The Native Vegetation of the Nattai and Bargo Reserves

Project funded under the Central Directorate Parks and Wildlife Division
Biodiversity Survey Priorities Program

Conservation Programs and Planning
Branch, Metropolitan
Environmental Protection and Regulation Division
Department of Environment and Conservation (NSW)
August 2004

Department of
Environment and
Conservation (NSW)

NATIVE VEGETATION OF THE
NATTAI AND BARGO RESERVES

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Project funded under the
Central Directorate Parks and Wildlife Division
Biodiversity Data Priorities Program

Conservation Assessment and Data Unit
Conservation Programs and Planning Branch, Metropolitan
Environmental Protection and Regulation Division
Department of Environment and Conservation

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White-striped Freetail-bat (Michael Todd), Rock Plate-Heath Mallee (DEC)
Black Crevice-skink (David O'Connor)
Tall Moist Blue Gum Forest (DEC)
Rainforest (DEC)
Short-beaked Echidna (D. O'Connor)
Grey Gum (Daniel Connolly)
Red-crowned Toadlet (Dave Hunter)

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EXECUTIVE SUMMARY

This report describes the distribution and composition of the native vegetation within and immediately surrounding Nattai National Park, Nattai State Conservation Area and Bargo State Conservation Area. The purpose of the project has been to provide detailed information on the type, extent and condition of the native vegetation communities. The project addresses a long-standing need for detailed vegetation information to meet the needs of park management associated with water catchment protection as well as management of wilderness and world heritage conservation values. The information and associated data layers generated from this project can now be directly integrated into fire management planning and conservation related assessments.

This mapping project extends the mapping work completed in the north of Nattai National Park under the mapping program for the Special Areas Plans of Management (SASPoM). Funding was provided by Central Directorate Parks and Wildlife Division to complete the southern half of Nattai National Park along with Bargo State Conservation Area and Bargo River Crown Reserves. The completion of this project provides a fine-scale vegetation mapping coverage from the Illawarra coast to Kanangra-Boyd National Park.

A comprehensive field survey program was carried out to augment the information gathered in the Warragamba and Woronora Special Area mapping projects. An additional 69 floristic survey sites were collected, bringing the total number in the study area to 364 sites. All vascular plants were identified and vegetation, soil and disturbance information were recorded and entered into an electronic database. This data was used to classify vegetation communities using quantitative analytical techniques. Thirty-seven vegetation communities have been identified and described in a separate profile. Each profile describes the composition and structure of the vegetation, example locations, disturbance levels present and includes a sample photograph.

The Nattai and Bargo reserves support a high level of floristic diversity. The diversity arises from the variations in soil and geological substrates, topographic variables, rainfall and elevation gradients. Within the reserves there are ten broad geology classes (Bryan, 1966; Rose, 1966); elevation that ranges from around 100 to 900 metres above sea level; rainfall ranging from approximately 700 to over 1000 millimetres per annum. Topographically the reserves include both narrow and broad sandstone tablelands, deeply incised valleys and escarpments and large river valleys supporting tall alluvial forests. Over 800 native flora species have been identified from field sampling and searches of existing literature. Structurally the vegetation varies between rainforest, tall forest, open forest, woodland, heath, mallee and swamps. The 37 vegetation communities include some typical of Sydney sandstone environments such as the shrubby forests across the Nattai Plateau, while the Burragorang Valley features dry grassy woodlands that have more in common with vegetation in the central west of NSW. Tall grassy forests found on shale and basalts of the Southern Highlands are uncommon within the reserves as were grassy and shrubby sandstone-shale transition forests.

Three Endangered Ecological Communities (TSC Act, 1995) were located and a further 14 were classified as vegetation communities of regional significance. Twenty-two of the species recorded are either Threatened (TSC Act, 1995) or listed as a RoTAP (Briggs and Leigh, 1995). Of the Threatened Species four are listed as Endangered and a further five as Vulnerable.

A 1: 25 000 scale map of the vegetation communities of the study area has been completed. This map was constructed using detailed Aerial Photograph Interpretation (API) of 1:25000 photography (1994) in conjunction with environmental data layers that describe the patterns in geology, elevation, rainfall and aspect. Digital data layers for use in ARCView GIS are available, which describe the distribution of vegetation communities as well as other landscape features such as exposed rock and cleared land. The derived mapping can now be used to display vegetation communities, vegetation structure, disturbance, amount of rock present, understorey type, canopy density and tree species present.

This data can now be widely applied to a number of uses ranging from environmental reporting, fire management planning, conservation assessments and field operations.

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1 INTRODUCTION

1.1 BACKGROUND

Nattai National Park (NP), Nattai State Conservation Area (SCA) and Bargo SCA (the Nattai and Bargo Reserves') were incorporated into National Parks estate in December 1991 (NPWS, 2001b). Parts of these reserves are included within the Scheduled lands of the Warragamba Special Area and as such form an important protective buffer for Sydney's largest water storage area.

Description of the vegetation of the reserves has been limited to broader regional studies. The Fire Management Plan (NPWS, 2001a) described the amount of vegetation data for the reserves as "scant", and this was confirmed in the review of biodiversity information held within each reserve in the NPWS Central Directorate (NPWS, 2003a). Recently, vegetation classification and mapping was completed across the Warragamba Special Area (NPWS, 2003b). This work covered the northern half of Nattai NP and Nattai SCA. In order to provide a comprehensive dataset, new work was proposed to complete the southern portions of Nattai National Park and the adjoining Bargo SCA and crown reserve.

The work forms part of a broader vision to ensure that a consistent level of biodiversity data covers all NPWS reserves. It also addresses a key objective of the management plan for these reserves (NPWS, 2001a) to document the distribution of plant communities.

1.2 APPROACH

This project aims to:

- Develop a hierarchical classification system in order to describe vegetation patterns using systematic field data and quantitative analytical methods;
- Describe the floristic composition of the defined vegetation communities and their environmental characteristics;
- Examine floristic relationships between the vegetation communities found in the study area and those occurring elsewhere within neighbouring landscapes;
- Delineate the extent of native vegetation cover using recent 1:25 000 scale aerial photography, including a coarse assessment of the intensity and type of disturbance present;
- Provide a seamless map of the distribution of vegetation communities over the reserves and adjoining lands.

Classification and mapping vegetation in NSW has been undertaken using a wide variety of methods and approaches (Benson, 1999; FEWG, 1997). Each method comes with strengths and weaknesses in terms of accuracy, efficiency and rigour (FEWG, 1997). The adoption of systematic field methods provides an explicit and repeatable means of describing recurring patterns in floristic assemblages, hereafter termed vegetation communities. These methods afford the application of quantitative classification techniques that provide robust supporting data to vegetation community definition. In addition, comparison and assessment of broader regional vegetation patterns is more easily achieved and is less clouded by subjective judgements.

Mapping of vegetation communities defined by field data is always a process of interpolation. In this project, Aerial Photo Interpretation (API) and extensive field reconnaissance have been used to develop an understanding of the patterns in vegetation communities within Nattai NP, Nattai SCA and Bargo SCA.

1.3 STUDY AREA

1.3.1 Location

The study area includes the Nattai and Bargo reserves an area 58 000 hectares in size. The Bargo River Crown Reserve has been included to provide a seamless vegetation map between the Nattai Reserves and the Nepean Catchment to the east. The inclusion of these additional lands extends the study area to cover over 71 000 hectares. The study area lies about 9km north of Mittagong (Map 1).and extends into the southern limit of the Cumberland Plain near Picton.

There are a number of well known physiographic landmarks within the study area. These are shown in Map 2. The Wollondilly River, the Burragorang Valley and Lake Burragorang form the western boundary of the study area. The Wanganderry, Nattai and Burragorang Tablelands define the sandstone plateau. The eastern extent of the study area is marked by the Bargo River gorge and the Sydney to Canberra Freeway.

1.3.2 Environmental Setting

Geomorphology

A large portion of the study area comprises rugged and inaccessible landscapes. The lithology of this area is presented in Map 3. The main geographic features of the reserves are the extensive sandstone tablelands and the rivers and tributaries which dissect them. The tablelands are comprised of Hawkesbury Sandstone formed in the Triassic Age (Bryan, 1966; Rose, 1966). This includes the Nattai Tableland, the southern portion of the Burragorang Tableland and the Wanganderry Tableland as well as the Wild Goat and Buxton Plateaux. The Nattai, Little and Wollondilly Rivers have cut through the Hawkesbury Sandstone and formed large river valleys. The many creeks and tributaries of these rivers have also incised the tablelands forming smaller valley features and canyon like environments. Small bands of Narrabeen Group Sandstone are often found underlying the Hawkesbury Sandstone. Both geologies, however, generate coarse-grained sandy soils that are quite infertile and often shallow and rocky. Slight enrichment of the sandstone tablelands occurs where sediments of Mittagong Formation are found. These sediments are restricted to the Wattle Ridge and Bargo River areas and the amount of shale enrichment in the soil is generally quite low.

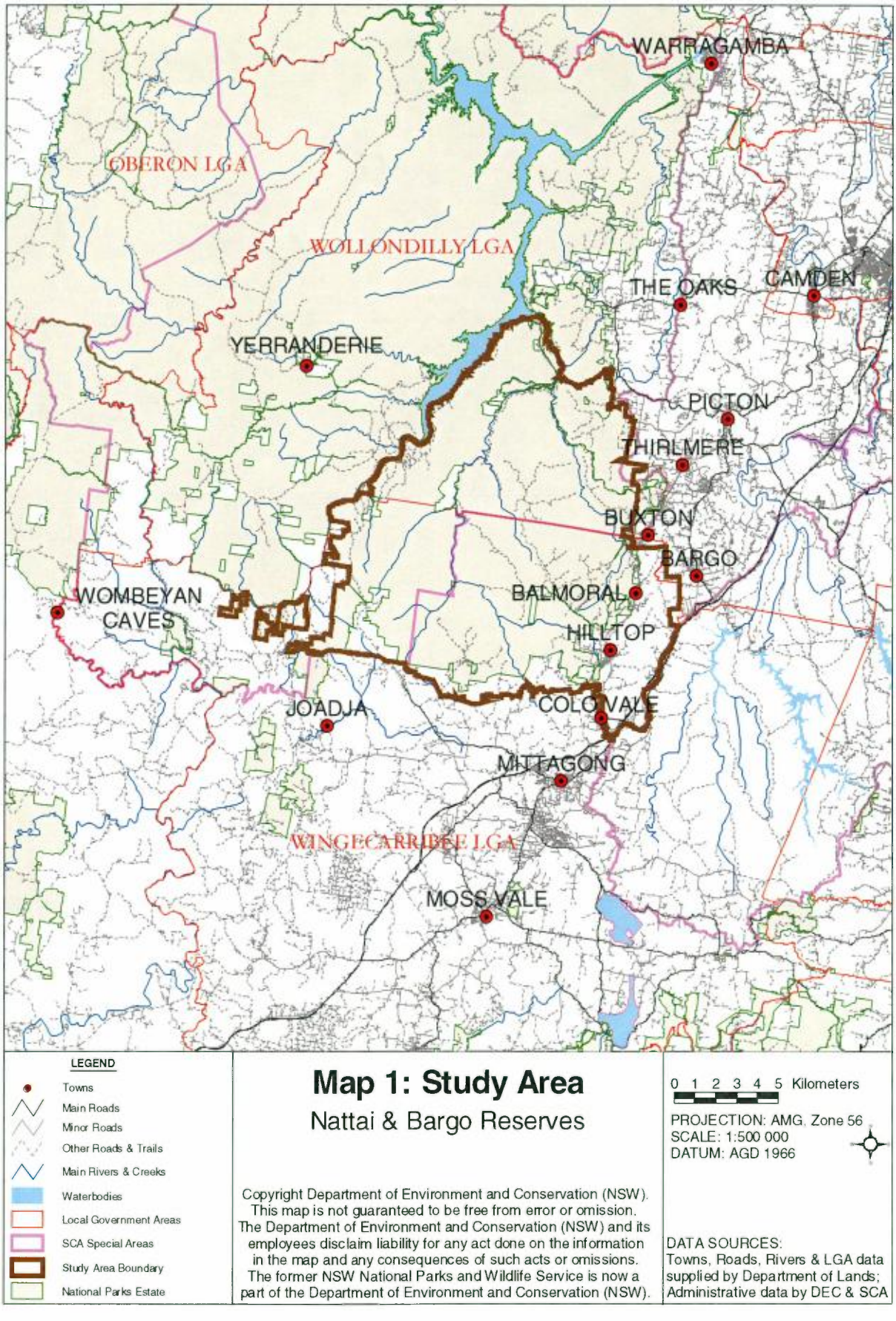
Impressive escarpments have formed above the main river valleys with pronounced clifflines indicating the change in geology. The escarpment slopes and valley floors are predominantly comprised of Permian Sediments mostly from the Shoalhaven Group. These sediments have a depositional origin, in which sedimentary rocks of varying grain size occur, including sandstone, shale and siltstone (Bryan, 1966; Rose, 1966). The sandstone produces an infertile sandy soil similar to that derived from the overlying Hawkesbury Sandstone (DLWC, 2002; Hamilton, 1976; Hazelton and Tille, 1990). The shale and siltstone material tends to occur in flatter locations, such as on footslopes or escarpment benches. A clay loam soil tends to develop in these areas, which is of slightly higher fertility with a better water holding capacity (DLWC, 2002; Hamilton, 1976; Hazelton and Tille, 1990).

Higher fertility soils are found in a number of restricted locations and are mostly volcanic in origin (DLWC, 2002; Hamilton, 1976; Hazelton and Tille, 1990). In the Wollondilly River area south from Douglas Scarp, Porphyritic material of Devonian Age is present. These rocks erode into a rocky clay soil of moderate depth and fertility. Smaller amounts of even higher fertility soil derived from shale, basalt and trachyte material are also found in the study area. Basalt outcrops are found at Mounts Wanganderry and Flora although they are mostly outside the reserves. Shale soils surrounding this basalt sediments and downslope movement of the basaltic material does however influence the adjoining vegetation. Wianamatta Shale soils are also found to the north and east of the reserves in the Thirlmere and Buxton areas where transitional soils of a mixture of shale and sandstone develop. Mount Jellore is an igneous intrusion of trachyte (Fisher *et al.*, 1995; Rose 1966; DLWC, 2002).

Alluvial soils occur along the larger river flats of the Wollondilly, Nattai and Little Rivers. The material found in these locations is a mixture of siltstone, shale and sandstone (DLWC, 2002; Hamilton, 1976; Hazelton and Tille, 1990). The soil is often found in deep sandy deposits although the soil richness varies according to the amount of siltstone and shale in the mixture. There are minor creeklines and tributaries on the sandstone tablelands where small amounts of sandy alluvium can be found. These are more common on the flatter, undulating country such as in the landscape neighbouring the town of Hilltop. This soil is a coarser sandy alluvium with some areas developing a swamp like habitat with organic material present that is periodically inundated with water. A number of hanging swamps also occur across the sandstone tablelands, although these are quite restricted in size.

Elevation

There is a moderate elevational range within the Nattai and Bargo reserves as shown in Map 4. The lowest areas occur around Lake Burragorang which, when completely full is at around 120 metres above sea level (ASL). Conversely the highest elevation is found on the peak of Mt Jellore, which lies at just over 830 metres ASL. Much of the reserves are found on the sandstone tablelands and these range between 500 and 700 metres ASL. There is a general decrease in elevation towards the north east with


WARRAGAMBA
OBERON LGA
WOLLONDILLY LGA
THE OAKS
CAMDEN
YERRANDERIE
PICTON
THIRLMERE
BUXTON
BARGO
WOMBEYAN CAVES
BALMORAL
HILLTOP
JOADJA
COLO VALE
MITTAGONG
WINGECARRIBEE LGA
MOSS VALE
LEGEND
Towns
Main Roads
Minor Roads
Other Roads & Trails
Main Rivers & Creeks
Waterbodies
Local Government Areas
SCA Special Areas
Study Area Boundary
National Parks Estate
Map 1: Study Area
Nattai & Bargo Reserves
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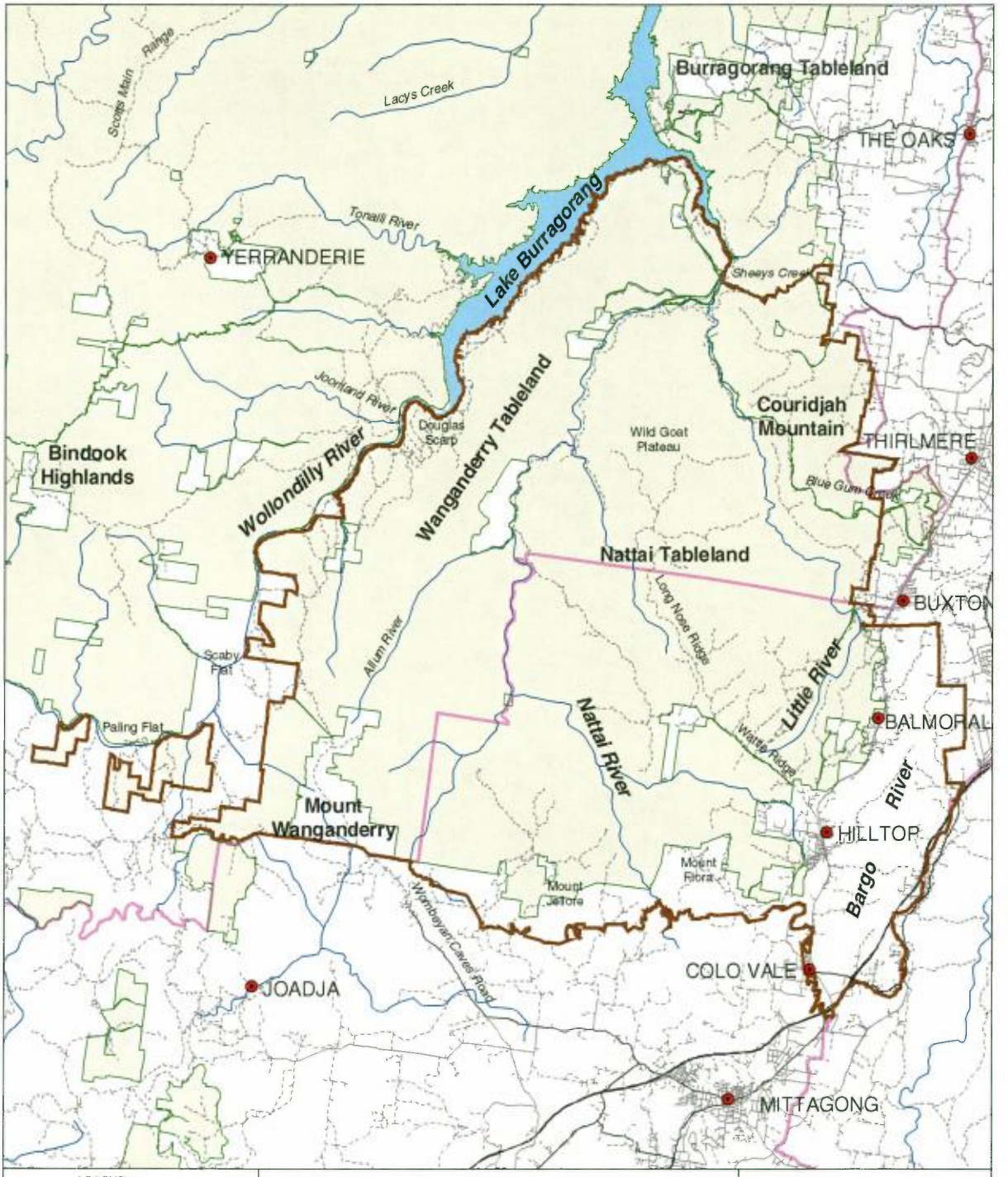
0 1 2 3 4 5 Kilometers
PROJECTION: AMG, Zone 56
SCALE: 1:500 000
DATUM: AGD 1966
DATA SOURCES:
Towns, Roads, Rivers & LGA data supplied by Department of Lands;
Administrative data by DEC & SCA



LEGEND

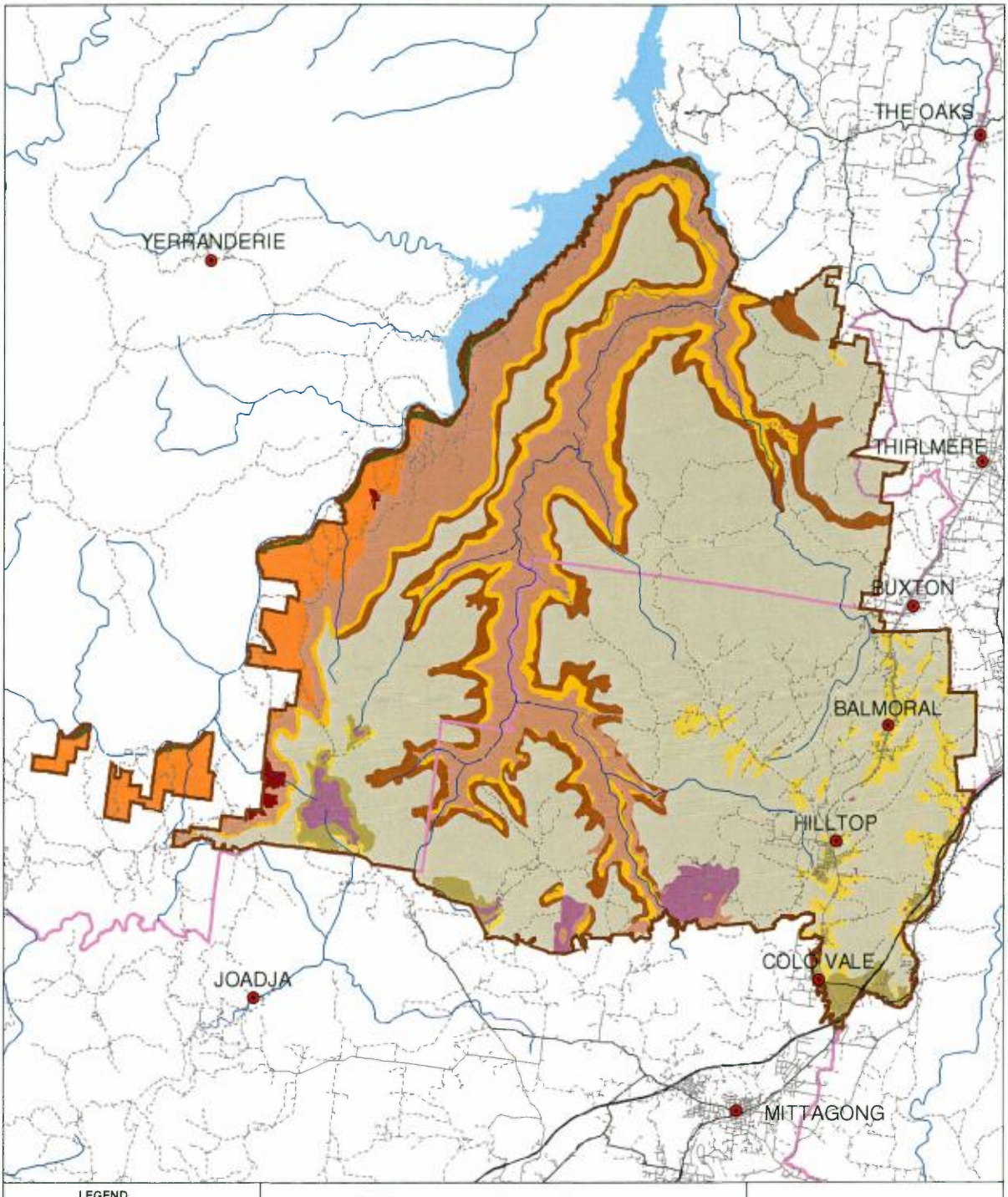
- Towns
- Main Roads
- Minor Roads
- Other Roads & Trails
- Main Rivers & Creeks
- Waterbodies
- SCA Special Areas
- Study Area Boundary
- National Parks Estate

Map 2: Physiographic Regions

0 1 2 3 4 5 Kilometers

PROJECTION: AMG, Zone 56
SCALE: 1:275 000
DATUM: AGD 1966

DATA SOURCES:
Towns, Roads & Rivers data supplied by Department of Lands;
Administrative data by DEC & SCA



LEGEND

- Towns
- Main Roads
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- Waterbodies
- SCA Special Areas
- Study Area Boundary

Lithology

- Hawkesbury Sandstone
- Narrabeen Sandstone
- Illawarra Coal Measures
- Shoalhaven Group
- Mittagong Formation
- Wianamatta Shale
- Volcanics
- Bindook Porphyry
- Quaternary Alluvium
- Silurian & Ordovician Metasediments

Map 3: Dominant Lithology

0 1 2 3 4 5 Kilometers

PROJECTION: AMG, Zone 56
SCALE: 1:275 000
DATUM: AGD 1966

DATA SOURCES:
Lithology data supplied by Department of Primary Industries; Towns, Roads & Rivers data supplied by Department of Lands; Administrative data by DEC & SCA

this northern boundary having a maximum height of 550 metres ASL. Below the sandstone tablelands the valley environments of the Nattai, Wollondilly and Little Rivers range between 200 and 400 metres ASL, again with a decrease in elevation as you move northwards towards Lake Burragorang.

Climate

The climate of the Nattai and Bargo reserves is variable, being mostly influenced by topography, including ruggedness, position and elevation. The lower elevations of the broad Burragorang and Nattai River Valleys have a warm and dry climate. In contrast to this, the higher elevation tablelands and highland areas have both a cooler and wetter climate (NPWS, 2003b). The mean annual rainfall is presented in Map 5. This shows the lowest annual rainfall areas around Paling Flat (Wollondilly River Valley) and the highest at elevated positions such as Mts. Jellore and Flora. An east to west rainfall gradient is also displayed on Map 5 with high rainfall areas along the eastern boundary such as around the townships of Colo Vale and Buxton. This declines to the west and especially in areas of low elevation or in rain shadows. At its highest, average annual rainfall reaches over 1040 millimetres, which contrasts to the 720 millimetres or less received in the driest areas.

Fire History

Fire history prior to 1957 is not well documented (Wootten, 1965) although it is suggested that much of the area has been burnt several times since European settlement. In addition, the burning regime used by the indigenous occupants is not known.

Fire history information is of varying quality and usually only consisting of the final extent of the fire has been recorded from 1957 to present (NPWS, 2001a). A number of small fires have occurred within that time. However, during the last ten years there have been two large fires in the reserves as well as others in the surrounding area. The northern half of the Wanganderry Tableland was burnt in December 1997 and a large, intense fire burnt the majority of the reserves in January 2002.

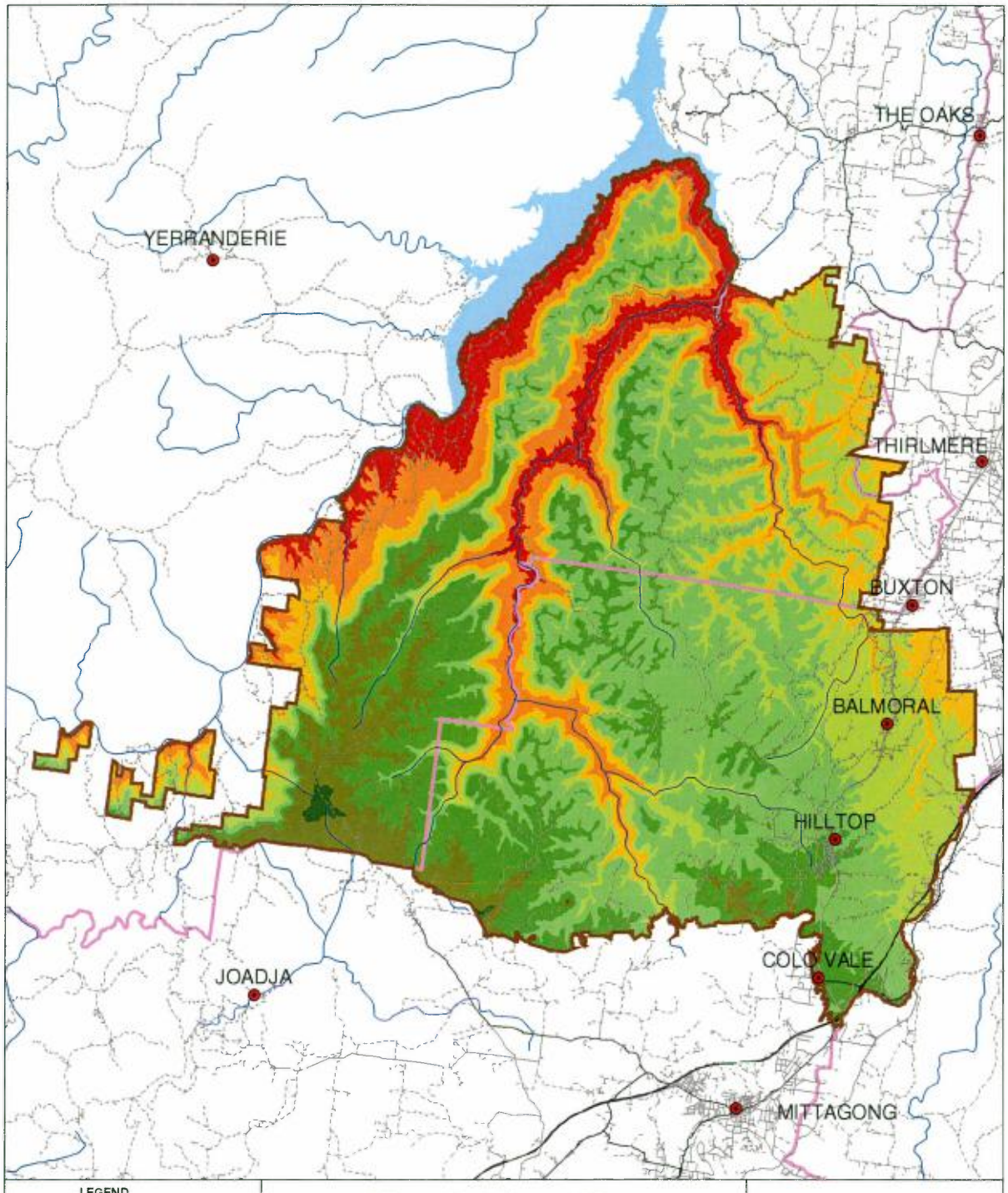
The majority of wildfires in the reserves are started by lightning strikes (NPWS, 2001a). Arson and the escape of small fires, including hazard reduction burns are also common. Much of the fire activity, including hazard reduction burns, has been along the eastern edge of the reserves near the townships of Thirlmere, Hilltop, Balmoral and Buxton. The northern portion of the Wanganderry Tableland has also received more frequent fire events than other areas. Map 6 displays the fire frequency of the study area.

Landuse and Tenure

The Nattai and Bargo reserves are thought to have been used for human occupation for at least 14000 years before present (NPWS, 1998). The current reserve boundaries represent part of the traditional home of the Dharawal and Gundangarra Aboriginal people (NPWS, 2001a). Particular lands within the region are thought to have supported different bands of the Gundungurra language, and had recognised titles such as Gingra, Burragorang and Nattai, now commonly identified landmarks (NPWS, 1998). Evidence of indigenous use and occupation of the reserves includes artefacts in rock shelters, camp sites, axe grinding grooves, rock engravings, stone arrangements, burial sites and sites of spiritual significance (NPWS, 2001a).

Shortly after the European occupation of Sydney, explorers were searching the region for routes to cross the Great Dividing Range (NPWS, 2001a). Routes were eventually found and these explorations also led to the development of agricultural activity in the area. Initially farming was mostly restricted to the richer alluvial soils in the Burragorang Valley. Over time small lots were established further into the Nattai and Little River Valleys. The higher fertility soils found on the porphyritic sediments in the Wollondilly Valley and the basalts and shales of the highlands were also utilised during this time. By 1835 the Burragorang Valley was settled and developing into a thriving agricultural community (NPWS, 2003b). This development continued right up until the 1950s when the Burragorang Valley was flooded through the construction of Warragamba Dam.

Agriculture was by far the largest activity carried out in the region, however logging and mining activities were also occurring on a smaller scale during the same time period. Parts of the reserves have been logged, particularly the more accessible gullies and sheltered slopes (NPWS, 2003b). A number of mining ventures have also occurred within or surrounding the reserves. By far the largest has been the targeting of coal reserves in the Burragorang area from a total of eight different collieries (NPWS, 2003b).



LEGEND

- Towns
- Main Roads
- Minor Roads
- Other Roads & Trails
- Main Rivers & Creeks
- Waterbodies
- SCA Special Areas
- Study Area Boundary

Elevation (metres)

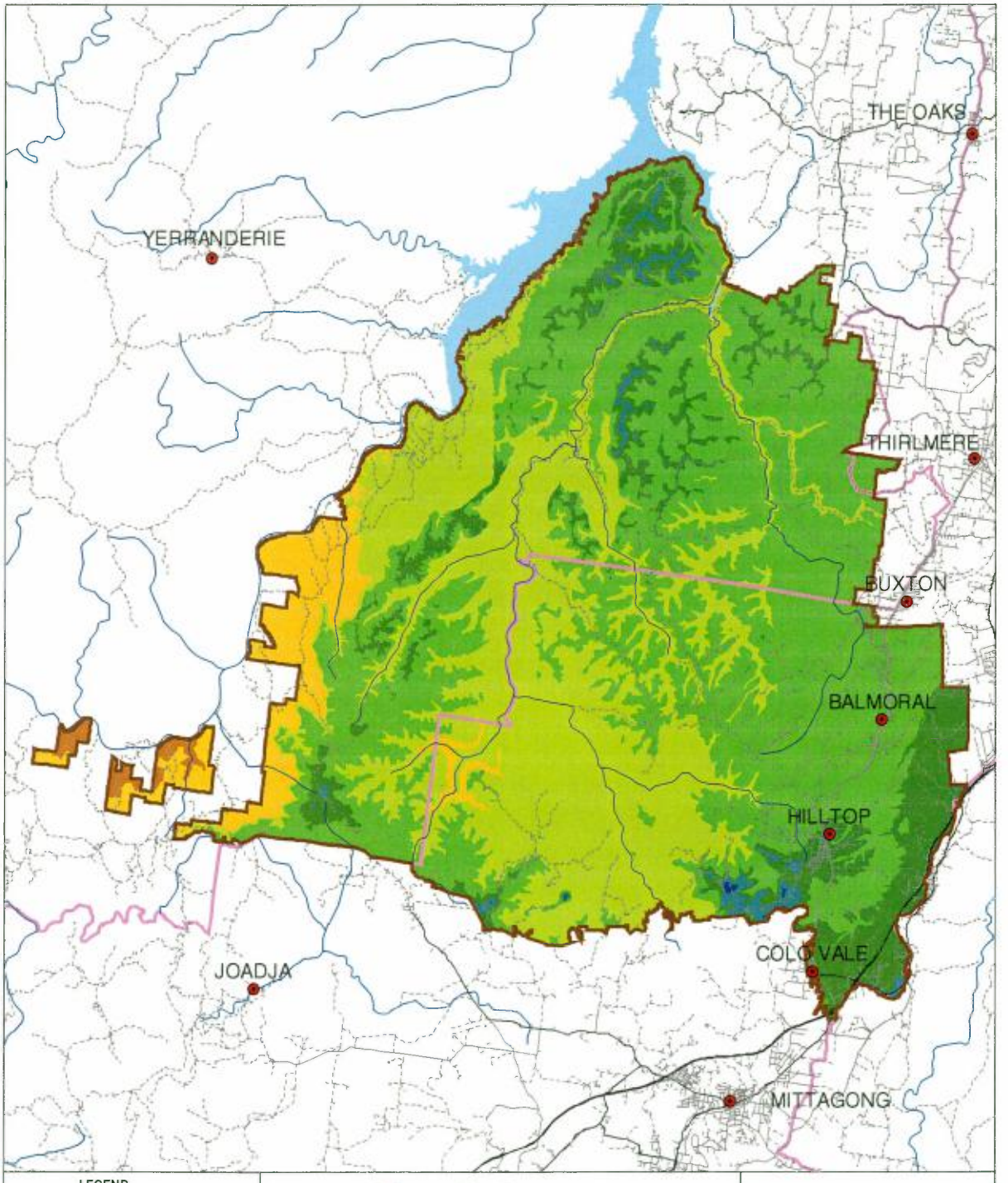
- 101-200
- 201-300
- 301-400
- 401-500
- 501-600
- 601-700
- 701-800
- 801-900

Map 4: Elevation

0 1 2 3 4 5 Kilometers

PROJECTION: AMG, Zone 56
SCALE: 1:275 000
DATUM: AGD 1966

DATA SOURCES:
Towns, Roads, Rivers & Elevation data supplied by Department of Lands;
Administrative data by DEC & SCA



LEGEND

- Towns
- Main Roads
- Minor Roads
- Other Roads & Trails
- Main Rivers & Creeks
- Waterbodies
- SCA Special Areas
- Study Area Boundary

Rainfall (millimetres)

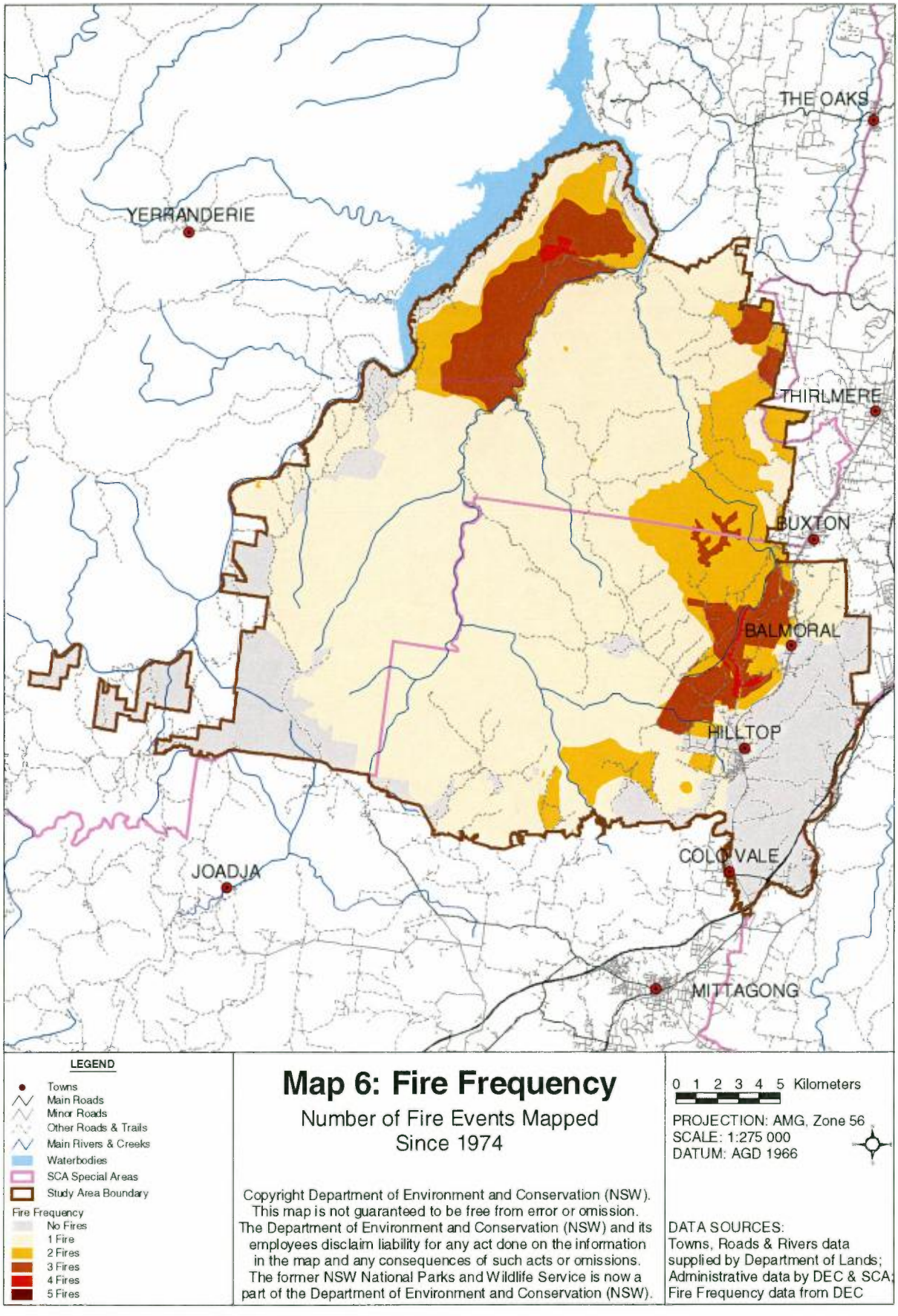
- 701-750
- 751-800
- 801-850
- 851-900
- 901-950
- 951-1000
- 1001-1050

Map 5: Average Annual Rainfall

0 1 2 3 4 5 Kilometers

PROJECTION: AMG, Zone 56
SCALE: 1:275 000
DATUM: AGD 1966

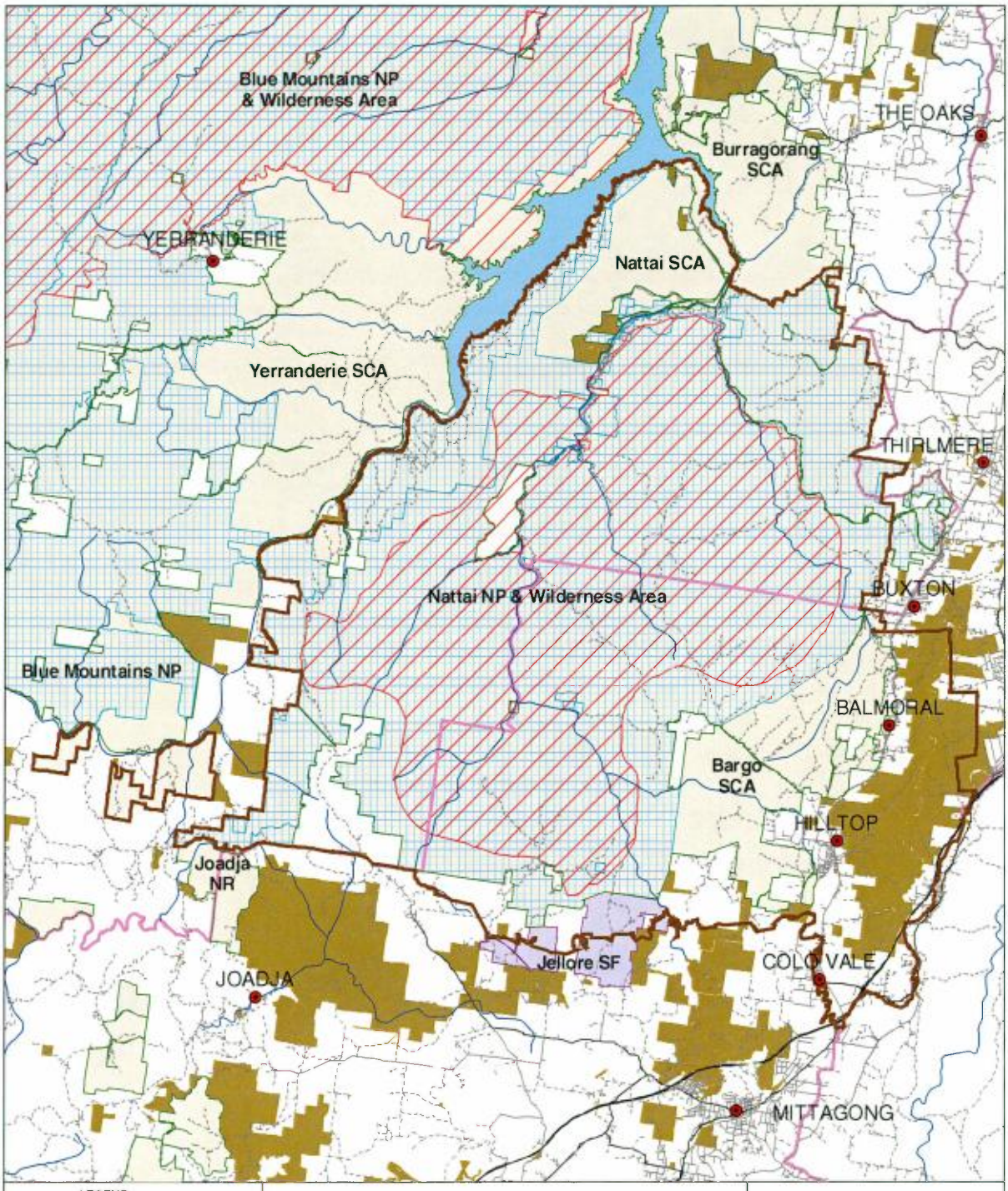
DATA SOURCES:
Towns, Roads & Rivers data supplied by Department of Lands;
Administrative data by DEC & SCA;
Rainfall data from DEC


THE OAKS
YERRANDERIE
THIRLMERE
BUXTON
BALMORAL
HILLTOP
COLO VALE
JOADJA
MITTAGONG
LEGEND
Towns
Main Roads
Minor Roads
Other Roads & Trails
Main Rivers & Creeks
Waterbodies
SCA Special Areas
Study Area Boundary
Fire Frequency
No Fires
1 Fire
2 Fires
3 Fires
4 Fires
5 Fires
Map 6: Fire Frequency
Number of Fire Events Mapped
Since 1974
Copyright Department of Environment and Conservation (NSW).
This map is not guaranteed to be free from error or omission.
The Department of Environment and Conservation (NSW) and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions.
The former NSW National Parks and Wildlife Service is now a part of the Department of Environment and Conservation (NSW).
0 1 2 3 4 5 Kilometers
PROJECTION: AMG, Zone 56
SCALE: 1:275 000
DATUM: AGD 1966
DATA SOURCES:
Towns, Roads & Rivers data supplied by Department of Lands;
Administrative data by DEC & SCA;
Fire Frequency data from DEC

These activities have only had a relatively minor impact on the reserves, which in many ways is due to the rugged and remote terrain, but also the infertile nature of the soils that make it unsuitable to large scale agricultural activities. The reserves were declared as National Parks estate in 1991 and their importance was further recognised in 2000 through the inclusion within the Greater Blue Mountains World Heritage Area (NPWS, 2001a). Almost 30000 hectares has also been declared as wilderness and the northern half of the reserves are found within the Warragamba Special Area, which includes both Schedule 1 and 2 lands for the protection of water quality (Map 7).

1.3.3 Regional Context

The Nattai and Bargo reserves lie within the Sydney Basin Bioregion (Thackway and Cresswell, 1995). This Bioregion is one of 85 that have been delineated in the Interim Biogeographic Regionalisation of Australia (IBRA). The purpose of these regions is to establish a framework for conservation planning using broad landscape characteristics to highlight similar influences on flora and fauna. The interactions between climate, geology and broad vegetation are the primary attributes that have been used. One of the applications of the IBRA system has been to review the reservation status of each Bioregion to assist with acquisition priorities for a representative national reserve system. Map 8 illustrates the location of the reserves within this Bioregion. The Sydney Basin Bioregion encompasses the dissected sandstone plateaux that extend from Ulladulla to the Hunter Valley. Skeletal sandy soils support extensive sclerophyllous woodlands and dry open forests. Shale and other fine-grained sediments are found on undulating plains outside of the sandstone plateaux. The reserves approach the western edge of the Bioregion and are also close to the maximum elevation of similar landscapes found within the Bioregion.



