environment so desirable. The fuel reduction program must be managed in a way that it does not increase the chance of bushfires. For example, too frequent burning of shrubby woodlands and forests often selects for more flammable fire promoting species.

With the increase in residential development a corresponding increase in exotic species is inevitable. Most species are distributed by wind, water, birds and insects. In 1976 Ratkowsky and Ratkowsky recorded 132 introduced species in the Wellington Range (which included most of the present study area). This number of introduced species has undoubtedly increased. Exotic species are also introduced directly by humans. For example, the rot root fungus *Phytophthora cinnamomi*, can be introduced by soil transfer via machinery or even footwear. As yet this species, which potentially poses a great risk to vegetation in Tasmania, is not known to have reached Hobart. However, an awareness by managers of the potential threat of this species and other exotics is essential for the long-term viability of native bushland. Unfortunately this awareness too often arises only once the species becomes a problem.

A number of rare or threatened plant species are located in Hobart, many of which are unreserved in Tasmania. Since many of these recordings are old or unspecific, further work is needed to update this database. The urgency of this work is highlighted by the knowledge that urban expansion has caused the recent disappearance of at least one of these species *Euphrasia scabra* (Two Hundred and Eight Network 1994a) It is imperative that, at the very least, proposed subdivisions be surveyed.

This thesis has demonstrated the utility of synusiae-based mapping and its application to the management of peri-urban areas such as Hobart. The maps, accompanying attributes and subsequent analysis constitute a significant database for academics, planners and managers of these bushland areas. Further, the digital form of this information will allow it to be used and manipulated for a variety of ends well into the future. Planners and others, who may have little or no environmental background will be able to use this information as a resource. It is hoped this will enhance understanding of the bushland and aid in the implementation of policies appropriate for long term conservation or preservation to the benefit of all parties concerned.

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Appendix I Fires in Hobart

This appendix is a summary of the fires attended by Hobart City Council Officers from 1980/81 to 1992/93. The date and area (ha) burnt by each fire is given.

Appendix I (a) - Wildfires (bushfires)

Appendix I (b) - Control burns or fuel reduction burns

Appendix I (a): A summary of wildfires attended by Hobart City Council Officers during the period 1980/81 to 1992/93

	Total Area (ha)	80/81 (Date) (ha)	81/82 (Date) (ha)	82/83 (Date) (ha)	83/84 (Date) (ha)	84/85 (Date) (ha)	85/86 (Date) (ha)	86/87 (Date) (ha)	87/88 (Date) (ha)	88/89 (Date) (ha)	89/90 (Date) (ha)	90/91 (Date) (ha)	91/92 (Date) (ha)	92/93 (Date) (ha)
Alpine communities														
DA	17.3													
DA(ub)	16.1													
WA	129.7													
DA-WA	11.0													
Nc-AS	11.0													
Eucalyptus coccifera communities/associations														
Ec/AS	116.2													
Ec/H*	1.9													
Ec/S-H*	33.0													
Ec/R	14.0													
Ec-Ed/S*	6.1													
Eucalyptus urnigera communities/associations														
Eu/S-H*	43.0													
Eu/R	10.8													
Ec-Eu/S-H*	92.6													
Ed-Eu/S*	53.9													
Ed-Eu/R	9.2													
Eucalyptus delegetensis communities/shrub community														
Ed/S	125.4			23/1/83 40.8			? 19.0							
Ed/BS-S	49.7			23/1/83 6.8										
Ed/BS	12.7													
Ed/R	10.6			23/1/83 2.3										
S/SD	5.0			23/1/83 4.7										

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Appendix I (a): A summary of wildfires attended by Hobart City Council Officers during the period 1980/81 to 1992/93 *(cont.)*

	Total Area (ha)	80/81 (Date) (ha)	81/82 (Date) (ha)	82/83 (Date) (ha)	83/84 (Date) (ha)	84/85 (Date) (ha)	85/86 (Date) (ha)	86/87 (Date) (ha)	87/88 (Date) (ha)	88/89 (Date) (ha)	89/90 (Date) (ha)	90/91 (Date) (ha)	91/92 (Date) (ha)	92/93 (Date) (ha)
Sandstone communities on Mt. Wellington														
Ej/S*	4.2													
Ej/H*	2.5													
Ed-Ej/S*	33.0													
H*/SD	2.5			23/1/83 2.5										
Eucalyptus delegetensis cassociations														
Ed-Eo/BS-S	28.2			23/1/83 2.0										
Ed-Eo/S	86.1			23/1/83 24.6			27/10/85 3.3							
Ed-Er/BS-S	22.3													
Eucalyptus obliqua communities														
Eo/BS	87.8													
Eo/BS-S	195.8													
Eo/S	257.4		22/3/82 4.7	23/1/83 6.2 25/10/82 6.6 13/10/82 17.9										
Eo/S-H	127.7			23/1/83 59.1 13/10/82 4.5 13/10/82 1.6						7/3/89 1.9	19/12/89 4.5			
Eo/H	73.9			23/1/83 13.0						13/11/88 12.8				
Eucalyptus tenuiramis communities/associations														
Et/H	51.2			23/1/83 7.7										
Eo-Et/H	133.2		19/1/82 3.6	23/1/83 26.9 13/10/82 13.9				5--11 8.3			19/12/89 13.9			
Eo-Et/S-H	37.3			23/1/83 5.7										
Eucalypt-dominated mountain gullies														
Er/BS	67.2													
Eo-Er/BS	25.1		23/1/82 7.3*											
Eo-Er/BS-S	58.0						27/10/85 7.2							

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Appendix I (a): A summary of wildfires attended by Hobart City Council Officers during the period 1980/81 to 1992/93 *(cont.)*

	Total Area (ha)	80/81 (Date) (ha)	81/82 (Date) (ha)	82/83 (Date) (ha)	83/84 (Date) (ha)	84/85 (Date) (ha)	85/86 (Date) (ha)	86/87 (Date) (ha)	87/88 (Date) (ha)	88/89 (Date) (ha)	89/90 (Date) (ha)	90/91 (Date) (ha)	91/92 (Date) (ha)	92/93 (Date) (ha)
Rainforest/wet gully communities														
RF	7.9		22/3/82 1.8*											
BS	3.7													
Ad/BS	40.1		23/1/82 5.8*											
AD/BS-S	9.1													
Foothill Gullies (1) communities														
GS(2)	2.4													
Eg/GS(2)	28.0			25/8/82 3.6* 30/10/82 11.0*										
Foothill Gullies (1) communities														
Eg/GS	25.1													
Eg/S	19.9													
Eg-Eo/BS-S	237.2			3/11/82 21.3										
Eg-Eo/S	254.8	1/3/81 4.4	9/10/81 9.8	3/11/82 7.3				19/2/87 5.7 19/2/87 6.3	14/2/88 2.7	31/3/89 1.0		? 2.9		
Foothill 1 communities														
Ecd/H	0.5			13/10/82 0.2										
Eo-Ep/S-H	101.7	10/1/81 10.6	11/12/81 0.7	13/10/82 7.0	4/1/84 2.2 4/1/84 0.7			19/2/87 0.5 22/4/87 3.2		7/3/89 2.0 2/3/89 1.9	26/9/89 0.7			22/2/93 1.2
Foothill 2 communities														
Eo-Ev/S	42.8													
Eo-Ev/S-H	36.9	10/1/81 2.4 1/3/81 2.8	11/12/81 0.7		4/1/84 0.7 4/1/84 2.4		29/1/86 1.0							
Eo-Ev/H	8.9			3/11/82 0.7										
Eo-Ev/G-Pe	9.3								11/2/88 4.2					18/2/93 4.2

(continued next page)

Appendix I (a): A summary of wildfires attended by Hobart City Council Officers during the period 1980/81 to 1992/93 *(cont.)*

