

Native vegetation mapping in the Blue Mountains 1999-2002



1. INTRODUCTION

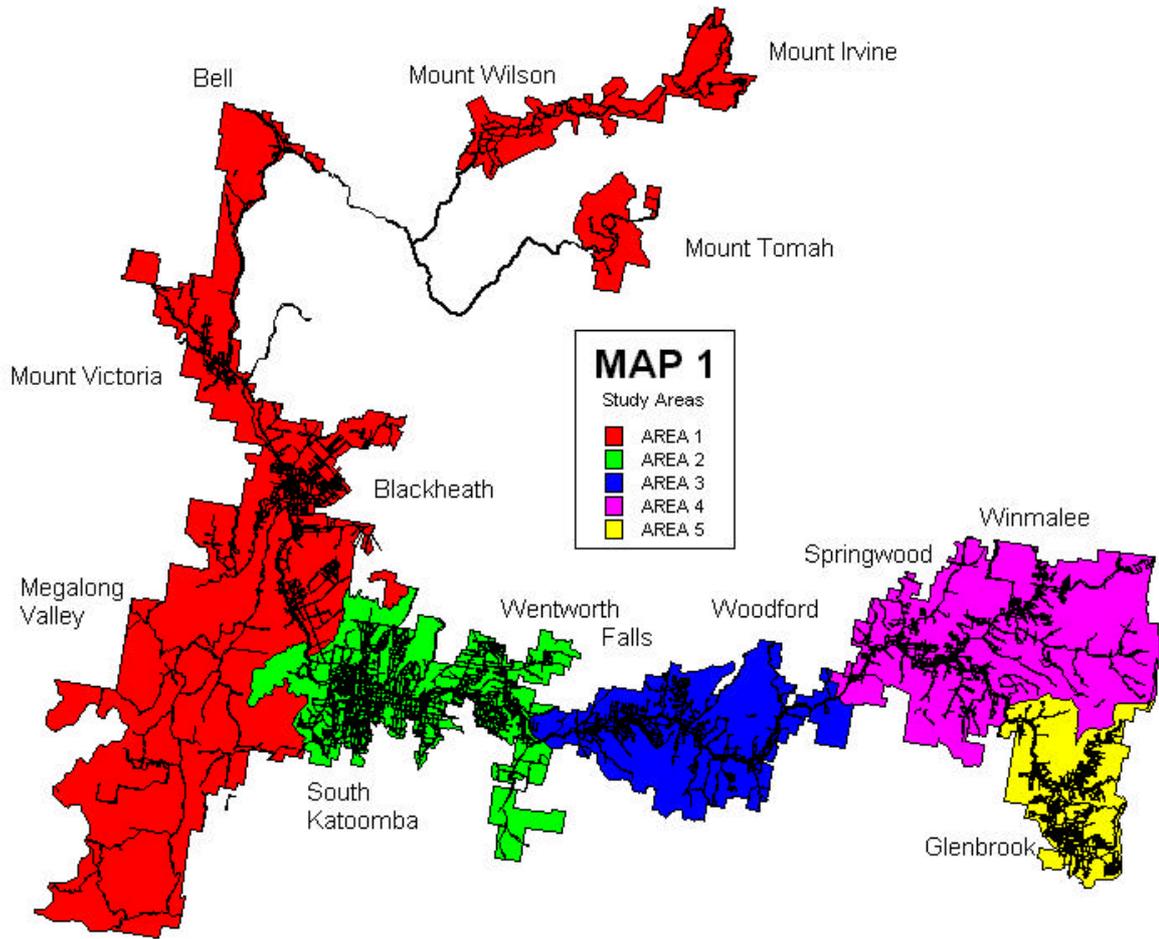
Ecological Surveys & Planning Pty Ltd (ESP) was engaged by Blue Mountains City Council to map the native vegetation of Planning Areas 1 to 5. This area comprises all lands in Blue Mountains Local Government Area (LGA) other than those under the control of the NSW National Park & Wildlife Service (with the exception of the recently declared Yellomundee Regional Park).

The boundaries of each of the Planning Areas have been determined by Council for planning and management purposes and are shown in Figure 1. Unlike the other Planning Areas, Area 1 was divided into 3 sections for ease of survey: The Mounts (basalt capped mountains and adjoining sandstone terrain in the north); Western Plateau (sandstone plateau and western escarpment from Medlow Bath to Bell); and Megalong Valley (Megalong Valley east of Cox's River plus Shipley Plateau and the upper Kanimbla Valley).

Bushland within the study area occurs mainly on vacant Crown land and to a lesser extent on Council-owned land, Sydney Catchment Authority properties associated with the provision of potable water, and substantial areas of freehold and leasehold, with the latter being most common in the largely rural Megalong Valley.

The vegetation of the study area has been previously mapped within the 1:100,000 vegetation map sheet for Katoomba as published by Keith and Benson (1988), the 1:100,000 sheet for Penrith by Benson (1992), with Mount Irvine, parts of Mount Wilson and Bell being within the Wallerawang 1:100,000 vegetation sheet by Benson and Keith (1990). Following this mapping, Smith and Smith (1995) mapped parts of the LGA at 1:25,000. Those vegetation communities recognized in these previous studies and identified from the API vegetation mapping process are presented in Appendix One.

Figure 1. Geographic Planning Areas of the City of Blue Mountains



2. METHODOLOGY

2.1 Aerial photography

Most of the native vegetation in the Blue Mountains City has been mapped using orthorectified infrared aerial photographs flown at a minimum resolution of 1:6000 from December 1998 to January 1999. The far western and southern parts of the Megalong Valley were mapped separately using orthorectified true-colour aerial photography flown at 1:50,000 in 1998. At Mount Tomah, mapping was undertaken at 1:2500 due to the complexity of the geology, disturbance histories and thus variations in vegetation structural classes. On the other basalt areas and in most of the sandstone terrain, a scale of 1:3500 – 1:6000 was used. In the case of small, very linear and/or poorly delineated vegetation types, scales as fine as 1:750 were employed using the infrared imagery.

The use of relatively high-resolution infrared photos for most of the study area provides a significant advantage over more conventional vegetation mapping, which often uses true-colour imagery at scales of 1:15,000 or 1:25,000. The higher resolution allows the digital images to be examined at scales as fine as 1:1000 without a significant loss of image quality, whereas the maximum useful scale for the 1:25,000 images is at best 1:7500.

In addition, the infrared photos appear to provide greater definition between vegetation structural classes than true-colour imagery. These photos are particularly effective in detecting vegetation in more fertile landscapes, for example, communities such as rainforest and tall open forest in sheltered gullies or on basalt, and remnants of forests and woodland on ridgetop shales. This has been a significant factor in detecting and mapping with a reasonable degree of accuracy, the endangered ecological communities of Blue Mountains Shale Cap Forest and variants of Shale / Sandstone Transition Forest (SSTF).

2.2 Vegetation mapping

Polygons denoting vegetation structural units were initially digitised from the aerial photos. Reference was made to existing resources including: the vegetation mapping of Areas 1-5 (Smith & Smith 1995), the 1:100,000 sheets of Keith and Benson (1988), Benson and Keith (1990) and Benson (1992) and limited ground-based mapping of hanging swamps undertaken by Council. A limited amount of ground truthing was undertaken to gain a basic appreciation of the Area's vegetation types. Additional layers such as contours, drainage lines and soil landscapes were used where required.

Structural divisions of vegetation are based on those of Specht (1970) with the notation used by Beard and Webb (1974) as illustrated in AUSLIG (1990). Where vegetation types were obvious from the

imagery or were known from previous sources or initial fieldwork, polygons were also assigned interim community codes primarily based on those of Smith and Smith (1995).

Three descriptors have been used to indicate polygons in which the native vegetation has been significantly altered: “modified bushland”, “cleared” and “introduced communities”. “Modified bushland” includes areas which have been degraded by clearing of understorey or significant weed invasion.

Areas not mapped as containing native vegetation are deemed to be “cleared” within the boundaries of the mapping areas. A map tag of “cleared” does not necessarily mean that no remnant native vegetation is present, but simply indicates that within the limits of this project, these areas were not considered worthy of mapping as bushland or modified bushland based on factors such as vegetation cover, vegetation type and land use. “Cleared” areas may still contain significant flora and fauna. However, the likelihood of their being present is considered low on the basis that the habitat has been significantly removed or detrimentally modified in a manner not likely to have been reversed since the date of the aerial photography.

“Introduced communities” are those areas that contain either high densities of introduced *Pinus* spp. or plantations of pine and/or non-endemic tree species such that the integrity of the original vegetation community has been significantly compromised or destroyed.

2.3 Limitations of the project

Several limitations restrict the accuracy of the vegetation mapping. These include:

- Quality of digitised aerial photos – differences in colour balance and photo edge distortion;
- Lack of infrared imagery – this applied in the western and southern parts of the Megalong Valley;
- Quality of the photo mosaics – these arise from errors in the assembly of the photo mosaics;
- Changes due to fire and other disturbances - recent fires within some of the LGA prior to the aerial photography made accurate identification of the vegetation structure difficult. Additionally, some areas of vegetation had been cleared or otherwise significantly modified since the aerial photos on which the mapping is based were taken;
- Limitations imposed by the number of quadrats - the number of quadrats able to be sampled in this study was limited due to available time and funding constraints.

2.4 Validating mapped vegetation communities

As part of this mapping project, Council will be undertaking a ground-truthing program to validate and further refine the Blue Mountains LGA vegetation mapping. The vegetation validation program will comprise the verification of mapped Scheduled and Non-scheduled vegetation communities and their boundaries. This project will be undertaken over a period of two years.

3. RESULTS OF CITY-WIDE MAPPING

Douglas (2001) identified 125 vegetation types ranging from cleared land to rainforest in the Blue Mountains Local Government Area (LGA). Some of these vegetation types are considered ecotones and/or sub-communities and as such several sub-communities or variants may represent the natural variation within a recognisable vegetation community. In the following descriptions, the sub-community numbers given at the start of each community refer to the 125 units identified by Douglas in his mapping.

Consultation with Douglas identified the vegetation communities considered to be significant within the Blue Mountains City according to the set of criteria presented below. These significant vegetation communities have been listed in the Schedule of Significant Vegetation Communities of DLEP2002 and in Draft Amendment 31 of LEP 1991. They are henceforth referred to as **Scheduled Vegetation** in this report.

Those vegetation types that did not fit the criteria for significance have been arranged into broad **Non-scheduled Vegetation** groups according to their floristic and structural similarities as identified by Douglas (2001), Smith and Smith (1995), and Keith and Benson (1988).

3.1 Maps

An example of the aerial infrared photography used for the vegetation mapping of the Radiata Plateau area in Blue Mountains City is given in Figure 2. The detailed vegetation **sub-community** mapping that resulted from the infrared photo interpretation of this area is presented in Figure 3. An example of the indicative vegetation maps that are supporting information for Draft Local Environment Plan 2002 (DLEP2002) is presented in Figure 4. This latter figure shows the vegetation **community groups** as listed in Tables 1 and 3.

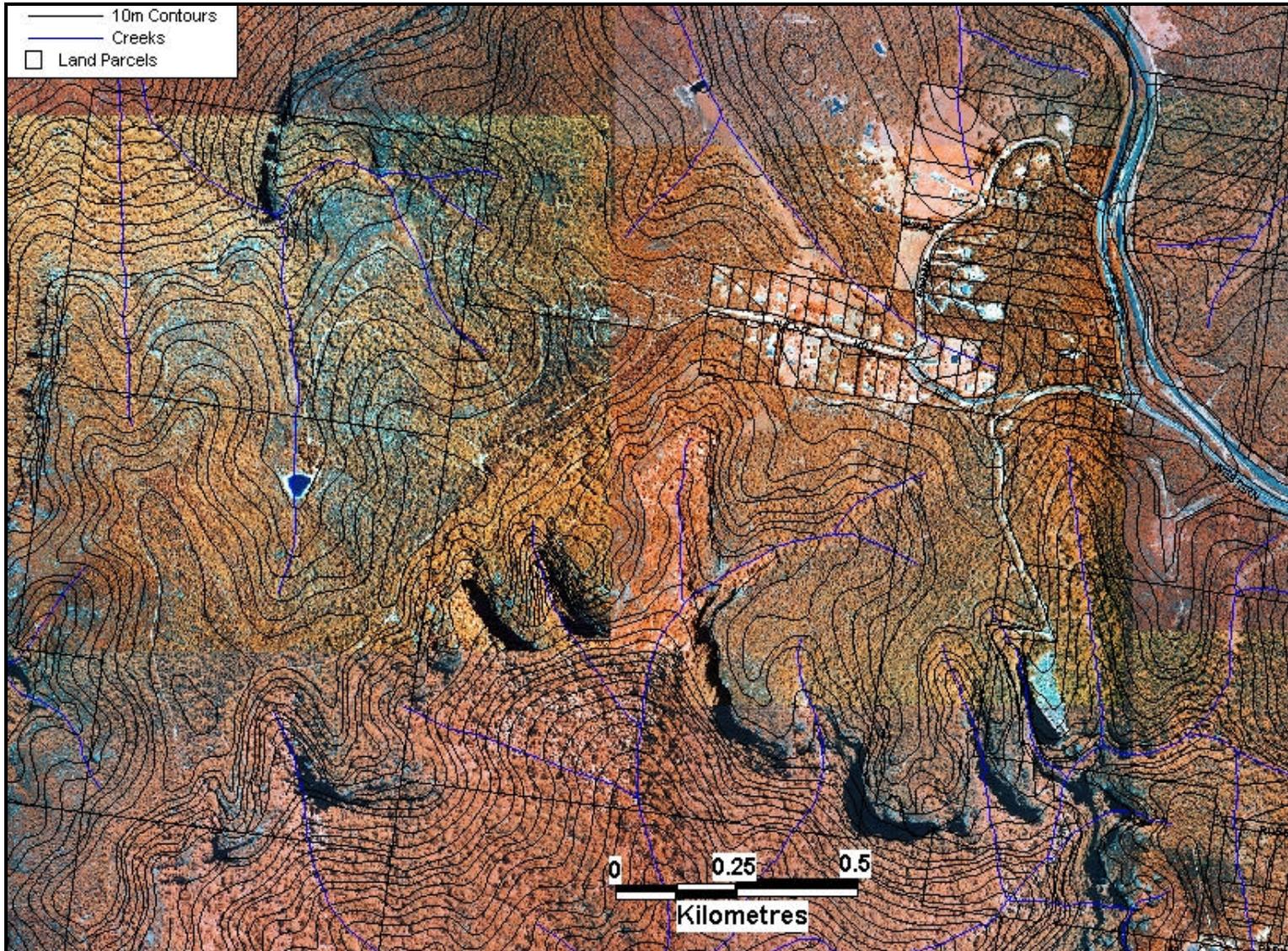


Figure 2. The use of relatively high-resolution infrared photos for most of the study area provides a significant advantage over more conventional vegetation mapping. The higher resolution allows zooming in of the digital images to scales as fine as 1:1000 without a significant loss of image quality.