LEGEND

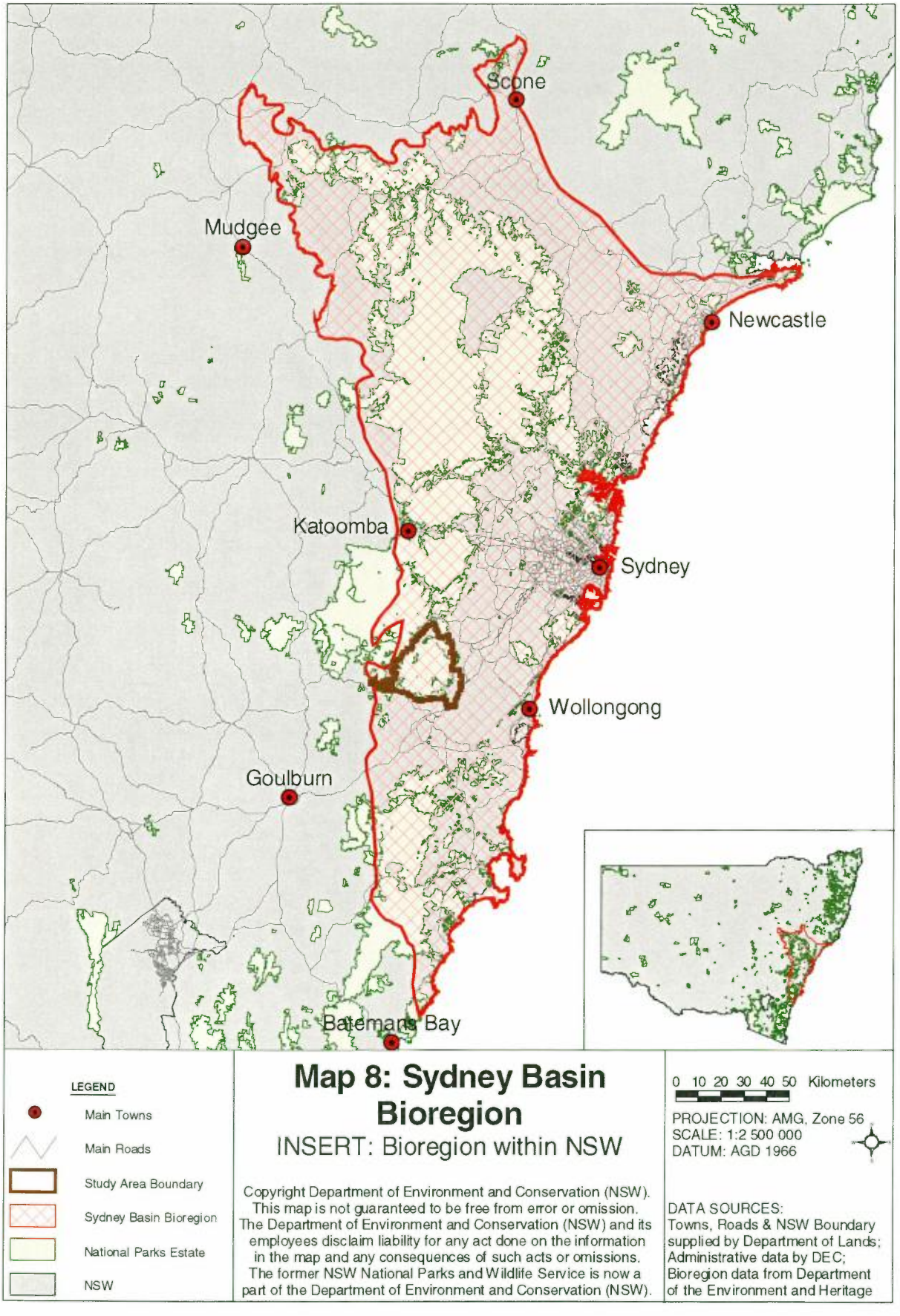
- Towns
- Main Roads
- Minor Roads
- Other Roads & Trails
- Main Rivers & Creeks
- Waterbodies
- SCA Special Areas
- Study Area Boundary
- Declared Wilderness
- World Heritage Areas
- National Parks Estate
- State Forest
- Crown Land

Map 7: Landuse

0 1 2 3 4 5 Kilometers

PROJECTION: AMG, Zone 56
SCALE: 1:275 000
DATUM: AGD 1966

DATA SOURCES:
Towns, Roads, Rivers & Crown Lands data supplied by the Department of Lands;
State Forest data supplied by the Department of Primary Industries;
Administrative data by DEC & SCA (inc Wilderness & World Heritage)



LEGEND

- Main Towns
- Main Roads
- Study Area Boundary
- Sydney Basin Bioregion
- National Parks Estate
- NSW

Map 8: Sydney Basin Bioregion

INSERT: Bioregion within NSW

0 10 20 30 40 50 Kilometers

PROJECTION: AMG, Zone 56
SCALE: 1:2 500 000
DATUM: AGD 1966

DATA SOURCES:
Towns, Roads & NSW Boundary supplied by Department of Lands; Administrative data by DEC; Bioregion data from Department of the Environment and Heritage

2 METHODS

2.1 REVIEW OF EXISTING INFORMATION

The vegetation of the Nattai and Bargo reserves had not been comprehensively studied prior to the vegetation mapping which was completed for the Warragamba Special Area (NPWS, 2003b). This study mapped just over half of northern Nattai NP and provided the basis for completion of mapping over the remaining portions of the reserves. Small portions of the study area, notably along the north eastern and eastern edges have been mapped during mapping for the Cumberland Plain Woodland Recovery Plan (NPWS, 2000b) and mapping completed for the Metropolitan Catchments (NPWS, 2003c).

Prior to this, regional scale vegetation mapping (1:100 000 scale) for the Burragorang mapsheet had been produced (Fisher *et al.*, 1995) along with draft mapping for the Wollongong mapsheet (Benson and Howell, 1994). The descriptions of the vegetation patterns are particularly useful, although the maps are not appropriate for use at 1:25 000 scale.

During the late 1950's and early 1960's the Warragamba Special Area was surveyed to explore the potential for commercial logging operations (Wootten, 1965). Volumes and timber stand condition were estimated across the region using a combination of field survey and aerial photograph interpretation. These maps are held in the Sydney Catchment Authority offices.

2.2 EXISTING SITE DATA

Existing information has been carefully reviewed in order to collate datasets that have been collected using a comparable field survey method. There are a number of studies of relevance that have been undertaken within and surrounding the reserves. These vary in the type and methodology used to capture the information and thus their usefulness to this project. Only sites of direct use for this project were chosen (i.e. similar methodology and within close proximity to the reserves) for inclusion in analysis. Table 1 provides an overview of the studies of relevance to this project and the number of sites utilised from each.

TABLE 1: EXISTING SURVEY DATA

Survey Name/Area	Sites Utilised	Total Sites Collected	Survey Method	Source
Warragamba Special Area	153	630	20 X 20 quadrat; 1-7 Braun-Blanquet	NPWS (2003b)
Priority 5 Management Area (P5MA)	60	800	20 X 20 quadrat; 1-7 Braun-Blanquet	DEC (in prep.)
Woronora, O'Hares and Metropolitan Catchments	34	347	20 X 20 quadrat; 1-6 Braun-Blanquet	NPWS (2003c)
RBG, Burragorang 1:100 000 Mapsheet	17	33	20 X 20 quadrat; 1-6 Braun-Blanquet	Fisher et al. (1995)
RBG, Wollongong 1:100 000 Mapsheet	15	114	20 X 20 quadrat; 1-6 Braun-Blanquet	Benson and Howell (1994)
Werriberri Catchment & Burragorang Mines	12	58	20 X 20 quadrat; 1-7 Braun-Blanquet	Unpublished, data collected by David Thomas (2001)
Joadja Nature Reserve	2	10	20 X 20 quadrat; 1-7 Braun-Blanquet	Mills (2002)
Western Sydney Cumberland Plain	1	403	20 X 20 quadrat; 1-7 Braun-Blanquet	NPWS (2000b)
Broad Headed Snake Potential Habitat Survey	1	25	20 X 20 quadrat; 1-7 Braun-Blanquet	Unpublished, data collected by Robert Payne (2001)

2.3 Survey Stratification and Site Selection

Field surveys employed by a number of projects (eg. NPWS, 2003b) have used a stratified survey design to assist with the selection of survey sites. Stratification is a method used to reduce the landscape into more homogenous sampling units so that sampling effort can be spread across the variation in environments present. Generally strata are derived from data layers describing the geology, rainfall, elevation and aspect (NPWS, 2003, DEC, in prep.).

The northern portion of Nattai NP and Nattai SCA were sampled extensively during the survey of the Warragamba Special Areas using this approach. For the southern portions of Nattai NP and the Bargo SCA and adjoining crown lands, Aerial Photograph Interpretation pattern types (canopy species, understorey and landscape) were used as the primary strata to allocate survey effort. This approach allowed the project to test for finer scale variations in the vegetation cover than is otherwise achieved from broader stratum derived from broader scale mapping such as geology and soils. The survey design also sought to address the significant spatial gaps in sampling that were present in the southern areas.

Existing sites were overlayed on aerial photo pattern types in order to determine sampling shortfalls. Sampling intensity within each stratum was determined by matching a proportionally equivalent number of sites to the proportional area each stratum covered within the study area. Those stratum that were unsampled were allocated highest priority followed by those that were proportionally undersampled.

A total of 33 API pattern types (strata) were chosen as requiring additional survey sites to those that had already been collected. Samples within each stratum were located across the spatial extent of that stratum. Sites were selected to minimise travel and walking times while maximising sampling options for different vegetation types. The more remote areas were surveyed during day bushwalks.

2.4 Field Sampling

Field survey sought to sample areas that were typical of the surrounding vegetation and were as free of obvious disturbance as possible. However given the intensive and extensive nature of the 2001-2002 bushfires much of the vegetation was burnt. These effects were more pronounced on the ridgetops where fire intensity ranged from total vegetation consumption to patchy and cooler understorey burns. A similar pattern was also observed in many of the sheltered forests, although the deepest most protected gorges escaped the fire. The Bargo River Crown Reserve was not affected by this large fire, although the area is subject to frequent hazard reduction burning and arson. Areas that had experienced total vegetation consumption during the fire were not sampled. Fire intensity mapping across the study area (Chafer, 2002) was used to guide sampling locations.

Sampling was carried out in teams of two people consisting of a botanist and an assistant. Species that could not be identified in the field were recorded to the nearest possible family or genus and tagged for later identification. Species that could not be identified accurately were sent to the NSW Herbarium for identification.

Field sample were 0.04 hectares in area. The area was marked out using a 20 by 20 metre quadrat, although in some communities (such as riparian vegetation) a rectangular configuration of the plot was required. Within each survey plot all vascular plant species were recorded and assigned a cover abundance score using a modified seven point Braun-Blanquet scale (Poore, 1955) as shown in Table 2 below.

TABLE 2 COVER ABUNDANCE SCORES

Score	Cover Abundance
1	Rare, few individuals present (three or less) and Cover <5%;
2	Uncommon (more than three but not consistently throughout plot) and Cover <5%;
3	Common (consistent throughout plot) and Cover <5%;
4a	Very Abundant and Cover <5% OR 4b Cover >5% and <25%;
5	Cover >25% and <50%;
6	Cover >50% and <75%;
7	Cover >75%

Estimates were made of the height range, projected foliage cover and dominant species of each structural stratum recognisable at the site. Measurements of slope, aspect and horizon azimuths were taken. Notes were also made on geology, soil type and soil depth. The percentage of rock out-cropping, surface rock, litter and bare soil were estimated. Evidence of recent fire, erosion, clearing, grazing, weed invasion or soil disturbance was also recorded. The location of the site was determined using a global positioning system (GPS) and/or a topographic map, using Datum AGD66. Elevations were taken off 1:25000 topographic maps. Digital photographs were also taken at each site and are attached to the floristic site data in an Access database.

2.5 Site Nomenclature

For the purpose of managing existing and new field data, each survey plot was given an eight digit alphanumerical survey identification number. A separate survey identification code was also given to all data to distinguish its source. Using this system enables the reader to understand basic geographical information about the survey site.

For example, site number HLL50H8V:

The first three letters "HLL" refer to the first three consonants of the 1:25000 topographic mapsheet name, in this case the Hilltop mapsheet.

The fourth and fifth digits "50" refer to the site number by mapsheet, ie. the fiftieth site on this mapsheet.

The sixth character "H" refers to the geological substrate evidenced at the site, in this case Hawkesbury Sandstone. The geologies found within the reserves were coded as follows:

N = Narrabeen Sandstone

H = Hawkesbury Sandstone

P = Permian Sediments (mostly sandstone, siltstone and shale)

D = Devonian Sediments (mostly porphyry and quartzite)

W = Wianamatta Shale

B = Basalt

A = Alluvium

Q = Quaternary sand

The seventh character "8" refers to the aspect observed at the site (NE in this case) using the following categories:

1 = 67.6 – 112.5 or E

2 = 112.6 – 157.5 or SE

3 = 157.6 – 202.5 or S

4 = 202.6 – 247.5 or SW

5 = 247.6 – 292.5 or W

6 = 292.6 – 337.5 or NW

7 = 337.6 – 22.5 or N

8 = 22.6 – 67.5 or NE

The eighth character "V" is used to describe the morphology. Morphology coding is as follows:

C = Crest

U = Upper Slope

L = Lower Slope

M = Mid Slope

V = Open Depression

D = Closed Depression

S = Simple Slope

F = Flat

R = Ridge

2.6 Database Storage

All the data collected during field survey was entered into an ACCESS 97 database. This database was developed by NPWS to facilitate the storage, entry and manipulation of systematic floristic survey data. Database entry windows are similar to the format used for field proformas to minimise data entry errors. All species recorded are coded using the Census of Australian Vascular Plant Species (CAPS). New species or subspecies, as identified by the Royal Botanic Gardens, not previously listed in the CAPS were assigned new codes to the master CAPS database. An extensive data validation procedure was undertaken to ensure that the data entered into the ACCESS database matched what had been recorded in the field. Accuracy of survey site locations was also reviewed against original field sheets. Site photographs have been electronically attached to sites and stored with the database.

2.7 Taxonomic Review

For this project, all nomenclature was reviewed and standardised across data sets for analysis. Synonyms were updated to reflect currently accepted revisions. Nomenclature was standardised to follow Harden (1990-1993 and revised editions 2000-2002). Recent taxonomic revisions have been identified using the PlantNET Website that has been developed by the Royal Botanic Gardens (2004). The principle outcomes of the taxonomic review are as follows:

- All exotic species were identified and excluded from the analysis dataset;
- The review highlighted species that were likely to have been incorrectly identified or incorrectly entered into the database. Original field sheets were reviewed to determine the status of these species and where data entry errors were detected, changes were made to the database. Where data entry errors were not detected, species were reviewed against existing literature. Where this indicated them to be outside their likely range, and no confirmation had been made, the record was deleted from the database;
- The review highlighted inconsistently collected records of species containing subspecies or varieties. In such cases, subspecies were either lumped to species level or were assigned to a single subspecies or variant if only one variety is present in the study area;
- The review identified species hybrids that are not recognised formally in the literature. These were assigned to one or other of the species based on the predominance of either in surrounding environments; and
- The review highlighted flora species identified to genus level only. Samples identified to genus level only which were low in number and low in cover scores (<5% cover) were deleted from the analysis dataset. Where genus only samples were numerous, but could not be clearly assigned to a single species, they were left unchanged.

2.8 Aerial Photograph Interpretation

2.8.1 Objectives

Aerial Photo Interpretation (API) was required to generate a complete spatial coverage of the Nattai and Bargo reserves (Map 9) showing the distribution of landcover elements including vegetation and other physical features.

The API component of this project has been used to meet several objectives. These are to:

- Quantify the extent of native vegetation cover across the reserves;
- Guide and inform the mapping of vegetation communities derived from field data; and
- Provide an index of relative vegetation condition for all native vegetation cover.

2.8.2 Area Mapped and Photography Used

Almost 34 000ha, totalling 52 percent of the study area had been mapped by previous studies (NPWS, 2000b, , 2003b). New interpretation covered over 35 000 hectares of southern Nattai NP, Bargo SCA and adjoining crown lands and freehold tenures. Table 3 shows the 1:25000 scale aerial photographs used in this project and Map 9 illustrates the extent of each API coverage used to generate the final mapped products.

TABLE 3: AERIAL PHOTOGRAPHY INTERPRETED

Title	Run Number	Prints	Run Date
Burragorang	7	34-41	24/10/1994
Burragorang	8	43-49	24/10/1994
Burragorang	9	173-179	25/10/1994
Burragorang	10	167-175	24/11/1994
Wollongong	8	23-28	05/01/1994
Wollongong	9	60-65	05/01/1994
Wollongong	10	67-70	05/01/1994
Wollongong	11	102-104	05/01/1994

2.8.3 Aerial Photo Interpretation and Landcover Classification

Aerial photo interpretation of vegetation cover components as required by this project essentially involved reducing the variability in the vegetation continuum according to a set of prescribed but open-ended criteria.

An API stratification of the unmapped portion of the reserves was undertaken by applying the following attribute classes to each polygon. The Aerial Photos were interpreted to provide information on each of the following features:

- Canopy Type;
- Non-canopy Features;
- API Confidence;
- Understorey
- Disturbance Types and Severity;

The coding system applied was consistent with the methods applied for the adjoining Metropolitan Special Area (NPWS, 2002) though different from that used for the Warragamba Special Area (NPWS, 2003). The pathway and attributes collected were identical although the coding systems differed between interpreters. Attributes for each of these features were coded directly onto photo transparency overlays and later coded into ArcView GIS for each polygon. To ensure consistency in the interpretation of features across the study area, interpretation was tied to explicit mapping thresholds within each of the above themes.

The prescribed minimum patch size for inclusion in the mapping was one hectare. However, smaller patch sizes were mapped at the interpreter's discretion. Small areas considered significant enough to map included rock outcrops, rainforest patches, sedgeland and heathland. Approximately 2700 polygons were mapped in total, with an average patch size of 12 hectares.

2.8.4 Patterns in Vegetation Cover

The vegetation cover within the study area is mostly contiguous. Cleared areas do occur around the townships of Hilltop, Balmoral, Bargo and Buxton. Fragmented patches of vegetation also occur surrounding these townships as well as a number of rural properties such as 'Wattle Ridge'. All vegetation cover was mapped using consistent criteria as follows:

No Vegetation Cover (Code X)

This includes obvious features such as man made structures, cleared paddocks, parks, ovals, house blocks and industrial premises. Cleared areas were classified as follows:

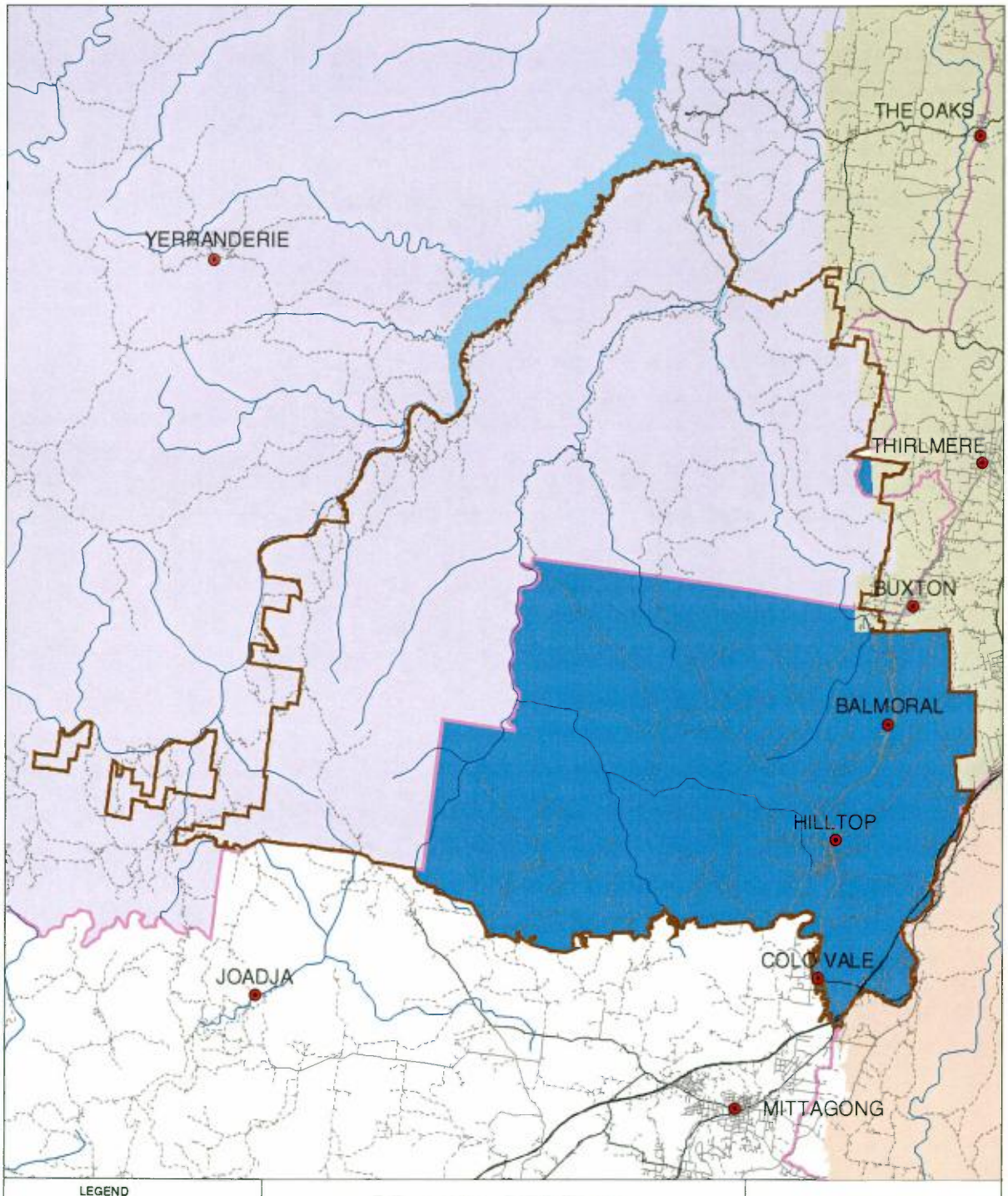
X/C cleared with cultivated land;

X/D cleared with native shrubs and grasses;

X/E cleared with native grasses;

X/H cleared with heathy shrubs;

X/Q cleared with exotic grasses;



LEGEND

- Towns
- Main Roads
- Minor Roads
- Other Roads & Trails
- Main Rivers & Creeks
- Waterbodies
- SCA Special Areas
- Study Area Boundary
- Western Sydney API (1:16 000)
- Woronora API (1:25 000)
- Warragamba API (1:25 000)
- Nattai & Bargo API (1:25 000)

Map 9: API Data Coverages

0 1 2 3 4 5 Kilometers

PROJECTION: AMG, Zone 56
SCALE: 1:275 000
DATUM: AGD 1966

DATA SOURCES:
Towns, Roads & Rivers data supplied by Department of Lands;
Administrative data by DEC & SCA;
API data developed by DEC

X/R cleared with rural landuse; and

X/U cleared with urban landuse.

Areas mapped with no vegetation cover were excluded from further assessment.

Other landscape features were also mapped including rock outcrops (codes L and L7), water bodies (code W) and exotic trees (code V).

Sparse/Scattered Vegetation Cover (Code Tx)

A regular feature of native vegetation cover in disturbed environments is the presence of scattered trees above an open or absent understorey in a mosaic of cleared and remnant vegetation. A code Tx was applied where Crown Canopy Projected Density (CCPD) of tree cover fell below ten percent. A minimum mapping area of one hectare was used. Vegetation cover coded as Tx was further assessed to describe the tree species present and the type of land use occurring under the tree cover, as follows:

Tx/C scattered trees within cultivated land;

Tx/Q scattered trees with exotic grasses;

Tx/R scattered trees within rural landuse; and

Tx/U scattered trees within urban landuse.

Tree Cover Greater than Ten Percent Crown Cover Projection and Greater than One Hectare

All vegetation cover that displayed canopy integrity was mapped. Canopy integrity has been defined as being greater than ten percent CCPD. All vegetation cover falling within this class and greater than one hectare has been mapped. This attribute covers large expanses of vegetation cover to remnant patches in a cleared landscape. Each patch is attributed with a code describing the canopy species present, the nature of the understorey and the type of disturbance (if any).

2.8.5 Patterns in Canopy Species

The array of vegetation patterns presented on a stereo pair of air photos is essentially a reflection of environmental variables that influence or determine the distribution of species or a vegetation community across a landscape. In areas that are relatively natural, particular species or groups of species commonly occupy localised areas and particular habitats. The conventional process of delineating such areas by drawing a line of best fit between areas has the effect of reducing the variability of the landcover into API pattern or canopy 'types'. A table of canopy types (feature codes) was compiled at the beginning of the photo interpretation phase and utilised the existing information to predict the canopy species likely to be found. This list was maintained throughout the course of the project and is included for reference in Appendix B. Appendix C displays the API feature codes developed during the Warragamba mapping project (NPWS, 2003b).

Interpretation Reliability

The level of interpretation that could be afforded to each polygon by the interpreter was recorded using the classes presented in Table 4. These classes enable the users to understand the reliability to which each of the features have been mapped.

TABLE 4: INTERPRETER CONFIDENCE CLASSES

Interpreter Confidence	Criteria
1: Very High	Polygon visited, features checked
2: High	Strong correlation of pattern based on extrapolation from adjacent visited polygons
3: Medium	Patterns consistent with general trend although less certainty with some or all of the polygon attributes
4: Low	Feature unusual, API uncertain, unconfident interpretation

2.8.6 *Understorey Patterns*

Understorey characteristics were interpreted where they were visible and grouped into a number of broad classes, as shown in Table 5. Understorey information was collected for a number of reasons. Firstly, it provides an additional layer of information that can be used to more accurately delineate vegetation community distribution. Secondly, it can be used to clarify habitat values for fauna. Understorey information was only collected where it varied from the understorey commonly present for the API canopy type. If no understorey tag is present then the characteristic understorey species that are commonly associated with the coded canopy species can be assumed to be present (e.g. Scribbly Gums with a sandstone shrub heath understorey).

TABLE 5: API UNDERSTOREY CODES

Understorey Code	Understorey Feature
A	Tall Dense Rainforest Canopy
B	Mesic/Rainforest Shrub Layer
C	Drier Shrubs Dominant
D	Native Shrubs and Grasses
E	Native Grasses Dominant
F	Melaleuca Dominant
G	Acacia Dominant
H	Heath
K	Casuarina Dominant
L	Exposed Rock
Q	Exotic Grasses
R3	Dry Rainforest

2.8.6 Disturbance Severity Classes

The level of disturbance was assessed for all vegetation cover. Codes to highlight the intensity and type of disturbance were only applied where these features were visible from aerial photography. Where disturbance is present, an initial code was applied to indicate the severity of disturbance based on a subjective assessment using any combination of disturbance patterns observable from the air. A three-class system was used: Low, Medium and High as described in Table 6. The dominant disturbance type has also been coded. These are described in the Disturbance Feature Code column of this table.

2.9 Digital Data Capture and Map Compilation

The linework from the Aerial Photo Interpretation was completed by hand on transparent overlays and delineated on every second photo frame.

The transfer of line work to a GIS format used a scanning and photogrammetric rectification process for each annotated photo. Ground control points were established using topographic maps and a 1:40000 series of digital orthographic photos. These control points were used to rectify (the adjustments used to compensate for distortion due to change in elevation) and geo-reference (reference the spatial location by using the locations of known features) each photograph. Following this process, the raster data was converted to vectors, cleaned, and converted to polygons. The polygons were then edge matched with polygons from the Warragamba (NPWS, 2003), Western Sydney (NPWS, 2000) and Metropolitan Special Area (NPWS, 2002) coverages to provide a seamless join.

A digital data layer supporting topology was cleaned and built in the ArcInfo GIS package. Polygons have been labelled with the attributes identified during the interpretation process including:

- Vegetation Pattern Code (Canopy Code);
- API Reliability Class;
- Understorey (2 fields);
- Disturbance Severity;
- Disturbance Type (2 fields).

TABLE 6: DISTURBANCE INTENSITY AND DISTURBANCE TYPE CODES

Interpreters Disturbance Assessment	Indicative API Disturbance Patterns	Disturbance Feature Codes	Disturbance Features
A – Low Level of Disturbance	No visible signs of disturbance from air. Polygon may have some established tracks dissecting. Evidence of weeds may not be visible or only identified during site investigations, generally at low intensity. Gaps in canopy are more likely to be natural dynamic between rainforest/Eucalypt structures	C D E	Tracks minor Regrowth dominant (>30%) Regrowth minor
B – Medium Level of Disturbance	Polygons exhibiting >75% integrity in forest canopy structure but contains features such as single or multiple canopy gaps where weed infestations have developed from light penetration. The polygon may also be marked by several poorly developed trails, dissecting paths or evidence of human disturbance such as clearing or understorey patchiness	B D E H	Tracks dominant Regrowth dominant (>30%) Regrowth minor Understorey patchy
C – High Level of Disturbance	Common around areas of previous mining and clearing. Dense weed infestations dominate the understorey or canopy. Structure of vegetation is limited to canopy and dense weed understorey. In some areas canopy may include exotic species amongst natives. Canopy gaps are clearly apparent. Evidence of soil disturbance may be apparent, as may be evidence of previous mining activities or clearing.	B C D E F G H Z	Tracks dominant Tracks minor Regrowth dominant (>30%) Regrowth minor Soil disturbance dominant Soil disturbance minor Understorey patchy Weed infestation obvious in large gaps in canopy or across understorey

2.10 VEGETATION CLASSIFICATION

The classification of vegetation communities integrated new survey work with existing classifications completed during the mapping of the Warragamba Special Area. Much of northern Nattai and the Burragorang Valley had been surveyed, classified and mapped prior to this project. As a result, the aim of this project was to determine whether undescribed vegetation communities were present in southern Nattai National Park and Bargo SCA.

To do this, all pre-existing site data was integrated with new survey work and reanalysed. This analysis involved a number of stages, as there were added complexities in the analyses as existing sites were sampled pre-2002 wildfire and new work was completed after the fire. Such impacts could draw erroneous conclusions as to the variation in species composition between sites.

Firstly, analysis of all raw species abundance data from all site data was undertaken using the PATN program (Belbin, 1994). The Bray-Curtis coefficient was generated to identify dissimilarity between survey sites. An association matrix displaying dissimilarity scores between all pairs of sites was produced. An unweighted pair group arithmetic averaging (UPGMA) clustering strategy was applied to the matrix to derive a hierarchical classification. The default beta value of –0.1 was used on all analyses.

A dendrogram was produced to display the hierarchical relationships between individual sites and groups of sites. Homogeneity analysis (Bedward *et al.*, 1992) was used as an initial guide as to the optimum number of vegetation groups. Perfect homogeneity of floristic assemblages within groups would only occur where each site in the data set is considered as an individual group. No two sites in vegetation sampling are ever identical given the natural continuums of vegetation patterns in the landscape. The question facing the analyst is to what degree are differences worthy of justifying unique groups of sites. These decisions are based on field observations and experience with similar vegetation.

An initial broad grouping of sites provided the start point for further investigation. Groups of sites were examined using the species that characterise the group, structural features such as height and Eucalypt cover, along with physical characteristics such as geology, topographic position and aspect. Each broad group was split to identify finer scale floristic assemblages in a sequential manner. This process was continued until further splits in site groupings did not resolve clearer or more consistent patterns of floristic assemblages.

A second analysis was performed on a transformed presence-absence dataset. The purpose of this analysis was twofold. Firstly, such an analysis minimises the impact that highly variable cover score arising from fire may have on the classification of sites. Secondly it provides an opportunity to include additional sites that used differing cover scores into the analyses. Sites were flagged in the analyses as those that were pre or post fire samples. Identical dissimilarity coefficient techniques were performed on the data to test the robustness of groups identified using raw abundance scores. The performance of new sites added to the data set was reviewed by examining their position within the derived dendrogram. Additional sites that clustered amongst sites used to define groups in the raw abundance score analyses were allocated to that group. Sites that were separated from clusters of sites defined in the raw abundance score analyses were reviewed in order to identify the species composition and habitat sampled. Where these sites signified an assemblage not previously described, a new group was identified.

2.11 Description of Vegetation Communities

Vegetation communities have been described in detail using a number of features. Firstly, combinations of sites defining unique groups in the cluster analysis were used to identify the characteristic flora species of that group. These species are presented as a summary for each community in the profiles found in Appendix A. Each vegetation community has been given a Map Unit name to describe the structure, dominant or characteristic species (generally tree species), broad understorey description and/or a geological or topographical feature.

Each profile supports a brief summary of key identifying features. These include commonly occurring plant species and habitat characteristics. Example locations are also given, as is a sample photograph to guide in recognition of the community. The proportion of each disturbance class (%) found within the mapped vegetation community is also presented along with figures highlighting the total extant area of the community within the study area. Data describing the vegetation structure (height and vegetation cover) has been generated from field sample points.

Each profile includes a list of diagnostic species. This species list is derived from the field site data and can be used to help define the floristic composition of a community in relation to all others present in the study area. A concept known as 'fidelity', developed by Keith and Bedward (1999) based on Westhoff and van der Maarel (1978) provides a systematic method for identifying 'diagnostic' or 'characteristic' species within an assemblage. This approach recognises that within a given vegetation community a species may be conspicuous by the frequency and abundance with which it has been recorded. However, in other communities the same species may only occur sparsely, at low abundance or not at all. Patterns may be revealed by analysing the performance of each individual species found within each community. Table 7 describes the criteria used to define positive, negative, uninformative and constant species. Positive species are recorded more frequently within a community and/or at a higher median cover abundance than in all other vegetation communities. Positive species also include those that are only recorded within the target community irrespective of their frequency of detection or abundance. A species that is present in all other communities but is less common or abundant or not present at all in the target community is defined as a negative diagnostic species. A constant species is one that occurs consistently within many communities. Uninformative are those that are recorded at lower abundance and less frequently across all communities. The profile lists all species classified as positive, negative and constant. In addition some uninformative species have been included in the species list to aid field identification.

TABLE 7: DEFINITIONS OF DIAGNOSTIC SPECIES

Occurrence of Species within Target Map Unit	Occurrence of Species in Residual Map Units		
	Frequency>=50% AND C/A>=2	Frequency<50% OR C/A<2	Frequency=0
Frequency>=50% AND C/A>=2	Constant	Positive Diagnostic	Positive Diagnostic
Frequency<50% OR C/A<2	Negative Diagnostic	Uninformative	Positive Diagnostic
Frequency=0	Negative Diagnostic	Uninformative	-

C/A = Cover Abundance

2.12 Mapping Vegetation Communities

The mapping of vegetation communities integrated patterns in canopy and understorey from aerial photo interpretation with soil and geology mapping. Soil and geological influences are included within the aerial photograph coding as each code is structured hierarchically underneath major landscape and geological feature.

Vegetation feature codes generated from the aerial photograph interpretation were intersected with site data. Allocation of a vegetation community to a mapped feature code was achieved using the following steps. Firstly, a number of vegetation communities appear as highly contrasting patterns on aerial photographs. These include swamps, rainforest, heaths and River Oak forests. These communities can be mapped with a high degree of reliability and correlate strongly with classified site data.

Secondly Eucalypt dominated vegetation codes were intersected with sample data. Feature codes that achieved 100 percent agreement in samples describing a single vegetation community in the analyses were allocated to that community. Feature codes that did not achieve complete agreement between sample point located within it were assessed for spatial accuracy. Sites that reached agreement within a 40 metre tolerance of the polygon boundary were subsequently allocated to the vegetation community. Sites that continued to indicate an alternative community to that described by the API feature code were investigated. Individual polygons were assessed against the mapping reliability code and where low, were recorded to that suggested by the sample point. Feature codes that retained mixed sample allocations were allocated to the vegetated community suggested by the majority of samples. A small number of codes were not sampled and these were allocated to a vegetation community based on field traverses or were amalgamated with adjoining communities based on similar geological, structural and floristic attributes.

The allocation of each feature code to a Vegetation Community Map Unit is summarised in Appendix B. Feature codes Mapping area and in Appendix C for the land covered by the mapping for Warragamba Special Area (NPWS, 2003b). The polygon allocations for the areas mapped in Western Sydney and the Metropolitan Catchments (NPWS, 2000b, NPWS, 2003c) were retained due to their limited area within the study area (252 hectares), and to ensure consistency between coverages.

2.13 Regional Significance of Vegetation Communities

A number of conservation assessments were carried out in order to provide information on the regional significance of the vegetation communities found in the study area. These assessments include:

- The regional distribution of the vegetation communities. Each vegetation community has been reviewed to determine the known extent of the community beyond the study area. Area figures (hectares) have been provided based on currently available knowledge presented in broader regional studies including DEC (in prep.), NPWS (2000a), NPWS (2000b), NPWS (2003b) and NPWS (2003c). These results are included with each vegetation community profile in Appendix A.
- The reservation status of each community within the formal reserve system. The area of each vegetation community (hectares) found within the reserve system managed by NPWS has also been calculated based on the above sources.

- The proportion of the disturbance classes found within each vegetation community has been calculated for areas within the study area;
- Vegetation communities have been reviewed against Endangered Ecological Community Determinations made under the Threatened Species Conservation Act (1995); and
- An analysis of the species richness within each community. Mean values and Standard Deviation were generated using field site data (400 square metre quadrats).

3 RESULTS

3.1 SURVEY SITES

Field sampling was conducted in October and November 2003. A total of 69 full floristic survey sites were sampled during this period. These sites augmented the existing 295 sites that were extracted from previous studies (Section 2.2). The total number of sites available for analysis reached 364, equating to a sampling density of one site per 196 hectares. These sites are displayed on Map 10.

3.1.1 Recent Fire

It should be noted that many of the sites collected during the survey phase (about 54) were positioned in areas affected by the January 2002 wildfire (Map 6). It is not the intent of this project to assess the impact of fire on vegetation and the project has not been designed for such analyses. However, a preliminary analyses of data did not suggest there was inherent bias in the composition of species between pre and post fire sample sites. Such trends are supported by existing research (Gill and Catling, 2002) that suggest that a full floristic composition returns shortly after a wildfire event for open forests such as those found in Sydney sandstone environments. In many cases high species diversity is found after fire followed by a gradual decline over time. The structural characteristics of vegetation communities (cover and abundance of species) are also altered by fire, however these can go through some fairly dramatic changes post fire, that typically stabilise within a number of years.

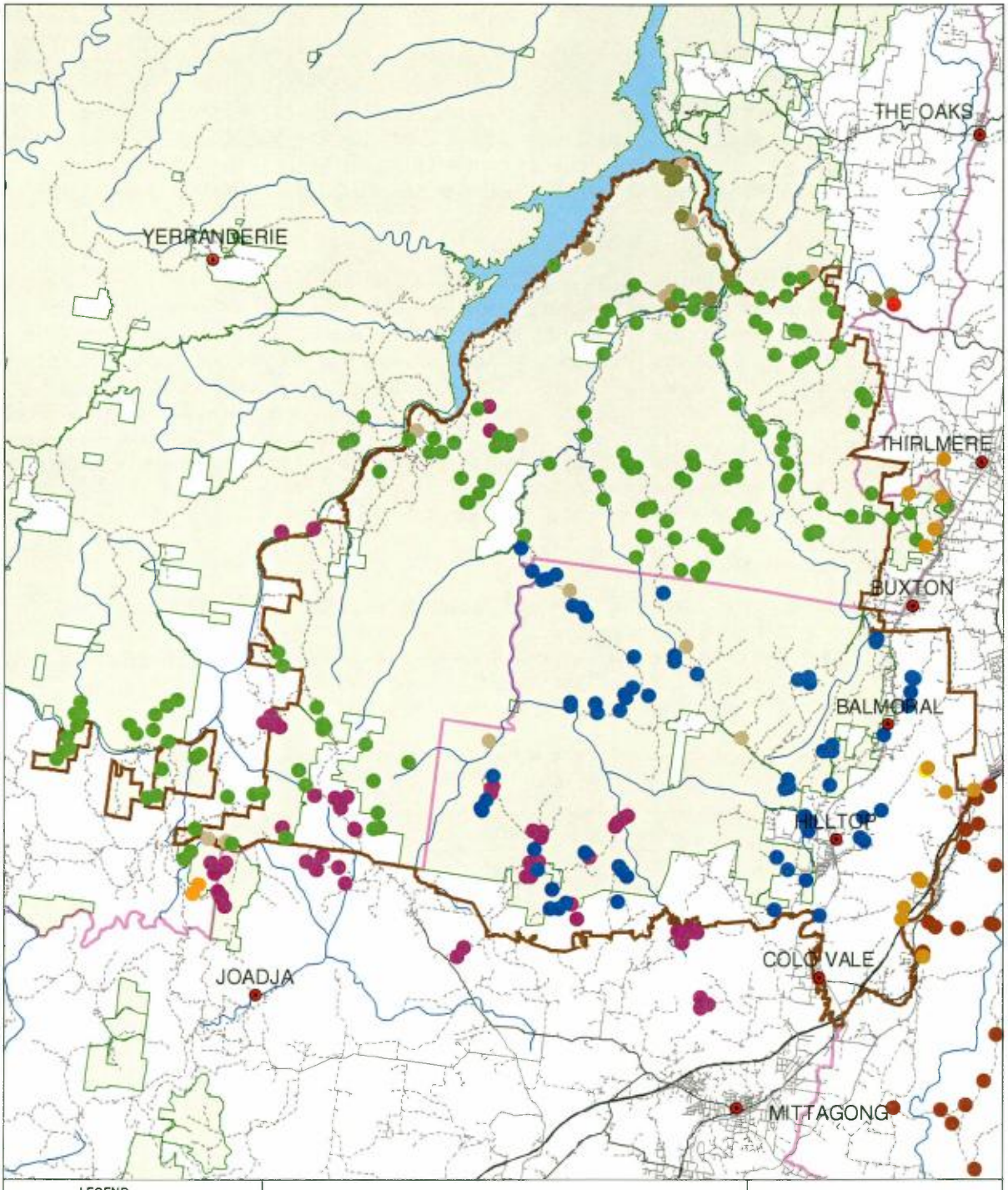
3.1.2 Sampling Performance

Sampling performance refers to the intensity to which the environmental strata have been sampled. The sampling performance has been summarised by utilising thirteen broad vegetation groups (as defined through API and quantitative floristic analysis), three elevation classes and three rainfall classes. Table 8 outlines the classification of these variables that led to the definition of 97 individual strata units. The full list of strata units matched to sampling effort is presented in Appendix D.

TABLE 8: CLASSIFICATION OF ENVIRONMENTAL VARIABLES FOR THE REVIEW OF SAMPLING PERFORMANCE

Broad Vegetation Groups	Elevation Classes	Annual Rainfall Classes
Sheltered Sandstone Forests	<350m	<845mm
Other Features	350-600m	845-876mm
Highland Scrubs	>600m	>876mm
Sandstone Shrub Woodlands		
Heath Woodland and Mallee		
Transitional Shale Grassy Forests		
Swamp Woodland and Heath		
Dry Woodlands (non-Sandstone)		
Shale/Sandstone Shrub Forests		
River Oak Forest		
Sandstone Moist Forest/Rainforest		
Sheltered Permian Forests		
Porphyry Woodlands		

Most strata within the study area were closely matched between the proportional area with the proportion of sampling effort. However a number of spatial gaps remain largely due to access constraints and resource limitations. The sampling review highlighted that Dry Woodlands (non-Sandstone), Sheltered Sandstone Forests and Sandstone Shrub Woodlands were undersampled in some areas particularly at



LEGEND

- Towns
- Vegetation Survey Sites
- Nattai & Bargo Reserves - This Study
- Warragamba Special Area
- Werriberri Catchment & Burragorang Mines
- Priority 5 Management Area (P5MA)
- Western Sydney, Cumberland Plain
- Broad Headed Snake Potential Habitat Survey
- Woronora, Ohares & Metropolitan Catchments
- RBG, Burragorang 1:100 000 Mapsheet
- RBG, Wollongong 1:100 000 Mapsheet
- Joadja Nature Reserve
- Main Roads
- Minor Roads
- Other Roads & Trails
- Main Rivers & Creeks
- Waterbodies
- SCA Special Areas
- Study Area Boundary
- National Parks Estate

Map 10: Vegetation Survey Sites

0 1 2 3 4 5 Kilometers

PROJECTION: AMG, Zone 56
SCALE: 1:275 000
DATUM: AGD 1966

DATA SOURCES:
Towns, Roads & Rivers data supplied by Department of Lands;
Administrative data by DEC & SCA;
Survey Site data from DEC

FIGURE 1: COMPARISON BETWEEN PROPORTION OF SAMPLING EFFORT (SITES) TO THE PROPORTION OF BROAD VEGETATION GROUPS (AREA)

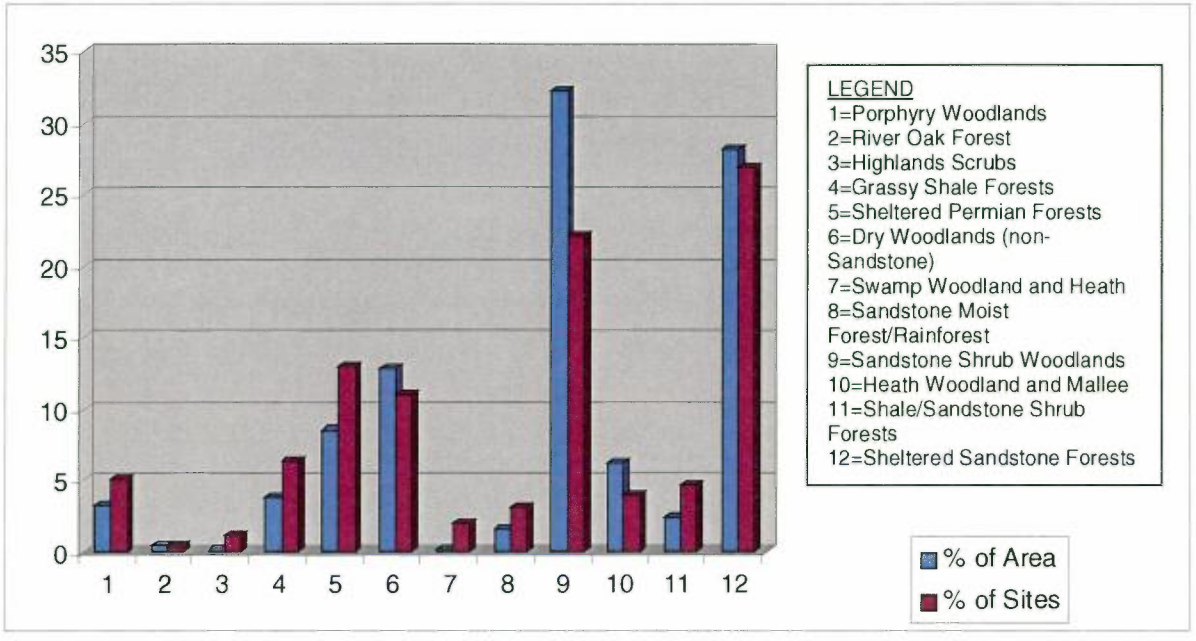


FIGURE 2: COMPARISON BETWEEN PROPORTION OF SAMPLING EFFORT (SITES) TO THE PROPORTION OF ELEVATION CLASSES (AREA)

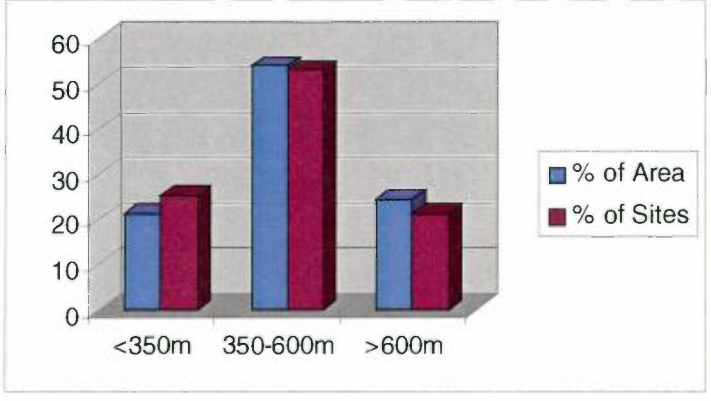
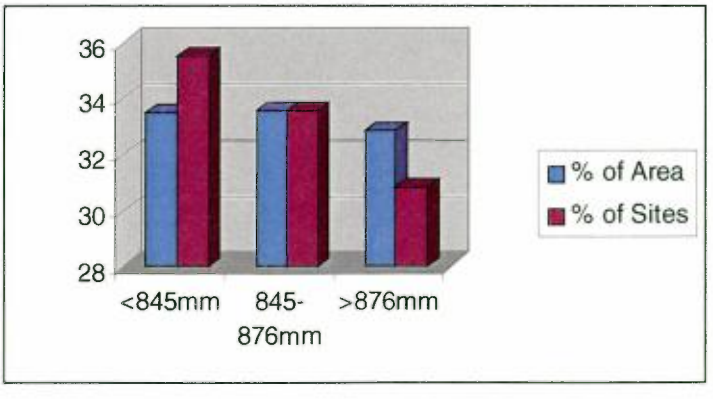


FIGURE 3: COMPARISON BETWEEN PROPORTION OF SAMPLING EFFORT (SITES) TO THE PROPORTION OF MEAN ANNUAL RAINFALL CLASSES (AREA)



higher elevations. Inaccessible and rugged areas across the sandstone plateau (such as the Southern Wanganderry Tablelands) contain fewer sample points, as do several of the smaller scale vegetation features, such as heaths and swamps. Figures 1-3 provide a comparison between the proportion of sampling effort and the proportion of area for the three environmental variables used in the stratification.

3.2 Aerial Photograph Interpretation

API of vegetation patterns has been completed over the unmapped portions of the Nattai and Bargo reserves. In total over 63 different landscape features have been mapped. These include vegetation patterns as well as landscape features such as rock outcrop and man made infrastructures such as easements.

3.2.1 Spatial Accuracy

The spatial accuracy of the API data layer is based on a detailed comparison of ten percent of polygons against linear and high contrast landscape features obvious in orthorectified 1:40000 digital air photo images and orthorectified digital images of the 1:25000 topographic mapsheets.

- Over 95 percent were found to be within a tolerance of 37.5 metres. Spatial accuracy is best on flat to undulating topography of the plateaux and plains and worst on the steep escarpment slopes and dissected gorges of the sandstone tablelands where displacement is greatest.
- Coding transfer error between photo linework and digital coverage was found to be less than 1 percent based on a sample review of original coding attribute and digital coverage.