	Total Area (ha)	80/81 (Date) (ha)	81/82 (Date) (ha)	82/83 (Date) (ha)	83/84 (Date) (ha)	84/85 (Date) (ha)	85/86 (Date) (ha)	86/87 (Date) (ha)	87/88 (Date) (ha)	88/89 (Date) (ha)	89/90 (Date) (ha)	90/91 (Date) (ha)	91/92 (Date) (ha)	92/93 (Date) (ha)
Foothill 3 communities														
Ea/S-H	4.2													
Ea/S-H(s)	5.3													
Ea/H	3.0													
Ea-Ev/H	49.7						29/1/86 8.0							
Ea-Eo/H	11.4													
Ea-Eo/S-H	17.6													
Foothill 4 communities														
Ea-Et/S-H	9.7		9/10/81 0.6											
Et-Ev/S-H	5.3													
Ea-Eg/S-H	3.1						29/1/86 0.8							
Foothill 5 communities														
Ep/S	37.2			5/11/82 1.2 30/10/82 14.7										
Ep/S-H	46.3		11/12/81 16.1	13/10/82 7.4	4/1/84 16.1						26/9/89 0.6			
Ep/H	109.3			11/10/82 1.2				19/2/87 17.7		7/3/89 3.5				22/2/93 0.8
Ep/G	47.1			30/10/82 1.8						2/3/89 3.0				
Foothill 6 communities														
Al/G	35.4			30/10/82 2.1			1/30/04 4.7							
Ep-Ev/S	91.5			5/11/82 3.3 3/10/82 4.7 19/9/82 3.7				19/2/87 1.4				6/3/91 2.8	? 2.0	
Ep-Ev/S-H	29.7							19/2/87 1.6 22/4/87 2.5						
Ep-Ev/H	113.2	10/1/81 3.7	9/10/81 3.5	19/12/82 8.3 11/10/82 2.7 29/10/82 1.8	19-1 8.3			19/2/87 5.5		17/11/88 1.8				
Ep-Ev/G	36.1			19/12/82 6.0	19-1 6.0		29/1/86 18.4					6/3/91 1.2		

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Appendix I (a): A summary of wildfires attended by Hobart City Council Officers during the period 1980/81 to 1992/93 *(cont.)*

	Total Area (ha)	80/81 (Date) (ha)	81/82 (Date) (ha)	82/83 (Date) (ha)	83/84 (Date) (ha)	84/85 (Date) (ha)	85/86 (Date) (ha)	86/87 (Date) (ha)	87/88 (Date) (ha)	88/89 (Date) (ha)	89/90 (Date) (ha)	90/91 (Date) (ha)	91/92 (Date) (ha)	92/93 (Date) (ha)
Foothill 7 communities														
Eg-Ep/S	101.9	1/3/81 0.8		20/1/83 3.9 16/9/82 4.5 30/10/82 2.0 5/11/82 0.7					12/2/88 3.9					18/12/92 1.8
Eg-Ep/S-H	33.1			30/10/82 1.5 19/12/82 4.6	9/1/84 4.6									
Eg-Ep/H	49.4						29/1/86 3.7							
Eg-Ep/G	42.5			20/1/83 18.2			29/1/86 2.0		11/2/88 36.6				18/2/92 23.6	
Foothill 8 communities														
Ev/S	79.4							19/2/87 24.4 19/2/87 1.5						
Ev/G	25.1	1/3/81 1.0					29/1/86 1.4	19/2/87 6.5 19/3/87 3.3						
Eg-Ev/G	10.7	1/3/81 2.2												
Eg-Ev/H	11.0													
Eg-Ev/S	14.3													
Foothill 9 communities														
Eov/H	4.0													
Eov-Ep/H	103.6		21/10/81 1.1	30/10/82 6.1 29/10/82 1.8						7/3/89 10.4 17/11/88 1.8				
Eov-Ep/S-H	29.8		21/10/81 2.6	16/9/82 1.0 30/10/82 0.6 5/11/82 0.9						7/3/89 1.8				
Eg-Eov/S	13.1			29/10/82 2.6						17/11/89 2.6				

Shading indicates areas which have been burnt more than once in the period 1980/81 to 1992/3

* Suspect fire maps are in error as ground truthing shows no evidence of fires

(continued next page)

Appendix I (b): A summary of control burns attended by Hobart City Council Officers during the period 1980/81 to 1992/93

	Total Area (ha)	80/81 (Date) (ha)	81/82 (Date) (ha)	82/83 (Date) (ha)	83/84 (Date) (ha)	84/85 (Date) (ha)	85/86 (Date) (ha)	86/87 (Date) (ha)	87/88 (Date) (ha)	88/89 (Date) (ha)	89/90 (Date) (ha)	90/91 (Date) (ha)	91/92 (Date) (ha)	92/93 (Date) (ha)
Alpine communities														
DA	17.3													
DA(ub)	16.1													
WA	129.7													
DA-WA	11.0													
Nc-AS	11.0													
Eucalyptus coccifera communities/associations														
Ec/AS	116.2													
Ec/H*	1.9													
Ec/S-H*	33.0													
Ec/R	14.0													
Ec-Ed/S*	6.1													
Eucalyptus urnigera communities/associations														
Eu/S-H*	48.0													
Eu/R	10.8													
Ec-Eu/S-H*	92.6													
Ed-Eu/S*	53.9													
Ed-Eu/R	9.2													
Eucalyptus delegetensis communities/shrub sommunity														
Ed/S	125.4													
Ed/BS-S	49.7													
Ed/BS	12.7													
Ed/R	10.6													
S/SD	5.0													

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Appendix I (b): A summary of control burns attended by Hobart City Council Officers during the period 1980/81 to 1992/93 *(cont.)*

	Total Area (ha)	80/81 (Date) (ha)	81/82 (Date) (ha)	82/83 (Date) (ha)	83/84 (Date) (ha)	84/85 (Date) (ha)	85/86 (Date) (ha)	86/87 (Date) (ha)	87/88 (Date) (ha)	88/89 (Date) (ha)	89/90 (Date) (ha)	90/91 (Date) (ha)	91/92 (Date) (ha)	92/93 (Date) (ha)
Sandstone communities on Mt. Wellington														
EJ/S*	4.2													
EJ/H*	2.5													
Ed-EJ/S*	33.0													
H*/SD	2.5													
Eucalyptus delegetensis associations														
Ed-Eo/BS-S	28.3													
Ed-Eo/S	86.1													
Ed-Er/BS-S	22.3													
Eucalyptus obliqua communities														
Eo/BS	87.8													
Eo/BS-S	195.8		25/11/81 1.6 27/11/81 1.6	25/10/82 1.6		23/10/84 2.8		? 2.9						
Eo/S	257.4		25/11/81 3.3	3/5/83 0.5			13/3/86 17.6	? 5.1 2/10/86 4.3 29/10/86 17.6 6/10/86 11.0 6/4/86 0.5	16/12/87 3.4 ? 4.3 ? 9.1		? 17.6	10/4/91 8.2 10/4/91 2.6		4th/93 0.7
Eo/S-H	127.7			10--12 3.4 25-10 2.0		3--5 6.8	10/4/86 3.4	6/4/87 6.8	5/1/88 5.9		15/11/89 3.4			
Eo/H	73.9	9/1/81 12.7			? 9.0		15/11/85 4.0 12/6/85 12.7	? 10.4			25/10/89 12.7			
Eucalyptus tenuiramis communities/associations														
Et/H	51.2		15/11/81 0.5	10/12/82 1.4	11/1/84 4.6 2/12/83 2.1 13/11/83 2.8		14/4/86 8.8 10/4/86 1.4 14/2/86 2.8	13/11/86 1.2	5/1/88 2.3 ? 4.0		15/11/89 1.4	15-11 3.5 11/4/91 3.2		Apr 4.0
Eo-Et/H	133.2	9/1/81 16.1		2/11/82 10.8	2/12/83 5.7 11/1/84 6.7 3/5/84 2.7 13/11/83 2.3		25/11/85 1.0 14/1/86 17.8 12/6/85 16.1 14/2/86 2.3	10/11/86 10.8 6/10/86 2.2 6/4/87 2.7			25/10/89 16.1		11/9/91 9.9	17/11/92 6.2 17/11/92 0.6
Eo-Et/S-H	37.4						14/4/86 9.1				Nov 2.0			