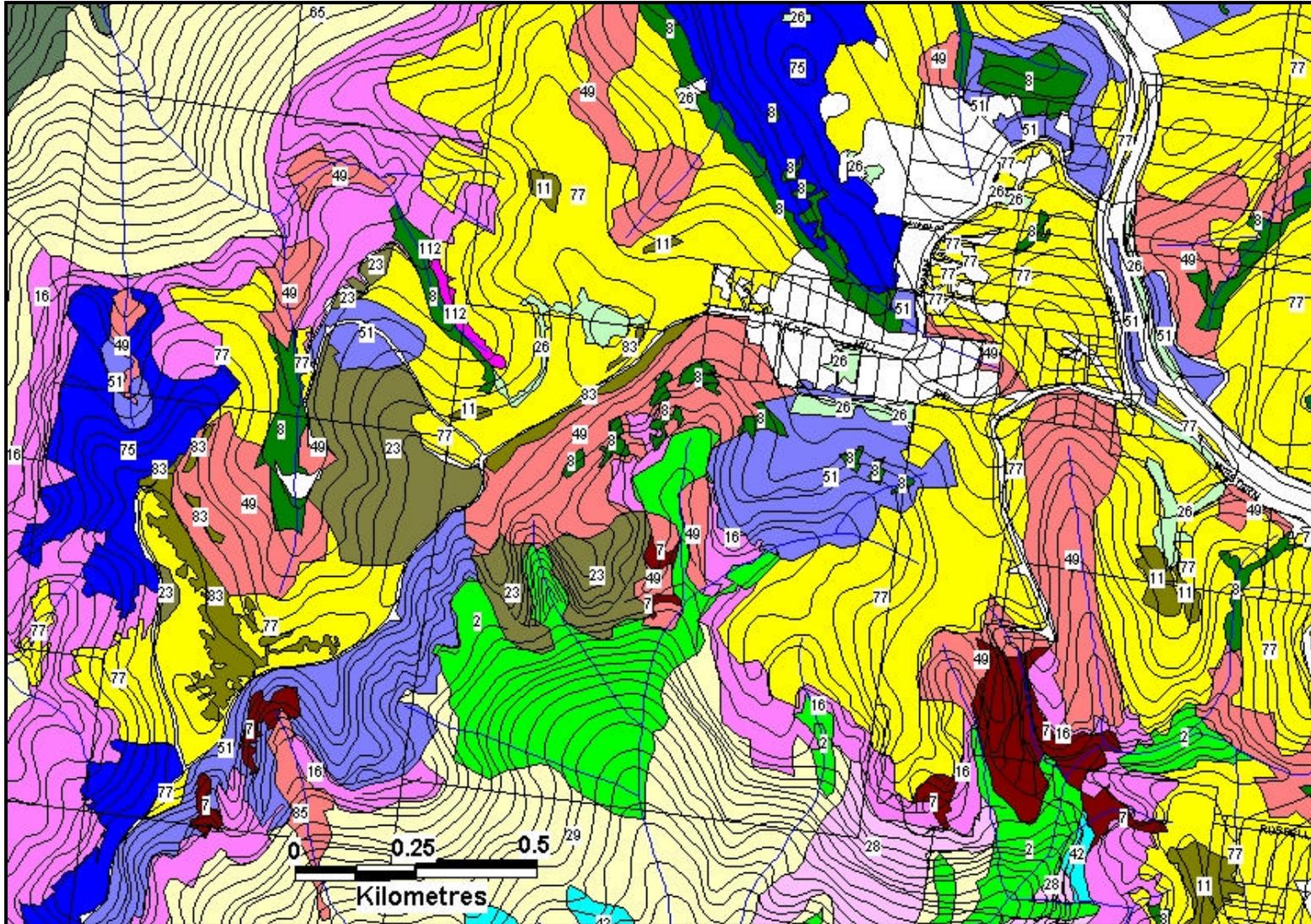


Figure 3. The numbered colour polygons represent some of the 125 vegetation units or “**sub-communities**” identified by Douglas (2001) in the Radiata Plateau area. These sub-communities were mapped using infrared photographic imagery techniques based on the infrared aerial photograph presented in Figure 2.

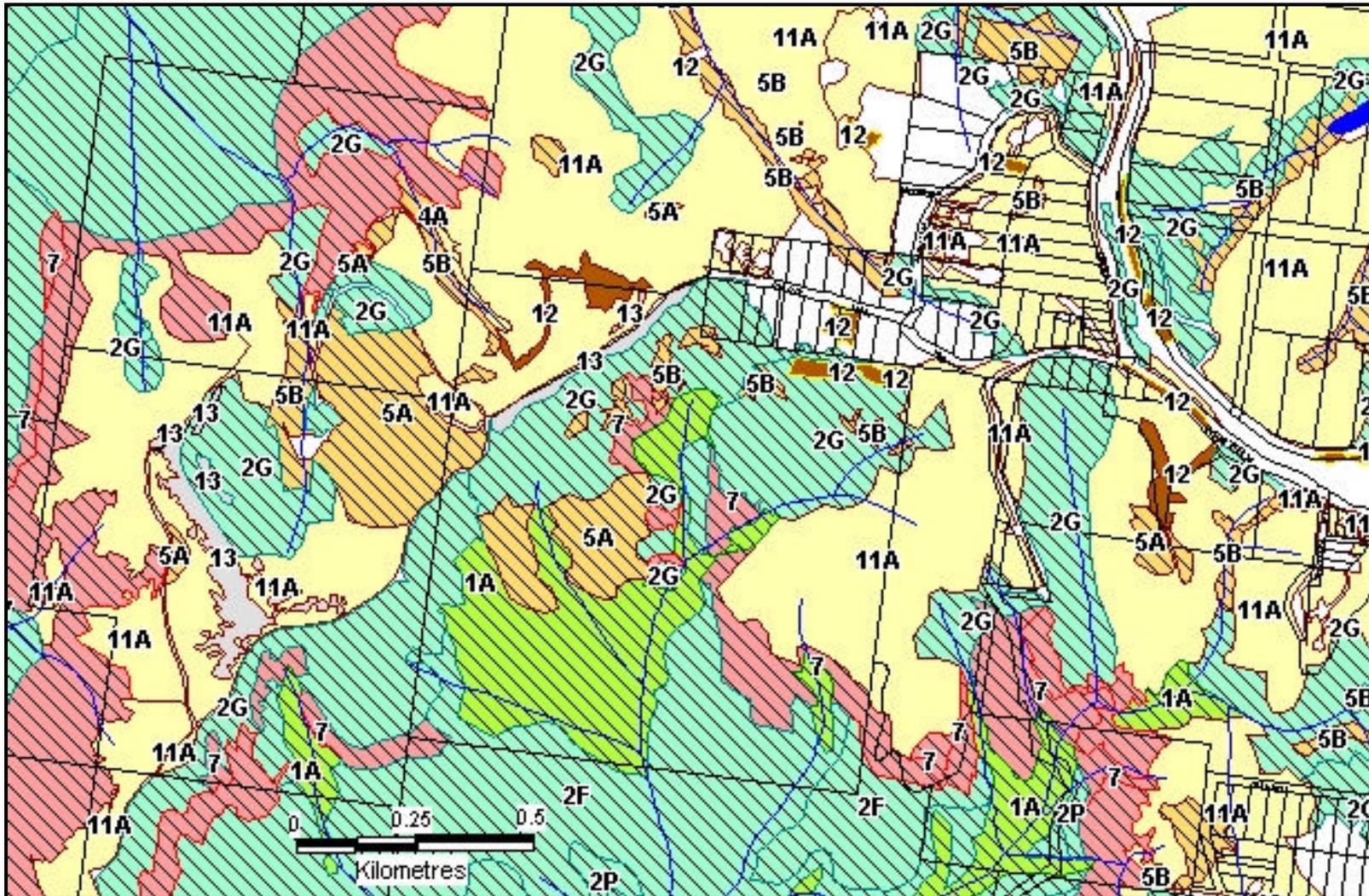


Figure 4. An example of the indicative vegetation maps for the Radiata Plateau area that accompany the Draft Local Environment Plan 2002 (DLEP2002). This map shows some of the vegetation **Community** groups as listed in Tables 1 and 3. The legend for the vegetation communities is presented on the following page.

Legend - Figure 4

Rainforest - Scheduled		Low Open Forest - Scheduled		Modified Bushland	
	Ceratopetalum apetalum - Doryphora sassafras Rainforest		Melaleuca linariifolia Low Open-forest		Modified Bushland
	Backhousia myrtifolia - Ceratopetalum apetalum Rainforest	Woodland - Scheduled		Introduced Communities	
	Megalong Granite Dry Rainforest		Eucalyptus gullickii Alluvial Woodland		Introduced Communities
Open Forest - Scheduled			Eucalyptus sclerophylla Bench Woodland		
	Moist Basalt Cap Forest		Kowmung Wilderness Complex		
	Blue Mountains Shale Cap Forest		Redgum Swamp Woodland		
	Turpentine - Ironbark Forest	Heath, Scrub and Swamp - Scheduled			
	Sandstone/Shale Transition Forest Complex		Blue Mountains Heath and Scrub		
	Eucalyptus deanei - E. piperita Tall Open-forest		Blue Mountains Swamps		
	Eucalyptus cypellocarpa - E. piperita Tall Open-forest		Pagoda Rock Complex		
	Eucalyptus oreades Open-forest/Tall Open-forest		Lagoon Vegetation (Glenbrook Lagoon)		
	Eucalyptus dalrympleana - E. piperita Tall Open-forest	Riparian Complex - Scheduled			
	Eucalyptus amplifolia Tall Open-forest		Blue Mountains Riparian Complex		
	Montane Gully Forest	Escarpment Complex - Scheduled			
	Blue Gum Riverflat Forest		Blue Mountains Escarpment Complex		
	Casuarina cunninghamiana River Oak Forest	Non-Scheduled Forest and Woodland			
	Eucalyptus radiata ssp. radiata - E. piperita Open Forest		Eucalyptus sieberi - Eucalyptus piperita		
	Melaleuca styphelioides - M. linariifolia Forest		Eucalyptus piperita - Angophora costata		
	Riparian Granite Slopes Forest		Corymbia gummifera - Corymbia eximia		
	Megalong Foothslopes Forest		Corymbia gummifera - Eucalyptus sclerophylla		
	Megalong Granite Forest		Corymbia gummifera - Eucalyptus sieberi		
			Corymbia gummifera - Eucalyptus sparsifolia		
			Eucalyptus sclerophylla		

4. SCHEDULED VEGETATION COMMUNITIES

As a result of the recent citywide vegetation mapping (excluding Blue Mountains National Park) 31 significant vegetation communities are recognised across the LGA. These include seven communities that occur only in the Megalong Valley (Douglas 2001).

Vegetation communities have been scheduled as significant within the City of Blue Mountains if they satisfy one or more of the following criteria:

- listed, or proposed for listing, in the *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth);
- listed, or proposed for listing, in Schedule 1 or 2 of the *Threatened Species Conservation Act 1995* (NSW);
- listed in Schedule 3 of LEP 1991;
- rare and/or restricted distribution within the City of Blue Mountains;
- poorly or not represented within the Blue Mountains National Park;
- protect hydrological functions; and/or
- habitat for rare, threatened or ultra-endemic fauna or flora species.

Further detail of the chronology and rationale for the recognition of Scheduled vegetation in the Blue Mountains City is presented in Volume 2 of Environmental Management Plan 2002, which supports the Draft Local Environment Plan 2002 (DLEP 2002). Complete descriptions of all Scheduled vegetation communities are given in draft Amendment 31 of LEP 1991 and have been adapted from the publications of Keith and Benson (1988), Smith and Smith (1998) and Douglas (2001). An abridged version of these descriptions is presented in this report. A list of Scheduled Vegetation communities by Planning Area is presented in Table 1.

Table 1

Scheduled vegetation groups in the City of Blue Mountains

SCHEDULED VEGETATION (<i>SENSU</i> DLEP2002)	Occurrence By Planning Area				
	1	2	3	4	5
1. CLOSED FOREST (RAINFOREST)					
(A) <i>Ceratopetalum apetalum</i> - <i>Doryphora sassafras</i> Rainforest	X	X	X	X	
(B) <i>Backhousia myrtifolia</i> - <i>Ceratopetalum apetalum</i> Rainforest	X				X
(C) Megalong Granite Dry Rainforest	X				

SCHEDULED VEGETATION (<i>SENSU</i> DLEP2002)	Occurrence By Planning Area				
	1	2	3	4	5
2. TALL FOREST/OPEN-FOREST					
(A) <i>Eucalyptus viminalis</i> - <i>E. blaxlandii</i> - <i>E. radiata</i> (Moist Basalt Cap Forest)					
(B) <i>Eucalyptus deanei</i> - <i>Syncarpia glomulifera</i> - <i>Eucalyptus cytellocarpa</i> (Blue Mountains Shale Cap Forest)	X			X	
(C) Turpentine-Ironbark Forest (<i>Syncarpia glomulifera</i> – <i>Eucalyptus punctata</i>)	X			X	X
(D) Shale/Sandstone Transition Forest Complex (<i>Eucalyptus crebra</i> - <i>Corymbia gummifera</i> - <i>C. exima</i>)				X	X
(E) <i>Eucalyptus deanei</i> - <i>E. piperita</i> Tall Open-forest	X	X	X	X	
(F) <i>Eucalyptus cytellocarpa</i> - <i>E. piperita</i> Tall Open-forest	X	X	X		
(G) <i>Eucalyptus oreades</i> Open-forest/Tall Open-forest	X	X	X		
(H) <i>Eucalyptus dalrympleana</i> - <i>E. piperita</i> Tall Open-forest	X				
(I) <i>Eucalyptus amplifolia</i> Tall Open-forest				X	
(J) Montane Gully Forest	X				
(K) Blue Gum Riverflat Forest (<i>E. deanei</i>)				X	X
(L) <i>Casuarina cunninghamiana</i> River Oak Forest	X				X
(M) <i>Eucalyptus radiata ssp. radiata</i> – <i>E. piperita</i> Open Forest		X			
(N) <i>Melaleuca styphelioides</i> – <i>M. linariifolia</i> Forest	X				
(O) Megalong Riparian Granite Slopes Forest	X				
(P) Megalong Footslopes Forest Complex	X				
(Q) Megalong Granite Forest/Woodland	X				
3. LOW OPEN-FOREST					
(A) <i>Melaleuca linariifolia</i>				X	X
4. WOODLANDS					
(A) <i>Eucalyptus gullickii</i> Alluvial Woodland	X	X	X		
(B) <i>Eucalyptus sclerophylla</i> Bench Woodland				X	X
(C) Kowmung Wilderness Complex	X				
(D) Redgum Swamp Woodland	X				
5. HEATH / SCRUB / SEDGELAND / FERNLAND					
(A) Blue Mountains Heath and Scrub	X	X	X	X	X
(B) Blue Mountains Swamps	X	X	X	X	X
(C) Pagoda Rock Complex	X				
(D) Lagoon Vegetation					X
6. BLUE MOUNTAINS RIPARIAN COMPLEX	X	X	X	X	X
7. BLUE MOUNTAINS ESCARPMENT COMPLEX	X	X	X	X	

Descriptions of each Scheduled Vegetation Community are given below with the approximate area of that community mapped within the Blue Mountains City presented in hectares at the beginning of each community description. These descriptions have been adapted from the publications of Keith and Benson (1988), Smith and Smith (1995) and Douglas (2001).