3.2.2 Vegetation Cover

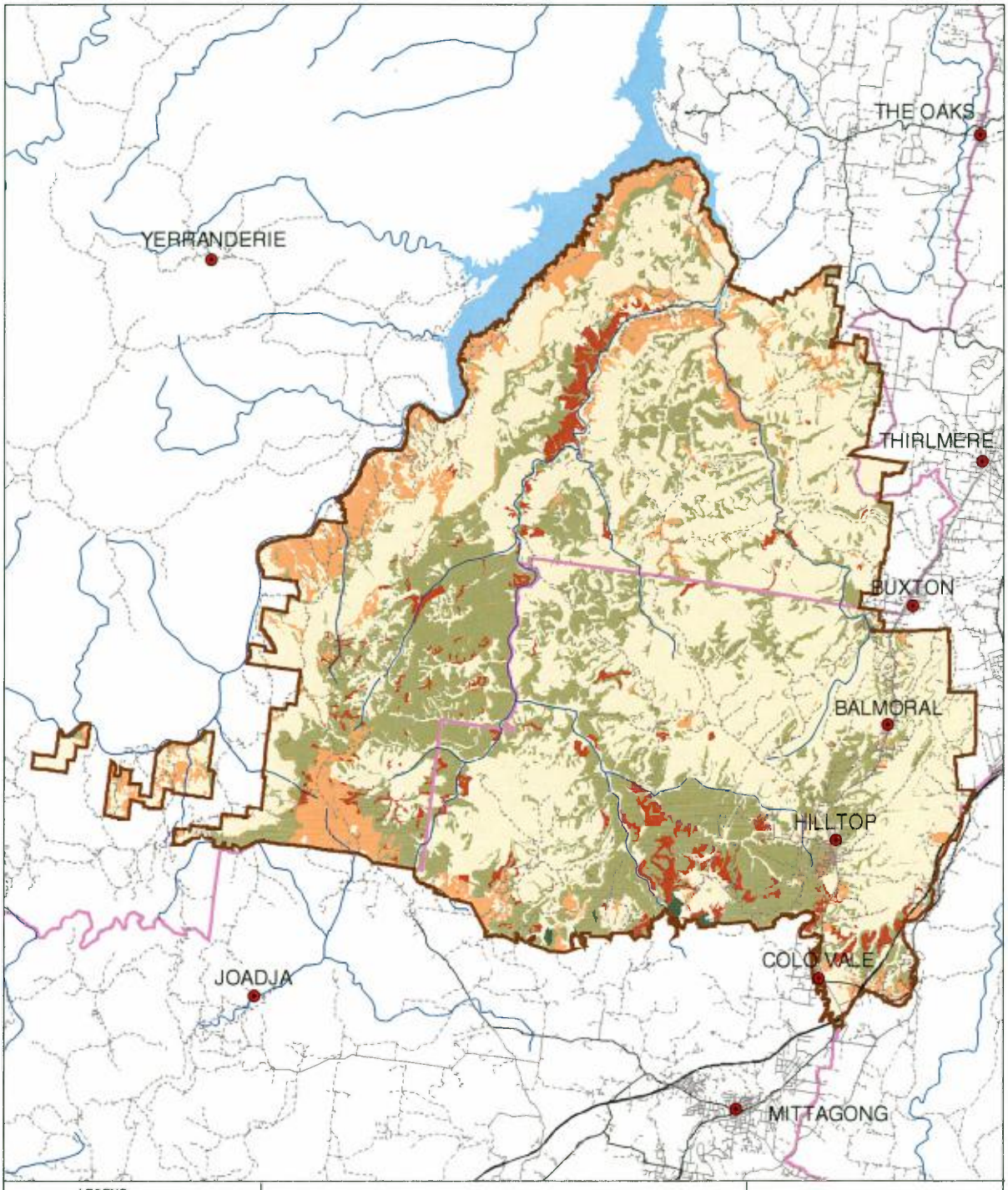
The combined coverages of vegetation mapping indicate that a total of over 70000 hectares have been identified as native vegetation cover. This comprises over 93 per cent of the mapping study area. Table 9 below indicates the area and proportion of broad mapping features found in the study area.

TABLE 9: BROAD MAPPING FEATURES WITH AREA AND PROPORTION OF STUDY AREA

Broad Mapping Feature	Area (ha)	Proportion (%)
Native Vegetation Cover	66301	93.13
Cleared-Modified Land	3364	4.73
Scattered Trees & Regenerating Vegetation	834	1.17
Exposed Rock	434	0.61
Unassessed Vegetation	134	0.19
Water Body	83	0.12
Exotic Trees	45	0.06
Total	71195	100

3.2.3 Interpretation Confidence

The classes describing the confidence in the interpretation of the landscape features are shown in Map 11 and provided in Table 10 below. Over 66 per cent of the study area was mapped with a high or very high level of confidence based on either the visitation of sites or the extrapolation of patterns based on visited areas (as described in Section 2.8). Lower confidence levels were obtained in areas that presented unique photo patterns to the interpreter. In most instances these arose in areas that were inaccessible.



LEGEND

- Towns
- Main Roads
- Minor Roads
- Other Roads & Trails
- Main Rivers & Creeks
- Waterbodies
- SCA Special Areas
- Study Area Boundary

API Confidence Classes

- Very High
- High
- Medium
- Low
- Unassessed

Map 11: API Confidence Classes

0 1 2 3 4 5 Kilometers

PROJECTION: AMG, Zone 56
SCALE: 1:275 000
DATUM: AGD 1966

DATA SOURCES:
Towns, Roads & Rivers data supplied by Department of Lands; Administrative data by DEC & SCA; API Confidence data from DEC

TABLE 10: API CONFIDENCE CLASSES WITH AREA AND PROPORTION OF STUDY AREA

Interpretation Confidence	Area (ha)	Proportion (%)
Very High	6918	9.72
High	40297	56.60
Medium	21316	29.94
Low	2530	3.55
Unassessed	134	0.19
Total	71195	100

3.3 Floristic Diversity and Species Richness

The Nattai and Bargo reserves span two botanical divisions, the Central Coast and Central Tablelands. Some 813 indigenous species have been recorded from all field data. The full list of native species is presented in Appendix E.

Species richness was estimated as the mean number of species found within each vegetation community using standard sites of 400 square metres. Richness scores varied between 13 and 62 taxa per site. The results for each individual community are presented in each vegetation community profile (Appendix A). Fifteen communities have richness scores above 50. Communities supporting lower richness scores generally included swamp, mallee and heath communities. Forests on shale or basalt soil and on sheltered aspects of the escarpment slopes or within the gorges of the sandstone plateau support the highest species richness scores.

3.4 Vegetation Classification

Quantitative analyses of floristic site data were used to identify 37 vegetation communities. Many of these communities had been described previously in existing literature (NPWS, 2003b; Fisher *et al.*, 1994), however six new vegetation communities were also identified. The collection and analysis of survey site data for previously identified communities refined these floristic descriptions using data relevant to the study area. Profiles describing each vegetation community are presented in Appendix A. Figure 4 presents a simplified dendrogram that indicates a potential hierarchical structure for the vegetation communities found in the Nattai and Bargo reserves.

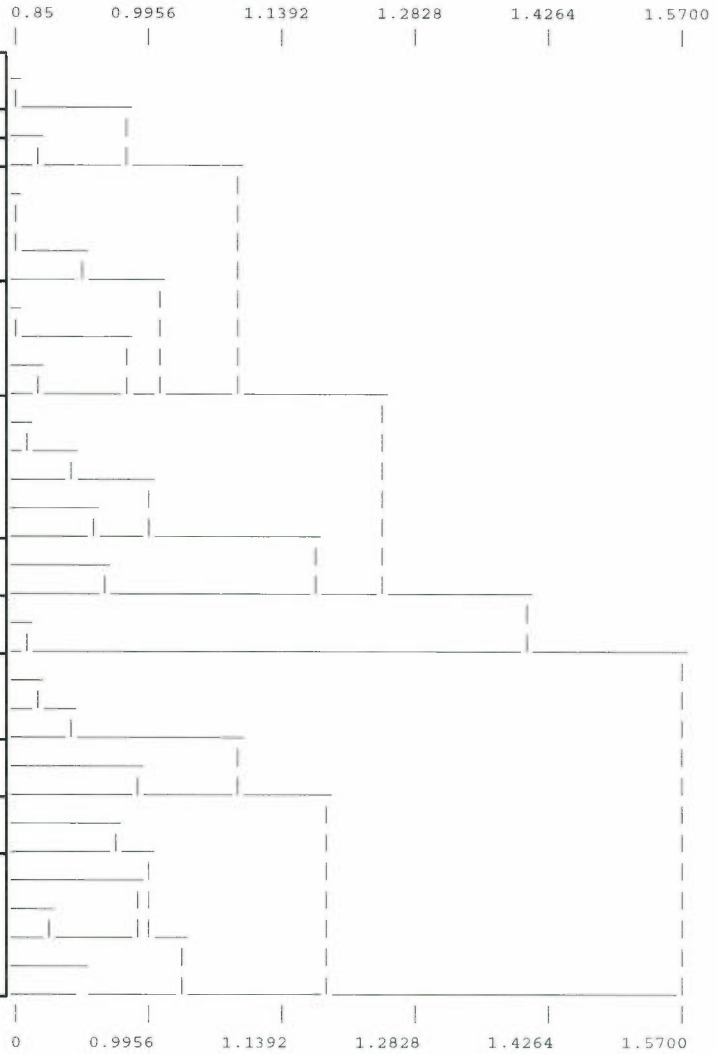
The dendrogram presents twelve broad vegetation groups each containing recognisable finer vegetation groups based on shared landscape and/or environmental characteristics and species overlap. The first group describes Porphyry grassy woodlands, which are found in the dry Burragorang Valley. They are dominated by trees such as *Eucalyptus tereticornis* and *E. moluccana.* The next group describes Tablelands River Oak Forest, which is found along the main riverbanks of the Wollondilly and Nattai and contains *Casuarina cunninghamiana* subsp. *cunninghamiana.* The third broad group describes the *Acacia* scrub and *Melaleuca* thicket found on disturbed Basalt and Shale landscapes such as around Mt Wanganderry. The next group encompasses the tall open grassy forests found on Permian footslopes, Permian alluvial sediments and shale soils in the Southern Highlands. A wide variety of trees are present though *Eucalyptus punctata* is the most commonly found.

Sheltered forests and dry woodlands found mostly on Permian geologies summarise the fifth and sixth broad vegetation groups. The fifth group contains a number of sheltered escarpment forests but also Burragorang River Flat Forest and Grey Myrtle Dry Rainforest. The sixth group introduces a number of dry woodlands that are linked by the abundance of shrub, grass and herb species found within them.

Vegetation communities growing on the extensive sandstone plateau form a broad cluster at the bottom of the dendrogram. Group seven contains the woodland and heath communities found in swampy environments. Sandstone Warm Temperate Rainforest and Sandstone Moist Blue Gum Forest with an emerging rainforest understorey typify the eighth. Groups nine and ten describe the dry shrub forests, exposed woodlands and heath-mallee communities. In contrast, groups eleven and twelve are those associated with sheltered locations such as the valley slopes and dissected gorges of the Nattai Tableland.

FIGURE 4: HIERACHIAL CLASSIFICATION OF VEGETATION COMMUNITIES

No.	Vegetation Groups	Map Units	Vegetation Communities
1	Porphyry Woodlands	30 & 32	Devonian Red Gum-Box Woodland Complex
		31	Devonian Red Gum-Ironbark Woodland
2	River Oak Forest	17	Tablelands River Oak Forest
3	Highland Scrubs	4 & 37	Highlands Scrub Complex
4	Grassy Shale Forests	8a	Highlands Shale Tall Open Forest: Form A
		8c	Highlands Shale Tall Open Forest: Form C
		8b	Highlands Shale Tall Open Forest: Form B
		18 & 23	Permian Grassy Forests
5	Sheltered Permian Forests	11	Escarpment Grey Gum Forest
		12	Escarpment Tall Box Forest
		9 & 10	Tall Blue Gum-River Gum Complex
		2	Grey Myrtle Dry Rainforest
6	Dry Woodlands (non-Sandstone)	22	Highlands Transitional Shale Woodland
		28	Mount Jellore Woodland
		24	Escarpment Slopes Dry Ironbark Woodland
		29	Douglas Scarp Woodland
		34	Rosy Paperbark Heath
7	Swamp Woodland and Heath	35a & 35b	Highlands Swamp Gum-Tea Tree Heath Woodland
		36	Upland Swamps: Cyperoid Heath
8	Sandstone Moist Forest/Rainforest	1	Sandstone Warm Temperate Rainforest
		5	Sandstone Moist Blue Gum Forest
9	Sandstone Shrub Woodlands	15	Nattai Sandstone Dry Shrub Forest
		21	Nepean Enriched Sandstone Woodland
		25 & 26	Exposed Sandstone Woodland Complex
10	Heath Woodland and Mallee	27	Rocky Sandstone Heath Woodland
		33	Rock Plate Heath-Mallee
11	Shale/Sandstone Shrub Forests	14	Couridjah Sheltered Sandstone Forest
		19 & 20	Transitional Shale Forests
12	Sheltered Sandstone Forests	7	Nattai Sandstone River Peppermint Forest
		6	Nepean Gorge Moist Forest
		3	Sandstone Riparian Scrub
		16	Highlands Sandstone Dry Shrub Forest
		13	Sheltered Sandstone Blue-leaved Stringybark Forest



3.5 Mapping Distribution of Vegetation Communities

A total of 37 vegetation communities have been mapped within the study area along with six additional landscape features. The distribution of the broad vegetation groups (Section 3.4) is shown in Map 12. Table 11 indicates the total area for each vegetation community grouped into structural classes. Structural classifications are based on tree height and crown separation (Walker and Hopkins, 1990).

TABLE 11: VEGETATION COMMUNITIES MAPPED IN THE STUDY AREA

Map Unit	Vegetation Community	Area(ha)	Proportion(%)
	RAINFOREST		
1	Sandstone Warm Temperate Rainforest	412	0.5
2	Grey Myrtle Dry Rainforest	159	0.2
3	Sandstone Riparian Scrub	36	0.05
4	Highlands Basalt *Acacia* Scrub	8	0.01
	Subtotal:	615	0.8
	TALL FOREST		
5	Sandstone Moist Blue Gum Forest	640	0.9
6	Nepean Gorge Moist Forest	803	1.1
7	Nattai Sandstone River Peppermint Forest	4060	5.7
8a	Highlands Shale Tall Open Forest: Form A Tall Gully Variant	222	0.3
8b	Highlands Shale Tall Open Forest: Form B Open Red Gum Variant	610	0.8
8c	Highlands Shale Tall Open Forest: Form C Tall Open Variant	780	1.1
9	Burragorang River Flat Forest	588	0.8
10	Sheltered Escarpment Blue Gum Forest	189	0.2
11	Escarpment Grey Gum Forest	4002	5.6
12	Escarpment Tall Box Forest	723	1.0
	Subtotal:	12619	17.7
	OPEN FOREST		
13	Sheltered Sandstone Blue-leaved Stringybark Forest	9535	13.3
14	Couridjah Sheltered Sandstone Forest	1526	2.1
15	Nattai Sandstone Dry Shrub Forest	5371	7.5
16	Highlands Sandstone Dry Shrub Forest	4269	6.0
17	Tablelands River Oak Forest	311	0.4
18	Permian Footslopes Grassy Red Gum-Box Forest	767	1.0
19	Transitional Shale Dry Ironbark Forest	80	0.1
20	Cumberland Plain Shale Sandstone Transition Forest (High Sandstone Influence)	19	0.0
	Subtotal:	21878	30.7
	WOODLAND		
21	Nepean Enriched Sandstone Woodland	3856	5.4
22	Highlands Transitional Shale Woodland	378	0.5

Map Unit	Vegetation Community	Area(ha)	Proportion(%)
23	Dry Alluvial Paperbark Woodland	147	0.2
24	Escarpment Slopes Dry Ironbark Woodland	7248	10.2
25	Exposed Permian Sandstone Woodland	375	0.5
26	Exposed Burragorang Sandstone Shrub Woodland	11765	16.5
27	Rocky Sandstone Heath Woodland	3240	4.5
28	Mount Jellore Woodland	30	0.04
29	Douglas Scarp Woodland	829	1.1
30	Devonian Red Gum-Grey Box Woodland	1360	1.9
31	Devonian Red Gum-Ironbark Woodland	701	1.0
32	Devonian Red Gum-Yellow Box Woodland	96	0.1
	Subtotal:	30025	42.1
	HEATHS & SWAMPS		
33	Rock Plate Heath-Mallee	959	1.3
34	Rosy Paperbark Heath	3	0.00
35a	Highlands Swamp Gum-Tea Tree Heath-Woodland	87	0.1
35b	Highlands Swamp Gum-Tea Tree Heath-Woodland: Form B (*Melaleuca*)	24	0.03
36	Upland Swamps: Cyperoid Heath	14	0.02
37	Highlands *Melaleuca* Thicket	78	0.1
	Subtotal:	1165	1.6
	OTHER FEATURES		
38	Cleared-Modified Land	3364	4.7
39	Scattered Trees & Regenerating Vegetation	834	1.1
40	Exotic Trees	45	0.06
41	Exposed Rock	434	0.6
42	Water Body	83	0.1
43	Unassessed Vegetation	134	0.2
	Subtotal:	1891	6.8

3.6 Reservation Status Assessment

Table 12 presents figures describing the regional reservation status for each vegetation community. The region refers to the Sydney Basin Bioregion (Thackway and Creswell, 1995). Reservation Status is calculated for the area (ha) and proportion (%) of each vegetation community located within NPWS estate, as at May 2004. These figures should be revised upon the completion of regional vegetation mapping for the South Coast and Southern Highlands (DEC, in prep.).

TABLE 12: REGIONAL RESERVATION STATUS

Map Unit	Vegetation Community	Regional Extant (ha)	Reserved Extent-ha (%)
	RAINFOREST		
1	Sandstone Warm Temperate Rainforest	>2000	>1500 (75)
2	Grey Myrtle Dry Rainforest	>7000	>5000 (70)
3	Sandstone Riparian Scrub	>1500	975(65)
4	Highlands Basalt *Acacia* Scrub	> 100	0 (0)
	TALL FOREST		
5	Sandstone Moist Blue Gum Forest	>11000	>8000 (72)
6	Nepean Gorge Moist Forest	>1500	1100 (73)
7	Nattai Sandstone River Peppermint Forest	>5000	4060 (80)
8	Highlands Shale Tall Open Forest: Forms A, B and C	8769	<500(0.05)
9	Burragorang River Flat Forest	>2000	806 (40)
10	Sheltered Escarpment Blue Gum Forest	>3000	3000 (100)
11	Escarpment Grey Gum Forest	>20000	20000 (100)
12	Escarpment Tall Box Forest	<1000	700 (70%)
	OPEN FOREST		
13	Sheltered Sandstone Blue-leaved Stringybark Forest	>15000	>10000 (66)
14	Couridjah Sheltered Sandstone Forest	<2000	1526 (75)
15	Nattai Sandstone Dry Shrub Forest	>15000	9622 (64)
16	Highlands Sandstone Dry Shrub Forest	83842	10269 (12)
17	Tablelands River Oak Forest	11602	2200 (19)
18	Permian Footslopes Grassy Red Gum-Box Forest	<2000	1200 (60)
19	Transitional Shale Dry Ironbark Forest	2766	0 (0)
20	Cumberland Plain Shale Sandstone Transition Forest (High Sandstone Influence)	8706	1075 (12)
	WOODLAND		
21	Nepean Enriched Woodland	>8876	<1000 (11)
22	Highlands Transitional Shale Woodland	>500	<200 (40)
23	Dry Alluvial Paperbark Woodland	645	604 (94)
24	Escarpment Slopes Dry Ironbark Woodland	28000	22265 (78)
25	Exposed Permian Sandstone Woodland	<2000	1500 (100)
26	Exposed Burragorang Sandstone Shrub Woodland	>30000	>25000 (83)
27	Rocky Sandstone Heath Woodland	>3500	>2518 (71)
28	Mount Jellore Woodland	<500	30 (1)
29	Douglas Scarp Woodland	1016	1000 (98)
30	Devonian Red Gum-Grey Box Woodland	<10000	3735 (37)
31	Devonian Red Gum-Ironbark Woodland	<5000	4467 (94)
32	Devonian Red Gum-Yellow Box Woodland	>11142	4090 (37)
	HEATHS & SWAMPS		
33	Rock Plate Heath-Mallee	<5500	5500 (99)
34	Rosy Paperbark Heath	N/A	N/A
35	Highlands Swamp Gum-Tea Tree Heath-Woodland	<5000	<1000 (20)
36	Upland Swamps: Cyperoid Heath	<5000	<5000 (99)
37	Highlands Melaleuca Thicket	<500	50 (10)

3.7 DISTURBANCE ASSESSMENTS

3.7.1 Disturbance Severity Classes

Evidence of human related impacts over the mapping area is minimal, with around 72 percent displaying a low level of disturbance. About 28 percent of the total study area have been classified as showing medium or a high level of disturbance. This figure, however, is an overestimate of disturbance severity within the Nattai and Bargo reserves as the mapping study area includes non-forested land outside the reserves. The mapping covers areas such as the townships of Balmoral, Colo Vale and Hilltop as well as cleared areas around Mt Wanganderry and "Wattle Ridge". Disturbance mapping can also be underestimate in forested areas as impacts may affect subcanopy vegetation and are not always visible using remote-sensing techniques such as those used in this project. Table 13 provides a summary of disturbance severity classes and Map 13 illustrates their location.

Around thirteen percent of the study area exhibits a high level of disturbance. This comprises predominantly cleared areas and those with regenerating or scattered vegetation. Other influences include tracks, soil disturbance (often track or clearing related), canopy gaps (various causes), water bodies and exotic trees. The most heavily disturbed areas are those cleared for rural and urban landuses and are mostly outside the Nattai and Bargo reserves. A number of previously cleared and regenerating areas are found within the reserves notably in the Wollondilly additions (Paling Flat area) as well as further downstream in the Fowlers Flat area.

An additional fifteen percent of the study area has been classified as having moderate disturbance. These areas cover vegetation that has been grazed in the past where regeneration and weed infestation tends to be patchy rather than extensive. The distribution of the moderately disturbed vegetation class reflects former grazing and pastoral landuse within the Burragorang, Nattai and Little River Valleys.

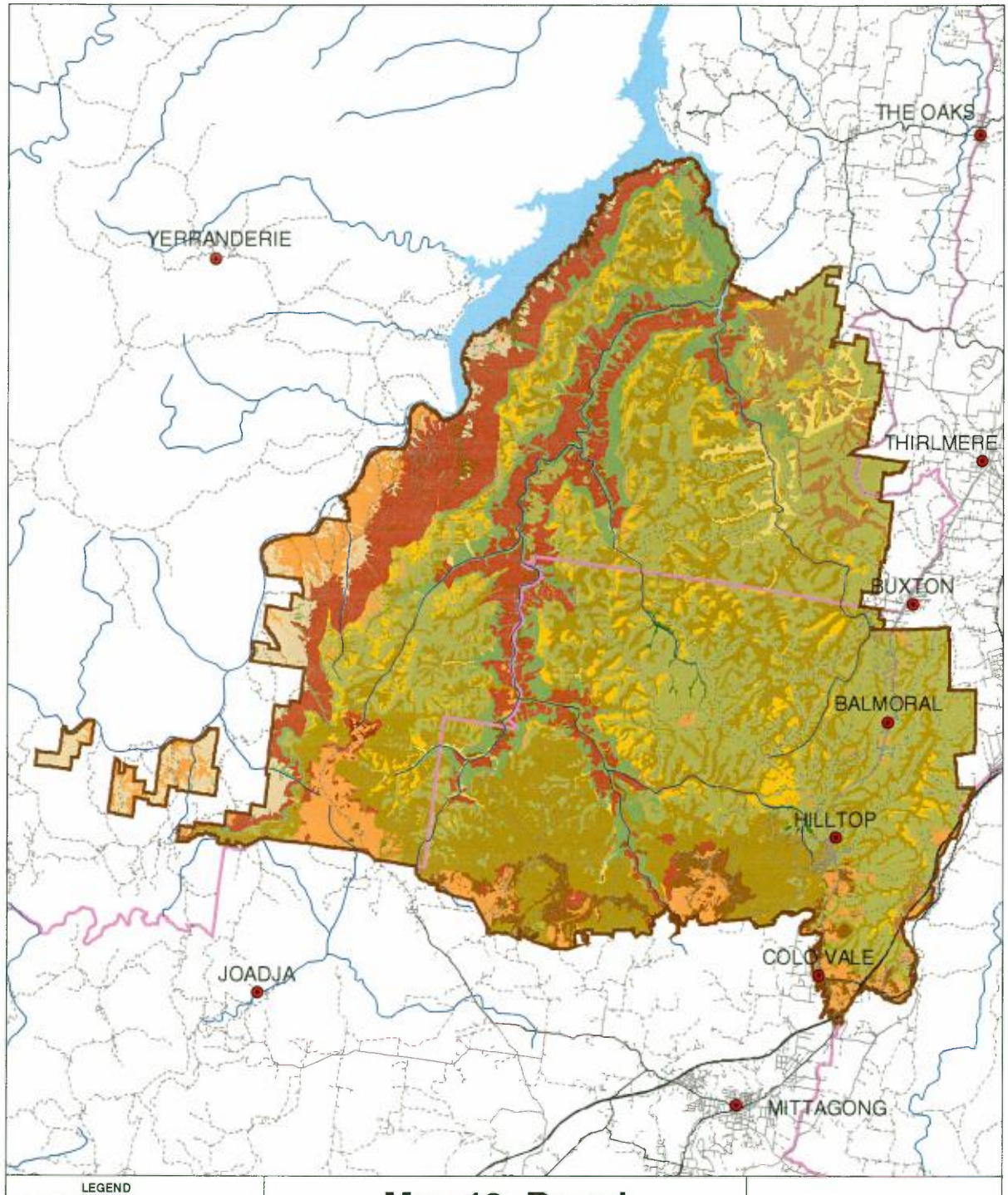
TABLE 13: AREA AND PROPORTION OF DISTURBANCE SEVERITY CLASSES

Code	Severity Classes	Area (ha)*	Proportion (%)*
A	Low Level Disturbance	50920	72
B	Medium Level Disturbance	10958	15
C	High Level Disturbance	9184	13

*Figures for Disturbance Severity Classes include all vegetation communities as well as other landscape features, such as Map Unit 38 Cleared-Modified Land and Map Unit 39 Scattered Trees & Regenerating Vegetation.

Table 14 lists the proportions of each vegetation community that have low, medium and high levels of disturbance. The highly disturbed class is mostly comprised of the scattered trees and regrowth vegetation disturbance type that describe a very open and often significantly disturbed canopy. A range of understorey types may be present varying from improved pasture grass to secondary native grassland. It is often apparent that areas of high disturbance continue to support high levels of native species as is demonstrated by the sample sites used to describe Highlands Basalt *Acacia* Scrub (most disturbed community).

The table is sorted in order of most disturbed to least, based on the proportion of area in the high disturbance class. The bulk of the vegetation communities displayed only minimal amounts of disturbance being mostly classified as low and medium. Ninety percent of the vegetation communities have less than half of their extant area classified as high disturbance and over 50 percent have less than ten percent classed as high. In contrast a small number of vegetation communities have been mostly classified as highly disturbed (> 50 percent) across their distribution. The communities featuring the highest levels of disturbance are generally those found on landscapes with richer soils such as alluvium, shale and porphyry. These are the areas that have historically been subject to intensive agricultural activities such as clearing, logging and grazing.



LEGEND

- Towns
- Main Roads
- Minor Roads
- Other Roads & Trails
- Main Rivers & Creeks
- Waterbodies
- SCA Special Areas
- Study Area Boundary

Broad Vegetation Groups

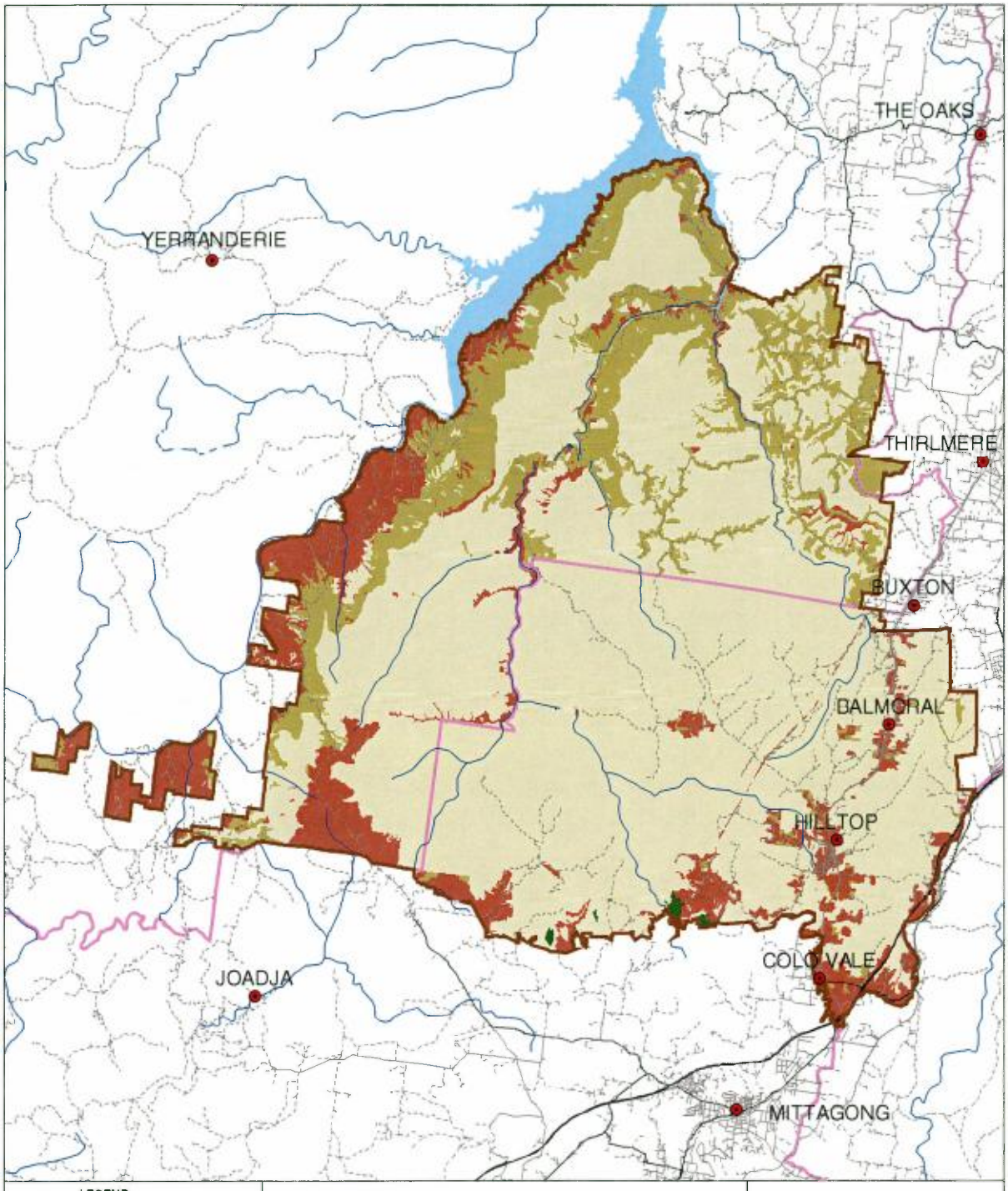
- Porphyry Woodlands
- River Oak Forest
- Highland Scrubs
- Transitional Shale Grassy Forests
- Sheltered Permian Forests
- Dry Woodlands (non-Sandstone)
- Swamp Woodland and Heath
- Sandstone Moist Forest/Rainforest
- Sandstone Shrub Woodlands
- Heath Woodland and Mallee
- Shale/Sandstone Shrub Forests
- Sheltered Sandstone Forests
- Other Features

Map 12: Broad Vegetation Groups

0 1 2 3 4 5 Kilometers

PROJECTION: AMG, Zone 56
SCALE: 1:275 000
DATUM: AGD 1966

DATA SOURCES:
Towns, Roads & Rivers data supplied by Department of Lands;
Administrative data by DEC & SCA;
Vegetation data developed by DEC



LEGEND

- Towns
- Main Roads
- Minor Roads
- Other Roads & Trails
- Main Rivers & Creeks
- Waterbodies
- SCA Special Areas
- Study Area Boundary

Disturbance Severity Classes

- High
- Medium
- Low
- Unassessed

Map 13: Disturbance Severity Classes

0 1 2 3 4 5 Kilometers

PROJECTION: AMG, Zone 56
SCALE: 1:275 000
DATUM: AGD 1966

DATA SOURCES:
Towns, Roads & Rivers data supplied by Department of Lands;
Administrative data by DEC & SCA;
Disturbance Severity data by DEC

TABLE 14: MAP UNIT WITH PROPORTION OF EACH DISTURBANCE INTENSITY CLASS (%)

Map Unit	Vegetation Community	High (%)	Medium (%)	Low (%)
4	Highlands Basalt *Acacia* Scrub	100	0	0
30	Devonian Red Gum-Grey Box Woodland	75	9	16
37	Highlands Melaleuca Thicket	71	0	29
8c	Highlands Shale Tall Open Forest: Form C Tall Open Variant	56	8	36
31	Devonian Red Gum-Ironbark Woodland	49	45	6
18	Permian Footslopes Grassy Red Gum-Box Forest	49	20	31
32	Devonian Red Gum-Yellow Box Woodland	47	47	6
29	Douglas Scarp Woodland	44	44	12
19	Transitional Shale Dry Ironbark Forest	44	0	56
17	Tablelands River Oak Forest	32	16	52
9	Burragorang River Flat Forest	31	39	30
23	Dry Alluvial Paperbark Woodland	30	59	11
22	Highlands Transitional Shale Woodland	28	2	70
8b	Highlands Shale Tall Open Forest: Form B Open Red Gum Variant	28	2	71
10	Sheltered Escarpment Blue Gum Forest	22	49	30
35a	Highlands Swamp Gum-Tea Tree Heath-Woodland	14	0	86
21	Nepean Enriched Sandstone Woodland	13	5	82
14	Couridjah Sheltered Sandstone Forest	8	41	52
11	Escarpment Grey Gum Forest	5	34	61
8a	Highlands Shale Tall Open Forest: Form A Tall Gully Variant	5	2	92
25	Exposed Permian Sandstone Woodland	4	29	68
20	Cumberland Plain Shale Sandstone Transition Forest (High Sandstone Influence)	3	58	38
2	Grey Myrtle Dry Rainforest	3	9	88
13	Sheltered Sandstone Blue-leaved Stringybark Forest	2	1	97
24	Escarpment Slopes Dry Ironbark Woodland	2	56	42
16	Highlands Sandstone Dry Shrub Forest	2	3	95
7	Nattai Sandstone River Peppermint Forest	2	3	95
26	Exposed Burragorang Sandstone Shrub Woodland	1	12	87
6	Nepean Gorge Moist Forest	1	3	97
5	Sandstone Moist Blue Gum Forest	0	28	72
15	Nattai Sandstone Dry Shrub Forest	0	15	85
12	Escarpment Tall Box Forest	0	17	83
33	Rock Plate Heath-Mallee	0	10	90
1	Sandstone Warm Temperate Rainforest	0	4	96
27	Rocky Sandstone Heath Woodland	0	1	99
3	Sandstone Riparian Scrub	0	0	100
28	Mount Jellore Woodland	0	0	100
34	Rosy Paperbark Heath	0	0	100
35b	Highlands Swamp Gum-Tea Tree Heath-Woodland: Form B (*Melaleuca*)	0	0	100
36	Upland Swamps: Cyperoid Heath	0	0	100

3.7.2 Exotic Species

Over 100 exotic species have been recorded from survey sites within the Nattai and Bargo reserves, although most of these were found at low frequency and abundance. A complete list is presented in Appendix F and their locations have been stored in an electronic database. Typically the locations of weed infestations are associated with areas of past disturbance, particularly lands utilised for agricultural activities. Escarpment slopes off the Wanganderry Tablelands, and the Wollondilly Additions (Paling Flat area) seem to be the major areas within the Nattai and Bargo reserves for weed diversity and abundance. In several locations weeds occur at such a density that they have been mapped during the API program. It should be noted that survey sites although weed infestations were not targeted or identified unless they were in patches large enough to mapped from the air. The total number of weed species is therefore likely to be underestimated.

Exotic species frequently recorded during systematic survey sites include:

- Catsear (*Hypochaeris radicata*);
- Spear Thistle (*Cirsium vulgare*);
- Fireweed (*Senecio madagascariensis*);
- Fleabane (*Conyza* spp.);
- Blackberry (*Rubus* spp.); and
- Nightshades *(Solanum* spp.)

4 DISCUSSION

4.1 PATTERNS IN VEGETATION COMMUNITIES

The collection of systematic field data and its quantitative analysis has confirmed that patterns in the composition and distribution of vegetation communities in the study area are influenced by complex interactions between geology, soil type, topography, elevation and rainfall. The following sections provide an overview of how the changes in environmental characteristics result in corresponding variation in vegetation composition. The sections below represent the breakdown of the dendrogram into broad vegetation groups as described in Section 3.4 (Figure 4). Many of the vegetation communities found in the study area have been described by NPWS (2003c, 2003b and 2000b) and this information forms the background for this discussion.

4.1.1 Porphyry Woodlands

Devonian Porphyritic geology covers an extensive area across the Wollondilly and Burragorang Valleys and the Bindook Highlands, spanning elevations between 200 to 900 metres above sea level. Much of this landscape is outside the study area however significant areas are included in Nattai NP on the east of the Wollondilly River in the Burragorang Valley with smaller areas within the Wollondilly Additions (Paling Flat area). The rocks are volcanic in origin and have an appearance similar to fine grained granites, although particle size can be quite variable. They erode to form a clay-loam soil that is of a moderate fertility.

At the lowest elevations on the undulating valley floor, Devonian Red Gum-Ironbark Woodland (MU31) is found. This community occupies exposed positions on the undulating hillslopes of the Jooriland area in the Burragorang Valley. Summer temperatures are amongst the warmest in the region and annual rainfall is low (less than 750 millimetres). These influences contribute to the persistence of a dry open savannah woodland dominated by *Eucalyptus tereticornis* in combination with *E. crebra* and a number of box trees that vary between *E. moluccana, E. melliodora* and *E. albens*. The understorey is generally comprised of a low sparse shrub layer with a diverse, abundant ground cover dominated by grasses. Frequent species include *Astroloma humifusum, Olearia viscidula, Cymbopogon refractus, Aristida ramosa, Oxalis perennans, Panicum effusum, Dichondra repens* and *Lomandra multiflora* subsp. *multiflora*. *Eucalyptus albens* is indicative of vegetation communities found more frequently on the western slopes of the Great Dividing Range. Its presence in the Jooriland Valley marks the easterly extent of this species. The area also highlights the convergence of coastal and westerly influences (Cambage, 1912) where two closely related species (*E. moluccana* and *E. albens*) hybridise in the same way that they do in the Upper Hunter Valley. These westerly influences suggest that this community forms a component of the White Box- Yellow Box-Blakely's Red Gum Woodland Endangered Ecological Community listed on Part 3 of Schedule 1 of the Threatened Species Conservation Act, 1995.

Further upstream, the Wollondilly Valley begins to narrow and the surrounding hillslopes become increasingly steep. This results in shallower soils and more exposed rock. From Campbell Creek upstream to Millnigang Creek, the Wollondilly Valley primarily runs in a north-south direction, offering protection from cold winter winds from the west. The low open woodland supports *Eucalyptus tereticornis* and *E. moluccana* and has been classified as Devonian Red Gum-Grey Box Woodland (MU30). As with other box woodland communities, grass diversity is high, although the slight increase in shelter (provided through increasing ruggedness) allows an array of moist shrub, herb and vine species to proliferate. *Dichondra repens, Desmodium varians, Ficus rubiginosa, Pandorea pandorana* subsp. *pandorana* and *Cissus opaca* are examples.

Further upstream, the Wollondilly River runs west to east and the surrounding valley is higher in elevation and often steeper than areas downstream. Increased exposure to westerly winds and cooler temperatures result in a change in the floristic composition. *Eucalyptus melliodora* replaces *E. moluccana* as the associate canopy species to *E. tereticornis*. The moist herbs and vines are no longer prominent and are replaced by an abundance of tussock grasses (*Poa* spp.) below a shrub layer of *Olearia viscidula, Lissanthe strigosa, Bursaria spinosa* and *Cassinia laevis*. Described as Devonian Red Gum-Yellow Box Woodland (MU32), this community is one of the more widespread communities occurring on Bindook Porphyry geology.

4.1.2 River Oak Forest

Extensive alluvial networks are found along the floor of the Wollondilly and Nattai River Valleys and a number of forests and woodlands occur on these deposits. Tablelands River Oak Forest (MU17) is the most widespread of these communities occurring along the banks, typically being found as a narrow ribbon of vegetation growing amongst the mobile alluvial sediments adjacent to the river channel. It often widens where alluvial sediments have been deposited to form a valley flat. This community can be readily identified by the tall *Casuarina cunninghamiana* subsp. *cunninghamiana*. Other canopy and understorey species are somewhat variable, being affected by location, soil depth and characteristics, disturbance, distance from waterline and time since flooding. *Angophora floribunda* is one of the more common associate species, most often forming a narrow band behind the ribbon of *Casuarina*. Generally, the understorey is dominated by a dense cover of forb and grass species. Weeds are often abundant within this community as a result of grazing pressure and water based weed dispersal.

4.1.3 Highland Scrubs

Fertile basalt and shale soils are found through the Southern Highlands and within the study area they neighbour the peaks of Mts. Wanganderry, Jellore and Flora. These rich soils allow tall open forests to develop as well as a number of diverse thickets and scrubs.

A moist low scrub is found where dry rocky knolls or scree slopes are present and are underlain by basalt or shale soils. This low scrub is either a depauperate rainforest or a regenerating rainforest recovering from heavy disturbance and has been described as Highlands Basalt *Acacia* Scrub (MU4). It is dominated by *Acacia melanoxylon* with *Rapanea howittiana, Aphanopetalum resinosum* and *Ficus rubiginosa* accompanied by a moist, scattered understorey of fern, herb and vine species. This community resembles other remnant rainforests present on the basalt soils of the Robertson Plateau to the east, although the rainfall levels are considerably lower (by around 500 millimetres per year). As a result many cool-warm temperate rainforest species reliant on higher levels of rainfall, such as *Doryphora sassafras, Acmena smithii* and *Quintinia sieberi*, are not present. Only tiny fragments of this community remain with remnants being highly disturbed.

In and around the drainage depressions and damper areas of these richer soils Highlands *Melaleuca* Thicket (MU37) can be found. On Mount Wanganderry the presence of the community marks the change in geology between the younger residual basalt cap and the underlying Wianamatta Shale. A water seepage area forms providing permanently damp or water logged soils. As a result this community is dominated by pure stands of Paperbark (*Melaleuca styphelioides*) forming a low dense canopy. The ground cover is dense with a mixture of grass, herb, sedge and rush species. *Microlaena stipoides* var. *stipoides, Eragrostis benthamii, Poa meionectes, Themeda quadrivalvis, Lomandra longifolia, Euchiton gymnocephalus, Plantago lanceolata, Carex breviculmis* and *Juncus gregiflorus* are common. Given the rich soil many plants are common to the tall open forests that surround this community. In contrast, herbaceous plants associated with damp areas provide a distinguishing feature and include *Epilobium billardiereanum* subsp. *cinereum, Acaena novae-zelandiae* and *Ranunculus lappaceus*. As with other vegetation types found on the fertile soil, this community is typically found in small heavily disturbed and isolated remnants.

4.1.4 Grassy Shale Forests

Tall open forests dominated by grasses and herbaceous plants are found on fine-grained, higher fertility sediments. Within the study area, these sediments include the basalt and shale soils of the Southern Highlands, and the shale and siltstone material of the Permian Shoalhaven Group. Many of these areas have been heavily cleared and disturbed through past and present agricultural activities

Highlands Shale Tall Open Forest (MU8) grows on fine grained, high fertility basalt and shale soils in the Southern Highlands region. It forms a component of the Southern Highlands Shale Woodland, an Endangered Ecological Community listed under the Threatened Species Conservation Act (1995) and extends to the south, beyond Moss Vale. Within the study area, this community is found in proximity to the interface with sandstone material and as such the soil characteristics and species assemblages tend to take on a transitional nature. This is particularly the case where the shale capping is thin and the underlying sandstone bedrock is close to the surface. Three forms have been described and mapped, representing changes in soil characteristics and available shelter. The canopy varies between *Eucalyptus tereticornis, E. punctata, E. blaxlandii* and *E. bosistoana* on gentle exposed slopes. *Eucalyptus elata* and *E. viminalis* on drainage lines and protected aspects. Apart from variation in the canopy species, the three described forms are floristically very similar, with only minor variations in the

abundance of understorey species. Form A is a tall forest that grows on sheltered aspects and along valley floors. It is the form most influenced by sandstone sediments. Form B is a lower open forest that grows in more exposed locations and on gentler slopes, usually close to the shale sandstone interface. Form C is a tall open forest found on the richer basalt and shale soils and it is the most widespread of the three Forms both within and outside the study area.

Grassy forests are found on Permian Sediments of the Shoalhaven Group where finer grained shales and siltstone are found. These sediments are restricted to escarpment footslopes and small drainage networks. On escarpment footslopes, Permian Footslopes Grassy Red Gum-Box Forest (MU18) is found. This community features *Eucalyptus moluccana* and *E. tereticornis* as the common tree species and a diverse understorey of grasses. On small exposed drainage networks, Dry Alluvial Paperbark Woodland (MU23) occurs. *Melaleuca styphelioides* is the prominent tree species occurring in and alongside dry creek beds. Trees typical of the surrounding Permian soils such as *Eucalyptus punctata* and *E. fibrosa* often overhang the creekline. *Backhousia myrtifolia* and *Acacia parramattensis* occur in patches, as does the cover of grasses and ferns.

4.1.5 Sheltered Permian Forests

The Permian sediments are mostly represented by the Shoalhaven Group, which is predominantly sandstone but also a mix of shale and siltstone in some areas. These sediments are more erodable than the overlying Triassic Sandstones and this has allowed the formation of broad valleys in contrast to the extensive sandstone plateaux above. The typical landscape pattern is a cliffline of residual sandstone with an escarpment slope below. The escarpment slope is steep at first but flattens out towards the valley floor and is often dissected by numerous gullies and small dry creeklines. Sediments in these areas are colluvial by nature and predominantly sandy. They are a mix of the various components of the Shoalhaven Group as well as eroded material from the sandstones above. Sediments along the valley floor tend to be finer grained with recent eroded alluvial sediments the exception. The patterns in vegetation composition can be explained mostly in reference to these soil patterns and to variation in shelter and landscape position.

Burragorang River Flat Forest (MU9) is a tall forest found on the deep alluvial sediments of the Nattai and Little Rivers. These sediments are derived from the eroding Permian valley slopes and as a result offer a suite of plant species similar to the surrounding valley slopes. Terracing is common on the alluviums with front terraces supporting *Angophora floribunda* and *Eucalyptus elata*. Very tall *Eucalyptus deanei* are also common at the junction of Valleys 1 and 2 although they are not present in the drier parts of the valley near the headwaters of the rivers. The Nattai Valley alluviums also feature the tree *Eucalyptus benthamii* at a number of disjunct locations. A dense cover of *Microlaena stipoides* var. *stipoides* and herbs is characteristic of the forest floor.

Away from the alluvial flats, Sheltered Escarpment Blue Gum Forest (MU10) develops on the steepest, most sheltered escarpment slopes. It is prominent directly below escarpment cliffs. It is characterised by a tall canopy of *Eucalyptus deanei* and a dense, often impenetrable cover of ferns, vines and climbers. Higher rainfall supports a prominent mesic component. As the rainfall levels decrease as the major valleys narrow, these tall forests are replaced by one of the more locally interesting communities of the reserves. Escarpment Tall Box Forest (MU12) also occupies the escarpment benches at the base of the clifflines hand it is dominated by *Eucalyptus hypostomatica,* a tree with a limited distribution within the Sydney Basin Bioregion. While the tree is found within Sheltered Escarpment Blue Gum Forest (MU10) to the north, here it combines with tall *E. tereticornis* above species such as *Brachychiton populneus* subsp. *populneus, Bursaria spinosa, Sigesbeckia orientalis* subsp. *orientalis* and *Acacia parramattensis*.