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Appendix I (b): A summary of control burns attended by Hobart City Council Officers during the period 1980/81 to 1992/93 *(cont.)*

	Total Area (ha)	80/81 (Date) (ha)	81/82 (Date) (ha)	82/83 (Date) (ha)	83/84 (Date) (ha)	84/85 (Date) (ha)	85/86 (Date) (ha)	86/87 (Date) (ha)	87/88 (Date) (ha)	88/89 (Date) (ha)	89/90 (Date) (ha)	90/91 (Date) (ha)	91/92 (Date) (ha)	92/93 (Date) (ha)
Eucalypt-dominated mountain gully communities														
Er/BS	67.2		25/11/81 28.7*											
Eo-Er/BS	25.1													
Eo-Er/BS-S	58.0		25/11/81 11.1				13-3 4.6	29-10 4.6			? 4.6			
Rainforest/wet gully communities														
RF	7.9													
BS	3.7													
Ad/BS	40.1		27/11/81 1.5											
AD/BS-S	9.1					23/10/84 0.7								
Foothill Gullies (1) communities														
GS(2)	2.4													
Eg/GS(2)	28.0		28/2/82 1.9*	21/9/82 2.1* 21/9/82 0.7				12-11 1.9*						
Foothill Gullies (2) communities														
Eg/GS	25.1		27/11/81 5.0*	22/10/82 9.5*					21/1/88 9.5*	14/1/89 9.5*				
Eg/S	19.9													
Eg-Eo/BS-S	237.2	9/1/81 8.0		15/11/82 2.7	14/12/83 6.5	3/9/84 9.5	12/6/85 8.0	6/10/86 11.1 25/11/86 4.6 2/10/86 0.7	17/12/87 39.2 ? 0.7		25/10/89 8.0 20-12 0.7			
Eg-Eo/S	254.8		27/1/81 1.6	22/10/82 5.0 10/12/82 3.7	11/1/84 0.5		25/11/85 6.3 13/3/86 6.9 10/4/86 3.7	14/4/87 1.3 29/10/86 6.9 ? 4.2 14/12/86 3.9	21/1/88 5.0 ? 4.2	14/1/89 5.0 4th 1.1	? 6.9 15/11/89 3.7 30/11/89 3.5			
Foothill 1 communities														
Ecd/11	0.5													
Eo-Ep/S-H	101.7		9/12/81 10.9		14/12/83 1.1			14/12/86 1.2						

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Appendix I (b): A summary of control burns attended by Hobart City Council Officers during the period 1980/81 to 1992/93 *(cont.)*

	Total Area (ha)	80/81 (Date) (ha)	81/82 (Date) (ha)	82/83 (Date) (ha)	83/84 (Date) (ha)	84/85 (Date) (ha)	85/86 (Date) (ha)	86/87 (Date) (ha)	87/88 (Date) (ha)	88/89 (Date) (ha)	89/90 (Date) (ha)	90/91 (Date) (ha)	91/92 (Date) (ha)	92/93 (Date) (ha)
Foothill 2 communities														
Eo-Ev/S	42.8					3/9/84 0.5			? 1.4					
Eo-Ev/S-H	36.9				11/1/84 7.9				11/1/88 2.9 5/1/88 1.8					
Eo-Ev/H	8.9		27/11/81 0.9	22/10/82 5.5					21/1/88 5.5 5/1/88 3.2	14/1/89 5.5				
Eo-Ev/G-Pe	9.3													
Foothill 3 communities														
Ea/S-H	4.2				23/11/83 2.7		15/4/86 2.7	30/10/87 1.6						
Ea/S-H(s)	5.3							? 2.8						
Ea/H	3.0							13/11/86 1.1						
Ea-Ev/H	49.7						14/2/86 2.6	30/10/86 1.3	17/12/87 6.5			15/11/90 2.4 10/4/91 3.1		
Ea-Eo/H	11.4				13/11/83 6.5		14/2/86 6.5 19/1/86 1.1	6/10/86 0.9	4/1/88 1.1 ? 1.6			11/4/91 0.9		4th/93* 1.1
Ea-Eo/S-H	17.6				13/11/83 5.0		14/2/86 5.0	30/10/86 2.4	11/1/88 1.3			10/4/91 0.8	3rd/92 2.3	
Foothill 4 communities														
Ea-Et/S-H	9.7													
Et-Ev/S-H	5.3										12th/89 0.8			
Ea-Eg/S-H	3.1													
Foothill 5 communities														
Ep/S	37.2			1/11/82 2.6										
Ep/S-H	46.3													
Ep/H	109.3	5/1/81 4.2	9/12/81 7.4			3/9/84 4.2		14/12/86 5.8						
Ep/G	47.1				1/2/84 2.6 14/12/83 3.1	3/9/84 20.6		6-10* 5.0				15-11 2.1 11-4 2.8		

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Appendix I (b): A summary of control burns attended by Hobart City Council Officers during the period 1980/81 to 1992/93 *(cont.)*

	Total Area (ha)	80/81 (Date) (ha)	81/82 (Date) (ha)	82/83 (Date) (ha)	83/84 (Date) (ha)	84/85 (Date) (ha)	85/86 (Date) (ha)	86/87 (Date) (ha)	87/88 (Date) (ha)	88/89 (Date) (ha)	89/90 (Date) (ha)	90/91 (Date) (ha)	91/92 (Date) (ha)	92/93 (Date) (ha)
Foothill 6 communities														
A1/G	35.4	25/11/80 0.8		3/12/82 0.8 9/12/82 2.2	21/1/84 2.2	7/11/84 2.2		11/12/86 0.8						
Ep-Ev/S	91.5	25/11/80 1.1 25/11/80 1.2		14/12/82 1.1 3/12/82 1.2 21/9/82 3.7 1/11/82 2.1				? 2.9 5/2/87 1.1 11/12/86 1.2	5/1/88 1.1		18/1/90 5.6			
Ep-Ev/S-H	29.7								17/12/87 2.1					
Ep-Ev/H	113.2	5/1/81 14.6				? 2.2 3/9/84 3.3		14/12/86 0.7	17/12/87 2.9	4th/89 3.5				
Ep-Ev/G	36.1				23/11/83 1.6		15/4/86 1.6							
Foothill 7 communities														
Eg-Ep/S	101.9			21/9/82 5.2 1/11/82 0.8										
Eg-Ep/S-H	33.1	5/1/81 2.7						14/12/86 6.5						
Eg-Ep/H	49.4												11/12/91 7.4 2nd/92 7.4	
Eg-Ep/G	42.5												11/12/91 2.1 2nd/92 2.1	
Foothill 8 communities														
Ev/S	79.4									2nd/89 9.8		14/11/90 14.0	14/11/91 9.8 2/12/91 9.8 1st/92 9.8	
Ev/G	25.1								? 2.1					
Eg-Ev/G	10.7				2/5/84 3.3									
Eg-Ev/H	11.0													
Eg-Ev/S	14.3									2nd/89 3.4			14/11/91 3.4 2/12/91 3.4 1st/92 3.4	

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Appendix I (b): A summary of control burns attended by Hobart City Council Officers during the period 1980/81 to 1992/93 *(cont.)*

	Total Area (ha)	80/81 (Date) (ha)	81/82 (Date) (ha)	82/83 (Date) (ha)	83/84 (Date) (ha)	84/85 (Date) (ha)	85/86 (Date) (ha)	86/87 (Date) (ha)	87/88 (Date) (ha)	88/89 (Date) (ha)	89/90 (Date) (ha)	90/91 (Date) (ha)	91/92 (Date) (ha)	92/93 (Date) (ha)
Foothill 9 communities														
Eov/H	4.0		21/9/81 0.8											
Eov-Ep/H	103.6													
Eov-Ep/S-H	29.8			1/11/82 1.9		? 3.1								
Eg-Eov/S	13.1													

Shading indicates areas which have been burnt more than once in the period 1980/81 to 1992/3

* Suspect fire maps are in error as ground truthing shows no evidence of fires

Appendix II Plant communities found in Hobart

This appendix is a list of the communities found in Hobart. Each community is listed according to the synusia(e) present using the system of notation described in Section 3.2.1. These are correlated to the synusia(e) present in each stratum.