Vegetation sub-communities that make up each scheduled community have been identified but are not individually described in this report.

(1) TALL CLOSED FOREST/CLOSED FOREST/LOW CLOSED FOREST (RAINFOREST)

1A *Ceratopetalum apetalum* - *Doryphora sassafras* Rainforest

Sub-communities: 2, 4, 85, 87, 88, 89
--

Area (ha): 511.1

As its name suggests this community is generally characterised by the occurrence of *Ceratopetalum apetalum* (Coachwood) and *Doryphora sassafras* (Sassafras). This rainforest is found on sedimentary geology at upper and middle altitudes in the Blue Mountains. A variant, the 'Montane Rainforest' also occurs on more fertile soils on the slopes of the basalt-capped mountains in the far north of the City of Blue Mountains area. These rainforest communities are replaced at lower altitudes by *Backhousia myrtifolia*-*Ceratopetalum apetalum* rainforest (described below). The upper and lower altitude communities intergrade in the Springwood area.

Ceratopetalum apetalum-*Doryphora sassafras* rainforest occurs in sheltered, moist sites that are rarely, if ever, burnt. The dominant tree species are usually *Ceratopetalum apetalum* or *Doryphora sassafras*. Other trees that are common in some stands are *Acacia elata* (Mountain Cedar Wattle), *Acmena smithii* (Lilly Pilly), *Callicoma serratifolia* (Black Wattle), *Hedycarya angustifolia* (Native Mulberry) and *Quintinia sieberi* (Possumwood). *Backhousia myrtifolia* (Grey Myrtle) is usually absent, although sometimes a minor component of the community. The vegetation structure is usually a closed-forest or low closed-forest. There may be a layer of emergent eucalypts above the rainforest canopy in ecotonal or partly disturbed communities. Ferns, vines and epiphytes are usually prominent features of this community.



Plate 1. *Ceratopetalum apetalum* - *Doryphora sassafras* rainforest at Mt Wilson.

1B *Backhousia myrtifolia* - *Ceratopetalum apetalum* Rainforest

Sub-community: 86

Area (ha): 341.7

Backhousia myrtifolia - *Ceratopetalum apetalum* (Grey Myrtle-Coachwood) rainforest refers to the community found on sedimentary geology at lower altitudes in the Blue Mountains. It is replaced at middle and upper altitudes by *Ceratopetalum apetalum*-*Doryphora sassafras* rainforest. *Backhousia myrtifolia*-*Ceratopetalum apetalum* rainforest occurs on relatively fertile soils in sheltered, moist sites that are rarely, if ever, burnt. The two communities intergrade in the Springwood area.

Backhousia myrtifolia (Grey Myrtle) is the dominant or co-dominant tree with *Ceratopetalum apetalum* (Coachwood) or *Acmena smithii* (Lilly Pilly). Other trees that may be common are *Acacia elata* (Mountain Cedar Wattle), *Callicoma serratifolia* (Black Wattle) and *Syncarpia glomulifera* (Turpentine). *Doryphora sassafras* (Sassafras) is often present, but not as a dominant. The vegetation structure is usually a closed-forest or low closed-forest. There may

be a layer of emergent eucalypts above the dense rainforest canopy in ecotonal or partly disturbed communities. Ferns, vines and epiphytes are usually prominent features of the community.



Plate 2. *Backhousia myrtifolia* - *Ceratopetalum apetalum* rainforest at Glenbrook.

1C Megalong Granite Dry Rainforest

Sub-community: 5

Area (ha): 23.9

This vegetation community was not described on granite by Keith and Benson (1988) but was discovered during this mapping project and subsequently mapped. Its extent is very small and

the few remnants that have been mapped are generally very narrow. This is because it is confined to south-facing rocky slopes in gullies that have survived clearing and grazing by livestock. There are likely to be more remnants than are mapped and these are likely to be very small, linear and/or are within the shadow of nearby peaks on the true-colour aerial photographs used for this area.

Although only one sample of this rare vegetation type was able to be collected it is considered likely to be representative of the other sites based on interpretation of data from Keith and Benson (1988) regarding dry rainforest within the nearby Kowmung Wilderness Complex (8d). It is evident that the dry rainforest on the granite is strongly allied with that in the Kowmung Wilderness on the Lambie Group.

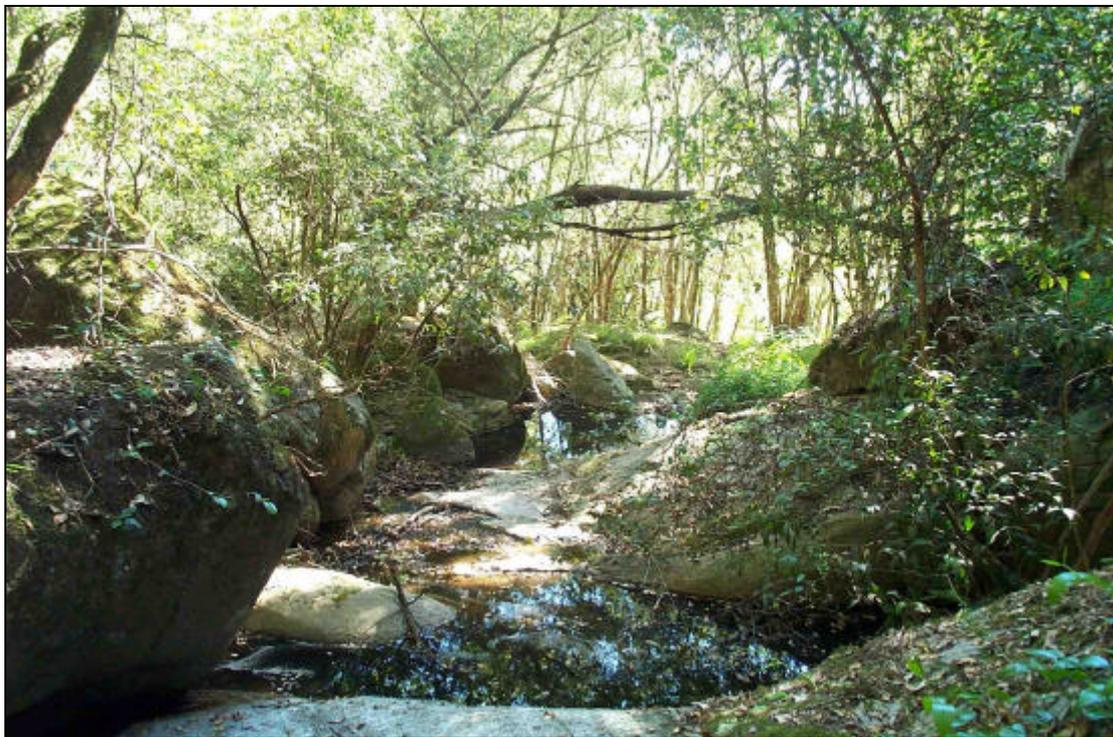


Plate 3. Megalong Granite Dry Rainforest.

(2) **TALL OPEN-FOREST/OPEN FOREST**

2A Moist Basalt Cap Forest (*Eucalyptus viminalis* - *E.blaxlandii* - *E.radiata*)

Sub-communities: 39, 40, 41, 60, 66, 101, 102,105, 106

Area (ha): 839.38

The basalt caps of Mt. Wilson, Mt. Tomah, Mt. Bell, Mt. Banks, Mt. Caley and Mt. Hay have weathered to a fertile clay-loam soil. At high altitudes (800-1000m), the summits and slopes support a tall open forest variously dominated by *Eucalyptus viminalis* (Ribbon Gum), *E. blaxlandii* (Blaxland's Stringybark) and *E. radiata* (Narrow-leaved Peppermint). Other canopy species that may be encountered include *E. cypellocarpa* (Monkey Gum), *E. oreades* (Blue Mountains Ash) and *E. fastigata* (Brown Barrel).

The understorey of Moist Basalt Cap Forest generally has scattered shrubs including *Acacia melanoxylon*, *A. penninervis*, *Polyscias sambucifolia*, *Astrotricha floccosa*, *Davesia ulicifolia* and *Leucopogon lanceolatus* with occasional tree ferns *Cyathea australis*. The ground cover includes numerous herbs and ferns.



Plate 4. Moist Basalt Cap Forest (tree fern variant)

2B Blue Mountains Shale Cap Forest (*Eucalyptus deanei* - *Syncarpia glomulifera* - *E.cypellocarpa*)

Sub-communities: 33, 42, 43

Area (ha): 26.2

The Blue Mountains Shale Cap Forest community is listed as an endangered ecological community in Part 3 of Schedule 1 of the *NSW Threatened Species Conservation Act*. This community is generally characterised by the occurrence of *Eucalyptus deanei* (Mountain Blue Gum) and *Syncarpia glomulifera* (Turpentine) and occurs as open to tall open-forest on deep, shale-rich soils on ridges and upper slopes. Within Blue Mountains City, such vegetation occurs only in the lower altitudes whereas it extends to the higher altitudes in the adjoining Hawkesbury City.

Within Blue Mountains City, this community is characterised by *Eucalyptus deanei* which is dominant or co-dominant with *Syncarpia glomulifera*. Other tree species that may be present include *Angophora costata* (Sydney Red Gum), *A. floribunda* (Rough-barked Apple), *Eucalyptus cypellocarpa* (Monkey Gum), *E. notabilis* (Blue Mountains Mahogany), *E. piperita* (Sydney Peppermint) and *E. punctata* (Grey Gum). The typical vegetation structure is tall open-forest, although this may vary depending on site conditions and history. It is generally a wet sclerophyll forest with soft-leaved plants prominent in the understorey.



Plate 5. Blue Mountains Shale Cap Forest

2C Turpentine-Ironbark Forest (STIF)

Sub-communities: 34, 56, 79, 81

Area (ha): 188.0

Within Blue Mountains City, this community incorporates the Sydney Turpentine-Ironbark Forest listed as an endangered ecological community in Part 3 of Schedule 1 of the *NSW Threatened Species Conservation Act*.

Turpentine-Ironbark Forest occurs on ridgetop caps of Wianamatta Shale. It may extend onto deeper areas of Hawkesbury Shale within the so-called Mittagong Formation. It is believed to be principally associated with the Blacktown, Luddenham and Kurrajong Soil Landscapes and is likely to extend onto the Lucas Heights Soil Landscape.

This community represents a drier and generally lower altitude variant of Blue Mountains Shale Cap Forest (BMSCF). The primary difference is the general absence of *Eucalyptus deanei* (Mountain Blue Gum) and *E. cypellocarpa* (Monkey Gum) and the usual dominance of *Syncarpia glomulifera* (Turpentine), sometimes along with various ironbark species such as *E. fibrosa* (Broad-leaved Ironbark), *Eucalyptus crebra* (Narrow-leaved Ironbark), and *E. beyeriana* (Beyer's Ironbark). The ironbarks can be absent or rare due to their extensive logging for fencing purposes. *Eucalyptus punctata* (Grey Gum), *E. notabilis* (Mountain Mahogany), *E. paniculata* (Grey Ironbark), *E. globoidea* (White Stringybark), and *E. eugenioides* (Thin-leaved Stringybark) may also be present.

The original distribution of this community and the boundary between it and BMSCF is unclear due to extensive clearing and/or modification of these vegetation types. The two communities are closely related and may intergrade extensively. In addition, this community intergrades with Shale/Sandstone Transition Forest (described below).

2D Sandstone/Shale Transitional Forest Complex (SSTF)

Sub-communities: 48, 55, 96

Area (ha): 220.0

This vegetation unit includes but is not restricted to the Shale/Sandstone Transition Forest that is listed as an endangered ecological community in Part 3 of Schedule 1 of the *NSW Threatened Species Conservation Act*.

This Complex is present primarily on ridgetops and is usually associated with the Lucas Heights and Faulconbridge Soil Landscapes but may occur elsewhere on unmapped remnant shale caps or lenses or immediately downslope of shale caps where the soils have been enriched by colluvium. Within Blue Mountains City, it is restricted to the lower altitudes and transitions between or within the Wianamatta and Hawkesbury Group of sediments.

Because it represents a transition from shale-based vegetation to that associated with sandstone environments, this Complex is inherently highly variable and difficult to define. Variations occur depending on the relative influence of the different geologies as well as due to differences in shelter and rainfall. The Shale/Sandstone Transition Complex can have considerable affinities to Turpentine-Ironbark Forest but generally has a greater influence from sandstone-oriented species and less influence from those more affiliated with shale soils.

Tree species that can occur in this Complex include *Syncarpia glomulifera* (Turpentine), *Eucalyptus punctata* (Grey Gum), *E. notabilis* (Mountain Mahogany), *E. crebra* (Narrow-leaved Ironbark), *E. fibrosa* (Broad-leaved Ironbark), *E. paniculata* (Grey Ironbark), *E. beyeriana* (Beyer's Ironbark), *E. globoidea* (White Stringybark), *E. sparsifolia* (Narrow-leaved Stringybark), *E. eugenioides* (Thin-leaved Stringybark) and *Angophora costata* (Sydney Red Gum). The stringybarks, *E. eugenioides* and *E. sparsifolia*, are generally diagnostic of the more sandstone-influenced form of this Complex.

The understorey can be highly variable depending on the extent of shale influence and proximity to the Cumberland Plain. Fire history and the effects of other forms of disturbance can also significantly affect both the structure and floristics of the understorey. It can range from grassy and herbaceous to densely scrubby. In areas close to the Cumberland Plain, the understorey may include species more typical of that environment such as *Melaleuca nodosa*, *M. erubescens* and *M. thymifolia*, especially in areas with slightly impeded drainage.