On less protected escarpment sites, Escarpment Grey Gum Forest (MU11) occurs. This community is the most widespread sheltered forest type on Permian sediments. It has a canopy dominated by *Eucalyptus punctata, E. eugenioides* and *Allocasuarina torulosa.* The understorey is characterised by a dense herbaceous layer with low growing vine and grass species. As shelter increases *Eucalyptus deanei* and *Syncarpia glomulifera* subsp. *glomulifera* are sometimes found. Conversely, the canopy opens and includes species such as *Eucalyptus fibrosa* as exposure gradually increases.

Grey Myrtle Dry Rainforest (MU2) is found on steep rocky slopes often alongside watercourses, and sheltered dry gullies. It is the most resilient of the rainforest communities, as it tolerates much lower rainfall levels. Dense thickets of *Backhousia myrtifolia* are typical for this community within the study area. It is often found with a mixture of herbaceous plants and small ferns in the understorey. *Asplenium flabellifolium, Adiantum aethiopicum, Pellaea* spp., *Pandorea pandorana* subsp. *pandorana* and *Dichondra repens* are common. On some steep rocky outcrops of protected escarpment slopes a more

complex rainforest develops to include different combinations of canopy species. Sprawling *Ficus rubiginosa* have been found growing alongside dense stands of *Dendrocnide excelsa* underneath Wanganderry Lookout.

4.1.6 Dry Woodlands (non-Sandstone)

The dry woodlands group encompasses exposed woodlands on Permian sediments and two high elevation woodlands found on different substrates at Mt Jellore and High Range. These communities are linked by their structure, being low and open with low species diversity, but also by the absence of the suite of shrub and heath species typically found on the Triassic Sandstone. The variation in assemblages of species is mostly due to changes in soil characteristics.

Highlands Transitional Shale Woodland (MU22) is found on the interface of shale and sandstone sediments in the Southern Highlands. This community is characterised by tall *Eucalyptus punctata* and *E. globoidea* along with a small mixture of understorey species common to both shale and sandstone soils. The understorey includes species such *as Leptospermum trinervium*, *Allocasuarina littoralis* and *Persoonia linearis* with the grasses *Entolasia stricta* and *Microlaena stipoides* var. *stipoides*.

Mount Jellore Woodland (MU28) is a low stunted woodland found growing over both the exposed and sheltered aspects of the igneous intrusion of Mt Jellore. The substrate found here is Trachyte, a fine-grained volcanic rock that develops a clay loam soil of high fertility (Fisher *et al.*, 1995). The steep slopes are covered with loose rocks and boulders that restrict soil development. A stunted open woodland dominated by *Eucalyptus blaxlandii* and *Allocasuarina littoralis* is indicative with *A. verticillata* common at lower abundance. A sparse understorey nestles alongside the many surface rocks and boulders.

Escarpment Slopes Dry Ironbark Woodland (MU24) is the most widespread community on the Permian sediments. It is found on crests and exposed escarpment slopes. Shallow sandy soils often with sandstone outcropping are found between upper to lower escarpment slopes. These environments are typified by very warm summers and mean annual rainfall between 800 and 900 millimetres per year. This community has a low open canopy comprising *Eucalyptus fibrosa* and *E. punctata*. The understorey is generally a sparse mixture of low sclerophyllous shrubs such as *Persoonia linearis* and *Lissanthe strigosa* and grasses including *Aristida vagans*. At times exposed soil completely dominates the ground with very little evidence of plant growth. These areas are highly erodable as evidenced recently in the post fire environments.

One of the more distinctive and unusual vegetation communities that occurs in the study area is the Douglas Scarp Woodland (MU29) (Fisher *et al.*, 1995). It comprises a canopy of *Eucalyptus crebra* and *Callitris endlicheri* with a shrub layer characterised by *Acacia binervia*. The cone shaped growth form of *Callitris* and the blue leaf of *Acacia binervia* is prominent. The most extensive area occurs on exposed Shoalhaven Group bedrock near Jooriland in the rain shadow of the Burragorang Valley. Like the adjoining Porphyry Woodlands this community clearly reflects the influences of drier environments typical of the inland plains and valleys of the tablelands and western slopes. While the larger species such as Callitris and *Acacia binervia* are obvious, smaller plants such as *Hibiscus sturtii* reflect a similar pattern. This species known commonly as Desert Rose is found in the Hunter Valley, a similarly dry environment, and more frequently on the slopes west of Nyngan and Dubbo. It is not common in the Sydney Basin Bioregion.

4.1.7 Swamp Woodland and Heath

A small number of swamps are found within or adjoining the reserves. These have formed where the soil is permanently or periodically water-logged. The vegetation that grows in these areas form a complex of structural forms such as wet heaths, sedgelands, bogs, and open woodlands. The variation in these communities relates to a number of factors, namely prevalence of water, soil type, elevation and disturbance history that includes fire and grazing (Keith and Benson, 1988; Keith and Myerscough, 1993; Kodela *et al.*, 1996).

Highlands Swamp Gum-Tea Tree Heath-Woodland (MU35) is a swamp complex found on periodically waterlogged soils. It was described by NPWS (2003b) as occurring on high elevation soaks, and within the study area it is found along a number of minor creeklines near the township of Hilltop. This swamp complex is generally observed as a dense scrub of Tea-tree (*Leptospermum* spp.) and/or Paperbark (*Melaleuca* spp.) that grows along the drainage line, fringed by an open woodland of Swamp Gum (*Eucalyptus ovata*). Sedge and rush species are usually found in the swamp with *Lepyrodia anarthria*, *Schoenus melanostachys* and *Juncus continuus* common. This quickly grades into grass and herb

species away from the swamp where *Lomandra longifolia* is often dominant along with *Poa sieberiana* var. *sieberiana*, *Dichondra repens* and *Entolasia stricta*. In this report the two structural forms have been mapped separately as Form A Swamp Gum Woodland, and Form B *Melaleuca*.

The second swamp community found within the study area is the Upland Swamps: Cyperoid Heath assemblage (MU36). These areas are poorly drained headwater valleys ("Hanging" Swamps) which support mosaics of wet heath, sedgeland and thickets that contrast markedly with surrounding Eucalypt woodland or forest (Keith and Myerscough, 1993). Variation in structure and local floristic composition depends on water availability and fire history. A few small patches were observed around the township of Hilltop. However they are more widely distributed on the Triassic Sandstone Tablelands in the north of the Warragamba Special Area (NPWS, 2003b) and east on the Woronora Plateau (2002). Upland Swamps: Cyperoid Heath are essentially areas with a dense cover of sedges from the Cyperaceae family growing on relatively deep, waterlogged organic sands. *Baumea rubiginosa*, *Lepidosperma limicola* and *Chorizandra sphaerocephala* are dominant along with scattered shrubs *Epacris obtusifolia*, *Leptospermum juniperinum* and *Acacia rubida*. The grass *Amphipogon strictus* var. *strictus* often occurs on the margins in dense clumps.

4.1.8 Sandstone Moist Forest/Rainforest

The deeply dissected gorges and heavily sheltered slopes associated with sandstone plateau provide sufficient protection from fire, wind and the sun to allow rainforest species to flourish. In the most protected aspects, Sandstone Warm Temperate Rainforest (MU1) is found. The rainforest is typical of those found in similar topographic positions right across the sandstone plateaux of the Blue Mountains. It features a dense canopy of *Ceratopetalum apetalum, Doryphora sassafras* and *Acmena smithii* developing over a cover of soft ferns. *Backhousia myrtifolia* and *Callicoma serratifolia* is often present in slightly drier sites or where fire has more frequently penetrated the rainforest. Rainfall is generally above 1000 millimetres per year, though some sites occur in deeper gorges where rainfall is only around 900 millimetres. As elevations approach 700 metres asl, cooler temperatures encourage the development of species such as *Quintinia sieberi,* and often a lowering of the canopy.

Sandstone Moist Blue Gum Forest (MU5) supports the highest abundance of mesic species within Eucalypt dominated communities found on sandstone. It is most often found adjoining warm temperate rainforest that occupies deeply incised gullies or on very protected south facing slopes. Tall to very tall *Eucalyptus deanei* are prominent in the canopy along with *Syncarpia glomulifera* subsp. *glomulifera*. The understorey supports a well-developed mesic layer that includes species that are typical of the adjoining rainforest including *Ceratopetalum apetalum* and *Acmena smithii*. A dense ground cover of *Calochlaena dubia, Blechnum cartilagineum* and *Cissus hypoglauca* is typical. A closely related community is Nepean Gorge Moist Forest (MU6) which shares a very similar layered understorey of tall rainforest trees above lower growing moist shrubs and ferns. The tall Eucalypt canopy differs though, as rainfall levels are too low to support *Eucalyptus deanei*. Instead *Eucalyptus elata, Eucalyptus punctata, Eucalyptus agglomerata* and *Eucalyptus cypellocarpa* are common. *Eucalyptus oreades* may also feature at elevations above 700 metres asl.

Along creeklines of the sandstone sediments, Sandstone Riparian Scrub (MU3) occurs. It commonly grows as a narrow strip of vegetation underneath the canopy of the surrounding vegetation, but is also found on larger drainage networks, such as the Bargo River. It is somewhat infrequent and difficult to map. In suitable areas it forms a very simple rainforest community that mixes elements of Warm Temperate Rainforest species with sclerophyllous shrubs. In the larger patches it is found as a low scrub with *Tristaniopsis laurina, Backhousia myrtifolia, Ceratopetalum apetalum* and *Allocasuarina littoralis*. Shrubs of *Tristania neriifolia, Lomatia myricoides* and *Acacia obtusifolia* are also typical. A dense cover of ground ferns, such as *Sticherus flabellatus* var. *flabellatus*, may occur accompanied by sedge and rush species, such as *Schoenus melanostachys* and *Lomandra fluviatilis*.

4.1.9 Sandstone Shrub Woodlands

A large proportion of the study area covers the Nattai, Wanganderry and Burragorang Tablelands. These are comprised of Triassic Group Sandstone and span an elevational range from 300 metres asl in the north east (Couridjah area) to 800 metres asl near Mt. Wanganderry in the south. Topography is generally quite rugged, typified by broad flat ridges dissected by many slopes and gullies. The soil is usually a quartz rich sandy loam that is highly acidic. There are subtle changes in these sandstone woodlands that reflect slight changes in soil depth, shale influence, exposure, elevation and rainfall. Where ridgetops are broad, deeper soils tend to be found and the forest/woodland is noticeably taller.

Where they are narrow or have shallow sandy soils, a shorter woodland is found with greater abundance of heath species.

There are two major dry forests that occupy slightly deeper soils on broad sandstone ridgetops. Nattai Sandstone Dry Shrub Forest (MU15) is the first of these and is found in the north and west of the study area on Hawkesbury Sandstone. This community has a canopy dominated by *Corymbia gummifera, Eucalyptus piperita* and *E. agglomerata.* The shrub species *Banksia spinulosa* var. *spinulosa, Persoonia levis* and *Leptospermum trinervium* are common. The ground stratum is sparse and is comprised of *Lomatia silaifolia, Entolasia stricta, Phyllanthus hirtellus, Pomax umbellata, Patersonia sericea* and *Lomandra obliqua.*

The second dry shrub forest is found in the south and east of the study area occurs on soils derived from the Mittagong Formation. This is the Nepean Enriched Sandstone Woodland (MU21) and is found where a slight shale influence results in a taller woodland with a less abundant and less diverse shrub layer. A well-developed canopy is present with *Corymbia gummifera* and *Eucalyptus globoidea/oblonga* found consistently, often with *E. punctata* growing at lower abundance. *Banksia spinulosa* var. *spinulosa, Bossiaea obcordata, Persoonia levis* and *Acacia terminalis* comprise the shrub layer while the ground supports a greater cover of grasses such as *Entolasia stricta* and *Austrostipa pubescens*, and the herb *Patersonia sericea.* This community extends outside the study area eastward from the township of Hilltop into the Metropolitan Catchments (NPWS, 2003c).

As soil depth decreases, and exposed rock plates and boulders are more prominent, exposed woodlands dominated by heathy shrubs occur. Exposed Burragorang Sandstone Shrub Woodland (MU26) grows in these areas, often covering narrow ridgetops and exposed upper slopes. It is the most widespread community on the sandstone sediments being found over the entire study area. A low open canopy is f dominated by *Eucalyptus piperita, Corymbia gummifera* and Stringybarks (mostly *E. sparsifolia, E. globoidea* and/or *E. oblonga*). More characteristic of this community is a well-developed heath and shrub stratum comprising *Banksia spinulosa* var. *spinulosa, Leptospermum trinervium, Hakea dactyloides* and *Lambertia formosa.* The ground cover is sparse at best including *Cyathochaeta diandra, Lomandra obliqua, Phyllanthus hirtellus, Bossiaea obcordata* and *Lomatia silaifolia.*

Higher elevations on the sandstone plateau near High Range present another variation in sandstone woodlands. Highlands Sandstone Dry Shrub Forest (MU16) has an open canopy dominated by *Eucalyptus agglomerata, E. sieberi* and *E. punctata.* Near the edges of open shale country, the forest supports *Angophora costata.* This is a disjunct occurrence of the species otherwise more commonly known north from the Burragorang SCA. Understorey species composition also differs. As an example *Stypandra glauca* is common and abundant in the understorey of MU16 distinguishing the community from sandstone woodlands further north.

While not associated with the broad sandstone plateau, Exposed Permian Sandstone Woodland (MU25) shares a number of sclerophyllous species with sandstone ridgetop woodlands. This community is found on the driest and most impoverished sites of the Permian sediments. It is typically associated with highly exposed locations on skeletal sandy soils often with outcropping sandstone bedrock. A low growing and open canopy layer may include species such as *Eucalyptus sclerophylla, Corymbia gummifera, Angophora costata* and *E. punctata.* Invariably, *Angophora bakeri* features as a small tree beneath the canopy. Combinations of species in the shrub layer such as *Banksia spinulosa* var. *spinulosa, Leptospermum trinervium* and *Hovea linearis* are equally indicative of this community when compared to adjoining woodlands occurring on Permian substrates.

4.1.10 Heath Woodland and Mallee

In very rocky or exposed locations, the woodland canopy is lower and sparser than elsewhere, with a thick heath layer often the dominant feature. In some areas, particularly rock plates, mallee Eucalypt species can be found.

Rocky Sandstone Heath Woodland (MU27) describes the extremely exposed assemblage which occurs across precipitous rocky escarpment edges and slopes of the sandstone plateaux. Canopy species most frequently include *Eucalyptus sieberi* (at higher elevations), *E. piperita, Angophora costata, Corymbia eximia*, and *E. sclerophylla. Banksia serrata* is more frequently found within this assemblage than any other, with *Hakea dactyloides* and *Isopogon anemonifolius* also frequently occurring. It is generally a very open and stunted canopy due to the exposure to winds and poor soil development. The community often forms a mosaic with Rock Plate Heath-Mallee (MU33) and bare exposed rock. A number of mallees have been recorded within this latter community and include *Eucalyptus stricta, E. apiculata, E.*

multicaulis, E burgessiana and *E obstans*. A dense though patchy heath can comprise *Leptospermum arachnoides, Isopogon* spp., *Petrophile* spp. and *Banksia* spp.

Rosy Paperbark Heath (MU34) (Smith and Smith, 1996) is a low growing heath community found on the lower slopes of Permian escarpments. This community has not been sampled during this project as only small isolated patches can be found in highly inaccessible country in the Nattai Valley. The heath community has been provisionally allocated to this community as it occupies identical landscape position and environments to Rosy Paperbark Heath found in the Kedumba Valley to the north. Future investigations are warranted to determine whether these small patches are dominated by *Melaleuca erubescens*. If so, it may also support a number of plant species that are uncommon elsewhere in the region, notably *Hibbertia cistoidea* and *Lepidosperma viscidum*..

4.1.11 Shale/Sandstone Shrub Forests

A broad group of sample sites described shrub dominated forests found on soils comprising a mixture of both shale and sandstone material. These occur on the fringe of the Cumberland Plain where Wianamatta Shale mixes with material from the Triassic Sandstone. In addition interbedded shale and sandstone originating from the Mittagong Formation provides an enriched soil upon which this forest develops. The species assemblages in these areas differ from other sandstone forests in their abundance and diversity of grass species. In contrast a number of shrub species typically found on pure sandstone soils are also found in these forests, which distinguishes these communities from those that occur on the shale soils of the Cumberland Plain.

Couridjah Sheltered Sandstone Forest (MU14) is a tall shrubby forest found on the southern end of the Burragorang Tableland. On ridgetops the forest is distinctively taller than the surrounding sandstone woodlands, and at sites with deep soil will include *E. deanei* growing alongside more typical trees of *E. piperita* and *E. punctata*, *Corymbia gummifera* and *C. eximia*. *Syncarpia glomulifera* subsp. *glomulifera* is often provides a dense small tree layer with *Allocasuarina torulosa*. On slopes *S. glomulifera* can virtually dominate to the exclusion of all other trees in profuse even aged regrowth. The understorey is a mixture of common sandstone shrub species in combination with moisture loving fern and herb species. *Elaeocarpus reticulatus*, *Blechnum cartilagineum* and *Persoonia linearis* are common.

Further noticeable changes occur when in close proximity to more widespread shale deposits. Cumberland Plain Shale Sandstone Transition Forest (High Sandstone Influence) (MU20) is found on shallow residual shale soils and on high quartz sandstone when there is a strong shale influence. It is a forest dominated by a wide variety of Eucalypt species although *Eucalyptus punctata* and *E. crebra* are the most common for this community in the study area. Smaller trees are often present including *Allocasuarina littoralis*, *Syncarpia glomulifera* subsp. *glomulifera* and *Acacia decurrens*. This community has a well developed shrub layer reflecting the influence of sandstone in the soil. The ground stratum has a mixture of grass and herb species, further evidence of the shale influence. Comprehensive survey, analysis and mapping of these areas was undertaken by NPWS (2000b) which provides more detailed discussions.

A similar transitional forest, Transitional Shale Dry Ironbark Forest (MU19) is found on the eastern boundary of the study area. This community marks the start of the shale sandstone transition, where the influence of sandstone is at its lowest. The canopy of this community is often dominated by Ironbarks (*Eucalyptus crebra, E. paniculata* subsp. *paniculata* and *E. fibrosa*) and Stringybarks (*E. globoidea* and *E. eugenioides*). *Eucalyptus punctata* is also frequently recorded. The understorey is predominantly grassy with a scattering of shrubs. In areas where sandstone influence in the soil is greater a more pronounced shrub layer is present and this resembles the species assemblage that is present in MU20. Both MU19 and MU20 form a component of Shale Sandstone Transition Forest listed on Part 3 of Schedule 1 of the NSW Threatened Species Conservation Act (1995).

4.1.12 Sheltered Sandstone Forests

A number of different forests occur on the sheltered slopes and gullies that dissect the sandstone tablelands. As a whole, these vegetation communities cover over one quarter of the study area. The occurrence of these communities is largely driven by changes in soil depth, shelter and elevation. Generally, ferns and pioneering rainforest species dominate the more sheltered sites, whereas greater exposure results in an increase of common sclerophyllous sandstone shrub species.

Nattai Sandstone River Peppermint Forest (MU7) is a tall forest that grows along sheltered creeklines and lower slopes of the Nattai and Wanganderry Tablelands. *Eucalyptus elata* is particularly indicative of

this community along with the diversity and abundance of fern and vine species. Species observed frequently include *Blechnum cartilagineum, Pteridium esculentum, Dianella caerulea, Microlaena stipoides* var. *stipoides, Eustrephus latifolius, Tylophora barbata* and *Lomandra longifolia.* A number of shrubs are present at low abundance including *Astrotricha latifolia, Grevillea arenaria* subsp. *arenaria* and *Leptospermum polygalifolium* subsp. *polygalifolium.* In more sheltered locations this community grades into Nepean Gorge Moist Forest (MU6)

On sandstone slopes that descend down into the gullies a drier shrub forest develops. This forest consistently occurs across the entire Nattai Tableland. Sheltered Sandstone Blue-leaved Stringybark Forest (MU13) is common on mid and upper slopes, and includes *Corymbia gummifera, Eucalyptus agglomerata, E. piperita* and *E. punctata.* Shrub species reflect the intermediate nature of most sites with dry species such as *Banksia spinulosa* growing alongside hardy mesic species such as *Ceratopetalum gummiferum.*

4.2 Threatened Species and Endangered Ecological Communities

4.2.1 Endangered Ecological Communities

The NSW Scientific Committee have listed a number of Endangered Ecological Communities (EEC's) under the Threatened Species Conservation Act, 1995 that are relevant to the vegetation that is found in the study area. These Endangered Ecological Communities are:

- White Box-Yellow Box-Blakely's Red Gum Woodland;
- Shale/Sandstone Transition Forest;
- Southern Highlands Shale Woodlands.

The determination that accompanies the listing of each of these communities under the TSC Act, 1995, provides information on habitat and typical species. In addition, example locations are provided as reference points. These were used to relate the vegetation communities defined in this report to potential Endangered Ecological Communities. Table 15 highlights the relationships between the two. Several of the EEC determinations describe broad vegetation communities that have been divided into their component parts in this report. The distribution of all Endangered Ecological Communities located within the study area is shown in Map 14.

TABLE 15: RELATIONSHIP BETWEEN ENDANGERED ECOLOGICAL COMMUNITIES (TSC ACT, 1995) AND VEGETATION COMMUNITIES DESCRIBED IN THIS REPORT

Endangered Ecological Community Name	Corresponding Vegetation Community (this report)
Southern Highlands Shale Woodland	8. Highlands Shale Tall Open Forest (Form A,B,C)
White Box Yellow Box Blakely's Red Gum Woodland	31. Devonian Red Gum-Ironbark Woodland
Shale/Sandstone Transition Forest	19. Transitional Shale Dry Ironbark Forest 20. Cumberland Plain Shale Sandstone Transition Forest (High Sandstone Influence)

4.2.2 Threatened Species and Rare or Threatened Plants

Records of threatened species were compiled from the Atlas of NSW Wildlife, NSW Herbarium, and all systematic survey site data. This information indicates that a total of 22 threatened species have been recorded within the study area. This includes 9 species listed on the Schedules of the Threatened Species Conservation Act (1995) and 13 additional species listed by Briggs and Leigh (1995) as Rare or Threatened Australian Plants (RoTAPs). Map 15 shows the distribution of threatened species RoTAPS within the study area.

Table 16 lists the threatened species recorded within the study area. It includes species that are listed under the TSC Act (1995) and/or RoTAP (Briggs and Leigh, 1995). Codes describing their status are as follows:

- V-Vulnerable, E1-Endangered (TSC);
- 2 -Distribution of less than 100 kilometres, 3-Distribution greater than 100km (RoTAP);
- E-Endangered, K-Poorly Known, R-Rare, V-Vulnerable (RoTAP);
- C-Within Conservation Reserve, a-Adequately Reserved (>1000 plants), I-Inadequately Reserved (<1000 plants), "-"-Reserve level unknown, t-Total Population within Conservation Reserve (RoTAP).

There are a number of species that have been listed within the Nattai Reserves Plan of Management (NPWS 2001b) for which there are no documented records. These are *Eucalyptus macarthurii, E. luehmanniana* and *Rupicola sprengelioides*. This study has been unable to confirm the presence of these species.

TABLE 16 THREATENED SPECIES AND RARE OR THREATENED AUSTRALIAN PLANTS (ROTAPS)

Scientific Name	TSC Act	RoTAP	Known Species Habitat	Total Known Distribution	Distribution within study area
Acacia bynoeana	E1	3VC-	Heath/Dry Sclerophyll on Sandy Soils	Dora Creek to Berrima	Hill Top Area
Acacia jonesii		3RCa	Dry Sclerophyll/Woodland on Sandstone	Bargo-Nowra-Goulburn	Martins Creek
Bossiaea oligosperma	V	2V	Stony Slopes/Ridges on Sandstone or River Banks	Lake Burragorang and Nerriga	Lake Burragorang, Martins Flat
Epacris coriacea		3RC-	Cliffs and Crevices in Sandstone	Woronora to Rylstone	Wanganderry Tableland
Epacris muelleri		3RC-	Damp Rock Faces on Sandstone	Blue Mountains to Wollemi	Wanganderry Tableland
Eucalyptus apiculata		3RC-	Mallee Shrubland on Sandstone	Linden to Berrima	Wanganderry Tableland, Wattle Ridge
Eucalyptus benthamii	V	2Vci	Wet Forests on Alluvial Valleys	Lower Nepean River/ Kedumba Valleys	Nattai River (range extension)
Eucalyptus burgessiana		2RCa	Mallee Shrubland on Sandstone	Lower Blue Mountains	Long Nose Ridge Road
Eucalyptus cunninghamii		2RCat	Mallee Shrubland on Sandstone	Central Blue Mountains	Wanganderry Tableland
Eucalyptus hypostomatica		3RC-	Grassy/Sclerophyll Forest on Slopes	Pokolbin to Kangaroo Valley	Below Clifflines, east and west Nattai Walls
Gonocarpus longifolius		3RC-	Shrubs on Sandstone	Armidale to Blue Mountains	Bargo River, Long Nose Ridge Road
Grevillea longifolia		2RC-	Moist Sclerophyll near creeks on Sandstone	Southern Sydney Basin	Below Ahearns Lookout
Hakea constablei		2RCa	Rocky Outcrops in Dry Sclerophyll	Bell to Mt. Wilson, Nattai NP	Wanganderry Tableland
Kunzea cambagei	V	2Vca	Heath	Mt. Werong to Berrima	Wanganderry Tableland
Lissanthe sapida		3RCa	Open Woodland/Dry Sclerophyll on Rocky Sandstone Ridges/Hillsides	Bargo to Blackheath	Kitty's Creek, Bargo River, Hilltop
Monotoca ledifolia		3RC-	Dry Sclerophyll on Sandstone	Woronora to Blue Mountains	Wanganderry Tableland, Hilltop
Myoporum floribundum		3RCi	Sclerophyll Forest	Jenolan Caves to Nepean River	Below Wanganderry Lookout, Long Nose Ridge Road
Persoonia acerosa	V	2VC-	Heath/Dry Sclerophyll on Sandstone	Blue Mtns to Hilltop	Hilltop

Scientific Name	TSC Act	RoTAP	Known Species Habitat	Total Known Distribution	Distribution within study area
Persoonia glaucescens	E1	2V	Woodland/Dry Sclerophyll on Sandstone	Picton to Berrima	Hilltop, Point Hill, Little River Trail (Bargo SCA)
Persoonia hirsuta (subsp. evoluta)	E1	3KCi	Woodland/Dry Sclerophyll on Sandstone	Putty to Hilltop	Hilltop, Bargo River, Buxton
Prostanthera cineolifera	V	2K	Sclerophyll Forest	Poorly Known	Below Wanganderry Walls

4.3 REGIONALLY SIGNIFICANT VEGETATION COMMUNITIES

This section reviews the distribution, extent and rates of clearing for each of the vegetation communities that occur in the Nattai and Bargo reserves. This review has been carried out using available regional data based on NPWS (2000a) and DEC (in prep.).

Not all vegetation communities share identical spatial configurations, distributions and threats. Some occur in small and patchy distributions throughout their known range. Others are more extensively distributed but have suffered extensively from land clearing because they occur on good soils, on flat to undulating terrain.

The list of regionally significant vegetation is presented in Table 17. The distribution of these communities is presented in Map 14. This table does not attempt to apply quantitative criteria to identify regional significance rather it is a subjective review of the floristic relationships between vegetation communities present in the study area compared to the descriptions and distribution of comparable vegetation classifications described in existing literature.

TABLE 17: REGIONALLY SIGNIFICANT VEGETATION COMMUNITIES

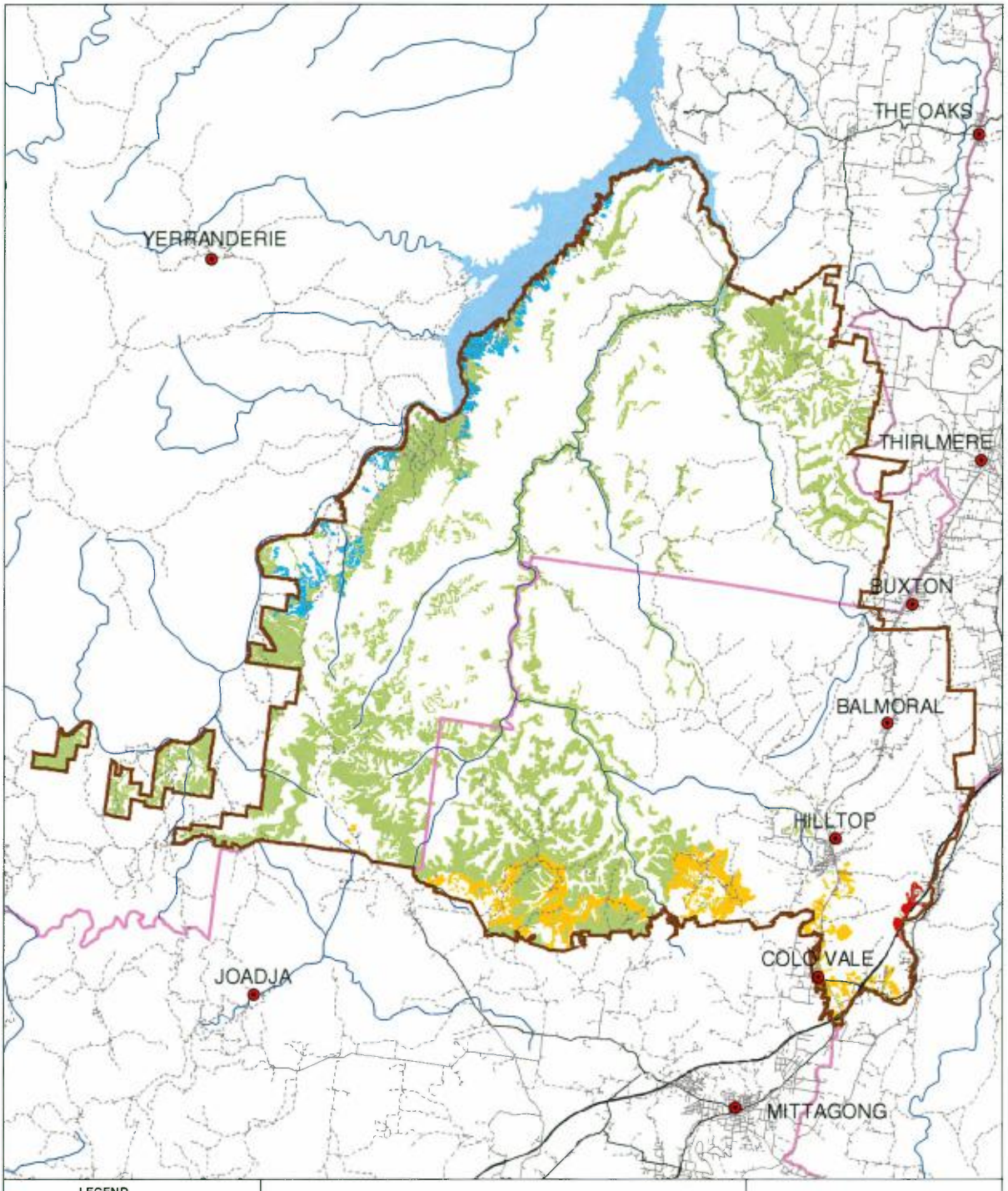
Regionally Significant Vegetation Community	Reason
Burragorang River Flat Forest	Forms part of a broad vegetation complex that once occurred on sandy alluviums of the Hawkesbury Nepean River systems. Extensively cleared in Western Sydney and large areas now drowned by Lake Burragorang. Includes the tree species *Eucalyptus benthamii* listed as vulnerable on the NSW TSC Act, (1995).
Couridjah Sheltered Sandstone Forest	An interesting tall forest found on residual shale caps and deeper soils of the sheltered slopes of the Mittagong Formation. While aligned to the shale sandstone transition forests found further east, sandstone influences remain strong in the composition of the understorey where *Banksia spinulosa* var *spinulosa* and *Persoonia linearis* remain common. Similar to forests that include prominent *Syncarpia glomulifera* subsp. *glomulifera* as a small tree layer. These are found on the ridges and slopes of the Burragorang Plateau to the north and the Woodford Range in the lower Blue Mountains.
Devonian Red Gum-Grey Box Woodland	Extensively cleared and modified in the Wollondilly Valley. Much of the remaining vegetation is disturbed and fragmented. Also extensive on the lower slopes of the Shoalhaven Gorge (DEC, in prep.).
Devonian Red Gum-Yellow Box Woodland	Extensively cleared and modified in the Wollondilly Valley. Much of the remaining vegetation is disturbed and fragmented. The vegetation community however is extensive on the lower slopes in the Shoalhaven Gorge (DEC, in prep.)
Douglas Scarp Woodland	Unusual community that marks the transition into the Shoalhaven Group geology (NPWS, 2003b; Fisher et al., 1995) or Devonian material (*pers. obs.).* Small total area and not known from outside of the study area or the Warragamba Special Area. Supports species more prominent in the inland slopes and valleys such as *Callitris endlicheri, Hibiscus sturtii, Eucalyptus albens* and *Acacia binervia.*
Dry Alluvial Paperbark Woodland	Restricted to gentle slopes on Permian soils. Unlikely to be extensively cleared given narrow habitat, although it is not described from outside the study area or the Warragamba Special Area. Closely related to Burragorang River Flat Forest.

Regionally Significant Vegetation Community	Reason
Escarpment Tall Box Forest	Restricted to sheltered colluvium underneath sandstone clifflines and escarpments. Floristically closely related to other sheltered escarpment forests however the dominant tree *Eucalyptus hypostomatica* is an unusual tree in the region and is known only from the Lower Hunter and Shoalhaven Valleys in similar topographic positions.
Highlands Basalt *Acacia* Scrub	Any vegetation occurring on basalt soils in the Southern Highlands has largely been removed or heavily modified. Moist scrubs such as these are aligned to those found on the Robertson Plateau, which supports Robertson Rainforest, an Endangered Ecological Community (EEC) listed on the NSW TSC Act (1995). While this community is less diverse than those described within the determination for this EEC, it is highly likely that this community suffers from similar threats. The Mt Wanganderry area provides the only sites of this assemblage in the study area, with patches located outside of the reserves.
Highlands *Melaleuca* Thicket	Small dense thickets that occur on drainage lines and seepage areas on the shale and basalt soils of the Southern Highlands. Not described in regional mapping (NPWS, 2000a; DEC, in prep., Fischer et al., 1995). All patches within the study area located outside of reserves.
Highlands Sandstone Dry Shrub Forest	Large areas persist across sandstones of the Southern Highlands although few areas are within NPWS estate (NPWS, 2000a).
Highlands Swamp Gum-Tea-tree Heath Woodland	Once likely to be extensively distributed across drainage lines, bogs and soaks of the Southern Highlands and Tablelands. Poorly represented in the current reserve system. Habitat overlaps with preferred agricultural lands. Many areas modified and drained. Areas of this community that support Eucalyptus ovata are found outside of the reserves near Hilltop
Highlands Transitional Shale Woodland	Poorly described community outside of the study area, although likely to suffer from similar rates of clearing to similar transition forests found on the fringe of the Cumberland Plain.
Mount Jellore Woodland	Low open woodland growing on exposed locations and rocky scree that supports Eucalyptus blaxlandii, Allocasuarina verticillata and A. littoralis. Unique and not described outside the study area.
Permian Footslopes Grassy Red Gum-Box Forest	Community restricted to the Burragorang and Nattai Valleys, being located on fine-grained sediments associated with the Shoalhaven Group. Mostly protected within the Warragamba Special Area although areas drowned by Lake Burragorang. Not been mapped or described by regional scale mapping (NPWS (2000a), DEC (in prep.)).
Rock Plate Heath-Mallee	A widespread though patchily distributed heath and mallee community found across rocky outcrops of the lower Blue Mountains. Within the study area *Eucalyptus apiculata* a species listed as a RoTAP (Briggs and Leigh, 1995) is found in this community.
Tablelands River Oak Forest	Widespread community that has been cleared extensively in the past (NPWS, 2000a) and remaining areas often heavily modified by grazing activities and weed infestations. Most remaining areas occur on private lands.
Upland Swamp: Cyperoid Heath	Common though patchy distribution across the Woronora Plateau to the east, Blue Mountains to the north and Morton National Park to the south. Only a small isolated patch was found in the study area, near Hilltop.

4.4 A Guide To Field Identification of Vegetation Communities

Each vegetation community profile includes a description of key identifying features and a list of diagnostic species. The diagnostic species list is presented to guide users in the process of differentiating communities from one another or confirming the type of vegetation at a site of interest. The list of diagnostic species has been drawn from survey site data collected in this project as well as a number of previously existing survey and mapping programs (Sections 2.2 and 3.1). They do not represent the total list present at any given location or within any given community. The first thing to note is the number of sites that have been used to describe the community. Vegetation communities that are described using fewer sites are likely to be less accurate in the diagnostic species list than those with a high number of replicates.

The Fidelity Class column lists up to three types of species: positive, negative and constant. A fourth type called 'uninformative' is not presented in this list but may be present in the Floristic Summary list in



LEGEND

- Towns
- Main Roads
- Minor Roads
- Other Roads & Trails
- Main Rivers & Creeks
- Waterbodies
- SCA Special Areas
- Study Area Boundary
- Vegetation of Regional Significance

Endangered Ecological Communities

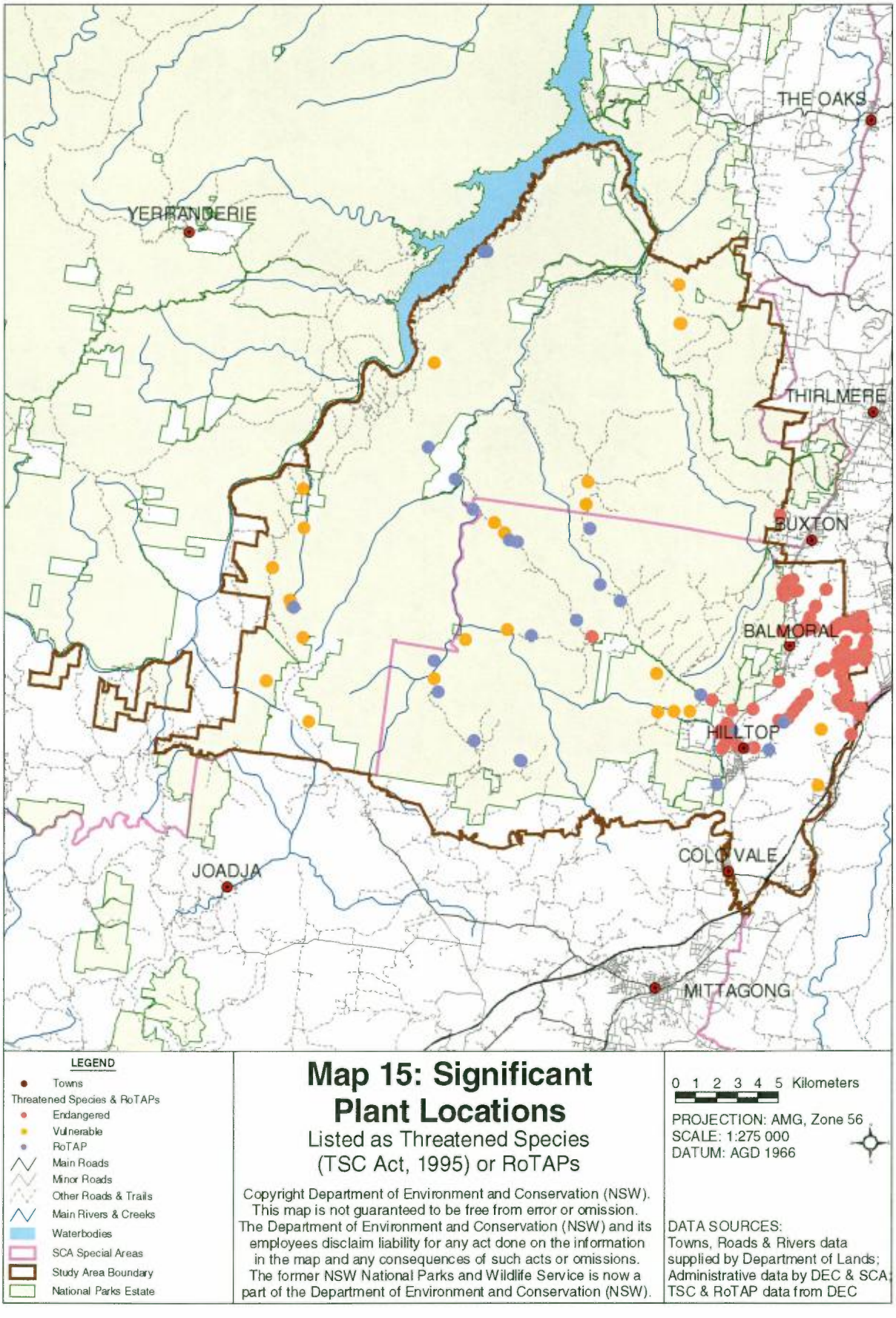
- Shale/Sandstone Transition Forest
- Southern Highlands Shale Woodland
- White Box Yellow Box Blakely's Red Gum Woodland

Map 14: Endangered Ecological Communities & Vegetation of Regional Significance

0 1 2 3 4 5 Kilometers

PROJECTION: AMG, Zone 56
SCALE: 1:275 000
DATUM: AGD 1966

DATA SOURCES:
Towns, Roads & Rivers data supplied by Department of Lands;
Administrative data by DEC & SCA;
Vegetation data developed by DEC


THE OAKS
YERRANDERIE
THIRLMERE
BUXTON
BALMORAL
HILLTOP
COLO VALE
JOADJA
MITTAGONG
LEGEND
Towns
Threatened Species & RoTAPs
Endangered
Vulnerable
RoTAP
Main Roads
Minor Roads
Other Roads & Trails
Main Rivers & Creeks
Waterbodies
SCA Special Areas
Study Area Boundary
National Parks Estate
Map 15: Significant Plant Locations
Listed as Threatened Species (TSC Act, 1995) or RoTAPs
Copyright Department of Environment and Conservation (NSW). This map is not guaranteed to be free from error or omission. The Department of Environment and Conservation (NSW) and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions. The former NSW National Parks and Wildlife Service is now a part of the Department of Environment and Conservation (NSW).
0 1 2 3 4 5 Kilometers
PROJECTION: AMG, Zone 56
SCALE: 1:275 000
DATUM: AGD 1966
DATA SOURCES:
Towns, Roads & Rivers data supplied by Department of Lands;
Administrative data by DEC & SCA;
TSC & RoTAP data from DEC

the profile if it is a conspicuous species or a canopy species. Table 18 provides an example from which to discuss the interpretation of the diagnostic species list.

TABLE 18: EXAMPLE DIAGNOSTIC SPECIES LIST

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Cassine australis var. australis	4	1.00	3	0.35	positive
Cayratia clematidea	2	0.55	1	0.24	positive
Croton verreauxii	3	0.82	3	0.23	positive
Diospyros australis	4	0.91	1	0.40	positive
Diospyros pentamera	1	0.09	0	0.00	positive
Doodia aspera	3	0.55	3	0.46	positive
Ficus superba var. henneana	5	0.09	0	0.00	positive
Pittosporum multiflorum	3	0.91	2	0.34	positive
Planchonella australis	4	0.73	4	0.10	positive
Streblus brunonianus	5	1.00	1	0.22	positive
Eustrephus latifolius	1	0.91	2	0.65	negative
Livistona australis	0	0.00	2	0.52	negative
Pittosporum undulatum	1	0.82	3	0.62	negative
Geitonoplesium cymosum	2	0.91	2	0.61	constant
Pandorea pandorana subsp. pandorana	2	1.00	2	0.61	constant

Group Score and Frequency: These refer to median cover abundance and the frequency at which species have been recorded at sample sites that have been used to define the community. For example in the table above it can be seen that *Croton verreauxii* occurred in 82 percent of sites and was recorded with a median cover abundance score of 5-20 percent. Cover abundance scores are provided in Section 2.4.

Non Group Score and Frequency: These provide a comparative cover abundance and frequency of occurrence for this species in relation to all other sites (communities). In this example, *Croton verreauxii* has occurred in 23 percent of all other sites at a cover abundance of 5-20 per cent.

Positive species are those that are recorded more frequently and at higher abundance within the given vegetation community compared to all other communities. They may also be species that are unique to that community, that is, they were not found amongst sites that defined any other community. In this example it is seen that *Cassine australis* var. *australis* occurs at 100 percent of the sites within this community at a mean cover abundance of 25-50 percent, while it occurred in only 35 percent of all other sites. It is also noted that *Ficus superba* var. *henneana* is unique to this community, and has not been recorded in any other sites (Non Group Frequency equals 0).

Negative species are the inverse of the positive species in that they are recorded less frequently and at lower abundance in the given community relative to all others. It may also be that the species has never been recorded within the sites that were used to describe the given community. In this example it is noted that *Livistona australis* has not been recorded at all in this community (Group Frequency score of 0), and that it occurs in 52 percent of sites outside this community. *Eustrephus latifolius* has also been recorded as a negative diagnostic species even though it has occurred in 91 percent of the sites within the community, though at lower cover abundance than at other sites. The Non Group scores indicate that generally this species occurs with a higher abundance elsewhere than recorded within this group so it is not an indicator species for this community.

Constant species are those that occur at relatively consistent frequency and abundance across all communities. As such they are not useful in differentiating vegetation communities but can however be useful in describing them. In this example it can be seen that *Pandorea pandorana* subsp. *pandorana* has occurred in 100 percent of sites within the community, at a mean cover abundance of 2. This does not help to differentiate this community as the species was recorded in 61 percent of all other sites also with a mean cover abundance of 2.

Diagnostic species are a guide only. They can be misleading in that species that appear as unique or absent from a community may result from insufficient sampling. However, with communities that have been sampled by a larger number of replicates, diagnostic species can be used to identify particular communities from one another, only if identical field survey methods are employed. Reliability of identification will increase with the greater number of positive diagnostic species identified at a site. Confidence can also be improved with an understanding of the habitat and structural characteristics of the vegetation community of interest.

4.5 Map Accuracy

4.5.1 Sources of Error

This report is accompanied by a map showing the predicted distribution of vegetation communities within the study area. This map should be interpreted with regard to the limitations inherent in the methods used in its compilation. The delineation of vegetation community boundaries has relied on the allocation of API feature codes to map units, as guided by existing literature and analyses of floristic site data. It is inevitable that errors in spatial and textual information are present in the mapping coverage and users should be aware of the limitations.

The spatial or positional accuracy arises mostly from the conversion of API linework into a GIS layer. This conversion is relatively simple on flat or undulating terrain. However distortion in steep and rugged landscapes can be significant. This has generated spatial discrepancies of up to 40 metres between aerial photo layer and 1:25000 topographic maps.

Errors may also arise during API, from misinterpretations of canopy patterns or interpretation difficulty. The latter can be assessed using the reliability code present in the digital coverage (Section 3.2, Map 11). Coding error may also arise during the data transfer process. However a number of precautionary checks are carried out to help minimise this occurrence. The reliability of the API is one method to review map accuracy. Another is to use the distribution and sampling intensity of survey site data presented in Map 10.

The derived vegetation community map relied on spatial data layers that are compiled at smaller scales. The Geology and Soil Landscape layers are available at 1:100000 and 1:250000 scale and may themselves contain spatial and attribution errors. This project has sought to overcome these problems by placing greater emphasis on larger scale API work than on data derived from these smaller scaled data sets.

Other studies (Keith and Bedward (1999); NPWS (2000c) have attempted to quantify the accuracy of derived vegetation mapping for broad regions. Using the same review process both studies achieved similar levels of accuracy ranging from 70 percent accuracy within 100 metres of a known point to 80 percent within 250 metres. No attempt has been made to quantify map accuracy for this project.

Finally, vegetation community boundaries rarely change abruptly. The transition between one community and another tends to be gradual and as such a line used to separate the two can be misleading. However, despite these shortcomings qualitative field review of the mapped outputs indicate that the delineation of vegetation community boundaries is accurate at scales of 1:25000 or larger.

4.5.2 Common Misapplications

The most common misapplication is the use of mapping products at a scale for which it has not been designed. GIS systems make it easy for users to zoom into a small area and simply overlay the vegetation map on the area of interest. Mapping linework and attribution does not hold the same accuracy at a focused area at say 1:4000 scale as it does at 1:25000 scale.

The attribution of the mapping work varies in accuracy across the study area. This arises from access constraints, sampling intensity and so on. Users should at least review the API confidence score and proximity of field sampling sites to judge accuracy of vegetation mapping at any given point.

4.6 USING THE MAP AND REPORT

4.6.1 Fire Management

The information during this project now provides an opportunity for field data and vegetation mapping to be applied to the development of fire management plans for the study area.

- Vegetation community profiles provide an estimate of vegetation structure (height), cover and vegetation strata. Importantly, the characteristics of the vegetation associated with each community are readily accessible. Broad fuel hazard classes associated with each vegetation type can be assessed using the floristic information contained within the profiles to complete a spatial coverage for the reserves. These broad hazard classes may then be refined using site based assessments such as those promoted by McCarthy *et al.* (1999) using bark hazard, elevated fuel hazard and surface fine fuel hazard.
- Planning for hazard reduction burns can utilise the array of information captured from API. Useful features include vegetation community boundaries, presence of rock outcrops, proportion of rock within each site, understorey characteristics and tree types present. Prominent landscape features such as rainforests and heaths are easily recognised.
- Each field sample site supports at least one digital photograph. These photographs can inform users of the nature of the vegetation in the area of interest.