Appendix II: List of communities in Hobart (based on synusiae)

Community	Dominant Stratum	Second Stratum	Understorey 3rd Stratum	Ground layer 4th Stratum
Ad/BS/F	Ad		BS	F
Ad/BS/F	Ad		BS	F
Ad/BS/F[RF]	Ad		BS	F
Ad/BS/F	Ad		BS	F
Ad/BS/F[RF]	Ad		BS	F
Ad/BS/F[RF]	Ad		BS	F
Ad/BS/F[RF]	Ad		BS	F
Ad/BS/F	Ad		BS	F
Ad/BS-S/F	Ad		BS-S	F
Ad/BS-S/F	Ad		BS-S	F
Al/S/G	Al		S	G
Al/S/G	Al		S	G
Al/S/G	Al		S	G
Al/S/G	Al		S	G
Al/S/G-SD	Al		S	G-SD
Al/S/SD-B	Al		S	SD-Bare
Al/S/G-B	Al			G-Bare
BS/F[RF]	BS			F
BS/F[RF]	BS			F
DA(sp)/R	DA			R
DA(sp)/R	DA			R
DA/R	DA			R
DA/R	DA			R
DA/R	DA			R
DA/R	DA			R
DA/R	DA			R
DA/R	DA			R
DA(sp)/R	DA			R
DA(sp)/R	DA			R
DA(sp)/R	DA			R
DA(sp)/R	DA			R
DA/R	DA			R
DA(sp)/R	DA			R
DA(sp)/R	DA			R
DA(ub)/R	DA(ub)			R
DA(ub)/R	DA(ub)			R
DA(ub)/R	DA(ub)			R
DA(ub)/R	DA(ub)			R
DA(ub)/R	DA(ub)			R
DA(ub)/R	DA(ub)			R
DA/WA/R	DA/WA			R
DA/WA/R	DA/WA			R
DA/WA/R	DA/WA			R
DA/WA/R	DA/WA			R
DA/WA/R	DA/WA			
Ea/H/B	Ea		H	Bare
Ea/Al/S-H/G	Ea	Al	S-H	G
Ea/S-H(s)/B	Ea		S-H(s)	Bare
Ea-Eg/S-H/B	Ea-Eg		S-H	B
Eo-Ea/H/B	Ea-Eo		H	Bare
Eo-Ea/H/B	Ea-Eo		H	Bare
Ea-Eo/H/B	Ea-Eo		H	Bare
Eo-Ea/H/Pe-B	Ea-Eo		H	Pe-Bare
Ea-Eo/Al/S-H/G-SD	Ea-Eo	Al	S-H	G-SD
Eo-Ea/S-H/Pe	Ea-Eo		S-H	Pe
Eo-Ea/S-H/Pe	Ea-Eo		S-H	Pe
Ea-Eo/S-H/Pe	Ea-Eo		S-H	Pe
Ea-Et/S-H/G	Ea-Et		S-H	G
Ea-Ev/H/B	Ea-Ev		H	Bare
Ea-Ev/H/B	Ea-Ev		H	Bare

Appendix II: List of communities in Hobart (based on synusiae) *(cont.)*

Community	Dominant Stratum	Second Stratum	Understorey 3rd Stratum	Ground layer 4th Stratum
Ev-Ea/H/G	Ea-Ev		H	G
Ea-Ev/H/G	Ea-Ev		H	G
Ev-Ea/H/G	Ea-Ev		H	G
Ea-Ev/H/G-B	Ea-Ev		H	G-Bare
Ea-Ev/H/G-B	Ea-Ev		H	G-Bare
Ea-Ev/H/G-B	Ea-Ev		H	G-Bare
Ec/AS/R	Ec		AS	R
Ec/AS/R	Ec		AS	R
Ec(sp)/AS/R	Ec		AS	R
Ec(sp)/AS/R	Ec		AS	R
Ec/AS/R	Ec		AS	R
Ec(sp)/AS/R	Ec		AS	R
Ec/AS/R	Ec		AS	R
Ec/AS/R	Ec		AS	R
Ec/AS/R	Ec		AS	R
Ec/AS/R	Ec		AS	R
Ec/AS/R	Ec		AS	R
Ec/H*	Ec		H*	
Ec/S-H*/R	Ec		S-H*	R
Ec/S-H*/R	Ec		S-H*	R
Ec/S-H*/R	Ec		S-H*	R
Ec(sp)/S-H*/R	Ec		S-H*	R
Ec/R	Ec			R
Ec(sp)/R	Ec			R
Ec(sp)/R	Ec			R
Ec(sp)/R	Ec			R
Ec(sp)/R	Ec			R
Ec(sp)/R	Ec			R
Ec(sp)/R	Ec			R
Ec(sp)/R	Ec			R
Ec(sp)/R	Ec			R
Ec(sp)/R	Ec			R
Ec(sp)/R	Ec			R
Ec(sp)/R	Ec			R
Ec/S-H*/R	Ec			
Ec/AS/R	Ec			
Ec(sp)/AS/R	Ec			
Ed-Ec/S*/R	Ec-Ed		S*	R
Eu-Ec/S-H*/R	Ec-Eu		S-H*	R
Ec-Eu/S-H*/R	Ec-Eu		S-H*	R
Ec-Eu(sp)/S-H*/R	Ec-Eu		S-H*	R
Ec-Eu(sp)/S-H*/R	Ec-Eu		S-H*	R
Ec-Eu/S-H*/R	Ec-Eu		S-H*	R
Ec-Eu/S-H*/SD	Ec-Eu		S-H*	SD
Ec-Eu/S-H*/SD	Ec-Eu		S-H*	SD
Eu-Ec/S-H*/SD	Ec-Eu		S-H*	SD
Eu-Ec/S-H*/SD	Ec-Eu		S-H*	SD
Ecd/H/SD	Ecd		H	SD
Ed(sp)/Ad/BS/F	Ed	Ad	BS	F
Ed(sp)/Ad/BS/F	Ed	Ad	BS	F
Ed/BS-S/R	Ed		BS-S	R
Ed/BS-S/SD	Ed		BS-S	SD
Ed/BS-S/SD	Ed		BS-S	SD
Ed/BS-S/SD	Ed		BS-S	SD
Ed/Ad/BS-S/SD-F	Ed	Ad	BS-S	SD-F
Ed/BS-S/SD-F	Ed		BS-S	SD-F
Ed/BS-S/SD-F	Ed		BS-S	SD-F
Ed/BS-S/SD-F	Ed		BS-S	SD-F
Ed/S/F	Ed		S	F
Ed/S/F	Ed		S	F