Plate 6. Sandstone/Shale Transitional Forest Complex (1)



Plate 7. Sandstone/Shale Transitional Forest Complex (2)

2E *Eucalyptus deanei* - *E. piperita* Tall Open-forest

Sub-communities: 27, 31, 59, 65, 103, 104, 107

Area (ha): 1283.3

Eucalyptus deanei-*E. piperita* tall open-forest refers to a vegetation community of mixed tree species composition, including *Eucalyptus piperita* (Sydney Peppermint), *E. deanei* (Mountain Blue Gum), *Syncarpia glomulifera* (Turpentine), *Angophora costata* (Sydney Red Gum), *A. floribunda* (Rough-barked Apple), *Eucalyptus punctata* (Grey Gum) and *E. crebra* (Narrow-leaved Ironbark). Not all of these species occur in every stand, except for *E. deanei*, whose presence is characteristic of the community.

This community is found in moist, sheltered sites on the talus slopes below the sandstone escarpments of the Jamison, Kedumba and Grose Valleys. It is replaced further west in the Megalong and Kanimbla Valleys by *Eucalyptus cypellocarpa*-*E. piperita* tall open-forest. The community also occurs in some moist, sheltered sites away from the escarpments. The typical vegetation structure is tall open-forest, although this may vary depending on site conditions and history. It is a wet sclerophyll forest with soft-leaved plants prominent in the understorey.

Eucalyptus deanei-*E. piperita* tall open-forest differs from *Eucalyptus deanei*-*Syncarpia glomulifera* tall open-forest in that it occurs on different geology (Illawarra Coal Measures, Shoalhaven Group and Narrabeen Group) and *E. deanei* is less prominent.

2F *Eucalyptus cypellocarpa* - *E. piperita* Tall Open-forest

Sub-communities: 28, 29

Area (ha): 1468.3

Eucalyptus cypellocarpa-*E. piperita* tall open-forest is characterised by the presence of *E. cypellocarpa* (Monkey Gum), occurring in association with one or more of *E. piperita* (Sydney Peppermint), *E. oreades* (Blue Mountain Ash) and *E. radiata* (Narrow-leaved Peppermint).

The community is found in moist, sheltered sites on the talus slopes below the sandstone escarpments of the western Blue Mountains (Megalong and Kanimbla Valleys). The community also occurs in some moist, sheltered sites away from the escarpments, and may occur as far east as Woodford. The typical vegetation structure is tall open-forest, although this may vary depending on site conditions and history. It is a wet sclerophyll forest, with soft-leaved plants prominent in the understorey.



Plate 8. *Eucalyptus cypellocarpa* – *E. piperita* Open/Tall Forest

2G

Eucalyptus oreades Open-forest/Tall Open-forest

Sub-communities: 49, 50, 51, 52

Area (ha): 1029.7

Eucalyptus oreades open forest/tall open-forest refers to those vegetation communities dominated by *E. oreades* (Blue Mountain Ash). A range of other eucalypts may also occur, most commonly *E. piperita* (Sydney Peppermint), *E. cypellocarpa* (Monkey Gum) and *E. radiata* (Narrow-leaved Peppermint). Since *E. oreades* is fire-sensitive, this community is found in fire-protected sites in the Upper Mountains, ranging from deep soils in sheltered gullies through to ridge top sites on poorer soils. The typical vegetation structure is tall open-forest, although this may vary depending on site conditions and history. In some places the understorey is shrubby, while in moister sites a ferny understorey can be present.



Plate 9. *Eucalyptus oreades* Open-forest/Tall Open-forest (mesic variant)



Plate 10. *Eucalyptus oreades* – *E. piperita* open forest

2H *Eucalyptus dalrympleana* – *E. piperita* Tall Open-forest

Sub-community: 57

Area (ha): 3.11

Eucalyptus dalrympleana-*E. piperita* tall open-forest is characterised by the presence of *Eucalyptus dalrympleana* (Mountain Gum), occurring in association with *E. piperita* (Sydney Peppermint) and *E. radiata* (Narrow-leaved Peppermint). In the City of Blue Mountains, this community appears to be restricted to one small stand at the upper end of Popes Glen Creek, Blackheath, where it occurs on a sheltered, south-facing slope of Narrabeen Group geology. The vegetation structure is variable within this disturbed stand, from tall open-forest to open-forest and woodland. It is a wet sclerophyll forest, with soft-leaved plants prominent in the understorey.

2I *Eucalyptus amplifolia* Tall Open-forest

Sub-community: 97

Area (ha): 3.62

This vegetation unit comprises the Sun Valley Cabbage Gum Forest that is listed as an endangered ecological community in Part 3 of Schedule 1 of the *NSW Threatened Species Conservation Act*.

Eucalyptus amplifolia tall open-forest is a community dominated by *Eucalyptus amplifolia* (Cabbage Gum) that occurs on the diatreme at Sun Valley. An associated tree species is *Eucalyptus eugenioides* (Thin-leaved Stringybark). Although there is still relatively good tree cover in the area (remnant trees and regeneration), the understorey of this community has been grossly altered through clearing and grazing. Remaining native understorey species include *Acacia parramattensis*, *Imperata cylindrica*, *Lomandra longifolia* and *Pteridium esculentum*, but the original composition of the understorey is difficult to assess.

2J **Montane Gully Forest**

Sub-communities: 30, 45, 67

Area (ha): 406.5

This group of communities is associated with slopes on the Narrabeen Group and Illawarra Coal Measures below the escarpments around Mount York and north to Bell. There is substantial intergradation with vegetation typical of the sandstone plateau close to the escarpments and with the *Eucalyptus cypellocarpa*/*E. piperita* communities between Blackheath and Mount Victoria.

Tree species include *E. fastigata* (Brown Barrel), *E. cypellocarpa* (Monkey Gum), *E. dalrympleana* (Mountain Gum) with *E. oreades* (Blue Mountain Ash), *E. blaxlandii* (Blaxland's Stringybark), *E. radiata* (Narrow-leaved Peppermint) and *E. sieberi* (Silvertop Ash). The shrub *Bursaria longisepala* is prevalent in the drier, more open variants and *Acacia dealbata* is more common in this community than in any other parts of the study area. It appears that *E. fastigata* occurs primarily in the more sheltered sites with *E. dalrympleana*

relatively common on the lower slopes where this unit blends into remnants of the vegetation found on the edge of the agricultural land around Little Hartley.

2K Blue Gum Riverflat Forest

Sub-community: 32

Area (ha): 221.9

This community is restricted to rare occurrences on relatively broad terraces of deep alluvium along larger watercourses of the lower Blue Mountains. *Eucalyptus deanei* (Blue Gum) is dominant and may be almost monospecific, with occasional *Angophora floribunda* (Rough-barked Apple) and a small tree layer which may contain large bipinnate wattles and infrequent *Allocasuarina torulosa* (Forest Oak). The understorey is open and often dominated by grasses and/or ferns with scattered mesic shrubs becoming denser in the immediate vicinity of the watercourse.

This community is generally characterised by the almost monospecific occurrence of *E. deanei* and it superficially resembles Blue Mountains Shale Cap Forest but the two occur in different positions in the landscape. It often intergrades with the more common Blue Gum Gully Forest which occurs primarily on colluvium in more sheltered and/or deeper gullies.



Plate 11. Blue Gum Riverflat Forest (*E. deanei*)

2L

Casuarina cunninghamiana ‘River Oak Forest’

Sub-community: 95

Area (ha): 190.7

Narrow bands of River Oak Forest occur on the alluvial banks of the Cox’s River. This community also occurs in small, unmapped occurrences along the Hawkesbury-Nepean River. The dominant canopy species is *Casuarina cunninghamiana* (River Oak) with occasional subdominants being *Angophora floribunda* (Rough-barked Apple) *Eucalyptus viminalis* (Ribbon Gum) and *E. tereticornis* (Forest Red Gum), and rarely *Angophora subvelutina* (Broad-leaved Apple). *Backhousia myrtifolia* (Grey Myrtle) can also occur on the sheltered fringes of this community. Along the larger tributaries to the east of the Cox’s River, the understorey is often dominated by species of *Leptospermum*. In these situations, *Lomandra longifolia* and several sedges can dominate the ground layer.

The understorey is generally sparse because of the mobile nature of the substrate (mobile gravels, sands and large areas of bare granite). The surrounding lands have often been cleared for agriculture and these communities are often highly prone to willow and other weed infestation.



Plate 12. *Casuarina cunninghamiana* ‘River Oak Forest’

2M

Eucalyptus radiata– *E. piperita* Open Forest

Sub-communities: 53, 54

Area (ha): 37.2

This community is only known from a small number of easterly-facing slopes in Katoomba and Leura but may occur elsewhere in the higher Blue Mountains. The dominant canopy trees are *Eucalyptus radiata* (Narrow-leaved Peppermint) and *E. piperita* (Sydney Peppermint). *E. sieberi* (Silvertop Ash) is also present, particularly where this community grades into the common *E. sieberi*/*E. piperita* community which tends to occur upslope. *E. gullickii* (Brittle Gum) can occur infrequently, particularly downslope towards adjoining swamp or riparian vegetation. The understorey is a mix of dry and wet sclerophyll species and may contain species associated with Blue Mountains Swamps where these communities adjoin.



Plate 13. *Eucalyptus radiata*– *E. piperita* Open Forest

2N

Melaleuca styphelioides – *M. linariifolia* Forest

Sub-community:	100
-----------------------	------------

Area (ha): 9.6

This rare community of swamp forest/woodland and riparian complex occurs primarily in the drainage lines that form near the junction of the *Eucalyptus cypellocarpa* – *E. piperita* Tall - open Forest and Megalong Footslopes Forest. The dominant emergents in this community include *Melaleuca styphelioides* (Prickly-leaved Paper-bark), *M. linariifolia*, *Eucalyptus cypellocarpa* (Monkey Gum), and *E. viminalis* (Ribbon Gum). The floristics appear to have been significantly altered in sites that have been grazed with unpalatable plants such as *Lomandra longifolia* being disproportionately abundant.

In the case of the *Melaleuca* stands, this community is likely to be of particular significance to nectarivores such as the vulnerable Grey-headed Flying Fox (*Pteropus poliocephalus*) and endangered Regent Honeyeater (*Xanthomyza phrygia*). They are also important for their role in water quality control. Threats to the remaining examples of this vegetation include grazing, which is a concern in the far north and northwest of the Megalong Valley.



Plate 14. *Melaleuca styphelioides* – *M. linariifolia* Forest

Sub-community: 94

Area (ha): 34.7

This unit occurs in the south of the Megalong Valley where the landscape changes from the heavily cleared low relief granite hills to the steep and largely still vegetated granite mountains. It occurs as linear strips along ephemeral watercourses before they become deeply incised during their rapid descent of the south and west-facing granite slopes draining to the Cox's River. The structure is generally woodland to open forest tending with a herb/grassland understorey.

The community has been modified by grazing, and whilst the floristics have no doubt been altered to some extent, the alteration of structure is probably more significant. The vegetation can have a very sparse canopy with the few fringing trees including *Allocasuarina torulosa* (Forest Oak) otherwise not recorded in the Megalong Valley, *Eucalyptus viminalis* (Ribbon Gum) and *Angophora floribunda* (Rough-barked Apple). The latter two are typical of the granite woodlands and forests. The understorey is typically moist and dominated by herbs and grasses, with ferns and occasional sedges mainly along the drainage line. Dry rainforest species such as *Rapanea howittiana* may be present as mature specimens (Douglas 2001).

Continued grazing of this community will result in further modification of its natural floristics and structure as will the relatively long interval between fires and the absence of any use of fire for ecological purposes. Weed invasion was not seen to be a major concern but the nature of this landscape makes it particularly prone to invasion if grazing pressure is too high.



Plate 15. Riparian Granite Slopes Forest

2P Megalong Foothslopes Forest

Sub-communities: 46, 47, 68, 69, 70, 108, 109, 115, 116

Area (ha): 664.3

This highly variable community includes open forest/woodland, woodland, woodland/heath and heath (all 9m). Ecotones between the 9m variants and those of Riparian Granite Slopes Forest (2O) and Megalong Granite Forest (2Q) have not been mapped, as the transitions are not always visible on the aerial photos nor were they obvious during fieldwork. It should be assumed when interpreting the map, therefore, that substantial ecotones are often present in the region where variants of 2O or 2Q communities meet those of the Foothslopes Forest. Detection of these ecotones is very unreliable because of the impacts of grazing which have altered both the structure and floristics of these communities.

This vegetation unit occurs on the well-drained sandy loams of the Permian Shoalhaven Group on undulating country between the escarpment slopes of Narrow Neck Peninsula at 400 to 750m elevation and at Mt Cook (Keith and Benson 1988). Dominant canopy species include *Eucalyptus eugenioides* (Thin-leaved Stringybark), *E. globoidea* (White Stringybark), *E. punctata* (Grey Gum), *E. sieberi* (Silvertop Ash) and *Angophora costata* (Sydney Red

Gum), but lacks *E. agglomerata* (Blue-leaved Stringybark) and *E. oblonga* (Sandstone Stringybark) previously recorded by Keith and Benson (1988) for this community elsewhere.

Variants within this complex include:

- *E. sclerophylla* woodland to open woodland often with a heath understorey (essentially an ecotone between heath and woodland);
- Two heath variants, with the most common one being similar to but distinct from the Lower Blue Mountains Heath and that within the Sydney Sandstone Ridgetop Woodland Complex of Keith and Benson (1988) and Benson (1992). The other variant is a seemingly unique community associated with a shale lens in the western edge of the Shoalhaven Group near its interface with the granite;
- Open forest/woodland in which *E. eugenoides*, *E. globoidea*, *E. punctata* and *Angophora costata* occur; and
- Open forest which is a more dense variant of the open/forest woodland, with greater development of the mid-storey and very few or no *E. sclerophylla*. *A. costata* is typical of this open forest variant.

The understorey of the woodland and forest variants includes scattered shrubs of *Persoonia linearis*, *P. levis*, *Banksia spinulosa*, *Acacia obtusifolia*, *A. linifolia*, *Lomatia silaifolia*, *Isopogon anemonifolius* and *Leptospermum attenuatum*. Ground cover species include *Lomandra longifolia*, *Stypandra glauca*, *Lepidosperma laterale* and grasses *Stipa pubescens*, *Echinopogon caespitosus* and *Microleana stipoides*.

The heath variant generally lacks species considered typical of “Montane Heath” as mapped by Keith and Benson (1988) and is quite variable because of subtle changes in soil type and depth, drainage and interaction with adjoining communities. It generally comprises a low open heath layer with scattered to occasionally dense shrub to 3 metres. *Eucalyptus sclerophylla* is the sole emergent tree and can occur frequently on the margins of heath where it grades into the woodland / heath unit (Douglas 2001).



Plate 16. Megalong Foothills Forest – *Eucalyptus sclerophylla* woodland variant.



Plate 17. Megalong Foothills Forest - *E. eugenioides*/*E. globoidea*/*E. punctata* variant

Sub-communities: 36, 37, 62, 63
--

Area (ha): 1925.0

Keith and Benson (1988) draw particular attention to the “Yellow Box Woodland” community mapped within unit 10o on the granites of the Cox’s River Valley. This has previously led to this community being recognised as significant within the Local Environmental Plan (LEP1991). However, woodland dominated by Yellow Box (*Eucalyptus melliodora*) appears to either be extinct within the Megalong Valley or more likely was never present in this area to the point where it warranted recognition as a distinct subunit of the 10o complex.