4.6.2 Conservation Assessment

Information provided in this report allows land managers to understand the conservation significance of different types of vegetation present within the study area. Mapping now delineates the extent of Endangered Ecological Communities at a scale of 1:25000, the presence of endangered plant species found within each vegetation community and regional reservation status. These are relevant for the preparation of Reviews of Environmental Factors (REFs).

4.6.3 Vegetation Disturbance Assessment

Information is now available that maps indicators of disturbance to native vegetation in the study area. Data has been recorded to indicate the intensity of these disturbances to native vegetation cover. This data can be used to guide land use management practices, by highlighting areas that may require further investigation. This data may be queried to understand dominant disturbance types such as weed infestations, regrowth forests, transmission lines, roads and trails etc. Remnant patches of vegetation have been mapped to areas greater than one hectare in size.

Disturbance indicators, as mapped, provide one measure of where vegetation condition may be effected. Conclusions about the condition of vegetation require close assessment of the patch of vegetation in question. Developing a detailed inventory of native species present and a review of the structural integrity of the vegetation is best achieved through a site inspection.

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APPENDIX A: VEGETATION COMMUNITY PROFILES

USING VEGETATION COMMUNITY PROFILES

The following provides a summary explanation of the vegetation community profiles presented in this report.

This number lets you know the number of field samples that have been used to classify the community

This number provides the mean number of native species recorded from each of the sites used to classify the community

Number of Sites: 6 No. taxa/plot: 48.5

❑ *DESCRIPTION*

This section summarises the abundant and frequently occurring plant species found in the community based on sample site data. The description provides an overview of the environmental characteristics of the community, in particular soil or geology type, elevation gradients and/or climatic features and spatial distribution within the special area. It also informs the reader of the community's conservation status under the NSW Threatened Species Conservation Act (1995) and known occurrence outside of the study area.

A photo from one of the sample sites is presented here as a means of illustrating the structural characteristics of the community

❑ *FLORISTIC SUMMARY*

Trees: This section provides summary scores for mean upper heights (in metres) for the upper strata of the vegetation community. It also provides an estimation of the total projected canopy cover for this stratum. A standard deviation score is provided for this cover estimate. All values are generated from field site data.

The dominant tree species are listed here. *Eucalyptus elata, Eucalyptus muelleriana, Eucalyptus radiata* subsp. *radiata, Eucalyptus cypellocarpa, Eucalyptus fastigata, Eucalyptus punctata*

Minor associates: Other tree species that have been recorded in this community are listed here.

Shrubs: Upper Height 3m Projected Canopy Cover 15%

Example Species: *Hibbertia aspera* subsp. *aspera, Leucopogon juniperinus, Persoonia linearis, Pittosporum revolutum, Zieria smithii, Dodonaea triquetra*

Ground covers: Upper Height 0.5m, Projected Canopy Cover 65%

Example Species: *Microlaena stipoides, Tylophora barbata, Lagenifera stipitata, Stypandra glauca, Opercularia diphylla, Viola hederacea, Lomandra longifolia, Echinopogon caespitosus* var. *caespitosus*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- This section describes prominent (and conspicuous) plant species found in the community using common names where available. It also describes the important environmental factors that are associated with this vegetation community.

❑ *EXAMPLE LOCATIONS*

Occurrences of the community are presented here especially for recognisable or accessible localities.

❑ *CONDITION ASSESSMENT*

This section provides figures for the disturbance intensity classes observed across the distribution of the communities within the study area.

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	835	78.
B Medium	221	20
C High	7	1
Total	1063	100

❑ *THREATENED PLANT SPECIES*

This section lists plant species that are on the NSW Threatened Species Conservation Act (1995) or are considered a Rare or Threatened Australian Plant (RoTAP) in Briggs and Leigh (1995).

❑ *DIAGNOSTIC SPECIES*

Diagnostic Species provide one method of quantitatively reviewing the performance of plant species within a given community as compared to all other communities found in the study area. Site data has been used to understand the median cover abundance (using a 1-7 cover scale) and frequency of occurrence of all species within the community. Species that occur frequently and at higher cover scores have been highlighted as diagnostic species to help with the field identification of the community.

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Adiantum aethiopicum	5	0.67	2	0.22	positive
Allocasuarina torulosa	1	0.10	3	0.67	negative
Austrostipa pubescens	3	0.60	3	0.54	constant
Brunoniella pumilio	1	0.20	3	0.33	uninformative

The fidelity class of the species has been classified as positive if it is unique to this community or it occurs more frequently and with higher median cover than all other communities found in the study area. It is negative if it is less abundant and less frequent in this community compared to other communities. It is constant if the species occurs as frequently and abundantly in all communities. It is uninformative if it is neither frequently recorded or abundant in sites.

This number presents the median cover score recorded for the species within sites used to classify the community. In this case a median score of 1 =<5% cover

This provides the frequency of occurrence within the sites used to classify the community. In this case the species has been found at 20% of sites

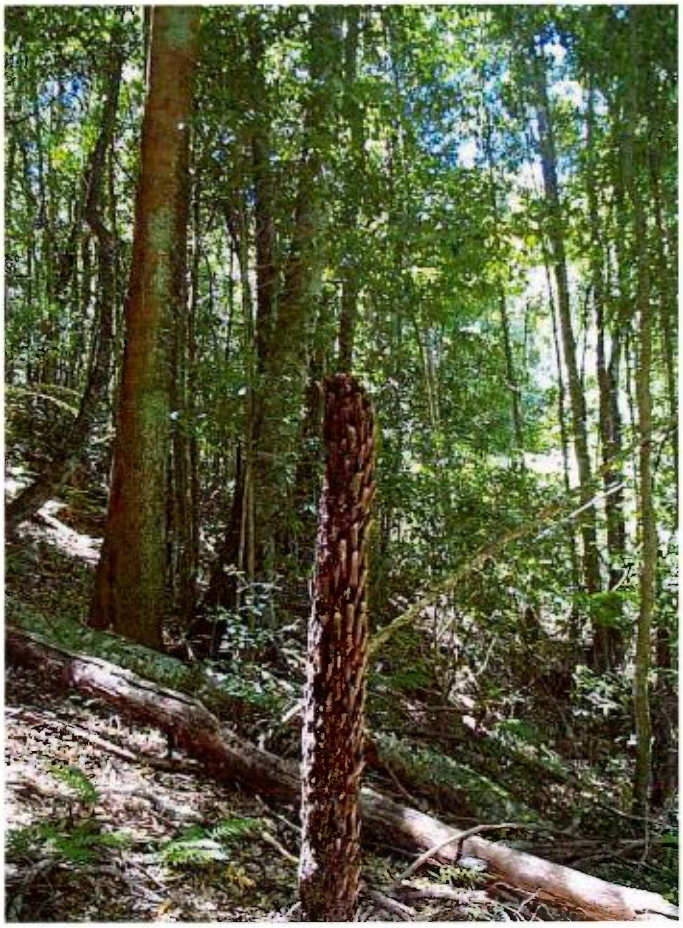
This number provides the median cover score for this species across all other communities in the study area. In this case the cover abundance is much lower in other communities (3= 5-25% cover)

This number tells you how frequently the species has been recorded in other groups. In this case other communities feature this species in 33% of sites

MU1 SANDSTONE WARM TEMPERATE RAINFOREST

Number of Sites: 13 No. taxa/plot: 28.2

❑ *DESCRIPTION*



Sandstone Warm Temperate Rainforest occurs on protected lower slopes and gullies within deeply dissected sandstone valleys, gorges and sheltered escarpment slopes. *Acmena smithii, Ceratopetalum apetalum* and *Doryphora sassafras* form a dense canopy. *Backhousia myrtifolia* may also be included in the canopy, particularly on the edges where fire has penetrated the rainforest. The understorey is relatively open due to shade cast by the canopy. However, scattered small trees such as *Callicoma serratifolia, Acacia elata* and *Notelaea longifolia* are often found. The lowest stratum is fern dominated and is comprised of *Blechnum cartilagineum, Asplenium flabellifolium, Pellaea nana* and *Adiantum hispidulum.* Creeklines are marked by the prevalence of ferns such as *Blechnum nudum, Todea barbara* and *Cyathea australis.* Vines such as *Morinda jasminoides, Cissus hypoglauca* and *Smilax australis* are also a feature of this assemblage with the latter becoming very dominant in areas affected by disturbance. In some locations, emergent Eucalypts such as *Eucalyptus deanei, E. elata* and *E. cypellocarpa* tower above the rainforest canopy.

Within the study area Sandstone Warm Temperate Rainforest is found in the deeper gorges and canyons of the Wild Goat Plateau and southern Wanganderry Tableland. It has a patchy distribution and is often only found as a narrow ribbon of vegetation at the bottom of the deepest gorges. Outside the study area, this community is widespread across the broader Blue Mountains region. It extends north to the Kings Tableland and Lower Blue Mountains area as well as into Wollemi National Park where similar climatic, geological and topographic characteristics prevail. This community grades into Montane Cool-Warm Temperate Rainforest (NPWS, 2003b) at higher elevations (usually over 800 metres ASL) such as along the western edge of the Warragamba Special Area. This community was mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Emergents: Mean Upper Height 29m. Mean Projected Canopy Cover 13% SD 12.1

Eucalyptus cypellocarpa, Eucalyptus deanei, Syncarpia glomulifera subsp. *glomulifera, Eucalyptus elata, Eucalyptus oreades*

Trees: Mean Upper Height 24m. Mean Projected Canopy Cover 67% SD 20.7

Ceratopetalum apetalum, Acmena smithii, Doryphora sassafras, Backhousia myrtifolia, Acacia elata

Low Trees/Ferns: Mean Upper Height 9m. Mean Projected Canopy Cover 35% SD 28.1

Cyathea australis, Todea barbara, Callicoma serratifolia, Notelaea longifolia, Pittosporum revolutum

Ground Covers: Mean Upper Height 0.8m. Mean Projected Canopy Cover 18% SD 6.8

Blechnum cartilagineum, Asplenium flabellifolium, Cissus hypoglauca, Pellaea nana, Adiantum hispidulum, Blechnum nudum, Calochlaena dubia, Pseuderanthemum variabile

Vines & Climbers: no structural data available

Morinda jasminoides, Smilax australis, Smilax glyciphylla, Cissus hypoglauca, Clematis aristata, Eustrephus latifolius

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Dense closed warm temperate rainforest canopy dominated by Lilly Pilly (*Acmena smithii*), Coachwood (*Ceratopetalum apetalum*), Sassafras (*Doryphora sassafras*) and Grey Myrtle (*Backhousia myrtifolia*).
- Found in deeply incised sandstone gorges, valleys and protected escarpment slopes.
- Diversity and abundance of fern species such as Gristle Fern (*Blechnum cartilagineum*), Rough Treefern (*Cyathea australis*) and Necklace Fern (*Asplenium flabellifolium*).
- Occasional emergent canopy species such as Mountain Grey Gum (*Eucalyptus cypellocarpa*), Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*) and Mountain Blue Gum (*E. deanei*).

❑ *EXAMPLE LOCATIONS*

Wanganderry Creek; Allum River Canyon; Martins Creek Canyon; Rocky Waterholes Creek

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	394	96
B Medium	18	4
C High	0	0
Total	**412**	**100**

❑ *THREATENED PLANT SPECIES*

Eucalyptus hypostomatica (3RC-)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acmena smithii	4	0.92	1	0.02	positive
Asplenium flabellifolium	2	0.69	2	0.20	positive
Backhousia myrtifolia	4	0.62	3	0.10	positive
Blechnum cartilagineum	4	1.00	3	0.11	positive
Callicoma serratifolia	2	0.54	3	0.03	positive
Ceratopetalum apetalum	5	1.00	4	0.02	positive
Cissus hypoglauca	3	0.62	2	0.10	positive
Cyathea australis	2	0.77	1	0.03	positive
Doryphora sassafras	4	0.85	4	0.01	positive
Hymenophyllum cupressiforme	2	0.62	2	0.02	positive
Morinda jasminoides	3	0.85	2	0.05	positive
Pellaea nana	2	0.62	2	0.04	positive
Smilax australis	2	0.54	2	0.06	positive
Todea barbara	3	0.69	2	0.01	positive
Lomandra longifolia	2	0.23	2	0.58	negative

MU2 GREY MYRTLE DRY RAINFOREST

Number of Sites: 28 No. taxa/plot: 46.5

❑ *DESCRIPTION*

Grey Myrtle Dry Rainforest occurs in the rainshadow areas of the Wollondilly and Nattai River Valleys. It is most prominent in gullies, small drainage areas and steep escarpment slopes of the Permian Group sediments. It is also found on Bindook Porphyries, in creeklines, protected rock outcrops and scree slopes. This community is a dry rainforest assemblage occurring in areas with mean annual rainfall generally less than 1000 millimetres.

Backhousia myrtifolia forms a dense canopy varying from stunted thickets to small trees in more protected locations. *Ficus rubiginosa* or *Rapanea howittiana* may also share the canopy. Emergent Eucalypts may also feature above the rainforest canopy including *Eucalyptus tereticornis, E. punctata* and *E hypostomatica. Melaleuca styphelioides* is occasionally found along drainage lines. The shrub layer is generally very sparse and may include scattered *Breynia oblongifolia* or *Notelaea longifolia* forma *longifolia.* An array of ferns and vines provide a sparse cover across a dry to damp soil. *Asplenium flabellifolium, Adiantum aethiopicum, Pellaea* spp., *Pandorea pandorana* subsp. *pandorana* and *Aphanopetalum resinosum* are typical. Also found are herbs including *Plectranthus parvifolius, Dichondra repens* and the small epiphyte *Pyrrosia rupestris.* At particularly dry sites, vines and ferns are virtually absent from the community leaving an open exposed dry soil or rock cover. Conversely, better developed examples reflect a more diverse rainforest community with species such as *Dendrocnide excelsa* being found.

Grey Myrtle Dry Rainforest is widespread throughout the Sydney Basin Bioregion in dry climates with infertile soils. As much of the sandstone reserve system falls within these environments, this community is well conserved throughout the Blue Mountains, Wollemi and Yengo reserves. This community was mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Emergents: Mean Upper Height 21m. Mean Projected Canopy Cover 6% SD 5.3

Eucalyptus tereticornis, Angophora floribunda, Eucalyptus punctata, Eucalyptus crebra, Eucalyptus albens, Eucalyptus deanei, Eucalyptus elata, Eucalyptus eugenioides, Eucalyptus fibrosa, Eucalyptus hypostomatica, Eucalyptus melliodora

Trees: Mean Upper Height 15m. Mean Projected Canopy Cover 49% SD 26.3

Backhousia myrtifolia, Ficus rubiginosa, Rapanea howittiana, Pittosporum undulatum, Melaleuca styphelioides, Dendrocnide excelsa

Shrubs: Mean Upper Height 7m. Mean Projected Canopy Cover 29% SD 25.6

Breynia oblongifolia, Notelaea longifolia forma *longifolia*

Ground Covers: Mean Upper Height 0.6m. Mean Projected Canopy Cover 24% SD 19.4

Pandorea pandorana subsp. *pandorana, Geitonoplesium cymosum, Asplenium flabellifolium, Adiantum aethiopicum, Pellaea falcata, Pellaea nana, Plectranthus parvifolius, Oplismenus imbecillis, Dichondra repens, Microlaena stipoides, Pyrrosia rupestris, Aphanopetalum resinosum, Desmodium varians, Eustrephus latifolius, Doodia aspera, Cissus antarctica*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Dense canopy cover of Grey Myrtle (*Backhousia myrtifolia*) in sheltered locations.
- A mixture of ferns and vines including Wonga Wonga Vine (*Pandorea pandorana* subsp. *pandorana*), Scrambling Lily (*Geitonoplesium cymosum*), Necklace Fern (*Asplenium flabellifolium*), Sickle Fern (*Pellaea falcata*) and Common Maidenhair (*Adiantum aethiopicum*).

❑ *EXAMPLE LOCATIONS*

Basket Creek; Little and Nattai River Valleys; Colemans Creek; Allum River Canyon; beneath Wanganderry Lookout

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	140	88
B Medium	15	9
C High	5	3
Total	**159**	**100**

❑ *THREATENED PLANT SPECIES*

Eucalyptus hypostomatica (3RC-)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Adiantum aethiopicum	3	0.75	2	0.21	positive
Aphanopetalum resinosum	2	0.61	2	0.03	positive
Asplenium flabellifolium	2	0.82	2	0.20	positive
Backhousia myrtifolia	6	0.86	2	0.09	positive
Cayratia clematidea	2	0.50	2	0.07	positive
Clematis aristata	2	0.54	2	0.34	positive
Desmodium varians	2	0.61	2	0.27	positive
Dichondra repens	2	0.64	3	0.36	positive
Eclipta platyglossa	1	0.04	0	0.00	positive
Eustrephus latifolius	2	0.61	1	0.14	positive
Geitonoplesium cymosum	2	0.86	2	0.28	positive
Microlaena stipoides	2	0.64	2	0.36	positive
Myoporum acuminatum	1	0.04	0	0.00	positive
Oplismenus imbecillis	3	0.64	2	0.16	positive
Pandorea pandorana subsp. pandorana	2	0.96	2	0.24	positive
Pellaea falcata	2	0.71	2	0.16	positive
Pellaea nana	3	0.68	1	0.02	positive
Plectranthus parviflorus	2	0.68	2	0.16	positive
Pterostylis species B	3	0.04	0	0.00	positive
Pyrrosia rupestris	2	0.64	2	0.04	positive
Lomandra longifolia	1	0.29	2	0.56	negative

MU3 SANDSTONE RIPARIAN SCRUB

Number of Sites: 4 No. taxa/plot: 37

❑ *DESCRIPTION*

Sandstone Riparian Scrub is a low mesic scrub less than five metres tall that occurs along rocky creeklines of often deeply incised sandstone gullies and gorges. It is restricted to several rocky gorges that in many instances are too narrow to map. Often this community grows as a small linear strip, less than 10 metres wide, with the surrounding forest type overhanging. It is generally found on recent alluvial materials including coarse sands, pebbles and boulders. Flooding and depositional events have an ongoing impact on this community.

Sandstone Riparian Scrub features a variable cover of shrubs that include *Tristaniopsis laurina*, *Leptospermum morrisonii*, *Tristania neriifolia*, *Allocasuarina littoralis*, *Ceratopetalum apetalum* and *Backhousia myrtifolia*. The latter two species tend to be more prominent amongst stream boulders (Keith, 1994) and around minor waterfalls. The smaller shrub layer is dominated by *Lomatia myricoides* with *Acacia obtusifolia* and *Dauera rubioides*. The ground cover supports an abundant cover of moisture loving ferns such as *Sticherus flabellatus* var. *flabellatus* and *Gleichenia microphylla*. The fern cover is often broken by a series of rock pools, recent sandy alluvial deposits and rock pavements. Branches of the surrounding Eucalypt forest form an occasional shade cover across the gully line. Tree species are variable depending on location but frequently are *Eucalyptus piperita*, *E. agglomerata* or *E. elata*.

Sandstone Riparian Scrub is common throughout Sydney sandstone environments, although it is not extensive given its preference for narrow gully habitats. Similar communities are found in the Warragamba Special Area (NPWS, 2003b), Woronora and Metropolitan Catchments (NPWS, 2003c), Holsworthy Military Area (French *et al.*, 2000) and Royal National Park (Keith and Tozer, in prep). Elsewhere in the Sydney Basin Bioregion it has been recorded in Wollemi and Yengo National Park (Bell, 1998) and would be expected to occur in several additional sandstone reserves to the south and east. This community was mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Trees: 20-30m. Mean Projected Canopy Cover 5%

Angophora costata, Eucalyptus piperita, Eucalyptus punctata, Eucalyptus pilularis, Eucalyptus elata

Taller Shrubs: 2-5m. Mean Projected Canopy Cover 40%

Tristaniopsis laurina, Tristania neriifolia, Ceratopetalum apetalum, Leptospermum morrisonii, Allocasuarina littoralis, Dodonaea triquetra, Callicoma serratifolia

Shrubs: 0.5-1.5m. Mean Projected Canopy Cover 30%

Lomatia myricoides, Acacia obtusifolia, Bauera rubioides, Hakea salicifolia

Ground Covers: 0.5-1m. Mean Projected Canopy Cover 35%

Sticherus flabellatus var. *flabellatus, Gleichenia microphylla, Schoenus melanostachys, Lepidosperma laterale, Lomandra longifolia, Entolasia stricta*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Gully line habitats on Hawkesbury Sandstone, often a small linear strip less than 10 metres wide. Rock pools, waterfalls, rock platforms and sandy banks are regularly observed along the creek lines.
- Water Gums (*Tristaniopsis laurina, Tristania neriifolia*) are the prominent feature of this community. They are generally low in height, although where there is greater shelter, the community is slightly taller and includes Coachwood (*Ceratopetalum apetalum*) and Grey Myrtle (*Backhousia myrtifolia*).
- Dense cover of ferns including the Umbrella Fern (*Sticherus flabellatus* var. *flabellatus*), Scrambling Coral Fern (*Gleichenia microphylla*) and some rushes (*Schoenus melanostachys*).

❑ *EXAMPLE LOCATIONS*

Rocky Waterholes Creek; Bargo River

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	36	100
B Medium	0	0
C High	0	0
Total	**36**	**100**

❑ *THREATENED PLANT SPECIES*

Grevillea longifolia (2RC-)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia obtusifolia	4	1.00	2	0.12	positive
Allocasuarina littoralis	2	0.50	1	0.14	positive
Bauera rubioides	2	0.67	2	0.07	positive
Dodonaea triquetra	3	0.50	2	0.12	positive
Gleichenia microphylla	4	0.50	3	0.04	positive
Lomatia myricoides	3	1.00	1	0.03	positive
Sticherus flabellatus var. flabellatus	4	0.67	2	0.04	positive
Tristania neriifolia	3	0.83	1	0.01	positive
Tristaniopsis laurina	3	0.83	3	0.02	positive
Entolasia stricta	2	0.67	2	0.53	constant

MU4 HIGHLANDS BASALT ACACIA SCRUB

Number of Sites: 2 No. taxa/plot: 31.5

❑ *DESCRIPTION*

Highlands Basalt Acacia Scrub occurs in localised patches on dry rocky knolls and scree slopes on the basalt capped Mt. Wanganderry. The upper stratum is principally composed of *Acacia melanoxylon* along with *Rapanea howittiana* and *Ficus rubiginosa*. Shrubs are sparse with *Hymenanthera dentata, Olearia viscidula* and *Sigesbeckia orientalis* subsp. *orientalis* occurring most frequently. The ground layer is dominated by ferns, herbs and scramblers such as *Urtica incisa, Geranium solanderi* var. *solanderi, Stellaria pungens, Aphanopetalum resinosum, Celastrus australis* and *Rubus parvifolius.*

Mt. Wanganderry has been subject to a history of clearing and disturbance, indicated by the abundance of *Acacia* spp. and *Urtica incisa* in this assemblage. Highlands Basalt Acacia Scrub is a depauperate rainforest assemblage that has close association with cool-warm temperate rainforest found at high elevations on richer soils of the Sydney Basin Bioregion. Examples of the well-developed rainforest occur on identical soils on the Robertson Plateau where considerably higher rainfall supports mesophyll trees such as *Acmena smithii* and *Doryphora sassafras.* This community was mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 8m. Mean Projected Canopy Cover 52% SD 17.6

Acacia melanoxylon, Rapanea howittiana, Ficus rubiginosa, Acacia mearnsii

Shrubs: Mean Upper Height 1.3m. Mean Projected Canopy Cover 20% SD 21.2

Hymenanthera dentata, Olearia viscidula, Sigesbeckia orientalis subsp. *orientalis*

Ground Covers: Mean Upper Height 0.4m. Mean Projected Canopy Cover 17.5% SD 17.6

Urtica incisa, Geranium solanderi var. *solanderi, Stellaria pungens, Asplenium flabellifolium, Clematis glycinoides* var. *glycinoides, Geitonoplesium cymosum, Lomandra longifolia, Aphanopetalum resinosum, Celastrus australis, Rubus parvifolius*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Rocky ground, scree slopes on basalt at Mt. Wanganderry with a forest canopy dominated by Blackwood (*Acacia melanoxylon*).
- A tall Acacia scrub with a moist understorey dominated by fern, herb and vine species. Species include Stinging Nettle (*Urtica incisa*), Native Geranium (*Geranium solanderi* var. *solanderi*), Necklace Fern (*Asplenium flabellifolium*) and Headache Vine (*Clematis glycinoides* var. *glycinoides*).

❑ *EXAMPLE LOCATIONS*

Mount Wanganderry

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	0	0
B Medium	0	0
C High	8	100
Total	**8**	**100**

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia mearnsii	2	0.50	2	0.00	positive
Acacia melanoxylon	5	1.00	2	0.04	positive
Adiantum aethiopicum	2	0.50	2	0.22	positive
Aphanopetalum resinosum	5	0.50	2	0.05	positive
Asplenium flabellifolium	2	1.00	2	0.22	positive
Celastrus australis	4	0.50	1	0.04	positive
Clematis glycinoides var. glycinoides	2	1.00	2	0.16	positive
Crassula sieberiana	2	0.50	1	0.08	positive
Einadia hastata	3	0.50	1	0.07	positive
Geitonoplesium cymosum	2	1.00	2	0.29	positive
Geranium solanderi var. solanderi	3	1.00	2	0.12	positive
Hymenanthera dentata	3	0.50	2	0.09	positive
Microlaena stipoides	2	1.00	2	0.37	positive
Notodanthonia longifolia	2	0.50	2	0.09	positive
Olearia viscidula	3	0.50	2	0.32	positive
Oxalis perennans	2	0.50	2	0.13	positive
Pellaea falcata	2	0.50	2	0.17	positive
Poa labillardierei var. labillardierei	2	0.50	2	0.14	positive
Pteridium esculentum	2	0.50	2	0.36	positive
Rapanea howittiana	5	0.50	2	0.03	positive
Rubus parvifolius	4	0.50	2	0.13	positive
Senecio quadridentatus	3	0.50	2	0.02	positive
Sigesbeckia orientalis subsp. orientalis	2	0.50	2	0.14	positive
Solanum opacum	2	1.00	1	0.01	positive
Stellaria pungens	3	1.00	2	0.14	positive
Tylophora barbata	3	0.50	2	0.18	positive
Urtica incisa	4	1.00	2	0.07	positive
Lomandra longifolia	2	1.00	2	0.55	constant

MU5 SANDSTONE MOIST BLUE GUM FOREST

Number of Sites: 10 No. taxa/plot: 31.2

❑ *DESCRIPTION*

Sandstone Moist Blue Gum Forest is a very tall mesic forest occurring in deep, protected gullies of the sandstone plateaux. Within the study area this community is predominantly found in the north east, such as in the Little River and Blue Gum Creek areas. It becomes more restricted and disappears as rainfall decreases and/or elevation increases. It is also found in less sheltered sites in the Couridjah area where downslope movement of capping shale and high rainfall leads to a slight enrichment of the soil. Massive *Eucalyptus deanei* that may attain heights of over 50 metres are the dominant feature of the canopy along with *Syncarpia glomulifera* subsp. *glomulifera, E. cypellocarpa* and *Angophora floribunda* along creek lines. The characteristic feature of this assemblage is a tall subcanopy of *Ceratopetalum apetalum* and *Acacia elata* often in association with smaller trees of *Callicoma serratifolia, Ceratopetalum gummiferum, Elaeocarpus reticulatus* and *Acmena smithii.* Given the shade cast by the canopy and subcanopy layer the ground cover is dominated by a cushion of ferns, the most abundant being *Calochlaena dubia,* along with *Blechnum cartilagineum, Pteridium esculentum* and *Asplenium flabellifolium.* Vines such as *Cissus hypoglauca* and *Morinda jasminoides* are also common amongst the ground cover as is scattered *Lomandra longifolia.* Where this assemblage occurs alongside watercourses, *Sticherus flabellatus* var. *flabellatus* and *Todea barbara* often become abundant.

Sandstone Moist Blue Gum Forest represents the most sheltered of the Eucalypt dominated forests found on sandstone derived soils. It grades into Sandstone Warm Temperate Rainforest (MU1) in more protected locations where *Doryphora sassafras* and *Acmena smithii* form a closed canopy with *Ceratopetalum apetalum.* It is not widespread within the study area being found in the Couridjah and Little River areas. This community is more common to the north in the Kings Tableland area as well as outside the Warragamba Special Area in the Blue Mountains and Wollemi National Parks (Bell, 1998). This community was mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 27m. Mean Projected Canopy Cover 42% SD 25.5

Eucalyptus deanei, Syncarpia glomulifera subsp. *glomulifera, Eucalyptus cypellocarpa, Angophora floribunda, Eucalyptus piperita, Angophora costata, Eucalyptus punctata*

Small Trees: Mean Upper Height 13m. Mean Projected Canopy Cover 22% SD 18.5

Acacia elata, Ceratopetalum apetalum, Ceratopetalum gummiferum, Acmena smithii, Callicoma serratifolia, Elaeocarpus reticulatus

Shrubs/Ferns: Mean Upper Height 6m. Mean Projected Canopy Cover 27% SD 15.6

Todea barbara, Leucopogon lanceolatus var. *lanceolatus*

Ground Covers: Mean Upper Height 1.4m. Mean Projected Canopy Cover 62% SD 25.7

Blechnum cartilagineum, Calochlaena dubia, Pteridium esculentum, Asplenium flabellifolium, Lomandra longifolia, Morinda jasminoides, Sticherus flabellatus var. *flabellatus, Cissus hypoglauca, Pellaea falcata, Tylophora barbata, Clematis aristata*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Tall Mountain Blue Gums (*Eucalyptus deanei*) located in deeply incised sandstone gorges.
- A mesic developing subcanopy characterised by Cedar Wattle (*Acacia elata*) and Coachwood (*Ceratopetalum apetalum*).
- A dense ground cover of Common Ground Fern (*Calochlaena dubia*) and Gristle Fern (*Blechnum cartilagineum*) along with Giant Water Vine (*Cissus hypoglauca*).

❑ *EXAMPLE LOCATIONS*

Martins Creek Canyon; Sandy Flat Creek

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	461	72
B Medium	177	28
C High	2	0
Total	**640**	**100**

❑ *THREATENED PLANT SPECIES*

Lissanthe sapida (3RCa)

❑ *DIAGNOSTIC SPECIES*

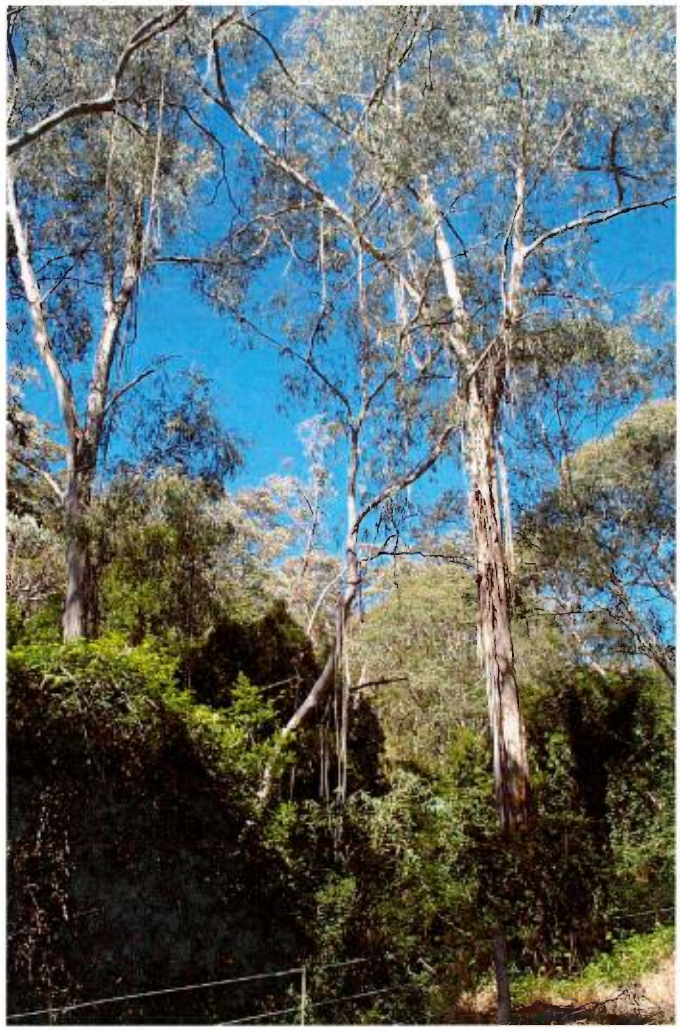
The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia elata	4	0.90	2	0.04	positive
Asplenium flabellifolium	2	0.60	2	0.21	positive
Blechnum cartilagineum	4	1.00	3	0.11	positive
Callicoma serratifolia	4	0.70	2	0.02	positive
Calochlaena dubia	6	0.90	3	0.07	positive
Ceratopetalum apetalum	5	0.70	4	0.03	positive
Ceratopetalum gummiferum	4	0.50	4	0.03	positive
Clematis aristata	2	0.50	2	0.35	positive
Elaeocarpus reticulatus	3	0.70	1	0.16	positive
Eucalyptus deanei	4	0.60	4	0.06	positive
Geitonoplesium cymosum	2	0.50	2	0.29	positive
Hymenophyllum cupressiforme	2	0.50	2	0.02	positive
Morinda jasminoides	2	0.60	2	0.06	positive
Pteridium esculentum	2	0.70	2	0.36	positive
Smilax glyciphylla	2	0.50	1	0.07	positive
Sticherus flabellatus var. flabellatus	4	0.50	3	0.01	positive
Todea barbara	4	0.50	2	0.01	positive
Viola hederacea	2	0.50	2	0.24	positive
Lomandra longifolia	2	0.60	2	0.55	constant

MU6 NEPEAN GORGE MOIST FOREST

Number of Sites: 1 No. taxa/plot: 39

❑ *DESCRIPTION*



Nepean Gorge Moist Forest occupies heavily sheltered aspects of deeply dissected Hawkesbury Sandstone gorges and valleys. It is found in isolated patches across the Nattai and Wanganderry Tablelands as well as into the Metropolitan Catchment.

Nepean Gorge Moist Forest is a tall forest with a moist subcanopy. Tall *Eucalyptus elata* are a feature of the canopy while other species include *E. agglomerata*, *E. punctata* and *E. piperita*. At higher elevations such as in the south west of the study area, *Eucalyptus oreades* can be found, reflecting the cooler environment. The understorey has a moderately tall small tree and shrub layer, often with emerging rainforest species. In the most protected sites *Ceratopetalum apetalum*, *Backhousia myrtifolia*, *C. gummiferum* and *Acacia elata* can grow up to around twelve metres in height. The smaller shrub stratum is less dense. It includes ferns, such as *Cyathea australis*, and shrubs and small trees such as *Elaeocarpus reticulatus* and *Notelaea longifolia* forma. *longifolia*. The shady habitat provides sufficient shelter for an abundant ground cover of ferns such as *Calochlaena dubia*, *Pteridium esculentum*, *Sticherus flabellatus* var. *flabellatus*, *Blechnum cartilagineum* and *Adiantum formosum*. Small succulent climbers such as *Tylophora barbata* and *Cissus hypoglauca* are also abundant.

Deep gorges often running east-west, provide sufficient shelter for narrow ribbons of this moist forest. The composition of the moist understorey is less diverse than other sheltered sandstone forests with the abundance of emerging rainforest species being an identifying feature. Nepean Gorge Moist Forest forms the link between Sandstone Warm Temperate Rainforest (MU1) and Nattai Sandstone River Peppermint Forest (MU7). Outside of the reserves, this community is found in the Nepean Catchment (NPWS, 2003c). This community was identified in the Metropolitan Catchments mapping (NPWS, 2003c) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Trees: 25-35m tall. Mean Projected Canopy Cover 40%

Eucalyptus elata, Eucalyptus agglomerata, Eucalyptus oreades, Eucalyptus cypellocarpa

Minor associates: *Eucalyptus punctata, Eucalyptus piperita, Corymbia gummifera*

Small Trees: 6-12m tall. Mean Projected Canopy Cover 35%

Acacia elata, Ceratopetalum apetalum, Ceratopetalum gummiferum, Cyathea australis, Backhousia myrtifolia

Shrubs: 2-5m tall. Mean Projected Canopy Cover 15%

Breynia oblongifolia, Elaeocarpus reticulatus, Persoonia linearis, Pultenaea flexilis, Leptospermum polygalifolium subsp. *polygalifolium, Leucopogon lanceolatus* var. *lanceolatus, Tristaniopsis collina*

Ground Covers: 0-0.5m tall. Mean Projected Canopy Cover 70%

Calochlaena dubia, Pteridium esculentum, Dianella caerulea, Lomandra longifolia, Lepidosperma laterale, Entolasia marginata, Billardiera scandens, Viola hederacea, Clematis aristata

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Deeply dissected gorges and valleys in the west of the Metropolitan Catchment and in the Nattai and Wanganderry Tablelands.
- Often a very tall forest dominated by River Peppermint (*Eucalyptus elata*) with obvious rainforest trees (to 12 metres tall) such as Mountain Cedar Wattle (*Acacia elata*), Christmas Bush (*Ceratopetalum gummiferum*), Coachwood (*C. apetalum*) and Rough Treefern (*Cyathea australis*).
- A shrubby understorey of Blueberry Ash (*Elaeocarpus reticulatus*), Tea-tree (*Leptospermum polygalifolium* subsp. *polygalifolium*), Lance-leaf Beard Heath (*Leucopogon lanceolatus* var. *lanceolatus*) and Native Olive (*Notelaea longifolia* forma. *longifolia*).
- The ground layer has a dense cover of Common Ground Fern (*Calochlaena dubia*), Bracken (*Pteridium esculentum*), Gristle Fern (*Blechnum cartilagineum*), Spiny-headed Mat-rush (*Lomandra longifolia*) and Snowgrass (*Poa sieberiana* var. *sieberiana*).

❑ *EXAMPLE LOCATIONS*

Deep Gorges off Centre Ridge; Allum River Canyon

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	776	97
B Medium	21	3
C High	7	1
Total	**803**	**100**

❑ *THREATENED PLANT SPECIES*

Eucalyptus hypostomatica (3RC-)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below has been derived from NPWS (2003c) and are based on a 1-6 Cover Score system.

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Asplenium flabellifolium	2	0.60	2	0.21	positive
Blechnum cartilagineum	4	1.00	3	0.11	positive
Callicoma serratifolia	4	0.70	2	0.02	positive
Calochlaena dubia	6	0.90	3	0.07	positive
Ceratopetalum apetalum	5	0.70	4	0.03	positive
Ceratopetalum gummiferum	4	0.50	4	0.03	positive
Clematis aristata	2	0.50	2	0.35	positive
Elaeocarpus reticulatus	3	0.70	1	0.16	positive
Eucalyptus elata	4	0.60	4	0.06	positive
Geitonoplesium cymosum	2	0.50	2	0.29	positive
Hymenophyllum cupressiforme	2	0.50	2	0.02	positive
Morinda jasminoides	2	0.60	2	0.06	positive
Pteridium esculentum	2	0.70	2	0.36	positive
Smilax glyciphylla	2	0.50	1	0.07	positive
Sticherus flabellatus var. flabellatus	4	0.50	3	0.01	positive
Todea barbara	4	0.50	2	0.01	positive
Viola hederacea	2	0.50	2	0.24	positive
Lomandra longifolia	2	0.60	2	0.55	constant

MU7 NATTAI SANDSTONE RIVER PEPPERMINT FOREST

Number of Sites: 9 No. taxa/plot: 56.3

❑ *DESCRIPTION*

Nattai Sandstone River Peppermint Forest is a tall forest with a dense canopy dominated by *Eucalyptus elata. Eucalyptus piperita, Angophora costata, E. agglomerata, E. punctata* and *E. cypellocarpa* are also sometimes observed. A scattered small tree layer is usually present including species such as *Acacia elata, Allocasuarina littoralis* and *Callicoma serratifolia.* The shrub layer is a sparse mix of emerging rainforest species and drier sandstone shrub species. Frequent species include *Astrotricha latifolia, Grevillea arenaria* subsp. *arenaria* and *Leptospermum polygalifolium* subsp. *polygalifolium.* The ground is typically covered by a dense layer of ferns and vines. Species observed frequently include *Blechnum cartilagineum, Pteridium esculentum, Dianella caerulea, Microlaena stipoides* var. *stipoides, Eustrephus latifolius, Tylophora barbata* and *Lomandra longifolia.*

Nattai Sandstone River Peppermint Forest is found across the Nattai and Wanganderry Tablelands, where it grows in sheltered positions, mostly along small creek lines and protected aspects. It is associated with sandy sediments derived from Hawkesbury Sandstone.

Variation in the floristic dynamics of this community is usually in response to available shelter, soil and the proximity to drainage lines. In areas with more shelter, a higher proportion of emerging rainforest species and ferns are observed such as *Elaeocarpus reticulatus, Cyathea australis* and *Calochlaena dubia.* When in or within close proximity to a drainage line, species such as *Sticherus flabellatus* var. *flabellatus* and *Juncus planifolius* occur more abundantly. In some locations a deep sandy alluvium persists on gentle, semi sheltered slopes. In these areas, the community is dominated by *Eucalyptus piperita* and *E. punctata* with small trees (*Melaleuca linariifolia*), and a higher abundance of dry sandstone shrubs. In all cases, ferns are a prominent feature of this community.

Nattai Sandstone River Peppermint Forest occurs in gullies of higher elevations and cooler climates of the sandstone plateaux. Rainfall is also marginally lower than the landscape to the north east where Sandstone Moist Blue Gum Forest (MU5) becomes prominent. As shelter is increased, this community grades into Nepean Gorge Moist Forest (MU6) and Sandstone Warm Temperate Rainforest (MU1). In

contrast to this, greater exposure leads to the emergence of Sheltered Sandstone Blue-leaved Stringybark Forest (MU13). Outside of the study area, this community occurs in the Nepean Catchment (NPWS, 2003c) as well as to the south in the Joadja area. Its distribution outside the study area is not well documented.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 28m. Mean Projected Canopy Cover 31% SD 12.7

Eucalyptus elata, Eucalyptus piperita, Eucalyptus cypellocarpa, Eucalyptus oreades

Minor associates: *Angophora costata, Corymbia gummifera, Eucalyptus punctata, Eucalyptus agglomerata*

Small Trees: Mean Upper Height 8m. Mean Projected Canopy Cover 14% SD 15.0

Acacia elata, Allocasuarina littoralis, Allocasuarina torulosa, Callicoma serratifolia, Melaleuca linariifolia

Shrubs: Mean Upper Height 3.7m. Mean Projected Canopy Cover 13% SD 5.1

Elaeocarpus reticulatus, Astrotricha latifolia, Grevillea arenaria subsp. *arenaria, Leptospermum polygalifolium* subsp. *polygalifolium, Leucopogon lanceolatus* var. *lanceolatus, Notelaea venosa*

Ground Covers: Mean Upper Height 0.8m. Mean Projected Canopy Cover 63% SD 28.6

Blechnum cartilagineum, Pteridium esculentum, Dianella caerulea, Microlaena stipoides var. *stipoides, Eustrephus latifolius, Tylophora barbata, Lomandra longifolia, Galium binifolium, Geitonoplesium cymosum, Gonocarpus teucrioides, Kennedia rubicunda, Viola hederacea, Wahlenbergia gracilis, Calochlaena dubia, Adiantum aethiopicum, Poranthera microphylla*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- This community is a tall forest that grows along the sheltered creeklines, gorges and lower slopes that drain the sandstone sediments of the Nattai and Wanganderry Tablelands.
- The abundance of River Peppermint (*Eucalyptus elata*) is particularly indicative of this community as is the presence of Cedar Wattle (*Acacia elata*) and Blueberry Ash (*Elaeocarpus reticulatus*). However understorey is more open and a mesic sub canopy is not present like MU6 Nepean Gorge Moist Forest
- A distinctive ground cover of dense ferns is a feature of this community including Gristle Fern (*Blechnum cartilagineum*), Bracken (*Pteridium esculentum*), and Common Ground Fern (*Calochlaena dubia*). The diversity of ferns and vines is a feature separating it from the moist forest and rainforest that this community grades into.
- A sparse to moderately dense shrub layer that includes a mix of pioneering rainforest species such as Black Wattle (*Callicoma serratifolia*) and Blueberry Ash (*Elaeocarpus reticulatus*) with sclerophyllous shrubs more typical on drier slopes such as *Grevillea arenaria* subsp. *arenaria* and Lance-leaf Beard Heath (*Leucopogon lanceolatus* var. *lanceolatus).*

❑ *EXAMPLE LOCATIONS*

Creeklines off the Starlights Trail; upper Little River; Jocks Creek; upper Nattai River; upper Wanganderry Creek

❑ CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	3875	95
B Medium	122	3
C High	63	2
Total	**4060**	**100**

❑ THREATENED PLANT SPECIES

Persoonia hirsuta subsp. *evoluta* (E1), *Gonocarpus longifolius* (3RC-), *Lissanthe sapida* (3RCa)

❑ DIAGNOSTIC SPECIES

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Adiantum aethiopicum	2	0.67	2	0.14	positive
Astrotricha latifolia	2	0.67	2	0.14	positive
Blechnum cartilagineum	4	1.00	3	0.16	positive
Brachyscome spathulata	3	0.11	0	0.00	positive
Calochlaena dubia	4	0.67	2	0.08	positive
Dianella caerulea	2	1.00	2	0.43	positive
Elaeocarpus reticulatus	2	1.00	2	0.22	positive
Endiandra sieberi	1	0.11	0	0.00	positive
Eucalyptus elata	4	0.89	2	0.06	positive
Eucalyptus piperita	2	0.67	4	0.35	positive
Eustrephus latifolius	2	0.89	1	0.14	positive
Galium binifolium	2	0.78	1	0.08	positive
Geitonoplesium cymosum	2	0.78	2	0.26	positive
Glycine clandestina	2	0.67	2	0.22	positive
Gonocarpus teucrioides	2	0.78	2	0.30	positive
Grevillea arenaria subsp. arenaria	2	0.67	2	0.22	positive
Kennedia rubicunda	2	0.78	2	0.06	positive
Lastreopsis microsora subsp. microsora	4	0.22	0	0.00	positive
Leptospermum polygalifolium subsp. polygalifolium	2	0.67	2	0.19	positive
Lomandra longifolia	2	0.78	2	0.43	positive
Microlaena stipoides var. stipoides	2	1.00	2	0.42	positive
Muellerina eucalyptoides	1	0.11	0	0.00	positive
Notelaea venosa	2	0.56	2	0.04	positive
Olearia argophylla	2	0.22	0	0.00	positive
Olearia asterotricha	1	0.11	0	0.00	positive
Pelargonium australe	1	0.11	0	0.00	positive
Plantago debilis	2	0.56	2	0.09	positive
Poranthera microphylla	2	0.67	2	0.13	positive
Pteridium esculentum	3	1.00	2	0.40	positive
Senecio glomeratus	1	0.11	0	0.00	positive
Senecio linearifolius	2	0.56	2	0.05	positive
Solanum prinophyllum	2	0.56	1	0.21	positive
Tylophora barbata	3	0.78	2	0.16	positive
Viola hederacea	2	0.78	2	0.20	positive
Wahlenbergia gracilis	2	0.78	1	0.18	positive
Entolasia stricta	2	0.33	2	0.55	negative
Persoonia linearis	1	0.78	2	0.50	negative

MU8 HIGHLANDS SHALE TALL OPEN FOREST: FORMS A, B AND C

Number of Sites: 16 No. taxa/plot: 55.2

❑ *DESCRIPTION*

Highlands Shale Tall Open Forest is found along the southern boundary of the Nattai and Bargo reserves. The community is characterised by a rich diversity and abundance of herbs and grasses and is visually distinctive from the dry, shrub dominated assemblages of the sandstone plateaux. It grows on basalt and shale soils that are finer grained and of higher fertility than the surrounding sandstone. These sediments, however, are mostly outside the current reserve boundary. When in close proximity to the shale sandstone interface, the characteristics of the sediments and the assemblage of species tend to take on a transitional nature. This community has been mapped in three forms that are essentially responses to changes in soil characteristics and available shelter. Highlands Shale Tall Open Forest: Form C, was mapped in both the Warragamba and Metropolitan Catchments mapping as Map Unit 19 and Map Unit 18 respectively (NPWS, 2003b; NPWS, 2003c). The information from these reports has been used alongside the information collected from this study, to develop this profile.