Appendix II: List of communities in Hobart (based on synusiae) *(cont.)*

Community	Dominant Stratum	Second Stratum	Understorey 3rd Stratum	Ground layer 4th Stratum
Ed/S/F	Ed		S	F
Ed/S/Pe	Ed		S	Pe
Ed(sp)/S/R	Ed		S	R
Ed/S/R	Ed		S	R
Ed/S/SD	Ed		S	SD
Ed/S/SD	Ed		S	SD
Ed/S/SD-R	Ed		S	SD-R
Ed(sp)/R	Ed			R
Ed(sp)/R	Ed			R
Ed/R	Ed			R
Ed(sp)/R	Ed			R
Ed(sp)/R	Ed			R
Ed(sp)/R	Ed			R
Ed(sp)/R	Ed			R
Ed(sp)/R	Ed			R
Ed(sp)/R	Ed			R
Ed-Ej/S*/F	Ed-Ej		S*	F
Ed-Ej/S*/F	Ed-Ej		S*	F
Ed-Ej/S*/R	Ed-Ej		S*	R
Ed-Ej/S*/SD	Ed-Ej		S*	SD
Ej-Ed/S*/SD	Ed-Ej		S*	SD
Ej-Ed/S*/SD	Ed-Ej		S*	SD
Ed-Ej/S*/SD	Ed-Ej		S*	SD
Ed-Eo/BS-S/F	Ed-Eo		BS-S	F
Ed-Eo/BS-S/F	Ed-Eo		BS-S	F
Ed-Eo/BS-S/F	Ed-Eo		BS-S	F
Ed-Eo/BS-S/F	Ed-Eo		BS-S	F
Ed-Eo/Ad/BS-S/SD	Ed-Eo	Ad	BS-S	SD
Ed-Eo/BS-S/SD	Ed-Eo		BS-S	SD
Ed-Eo/Ad/S	Ed-Eo	Ad	S	F
Ed-Eo/S/F	Ed-Eo		S	F
Ed-Eo/Ad/S/Pe	Ed-Eo	Ad	S	Pe
Eo-Ed/Av/S/SD	Ed-Eo	Av	S	SD
Ed-Eo/S/SD	Ed-Eo		S	SD
Ed-Eo/S/SD	Ed-Eo		S	SD
Ed-Eo/S/SD	Ed-Eo		S	SD
Ed-Eo/S/SD	Ed-Eo		S	SD
Ed-Eo/Av/S/SD-F	Ed-Eo	Av	S	SD-F
Er-Ed/BS-S/F	Ed-Er		BS-S	F
Ed-Er/BS-S/SD-F	Ed-Er		BS-S	SD-F
Ed-Eu/S*/F	Ed-Eu		S*	F
Ed-Eu/S*/R	Ed-Eu		S*	R
Ed-Eu/S*/R	Ed-Eu		S*	R
Ed-Eu/S*/R	Ed-Eu		S*	R
Ed-Eu/S*R	Ed-Eu		S*	R
Eu-Ed/S*/R	Ed-Eu		S*	R
Ed-Eu/S*/R	Ed-Eu		S*	R
Eu-Ed/S*/SD	Ed-Eu		S*	SD
Ed-Eu/S*/SD	Ed-Eu		S*	SD
Ed-Eu/S*/SD	Ed-Eu		S*	SD
Ed-Eu/S*/SD	Ed-Eu		S*	SD
Eu-Ed/S*/SD	Ed-Eu		S*	SD
Ed-Eu/S*/SD-R	Ed-Eu		S*	SD-R
Ed-Eu/R	Ed-Eu			R
Ed-Eu(sp)/R	Ed-Eu			R
Eg/Ad/GS/F	Eg	Ad	GS	F
Eg/Ad/GS/F	Eg	Ad	GS	F
Eg/GS/F	Eg		GS	F
Eg/Ad/GS/F-SD	Eg	Ad	GS	F-SD
Eg/Ad/GS/F-SD	Eg	Ad	GS	F-SD

Appendix II: List of communities in Hobart (based on synusiae) *(cont.)*

Community	Dominant Stratum	Second Stratum	Understorey 3rd Stratum	Ground layer 4th Stratum
Eg(sp)/GS(2)/F-SD	Eg		GS(2)	F-SD
Eg(sp)/GS(2)/F-SD	Eg		GS(2)	F-SD
Eg/GS(2)/F-SD	Eg		GS(2)	F-SD
Eg/GS(2)/SD	Eg		GS(2)	SD
Eg/S/SD	Eg		S	SD
Eg/S/SD-R	Eg		S	SD-R
Eg-Ep/[S]/G	Eg-Eo		[S]	G
Eg-Eo/Ad/BS-S/F	Eg-Eo	Ad	BS-S	F
Eo-Eg/Ad/BS-S/F	Eg-Eo	Ad	BS-S	F
Eo-Eg/Ad/BS-S/F	Eg-Eo	Ad	BS-S	F
Eo-Eg/Ad/BS-S/F	Eg-Eo	Ad	BS-S	F
Eo-Eg/Ad/BS-S/F	Eg-Eo	Ad	BS-S	F
Eo-Eg/Ad/BS-S/F	Eg-Eo	Ad	BS-S	F
Eo-Eg/Ad/BS-S/F	Eg-Eo	Ad	BS-S	F
Eg-Eo/Ad/BS-S/F	Eg-Eo	Ad	BS-S	F
Eg-Eo/BS-S/F	Eg-Eo		BS-S	F
Eg-Eo/BS-S/F	Eg-Eo		BS-S	F
Eo-Eg/Ad/BS-S/F-SD	Eg-Eo	Ad	BS-S	F-SD
Eo-Eg/Ad/BS-S/F-SD	Eg-Eo	Ad	BS-S	F-SD
Eo-Eg/Av/BS-S/SD	Eg-Eo	Av	BS-S	SD
Eo-Eg/Av/BS-S/SD	Eg-Eo	Av	BS-S	SD
Eo-Eg/Av/BS-S/SD	Eg-Eo	Av	BS-S	SD
Eo-Eg/BS-S/SD	Eg-Eo		BS-S	SD
Eo-Eg/Av/BS-S/SD-F	Eg-Eo	Av	BS-S	SD-F
Eo-Eg/BS-S/SD-F	Eg-Eo		BS-S	SD-F
Eo-Eg/S/B	Eg-Eo		S	Bare
Eo-Eg/Ad/S/Pe	Eg-Eo	Ad	S	Pe
Eg-Eo/Ad/S/Pe	Eg-Eo	Ad	S	Pe
Eo-Eg/Ad/S/Pe	Eg-Eo	Ad	S	Pe
Eo-Eg/Ad/S/Pe	Eg-Eo	Ad	S	Pe
Eo-Eg/Ad/S/Pe	Eg-Eo	Ad	S	Pe
Eg-Eo/Am/S/Pe	Eg-Eo	Am	S	Pe
Eo-Eg/S/Pe	Eg-Eo		S	Pe
Eg-Eo/S/Pe	Eg-Eo		S	Pe
Eo-Eg/S/Pe	Eg-Eo		S	Pe
Eo-Eg/S/Pe-SD	Eg-Eo		S	Pe-SD
Eg-Eo/S/Pe-SD	Eg-Eo		S	Pe-SD
Eg-Eo/Ad/S/SD	Eg-Eo	Ad	S	SD
Eg-Eo/Al/S/SD	Eg-Eo	Al	S	SD
Eo-Eg/S/SD	Eg-Eo		S	SD
Eg-Eo/S/SD	Eg-Eo		S	SD
Eg-Eo/S/SD	Eg-Eo		S	SD
Eo-Eg/S/SD	Eg-Eo		S	SD
Eg-Eo/S/SD	Eg-Eo		S	SD
Eo-Eg/S/SD	Eg-Eo		S	SD
Eo-Eg/S/SD-G	Eg-Eo		S	SD-G
Eo-Eg/Ad/S/SD-Pe	Eg-Eo	Ad	S	SD-Pe
Eg-Eov/S/SD	Eg-Eov		S	SD
Eg-Eov/S/SD	Eg-Eov		S	SD
Eg-Eov/S/SD-G	Eg-Eov		S	SD-G
Eg-Ep/[H]/G	Eg-Ep		[H]	G
Eg-Ep/[H]/G	Eg-Ep		[H]	G
Eg-Ep/[S]/[Pe-G]	Eg-Ep		[S]	[Pe-G]
Ep-Eg/H/G	Eg-Ep		H	G
Eg-Ep/H/G	Eg-Ep		H	G
Ep-Eg/H/G	Eg-Ep		H	G
Eg-Ep/H/G	Eg-Ep		H	G
Eg-Ep/H/Go	Eg-Ep		H	Gorse
Ep-Eg/H/SD	Eg-Ep		H	SD
Ep-Eg/H/SD	Eg-Ep		H	SD