The fieldwork for this vegetation mapping project located only a very small number of old, isolated Yellow Box in the Megalong Valley. These were present in otherwise cleared, pastoral landscapes on relatively gentle, accessible terrain so it is feasible that the *E. melliodora* variant of this vegetation was selectively cleared on the “better” country to the point where little evidence of its existence remains east of the Cox’s River.

As *E. melliodora* is not a significant canopy component of granite-based vegetation in the Megalong Valley therefore, the community is better described as Megalong Granite Woodland. Note that the use of the term “woodland” is generic as open forest forms do occur, however most of the vegetation is either of a natural woodland to open forest structure or is a “derived” woodland (*sensu* Keith and Benson, 1988).

Eucalyptus tereticornis (Forest Red Gum) and *E. viminalis* (Ribbon Gum) are the characteristic tree species although *E. eugenioides* (Thin-leaved Stringybark) becomes particularly common east of Cox’s River. *E. dalrympleana* (Mountain Gum) can be locally dominant particularly on the higher elevations (which are often quite exposed). Similarly, *Angophora floribunda* (Rough-barked Apple) is quite common and extends well beyond the lower slopes and watercourses (Douglas 2001). *E. macrorhyncha* (Red Stringybark) occurs mainly in the western areas of the granite vegetation but is occasionally a significant canopy component. *Acacia falciformis* may also be a locally significant canopy species and is present in most variants of the granite communities.

E. bridgesiana, *E. dives*, *E. rubida* and *E. camphora* are generally rare within this community and are not considered characteristic of it. These less common eucalypts are generally associated with the complex ecotones on the eastern edges of the granite vegetation or with other very localised conditions. It should be noted that *E. dalrympleana*, *E. viminalis* and to a lesser extent *E. rubida*, can intergrade and are also regarded as difficult to separate in the field (Brooker and Kleinig, 1983). Numerous eucalypt hybrids have been described for the Blue Mountains, including the Megalong Valley by Burgess (1967) so care should be taken to avoid reliance on the presence or dominance of a particular species to detect some plant communities, but in particular, the Megalong Granite Forest/Woodland.

The understorey of the Megalong Granite Forest/Woodland tends to be low and dominated by grasses, graminoids (particularly *Lomandraceae*) and herbs, in particular, *Asteraceae*. Climbers such as *Desmodium*, *Glycine* and *Clematis* are often present. Shrubs are either relatively rare or else the shrub layer consists on a small number of common unpalatable species such as *Bursaria* spp. and *Lissanthe strigosa*. The understorey composition can vary greatly depending on the amount of exposure.



Plate 18. Megalong Granite Forest/Woodland (*Eucalyptus tereticornis* and *E. viminalis*)

(3) **LOW OPEN-FOREST - *Melaleuca linariifolia***

Sub-community: 25

Area (ha): 13.1

This low open-forest community is found on sandy alluvial soils along certain creeks in the lower Blue Mountains in which the low paperbark tree, *Melaleuca linariifolia* (Snow-in-summer), dominates the vegetation. This riparian vegetation is associated with creeks on deep alluvial sand deposits, rather than the sandstone substrates more typical of Blue Mountains creeks. The typical vegetation structure is a narrow band of low open-forest or low closed-forest along the creek. Occasional emergent *Eucalyptus* or *Angophora* trees may be present above the *Melaleuca* canopy.

(4) **WOODLAND**

4A *Eucalyptus gullickii* Alluvial Woodlands

Sub-communities: 46, 47, 69, 70, 108, 109, 115, 116
--

Area (ha): 19.9

These woodlands in which *Eucalyptus gullickii* (Brittle Gum) is the dominant tree species or co-dominant with *E. radiata* (Narrow-leaved Peppermint) are found on alluvial soils along certain creeks in the upper Blue Mountains. The association of the community with creekside alluvium is a critical feature in its definition, since *E. gullickii* and *E. radiata* may also be common species in other communities in the upper Blue Mountains. The vegetation structure is woodland or open-forest. *E. gullickii* occurs in some sites as a sparse tree layer (an open-woodland) over swamp vegetation, but such stands are better classified within the Blue Mountains swamp communities rather than as *E. gullickii* alluvial woodland.

Two forms of *Eucalyptus gullickii* alluvial woodland may be distinguished. At higher altitudes (Mount Victoria-Blackheath), *E.gullickii* is the main tree species and the community

is termed *E.gullickii* woodland. At slightly lower altitudes (Katoomba-Leura), *E.gullickii* and *E.radiata* are co-dominant and the community is termed *E. gullickii-E. radiata* woodland.



Plate 19. *Eucalyptus gullickii* Alluvial Woodlands

4B ***Eucalyptus sclerophylla* BenchWoodland**

Sub-community: 6

Area (ha): 83.1

Eucalyptus sclerophylla Bench Woodlands occur on dry sandy alluvial benches along certain creek systems in the lower Blue Mountains. This community may also occur on higher benches on a mix of alluvial and colluvial soils. *Eucalyptus sclerophylla* (Hard-leaved Scribbly Gum) is the dominant tree species, sometimes co-dominant with *Angophora bakeri* (Narrow-leaved Apple). The typical vegetation structure is woodland, although this may vary depending on site conditions and history. The association between this community and alluvial or colluvial soils is a critical feature in its definition since *E. sclerophylla* is also the dominant tree species in another, more common vegetation community with a different understorey, that occurs on northern and western aspects on sandstone geology in the middle

and upper Blue Mountains. The *E. sclerophylla* trees in the latter community tend to be smaller than those in the *E. sclerophylla* Bench Woodland.



Plate 20. *Eucalyptus sclerophylla* Bench Woodland



Plate 21. *Eucalyptus sclerophylla* Bench Woodland – wet heath form.

Sub-communities: 38, 64, 121

Area (ha): 1004.9

Within the study area, the dominant vegetation of the Kowmung Wilderness Complex appears to be woodland of *Eucalyptus crebra* (Narrow-leaved Ironbark) on the ridges and upper slopes, with open forest/woodland containing *E. tereticornis* (Forest Red Gum), *E. eugenioides* (Thin-leaved Stringybark) and *E. punctata* (Grey Gum) in slightly more sheltered situations. *E. viminalis* (Ribbon Gum) and *Angophora floribunda* (Rough-barked Apple) are present on the sheltered lower slopes and along watercourses. The vegetation along watercourses contains rainforest elements such as *Trema aspera*, *Ficus coronata* and *Marsdenia* spp.

The understorey is variable, supporting *Bursaria* spp., *Breynia oblongifolia*, *Lissanthe strigosa*, *Persoonia linearis* with numerous herbs including *Dichondra repens*, *Centella asiatica*, *Pratia purpurascens*, *Senecio lautus* ssp. *dissectifolius*, *Wahlenbergia* spp. (particularly *W. stricta*), twiners such as *Desmodium varians* and *Glycine* spp, the ferns *Cheilanthes sieberi* and *C. distans*, and grasses including *Themeda australis*, *Dichelachne micrantha*, *Oplismenus imbecillis* and *Panicum effusum*.

A population of the threatened shrub *Acacia clunies-rossiae* was detected within this vegetation type during mapping fieldwork. It was present in very low numbers in the *E. crebra* woodland and was more numerous though never common in the areas where *Eucalyptus tereticornis* and *Angophora floribunda* dominated the canopy. This population is probably at the northern limit of the species' distribution and appears to be at risk from grazing and the lack of a suitable fire regime.



Plate 22. Kowmung Wilderness Complex

4D Redgum Swamp Woodland

Sub-community: 90

Area (ha): 0.7

This very rare community was previously mapped as Cox's River Swamps by Keith and Benson (1988), but has been separated from that unit as a distinct variant in this mapping. Both swamp communities are generally dominated by emergent *Eucalyptus tereticornis* (Forest Red Gum) and *Melaleuca linariifolia*, with a shrubby cover of *Leptospermum* spp. including *L. morrisonii*, *L. juniperinum* and *L. obovatum*. The main difference between the two forms is structure *ie* Megalong Valley Swamps are generally closed to tall closed scrub whereas Cox's River Swamps tend to be more open and the tallest shrub layer is lower. Floristics differ to a lesser extent *eg* Cox's River Swamps feature *L. obovatum*, a species that is rare or absent from Megalong Valley Swamps. The ground stratum of both communities includes various sedges and wetland herbs.

Redgum Swamp Woodland occurs at the eastern end of Nellies Glen Road in the Megalong Valley and is the only known habitat of *Callistemon sp. nov.* Megalong Valley, which was

discovered during mapping fieldwork. This plant has been nominated for listing as a Vulnerable species under the Threatened Species Conservation Act.

The community is naturally rare because of its narrow habitat requirements and has been reduced by clearing for grazing, which is the largest threat to both swamp communities at present.

(5) HEATH/SCRUB/SEDGELAND/FERNLAND

5A Blue Mountains Heath and Scrub

Sub-communities: 11, 12, 13, 14, 15, 19, 20, 21, 23, 117

Area (ha): 3031.5

Blue Mountains Heath and Scrub consists of a well-developed shrub layer, with no tree layer or only a sparse layer of scattered low trees, sometimes with a mallee habit (low, multi-stemmed shrub eucalypts). It occurs primarily in exposed sites with very shallow soils on Narrabeen Group and Hawkesbury Sandstone geology. Typical situations are cliff tops and high, rocky ridges, especially on the westerly aspect and with skeletal soils.

The vegetation structure is typically an open-heath, less often a closed-heath, and may be interspersed with patches of open-scrub or closed-scrub formed by stands of mallees or *Leptospermum* spp. It is also typically interspersed with areas of bare rock. It can occur on the fringes of or within so-called hanging swamps and in such situations it can also intergrade with vegetation of the Riparian Complex. There is also considerable intergradation between forms of woodland to open woodland with a *Eucalyptus sclerophylla* (Hard-leaved Scribbly Gum) canopy with Blue Mountains Heath and Scrub forming the understorey in such communities.

Blue Mountains Heath and Scrub has a mixed and variable species composition. Common shrub species include *Allocasuarina distyla*, *A. nana*, *Banksia ericifolia*, *Epacris microphylla*, *Eucalyptus stricta*, *Hakea laevipes*, *Hakea teretifolia*, *Kunzea capitata*, *Leptospermum trinervium* and *Petrophile pulchella*. Common herb and sedge species include *Actinotus minor*, *Platysace linifolia*, *Lepidosperma filiforme*, *L. viscidum*, *Lepyrodia scariosa*, *Ptilothrix deusta* and *Schoenus villosus*.

Two forms of Blue Mountains heath have been distinguished (Keith and Benson 1988, Smith and Smith 1995): **montane heath** above about 850-900m elevation and **lower Blue Mountains heath** below this level. The two forms intergrade between Wentworth Falls and Katoomba. Montane heath is characterised by the presence of high altitude species such as *Allocasuarina nana*, *Darwinia taxifolia* and *Phyllota squarrosa*, while lower Blue Mountains heath is characterised by the presence of low altitude species such as *Allocasuarina distyla*, *Darwinia fascicularis* and *Phyllota phyllicoides*. However, most of the more common heath plants occur across the full altitudinal range.

It is also possible to distinguish two forms of lower Blue Mountains heath: a Hawkesbury Sandstone form at lower altitudes (chiefly in the Faulconbridge to Woodford area), and a Narrabeen Sandstone form at intermediate altitudes (Hazelbrook to Wentworth Falls). The Hawkesbury Sandstone form is characterised by species such as *Acacia oxycedrus*, *Baeckea brevifolia* and *Eucalyptus burgessiana* that are absent from heath on Narrabeen Sandstone.

In the prolonged absence of fires, the heath shrubs grow taller and thicker, transforming the vegetation from an open-heath to a closed-scrub, especially in relatively moist and sheltered sites. These communities may be floristically similar to the closed heaths described above but are structurally unique. Shrubs including, *Banksia ericifolia*, *B. serrata*, *B. spinulosa*, *Hakea laevipes*, *H. teretifolia* and a range of *Leptospermum* species may all attain heights of up to 8m over a generally grassy, herbaceous understorey. In locally moist areas, the fern *Gleichenia dicarpa* may become common in the ground stratum.

Megalong Valley

In the Megalong Valley, forms of heath occur which are floristically and geologically distinct from those others within the scope of the Blue Mountains Heath description. The majority of Megalong Valley Heath is associated with the Shoalhaven Group of sediments with a rare exception associated with the Carboniferous Granite. Dominant species of the heath include *Leptospermum trinervium*, *L. polygalifolium*, *L. juniperinum*, *Isopogon anemonifolius*, *Hakea salicifolia*, *H. sericea* and *Banksia spinulosa* while the locally uncommon shrub *Mirbelia pungens* may also be present.

Only one example is known of heath occurring on granite within the Megalong Valley, however other examples are likely to occur outside Blue Mountains City, west of the Cox's River. This granite example is dominated by a relatively low-growing shrubby *Acacia* which was not been able to be identified but is apparently related to *Acacia floribunda*.



Plate 23. Blue Mountains heath



Plate 24. Tall heath with emergent *E. sclerophylla*.



Plate 25. Megalong Valley heath

5B Blue Mountains Swamps

Sub-communities: 3, 8, 9, 10, 18, 98, 99

Area (ha): 1134.8

A range of swamps occurs within the Blue Mountains. Swamp vegetation develops on poorly drained sites where the soil is waterlogged for prolonged periods. Several variants are recognised and are described below.

In the Blue Mountains, swamps occur not only in low-lying sites on valley floors ('valley swamps') but also in the headwaters of creeks and on steep hillsides ('hanging swamps'). Some swamps represent a combination of valley swamp and hanging swamp. The upper boundary of the swamp is often clearly defined by the outcropping of a layer of claystone. Groundwater seeps along the top of the impermeable claystone layer, reaching the surface where the claystone protrudes, thus forming a swamp on the hillside below. Other swamps receive their water supply from feeder streams rather than groundwater, or from a combination of the two.

Blue Mountains Swamps vary greatly in their structure and plant species composition, ranging from closed-sedgeland or closed-fermland to open-heath or closed-heath, sometimes open-scrub or closed-scrub. The shrub-dominated swamps are similar in vegetation structure to some of the forms of Blue Mountains Heath/Scrub, but they differ in species composition and ecological function, and are more appropriately classified with the sedge- and fern-dominated swamps. However, in many instances the botanical boundary between Blue Mountains Swamp and Blue Mountains Heath/Scrub communities is unclear or can only be defined at a small scale, as the two vegetation types can intergrade extensively.