Form A

Form B

Form A is a tall forest that grows on sheltered aspects and along valley floors. It is the form most influenced by sandstone sediments. Form B is a lower open forest that grows in more exposed locations and on gentler slopes usually close to the shale sandstone interface. Form C is a tall open forest found on the richer basalt and shale soils. It is also the most widespread of the three forms within the study area. Apart from variation in the canopy species, these three forms are floristically very similar, with only minor variations in the abundance of understorey species. Much of the former habitat of this community

(particularly for Form C) has been cleared for agricultural activities with clearing and grazing an ongoing disturbance.

FORM A TALL GULLY VARIANT

Form A is a tall forest of *Eucalyptus elata* and *Eucalyptus viminalis* with small trees *Acacia falciformis* and *Angophora floribunda*. *Olearia viscidula, Rubus parvifolius* and *Indigofera australis* are frequent shrub species. A dense ground layer is dominated by *Lomandra longifolia, Echinopogon ovatus, Microlaena stipoides* var. *stipoides, Dichondra repens, Viola hederacea, Adiantum aethiopicum, Clematis aristata, Dianella caerulea* and *Pteridium esculentum*. This community is likely to be related to Highlands Ribbon Gum Gully Forest on the Robertson Plateau NPWS (2003c).

FORM B OPEN RED GUM VARIANT

Form B is an open forest of *Eucalyptus tereticornis* and *E. punctata* often with the small tree *Acacia parramattensis*. *Eucalyptus eugenioides* and *E. moluccana* also occur infrequently within this form. Common shrubs include *Olearia viscidula* and *Bursaria spinosa*. The ground layer is sparser than Form A, with more grasses and herbaceous species. Common species include *Desmodium varians, Microlaena stipoides* var. *stipoides, Dichondra repens, Cheilanthes sieberi* subsp. *sieberi, Echinopogon ovatus, Austrodanthonia racemosa* var. *racemosa, Pratia purpurascens, Lomandra longifolia* and *L. filiformis* subsp. *filiformis*.

FORM C TALL OPEN VARIANT

Form C is a tall open grassy forest with a canopy dominated by *Eucalyptus blaxlandii, E. bosistoana, E. tereticornis* and *E. viminalis*. Small trees and shrubs are sparse or absent but may include *Acacia melanoxylon* and *Hymenanthera dentata*. A dense ground cover is typical with a diverse combination of grass and herb species. This includes *Microlaena stipoides* var. *stipoides, Poa labillardieri* var. *labillardieri, Austrostipa rudis* subsp. *nervosa, Acaena novae-zelandiae* and *Stellaria pungens*.

Form C

Highlands Shale Tall Open forest is closely associated with open grassy forests found across the Southern Highlands, such as around Mittagong and Moss Vale. Clearing and grazing have removed or severely disturbed this community to the point that it is listed on the NSW TSC Act (1995) as an Endangered Ecological Community.. These forests varies from the forests and woodlands found on the Wianamatta Shale soils of the Cumberland Plain. This is a factor of the mix of rainfall and elevation (around 800 metres) making a cool and wet climate.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 26m. Mean Projected Canopy Cover 32% SD 12.2

Eucalyptus tereticornis, Eucalyptus elata, Eucalyptus viminalis, Eucalyptus punctata, Eucalyptus blaxlandii, Eucalyptus bosistoana

Minor associates: *Eucalyptus eugenioides, Eucalyptus piperita, Eucalyptus cypellocarpa, Eucalyptus cinerea, Eucalyptus radiata* subsp. *radiata, Eucalyptus agglomerata, Eucalyptus globoidea, Eucalyptus moluccana*

Small Trees: Mean Upper Height 7m. Mean Projected Canopy Cover 14% SD 11.9

Acacia parramattensis, Acacia longifolia, Angophora floribunda, Acacia falciformis, Allocasuarina littoralis, Melaleuca linariifolia, Acacia melanoxylon

Shrubs: Mean Upper Height 1.9m. Mean Projected Canopy Cover 24% SD 15.9

Olearia viscidula, Rubus parvifolius, Indigofera australis, Hymenanthera dentata

Ground Covers: Mean Upper Height 0.7m. Mean Projected Canopy Cover 45% SD 33.8

Echinopogon ovatus, Microlaena stipoides var. *stipoides, Lomandra longifolia, Dichondra repens, Acaena novae-zelandiae, Plantago debilis, Galium propinquum, Brachyscome angustifolia* var. *angustifolia, Desmodium varians, Pteridium esculentum, Wahlenbergia gracilis, Hypericum gramineum, Pratia purpurascens, Solanum prinophyllum, Veronica plebeia, Austrodanthonia racemosa* var. *racemosa, Geranium solanderi* var. *solanderi*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A tall open forest growing on basalt and shale soils in the Southern Highlands region. It is also found around the boundary of shale and sandstone sediments.
- The canopy varies between Forest Red Gum (*Eucalyptus tereticornis*), Grey Gum (*E. punctata*), Blaxland's Stringybark (*E. blaxlandii*) and Coast Grey Gum (*E. bosistoana*) when on gentle exposed slopes. River Peppermint (*Eucalyptus elata*) and Ribbon Gum (*E. viminalis*) favour drainage lines and more protected aspects.
- The presence and high abundance of Wallaby Weed (*Olearia viscidula*), Spiny-headed Mat-rush (*Lomandra longifolia*), Kidney Weed (*Dichondra repens*) and grasses such as *Microlaena stipoides* var. *stipoides* and *Echinopogon ovatus*.

❑ *EXAMPLE LOCATIONS*

Mount Wanganderry; Deep Creek; High Range; Jellore Creek; upper Nattai River; Colo Vale

❑ *CONDITION ASSESSMENT*

Forms a component of the Southern Highlands Shale Woodland, an Endangered Ecological Community listed under the Threatened Species Act (1995).

Disturbance Class	Area (ha)*	Proportion Extant (%)*
A Low	920	57
B Medium	74	5
C High	619	38
Total	1613	100

*Area and proportion of extant are a combined total for all forms

❑ *THREATENED PLANT SPECIES*

None Recorded

❑ *DIAGNOSTIC SPECIES*

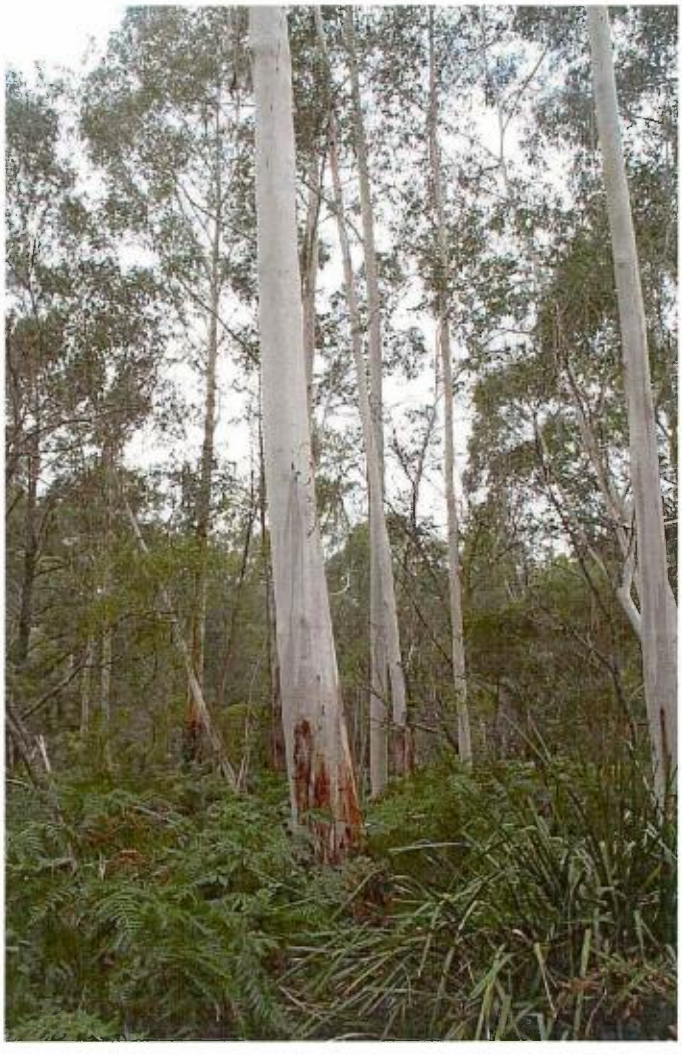
Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia dealbata	4	0.06	0	0.00	positive
Acacia deanei subsp. deanei	4	0.06	0	0.00	positive
Adiantum aethiopicum	3	0.56	2	0.14	positive
Brachyscome angustifolia var. angustifolia	2	0.50	1	0.13	positive
Brachyscome angustifolia var. heterophylla	2	0.13	0	0.00	positive
Bracteantha viscosa	2	0.06	0	0.00	positive
Bulbine bulbosa	1	0.06	0	0.00	positive
Chiloglottis seminuda	1	0.06	0	0.00	positive
Chrysocephalum semipapposum	1	0.06	0	0.00	positive
Clematis aristata	3	0.50	2	0.25	positive
Corybas pruinosus	3	0.06	0	0.00	positive
Cotula australis	1	0.06	0	0.00	positive
Desmodium varians	4	0.56	2	0.21	positive
Dichondra repens	3	0.94	2	0.30	positive
Echinopogon ovatus	2	1.00	2	0.15	positive
Eremophila debilis	1	0.06	0	0.00	positive
Eriochilus autumnalis	2	0.06	0	0.00	positive
Geranium solanderi var. solanderi	3	0.50	2	0.08	positive
Glycine clandestina	2	0.56	2	0.22	positive
Indigofera australis	2	0.63	1	0.16	positive
Juncus australis	1	0.06	0	0.00	positive
Juncus filicaulis	1	0.06	0	0.00	positive
Lomandra longifolia	2	0.81	2	0.43	positive
Luzula ovata	1	0.06	0	0.00	positive
Mentha satureioides	1	0.06	0	0.00	positive
Microlaena stipoides var. stipoides	4	1.00	2	0.42	positive
Olearia viscidula	4	0.81	2	0.30	positive
Oxalis perennans	2	0.50	2	0.10	positive
Plantago debilis	3	0.69	2	0.09	positive
Pratia purpurascens	2	0.69	2	0.28	positive
Pteridium esculentum	2	0.69	2	0.40	positive
Rubus parvifolius	2	0.69	2	0.09	positive
Senecio bipinnatisectus	1	0.13	0	0.00	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Solenogyne gunnii	1	0.06	0	0.00	positive
Sorghum leiocladum	1	0.06	0	0.00	positive
Sporobolus elongatus	3	0.06	0	0.00	positive
Stellaria pungens	3	0.56	2	0.03	positive
Veronica plebeia	2	0.63	1	0.18	positive
Wahlenbergia gracilis	2	0.56	1	0.18	positive
Entolasia stricta	2	0.31	2	0.55	negative
Persoonia linearis	2	0.13	2	0.50	negative

MU9 BURRAGORANG RIVER FLAT FOREST

Number of Sites: 12 No. taxa/plot: 40

❑ *DESCRIPTION*



Burragorang River Flat Forest is distributed extensively on deep sandy loam deposits of the alluvial flats associated with the major rivers and creek systems of the Little and Nattai River Valleys. The forest is tall to very tall reaching heights around 35 metres, and generally includes prominent stands of *Eucalyptus deanei*. At a number of disjunct locations *Eucalyptus benthamii* (a species listed on the NSW TSC Act, 1995) may dominate the canopy. Small terraces adjoining the riverbanks may have *Eucalyptus elata, Casuarina cunninghamiana* subsp. *cunninghamiana* or *Angophora floribunda,* while *E. tereticornis* occurs in proximity to the escarpment footslopes. The understorey features an open shrub layer with species such as *Acacia parramattensis, Breynia oblongifolia* and *Hymenanthera dentata.* The alluvial flats are relatively open with few mesic species establishing dominance in the understorey. As a result a diverse cover of grass species typifies most sites with *Microlaena stipoides* var *stipoides, Oplismenus aemulus* and *Entolasia marginata* most abundant. Herbs such as *Dichondra repens* and *Pratia purpurascens* are common below *Pteridium esculentum* and *Lomandra longifolia.* Small vines such as *Stephania japonica* var. *discolor* and *Clematis aristata* also feature.

Burragorang River Flat Forest occupies locations that are periodically inundated by floodwaters, such as the first flood terrace back from the river or creek. This flooding regularly deposits fresh alluvial material but also results in disturbance to the structure and composition of the understorey. This community is also found outside the study area distributed along the Kedumba River. The construction of the Warragamba Dam has drowned extensive areas of this community through the Burragorang Valley, and altered the hydrological regime for remaining areas. Past disturbance from agriculture, clearing and forestry operations has affected most of the remaining habitat. Prior to disturbance or removal, this community would have been more common on the sandy alluvial flats of the Hawkesbury and Nepean Rivers.

Burragorang River Flat Forest is closely related to forests found on the escarpment footslopes and sheltered escarpment slopes such as Permian Footslopes Grassy Red Gum-Box Forest (MU18), Sheltered Escarpment Blue Gum Forest (MU10) and Escarpment Grey Gum Forest (MU11). Burragorang River Flat Forest differs from these communities, being dominated by a tall canopy of *Eucalyptus deanei* and *Eucalyptus benthamii*, with a dense understorey mix of grasses, herbs, ferns and vines. In contrast to this community, Map Unit 18 is dominated by *Eucalyptus tereticornis* and Map Unit

11 has a sparser understorey with *Eucalyptus punctata* dominant in the canopy. Burragorang River Flat Forest was mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report. It should also be noted that this community shares a strong floristic affinity to the Sydney Coastal River-flat Forest, an Endangered Ecological Community (NSW TSC Act,1995), found on the floodplains of the Hawkesbury River.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 27m. Mean Projected Canopy Cover 36% SD 15.4

Eucalyptus deanei, Eucalyptus benthamii, Eucalyptus elata, Casuarina cunninghamiana subsp. *cunninghamiana, Angophora floribunda*

Minor associates: *Eucalyptus tereticornis, Eucalyptus eugenioides, Eucalyptus fibrosa, Melaleuca styphelioides*

Shrubs: Mean Upper Height 8m. Mean Projected Canopy Cover 19% SD 10.6

Acacia parramattensis, Hymenanthera dentata, Breynia oblongifolia, Pimelea linifolia, Clerodendrum tomentosum, Notelaea longifolia forma *longifolia, Duboisia myoporoides, Astrotricha latifolia, Leptospermum polygalifolium* subsp. *polygalifolium*

Ground Covers: Mean Upper Height 1m. Mean Projected Canopy Cover 85% SD 17.5

Pteridium esculentum, Microlaena stipoides var. *stipoides, Lomandra longifolia, Echinopogon ovatus, Oplismenus aemulus, Pratia purpurascens, Glycine clandestina, Dichondra repens, Entolasia marginata, Cayratia clematidea, Clematis aristata, Hydrocotyle peduncularis, Adiantum aethiopicum, Austrostipa ramosissima, Stephania japonica* var. *discolor, Lepidosperma laterale, Cissus hypoglauca, Gahnia aspera, Imperata cylindrica* var. *major*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Alluvial flats, supporting a deep sandy loam material that adjoins the major river and creek systems within the Burragorang Valley, including the Nattai and Little Rivers.
- Tall Mountain Blue Gum (*Eucalyptus deanei*) and Nepean River Gum (*E. benthamii*) are indicative canopy species. River Peppermint (*Eucalyptus elata*) and Rough-barked Apple (*Angophora floribunda*) are also found. Trees that are common in other Blue Gum Forests, such as Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*), do not occur in this community.
- Sydney Green Wattle (*Acacia parramattensis*) is found within an open shrub layer. Moist shrubs such as Sweet Pittosporum (*Pittosporum undulatum*) and Maidens Wattle (*Acacia maidenii*) are absent or uncommon.
- The ground layer is characterised by a diverse and dense cover including native grasses *Microlaena stipoides* var *stipoides,* Bracken Fern (*Pteridium esculentum*) and Spiny-headed Mat-rush (*Lomandra longifolia*). Moisture loving species such as ferns and vines are present in low abundance.

❑ *EXAMPLE LOCATIONS*

Little and Nattai Rivers; Reedy Creek;

❑ CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	177	30
B Medium	228	39
C High	183	31
Total	**588**	**100**

❑ THREATENED PLANT SPECIES

Eucalyptus benthamii (V)

❑ DIAGNOSTIC SPECIES

The diagnostic species presented below have been derived from NPWS (2003b).

Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Adiantum aethiopicum	3	0.57	2	0.24	positive
Austrostipa ramosissima	3	0.57	2	0.07	positive
Cayratia clematidea	2	0.71	2	0.08	positive
Clematis aristata	2	0.71	2	0.33	positive
Dichondra repens	4	0.57	3	0.39	positive
Echinopogon ovatus	2	0.86	2	0.20	positive
Entolasia marginata	5	0.57	2	0.11	positive
Glycine clandestina	2	0.86	2	0.32	positive
Hydrocotyle peduncularis	2	0.57	2	0.08	positive
Microlaena stipoides	5	0.86	2	0.41	positive
Oplismenus aemulus	4	0.86	2	0.09	positive
Pratia purpurascens	3	0.86	2	0.32	positive
Pteridium esculentum	3	1.00	2	0.37	positive
Rubus parvifolius	2	0.57	2	0.13	positive
Stephania japonica var. discolor	3	0.57	2	0.10	positive
Lomandra longifolia	4	0.86	2	0.57	constant

MU10 SHELTERED ESCARPMENT BLUE GUM FOREST

Number of Sites: 4 No. taxa/plot: 54.5

❑ *DESCRIPTION*

Sheltered Escarpment Blue Gum Forest is found on protected colluvial slopes beneath the extensive escarpments and walls formed by the Triassic Sandstone Plateaux. Within the study area it can be found below the East and West Nattai Walls. The geology comprises Permian Sediments from the Shoalhaven Group. However, these areas are influenced by downslope movement of soil materials derived from the eroding sandstone cliffs above. Soils are typically infertile and comprised of a loamy sand surface material.

Sheltered Escarpment Blue Gum Forest, as the title suggests, is dominated by *Eucalyptus deanei*. Other tree species include *Syncarpia glomulifera* subsp. *glomulifera* and *Eucalyptus punctata*. *Eucalyptus hypostomatica* can be occasionally found following a narrow band under the escarpment cliftlines. *Allocasuarina torulosa* is frequently abundant as a small tree layer, sometimes with *Pittosporum undulatum, Melaleuca styphelioides* and *Acacia maidenii*. Only a few select species persist in the shrub layer including *Clerodendrum tomentosum, Breynia oblongifolia* and *Pittosporum revolutum*. A high vine load is characteristic of many sites, with species such as *Cissus hypoglauca, Stephania japonica* var. *discolor, Smilax australis, Eustrephus latifolius* and *Geitonoplesium cymosum* being abundant. A dense ground cover is also usually present comprised of ferns, herbs and rushes. Common species include *Lomandra longifolia, Adiantum aethiopicum, Dichondra repens, Pratia purpurascens, Oplismenus aemulus* and *Pteridium esculentum*.

The high degree of shelter found directly beneath escarpment clifflines is the driving force in the occurrence of this community. Escarpment Grey Gum Forest (MU11) is closely related to this community although it occurs in less sheltered positions (mid and lower slopes) and the vine load is far less pronounced. Escarpment Tall Box Forest (MU12) is also similar to this community in that it is also found directly beneath escarpment clifflines. However, it is a much more open forest, with herbs and grasses dominating the ground layer. This community was mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 31m. Mean Projected Canopy Cover 21% SD 10.3

Eucalyptus deanei, Syncarpia glomulifera subsp. *glomulifera*

Minor associates: *Eucalyptus punctata, Eucalyptus eugenioides, Eucalyptus tereticornis, Eucalyptus hypostomatica, Angophora floribunda, Eucalyptus piperita, Eucalyptus crebra*

Small Trees: Mean Upper Height 15m. Mean Projected Canopy Cover 16% SD 7.5

Allocasuarina torulosa, Pittosporum undulatum, Pittosporum revolutum, Melaleuca styphelioides, Acacia maidenii, Casuarina cunninghamiana subsp. *cunninghamiana*

Ground Covers: Mean Upper Height 0.8m. Mean Projected Canopy Cover 49% SD 41.1

Lomandra longifolia, Adiantum aethiopicum, Pratia purpurascens, Oplismenus aemulus, Dichondra repens, Pteridium esculentum, Doodia aspera, Pellaea falcata, Echinopogon ovatus, Gahnia melanocarpa, Poa labillardierei var. *labillardierei, Dianella caerulea*

Vines & Climbers: no structural data available

Cissus hypoglauca, Stephania japonica var. *discolor, Smilax australis, Tylophora barbata, Clematis aristata, Eustrephus latifolius, Pandorea pandorana* subsp. *pandorana, Cissus antarctica, Geitonoplesium cymosum, Morinda jasminoides, Aphanopetalum resinosum*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A tall sheltered forest with an open canopy of Mountain Blue Gum (*Eucalyptus deanei*) and Forest Oak (*Allocasuarina torulosa*). Shrub species, such as *Clerodendrum tomentosum* and Rough Fruit Pittosporum (*Pittosporum revolutum*) are infrequently observed.
- A sheltered forest found on colluvial slopes of Permian Sediments directly below the major walls and cliffllines of the Triassic Sandstone Tablelands.
- A dense, sometimes impenetrable layer of vines and climbers including Giant Water Vine (*Cissus hypoglauca*), Snake Vine (*Stephania japonica* var. *discolor*) and Scrambling Lily (*Geitonoplesium cymosum*). These species are often found growing in the small tree and canopy layers.
- A dense semi-mesic ground cover predominantly comprised of ferns such as Common Maidenhair (*Adiantum aethiopicum*) and Sickle Fern (*Pellaea falcata*) but also herbs including Kidney Weed (*Dichondra repens*) and rushes such as Spiny-headed Mat-rush (*Lomandra longifolia*).

❑ *EXAMPLE LOCATIONS*

West Nattai Walls; Martins Creek Canyon

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	56	30
B Medium	92	49
C High	41	22
Total	**189**	**100**

❑ *THREATENED PLANT SPECIES*

Eucalyptus hypostomatica (3RC-)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Adiantum aethiopicum	3	1.00	2	0.23	positive
Allocasuarina torulosa	4	0.67	3	0.18	positive
Breynia oblongifolia	2	1.00	1	0.19	positive
Cissus antarctica	2	0.50	2	0.03	positive
Cissus hypoglauca	5	1.00	1	0.11	positive
Clematis aristata	2	0.67	2	0.33	positive
Clerodendrum tomentosum	2	1.00	1	0.08	positive
Dichondra repens	4	0.67	3	0.39	positive
Doodia aspera	3	0.50	2	0.10	positive
Echinopogon ovatus	2	0.50	2	0.21	positive
Eucalyptus deanei	5	1.00	4	0.07	positive
Eustrephus latifolius	2	0.67	1	0.15	positive
Geitonoplesium cymosum	3	1.00	2	0.28	positive
Indigofera australis	2	0.50	2	0.18	positive
Melaleuca styphelioides	3	0.50	2	0.06	positive
Morinda jasminoides	2	0.50	2	0.06	positive
Oplismenus aemulus	5	0.67	2	0.09	positive
Pandorea pandorana subsp. pandorana	2	0.67	2	0.24	positive
Pellaea falcata	2	0.50	2	0.14	positive
Pittosporum revolutum	2	0.67	1	0.07	positive
Poa labillardierei var. labillardierei	2	0.50	2	0.14	positive
Pratia purpurascens	2	0.83	2	0.32	positive
Pteridium esculentum	2	0.67	2	0.37	positive
Rubus moluccanus var. trilobus	2	0.50	1	0.02	positive
Smilax australis	3	0.67	2	0.06	positive
Stephania japonica var. discolor	3	1.00	2	0.09	positive
Syncarpia glomulifera subsp. glomulifera	2	0.50	4	0.12	positive
Tylophora barbata	3	0.67	2	0.17	positive
Lomandra longifolia	4	1.00	2	0.57	constant

MU11 ESCARPMENT GREY GUM FOREST

Number of Sites: 35 No. taxa/plot: 55.2

❑ *DESCRIPTION*

Escarpment Grey Gum Forest is a widespread sheltered forest found on the Permian soils in the Burragorang, Nattai and Little River Valleys. It is associated with deeper colluvial soils on escarpment midslopes and benches on southern and eastern aspects. This community is generally found at elevations between 200 and 450 metres above sea level.

Escarpment Grey Gum Forest is a tall forest with a canopy dominated by *Eucalyptus punctata* and *Allocasuarina torulosa*. *Eucalyptus tereticornis, E. fibrosa, Syncarpia glomulifera* subsp. *glomulifera* and *E. deanei* also occur, but are less frequent. The understorey typically has a relatively sparse shrub layer comprised of *Breynia oblongifolia, Olearia viscidula, Indigofera australis* and *Clerodendrum tomentosum*. The retention of soil moisture provides for a typically dense cover of herbaceous species mixed with low growing vines, some ferns and grasses. Common ground cover species include *Dichondra repens, Desmodium varians, Pratia purpurascens, Plectranthus parviflorus, Tylophora barbata, Glycine clandestina, Oplismenus imbecillis, Adiantum aethiopicum, Microlaena stipoides* var. *stipoides* and *Lomandra longifolia*.

This community grades into MU10 Sheltered Escarpment Blue Gum Forest and MU12 Escarpment Tall Box Forest in more protected locations. As soil depth decreases and the aspect becomes more exposed, MU24 Escarpment Slopes Dry Ironbark Woodland becomes increasingly prevalent.

Distribution of this community outside of the reserves and the Warragamba Special Area is not well understood. It is unlikely to be extensive elsewhere as available knowledge (NPWS, 2000a) point to different plant community occurring in deep gorges and escarpment slopes of the Shoalhaven and Wingecarribee Catchments. This community has been identified as widespread in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 28m. Mean Projected Canopy Cover 30% SD 13.1

Eucalyptus punctata, Eucalyptus tereticornis, Eucalyptus deanei

Minor associates: *Eucalyptus fibrosa, Syncarpia glomulifera* subsp. *glomulifera, Angophora floribunda, Eucalyptus crebra, Eucalyptus eugenioides, Eucalyptus hypostomatica, Eucalyptus moluccana*

Small Trees: Mean Upper Height 13m. Mean Projected Canopy Cover 15% SD 12.9

Allocasuarina torulosa, Melaleuca styphelioides, Backhousia myrtifolia

Shrubs: Mean Upper Height 2m. Mean Projected Canopy Cover 7% SD 5.1

Breynia oblongifolia, Olearia viscidula, Indigofera australis, Clerodendrum tomentosum, Persoonia linearis, Notelaea longifolia forma *longifolia*

Ground Covers: Mean Upper Height 0.8m. Mean Projected Canopy Cover 40% SD 25.6

Dichondra repens, Desmodium varians, Pratia purpurascens, Plectranthus parviflorus, Tylophora barbata, Glycine clandestina, Oplismenus imbecillis, Adiantum aethiopicum, Microlaena stipoides, Lomandra longifolia, Pseuderanthemum variabile, Dianella caerulea, Geitonoplesium cymosum, Billardiera scandens var. *scandens, Eustrephus latifolius.*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A tall forest with abundant Forest Oak (*Allocasuarina torulosa*) in combination with Grey Gum (*Eucalyptus punctata*) is particularly indicative of this community.
- Well developed cover of herbs, grasses and vines on moderately deep colluvial Permian Sediments.
- This community tends to occupy sheltered midslopes locations in preference to upper escarpment slopes, lower slopes, footslopes or valley flats.

❑ *EXAMPLE LOCATIONS*

Sheltered escarpment slopes off East and West Nattai Walls; Wanganderry Walls; Sheehys Creek; Burragorang Walls

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	2430	61
B Medium	1353	34
C High	218	5
Total	**4002**	**100**

❑ *THREATENED PLANT SPECIES*

Eucalyptus hypostomatica (3RC-), *Lissanthe sapida* (3RCa), *Lomandra fluviatilis* (3RCa), *Myoporum floribundum* (3RCi), *Epacris coriacea* (3RC-), *Eucalyptus hypostomatica* (3RC-), *Grevillea longifolia* (2RC-)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Adiantum aethiopicum	2	0.61	2	0.21	positive
Allocasuarina torulosa	3	0.85	3	0.15	positive
Billardiera scandens var. scandens	2	0.51	1	0.32	positive
Breynia oblongifolia	2	0.59	1	0.17	positive
Cayratia clematidea	2	0.51	2	0.06	positive
Cissus hypoglauca	2	0.56	2	0.08	positive
Clerodendrum tomentosum	2	0.61	1	0.06	positive
Desmodium varians	2	0.80	2	0.26	positive
Dianella caerulea	2	0.83	2	0.33	positive
Dichondra repens	3	0.76	2	0.35	positive
Doodia aspera	2	0.51	2	0.09	positive
Entolasia marginata	2	0.51	2	0.08	positive
Eucalyptus punctata	4	0.65	3	0.33	positive
Eustrephus latifolius	2	0.51	1	0.14	positive
Geitonoplesium cymosum	2	0.83	2	0.27	positive
Glycine clandestina	2	0.76	2	0.29	positive
Hardenbergia violacea	2	0.59	1	0.26	positive
Indigofera australis	2	0.56	2	0.18	positive
Lepidosperma laterale	2	0.56	2	0.25	positive
Lomandra fluviatilis	3	0.05	0	0.00	positive
Microlaena stipoides	3	0.73	2	0.35	positive
Olearia viscidula	2	0.63	2	0.31	positive
Oplismenus imbecillis	3	0.66	2	0.16	positive
Pandorea pandorana subsp. pandorana	2	0.56	2	0.25	positive
Plectranthus parviflorus	2	0.76	2	0.15	positive
Pratia purpurascens	2	0.66	2	0.32	positive
Rubus parvifolius	2	0.54	2	0.11	positive
Stephania japonica var. discolor	2	0.56	2	0.08	positive
Tylophora barbata	3	0.80	2	0.15	positive
Lomandra longifolia	2	0.76	2	0.54	constant

MU12 ESCARPMENT TALL BOX FOREST

Number of Sites: 6 No. taxa/plot: 51.5

❑ *DESCRIPTION*

Escarpment Tall Box Forest is a restricted community, being found in isolated ribbons on benches directly below escarpment clifflines. It grows on Permian Sediments, and may trace a geological layer that is exposed beneath the sandstone plateau. The deep soils are combined with sandstone colluvium on protected aspects to produce a tall forest dominated by *Eucalyptus hypostomatica, E. tereticornis* and *E. punctata*. A number of smaller trees may be present *Brachychiton populneus* subsp. *populneus and Allocasuarina torulosa*. The latter species can be particularly abundant and can result in a soft cushion of *Casuarina* needles being present on the forest floor. The understorey is moderately shrubby with species such as *Olearia viscidula, Bursaria spinosa, Acacia parramattensis* and *Dodonaea viscosa* subsp. *angustifolia* commonly found. The ground layer is quite herbaceous and viny but provides little cover. Common species include *Desmodium varians, Eustrephus latifolius, Lepidosperma laterale, Geitonoplesium cymosum, Solanum prinophyllum, Clematis aristata* and *Stephania japonica* var. *discolor*.

This community is forms a component of several closely related vegetation communities found on sheltered aspects of the major Permian Valleys. Other communities MU11 Escarpmont Grey Gum Forest and MU12 Sheltered Escarpment Blue Gum Forest represent drier and moister grades respectively. The distribution of Escarpment Box Forest outside of the reserves is not well understood. In mapping for the Warragamba Special Area (NPWS, 2003c) similar communities were included within MU12 as areas were not considered extensive enough to map. Beyond this area, a similar vegetation community has been observed in Pokolbin State Forest and Yengo National Park in the Hunter Valley (D. Connolly *pers.obs*).

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 28m. Mean Projected Canopy Cover 29% SD 5.9

Eucalyptus hypostomatica, Eucalyptus punctata, Eucalyptus tereticornis

Minor associates: *Eucalyptus fibrosa, Eucalyptus globoidea*

Small Trees: Mean Upper Height 12m. Mean Projected Canopy Cover 12% SD 2.6

Brachychiton populneus subsp. *populneus, Allocasuarina torulosa, Pittosporum revolutum*

Shrubs: Mean Upper Height 2.8m. Mean Projected Canopy Cover 23% SD 21.0

Olearia viscidula, Bursaria spinosa, Acacia parramattensis, Dodonaea viscosa subsp. *angustifolia, Plectranthus parviflorus, Dodonaea triquetra, Indigofera australis*

Ground Covers: Mean Upper Height 0.8m. Mean Projected Canopy Cover 21% SD 11.4

Desmodium varians, Eustrephus latifolius, Lepidosperma laterale, Geitonoplesium cymosum, Solanum prinophyllum, Clematis aristata, Crassula sieberiana, Sarcopetalum harveyanum, Sigesbeckia orientalis subsp. *orientalis, Stephania japonica* var. *discolor, Tylophora barbata, Urtica incisa, Dichondra repens, Pandorea pandorana* subsp. *pandorana, Viola hederacea*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- The presence of the tall box, *Eucalyptus hypostomatica* with Grey Gum (*E. punctata*). Kurrajong (*Brachychiton populneus* subsp. *populneus*) is also often present.
- Escarpment benches and upper slopes directly below sandstone walls and cliffs in the Nattai and Little River Valleys.
- A rocky surface with a sandy loam soil. Port Jackson Fig (*Ficus rubiginosa*), Rough-fruit Pittosporum (*Pittosporum revolutum*) and Snake Orchid (*Cymbidium suave*) are sometimes seen growing amongst the boulders.
- A mix of shrub, grass and vine species comprise the generally sparse understorey. Common species include Wallaby Weed (*Olearia viscidula*), Slender Tick-trefoil (*Desmodium varians*), Wombat Berry (*Eustrephus latifolius*) and Scrambling Lily (*Geitonoplesium cymosum*).

❑ *EXAMPLE LOCATIONS*

Below Wanganderry Lookout; beneath escarpment cliffline on Nattai Road; Burragorang Walls;

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	601	83
B Medium	123	17
C High	0	0
Total	723	100

❑ *THREATENED PLANT SPECIES*

Eucalyptus hypostomatica (3RC-), *Myoporum floribundum* (3RCi)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Allocasuarina torulosa	4	0.83	2	0.15	positive
Brachyscome angustifolia var. angustifolia	2	0.50	1	0.13	positive
Dendrobium linguiforme	1	0.17	0	0.00	positive
Desmodium varians	2	0.83	2	0.21	positive
Dianella caerulea	2	0.67	2	0.43	positive
Dichondra repens	3	1.00	2	0.30	positive
Doodia caudata	3	0.17	0	0.00	positive
Entolasia marginata	2	0.50	2	0.16	positive
Eucalyptus fibrosa	4	0.50	3	0.05	positive
Eucalyptus hypostomatica	4	1.00	1	0.01	positive
Eucalyptus punctata	4	1.00	3	0.33	positive
Geitonoplesium cymosum	2	0.83	2	0.26	positive
Glycine clandestina	3	0.67	2	0.22	positive
Goodenia ovata	2	0.50	2	0.06	positive
Hardenbergia violacea	2	0.67	1	0.28	positive
Lepidium pseudohyssopifolium	1	0.17	0	0.00	positive
Lepidosperma laterale	2	0.83	2	0.40	positive
Lomandra longifolia	2	0.67	2	0.43	positive
Maytenus silvestris	1	0.17	0	0.00	positive
Melaleuca styphelioides	3	0.50	2	0.05	positive
Microlaena stipoides var. stipoides	2	0.67	2	0.42	positive
Olearia viscidula	3	1.00	2	0.30	positive
Oplismenus imbecillis	3	0.50	2	0.07	positive
Pandorea pandorana subsp. pandorana	3	0.67	2	0.19	positive
Plectranthus parviflorus	3	0.83	2	0.10	positive
Pratia purpurascens	2	0.50	2	0.28	positive
Solanum prinophyllum	2	1.00	1	0.21	positive
Solanum vescum	1	0.17	0	0.00	positive
Tylophora barbata	2	0.83	2	0.16	positive
Vernonia cinerea var. cinerea	2	0.50	1	0.06	positive
Entolasia stricta	2	0.67	2	0.55	constant
Persoonia linearis	2	0.67	2	0.50	constant

MU13 SHELTERED SANDSTONE BLUE-LEAVED STRINGYBARK FOREST

Number of Sites: 26 No. taxa/plot: 49.7

❑ *DESCRIPTION*

Sheltered Sandstone Blue-leaved Stringybark Forest is extensively distributed across mid to lower slopes in sandstone gullies of the Nattai and Wanganderry Tablelands. It is an open forest assemblage with a canopy dominated by *Corymbia gummifera, Eucalyptus punctata, E. piperita* and *E. agglomerata.* An unusual occurrence of *Angophora costata* near Mount Wanganderry is also included within this community. Sites of greater shelter may include small trees of *Acacia elata, Ceratopetalum gummiferum* and *Allocasuarina torulosa,* which occur just below the Eucalypt canopy. The shrub layer is more consistent with species such as *Persoonia linearis, Elaeocarpus reticulatus, Leucopogon lanceolatus* var. *lanceolatus, Astrotricha latifolia, Xylomelum pyriforme* and *Banksia spinulosa* var. *spinulosa* a common feature. These species generally reflect the drier, less protected locations that characterise this forest. Low shrubs such as *Lomatia silaifolia, Gonocarpus teucrioides* and *Phyllanthus hirtellus* grow amongst *Pteridium esculentum, Blechnum cartilagineum* and *Entolasia stricta.* Small vines including *Smilax glyciphylla* and *Pandorea pandorana* subsp. *pandorana* are found at low abundance.

Sheltered Sandstone Blue-leaved Stringybark Forest extends outside of the study area into the Warragamba Special Area and Metropolitan Catchments in areas of similar habitat. In the latter area it has been mapped and described as Nepean Sandstone Gully Forest (NPWS, 2003c). This community marks the gradient that links the exposed forests and woodlands of the ridges to the tall sheltered and closed forests of the deeper gorges. This community was mapped and described in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report. It is well conserved throughout its range.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 23.7m. Mean Projected Canopy Cover 33% SD 9.4

Corymbia gummifera, Eucalyptus punctata, Eucalyptus piperita, Eucalyptus agglomerata

Minor associates: *Angophora costata, Angophora floribunda, Eucalyptus deanei, Angophora bakeri, Eucalyptus sieberi, Syncarpia glomulifera* subsp. *glomulifera, Eucalyptus eugenioides, Eucalyptus globoidea*

Small Trees: Mean Upper Height 10m. Mean Projected Canopy Cover 19% SD 13.5

Elaeocarpus reticulatus, Ceratopetalum gummiferum, Allocasuarina torulosa, Acacia elata

Shrubs: Mean Upper Height 3.8m. Mean Projected Canopy Cover 20% SD 16.9

Persoonia linearis, Astrotricha latifolia, Leucopogon lanceolatus var. *lanceolatus, Xylomelum pyriforme, Banksia spinulosa* var. *spinulosa, Persoonia levis, Bossiaea* spp. (*neo-anglica, obcordata, heterophylla*), *Acacia obtusifolia, Leptospermum polygalifolium* subsp. *polygalifolium*

Ground Covers: Mean Upper Height 1m. Mean Projected Canopy Cover 37% SD 23.1

Lomatia silaifolia, Phyllanthus hirtellus, Gonocarpus teucrioides, Pteridium esculentum, Entolasia stricta, Dianella caerulea, Dampiera purpurea, Lepidosperma laterale, Xanthosia pilosa, Blechnum cartilagineum, Billardiera scandens var. *scandens, Lomandra longifolia*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Steep sandstone slopes (generally sheltered) of the Nattai and Wanganderry Tablelands.
- Open forest dominated by Red Bloodwood (*Corymbia gummifera*), Blue-leaved Stringybark (*Eucalyptus agglomerata*), Sydney Peppermint (*E. piperita*) and Grey Gum (*E. punctata*).
- Shrubs and small trees such as Narrow-leaved Geebung (*Persoonia linearis*), Blueberry Ash (*Elaeocarpus reticulatus*), Lance-leaf Beard-heath (*Leucopogon lanceolatus* var. *lanceolatus*) and *Astrotricha latifolia.*

❑ *EXAMPLE LOCATIONS*

Wild Goat Plateau; southern Nattai Tableland; north and south Wanganderry Tableland; and Bargo River area

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	9257	97
B Medium	54	1
C High	224	2
Total	**9535**	**100**

❑ *THREATENED PLANT SPECIES*

Lissanthe sapida (3RCa)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Astrotricha latifolia	2	0.62	2	0.08	positive
Banksia spinulosa var. spinulosa	2	0.50	2	0.21	positive
Blechnum cartilagineum	3	0.58	3	0.10	positive
Clematis aristata	2	0.69	2	0.34	positive
Corymbia gummifera	4	0.81	4	0.11	positive
Dampiera purpurea	2	0.62	2	0.16	positive
Dianella caerulea	2	0.73	2	0.34	positive
Elaeocarpus reticulatus	2	0.77	1	0.15	positive
Entolasia stricta	2	0.77	2	0.35	positive
Eucalyptus agglomerata	4	0.62	4	0.13	positive
Eucalyptus piperita	4	0.65	4	0.14	positive
Eucalyptus punctata	2	0.77	3	0.33	positive
Gonocarpus teucrioides	3	0.77	2	0.15	positive
Lepidosperma laterale	2	0.62	2	0.25	positive
Leucopogon lanceolatus var. lanceolatus	2	0.62	2	0.27	positive
Lomatia silaifolia	2	0.88	2	0.24	positive
Pandorea pandorana subsp. pandorana	2	0.50	2	0.25	positive
Persoonia linearis	3	0.92	2	0.43	positive
Phyllanthus hirtellus	2	0.85	2	0.27	positive
Polycarpaea corymbosa var. minor	3	0.04	0	0.00	positive
Pteridium esculentum	3	0.77	2	0.35	positive
Smilax glyciphylla	2	0.54	1	0.07	positive
Xylomelum pyriforme	2	0.62	2	0.06	positive
Lomandra longifolia	2	0.42	2	0.55	negative

MU14 COURIDJAH SHELTERED SANDSTONE FOREST

Number of Sites: 13 No. taxa/plot: 51.5

❑ *DESCRIPTION*

Couridjah Sheltered Sandstone Forest is found on the southern end of the Burragorang Tableland between Sheehys and Blue Gum Creeks. It has an unusual distribution in that it is found on ridgetops where a strong shale influence is present in the soil as well as in more typical sheltered forest locations on slopes and gullies. At first glance the community appears similar to other sheltered sandstone forests particularly MU13 Sheltered Sandstone Blue-leaved Stringybark Forest. However, in many locations the forest includes very dense stands of *Syncarpia glomulifera* var. *glomulifera* growing as small trees. This species is not present in MU13. While not always profuse, the species is often an indicator of changes to the soil in the Nattai and Bargo reserves. The tree species *Eucalyptus resinifera* subsp. *resinifera* is a similar indicator of the enriched soils, having been only recorded within this forest.

The forest is moderately tall and has a dense canopy dominated by *Eucalyptus piperita* and *E. punctata*. *Eucalyptus deanei* and *E. agglomerata* are also found as is either *Corymbia eximia* or *Corymbia gummifera*. A small tree layer is also usually present consisting of abundant *Allocasuarina torulosa*. Common shrub species include *Lomatia silaifolia, Leucopogon lanceolatus* var. *lanceolatus, Persoonia linearis, P. mollis* and *Elaeocarpus reticulatus*. Ground covers occur at lower abundance and are a mixture of shelter loving species such as *Dianella caerulea, Entolasia stricta, Lomandra longifolia, Pteridium esculentum* and *Clematis aristata*. Shrubs common to MU13 such as *Banksia spinulosa* var *spinosa* are not frequently recorded within this community.

On Hoddles Track residual shale caps provide soil deep and rich enough to support a distinctively tall forest compared to the surrounding ridgetop woodlands. The floristic composition of these sites are aligned to this community as they support a number of species more typical of sheltered locations such as *Eucalyptus deanei, E. punctata, Leucopogon lanceolatus* var. *lanceolatus* and *Ceratopetalum gummiferum*. The community is an interesting variation to the forests occurring throughout the broad plateaus of the Burragorang Tableland and Woodford Ranges in the Lower Blue Mountains NP. It is well protected in formal reserves though it is not extensive in area.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 23m. Mean Projected Canopy Cover 41% SD 8.6

Eucalyptus piperita, Eucalyptus punctata, Eucalyptus deanei, Eucalyptus agglomerata

Minor associates: *Corymbia eximia, Corymbia gummifera, Angophora floribunda, Eucalyptus resinifera* subsp. *resinifera, Eucalyptus elata, Eucalyptus crebra, Eucalyptus fibrosa*

Small Trees: Mean Upper Height 12m. Mean Projected Canopy Cover 23% SD 12.9

Allocasuarina torulosa, Syncarpia glomulifera subsp. *glomulifera, Acacia falciformis*

Shrubs: Mean Upper Height 4m. Mean Projected Canopy Cover 20% SD 13.7

Lomatia silaifolia, Leucopogon lanceolatus var. *lanceolatus, Persoonia linearis, Hibbertia aspera* subsp. *aspera, Persoonia mollis, Phyllanthus hirtellus, Elaeocarpus reticulatus, Persoonia levis, Pimelea linifolia, Astrotricha latifolia, Podolobium ilicifolium*

Ground Covers: Mean Upper Height 1m. Mean Projected Canopy Cover 37% SD 28.9

Dianella caerulea, Entolasia stricta, Lomandra longifolia, Pteridium esculentum, Clematis aristata, Lepidosperma laterale, Xanthosia pilosa, Blechnum cartilagineum, Glycine clandestina, Billardiera scandens var. *scandens, Hardenbergia violacea, Pomax umbellata*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A tall forest found on protected aspects of the southern Burragorang Tableland, between Sheehys Creek and Little River.
- A dense canopy dominated by Sydney Peppermint (*Eucalyptus piperita*), Grey Gum (*E. punctata*), Bloodwoods (*Corymbia eximia* or *Corymbia gummifera*) and often with a small tree layer of Forest Oak (*Allocasuarina torulosa*) and dense Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*).
- A diverse understorey with some shelter loving species such as Blueberry Ash (*Elaeocarpus reticulatus*) and Gristle Fern (*Blechnum cartilagineum*) mixed with species commonly found in more exposed locations including Narrow-leaved Geebung (*Persoonia linearis*).

❑ *EXAMPLE LOCATIONS*

Blue Gum Creek; Couridjah Creek; Kittys Creek; Slopes off Hoddles Track

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	793	52
B Medium	618	41
C High	115	8
Total	**1526**	**100**

❑ *THREATENED PLANT SPECIES*

Lissanthe sapida (3RCa)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Allocasuarina torulosa	4	0.69	2	0.15	positive
Blechnum cartilagineum	4	0.62	3	0.16	positive
Clematis aristata	2	0.77	2	0.25	positive
Dianella caerulea	2	1.00	2	0.43	positive
Eucalyptus piperita	4	0.77	4	0.35	positive
Eucalyptus resinifera subsp. resinifera	4	0.15	0	0.00	positive
Glycine clandestina	2	0.62	2	0.22	positive
Hibbertia aspera subsp. aspera	3	0.77	2	0.16	positive
Lepidosperma laterale	2	0.62	2	0.40	positive
Leucopogon lanceolatus var. lanceolatus	2	0.92	1	0.26	positive
Lomandra longifolia	2	0.85	2	0.43	positive
Lomatia silaifolia	2	0.85	2	0.46	positive
Persoonia levis	2	0.54	2	0.35	positive
Persoonia mollis	2	0.77	2	0.07	positive
Pteridium esculentum	3	0.69	2	0.40	positive
Tristaniopsis collina	2	0.54	3	0.02	positive
Viola hederacea	2	0.62	2	0.20	positive
Entolasia stricta	2	0.92	2	0.55	constant
Persoonia linearis	3	0.69	2	0.50	constant

MU15 NATTAI SANDSTONE DRY SHRUB FOREST

Number of Sites: 21 No. taxa/plot: 49.0

❑ *DESCRIPTION*

Nattai Sandstone Dry Shrub Forest is a dry open forest found on the broad Hawkesbury Sandstone ridges and exposed upper slopes of the Nattai, Wanganderry and Burragorang Tablelands. The canopy is moderately tall and open with *Corymbia gummifera, Eucalyptus piperita* and Stringybarks (*E. agglomerata, E. globoidea, E. oblonga* and *E. eugenioides*) most frequently recorded. The understorey is a diverse mix of low shrubs and heath species such as *Banksia spinulosa* var. *spinulosa, Persoonia levis, Leptospermum trinervium, Acacia linifolia, Xylomelum pyriforme* and *Leucopogon lanceolatus* var. *lanceolatus.* The sparse ground stratum is comprised of *Lomatia silaifolia, Entolasia stricta, Phyllanthus hirtellus, Pomax umbellata, Patersonia sericea* and *Lomandra obliqua.*

The broad ridgetops where Nattai Sandstone Dry Shrub Forest occurs have an infertile but marginally deeper soil than those types found on the bony narrow ridges where a heath understorey becomes more abundant. In these areas the canopy tends to be lower and more open supporting shrub-heath woodlands such as MU26 Exposed Burragorang Sandstone Shrub Woodland. This community was mapped in the Warragamba Special Area (NPWS, 2003b) and is known to occur extensively across the Nattai and Lacys Tablelands. This profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 21m. Mean Projected Canopy Cover 38% SD 7.3

Corymbia gummifera, Eucalyptus piperita, Eucalyptus agglomerata, Eucalyptus globoidea, Eucalyptus oblonga

Minor associates: *Syncarpia glomulifera* subsp. *glomulifera, Corymbia eximia, Eucalyptus punctata, Eucalyptus sieberi, Eucalyptus sclerophylla, Eucalyptus eugenioides, Eucalyptus fibrosa, Angophora bakeri*

Shrubs: Mean Upper Height 3.5m. Mean Projected Canopy Cover 29% SD 17.1

Banksia spinulosa var. *spinulosa, Persoonia levis, Leptospermum trinervium, Acacia linifolia, Xylomelum pyriforme, Leucopogon lanceolatus* var. *lanceolatus, Bossiaea neo-anglica, Leptomeria acida,*

Podolobium ilicifolium, Acacia ulicifolia, Grevillea mucronulata, Gompholobium latifolium, Pimelea linifolia, Persoonia linearis

Ground Covers: Mean Upper Height 0.9m. Mean Projected Canopy Cover 32% SD 21.1

Lomatia silaifolia, Entolasia stricta, Phyllanthus hirtellus, Pomax umbellata, Patersonia sericea, Lomandra obliqua, Billardiera scandens var. *scandens, Xanthosia pilosa, Dianella caerulea, Goodenia hederacea* subsp. *hederacea, Hovea linearis*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Broad Hawkesbury Sandstone ridges and exposed upper slopes of the Nattai, Wanganderry and Burragorang Tablelands.
- Open Forest dominated by Red Bloodwood (*Corymbia gummifera*), Sydney Peppermint (*Eucalyptus piperita*) and Stringybarks (*E. agglomerata, E. globoidea, E. eugenioides, E. oblonga*). Note the Stringybarks are difficult to identify in this region and are a source of taxonomic uncertainty.
- Diverse shrub understorey featuring Banksias, Geebungs (*Persoonia* spp.), Wattles (*Acacia ulicifolia, A. linifolia*) and Tea-tree (*Leptospermum trinervium*).