Appendix II: List of communities in Hobart (based on synusiae) *(cont.)*

Community	Dominant Stratum	Second Stratum	Understorey 3rd Stratum	Ground layer 4th Stratum
Eg-Ep/H/SD	Eg-Ep		H	SD
Eg-Ep/S/G	Eg-Ep		S	G
Eg-Ep/S/G	Eg-Ep		S	G
Eg-Ep/S/G	Eg-Ep		S	G
Eg-Ep/S/G	Eg-Ep		S	G
Eg-Ep/S/G	Eg-Ep		S	G
Eg-Ep(sp)/S/G	Eg-Ep		S	G
Eg-Ep/S/G	Eg-Ep		S	G
Eg-Ep/S/G	Eg-Ep		S	G
Ep-Eg/S/G	Eg-Ep		S	G
Eg-Ep/S/G-SD	Eg-Ep		S	G-SD
Eg-Ep/S/Sd	Eg-Ep		S	SD
Eg-Ep/Al/S/SD-B	Eg-Ep	Al	S	SD-Bare
Eg-Ep/S/SD-G	Eg-Ep		S	SD-G
Eg-Ep/S/SD-G	Eg-Ep		S	SD-G
Ep-Eg/S/SD-G	Eg-Ep		S	SD-G
Eg-Ep/S/SD-R	Eg-Ep		S	SD-R
Eg-Ep/S-H/G	Eg-Ep		S-H	G
Eg-Ep/S-H/G-SD	Eg-Ep		S-H	G-SD
Eg-Ep/S-H/G-SD	Eg-Ep		S-H	G-SD
Ep-Eg/Ad/S-H/SD-G	Eg-Ep	Ad	S-H	SD-G
Eg-Ep/S-H/SD-G	Eg-Ep		S-H	SD-G
Eg-Ep/S-H/SD-G	Eg-Ep		S-H	SD-G
Ep-Eg/S-H/SD-G	Eg-Ep		S-H	SD-G
Ev-Eg/(S)/G	Eg-Ev		(S)	G
Eg-Ev/(S)/G	Eg-Ev		(S)	G
Eg-Ev/[S]/G	Eg-Ev		[S]	G
Eg-Ev/H/G	Eg-Ev		H	G
Ev-Eg/H/G	Eg-Ev		H	G-SD
Ev-Eg/Av/S/G	Eg-Ev	Av	S	G
Eg-Ev/S/G	Eg-Ev		S	G
Ev-Eg/S/Pe-G	Eg-Ev		S	Pe-G
Eg-Ev/Ad/S/SD-G	Eg-Ev	Ad	S	SD-G
Ej/H*/SD	Ej		H*	SD
Ej(sp)/H*/SD	Ej		H*	SD
Ej/S*/SD	Ej		S*	SD
Eo(sp)/Ad/BS/F	Eo	Ad	BS	F
Eo(sp)/Ad/BS/F	Eo	Ad	BS	F
Eo/Ad/BS/F	Eo	Ad	BS	F
Eo(sp)/Ad/BS/F	Eo	Ad	BS	F
Eo(sp)/Ad/BS/F	Eo	Ad	BS	F
Eo/Ad/BS/F	Eo	Ad	BS	F
Eo(sp)/Ad/BS/F	Eo	Ad	BS	F
Eo(sp)/Ad/BS/F	Eo	Ad	BS	F
Eo/Ad/BS/F	Eo	Ad	BS	F
Eo/Ad/BS/F	Eo	Ad	BS	F
Eo(sp)/Ad/BS/F	Eo	Ad	BS	F
Eo/BS/F	Eo		BS	F
Eo(sp)/BS/F	Eo		BS	F
Eo/Ad/BS/F	Eo		BS	F
Eo/BS/F	Eo		BS	F
Eo/BS/F[RF]	Eo		BS	F
Eo(sp)/Ad/BS/SD-F	Eo	Ad	BS	SD-F
Eo/Ad/BS-S/F	Eo	Ad	BS-S	F
Eo/Av/BS-S/F	Eo	Av	BS-S	F
Eo/Av/BS-S/F	Eo	Av	BS-S	F
Eo/Av/BS-S/F	Eo	Av	BS-S	F
Eo/BS-S/F	Eo		BS-S	F
Eo/Ad/BS-S/F	Eo		BS-S	F
Eo/Ad/BS-S/F-SD	Eo	Ad	BS-S	F-SD

Appendix II: List of communities in Hobart (based on synusiae) *(cont.)*

Community	Dominant Stratum	Second Stratum	Understorey 3rd Stratum	Ground layer 4th Stratum
Eo/Ad/BS-S/F-SD	Eo	Ad	BS-S	F-SD
Eo/Ad/BS-S/F-SD	Eo	Ad	BS-S	F-SD
Eo/Av/BS-S/F-SD	Eo	Av	BS-S	F-SD
Eo/BS-S/F-SD	Eo		BS-S	F-SD
Eo/Ad/BS-S/Pe	Eo	Ad	BS-S	Pe
Eo/Av/BS-S/Pe	Eo	Av	BS-S	Pe
Eo/BS-S/Pe	Eo		BS-S	Pe
Eo/Ad/BS-S/SD-F	Eo	Ad	BS-S	SD-F
Eo/BS-S/SD-F	Eo		BS-S	SD-F
Eo/BS-S/SD-F	Eo		BS-S	SD-F
Eo/H/B	Eo		H	Bare
Eo/H/B	Eo		H	Bare
Eo/H/B	Eo		H	Bare
Eo/Ad/H/Pe	Eo	Ad	H	Pe
Eo/Av/H/Pe	Eo	Av	H	Pe
Eo/H/Pe	Eo		H	Pe
Eo/H/Pe	Eo		H	Pe
Eo/H/Pe	Eo		H	Pe
Eo/H/Pe/B	Eo		H	Pe-Bare
Eo/H/Pe/B	Eo		H	Pe-Bare
Eo/H/SD	Eo		H	SD
Eo/Ad/S/F	Eo	Ad	S	F
Eo/Av/S/F	Eo	Av	S	F
Eo/Av/S/F	Eo	Av	S	F
Eo/S/F	Eo		S	F
Eo/Ad/S/Pe	Eo	Ad	S	Pe
Eo/Ad/S/Pe	Eo	Ad	S	Pe
Eo/Av/S/Pe	Eo	Av	S	Pe
Eo/Av/S/Pe	Eo	Av	S	Pe
Eo/Av/S/Pe	Eo	Av	S	Pe
Eo/Av/S/Pe	Eo	Av	S	Pe
Eo/Av/S/Pe	Eo	Av	S	Pe
Eo/S/Pe	Eo		S	Pe
Eo/Ad/S/SD	Eo	Ad	S	SD
Eo/Av/S/SD	Eo	Av	S	SD
Eo/Av/S/SD	Eo	Av	S	SD
Eo/Av/S/SD	Eo	Av	S	SD
Eo/Av/S/SD	Eo	Av	S	SD
Eo/Av/S/SD	Eo	Av	S	SD
Eo/Av/S/SD	Eo	Av	S	SD
Eo/Av/S/SD	Eo	Av	S	SD
Eo/S/SD	Eo		S	SD
Eo/S/SD	Eo		S	SD
Eo/S/SD	Eo		S	SD
Eo/Av/S/SD-F	Eo	Av	S	SD-F
Eo/Av/S/SD-F	Eo	Av	S	SD-F
Eo/Av/S/SD-F	Eo	Av	S	SD-F
Eo/Ad/S/SD-Pe	Eo	Ad	S	SD-Pe
Eo/Ad/S-H/B	Eo	Ad	S-H	Bare
Eo/S-H/B	Eo		S-H	Bare
Eo/Ad/S-H/Pe	Eo	Ad	S-H	Pe
Eo/Ad/S-H/Pe	Eo	Ad	S-H	Pe
Eo/Ad/S-H/Pe	Eo	Ad	S-H	Pe
Eo/Ad/S-H/Pe	Eo	Ad	S-H	Pe
Eo/S-H/Pe	Eo		S-H	Pe
Eo/S-H/Pe	Eo		S-H	Pe
Eo/S-H/Pe	Eo		S-H	Pe
Eo/S-H/Pe	Eo		S-H	Pe
Eo/S-H/Pe	Eo		S-H	Pe
Eo/S-H/SD	Eo		S-H	SD