Common shrubs in the Blue Mountains Swamps that occur on the sandstone plateaux include *Acacia ptychoclada*, *Baeckea linifolia*, *Banksia ericifolia*, *Callistemon citrinus*, *Epacris obtusifolia*, *Grevillea acanthifolia*, *Hakea teretifolia*, *Leptospermum grandifolium*, *L. juniperinum* and *L. polygalifolium*. Common sedges include *Empodisma minus*, *Gymnoschoenus sphaerocephalus*, *Lepidosperma limicola* and *Xyris ustulata*. The main fern species is *Gleichenia dicarpa*. The swamps of the plateaux include communities described by Keith and Benson (1988) and Benson and Keith (1990) as Blue Mountains Sedge Swamps and Newnes Plateau Shrub Swamps.

The Kurrajong Fault Swamps are valley swamps that occur in the lower Blue Mountains on sandy alluvial deposits associated with the Kurrajong Fault. These may be distinguished from the typical Blue Mountains Swamps because the vegetation structure is usually an open-scrub or closed-scrub. Common shrubs are *Acacia rubida*, *Callicoma serratifolia*, *Callistemon citrinus*, *Leptospermum juniperinum* and *Melaleuca linariifolia*. Common species in the understorey are *Baumea rubiginosa*, *Gahnia clarkei*, *Gleichenia dicarpa* and *Schoenus melanostachys*.

The Cox's River Swamp is another variant encompassed by this community. These swamps occur on the clayey organic sediments derived from the Illawarra Coal Measures where creeks drain at the base of the escarpment. They support a simple flora dominated by *Leptospermum obovatum*, *L. juniperinum* and *Grevillea acanthifolia* with a dense ground cover of *Carex* and *Juncus* spp.



Plate 26. Blue Mountains Hanging Swamp



Plate 27. Cox's River Swamp

5C Pagoda Rock Complex

Sub-community: 82

Area (ha): 103.5

Within Blue Mountains City, this community occurs only in the far northwest near Bell. It occurs primarily outside the City on the Newnes Plateau where it is exemplified in Gardens of Stone National Park.

Benson and Keith (1990) list three structural divisions within this Complex: open heath of *Allocasuarina nana*, *Leptospermum arachnoides*, *Lepidosperma viscidum*, *Platysace lanceolata* and *Banksia ericifolia*; open mallee scrub of *Eucalyptus sp. nov.* "MOKII" which is not known from Blue Mountains City; and woodland of *E. sieberi* (Silvertop Ash), *E. piperita* (Sydney Peppermint) and *E. oblonga* (Sandstone Stringybark). This mosaic of communities intergrades with the higher altitude variant of Blue Mountains Heath.

5D Lagoon Vegetation

Sub-community: 22

Area (ha): 9.9

Lagoon Vegetation (Glenbrook Lagoon) is the wetland vegetation associated with Glenbrook Lagoon. This waterbody is the only naturally occurring upland lagoon in the City of Blue Mountains, although wetland vegetation has also developed around artificially created water bodies such as Wentworth Falls Lake and Woodford Lake. Glenbrook Lagoon consists of an area of open water with submerged aquatic vegetation, surrounded by extensive reedbeds dominated by the large sedges *Lepironia articulata* and *Eleocharis sphacelata*. Fringing the reedbeds is a narrow band of low paperbark trees *Melaleuca linariifolia*.



Plate 28. Glenbrook Lagoon

(6) BLUE MOUNTAINS RIPARIAN COMPLEX

Sub-communities: 91, 92, 93

Area (ha): 429.4

Blue Mountains Riparian Complex refers to the narrow bands of vegetation found along perennial and non-perennial watercourses in the Blue Mountains. It applies to those sections of the creek where there are distinct differences between the creekside vegetation and the adjacent vegetation further from the creek.

Riparian (creekline) vegetation can be diverse and variable in structure and composition. It typically consists of species that are restricted to the immediate creekside environment plus other species from the adjacent vegetation communities. Although a variety of eucalypts may occur along the creeks, they generally reflect the composition of the adjacent vegetation community rather than the riparian vegetation itself. Pockets of rainforest, swamp and moist

cliffline (waterfall) vegetation are often present along the creeks and add to the floristic diversity of the riparian vegetation.

Common shrubs and low trees characteristic of riparian vegetation in the Blue Mountains include *Acacia rubida*, *Baeckea linifolia*, *Bauera rubioides*, *Callicoma serratifolia*, *Callistemon citrinus*, *Leptospermum polygalifolium*, *Lomatia myricoides*, *Tristania nerifolia* and *Tristaniopsis laurina*. Ferns tend to be a major component of the riparian vegetation, and include *Blechnum nudum*, *Calochlaena dubia*, *Gleichenia microphylla*, *Sticherus flabellatus* and *Todea barbara*. Common sedges and rushes include *Gahnia sieberiana*, *Juncus planifolius* and *Schoenus melanostachys*.

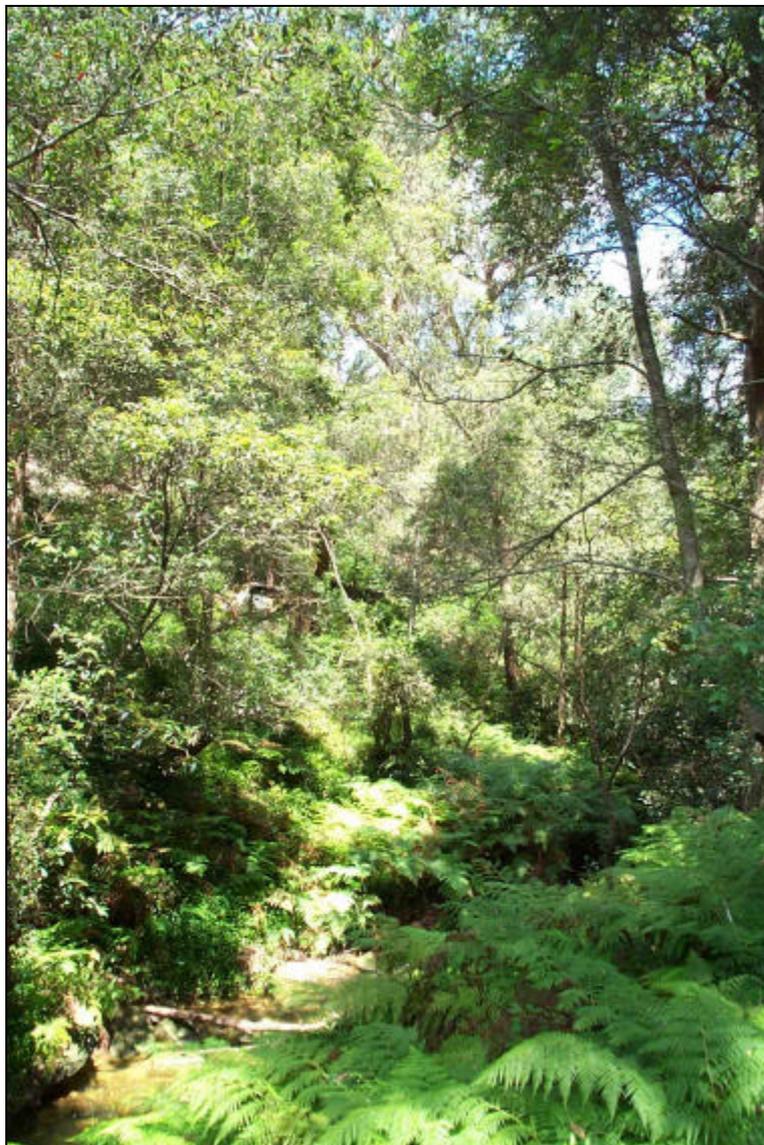


Plate 29. Blue Mountains Riparian Complex

(7) **BLUE MOUNTAINS ESCARPMENT COMPLEX**

Sub-communities: 7, 16, 17, 24

Area (ha): 1285.0

Blue Mountains Escarpment Complex refers to the distinctive vegetation communities associated with moist, sheltered rock faces, the escarpments and other extensive outcroppings of sandstones in the Blue Mountains. The habitat of this vegetation varies from rock crevices, ledges, caves and the talus at cliff bases through to isolated rock outcrops. The vegetation consists of a diverse mixture of moist cliffline vegetation, heath, swamp, rainforest, mallee and forest communities that can vary on a very small scale.

Species found in the moist sites include *Alania endlicheri*, *Baekkea linifolia*, *Blechnum ambiguum*, *B. wattsi*, *Callicoma serratifolia*, *Dracophyllum secundum*, *Drosera binata*, *Epacris reclinata*, *Gleichenia microphylla*, *G. rupestris*, *Leptospermum rupicola*, *Sprengelia monticola* and *Todea barbara*. Where a tree canopy is present, it can contain elements of various communities but *E. oreades* (Blue Mountain Ash) is by far the most common. *E. piperita* (Sydney Peppermint), *E. sieberi* (Silvertop Ash) and a range of mallees particularly the common *E. stricta* (Mallee Ash), can also be locally prevalent.

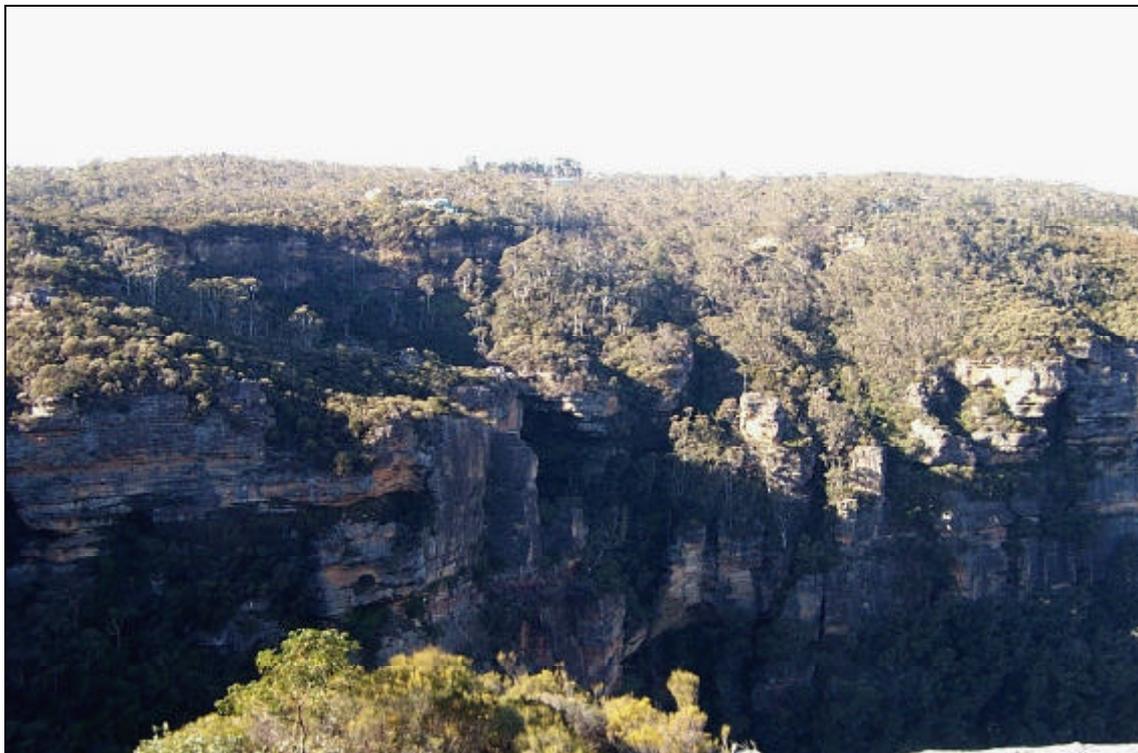


Plate 30. Escarpment Complex

5. NON-SCHEDULED VEGETATION COMMUNITY GROUPS*

*Preliminary groupings only – subject to validation.

Those vegetation sub-communities not classified as Scheduled Vegetation under the Significance Criteria were classified into broad community groups according to their floristic and structural similarities as identified by Douglas (2001), Smith and Smith (1995), and Keith and Benson (1988). These groupings should be considered as preliminary only, and subject to ratification by field validation to be undertaken by Council from 2002 to 2004.

5.1 Non-scheduled vegetation communities as “habitat”

It should be stressed that non-scheduled sclerophyll woodlands in the Blue Mountains City provide significant habitat for a large number of threatened plant and animal species. Mokany and Adam (2000) identified dry eucalypt woodland communities as containing more threatened plant species than any other plant community in NSW. This finding supports that of Leigh and Briggs (1992) who also showed that woodland communities possess the largest number of endangered plant species in NSW.

Those threatened flora and fauna species known or likely to occur within or make use of these non-scheduled vegetation communities are listed in Table 2 below.

Table 2

Threatened fauna and flora species known or likely to occur in non-scheduled vegetation in the Blue Mountains Local Government Area

Common Name	Scientific Name	TSC Schedule*
AMPHIBIANS		
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	V
Red-Crowned Toadlet	<i>Pseudophryne australis</i>	V
REPTILES		
Broad-Headed Snake	<i>Hoplocephalus bungaroides</i>	E
MAMMALS		
Southern Brown Bandicoot	<i>Isodon obesulus</i>	E
Spotted-Tailed Quoll	<i>Dasyurus maculatus</i>	V
Squirrel Glider	<i>Petaurus norfolcensis</i>	V
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	V
Koala	<i>Phascolarctos cinereus</i>	V
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	V

Common Name	Scientific Name	TSC Schedule*
Common Bentwing Bat	<i>Miniopterus schreibersii</i>	V
Large Eared Pied Bat	<i>Chalinolobus dwyeri</i>	V
BIRDS		
Regent Honeyeater	<i>Xanthomyza phrygia</i>	E
Swift Parrot	<i>Lathamus discolor</i>	E
Glossy Black Cockatoo	<i>Calyptorhynchus lathami</i>	V
Turquoise Parrot	<i>Neophema pulchella</i>	V
Masked Owl	<i>Tyto novaehollandiae</i>	V
Sooty Owl	<i>Tyto tenebricosa</i>	V
Barking Owl	<i>Ninox connivens</i>	V
FLORA		
No Common Name	<i>Acacia bynoeana</i>	E
Kowmung Wattle	<i>Acacia clunies-rossiae</i>	V
No Common Name	<i>Acacia flocktoniae</i>	V
No Common Name	<i>Acacia gordonii</i>	E
Downy Wattle	<i>Acacia pubescens</i>	V
No Common Name	<i>Acrophyllum australe</i>	V
No Common Name	<i>Darwinia peduncularis</i>	V
No Common Name	<i>Dillwynia tenuifolia</i>	V
Buttercup Double-Tail Orchid	<i>Diuris aequalis</i>	V
Pendant Beard Heath	<i>Leucopogon fletcheri ssp. fletcheri</i>	E
No Common Name	<i>Persoonia acerosa</i>	V
Hairy Geebung	<i>Persoonia hirsuta</i>	E
No Common Name	<i>Pultenaea glabra</i>	V
No Common Name	<i>Pultenaea villifera</i>	E
No Common Name	<i>Zieria covenyi</i>	E
No Common Name	<i>Zieria murphyi</i>	V

* Scheduled under the *NSW Threatened Species Conservation Act*. V= vulnerable; E= endangered.