❑ *EXAMPLE LOCATIONS*

Centre Ridge, Wattle Ridge, Long Nose Ridge (Nattai Tableland); Mount Gorman, Bonnum Pic (Wanganderry Tablelands)

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	4565	85
B Medium	804	15
C High	2	0
Total	**5371**	**100**

❑ *THREATENED PLANT SPECIES*

Persoonia hirsuta (E1), *Tetratheca glandulosa* (V), *Lissanthe sapida* (3RCa), *Lomandra fluviatilis* (3RCa)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

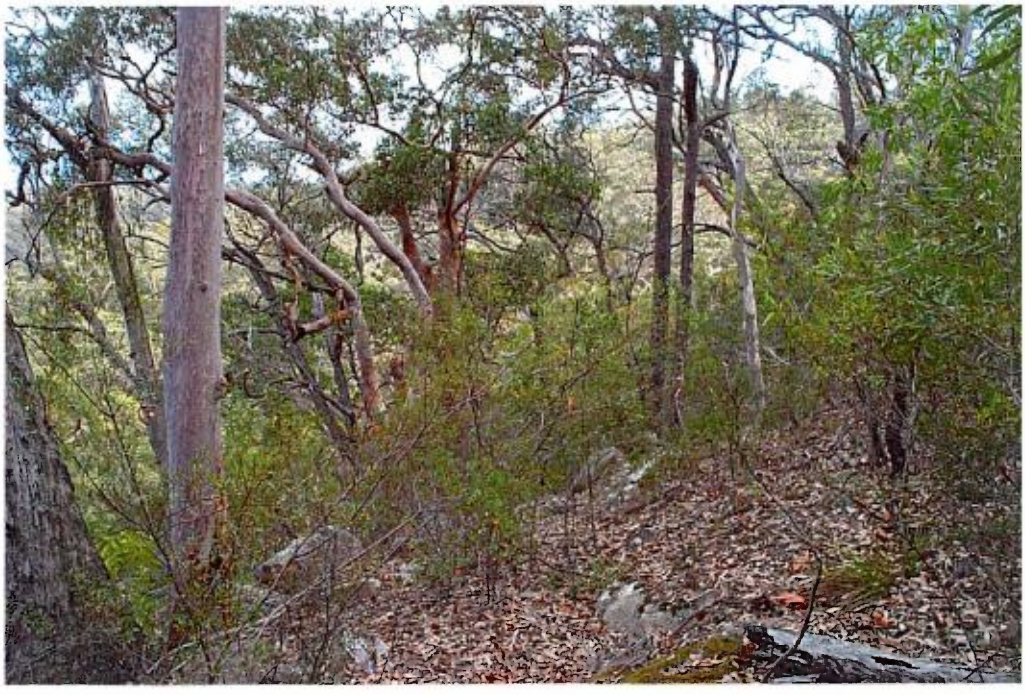
Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia linifolia	2	0.62	2	0.08	positive
Banksia spinulosa var. spinulosa	3	0.71	2	0.21	positive
Billardiera scandens var. scandens	2	0.67	1	0.32	positive
Boronia polygalifolia	1	0.05	0	0.00	positive
Bossiaea neo-anglica	3	0.52	2	0.01	positive
Corymbia gummifera	3	0.95	4	0.11	positive
Dianella caerulea	2	0.52	2	0.35	positive
Dillwynia elegans	4	0.05	0	0.00	positive
Entolasia stricta	3	0.90	2	0.35	positive
Eucalyptus piperita	4	0.71	4	0.14	positive
Lepidosperma laterale	2	0.52	2	0.26	positive
Leptomeria acida	2	0.52	1	0.07	positive
Leptospermum trinervium	4	0.62	3	0.16	positive
Leucopogon lanceolatus var. lanceolatus	2	0.57	2	0.27	positive
Lomandra obliqua	2	0.76	2	0.19	positive
Lomatia silaifolia	2	1.00	2	0.24	positive
Patersonia sericea	2	0.81	2	0.07	positive
Persoonia hirsuta	2	0.05	0	0.00	positive
Persoonia levis	2	0.71	1	0.14	positive
Phyllanthus hirtellus	2	0.90	2	0.27	positive
Platysace linearifolia	2	0.57	2	0.06	positive
Podolobium ilicifolium	2	0.52	2	0.17	positive
Pomax umbellata	2	0.86	2	0.29	positive
Pultenaea hispidula	4	0.05	0	0.00	positive
Xanthosia pilosa	2	0.67	2	0.07	positive
Xylomelum pyriforme	2	0.62	2	0.07	positive
Lomandra longifolia	2	0.33	2	0.55	negative

MU16 HIGHLANDS SANDSTONE DRY SHRUB FOREST

Number of Sites: 22 No. taxa/plot: 44

❑ *DESCRIPTION*

Highlands Sandstone Dry Shrub Forest is found on the higher elevation sandstone sediments of the southern Nattai and Wanganderry Tablelands. It is generally found across elevations between 500 and 800 metres in the south west corner of the study area. The principal canopy species are *Eucalyptus agglomerata, E. punctata, E. sieberi, Angophora costata, E. piperita* and *E. sclerophylla. Eucalyptus sieberi* and *E. piperita* are often dominant in exposed positions. *Eucalyptus agglomerata* and *E. punctata* tend to occur on the upper slopes and crests where soils are marginally deeper and sometimes slightly shale influenced. The forest is tall, usually above twenty metres in height, and may include *Allocasuarina littoralis* as a small tree layer. The forest has an open cover of tall dry shrubs. This includes *Persoonia linearis, P. levis, Leptomeria acida, Acacia terminalis, A. ulicifolia, Podolobium ilicifolium, Banksia spinulosa* var. *spinulosa, Bossiaea obcordata* and *Leptospermum trinervium.* The presence of *Boronia algida* in the shrub layer is indicative of the higher elevations. Low growing shrubs feature prominently amongst the ground covers. These include *Phyllanthus hirtellus, Tetratheca thymifolia* and *Hibbertia empetrifolia* subsp. *empetrifolia. Patersonia glabrata, Pomax umbellata, Stypandra glauca* and *Entolasia stricta* are also common amongst this sparse low stratum.



Outside of the study area this community is more extensively distributed throughout the Shoalhaven and Wollondilly Catchments (Forest Ecosystem 15, NPWS 2000a). NPWS (2000a) suggests that the original distribution has been reduced through clearing with only small areas currently located in formal reserves. Within the study area, this community grades into MU15 Nattai Sandstone Dry Shrub Forest, which is found at lower elevations to the north and east. This community was mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 21m. Mean Projected Canopy Cover 24% SD 10.1

Eucalyptus agglomerata, Eucalyptus punctata, Eucalyptus sieberi, Angophora costata, Eucalyptus piperita, Eucalyptus sclerophylla

Minor associates: *Eucalyptus globoidea, Eucalyptus sideroxylon, Syncarpia glomulifera* subsp. *glomulifera, Angophora floribunda, Eucalyptus elata*

Shrubs: Mean Upper Height 6.6m. Mean Projected Canopy Cover 19% SD 12.7

Persoonia linearis, Persoonia levis, Tetratheca thymifolia, Podolobium ilicifolium, Bossiaea obcordata, Leptospermum trinervium, Banksia spinulosa var. *spinulosa, Leptomeria acida, Allocasuarina littoralis*

Ground Covers: Mean Upper Height 0.8m. Mean Projected Canopy Cover 10% SD 7.9

Pomax umbellata, Entolasia stricta, Stypandra glauca, Dampiera purpurea, Lomatia silaifolia, Pteridium esculentum

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Crests and upper slopes of the southern Nattai and Wanganderry Tablelands, above 500 metres in elevation.
- A canopy dominated by Blue-leaved Stringybark (*Eucalyptus agglomerata*) and sometimes Silvertop Ash (*E. sieberi*), Sydney Peppermint (*E. piperita*) and Smooth-barked Apple (*Angophora costata*). Grey Gum (*E. punctata*) is often associated with these species.
- An absence of Red Bloodwood (*Corymbia gummifera*) which is consistently found on sandstones of lower elevations, but not within in this community.
- A tall dry shrub layer comprising *Banksia spinulosa* var. *spinulosa*, Geebungs (*Persoonia* spp.) and Sunshine Wattle (*Acacia terminalis*).
- The prominence of Nodding Blue Lily (*Stypandra glauca*) amongst a sparse ground cover.

❑ *EXAMPLE LOCATIONS*

Ridgetops north of Mt Wanganderry; Burragorang Lookout; Wanganderry Lookout

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	4040	95
B Medium	148	3
C High	81	2
Total	**4269**	**100**

❑ *THREATENED PLANT SPECIES*

Hakea constablei (2RCa)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Banksia spinulosa var. spinulosa	2	0.56	2	0.21	positive
Billardiera scandens var. scandens	2	0.76	1	0.32	positive
Boronia algida	2	0.04	0	0.00	positive
Bossiaea obcordata	3	0.68	2	0.08	positive
Dampiera purpurea	2	0.72	2	0.16	positive
Entolasia stricta	2	0.80	2	0.35	positive
Eucalyptus agglomerata	4	0.72	4	0.13	positive
Gonocarpus teucrioides	2	0.68	2	0.15	positive
Goodenia hederacea subsp. hederacea	3	0.76	2	0.25	positive
Hibbertia empetrifolia subsp. empetrifolia	2	0.80	2	0.07	positive
Leptospermum trinervium	2	0.60	3	0.16	positive
Lomandra cylindrica	2	0.52	2	0.04	positive
Lomandra obliqua	2	0.60	2	0.19	positive
Lomatia silaifolia	2	0.72	2	0.25	positive
Patersonia glabrata	2	0.80	2	0.10	positive
Persoonia levis	2	0.76	2	0.14	positive
Persoonia linearis	2	1.00	2	0.43	positive
Phyllanthus hirtellus	2	0.72	2	0.27	positive
Podolobium ilicifolium	2	0.72	2	0.16	positive
Pomax umbellata	2	0.88	2	0.28	positive
Stypandra glauca	3	0.72	3	0.20	positive
Tetratheca thymifolia	2	0.76	2	0.03	positive
Lomandra longifolia	1	0.40	2	0.55	negative

MU17 TABLELANDS RIVER OAK FOREST

Number of Sites: 15 No. taxa/plot: 54.1

❑ *DESCRIPTION*

Tablelands River Oak Forest is found along the fringes of major watercourses and associated river banks in broad valleys. Tall *Casuarina cunninghamiana* subsp. *cunninghamiana* form a narrow ribbon of vegetation on mobile alluvial sediments which settle amongst river boulders and pebbles. With increasing soil depth *Angophora floribunda* is common, often with a wide variety of Eucalypt species. The understorey is highly variable depending on time since flooding, soil depth, disturbance and distance from waterline. Commonly, the ground cover features a layer of rapid recolonising herbs and grasses such as *Microlaena stipoides, Dichondra repens, Lomandra longifolia* and *Oplismenus aemulus*. Close to the water edge *Juncus subsecundus, Ranunculus plebeius* and *R. lappaceus* are found. Shrubs are sparse and may include *Hymenanthera dentata, Ficus coronata* and on rocky river banks, the small tree *Tristaniopsis laurina*. Twiners and vines are common on rocks and amongst the ground cover with *Pandorea pandorana* subsp. *pandorana* and *Stephania japonica* var. *discolor* being typical.

Tablelands River Oak Forest is a highly variable in its floristic composition, with variations of it extending from the Tablelands to the Coast within the Sydney Basin Bioregion. Widespread clearing has depleted much of the original distribution, with existing areas often highly degraded by ongoing grazing pressures and weed infestation. Feral pigs also feed and wallow on the deeper soils of the riverbanks, which often support this community. This community was mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 26m. Mean Projected Canopy Cover 35% SD 17.3

Casuarina cunninghamiana subsp. *cunninghamiana*

Minor associates: *Backhousia myrtifolia, Eucalyptus tereticornis, Angophora floribunda, Eucalyptus eugenioides, Eucalyptus deanei, Eucalyptus crebra, Eucalyptus punctata, Eucalyptus quadrangulata*

Small Trees/Shrubs: Mean Upper Height 6m. Mean Projected Canopy Cover 21% SD 17

Hymenanthera dentata, Ficus coronata, Tristaniopsis laurina, Sigesbeckia orientalis subsp. *orientalis*

Ground Covers: Mean Upper Height 0.8m. Mean Projected Canopy Cover 51% SD 30.3

Microlaena stipoides, Lomandra longifolia, Oplismenus aemulus, Pandorea pandorana subsp. *pandorana, Dichondra repens, Entolasia marginata, Stephania japonica* var. *discolor, Rubus* spp., *Rumex brownii, Commelina cyanea, Isolepis inundata*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A canopy dominated by River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) growing on mobile alluvial sediments, on the fringes of major watercourses often with many river pebbles and boulders.
- An understorey dominated by herbs and grasses, but also containing vines and moisture loving small trees such as Sandpaper Fig (*Ficus coronata*) and Water Gum (*Tristaniopsis laurina*).

❑ *EXAMPLE LOCATIONS*

All major rivers within the study area including Wollondilly, Nattai and Little Rivers.

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	162	52
B Medium	50	16
C High	99	32
Total	**311**	**100**

❑ *THREATENED PLANT SPECIES*

Gonocarpus longifolius (3RC-)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Adiantum aethiopicum	3	0.50	2	0.22	positive
Amyema cambagei	1	0.13	0	0.00	positive
Casuarina cunninghamiana subsp. cunninghamiana	5	0.88	3	0.02	positive
Clematis glycinoides var. glycinoides	2	0.56	2	0.16	positive
Dichondra repens	2	0.69	3	0.36	positive
Entolasia marginata	2	0.63	2	0.09	positive
Geitonoplesium cymosum	2	0.50	2	0.29	positive
Hymenanthera dentata	3	0.94	2	0.08	positive
Leptospermum morrisonii	1	0.06	0	0.00	positive
Microlaena stipoides	4	1.00	2	0.36	positive
Oplismenus aemulus	3	0.75	2	0.07	positive
Pellaea falcata	2	0.56	2	0.16	positive
Potamogeton tricarinatus	4	0.06	0	0.00	positive
Ranunculus plebeius	3	0.06	0	0.00	positive
Rumex brownii	2	0.50	1	0.04	positive
Sigesbeckia orientalis subsp. orientalis	2	0.50	2	0.13	positive
Stephania japonica var. discolor	2	0.63	2	0.09	positive
Urtica incisa	3	0.56	2	0.06	positive
Lomandra longifolia	2	0.88	2	0.54	constant

MU18 PERMIAN FOOTSLOPES GRASSY RED GUM-BOX FOREST

Number of Sites: 9 No. taxa/plot: 52.4

❑ *DESCRIPTION*

Permian Footslopes Grassy Red Gum-Box Forest is an open forest found on flat and gently sloping escarpment footslopes of the broad Burragorang and Nattai Valleys. *Eucalyptus moluccana* and *E. tereticornis* are prominent in this community which contrasts to their restricted distribution (especially *E. moluccana*) in surrounding vegetation communities. *Eucalyptus eugenioides* and *Angophora floribunda* are also frequent amongst the tree layer. Smaller trees are also usually present including *Acacia parramattensis, Acacia floribunda* and *Melaleuca styphelioides*. Shrubs commonly present include *Olearia viscidula, Rubus parvifolius* and *Breynia oblongifolia*. The ground cover supports an abundant cover of grasses such as *Microlaena stipoides* var. *stipoides, Entolasia marginata* and *Austrostipa ramosissima* with the herbs *Dichondra repens* and *Solanum prinophyllum* also common.

Permian Footslopes Grassy Red Gum-Box Forest is found on finer grained Permian sediments. These are typically found on lower escarpment slopes particularly at the confluence of major alluvial terraces. Much of the suitable habitat for this community is in the lower Burragorang Valley and has been flooded since the construction of Warragamba Dam. Remnants can be observed on some of the foreshores of Lake Burragorang and in footslopes of the Nattai River Valley.

The unusual occurrence of Grey Box Forest was noted in the field observations of Lembit (1989) who also commented on the conservation importance of such remnants. Many examples of this community are regenerating from previous disturbance associated with land clearing and grazing across the valley. Permian Footslopes Grassy Red Gum-Box Forest is closely related to other grassy forests and woodlands such as those found on richer soils derived from shale and porphyry material. This community was described and mapped as MU32 in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report. Similar forests are not described outside of the Special Area and the community is likely to be restricted to these major valley systems.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 23m. Mean Projected Canopy Cover 31% SD 10.9

Eucalyptus tereticornis, Eucalyptus eugenioides, Eucalyptus moluccana

Minor associates: *Angophora floribunda, Eucalyptus elata, Eucalyptus punctata, Eucalyptus fibrosa, Eucalyptus crebra*

Small Trees: Mean Upper Height 7m. Mean Projected Canopy Cover 18% SD 15.0

Acacia parramattensis, Acacia floribunda, Melaleuca styphelioides, Casuarina cunninghamiana subsp. *cunninghamiana, Allocasuarina torulosa, Brachychiton populneus* subsp. *populneus*

Shrubs: Mean Upper Height 2.3m. Mean Projected Canopy Cover 22% SD 9.5

Olearia viscidula, Rubus parvifolius, Pimelea linifolia, Hibbertia aspera subsp. *aspera, Breynia oblongifolia, Lissanthe strigosa, Phyllanthus gunnii, Clerodendrum tomentosum*

Ground Covers: Mean Upper Height 1m. Mean Projected Canopy Cover 40% SD 31.2

Microlaena stipoides var. *stipoides, Entolasia marginata, Austrostipa ramosissima, Solanum prinophyllum, Billardiera scandens* var. *scandens, Dichondra repens, Pratia purpurascens, Echinopogon ovatus, Stephania japonica* var. *discolor, Glycine clandestina, Poranthera microphylla, Pteridium esculentum, Clematis glycinoides* var. *glycinoides, Veronica plebeia, Oplismenus aemulus*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- The presence and abundance of Grey Box (*Eucalyptus moluccana*) and Forest Red Gum (*E. tereticornis*) are dominant features of this community, being rarely found in other vegetation communities growing on Permian soils. A small tree layer generally occurs typically including Wattles (*Acacia* spp.) and Rough-barked Apple (*Angophora floribunda*).
- This community has a predominantly grassy understorey. Indicative understorey species include *Microlaena stipoides* var. *stipoides*, Bordered Panic Grass (*Entolasia marginata*), Stout Bamboo Grass (*Austrostipa ramosissima*), Forest Nightshade (*Solanum prinophyllum*), Kidney Weed (*Dichondra repens*) and Wallaby Weed (*Olearia viscidula*).
- Found in disturbed isolated patches on escarpment footslopes and benches predominantly around the foreshores of Lake Burragorang and through the Nattai River Valley.

❑ *EXAMPLE LOCATIONS*

Footslopes in the Nattai River Valley (Colleys Flat, Middle Flat, McArthurs Flat); Disturbed remnants on the foreshores of Lake Burragorang (Tonalli River, Lacys Creek and Blattman Point)

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	239	31
B Medium	155	20
C High	374	49
Total	**767**	**100**

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia filicifolia	1	0.11	0	0.00	positive
Acacia parramattensis	2	0.67	1	0.07	positive
Alternanthera denticulata	2	0.11	0	0.00	positive
Austrostipa ramosissima	2	0.67	2	0.03	positive
Babingtonia pluriflora	4	0.11	0	0.00	positive
Billardiera scandens var. scandens	2	0.78	1	0.48	positive
Calystegia marginata	1	0.11	0	0.00	positive
Cheilanthes sieberi subsp. sieberi	2	0.78	1	0.18	positive
Chenopodium pumilio	1	0.11	0	0.00	positive
Dichondra repens	2	0.89	2	0.30	positive
Entolasia marginata	3	0.67	2	0.16	positive
Eucalyptus eugenioides	4	0.56	3	0.06	positive
Eucalyptus tereticornis	4	0.78	4	0.12	positive
Gahnia aspera	2	0.56	2	0.07	positive
Hydrocotyle laxiflora	2	0.67	2	0.13	positive
Lissanthe strigosa	3	0.56	2	0.18	positive
Lomandra longifolia	2	0.67	2	0.43	positive
Microlaena stipoides var. stipoides	4	0.89	2	0.42	positive
Olearia viscidula	2	0.89	2	0.30	positive
Pimelea curviflora var. subglabrata	4	0.22	0	0.00	positive
Poranthera microphylla	2	0.67	2	0.13	positive
Pratia purpurascens	2	0.78	2	0.28	positive
Pterostylis longipetala	1	0.11	0	0.00	positive
Scaevola albida	2	0.11	0	0.00	positive
Stephania japonica var. discolor	2	0.56	2	0.11	positive
Entolasia stricta	2	0.44	2	0.55	negative
Persoonia linearis	1	0.56	2	0.50	negative

MU19 TRANSITIONAL SHALE DRY IRONBARK FOREST

Number of Sites: 21

❑ *DESCRIPTION*

Transitional Shale Dry Ironbark Forest occurs along the western edge of the Metropolitan Catchment where shale soils of the Cumberland Plain interface with the sandstone geologies of the Mittagong and Hawkesbury Formations. Remnant caps of shale soil also occur on top of the sandstone geologies at a number of disjunct locations in this area. The mix of both shale and sandstone soils produces a species composition that reflects the ecotone between the two environments. The ecotones vary in the degree of shale influence in the soil such that NPWS (2000b) identified two Transitional Shale-Sandstone Forests. This variation can be gradual as the distance from shale soil increases into sandstone geology or highly localised on the isolated shale caps. No attempt has been made to map these two variations separately.

Ironbarks (*Eucalyptus crebra, E. fibrosa* and *E. paniculata* subsp. *paniculata*) and Stringybarks (*E. globoidea* and *E. eugenioides*) characterise the canopy species in this community, with *Eucalyptus punctata* a regular associate species. Other associated canopy species depend upon the thickness of the shale soil. At greater thickness, boxes (*Eucalyptus moluccana* and *E. bosistoana*) and Forest red gum (*E. tereticornis*) are more pronounced, while *Corymbia gummifera* marks the sandstone end of the gradient. The shrub stratum responds similarly to slight changes in soil fertility. *Bursaria spinosa* is the characteristic species of the small shrub layer in areas with greater shale influence. Scattered individuals of *Allocasuarina littoralis*, *Acacia irrorata* subsp. *irrorata* and *Acacia decurrens* are an occasional taller shrub stratum. In contrast, additional species such as *Kunzea ambigua*, *Persoonia linearis*, *Banksia ericifolia* subsp. *ericifolia* and *B. spinulosa* var. *spinulosa* are more common in the shrub layer where the sandstone influence is greater. The ground cover is distinctly grassy, supporting an amalgam of *Themeda australis*, *Entolasia stricta*, *E. marginata*, *Imperata cylindrica* var. *major* and *Echinopogon caespitosus* var. *caespitosus*. *Lepidosperma laterale*, *Lomandra longifolia*, *Pomax umbellata*, *Glycine clandestina* and *Hardenbergia violacea* also feature prominently.

Transitional Shale Dry Ironbark Forest forms a component of Shale Sandstone Transition Forest listed on Part 3 of Schedule 1 of the NSW TSC Act (1995). Elsewhere, Benson and Howell (1994) refer to this community as Bargo Brush Forest, in response to early settler descriptions (cf. Atkinson, 1826, in Benson and Howell, 1994) of the vegetation in the Bargo area. The community is considerably more extensive than this area alone. Similar vegetation is present outside of the study area, extending northwards into

Holsworthy Military Area and Westwards near Picton and Camden. This community was identified in the Metropolitan Catchments mapping (NPWS, 2003c) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Trees: 20-30m tall. Mean Projected Canopy Cover 25%

Eucalyptus crebra, Eucalyptus fibrosa, Eucalyptus paniculata subsp. *paniculata, Eucalyptus globoidea, Eucalyptus eugenioides, Eucalyptus punctata*

Minor associates: *Eucalyptus moluccana, Eucalyptus bosistoana, Eucalyptus tereticornis, Eucalyptus longifolia, Corymbia gummifera, Eucalyptus pilularis, Eucalyptus oblonga, Eucalyptus sparsifolia, Eucalyptus resinifera* subsp. *resinifera, Eucalyptus beyeriana, Angophora floribunda, Syncarpia glomulifera* subsp. *glomulifera*

Shrubs: 2-5m tall. Mean Projected Canopy Cover 25%

Allocasuarina littoralis, Acacia decurrens, Acacia mearnsii, Acacia irrorata subsp. *irrorata, Bursaria spinosa, Angophora bakeri, Daviesia ulicifolia, Kunzea ambigua, Persoonia linearis, Banksia ericifolia* subsp. *ericifolia, Banksia spinulosa* var. *spinulosa, Ricinocarpos pinifolius, Jacksonia scoparia, Dodonaea triquetra, Lissanthe strigosa*

Ground Covers: Mean Upper Height m. Mean Projected Canopy Cover % SD

Themeda australis, Aristida vagans, Entolasia stricta, Entolasia marginata, Aristida ramosa, Imperata cylindrica var. *major, Lepidosperma laterale, Echinopogon caespitosus* var. *caespitosus, Hardenbergia violacea, Lomandra longifolia, Lomandra glauca, Lomandra multiflora* subsp. *multiflora, Opercularia diphylla, Pomax umbellata*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Ironbarks (*Eucalyptus fibrosa, E. paniculata* subsp. *paniculata* and *E. crebra*) in combination with White Stringybark (*E. globoidea*) and Grey Gum (*E. punctata*).
- Small and discontinuous patches of shale soil amongst an expanse of exposed sandstone woodland and forest. Restricted to the eastern edge of study area in the Bargo area.
- An open grassy understorey dominated by Kangaroo Grass (*Themeda australis*), Blady Grass (*Imperata cylindrica* var. *major*) and Spiny-headed Mat-rush (*Lomandra longifolia*). A shrub layer with typical sandstone species as well as a number usually found on shale. Species include Native Blackthorn (*Bursaria spinosa*), *Banksia* spp. and Dogwood (*Jacksonia scoparia*).

❑ *EXAMPLE LOCATIONS*

Yerrinbool; Avon Dam Road near Freeway Junction; Picton Road near Cascade Creek

❑ *CONDITION ASSESSMENT*

Forms a component of the Shale/Sandstone Transition Forest, an Endangered Ecological Community listed under the Threatened Species Act (1995).

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	45	56
B Medium	0	0
C High	35	44
Total	80	100

❑ *THREATENED PLANT SPECIES*

Epacris purpurascens var. *purpurascens* (V)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003c) and are based on a 1-6 Cover Score system.

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Aristida ramosa	2	0.67	2	0.02	positive
Dodonaea triquetra	3	0.67	2	0.12	positive
Entolasia marginata	3	0.67	2	0.23	positive
Eucalyptus globoidea	2	0.67	3	0.12	positive
Eucalyptus paniculata subsp. paniculata	3	0.67	3	0.01	positive
Eucalyptus punctata	2	1.00	2	0.08	positive
Glycine clandestina	2	0.67	1	0.13	positive
Jacksonia scoparia	2	0.67	1	0.01	positive
Kunzea ambigua	3	1.00	1	0.06	positive
Lepidosperma laterale	2	0.67	1	0.32	positive
Lomandra filiformis subsp. coriacea	2	0.67	2	0.10	positive
Lomandra longifolia	2	0.67	2	0.43	positive
Phyllanthus hirtellus	2	0.67	2	0.22	positive
Pomax umbellata	2	1.00	1	0.11	positive
Themeda australis	2	0.67	2	0.08	positive
Corymbia gummifera	2	0.67	2	0.52	constant
Entolasia stricta	2	1.00	2	0.53	constant

MU20 CUMBERLAND PLAIN SHALE SANDSTONE TRANSITION FOREST (HIGH SANDSTONE INFLUENCE)

Number of Sites: 59 No. taxa/plot: 50.1

❑ *DESCRIPTION*

Cumberland Plain Shale Sandstone Transition Forest (High Sandstone Influence) occurs along the very eastern edge of the Nattai and Bargo reserves between Buxton and Warragamba. A small area is found within the Nattai NP which links to more extensive areas found on the Burragorang Plateau to the east and north. Comprehensive survey, analysis and mapping of this community was undertaken by NPWS (2000b) and this information forms the basis of this profile. This community is extensively distributed around the periphery of the Cumberland Plain in close proximity to the shale/sandstone boundary. The majority of sample sites for this community were located within approximately 400 metres of the shale/ sandstone boundary and varied considerably in response to the degree of sandstone influence evident in the soil.

Cumberland Plain Shale Sandstone Transition Forest (High Sandstone Influence) is dominated by a wide variety of Eucalypt species. *Eucalyptus punctata* and *E. crebra* were regularly recorded, with *E. fibrosa*, *Corymbia gummifera* and *Syncarpia glomulifera* subsp. *glomulifera* occurring less frequently. Within the study area *Eucalyptus notabilis* and the closely related *E. resinifera* subsp. *resinifera* may be more prominent with *Corymbia eximia* also featured. A smaller tree stratum is usually present and is most often dominated by *Allocasuarina littoralis*, *Syncarpia glomulifera* subsp. *glomulifera* and *Acacia decurrens*. This community usually has a well-developed shrub layer which is more diverse in species than in communities with less sandstone influence in the soil. *Kunzea ambigua*, *Persoonia linearis* and *Bursaria spinosa* dominate the shrub stratum with *Jacksonia scoparia* becoming more common with increasing sandstone influence. The ground stratum is dominated by *Entolasia stricta*, *Themeda australis*, *Austrostipa pubescens*, *Lepidosperma laterale*, *Aristida vagans* and *Pomax umbellata*.

Cumberland Plain Shale Sandstone Transition Forest (High Sandstone Influence) is essentially a shale community, and is most likely to occur on shallow, residual clay soils derived from Wianamatta Shale.

However, it may also be found on high-quartz sandstone-derived soils where there is a strong colluvial shale influence (for example, the upper slopes of sandstone gullies adjoining shale soils), and on outcrops of pure shale soils derived from the Mittagong Formation. It occurs primarily on upper slopes and ridges on gently undulating terrain and grades into Cumberland Plain Shale Sandstone Transition Forest (Low Sandstone Influence) as the influence of shale increases (not found in the study area). Sometimes this transition is abrupt, and it may grade directly into Cumberland Shale Plains Woodland (outside the study area).

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 21m. Mean Projected Canopy Cover 20% SD 9.9

Eucalyptus punctata, Eucalyptus crebra

Minor associates: *Eucalyptus fibrosa, Eucalyptus eugenioides, Eucalyptus pilularis, Eucalyptus globoidea, Corymbia eximia, Eucalyptus notabilis, Eucalyptus beyeriana, Eucalyptus tereticornis, Corymbia gummifera*

Small Trees: Mean Upper Height 10m. Mean Projected Canopy Cover 11% SD 9.1

Syncarpia glomulifera subsp. *glomulifera, Allocasuarina littoralis, Acacia decurrens*

Shrubs: Mean Upper Height 3m. Mean Projected Canopy Cover 12% SD 10.6

Persoonia linearis, Kunzea ambigua, Pimelea linifolia subsp. *linifolia, Bursaria spinosa, Ozothamnus diosmifolius, Phyllanthus hirtellus*

Ground covers: Mean Upper Height 0.7m. Mean Projected Canopy Cover 34% SD 21.3

Lepidosperma laterale, Aristida vagans, Entolasia stricta, Lomandra multiflora subsp. *multiflora, Pomax umbellata, Panicum simile, Cheilanthes sieberi* subsp. *sieberi, Pratia purpurascens, Echinopogon caespitosus* var. *caespitosus, Themeda australis, Austrostipa pubescens, Glycine clandestina, Billardiera scandens*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- The canopy is dominated by Grey Gum (*Eucalyptus punctata*) and Narrow-leaved Ironbark (*E. crebra*). Blue Mountains Mahogany (*E. notabilis*) is prevalent between Buxton and Oakdale.
- The presence of Red and Yellow Bloodwood (*Corymbia gummifera* and *C. eximia*) help distinguish transition forests with high sandstone influence.
- A diverse shrub layer highlights its variation from communities found on richer shale soils. Such species include Tick Bush (*Kunzea ambigua*), Narrow-leaved Geebung (*Persoonia linearis*) and Dogwood (*Jacksonia scoparia*).
- The ground cover includes a diverse cover of grasses that are not present on soils derived from Quartz Sandstones. These include Threeawn Speargrass (*Aristida vagans*), Tufted Hedgehog Grass (*Echinopogon caespitosus* var. *caespitosus*) and Kangaroo Grass (*Themeda australis*).

❑ *EXAMPLE LOCATIONS*

Almost entirely outside the study area except for a few small patches in the Couridjah Area (Cedar Creek, Stonequarry Creek)

❑ *CONDITION ASSESSMENT*

Forms a component of the Shale/Sandstone Transition Forest, an Endangered Ecological Community listed under the Threatened Species Act (1995).

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	7	3
B Medium	11	58
C High	1	38
Total	**19**	**100**

❑ *THREATENED PLANT SPECIES*

Persoonia hirsuta (E1), *Lissanthe sapida* (3RCa)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below are taken straight from NPWS (2003b). Sites collected in the current study were not utilised to generate this list.

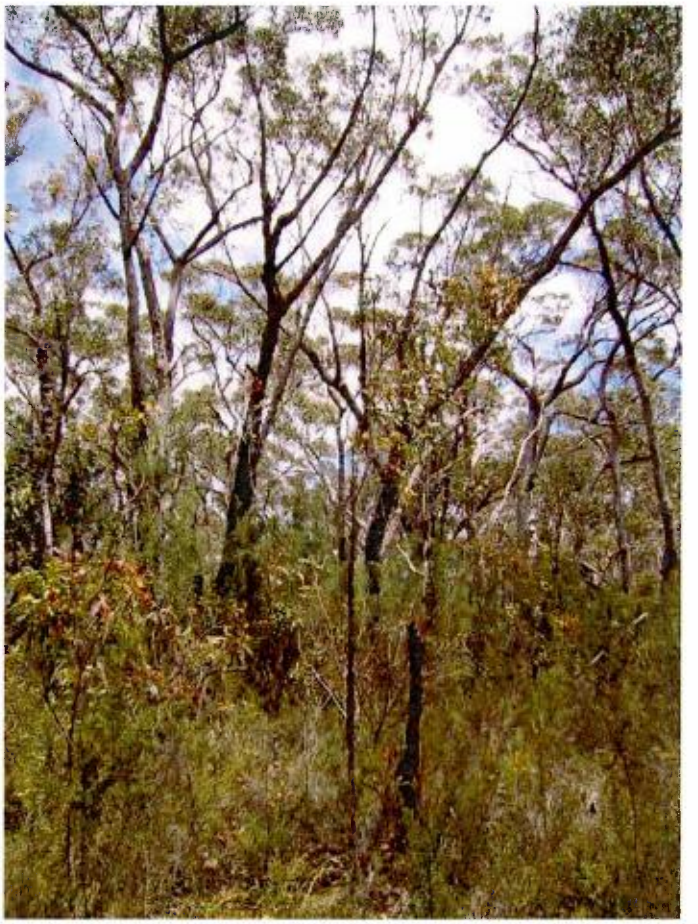
Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Allocasuarina torulosa	4	0.50	3	0.18	positive
Angophora costata	3	0.50	4	0.11	positive
Aristida vagans	2	0.88	2	0.13	positive
Austrostipa pubescens	3	0.63	2	0.05	positive
Billardiera scandens var. scandens	3	1.00	1	0.31	positive
Bursaria spinosa	2	0.50	2	0.22	positive
Corymbia gummifera	3	0.63	4	0.14	positive
Dianella caerulea	2	0.75	2	0.33	positive
Dichopogon strictus	1	0.13	0	0.00	positive
Entolasia marginata	3	0.50	2	0.11	positive
Entolasia stricta	3	1.00	2	0.41	positive
Eucalyptus eugenioides	4	0.63	4	0.13	positive
Glycine clandestina	2	1.00	2	0.32	positive
Gonocarpus tetragynus	2	0.75	2	0.24	positive
Goodenia hederacea subsp. hederacea	2	0.88	2	0.27	positive
Grevillea mucronulata	2	0.63	2	0.05	positive
Hardenbergia violacea	2	0.75	1	0.28	positive
Hibbertia aspera subsp. aspera	3	0.63	2	0.12	positive
Hibbertia diffusa	2	0.63	1	0.03	positive
Kunzea ambigua	4	0.50	1	0.02	positive
Lepidosperma laterale	3	0.50	2	0.28	positive
Lindsaea microphylla	2	0.63	1	0.10	positive
Lomandra multiflora subsp. multiflora	2	0.75	2	0.39	positive
Lomandra obliqua	2	0.63	2	0.21	positive
Melaleuca thymifolia	3	0.13	0	0.00	positive
Microlaena stipoides	3	0.50	2	0.41	positive
Panicum simile	2	0.88	1	0.06	positive
Persoonia lanceolata	2	0.13	0	0.00	positive
Persoonia linearis	2	1.00	2	0.44	positive
Phyllanthus hirtellus	2	1.00	2	0.31	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Pimelea linifolia subsp. linifolia	2	0.75	2	0.08	positive
Pomax umbellata	2	0.88	2	0.31	positive
Pratia purpurascens	2	0.63	2	0.32	positive
Syncarpia glomulifera subsp. glomulifera	4	1.00	4	0.11	positive
Themeda australis	3	0.63	1	0.08	positive
Tricoryne simplex	1	0.13	0	0.00	positive
Lomandra longifolia	3	0.50	2	0.58	constant

MU21 NEPEAN ENRICHED SANDSTONE WOODLAND

Number of Sites: 27

❑ *DESCRIPTION*



Nepean Enriched Sandstone Woodland is a moderately tall forest-woodland occurring on moderately enriched sandstone ridges at higher elevations above the Nepean and Bargo Rivers. *Corymbia gummifera* and *Eucalyptus globoidea/oblonga* occur consistently in the canopy. Other associate tree species are less regularly observed and include *Eucalyptus sieberi, E. piperita, E. sclerophylla* and *E. punctata.* The shrub layers comprise species that are common to other sandstone ridgetops such as *Banksia spinulosa* var. *spinulosa, Lambertia formosa, Petrophile pulchella, Hakea dactyloides* and *Leptospermum trinervium..* The ground cover is a mixture of *Cyathochaeta diandra, Entolasia stricta, E. marginata, Lomandra obliqua* and *L. filiformis* var. *filiformis* amongst small shrubs of *Phyllanthus hirtellus* and *Goodenia heterophylla.* A number of species appear unique to this community within the study area, including the small shrubs *Epacris calvertiana* var. *calvertiana* and *Daviesia acicularis* and the ground cover *Mirbelia platylobioides.*

Nepean Enriched Sandstone Woodland favours sandstone ridgetops from the Mittagong Formation. The Mittagong Formation alternates bands of shale and fine-grained sandstone (Herbert and Helby, 1980). This community is also found on Triassic Group Sandstones that are in close proximity to small, thin caps of Wianamatta Shale soil, such as on "Wattle Ridge". The sediments are characteristically sandstone, however, the minimal shale influence is likely to provide a slightly more fertile soil. Hence, the appearance of the forest is generally taller with a less heathy understorey than woodlands found on soils of pure Hawkesbury Sandstone (MU26 Exposed Burragorang Sandstone Shrub Woodland). This community was identified in the Metropolitan Catchments mapping (NPWS, 2003c) and this profile has been adapted from that report. It is widespread across the Nepean Catchments to the east.

❑ *FLORISTIC SUMMARY*

Trees: 25-35 m tall. Mean Projected Canopy Cover 45%

Corymbia gummifera, Eucalyptus globoidea, Eucalyptus oblonga, (including hybrids)

Minor associates: *Eucalyptus eugenioides, Eucalyptus piperita, Eucalyptus sieberi, Eucalyptus punctata*

Shrubs: 2-8m tall. Mean Projected Canopy Cover 35%

Banksia spinulosa var. *spinulosa, Persoonia levis, Lomatia silaifolia, Leptospermum trinervium, Acacia terminalis, Acacia myrtifolia, Acacia longifolia* subsp. *longifolia, Hakea dactyloides, Petrophile pulchella, Pimelea linifolia* subsp. *linifolia, Lambertia formosa, Hibbertia aspera* subsp. *aspera*

Ground Covers: 0-1m tall. Mean Projected Canopy Cover 20%

Cyathochaeta diandra, Patersonia sericea, Entolasia stricta, Entolasia marginata, Lomandra obliqua, Lomandra filiformis var. *filiformis, Dianella longifolia, Phyllanthus hirtellus*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Broad sandstone ridgetops and slopes at elevations greater than 450 metres draining into the Nepean, Burke, Bargo and Little Rivers.
- Sediments of Mittagong Formation where the colour of the soil tends to be red-orange and rock outcrops are infrequent or absent.
- A tall forest which has a dense canopy of Red Bloodwood (*Corymbia gummifera*) and White Stringybark (*Eucalyptus globoidea*) as a common thread (and sometimes completely dominating). Several other tree species co-occur including Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*) and Sydney Peppermint (*E. piperita*).
- The shrub understorey has a slightly different visual appearance to other exposed sandstone vegetation. *Banksia serrata* is not present in this assemblage, while elsewhere it is conspicuous. Sunshine Wattle (*Acacia terminalis*) is more commonly recorded in this community.
- The ground cover tends to be grassy with a dominance of Bordered Panic (*Entolasia marginata*), Wiry Panic (*Entolasia stricta*) and *Austrostipa pubescens*.

❑ *EXAMPLE LOCATIONS*

Camelot; Wattle Ridge; West Road Fire Trail; Fire Road P3, Bargo River;

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	3146	82
B Medium	192	5
C High	518	13
Total	**3856**	**100**

❑ *THREATENED PLANT SPECIES*

Acacia bynoeana (E1), *Persoonia glaucescens* (E1), *Persoonia hirsuta subsp. evoluta* (E1), *Persoonia acerosa* (V), *Lissanthe sapida* (3RCa)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003c) and are based on a 1-6 Cover Score system.

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Austrostipa pubescens	2	0.59	2	0.13	positive
Austrostipa verticillata	1	0.11	0	0.00	positive
Banksia spinulosa var. spinulosa	2	1.00	2	0.42	positive
Billardiera scandens	2	0.56	1	0.27	positive
Bossiaea obcordata	2	0.89	2	0.10	positive
Corymbia gummifera	2	0.89	2	0.50	positive
Cryptandra spinescens	2	0.04	0	0.00	positive
Cyathochaeta diandra	2	0.85	2	0.30	positive
Daviesia acicularis	1	0.04	0	0.00	positive
Dianella longifolia	2	0.56	2	0.05	positive
Epacris calvertiana var. calvertiana	1	0.04	0	0.00	positive
Eucalyptus sclerophylla	2	0.70	2	0.28	positive
Eucalyptus sieberi	2	0.59	2	0.23	positive
Euchiton sphaericus	1	0.04	0	0.00	positive
Goodenia bellidifolia subsp. bellidifolia	2	0.59	2	0.12	positive
Goodenia hederacea subsp. hederacea	2	0.63	2	0.09	positive
Grevillea phylicoides	1	0.04	0	0.00	positive
Hibbertia aspera subsp. aspera	2	0.56	2	0.11	positive
Lambertia formosa	2	0.56	2	0.37	positive
Leptospermum trinervium	2	0.67	2	0.47	positive
Lomandra filiformis subsp. filiformis	2	0.67	2	0.17	positive
Lomandra obliqua	2	0.78	2	0.43	positive
Lomatia silaifolia	2	0.89	1	0.38	positive
Mirbelia platylobioides	1	0.11	0	0.00	positive
Patersonia sericea	2	0.78	1	0.24	positive
Persoonia levis	2	0.81	1	0.46	positive
Petrophile pulchella	2	0.59	2	0.29	positive
Phyllanthus hirtellus	2	0.67	2	0.20	positive
Pimelea linifolia subsp. linifolia	2	0.59	2	0.19	positive
Tetratheca thymifolia	2	0.63	1	0.02	positive
Entolasia stricta	2	0.81	2	0.52	constant

MU22 HIGHLANDS TRANSITIONAL SHALE WOODLAND

Number of Sites: 3 No. taxa/plot: 51.2

❑ *DESCRIPTION*

Highlands Transitional Shale Woodland is restricted to residual shale soil overlying sandstone on the Southern Highlands around Mt Wanganderry. The degree of weathering of the original shale cap appears to result in a soil that blends both coarse and fine grained sediments which forms a transitional shale-sandstone substrate.

These soils support a moderately tall (to 25 metres) and open canopy dominated by *Eucalyptus globoidea* and *E. punctata* with a number of other less prominent Eucalypt species. The understorey comprises an open shrub layer of *Leptospermum polygalifolium* subsp. *polygalifolium, Helichrysum elatum, Olearia viscidula* and scattered *Persoonia linearis*. The lower stratum supports an open cover of herbs, grasses and climbers. The species composition reflects the influence of both shale and sandstone parent material in the soil. Typical combinations of species include *Gonocarpus tetragynus, Goodenia hederacea* subsp. *hederacea, Billardiera scandens* var. *scandens, Hardenbergia violacea, Hibbertia empetrifolia* subsp. *empetrifolia, Lomandra filiformis* subsp. *coriacea, Lomatia silaifolia, Phyllanthus hirtellus, Viola hederacea, Entolasia stricta* and *Pratia purpurascens*.

Highlands Transitional Shale Woodland is not described outside of the study area, although it is likely that the community is found in narrow bands at the interface of shale and sandstone geology throughout the Southern Highlands. It is also likely that clearing for agriculture has impacted on the original distribution of the community. This community is closely associated with the MU8 complex, Highlands Shale Tall Open Forest. Highlands Transitional Shale Woodland, however, has more sandstone influence in its soil, which is reflected by the abundance of herbs and sandstone shrubs. Indicative species include *Persoonia linearis*, *Goodenia hederacea* subsp. *hederacea, Billardiera scandens* var. *scandens* and *Gonocarpus tetragynus*. This community was mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 23m. Mean Projected Canopy Cover 28% SD 11.5

Eucalyptus globoidea, Eucalyptus punctata

Minor associates: *Eucalyptus tereticornis, Eucalyptus sieberi, Eucalyptus radiata* subsp. *radiata, Eucalyptus elata, Angophora costata*

Shrubs: Mean Upper Height 9m. Mean Projected Canopy Cover 26% SD 10.4

Allocasuarina littoralis, Leptospermum polygalifolium subsp. *polygalifolium, Helichrysum elatum, Olearia viscidula, Persoonia linearis, Acacia ulicifolia*

Ground Covers: Mean Upper Height 0.2m. Mean Projected Canopy Cover 30% SD 27.8

Gonocarpus tetragynus, Goodenia hederacea subsp. *hederacea, Billardiera scandens* var. *scandens, Hardenbergia violacea, Hibbertia empetrifolia* subsp. *empetrifolia, Lomandra filiformis* subsp. *coriacea, Lomatia silaifolia, Phyllanthus hirtellus, Viola hederacea, Entolasia stricta, Pratia purpurascens, Veronica plebeia*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Interface of shale and sandstone geologies at elevations above 600 metres.
- A moderately tall but open stand of trees that are dominated by White Stringybark (*Eucalyptus globoidea*), Grey Gum (*E. punctata*) and Forest Red Gum (*E. tereticornis*)
- An understorey that includes a mix of sclerophyllous shrubs such as Narrow-leaved Geebung (*Persoonia linearis*), *Leptospermum polygalifolium* subsp. *polygalifolium* and Straight Wattle (*Acacia stricta*) with an open grassy and herbaceous understorey that includes *Gonocarpus tetragynus, Goodenia hederacea* subsp. *hederacea*, Nodding Blue Lily (*Stypandra glauca*) and *Microlaena stipoides*.