Appendix II: List of communities in Hobart (based on synusiae) *(cont.)*

Community	Dominant Stratum	Second Stratum	Understorey 3rd Stratum	Ground layer 4th Stratum
Eo/S-H/SD	Eo		S-H	SD
Eo/S-H/SD	Eo		S-H	SD
Eo/S-H/SD	Eo		S-H	SD
Eo/Ad-Am/S-H/SD-G	Eo	Ad-Am	S-H	SD-G
Eo/S-H/SD-Pe	Eo		S-H	SD-Pe
Eo/S-H/SD-Pe	Eo		S-H	SD-Pe
Eo/Av/BS-S/F	Eo			
Eo-Ep/S/SD-G	Eo-Ep		S	SD-G
Ep-Eo/S-H/SD	Eo-Ep		S-H	SD
Ep-Eo/S-H/SD	Eo-Ep		S-H	SD
Ep-Eo/S-H/SD	Eo-Ep		S-H	SD
Eo-Ep/S-H/SD	Eo-Ep		S-H	SD
Eo-Ep/S-H/SD	Eo-Ep		S-H	SD
Ep-Eo/S-H/SD	Eo-Ep		S-H	SD
Ep-Eo/S-H/SD	Eo-Ep		S-H	SD
Ep-Eo/S-H/SD	Eo-Ep		S-H	SD
Ep-Eo/S-H/SD	Eo-Ep		S-H	SD
Eo-Ep/S-H/SD	Eo-Ep		S-H	SD
Eo-Ep/S-H/SD-G	Eo-Ep		S-H	SD-G
Eo-Ep/S-H/SD-G	Eo-Ep		S-H	SD-G
Ep-Eo/S-H/SD-G	Eo-Ep		S-H	SD-G
Eo-Er/Ad/BS/F	Eo-Er	Ad	BS	F
Eo-Er/Ad/BS/F	Eo-Er	Ad	BS	F
Eo-Er/Ad/BS/F	Eo-Er	Ad	BS	F
Eo-Er/Ad/BS/F	Eo-Er	Ad	BS	F
Er-Eo/Ad/BS/F	Eo-Er	Ad	BS	F
Eo-Er/Ad/BS/F	Eo-Er	Ad	BS	F
Eo-Er/Ad/BS-S/F	Eo-Er	Ad	BS-S	F
Eo-Er/BS-S/F	Eo-Er		BS-S	F
Eo-Er/Ad/BS-S/Pe	Eo-Er	Ad	BS-S	Pe
Er-Eo(sp)/Ad/BS-S/Pe	Eo-Er	Ad	BS-S	Pe
Er-Eo/BS-S/SD-F	Eo-Er		BS-S	SD-F
Eo-Et/Ad/H/B	Eo-Et	Ad	H	Bare
Eo-Et/H/B	Eo-Et		H	Bare
Eo-Et/H/B	Eo-Et		H	Bare
Eo-Et/H/B	Eo-Et		H	Bare
Eo-Et/H/B	Eo-Et		H	Bare
Eo-Et/H/B	Eo-Et		H	Bare
Eo-Et/H/Pe	Eo-Et		H	Pe
Eo-Et/H/Pe	Eo-Et		H	Pe
Eo-Et/H/Pe	Eo-Et		H	Pe
Et-Eo/H/Pe	Eo-Et		H	Pe
Et-Eo/H/Pe	Eo-Et		H	Pe
Eo-Et/H/Pe-B	Eo-Et		H	Pe-Bare
Eo-Et/H/Pe-B	Eo-Et		H	Pe-Bare
Eo-Et/Ad/S-H/G	Eo-Et	Ad	S-H	G
Eo-Et/S-H/G	Eo-Et		S-H	G
Eo-Et/S-H/G	Eo-Et		S-H	G
Eo-Et/S-H/Pe	Eo-Et		S-H	Pe
Eo-Et/S-H/Pe	Eo-Et		S-H	Pe
Eo-Et/S-H/Pe	Eo-Et		S-H	Pe
Eo-Et/S-H/Pe	Eo-Et		S-H	Pe
Eo-Et/Ad/S-H/Pe-G	Eo-Et	Ad	S-H	Pe-G
Ev-Eo/[S-H]/G-Pe	Eo-Ev		[S-H]	G-Pe
Eo-Ev/[S-H]/Pe-G	Eo-Ev		[S-H]	Pe-G
Eo-Ev/H/B	Eo-Ev		H	Bare
Eo-Ev/H/B	Eo-Ev		H	Bare
Eo-Ev/H/Pe-SD	Eo-Ev		H	Pe-SD
Eo-Ev/Ad/S/Pe-SD	Eo-Ev	Ad	S	Pe-SD
Eo-Ev/S/Pe-G	Eo-Ev		S	Pe-SD

Appendix II: List of communities in Hobart (based on synusiae) *(cont.)*

Community	Dominant Stratum	Second Stratum	Understorey 3rd Stratum	Ground layer 4th Stratum
Ev-Eo/S/SD	Eo-Ev		S	SD
Eo-Ev/S/SD-G	Eo-Ev		S	SD-G
Eo-Ev/Ad/S-H/Pe	Eo-Ev	Ad	S-H	Pe
Eo-Ev/S-H/Pe	Eo-Ev		S-H	Pe
Eo-Ev/S-H/SD	Eo-Ev		S-H	SD
Ev-Eo/S-H/SD	Eo-Ev		S-H	SD
Eo-Ev/S-H/SD-G	Eo-Ev		S-H	SD-G
Eov/H/SD	Eov		H	SD
Eov(sp)/H/SD	Eov		H	SD
Ep-Eov/H/G	Eov-Ep		H	G
Ep-Eov/H/G	Eov-Ep		H	G
Ep-Eov/H/G	Eov-Ep		H	G
Eov-Ep/H/G	Eov-Ep		H	G
Ep-Eov/Al/H/G-B	Eov-Ep	Al	H	G-Bare
Ep-Eov(sp)/H/G-B	Eov-Ep		H	G-Bare
Eov-Ep/H/G-SD	Eov-Ep		H	G-SD(burnt
Ep-Eov/H/SD	Eov-Ep		H	SD
Ep-Eov/H/SD	Eov-Ep		H	SD
Eov-Ep/H/SD-G	Eov-Ep		H	SD-G
Ep-Eov/H/SD-G	Eov-Ep		H	SD-G
Ep-Eov/H/SD-G	Eov-Ep		H	SD-G
Ep-Eov/Al/S-H/G	Eov-Ep	Al	S-H	G
Ep-Eov/S-H/G	Eov-Ep		S-H	G
Eov-Ep/S-H/G	Eov-Ep		S-H	G
Ep-Eov/S-H/G	Eov-Ep		S-H	G
Ep-Eov/S-H/SD-B	Eov-Ep		S-H	SD-Bare
Ep-Eov/S-H/SD-G	Eov-Ep		S-H	SD-G
Ep-Eov/S-H/SD-G	Eov-Ep		S-H	SD-G
Ep/Al/H/G	Ep	Al	H	G
Ep/Al/H/G	Ep	Al	H	G
Ep/Al/H/G	Ep	Al	H	G
Ep/H/G	Ep		H	G
Ep/H/G	Ep		H	G
Ep/H/G-SD	Ep		H	G-SD
Ep/H/G-SD	Ep		H	G-SD
Ep/H/G-SD	Ep		H	G-SD
Ep/H/SD	Ep		H	SD
Ep/H/SD-G	Ep		H	SD-G
Ep/H/SD-G	Ep		H	SD-G
Ep/H	Ep		H	
Ep(sp)/Ar/S/G	Ep	Ar	S	G
Ep/S/G	Ep		S	G
Ep/Al/S/G-R	Ep	Al	S	G-R
Ep/Al/S/SD-B	Ep	Al	S	SD-Bare
Ep/S-H/G	Ep		S-H	G
Ep/S-H/SD	Ep		S-H	SD
Ep/S-H/SD	Ep		S-H	SD
Ep/S-H/SD	Ep		S-H	SD
Ep/S-H/SD	Ep		S-H	SD
Ep/S-H/SD	Ep		S-H	SD
Ep/Al/S-H	Ep	Al	S-H	
Ep(sp)/G	Ep			G
Ep/G	Ep			G
Ep/G	Ep			G
Ep(sp)/G	Ep			G
Ep(sp)/G	Ep			G
Ep-Ev/(S)/G	Ep-Ev		(S)	G
Ep-Ev/(S)/G	Ep-Ev		(S)	G
Ev-Ep/[S]/G	Ep-Ev		[S]	G
Ev-Ep(sp)/[S]/G	Ep-Ev		[S]	G