5.2 Non-scheduled vegetation communities

Non-scheduled vegetation communities comprise "similar" woodland/open forest sub-communities placed into groups which are floristically and structurally related. The structure of each community depends upon a number of criteria including altitude, nutrient availability, soil moisture, aspect and fire history. For example, heath and low woodland may differ structurally but exhibit similar floristics in response to the time since the last fire. Similarly, increasing altitude and exposure tend to be reflected in the structure of a vegetation community.

Detailed descriptions and total area of each non-scheduled vegetation community are given below. These descriptions have been adapted from the publications of Keith and Benson (1988), Smith and Smith (1995) and Douglas (2001). Vegetation sub-communities that make

up each non-scheduled community have been identified but are not individually described in this report. A list of the recognised non-scheduled vegetation communities by Planning Area is presented in Table 3.

Table 3
Vegetation groups in the City of Blue Mountains

NON-SIGNIFICANT VEGETATION GROUPS (SENSU DLEP2002)	Occurrence By Planning Area				
	1	2	3	4	5
11. OPEN FOREST/WOODLAND					
(A) <i>Eucalyptus sieberi</i> - <i>E. piperita</i>	X	X	X		
(B) <i>Eucalyptus piperita</i> - <i>Angophora costata</i>			X	X	X
(C) <i>Corymbia eximia</i> – <i>Corymbia gummerifera</i>				X	X
(D) <i>Corymbia gummifera</i> - <i>Eucalyptus sclerophylla</i>	X		X		
(E) <i>Corymbia gummifera</i> – <i>Eucalyptus seiberi</i>			X		
(F) <i>Corymbia gummifera</i> – <i>Eucalyptus sparsifolia</i>				X	X
(G) <i>Eucalyptus sclerophylla</i>		X	X	X	X
12. MODIFIED BUSHLAND	X	X	X	X	X
13. INTRODUCED COMMUNITIES (PINES & PLANTATIONS)	X	X			

(11) OPEN FOREST/WOODLAND/LOW WOODLAND

11A *Eucalyptus sieberi* – *E. piperita* Open-forest/Woodland

Sub-communities: 44, 75, 76, 77, 78, 114

Area (ha): 2231.4

This community is described as open forest Blue Mountains Sandstone Plateau Forest (9i) by Keith and Benson (1988) and forms the typical vegetation of plateaux, ridges and exposed slopes on Narrabeen Group sandstones wherever there is a reasonably good soil depth. This vegetation unit and its variants dominate much of the Triassic sandstone plateau at higher altitudes (800-1150m) and comprise the most extensive vegetation community in the upper mountains (Areas 1, 2, 3, Western Plateau and Megalong).

Generally the community comprises open forest/woodland of *Eucalyptus sieberi* (Silver-top Ash) and *E. piperita* (Sydney Peppermint), with occasional *E. sclerophylla* (Hard-leaved Scribbly Gum), *E. oblonga* (Sandstone Stringybark), *E. sparsifolia* (Narrow-leaved Stringybark), *E. gullickii* (Brittle Gum) and *E. radiata* (Narrow-leaved Peppermint). *E. piperita* is the dominant tree species in areas on exposed sites below the sandstone escarpments on soils derived from the Illawarra Coal Measures.

The primarily sclerophyll understorey is diverse and varies from heath to scrub, with *Leptospermum trinervium* (wide and narrow-leaved forms) being a particularly common component. The community also supports the vulnerable shrubs *Persoonia acerosa* and *Pultenaea glabra* (TSC 1995), particularly on laterised soils on the broader ridges and plateaux,. It is likely habitat for the endangered *Persoonia hirsuta*, which reaches its western and altitudinal limit at Shipley Plateau, and could also support the endangered *Acacia bynoeana* (Douglas 2001). Common shrubs that have been recorded in this community include *Banksia spinulosa*, *B. cunninghamii*, *Persoonia chamaepitys*, *P. myrtilloides*, *Boronia microphylla* and *Stellaria pungens*.



Plate 31. *Eucalyptus sieberi* – *E. piperita* Open-forest/Woodland (1)



Plate 32. *Eucalyptus sieberi* – *E. piperita* Open-forest/Woodland (2)

11B *Eucalyptus piperita* - *Angophora costata* Open-forest/Woodland

Sub-communities: 58, 72, 80

Area (ha): 4431.03

This open forest/woodland unit is one of the most extensive vegetation types on Hawkesbury Sandstone in Areas 3 and 4 (Bullaburra to Hawkesbury Heights) (Smith & Smith 1995) and Area 5 (Warrimoo to Lapstone). In these areas the community is common on upper slopes and sheltered gullies with well-drained, shallow sandy loams on Hawkesbury and Narrabeen group sandstones (Benson 1988).

The community is an open forest of *Eucalyptus piperita* (Sydney Peppermint), *Angophora costata* (Sydney Red Gum), *Syncarpia glomulifera* (Turpentine), *E. agglomerata* (Blue-leaved Stringybark), *E. sieberi* (Silvertop Ash), and *Corymbia gummifera* (Red Bloodwood). The variant that occurs in the Blue Mountains City often contains tree species that are absent or rare in those lower altitude forests eg *E. notabilis*, *E. punctata*, and *E. agglomerata*

Common small trees occurring within this community include *Allocasuarina littoralis*, *A. torulosa* and *Banksia serrata*. The diverse shrubby understorey comprises a diverse layer that can include *Leptospermum trinervium*, *Pultenaea scabra*, *Banksia spinulosa*, *Lambertia formosa*, *Dillwynia retorta*, and *Bossiaea obcordata* (Douglas 2001). Ground cover plants include *Calochlaena dubia* (Common Ground Fern), *Entolasia stricta* (Wiry Panic), *Pteridium esculentum* (Bracken), *Lomandra longifolia* (Spiny-headed Mat-rush), *Dianella caerulea* (Blue Flax Lily) and *Phyllanthus hirtellus* (Thyme Spurge).

The original distribution of this community and the boundary between it and Blue Mountains Shale Cap Forest (2B) is unclear due to extensive clearing and/or modification of these vegetation types. The two communities are closely related and may intergrade extensively. In addition, this community intergrades with Shale/Sandstone Transition Forest.



Plate 33. *Eucalyptus piperita* - *Angophora costata* Open-forest/Woodland

11C *Corymbia eximia* - *C. gummifera* Open-forest/Woodland Heath

Sub-communities: 120, 125

Area (ha): 1183.39

This *Corymbia* woodland/open forest community occurs in the lower mountains in Areas 4 and 5, largely in the easternmost areas and is characterized by the presence of *Corymbia eximia* (Yellow Bloodwood). It is associated with rocky, often exposed sites on ridgetops and upper slopes on the upper Hawkesbury Group. *Corymbia eximia* and *C. gummifera* (Red Bloodwood) are the dominant canopy species, though other tree species can be present, particularly where there is intergradation with Community (12 - *Eucalyptus piperita*/*Angophora costata* open forest/woodland), in which case *Angophora costata* (Sydney Red Gum), *Eucalyptus piperita* (Sydney Peppermint) and *E. agglomerata* (Blue-leaved Stringybark) may occur (Douglas 2001). The woodland/heath variant is associated with both large rock outcrops and escarpments (dry heath understorey) or where there is intergradation between this community and *Eucalyptus sclerophylla* Bench woodland (wet heath understorey).

This vegetation community is exemplified on the upper slopes and ridges associated with the Lapstone Monocline, and is evident along the Great Western Highway at Lapstone (Douglas 2001). The understorey is variable but is generally sparse in the more rocky situations, shrubby in typical sites, and grassy where there is some influence from clay and associated impeded drainage (Smith and Smith 1995).

The grasses *Joycea pallida* and *Entolasia stricta* can be prevalent (Smith and Smith 1995). This community is comparatively abundant in the Blue Mountains City and is relatively well conserved in Blue Mountains National Park. The recent gazettal of Yellomundee Regional Park conserved additional areas of this community but its status would be improved with the reservation of additional large Crown holdings in the eastern lower mountains (Douglas 2001).



Plate 34. *Corymbia eximia* - *C. gummifera* Open-forest/Woodland Heath (1)



Plate 35. *Corymbia eximia* - *C. gummifera* Open-forest/Woodland Heath (2)

11D *Corymbia gummifera* - *Eucalyptus sclerophylla* Open-forest/ Woodland

Sub-communities: 61, 74, 113, 119

Area (ha): 1863.22

This unit is widespread on ridges and open slopes on shallow, well-drained sandy soils on Hawkesbury and Narrabeen Group Sandstones in Areas 1 and 3. Structurally the community varies from open forest to low woodland, dominated by *Corymbia gummifera* (Red Bloodwood), *Eucalyptus sclerophylla* (Hard-leaved Scribbly Gum), *E. piperita* (Sydney Peppermint), *E. sieberi* (Silvertop Ash) and *E. sparsifolia* (Narrow-leaved Stringybark), with canopy trees often taking on a stunted or mallee form (Smith and Smith 1995). Vegetation structure varies from low woodland on rocky, exposed sites with shallow soils, to open forest on better soils with deeper soils.

A variant of this community comprises more open woodland stunted trees or mallees over a heath or scrub understorey (Douglas 2001), and occurs in exposed locations on very shallow, stony soil east of the Mt Wilson township.

Common understorey shrubs include *Banksia spinulosa*, *Hakea dactyloides* (multi-stemmed form), *Persoonia laevis*, *Leptospermum attenuatum*, *Kunzea ambigua*, *Pultenaea elliptica* and *Acacia longifolia*. The community also supports the vulnerable shrub *Persoonia acerosa*.



Plate 36. *Corymbia gummifera* - *Eucalyptus sclerophylla* Open-forest/Woodland.

11E *Corymbia gummifera* – *E. sieberi* Open-forest/Woodland

Sub-community: 71

Area (ha): 917.159

This unit comprises the most common forest/woodland community in Area 3 (Douglas 2001) and typifies that vegetation found on ridges and exposed slopes on Hawkesbury and Narrabeen Sandstones. Dominant tree canopy species include all or most of the following: *Corymbia gummifera* (Red Bloodwood), *Eucalyptus sieberi* (Silvertop Ash), *E. sparsifolia* (Narrow-leaved Stringybark), *E. piperita* (Sydney Peppermint), *E. sclerophylla* (Hard-leaved Scribbly Gum) and occasional *Angophora costata* (Sydney Red Gum).

Vegetation structure varies from low woodland on rocky exposed sites with shallow soils, to open-forest on sites with deeper soils. Common low trees and shrubs include *Leptospermum*

trinervum, *Petrophila pulchella*, *Dillwynia retorta*, *Hakea dactyloides* (multi-stemmed form), *Banksia serrata*, *B. spinulosa*, *Persoonia laevis*, *Kunzea ambigua*, *Daviesia corymbosa*, *Isopogon anemonifolius*, and *Grevillea buxifolia*. Common ground layer species include *Caustis flexuosa*, *Cyatochaeta diandra*, *Lepyrodia scariosa*, *Schoenus imberbis*, *Patersonia sericea* and *Stipa pubescens*.

Extensive variation is recognized within this vegetation community. The unit intergrades with *Eucalyptus sieberi* - *E. piperita* forest to the west (Area 2) and *E. piperita* - *Angophora costata* forest to the east (Area 4). This sub-community also includes a variant that merges with low woodland\woodland dominated by *E. sclerophylla* in very exposed situations with shallow soils and/or impeded drainage (Douglas 2001).



Plate 37. *Corymbia gummifera* – *E. sieberi* Open-forest/Woodland

11F *Corymbia gummifera* - *Eucalyptus sparsifolia* Open-forest/Woodland

Sub-communities: 73, 110, 122, 123

Area (ha): 1899.15

This is a highly variable vegetation community, occurring mainly on ridgetops and exposed upper slopes associated with the Faulconbridge Soil Landscape in the lower to middle mountains (Areas 4 and 5). The unit is a dry sclerophyll woodland or open forest community that varies in structure from low woodland on rocky, exposed sites with very shallow soils, to open-forest on better sites with deeper soils.

The abundance of tall *E. sparsifolia* (Narrow-leaved Stringybark) in this unit represents the main difference from the similar communities of 11B and 11E. It may include elements of Sandstone/Shale Transition Forest (high sandstone variant) in the lower mountains (Douglas 2001).

Dominant canopy species are *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus sparsifolia* (Smith and Smith 1995). Associated tree species include *E. piperita* (Sydney Peppermint), *E. eugenioides* (Thin-leaved Stringybark), *E. notabilis* (Blue Mountains Mahogany), *E. sclerophylla* (Hard-leaved Scribbly Gum), and *Angophora costata* (Sydney Red Gum). Low tree species include *Banksia serrata* and *Allocasuarina littoralis*. *Syncarpia glomulifera* (Turpentine) is rare as a canopy species but is sometimes common in the understorey (Smith and Smith 1995).

This community has a diverse shrub layer which may include *Leptospermum trinervium*, *Banksia spinulosa*, *Dillwynia retorta*, *Acacia sauveolens*, *A. ulicifolia*, *Daviesia corymbosa*. Common ground plants include *Caustis flexuosa*, *Lomandra glauca*, *Entolasia stricta*, *Lepyrodia scariosa* and *Patersonia sericea*.

This community provides habitat for the endangered population of the small shrub *Pultenaea villifera* (Part 2 of Schedule 1 – TSC 1995), the endangered plant species *Acacia bynoeana* and *Persoonia hirsute* (Part 2 of Schedule 1 – TSC 1995), and the vulnerable shrub *Persoonia acerosa* (Part 2 of Schedule 2 – TSC 1995).



Plate 38. *Corymbia gummifera* – *Eucalyptus sparsifolia* Open-forest/Woodland

11G *Eucalyptus sclerophylla* Woodland/Low Woodland

Sub-communities: 111, 118, 124

Area (ha): 1802.29

This vegetation unit comprises highly variable dry sclerophyll woodland to low woodland dominated by *Eucalyptus sclerophylla* (Hard-leaved Scribbly Gum) with a diverse sclerophyll understorey, sometimes tending to heath. It is found on exposed aspects with shallow, stony soil, often associated with exposed sandstone benches and extensive heathlands.

Depending on altitude and location in the landscape, other canopy tree species that may be present in low numbers include *Eucalyptus sparsifolia* (Narrow-leaved Stringybark), *E. piperita* (Sydney Peppermint), *E. notabilis* (Blue Mountains Mahogany), and *Corymbia gummifera* (Red Bloodwood). If present as an associated tree species in the understorey, *Angophora bakeri* (Narrow-leaved Apple) may identify the unit as the significant vegetation community “*E. sclerophylla* bench woodland” (4B).

Smith and Smith (1995) noted a number of *E. sclerophylla* woodland variants including:

- **Area 2** – *Eucalyptus sieberi* and *E. mannifera* canopy tree species are uncommon and the regionally significant species *E. ligustrina* (Privet-leaved Stringybark) is present in this community on Kings Tableland;
- **Area 4** – two forms of woodland dominated by *E. sclerophylla* occur in Area 4: (A) low woodland on moderate slopes with a northwest aspect around the heads of several small creeks to north of Faulconbridge and Springwood; (B) a taller woodland form on sandy alluvial soils in broad shallow valleys on upper parts of creeks on the eastern side of Winmalee. Associated canopy trees include *E. piperita* and *E. notabilis* with *Melaleuca linariifolia* forming thickets along creeklines. Shrubs include *Banksia spinulosa* and *B. oblongifolia* (Rock Banksia). Ground cover plants include *Pteridium esculentum*, *Lomandra longifolia*, and *Imperata cylindrica*.

Common shrubs include *Daviesia corymbosa*, *Bossiaea rhombifolia*, *Leptospermum trinervium*, *Banksia spinulosa*, *B. serrata*, *Platysace linearifolia*, *Petrophile pulchella*, *Lambertia formosa*, *Isopogon anemonifolius*, *Hakea sericea*, *Hakea dactyloides*. Common ground plants include *Lomandra glauca*, *Patersonia sericea*, *Entolasia stricta*, *Caustis flexuosa*, *Lepyrodia scariosa*, *Epacris pulchella*, *Imperata cylindrica* and *Stipa pubescens*.

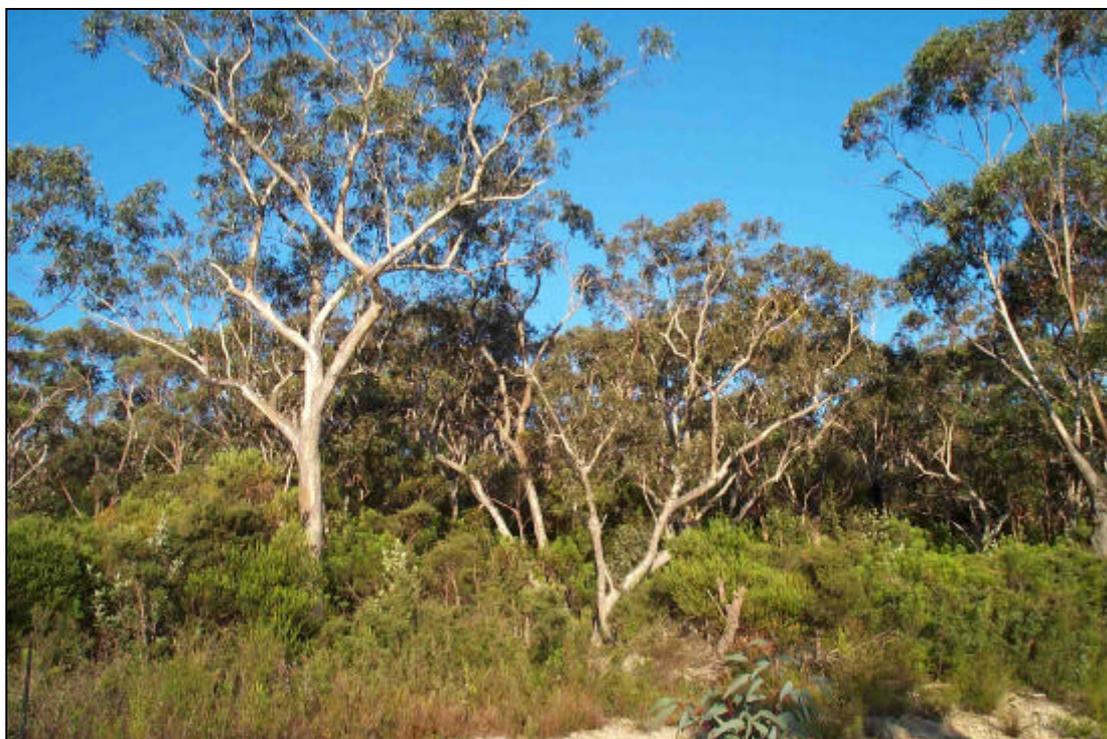


Plate 39. *Eucalyptus sclerophylla* Woodland/Low Woodland (1)



Plate 40. *Eucalyptus sclerophylla* Woodland/Low Woodland (2)

(12) MODIFIED BUSHLAND

Community: 26

Area (ha): 814.70

This category was initially tagged as “disturbed” but was renamed “modified bushland” to clarify that such areas cannot be dismissed as having no flora or fauna value. Most areas given this tag contain a majority of indigenous species, though some areas have substantial problems with weed infestation. Areas under powerlines where the vegetation is repeatedly trimmed or slashed, slashed road and trail verges, small remnants in urban areas or patches of trees over native pasture in rural areas are included in this category. Whilst some areas in the category are degraded, others are being regenerated and each area should be assessed individually.

It is important to note that several of the study area’s threatened plant species are favoured by disturbance regimes which can mean that they occur primarily in areas that may have been mapped as “modified bushland” in this report. The vulnerable shrub, *Personia acerosa* is a particularly good example of this situation.

(13) INTRODUCED COMMUNITIES - PINES AND PLANTATIONS

Communities: 83, 84

Area (ha): 14.5 ha

The category “pines” generally pertains to areas of bushland often modified by proximity to urban areas and associated degradation, which have been invaded by pines, predominantly *Pinus radiata*. In this mapping only those areas in which pines were sufficiently dense over a relatively large area were mapped as “pines”. Most areas of significant pine infestation were mapped in Area 2, which includes Radiata Plateau, parts of which were once cleared and planted as a pine forest but which was soon abandoned and has been unmanaged for several

decades. Currently, Radiata Plateau contains predominantly native vegetation with strips and patches in which pines remain dominant, along with areas in which pines have invaded bushland. Additionally, three small pine plantations totaling approximately five hectares occur in the Megalong Valley.

6. REFERENCES

Benson D.H. 1992. "Natural vegetation of the Penrith 1:100 000 map sheet." *Cunninghamia* 2(4) pp.541-596.

Benson D.H. and Keith D.A. 1990. "The natural vegetation of the Wallerawang 1:100,000 map sheet." *Cunninghamia* 2(2) pp.305-336.

Douglas S. (2001). Native vegetation mapping of Areas 1 to 5 in Blue Mountains local government area 2001. *Consultant report to Blue Mountains City Council*.

Keith D.A. and Benson D.H. 1988. "The natural vegetation of the Katoomba 1:100,000 map sheet". *Cunninghamia* 2(1) pp.107-144.

Smith P. and Smith J. 1995. Flora and fauna study for Blue Mountains Environmental Management Plan: Areas 1 to 5. *P & J Smith Ecological Consultants, Blaxland*.

Specht R.L. 1970. "Vegetation", in G.W. Leeper (ed.). *The Australian Environment*, 4th edition. CSIRO in association with Melbourne University Press, Melbourne.

APPENDIX 1

The following vegetation communities “groupings” were identified by Douglas (2001) from the API vegetation mapping process. The figures and numbers (eg 10ar) refer to the communities previously described by Keith and Benson (1988), and Smith and Smith (1995).

Forest communities	Woodland communities	Heath, swamp, scrub, mallee & escarpment communities	Rainforest & riparian communities	Miscellaneous
Open / tall open forest (O) (9i)	Corymbia Woodland / Open forest and Woodland / heath (X, 10ar)	Heath (H1) (21c / 21f)	Closed forest / rainforest (R) (6h / 8c / 9i)	Modified Bushland
Open forest (P & O) (9i)	Scribbly Gum (<i>E. sclerophylla</i>) Bench Woodland (L2) (10ar)	Heath (H2) (21c / 21f)	Closed forest / rainforest (R) (10ag)	Pines
Open forest / woodland (P) (9i)	Low woodland / woodland (L) (10ar)	Heath (H3) (9m)	Montane rainforest (8c)	
Open forest (Q) (9i)	Woodland / heath (L) (9i / 21f / 21c)	Heath (H4) (10o)	Depauperate rainforest (8c) regen.	
Open forest (P & Q) (9i)	Low woodland / forest (P & L) (9i)	Heath (H, 21f/10ar) includes areas tagged simply as “heath”	Riparian complex (E) (6h, 9i, 10ag)	
Open / tall open forest (J) (6h)	Low woodland (L) / heath (H 1 & 2) (9i / 21f / 21c)	Heath - escarpment complex (9i / 21c / 21f / 26a)	Forest / dry rainforest (10o)	
Open / tall open forest (C) (6h)	Woodland / heath (L/AB) (9i / 10ar / 21f)	Mallee - escarpment complex (9i / 21c / 21f)	Riparian scrub complex (Megalong) (6h)	

Forest communities	Woodland communities	Heath, swamp, scrub, mallee & escarpment communities	Rainforest & riparian communities	Miscellaneous
Open / tall open forest (C) / (6h) (f)	Woodland / heath (F/X) (10ar / 21f)	Pagoda Rock Complex (21d)	Riparian slope complex (10o) Moist woodland to open woodland	
Open forest / woodland (Y) (6h, 10ar & 10ag)	Megalong Footslopes Woodland (9m)	Plateau swamp (S) (26a)	River Oak Forest / Woodland (9x)	
Moist basalt cap forest (Tall open forest 6g)	Megalong Footslopes Woodland / heath (9m)	Montane hanging swamp (20a) (Newnes Plateau Shrub Swamps)		
Moist basalt cap forest / rainforest (Tall open forest/rainforest 6g)	Kowmung Wilderness Complex Woodland (10p)	Coxs River swamp (wet heath over open sedgeland) (20b)		
Basalt / Shale Transition Forest Open forest (6g)	Kowmung Wilderness Complex Woodland / open forest (10p)	Megalong swamp (closed wet scrub over open sedgeland) (20b subunit or variant)		
Montane Gully Forest Open forest / woodland, open forest and open forest / tall open forest (9j)	Woodland / open woodland (M) (9i)	Melaleuca swamp forest (Megalong) (9m)		
Megalong Footslopes Forest Open forest / woodland (9m)		Lagoon fringe reedland (AA) (28a)		
Megalong Granite Woodland Open forest / woodland (10o) includes riparian variant		Melaleuca swamp forest (Z) (10ar / 26a)		

Forest communities	Woodland communities	Heath, swamp, scrub, mallee & escarpment communities	Rainforest & riparian communities	Miscellaneous
Blue Mountains Shale Cap Forest (small part of T) (9a)		Redgum swamp woodland (10o variant)		
Shale / Sandstone Transition Forest (part F, part T) (10ar / 9a)				
Shale / Sandstone Transition Forest (monocline) (part T) (10ar / 10ag / 9e)				
Red Bloodwood / Stringybark Woodland / Open forest (part F) (10ar)				
Open forest (F & T) (10ar)				
Open forest / woodland (AB) (10ar)				
Open forest / woodland (L/AB, 10ar)				
Blue Gum Gully Forest open / tall open forest (N) (10ag)				

Forest communities	Woodland communities	Heath, swamp, scrub, mallee & escarpment communities	Rainforest & riparian communities	Miscellaneous
Blue Gum Riverflat Forest Subset of N (10ag)				
<i>Eucalyptus amplifolia</i> open forest Sun Valley Cabbage Gum Forest (variant of 6c)				

APPENDIX 2

Scientific and common names of canopy tree species mentioned in text (alphabetical order)

Scientific Name	Common Name
<i>Acacia elata</i>	Mountain Cedar Wattle
<i>Acmena smithii</i>	Lillypilly
<i>Allocasuarina torolosa</i>	Forest Oak
<i>Angophora bakeri</i>	Narrow-leaved Apple
<i>Angophora costata</i>	Sydney Red Gum
<i>Angophora floribunda</i>	Rough-barked Apple
<i>Backhousia myrtifolia</i>	Grey Myrtle
<i>Callicoma serratifolia</i>	Black Wattle
<i>Casuarina cunninghamiana</i>	River Oak
<i>Ceratopetalum apetalum</i>	Coachwood
<i>Corymbia exima</i>	Yellow Bloodwood
<i>Corymbia gummifera</i>	Red Bloodwood
<i>Corymbia maculata</i>	Spotted Gum
<i>Doryphora sassafras</i>	Sassafras
<i>Eucalyptus acmenoides</i>	White Mahogany
<i>Eucalyptus agglomerata</i>	Blue-leaved Stringybark
<i>Eucalyptus amplifolia</i>	Cabbage gum
<i>Eucalyptus beyeriana</i>	Beyer's Ironbark
<i>Eucalyptus blaxlandii</i>	Blaxland's Stringybark
<i>Eucalyptus bridgesiana</i>	Apple Box
<i>Eucalyptus camphora</i>	Mountain Swamp Gum
<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark
<i>Eucalyptus cypellocarpa</i>	Monkey Gum
<i>Eucalyptus dalrympleana</i>	Mountain Gum
<i>Eucalyptus deanei</i>	Mountain Blue Gum
<i>Eucalyptus deanii</i>	Mountain Blue Gum
<i>Eucalyptus dives</i>	Broad-leaved Peppermint
<i>Eucalyptus eugenioides</i>	Thin-leaved Stringybark
<i>Eucalyptus fastigata</i>	Brown Barrel
<i>Eucalyptus fibrosa</i>	Broad-leaved Ironbark
<i>Eucalyptus globoidea</i>	White Stringybark
<i>Eucalyptus gullicki</i>	Brittle Gum
<i>Eucalyptus macrorhyncha</i>	Red Stringybark
<i>Eucalyptus notabilis</i>	Mountain Mahogany

Scientific Name	Common Name
<i>Eucalyptus oblonga</i>	Sandstone Stringybark
<i>Eucalyptus oreades</i>	Blue Mountains Ash
<i>Eucalyptus paniculata</i>	Grey Ironbark
<i>Eucalyptus piperita</i>	Sydney Peppermint
<i>Eucalyptus punctata</i>	Grey Gum
<i>Eucalyptus radiata</i>	Narrow-leaved Peppermint
<i>Eucalyptus rubida</i>	White Gum
<i>Eucalyptus sclerophylla</i>	Hard-leaved Scribbly Gum
<i>Eucalyptus sieberi</i>	Silvertop Ash
<i>Eucalyptus tereticornis</i>	Forest Red Gum
<i>Eucalyptus viminalis</i>	Ribbon Gum
<i>Eucalyptus sparsifolia</i>	Narrow-leaved Stringybark
<i>Melaleuca linariifolia</i>	Snow-in-summer
<i>Melaleuca styphelioides</i>	Prickly-leaved Teatree
<i>Quintinia sieberi</i>	Possumwood
<i>Syncarpia glomulifera</i>	Turpentine