Appendix II: List of communities in Hobart (based on synusiae) *(cont.)*

Community	Dominant Stratum	Second Stratum	Understorey 3rd Stratum	Ground layer 4th Stratum
Ep-Ev/[S]/G	Ep-Ev		[S]	G
Ep-Ev(sp)/(S)/G	Ep-Ev		[S]	G
Ep-Ev/H/G	Ep-Ev		H	G
Ep-Ev/H/G	Ep-Ev		H	G
Ev-Ep/H/G	Ep-Ev		H	G
Ev-Ep/H/G	Ep-Ev		H	G
Ev-Ep/H/G	Ep-Ev		H	G
Ev-Ep/H/G	Ep-Ev		H	G
Ep-Ev/H/G	Ep-Ev		H	G
Ev-Ep/H/G	Ep-Ev		H	G
Ep-Ev/H/G	Ep-Ev		H	G
Ep-Ev/H/G	Ep-Ev		H	G
Ev-Ep/H/G	Ep-Ev		H	G
Ep-Ev/H/SD	Ep-Ev		H	SD
Ev-Ep/H/SD-G	Ep-Ev		H	SD-G
Ep-Ev/H/SD-G	Ep-Ev		H	SD-G
Ev-Ep/H/SD-G	Ep-Ev		H	SD-G
Ev-Ep(sp)/Al/S/G	Ep-Ev	Al	S	G
Ev-Ep/S/G	Ep-Ev		S	G
Ev-Ep/S/G	Ep-Ev		S	G
Ev-Ep(sp)/S/G	Ep-Ev		S	G
Ev-Ep/Al/S/SD	Ep-Ev	Al	S	SD
Ep-Ev/S/SD	Ep-Ev		S	SD
Ep-Ev/S/SD-G	Ep-Ev		S	SD-G
Ep-Ev/S-H/G	Ep-Ev		S-H	G
Ev-Ep/S-H/G	Ep-Ev		S-H	G
Ep-Ev/S-H/G	Ep-Ev		S-H	G
Ep-Ev/S-H/G	Ep-Ev		S-H	G
Ep-Ev/S-H/G	Ep-Ev		S-H	G
Ep-Ev/S-H/G	Ep-Ev		S-H	G
Ep-Ev//S-H/SD-G	Ep-Ev		S-H	SD-G
Er/Ad/BS/F	Er	Ad	BS	F
Er(sp)/Ad/BS/F	Er	Ad	BS	F
Er(sp)/Ad/BS/F	Er	Ad	BS	F
Er/Ad/BS/F	Er	Ad	BS	F
Er/Ad/BS/F	Er	Ad	BS	F
Er(sp)/Ad/BS/F	Er	Ad	BS	F
Er/Ad/BS/F	Er	Ad	BS	F
Er/Ad/BS/F[RF]	Er	Ad	BS	F
Er/Ad/BS/F	Er	Ad	BS	F
Er(sp)/Ad/BS/F	Er	Ad	BS	F
Er/Ad/BS/F	Er	Ad	BS	F
Er(sp)/Ad/BS/F[RF]	Er	Ad	BS	F
Er(sp)/Ad/BS/F	Er	Ad	BS	F
Er(sp)/BS/F	Er		BS	F
Er/BS/F[RF]	Er		BS	F
Er/BS/F	Er		BS	F
Er(sp)/BS/F	Er		BS	F
Er/BS/SD	Er		BS	SD
Et/H/B	Et		H	Bare
Et/H/B	Et		H	Bare
Et/H/B	Et		H	Bare
Et/H/B	Et		H	Bare
Et/H/B	Et		H	Bare
Et/H/B	Et		H	Bare
Et/H/B	Et		H	Bare
Et/H/B	Et		H	Bare
Et/H/B	Et		H	Bare
Et/H/B	Et		H	Bare
Et/H/B	Et		H	Bare

Appendix II: List of communities in Hobart (based on synusiae) *(cont.)*

Community	Dominant Stratum	Second Stratum	Understorey 3rd Stratum	Ground layer 4th Stratum
Et/H/B	Et		H	Bare
Et/H/B	Et		H	Bare
Et/H/G-B	Et		H	G-Bare
Et/H/R	Et		H	Rock
Ev-Et/S-H/G-Pe	Et-Ev		S-H	G-Pe
Et-Ev/S-H/Pe-G	Et-Ev		S-H	Pe-G
Eu(sp)/S-H*/R	Eu		S-H*	R
Eu(sp)/S-H*/R	Eu		S-H*	R
Eu/S-H*/R	Eu		S-H*	R
Eu(sp)/S-H*/R	Eu		S-H*	R
Eu(sp)/S-H*/R	Eu		S-H*	R
Eu/S-H*/R	Eu		S-H*	R
Eu/S-H*/SD	Eu		S-H*	SD
Eu(sp)/S-H*SD	Eu		S-H*	SD
Eu(sp)/S-H*/SD	Eu		S-H*	SD
Eu/S-H*/SD	Eu		S-H*	SD
Eu/S-H*/SD-R	Eu		S-H*	SD-R
Eu(sp)/R	Eu			R
Eu(sp)/R	Eu			R
Eu/R	Eu			R
Eu/R	Eu			R
Eu(sp)/R	Eu			R
Eu(sp)/R	Eu			R
Eu(sp)/R	Eu			R
Eu(sp)/R	Eu			R
Eu(sp)/S-H*/SD	Eu			
Ev/Al/S/G	Ev	Al	S	G
Ev/Al/S/G	Ev	Al	S	G
Ev/Ar/S/G	Ev	Ar	S	G
Ev(sp)/Av/S/G	Ev	Av	S	G
Ev/Av/S/G	Ev	Av	S	G
Ev(sp)/S/G	Ev		S	G
Ev(sp)/G	Ev			G
Ev(sp)/G	Ev			G
Ev(sp)/G	Ev			G
GS(2)/F	GS			F
H*/SD	H*			SD
Nc-AS/R	Nc-AS			R
Nc-AS(sp)/R	Nc-AS			R
Nc-AS/R	Nc-AS			R
RF/F	RF			F
RF/F	RF			F
S/SD	S			SD
S/SD	S			SD
S/SD	S			SD
S/SD	S			SD
WA/R	WA			R
WA/R	WA			R
WA/R	WA			R
WA/R	WA			R
WA/R	WA			R
WA/R	WA			R
WA/R	WA			R
Wa/R	WA			R
WA	WA			
WA	WA			
WA	WA			
WA	WA			
WA	WA			
WA	WA			