❑ *EXAMPLE LOCATIONS*

Slopes around Mt. Wanganderry; High Range; Mt Flora; Mt Jellore

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	265	70
B Medium	6	2
C High	106	28
Total	**378**	**100**

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia longifolia subsp. longifolia	2	0.56	2	0.07	positive
Allocasuarina littoralis	2	0.67	2	0.12	positive
Billardiera scandens var. scandens	2	0.89	1	0.32	positive
Dianella revoluta var. revoluta	2	0.78	2	0.23	positive
Eucalyptus globoidea	4	0.78	4	0.03	positive
Eucalyptus punctata	4	0.78	3	0.34	positive
Gonocarpus tetragynus	3	0.89	2	0.19	positive
Goodenia hederacea subsp. hederacea	3	0.89	2	0.26	positive
Hardenbergia violacea	2	0.89	2	0.27	positive
Helichrysum scorpioides	4	0.56	2	0.11	positive
Hibbertia empetrifolia subsp. empetrifolia	2	0.67	2	0.09	positive
Hydrocotyle laxiflora	2	0.67	2	0.20	positive
Hypericum gramineum	2	0.56	2	0.14	positive
Joycea pallida	5	0.67	2	0.06	positive
Lomandra filiformis subsp. coriacea	2	0.67	2	0.15	positive
Lomandra multiflora subsp. multiflora	2	0.89	2	0.36	positive
Microlaena stipoides	3	0.89	2	0.36	positive
Olearia viscidula	2	0.78	2	0.32	positive
Opercularia diphylla	2	0.67	1	0.08	positive
Phyllanthus hirtellus	2	0.67	2	0.28	positive
Poranthera microphylla	2	0.67	2	0.18	positive
Stypandra glauca	4	0.56	3	0.21	positive
Viola hederacea	2	0.67	2	0.24	positive
Lomandra longifolia	2	0.33	2	0.55	negative

MU23 DRY ALLUVIAL PAPERBARK WOODLAND

Number of Sites: 13 No. taxa/plot: 58.5

❑ *DESCRIPTION*

Dry Alluvial Paperbark Woodland is found along the smaller drainage networks of flat or gently inclined Permian Sediments. It is found on a sandy loam alluvium within and adjoining creeklines of small intermittent creeks as well as on valley flats of the larger creeks and rivers. In the study area, Dry Alluvial Paperbark Woodland occurs along the Nattai River and in the Douglas Scarp Area.

Melaleuca styphelioides is the prominent tree species in Dry Alluvial Paperbark Woodland and occurs amongst the mid to upper strata. The height of this stratum is between six and twelve metres and is variable in cover abundance depending on location. A wide variety of tree species may occupy the drainage line or adjoining vegetation. The most frequently recorded species include *Angophora floribunda, Eucalyptus eugenioides, E. tereticornis* and *Casuarina cunninghamiana* subsp. *cunninghamiana*. Suitable habitat for this community is not particularly sheltered resulting in few mesic species in the shrub layer. *Backhousia myrtifolia* may occur amongst other shrubs and small trees such as *Acacia parramattensis, Callistemon salignus, Breynia oblongifolia, Astrotricha latifolia, Olearia viscidula, Indigofera australis, Acacia longifolia* subsp. *longifolia* and *Bursaria spinosa*. Common ground cover species include an abundance of grasses such as *Microlaena stipoides, Entolasia marginata* and *E. stricta*. The fern *Adiantum aethiopicum* and rush *Lomandra longifolia* and low shrub *Rubus parvifolius* are also frequently recorded. This community was mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report. The community is closely related floristically to the Burragorang River Flat Forest (MU9), and regional scale vegetation mapping has included this community within broader map units.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 24m. Mean Projected Canopy Cover 23% SD 11.0

Angophora floribunda, Eucalyptus eugenioides, Eucalyptus tereticornis

Minor associates: *Eucalyptus fibrosa, Eucalyptus punctata, Eucalyptus deanei, Eucalyptus sclerophylla, Eucalyptus piperita, Eucalyptus melliodora, Syncarpia glomulifera* subsp. *glomulifera*

Small Trees: Mean Upper Height 11.5m. Mean Projected Canopy Cover 23% SD 13.8

Melaleuca styphelioides, Acacia parramattensis, Casuarina cunninghamiana subsp. *cunninghamiana, Backhousia myrtifolia, Callistemon salignus, Brachychiton populneus* subsp. *populneus, Allocasuarina torulosa, Allocasuarina littoralis, Pittosporum revolutum, Pittosporum undulatum, Acacia falciformis, Acacia filicifolia, Acacia binervia, Acacia maidenii, Acacia elata*

Shrubs: Mean Upper Height 3m. Mean Projected Canopy Cover 23% SD 23.8

Breynia oblongifolia, Astrotricha latifolia, Olearia viscidula, Indigofera australis, Acacia longifolia subsp. *longifolia, Bursaria spinosa, Leptospermum polygalifolium* subsp. *polygalifolium, Persoonia linearis*

Ground Covers: Mean Upper Height 0.7m. Mean Projected Canopy Cover 43% SD 22.1

Adiantum aethiopicum, Microlaena stipoides, Dichondra repens, Lepidosperma laterale, Pratia purpurascens, Rubus parvifolius, Billardiera scandens var. *scandens, Entolasia marginata, Entolasia stricta, Gahnia aspera, Hydrocotyle laxiflora, Veronica plebeia, Oplismenus imbecillis, Glycine clandestina, Lomandra longifolia, Pteridium esculentum*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A dry grassy alluvial woodland with abundance of Prickly-leaved Tea-tree (*Melaleuca styphelioides*) and often dominated by *Microlaena stipoides*.
- High diversity of tall shrub and small tree species including Sydney Green Wattle (*Acacia parramattensis*), Sweet Willow Bottlebrush (*Callistemon salignus*), *Astrotricha latifolia*, *Leptospermum polygalifolium* subsp. *polygalifolium* and Rough-barked Apple (*Angophora floribunda*).
- Found on drainage lines of the Permian sediments in the dry Burragorang Valley, including gently sloping footslopes and alluvial flats.

❑ *EXAMPLE LOCATIONS*

Nattai River, valley flats; creeklines, Douglas Scarp Area

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	16	11
B Medium	87	59
C High	44	30
Total	**147**	**100**

❑ *THREATENED PLANT SPECIES*

Gonocarpus longifolius (3RC-)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia parramattensis	2	0.92	2	0.12	positive
Adiantum aethiopicum	2	0.92	2	0.23	positive
Angophora floribunda	3	0.54	2	0.09	positive
Astrotricha latifolia	3	0.54	2	0.09	positive
Backhousia myrtifolia	2	0.54	3	0.11	positive
Billardiera scandens var. scandens	2	0.69	1	0.31	positive
Breynia oblongifolia	2	0.69	1	0.19	positive
Callistemon salignus	3	0.23	0	0.00	positive
Cheilanthes sieberi subsp. sieberi	2	0.54	2	0.23	positive
Dichondra repens	3	0.77	3	0.38	positive
Entolasia marginata	2	0.69	2	0.10	positive
Entolasia stricta	2	0.69	2	0.41	positive
Eucalyptus eugenioides	3	0.54	4	0.13	positive
Gahnia aspera	2	0.69	2	0.09	positive
Hydrocotyle laxiflora	2	0.69	2	0.20	positive
Imperata cylindrica var. major	2	0.54	1	0.06	positive
Lepidosperma laterale	2	0.77	2	0.28	positive
Melaleuca styphelioides	4	0.77	2	0.06	positive
Microlaena stipoides	5	0.85	2	0.40	positive
Olearia viscidula	2	0.54	2	0.33	positive
Oplismenus imbecillis	3	0.62	2	0.16	positive
Phebalium squamulosum subsp. squamulosum	2	0.08	0	0.00	positive
Pratia purpurascens	2	0.77	2	0.32	positive
Pseuderanthemum variabile	2	0.54	2	0.08	positive
Pteridium esculentum	3	0.54	2	0.37	positive
Rubus parvifolius	2	0.77	2	0.13	positive
Veronica plebeia	2	0.69	2	0.23	positive
Lomandra longifolia	2	0.77	2	0.57	constant

MU24 ESCARPMENT SLOPES DRY IRONBARK WOODLAND

Number of Sites: 47 No. taxa/plot: 46.1

❑ *DESCRIPTION*

Escarpment Slopes Dry Ironbark Woodland is widespread on exposed escarpment slopes of the Nattai, Little and Burragorang Valleys. It is generally found on dry colluvial slopes that mix eroded Triassic Sandstone material with the Permian sediments of the underlying strata (sandstone, siltstone, and shale). The soil is generally shallow and infertile with some areas subject to slope erosion and landslip.

Escarpment Slopes Dry Ironbark Woodland is dominated by a low, sparse canopy cover of *Eucalyptus fibrosa, E. punctata, E. eugenioides* and less frequently *E. crebra*. A very open small tree layer comprising *Allocasuarina littoralis* and *Angophora bakeri* are often found. The small tree *Eucalyptus ralla* was also found to be locally abundant in a number of locations. The understorey is characterised by a dry open shrub layer that consistently includes *Persoonia linearis, Lissanthe strigosa* and *Notelaea longifolia* forma *longifolia*. The ground cover is more diverse, providing moderate cover, and includes *Entolasia stricta, Aristida vagans, Lomandra multiflora* subsp. *multiflora, L. obliqua, Dianella revoluta* var. *revoluta, Phyllanthus hirtellus* and *Pomax umbellata*. This community was mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report. It is extensively distributed throughout the Warragamba Special Area along Scotts Main Range and the Kedumba Valley. However it is not described outside of this area.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 20m. Mean Projected Canopy Cover 26% SD 11.8

Eucalyptus fibrosa, Eucalyptus punctata, Eucalyptus eugenioides, Eucalyptus crebra

Minor associates: *Eucalyptus agglomerata, Eucalyptus sclerophylla*

Small Trees: Mean Upper Height 6m. Mean Projected Canopy Cover 14% SD 12.9

Eucalyptus ralla, Allocasuarina littoralis, Angophora bakeri

Shrubs: Mean Upper Height 2.3m. Mean Projected Canopy Cover 12% SD 8.7

Persoonia linearis, Lissanthe strigosa, Notelaea longifolia forma *longifolia, Bursaria longisepala, Exocarpos strictus, Leptospermum trinervium, Podolobium ilicifolium, Grevillea aspleniifolia*

Ground Covers: Mean Upper Height 0.7m. Mean Projected Canopy Cover 29% SD 21.9

Aristida vagans, Lomandra multiflora subsp. *multiflora, Pomax umbellata, Goodenia hederacea* subsp. *hederacea, Dianella revoluta* var. *revoluta, Lomandra obliqua, Panicum simile, Lepidosperma laterale, Lepidosperma gunnii, Glycine clandestina, Billardiera scandens, Phyllanthus hirtellus*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Low open woodland on dry, exposed escarpment slopes that is characterised by Red Ironbark (*Eucalyptus fibrosa*), Grey Gum (*E. punctata*) and Thin-leaved Stringybark (*E. eugenioides*).
- A low open dry shrub layer of Narrow-leaved Geebung (*Persoonia linearis*) and Peach Heath (*Lissanthe strigosa*).
- A ground cover that includes Threeawn Speargrass (*Aristida vagans*), Two Colour Panic (*Panicum simile*) and Wiry Panic (*Entolasia stricta*).

❑ *EXAMPLE LOCATIONS*

Escarpment Slopes in the Wollondilly, Nattai and Little River Valleys

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	3041	42
B Medium	4057	56
C High	150	2
Total	7248	100

❑ *THREATENED PLANT SPECIES*

Bossiaea oligosperma (V), *Prostanthera cineolifera* (V), *Lomandra brevis* (2RC-)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Aristida vagans	2	0.81	2	0.09	positive
Bursaria longisepala	2	0.53	2	0.06	positive
Cheilanthes sieberi subsp. sieberi	2	0.57	2	0.24	positive
Cryptandra spinescens	2	0.02	0	0.00	positive
Dianella revoluta var. revoluta	2	0.77	2	0.21	positive
Entolasia stricta	2	0.91	2	0.33	positive
Eucalyptus fibrosa	4	0.77	2	0.04	positive
Eucalyptus punctata	4	0.89	3	0.31	positive
Eucalyptus ralla	4	0.02	0	0.00	positive
Exocarpos strictus	2	0.51	2	0.12	positive
Goodenia hederacea subsp. hederacea	2	0.83	2	0.24	positive
Hardenbergia violacea	2	0.62	1	0.25	positive
Lepidosperma laterale	2	0.51	2	0.25	positive
Lissanthe strigosa	2	0.81	2	0.14	positive
Lomandra multiflora subsp. multiflora	2	0.85	2	0.34	positive
Notelaea longifolia forma longifolia	2	0.62	1	0.15	positive
Persoonia linearis	2	1.00	2	0.41	positive
Phyllanthus hirtellus	2	0.85	2	0.26	positive
Pomax umbellata	2	0.89	2	0.27	positive
Pratia purpurascens	2	0.60	2	0.32	positive
Lomandra longifolia	2	0.57	2	0.55	constant

MU25 EXPOSED PERMIAN SANDSTONE WOODLAND

Number of Sites: 14 No. taxa/plot: 36.6

❑ *DESCRIPTION*

Exposed Permian Sandstone Woodland occupies the driest most impoverished sites on the Permian Geologies (Berry Formation and Illawarra Coal Measures). It is typically associated with highly exposed locations on skeletal soils often with outcropping sandstone bedrock on the footslopes of major escarpments of the Nattai and Little River Valleys.

This low dry open woodland includes species typical of both Triassic Sandstone and Permian geologies. Canopy height varies between eight and fifteen metres. While no single tree species is dominant, *Angophora bakeri* and *Corymbia gummifera* are often characteristic. The understorey contains a mix of shrub and heath species that includes *Xylomelum pyriforme, Hovea linearis, Banksia spinulosa* var. *spinulosa, Leptospermum trinervium, Acacia linifolia Persoonia linearis, Phyllanthus hirtellus* and *Dillwynia retorta*. The ground layer is mostly a mix of grasses and rushes often in low abundance. Typical species include *Lomandra obliqua, L. filiformis* subsp. *filiformis, Entolasia stricta, Cyathochaeta diandra* and *Pomax umbellata*. Rock boulders and exposed soil are common.

Unlike exposed shrubby woodlands found on the Hawkesbury and Narrabeen Sandstone Plateaux, this community is found on Sandstones associated with Permian geologies. As a result, exposed escarpment footslopes and narrow residual Permian Sandstone ridges form core areas for the distribution of this community. These areas are generally conspicuous as they are surrounded by the slightly more fertile shales and siltstones found within the Permian geology. This community was mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report. It is unlikely to be distributed outside of this area.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 19m. Mean Projected Canopy Cover 20% SD 8.1

Corymbia gummifera, Angophora bakeri

Minor associates: *Angophora costata, Eucalyptus punctata, Eucalyptus agglomerata, Eucalyptus sclerophylla, Eucalyptus sparsifolia*

Shrubs: Mean Upper Height 6m. Mean Projected Canopy Cover 20% SD 9.5

Hovea linearis, Xylomelum pyriforme, Dillwynia phylicoides, Dillwynia retorta, Persoonia linearis, Banksia spinulosa var. *spinulosa, Phyllanthus hirtellus, Leptospermum trinervium, Pimelea linifolia, Lomatia silaifolia, Acacia linifolia*

Ground covers: Mean Upper Height 0.7m. Mean Projected Canopy Cover 17% SD 17.8

Xanthorrhoea media, Lomandra obliqua, Entolasia stricta, Pomax umbellata, Goodenia hederacea subsp. *hederacea, Cyathochaeta diandra, Lomandra filiformis* subsp. *filiformis, Hardenbergia violacea, Stypandra glauca, Actinotus helianthi*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Locations on Permian sediments that are very dry and exposed with sandstone outcrops, such as exposed spurs and ridgelines with a rocky soil surface.
- An understorey with a very sparse coverage of ground dwelling species and a distinctive composition of sandstone shrubs with Flax-leaved Wattle (*Acacia linifolia*), Prickly Moses (*A. ulicifolia*), *Banksia spinulosa* var. *spinulosa* and Narrow-leaved Geebung (*Persoonia linearis*).
- Low open woodland often featuring Narrow-leaved Apple (*Angophora bakeri*) and Red Bloodwood (*Corymbia gummifera*).

❑ *EXAMPLE LOCATIONS*

Middle Flat; Nattai River Valley; Buckland Walls

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	255	68
B Medium	107	29
C High	13	4
Total	**375**	**100**

❑ *THREATENED PLANT SPECIES*

None Recorded

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Angophora bakeri	4	0.57	2	0.03	positive
Banksia spinulosa var. spinulosa	2	0.79	2	0.21	positive
Corymbia gummifera	4	0.50	4	0.12	positive
Cyathochaeta diandra	4	0.57	3	0.07	positive
Entolasia stricta	2	0.93	2	0.35	positive
Goodenia hederacea subsp. hederacea	2	0.79	2	0.26	positive
Hovea linearis	2	0.71	1	0.08	positive
Leptospermum trinervium	3	0.57	3	0.17	positive
Lomandra multiflora subsp. multiflora	2	0.64	2	0.36	positive
Lomandra obliqua	2	1.00	2	0.19	positive
Lomatia silaifolia	2	0.64	2	0.25	positive
Persoonia linearis	2	0.93	2	0.43	positive
Phyllanthus hirtellus	2	0.86	2	0.27	positive
Pimelea linifolia	2	0.50	2	0.07	positive
Podolobium ilicifolium	2	0.50	2	0.17	positive
Pomax umbellata	2	0.86	2	0.29	positive
Poranthera ericifolia	2	0.50	2	0.02	positive
Xanthorrhoea media	2	0.64	1	0.03	positive
Lomandra longifolia	0	0.00	2	0.56	negative

MU26 EXPOSED BURRAGORANG SANDSTONE SHRUB WOODLAND

Number of Sites: 32 No. taxa/plot: 43.0

❑ *DESCRIPTION*

Exposed Burragorang Sandstone Shrub Woodland is extensively distributed across ridgetops of Nattai, Burragorang and Wanganderry Tablelands on skeletal sandstone soils. It is a low open forest to woodland dominated by *Eucalyptus piperita* and *Corymbia gummifera* with Stringybarks (*E. sparsifolia* and *E. globoidea*). *Eucalyptus sieberi* is found at higher elevations but occurs less frequently and at lower abundance. A relatively dense sandstone shrub and heath layer is usually dominated by *Persoonia levis, Banksia spinulosa* var. *spinulosa, Hakea dactyloides, Acacia terminalis, Lambertia formosa* and *Leptospermum trinervium*. Ground covers include *Cyathochaeta diandra, Lomandra obliqua* and *Entolasia stricta* amongst low shrubs such as *Phyllanthus hirtellus, Bossiaea obcordata* and *Lomatia silaifolia*.

Exposed Burragorang Sandstone Shrub Woodland occurs across Hawkesbury and Narrabeen Sandstones at elevations between 250 and 800 metres. The infertile sandy substrates that this community occurs on are extensive across the Blue Mountains and Wollemi National Parks. Other vegetation communities found on sandstone are closely related. The distinguishing feature of Exposed Burragorang Sandstone Shrub Woodland is the increased abundance and diversity of sclerophyllous shrubs in the understorey. This community was mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 16m. Mean Projected Canopy Cover 26% SD 8.9

Eucalyptus piperita, Corymbia gummifera, Angophora costata, Eucalyptus sieberi, Eucalyptus sparsifolia

Minor associates: *Eucalyptus agglomerata, Eucalyptus globoidea, Eucalyptus punctata, Eucalyptus stricta, Syncarpia glomulifera* subsp. *glomulifera, Corymbia eximia, Eucalyptus sclerophylla*

Tall Shrubs: Mean Upper Height 6m. Mean Projected Canopy Cover 30% SD 20.3

Leptospermum trinervium, Hakea dactyloides, Persoonia levis, Banksia serrata

Low Shrubs: Mean Upper Height 2.7m. Mean Projected Canopy Cover 42% SD 15.8

Lambertia formosa, Acacia terminalis, Acacia ulicifolia, Acacia linifolia, Bossiaea obcordata, Banksia spinulosa var. *spinulosa*

Ground Covers: Mean Upper Height 0.9m. Mean Projected Canopy Cover 22% SD 18.8

Cyathochaeta diandra, Lomatia silaifolia, Amperea xiphoclada var. *xiphoclada, Caustis flexuosa, Entolasia stricta, Lepidosperma laterale, Lomandra obliqua, Platysace linearifolia, Patersonia sericea, Xanthosia tridentata*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Shallow sandy soils found across the Hawkesbury Sandstone ridges of the Nattai, Burragorang and Wanganderry Tablelands.
- A dense shrub and heath understorey typified by an abundance of *Banksia spinulosa* var. *spinulosa*, Tea-tree (*Leptospermum trinervium*) and Mountain Devil (*Lambertia formosa*).
- A low open tree cover of Sydney Peppermint (*Eucalyptus piperita*), Red Bloodwood (*Corymbia gummifera*), Silvertop Ash (*E. sieberi*) and Stringybarks (*E. sparsifolia*, *E. agglomerata* and *E. globoidea*).

❑ *EXAMPLE LOCATIONS*

Wild Goat Plateau; Buxton Plateau; Burragorang Tableland; Wanganderry Tableland (north and south); Nattai Tableland

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	10178	87
B Medium	1448	12
C High	139	1
Total	**11765**	**100**

❑ *THREATENED PLANT SPECIES*

Persoonia glaucescens (E1), *Persoonia hirsuta* subsp. *evoluta* (E1), *Persoonia acerosa* (V), *Pterostylis pulchella* (V), *Eucalyptus burgessiana* (2RCa), *Eucalyptus cunninghamii* (2RCat), *Hakea constablei* (2RCa), *Lomandra brevis* (2RC-), *Lissanthe sapida* (3RCa), *Monotoca ledifolia* (3RC-), *Eucalyptus apiculata* (3RC-)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia linifolia	2	0.59	2	0.07	positive
Acacia terminalis	2	0.72	2	0.07	positive
Acacia ulicifolia	2	0.69	1	0.11	positive
Banksia spinulosa var. spinulosa	3	1.00	2	0.19	positive
Bossiaea obcordata	3	0.63	2	0.08	positive
Callitris muelleri	1	0.03	0	0.00	positive
Caustis flexuosa	3	0.50	2	0.03	positive
Corymbia gummifera	4	0.84	4	0.10	positive
Cyathochaeta diandra	3	0.63	3	0.06	positive
Dillwynia retorta	2	0.50	2	0.06	positive
Entolasia stricta	2	0.78	2	0.34	positive
Eucalyptus piperita	4	0.75	4	0.13	positive
Hakea dactyloides	4	0.66	2	0.11	positive
Lambertia formosa	4	0.84	3	0.04	Positive
Lepidosperma laterale	2	0.63	2	0.25	Positive
Leptospermum trinervium	4	0.94	2	0.15	Positive
Lomandra obliqua	3	0.91	2	0.17	positive
Lomatia silaifolia	2	0.72	2	0.25	positive
Monotoca ledifolia	1	0.03	0	0.00	positive
Persoonia levis	2	0.91	2	0.13	positive
Phyllanthus hirtellus	2	0.91	2	0.26	positive
Lomandra longifolia	2	0.13	2	0.56	negative

MU27 ROCKY SANDSTONE HEATH WOODLAND

Number of Sites: 5 No. taxa/plot: 31.6

❑ *DESCRIPTION*

Rocky Sandstone Heath Woodland occurs on rocky cliff edges, exposed slopes and rock plates of the Hawkesbury Sandstone of Wanganderry, Nattai and Burragorang Tablelands. Due to high exposure and infertile shallow rocky soils, the canopy is generally very open and the trees are stunted. The sparse tree layer features *Eucalyptus sieberi* or *E. piperita* and can also include *Angophora costata, Corymbia eximia* or *E. sclerophylla*. In the Bonnum Pic area isolated stands of *Callitris muelleri* are included within this community. The heath layer is dominated by Proteaceae species such as *Banksia serrata, Isopogon anethifolius, Persoonia linearis* and *Hakea dactyloides, B. spinulosa* var. *spinulosa* with *Boronia ledifolia, Xanthorrhoea* spp., *Allocasuarina littoralis* and *Leptospermum trinervium* also present. Ground cover is sparse and restricted to scattered *Lomandra obliqua, L. multiflora* subsp. *multiflora, Amperea xiphoclada* and *Patersonia sericea*.

Rocky Sandstone Heath Woodland is prominent in and around the rock plates and pagodas of the Wanganderry Tableland. It shares many species with the adjoining vegetation and in regional terms is a structural variation of the more widespread sandstone ridge top woodlands. Outside the study area it is not as widespread but has been mapped in the north of the Warragamba Special Area (NPWS, 2003b). It is also likely that this community extends north into the Blue Mountains and Wollemi National Parks although it is not well described in existing literature. This profile has been adapted from (NPWS, 2003b).

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 14m. Mean Projected Canopy Cover 19% SD 10.8

Eucalyptus sieberi, Eucalyptus piperita

Minor associates: *Angophora costata, Corymbia eximia, Eucalyptus sclerophylla*

Shrubs: Mean Upper Height 5.8m. Mean Projected Canopy Cover 21% SD 8.9

Leptospermum trinervium, Banksia serrata, Hakea dactyloides, Isopogon anethifolius, Persoonia linearis, Banksia spinulosa var. *spinulosa, Dillwynia retorta, Allocasuarina littoralis, Xanthorrhoea resinifera, Boronia ledifolia*

Ground Covers: Mean Upper Height 0.7m. Mean Projected Canopy Cover 18% SD 28.1

Lomandra obliqua, Amperea xiphoclada, Lomandra multiflora subsp. *multiflora, Patersonia sericea*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Cliff edges, precipitous rocky slopes, rock plates and benches.
- Low open canopy with small stunted trees, frequently Silvertop Ash (*Eucalyptus sieberi*).
- Stands of Illawarra Pine (*Callitris muelleri*) near Bonnum Pic
- Scattered Proteaceae shrubs with a sparse dry ground layer.

❑ *EXAMPLE LOCATIONS*

Upper Martins Creek Canyon (rocky scarps); Wanganderry Creek (cliff edge); Wattle Ridge and Long Nose Ridge (rock plates); northern Wanganderry Tableland

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	3194	99
B Medium	46	1
C High	0	0
Total	3240	100

❑ *THREATENED PLANT SPECIES*

Persoonia bargoensis (E1), *Lissanthe sapida* (3RCa), *Eucalyptus apiculata* (3RC-)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Baeckea imbricata	2	0.20	0	0.00	positive
Banksia serrata	4	0.80	2	0.05	positive
Dillwynia retorta	3	0.60	2	0.07	positive
Eucalyptus piperita	4	0.80	4	0.15	positive
Eucalyptus sieberi	4	1.00	4	0.14	positive
Hakea dactyloides	2	0.80	2	0.12	positive
Hibbertia monogyna	2	0.20	0	0.00	positive
Isopogon anethifolius	2	0.80	1	0.01	positive
Lambertia formosa	2	0.60	4	0.06	positive
Leptospermum trinervium	3	1.00	3	0.17	positive
Lomandra obliqua	3	0.80	2	0.19	positive
Persoonia bargoensis	1	0.20	0	0.00	positive
Persoonia linearis	2	0.80	2	0.44	positive
Lomandra longifolia	0	0.00	2	0.55	negative

MU28 MOUNT JELLORE WOODLAND

Number of Sites: 2 No. taxa/plot: 67.5

❑ *DESCRIPTION*

Mount Jellore Woodland is a low woodland found growing on the igneous intrusion of Mt Jellore. This is the only location where this woodland was recorded and has been mapped over both the exposed and sheltered aspects. The substrate of Mount Jellore is Trachyte, a fine-grained volcanic rock that develops a clay loam soil of high fertility (Fisher *et al.,* 1995). The steep slopes of Mount Jellore restrict soil development and much of the surface is covered with loose rocks and boulders.

Mount Jellore Woodland is dominated by low growing *Eucalyptus blaxlandii* and *Allocasuarina littoralis*. *Allocasuarina verticillata* is also present at lower abundance and *Eucalyptus elata* was also recorded on sheltered aspects. The understorey is sparse and is comprised of grasses and rushes with a scattering of shrubs. Common understorey plants are *Phyllanthus hirtellus, Grevillea arenaria* subsp. *arenaria, Persoonia linearis, Lomandra filiformis* subsp. *filiformis, Lomandra multiflora* subsp. *multiflora, Billardiera scandens* var. *scandens, Dichelachne micrantha, Stypandra glauca, Notodanthonia longifolia, Gonocarpus teucrioides and Poa tenera.*

Mount Jellore Woodland represents one of the more interesting vegetation communities found in the Nattai and Bargo reserves. The vegetation shares species with other communities found on enriched soils of the southern highlands, however exposure and limited soil development results in a low shrub woodland. Further the geological substrates on other igneous intrusions, such as Mts Gibraltar and Flora are somewhat different from those on Mount Jellore (Fisher *et al.,* 1995; DLWC, 2002) and support taller grassier forests. The total distribution of this community in the region is unknown, although it is likely to limited in area given the small number of these residual igneous peaks.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 8m. Mean Projected Canopy Cover 15% SD 4.0

Eucalyptus blaxlandii, Allocasuarina littoralis, Allocasuarina verticillata

Minor associates: *Eucalyptus elata*

Shrubs: Mean Upper Height 2m. Mean Projected Canopy Cover 25% SD 12.1

Phyllanthus hirtellus, Grevillea arenaria subsp. *arenaria, Lissanthe strigosa, Bossiaea obcordata, Lasiopetalum parviflorum, Pimelea linifolia, Westringia longifolia*

Ground Covers: Mean Upper Height 1m. Mean Projected Canopy Cover 11% SD 2.2

Lomandra filiformis subsp. *filiformis, Lomandra multiflora* subsp. *multiflora, Billardiera scandens* var. *scandens, Lomandra longifolia, Dichelachne micrantha, Galium gaudichaudii, Hydrocotyle geraniifolia, Lepidosperma laterale, Pandorea pandorana* subsp. *pandorana, Stypandra glauca, Adiantum aethiopicum, Austrostipa rudis* subsp. *rudis, Dianella longifolia, Doodia aspera, Gonocarpus teucrioides, Goodenia ovata, Lomandra filiformis* subsp. *coriacea, Notodanthonia longifolia, Poa tenera, Microlaena stipoides* var. *stipoides*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A low open woodland dominated by Brown Stringybark (*Eucalyptus blaxlandii*) and Black Sheoak (*Allocasuarina littoralis*). Drooping Sheoak (*Allocasuarina verticillata*) is also common at lower abundance.
- The distinctive domed igneous intrusion of Mount Jellore.
- A sparse understorey comprised of grasses, rushes and herbaceous plants growing amongst the many surface rocks and boulders. Common understorey species include Shorthair Plumegrass (*Dichelachne micrantha*), Wattle Matt-rush (*Lomandra filiformis* subsp. *filiformis*) and Long-leaved Wallaby Grass (*Notodanthonia longifolia*).

❑ *EXAMPLE LOCATIONS*

Mt Jellore, approximately 12km NW of Mittagong

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	30	100
B Medium	0	0
C High	0	0
Total	**30**	**100**

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Adiantum aethiopicum	3	0.50	2	0.14	positive
Allocasuarina littoralis	4	1.00	1	0.17	positive
Allocasuarina verticillata	2	1.00	2	0.03	positive
Austrostipa rudis subsp. rudis	3	0.50	0	0.00	positive
Billardiera scandens var. scandens	2	1.00	1	0.48	positive
Bossiaea obcordata	2	0.50	2	0.24	positive
Cheilanthes austrotenuifolia	2	0.50	2	0.05	positive
Clematis glycinoides var. glycinoides	2	0.50	2	0.17	positive
Crassula sieberiana	2	1.00	1	0.07	positive
Cyathea howeana	2	0.50	1	0.03	positive
Dendrobium striolatum	2	0.50	2	0.01	positive
Dianella longifolia	3	0.50	2	0.07	positive
Dichelachne micrantha	3	1.00	1	0.09	positive
Diuris sulphurea	2	0.50	2	0.01	positive
Dodonaea triquetra	2	0.50	2	0.18	positive
Echinopogon mckiei	2	0.50	0	0.00	positive
Eucalyptus blaxlandii	4	1.00	4	0.01	positive
Gahnia microstachya	2	0.50	2	0.01	positive
Galium gaudichaudii	3	1.00	2	0.01	positive
Goodenia ovata	3	0.50	2	0.06	positive
Grevillea arenaria subsp. arenaria	3	1.00	2	0.22	positive
Hardenbergia violacea	2	0.50	1	0.28	positive
Helichrysum scorpioides	2	0.50	2	0.06	positive
Hibbertia empetrifolia subsp. empetrifolia	2	1.00	2	0.19	positive
Hydrocotyle geraniifolia	3	1.00	1	0.04	positive
Isotoma axillaris	1	0.50	0	0.00	positive
Lagenifera gracilis	2	0.50	1	0.04	positive
Lasiopetalum parviflorum	3	0.50	4	0.00	positive
Lepidosperma laterale	3	1.00	2	0.40	positive
Leptospermum polygalifolium subsp. polygalifolium	2	1.00	2	0.19	positive
Leucopogon appressus	2	0.50	2	0.00	positive
Liparis reflexa	3	0.50	1	0.01	positive
Lissanthe strigosa	3	1.00	2	0.18	positive
Lomandra cylindrica	2	0.50	2	0.13	positive
Lomandra filiformis subsp. filiformis	3	1.00	2	0.23	positive
Lomandra gracilis	2	0.50	2	0.12	positive
Lomandra longifolia	3	1.00	2	0.43	positive
Lomandra multiflora subsp. multiflora	3	1.00	2	0.35	positive
Lomandra obliqua	2	0.50	2	0.34	positive
Microlaena stipoides var. stipoides	2	1.00	2	0.42	positive
Monotoca scoparia	2	0.50	1	0.14	positive
Muehlenbeckia rhyticarya	2	0.50	0	0.00	positive
Notelaea venosa	2	0.50	2	0.04	positive
Notodanthonia longifolia	4	0.50	2	0.06	positive
Ozothamnus obcordatus subsp. major	2	0.50	0	0.00	positive
Pandorea pandorana subsp. pandorana	3	1.00	2	0.19	positive
Patersonia glabrata	2	0.50	2	0.16	positive
Pelargonium inodorum	2	0.50	2	0.02	positive
Phyllanthus gunnii	2	1.00	2	0.06	positive
Phyllanthus hirtellus	3	1.00	2	0.48	positive
Pimelea linifolia	3	0.50	2	0.29	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Platysace ericoides	2	0.50	2	0.10	positive
Poa tenera	4	0.50	3	0.01	positive
Pomaderris ferruginea	2	0.50	1	0.04	positive
Poranthera corymbosa	2	0.50	2	0.09	positive
Poranthera microphylla	2	0.50	2	0.13	positive
Smilax glyciphylla	2	0.50	1	0.18	positive
Solanum prinophyllum	2	0.50	1	0.21	positive
Stackhousia viminea	2	1.00	1	0.06	positive
Stypandra glauca	3	1.00	3	0.14	positive
Tetratheca thymifolia	2	0.50	2	0.16	positive
Wahlenbergia gracilis	2	0.50	1	0.18	positive
Westringia longifolia	4	0.50	4	0.01	positive

MU29 DOUGLAS SCARP WOODLAND

Number of Sites: 4 No. taxa/plot: 41.3

❑ *DESCRIPTION*

Douglas Scarp Woodland is visually distinctive, occurring on the low-lying Permian sediments of the Burragorang Valley, near Murphys Flat. A distinctive bench or scarp forms on the westerly footslopes of the Wanganderry Walls. This scarp traces the transition between the Permian sediments and the Porphyry intrusion found throughout the valley below. The environment is driest of the Nattai and Bargo reserves receiving less than 750 millimetres per year.

This open grassy woodland is dominated by *Eucalyptus crebra* often with *Callitris endlicheri* occurring in the canopy. *Angophora floribunda, Eucalyptus moluccana, E. eugenioides, E. punctata* and *E. tereticornis* are associated tree species. *Acacia binervia* is dominant and makes the shrub layer very distinctive with its blue foliage. Other shrubs such as, *Leucopogon muticus, Astroloma humifusum, Lissanthe strigosa* and *Persoonia linearis* are also present. The lowest stratum is particularly open and quite rocky with scattered herbs and grasses such as *Cheilanthes sieberi* subsp. *sieberi, Cymbopogon refractus, Pomax umbellata, Lepidosperma laterale* and *Lomandra filiformis* subsp. *coriacea.*

The Douglas Scarp Woodland is suggestive of vegetation found on inland valleys and escarpments. A number of species are indicative of these influences. Larger species such as the *Callitris, Acacia* and *Eucalypts* are found in these combinations near Mudgee, the Hunter Valley and Dubbo. So too are smaller plants such as *Hibiscus sturtii,* a significant southern and eastern range extension for this species that is more common in the central west of NSW. This community has been described and mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report. Nattai NP encompasses virtually all of the known distribution of this community.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 19m. Mean Projected Canopy Cover 22% SD 11.6

Eucalyptus crebra, Callitris endlicheri

Minor associates: *Eucalyptus moluccana, Angophora floribunda, Eucalyptus eugenioides, Eucalyptus punctata, Eucalyptus tereticornis*

Small Trees/Shrubs: Mean Upper Height 6m. Mean Projected Canopy Cover 10% SD 7.2

Leucopogon muticus, Acacia binervia, Astroloma humifusum, Lissanthe strigosa, Persoonia linearis, Acacia implexa, Brachychiton populneus subsp. *populneus*

Ground Covers: Mean Upper Height 0.8m. Mean Projected Canopy Cover 20% SD 8.1

Pomax umbellata, Cheilanthes sieberi subsp. *sieberi, Cymbopogon refractus, Lepidosperma laterale, Lomandra filiformis* subsp. *coriacea, Aristida vagans, Dichondra repens, Echinopogon ovatus*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- The rocky scarp known as Douglas Scarp which is very visible on the approach toward the Wollondilly Valley.
- A low open canopy dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*) with a sparse understorey.
- The conical canopies of Black Cypress Pine (*Callitris endlicheri*) and the very blue-leaved Coast Myall (*Acacia binervia*) are very distinctive.

❑ *EXAMPLE LOCATIONS*

Douglas Scarp (near Murphys Flat on the Wollondilly River)

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	100	12
B Medium	361	44
C High	368	44
Total	**829**	**100**

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia binervia	2	0.60	2	0.01	positive
Aristida vagans	2	0.60	2	0.13	positive
Astroloma humifusum	2	0.80	2	0.07	positive
Callitris endlicheri	4	0.60	2	0.00	positive
Cheilanthes sieberi subsp. sieberi	3	0.80	2	0.23	positive
Cymbopogon refractus	2	0.80	2	0.11	positive
Dichondra repens	2	0.60	3	0.39	positive
Echinopogon ovatus	2	0.60	2	0.21	positive
Eucalyptus crebra	4	1.00	3	0.11	positive
Lepidosperma laterale	2	0.80	2	0.28	positive
Leucopogon muticus	4	0.80	1	0.04	positive
Lissanthe strigosa	2	0.80	2	0.20	positive
Lomandra filiformis subsp. coriacea	2	0.80	2	0.19	positive
Persoonia linearis	2	0.60	2	0.45	positive
Pomax umbellata	2	1.00	2	0.31	positive
Vernonia cinerea var. cinerea	2	0.60	1	0.06	positive
Veronica plebeia	2	0.60	2	0.24	positive
Wahlenbergia gracilis	2	0.60	1	0.16	positive
Lomandra longifolia	0	0.00	2	0.58	negative

MU30 DEVONIAN RED GUM-GREY BOX WOODLAND

Number of Sites: 15 No. taxa/plot: 51.5

❑ *DESCRIPTION*

Devonian Red Gum-Grey Box Woodland occurs at lower elevations on the hills rising to the east and west of the Wollondilly River in the Burragorang Valley. It forms a low open woodland dominated by *Eucalyptus tereticornis* and *E. moluccana* and occurs on rocky, erodable slopes derived from granite like sediments of Bindook Porphyry Geology. A small tree layer is sparse but regularly includes isolated *Brachychiton populneus* subsp. *populneus* and occasionally *Ficus rubiginosa, Allocasuarina verticillata* and *Pittosporum undulatum.* The latter species are more prominent on steep rocky scree slopes or amongst other rock outcrops. The understorey can regularly be shrubby with species such as *Olearia viscidula, Bursaria spinosa* and *Cassinia laevis* common with occasional *Breynia oblongifolia* and *Indigofera australis.* Despite the shallow rocky soil and low rainfall, the ground cover retains a very high diversity of grass species and an abundance of herbs. This reflects the relative fertility of the soil. *Dichondra repens, Gahnia aspera, Calotis lappulacea, Desmodium varians, D. brachypodum, Aristida ramosa, Austrostipa scabra* subsp. *falcata, Lomandra longifolia, L. multiflora* subsp. *multiflora* and *Cymbopogon refractus* are all present in the ground layer. A high diversity of small twiners and vines are also encountered. These include *Geitonoplesium cymosum, Cissus opaca, Pandorea pandorana* subsp. *pandorana, Cayratia clematidea, Clematis aristata* and *Stephania japonica* var. *discolor.*

Devonian Red Gum-Grey Box Woodland is closely related to other vegetation communities found on Porphyry Sediments of the Wollondilly Valley and Bindook Highlands. It is likely that subtle changes in elevation, topographic position and soil fertility result in slightly different moisture retention capacity of the soil. The composition of this community supports greater abundance and diversity of moisture loving herb and vine species. Much of this community persists on steep and unstable slopes of the Wollondilly Valley. However, there is widespread evidence of past grazing activities even on marginal sites, with slopes, benches and foothills all being heavily cleared. This community was described and mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report. A closely related community is present on the lower slopes on the lower reaches of the Shoalhaven Gorge.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 17m. Mean Projected Canopy Cover 17% SD 9.5

Eucalyptus moluccana, Eucalyptus tereticornis, Brachychiton populneus subsp. *populneus*

Minor associates: *Eucalyptus albens, Eucalyptus eugenioides*

Small Trees: Mean Upper Height 7m. Mean Projected Canopy Cover 9% SD 10.9

Allocasuarina verticillata, Angophora floribunda, Backhousia myrtifolia, Acacia falciformis, Melaleuca styphelioides, Ficus rubiginosa

Shrubs: Mean Upper Height 2.8m. Mean Projected Canopy Cover 19% SD 15.2

Olearia viscidula, Bursaria spinosa, Cassinia laevis, Breynia oblongifolia, Indigofera australis

Ground Covers: Mean Upper Height 0.5m. Mean Projected Canopy Cover 21% SD 12.7

Dichondra repens, Desmodium brachypodum, Calotis lappulacea, Aristida ramosa, Cenchrus caliculatus, Cheilanthes distans, Cheilanthes sieberi subsp. *sieberi, Desmodium varians, Gahnia aspera, Arthropodium milleflorum, Cymbopogon refractus, Lomandra longifolia, Lomandra multiflora* subsp. *multiflora, Solanum prinophyllum, Chloris ventricosa*

Vine & Climbers: no structural data available

Pandorea pandorana subsp. *pandorana, Cayratia clematidea, Geitonoplesium cymosum, Cissus opaca, Clematis aristata, Clematis glycinoides* var. *glycinoides, Stephania japonica* var. *discolor, Aphanopetalum resinosum*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A low open woodland dominated by Grey Box (*Eucalyptus moluccana*) and Forest Red Gum (*E. tereticornis*) found on steep slopes of Porphyry geology in the Wollondilly River Valley. The absence of Narrow-leaved Ironbark (*E. crebra*) and Yellow Box (*E. melliodora*) are useful in distinguishing from other grassy woodlands found on Porphyry Sediments. Kurrajong (*Brachychiton populneus* subsp. *populneus*) is a particularly common and indicative species.
- An abundance of herbs such as Tick-trefoils (*Desmodium* spp.), Kidney Weed (*Dichondra repens*) and a high diversity of twiners and small vines such as Wonga Wonga Vine (*Pandorea pandorana* subsp. *pandorana*) and Small leaved Water Vine (*Cissus opaca*).
- Wallaby Weed (*Olearia viscidula*) and Blackthorn (*Bursaria spinosa*) are common shrub species.

❑ *EXAMPLE LOCATIONS*

Stringers Flat; Palling Flat; Basket Creek; Burnt Flat Creek; Murphys Flat

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	216	16
B Medium	128	9
C High	1016	75
Total	**1360**	**100**

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Aristida ramosa	2	0.80	2	0.08	positive
Arthropodium milleflorum	2	0.67	2	0.09	positive
Brachychiton populneus subsp. populneus	2	1.00	1	0.10	positive
Bursaria spinosa	2	0.73	2	0.24	positive
Calotis lappulacea	3	0.80	2	0.02	positive
Cassinia laevis	2	0.60	2	0.04	positive
Cayratia clematidea	2	0.80	2	0.07	positive
Cenchrus caliculatus	2	0.80	2	0.03	positive
Cheilanthes distans	2	0.80	2	0.08	positive
Cheilanthes sieberi subsp. sieberi	2	0.67	2	0.25	positive
Cissus opaca	2	0.67	1	0.01	positive
Cymbopogon refractus	2	0.67	2	0.09	positive
Desmodium brachypodum	2	0.87	2	0.08	positive
Desmodium varians	2	0.80	2	0.27	positive
Dichondra repens	3	1.00	3	0.35	positive
Eucalyptus moluccana	4	0.67	4	0.03	positive
Eucalyptus tereticornis	4	0.53	4	0.14	positive
Gahnia aspera	2	0.73	2	0.08	positive
Geitonoplesium cymosum	2	0.73	2	0.29	positive
Olearia viscidula	3	0.87	2	0.31	positive
Pandorea pandorana subsp. pandorana	2	0.93	2	0.25	positive
Scaevola aemula	3	0.07	0	0.00	positive
Vittadinia cuneata	2	0.53	2	0.03	positive
Lomandra longifolia	2	0.73	2	0.55	constant

MU31 DEVONIAN RED GUM-IRONBARK WOODLAND

Number of Sites: 11 No. taxa/plot: 49.5

❑ *DESCRIPTION*

Devonian Red Gum-Ironbark Woodland is a tall, open woodland found in the Upper Burragorang Valley near Joorilands Homestead. It occupies exposed positions on undulating foothills derived of fertile Porphyry material. These areas are at low elevations (between 100-300 metres asl) and receive low annual rainfall along with high mean annual temperatures. These habitat features produce a community that is not dissimilar to Grassy Box-Ironbark Woodlands that are common on fertile valleys and plateaux of the central western tablelands of NSW and the Cumberland Plain.

Eucalyptus tereticornis dominates the canopy sometimes with a local abundance of box trees *E. moluccana, E. melliodora* and *E. albens*. *Eucalyptus crebra* is also characteristic of this community being absent from other Porphyry Box woodlands. *Eucalyptus crebra* rarely dominates, occurring consistently but at low abundance. A dry sparse shrub layer includes species such as *Astroloma humifusum, Acacia implexa, Olearia viscidula* and *Bursaria spinosa.* The ground cover is more characteristic with a high diversity and abundance of grasses such as *Cymbopogon refractus, Aristida ramosa, A. vagans, Microlaena stipoides, Oxalis perennans* and *Panicum effusum.* Herbs and forbs such as *Dichondra repens* and *Lomandra multiflora* subsp. *multiflora* are also prevalent.

Devonian Red Gum-Ironbark Woodland has been extensively cleared and grazed with many of the remaining areas being highly fragmented. Natural regeneration is occurring, although grazing pressure from cattle and kangaroos suppresses the recovery in some areas. The profusion of Serrated Tussock (*Nassella trichotoma*) that is extensive on these richer soils to the south of the valley represents a serious threat to this community were it to establish in the Upper Burragorang Valley. Despite minor differences in canopy and shrub species, Devonian Red Gum-Ironbark Woodland forms a component of the White Box-Yellow Box-Blakely's Red Gum Woodland, Endangered Ecological Community listed on Part 3 of Schedule 1 of the NSW TSC Act, (1995). This community has been described and mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 19m. Mean Projected Canopy Cover 28% SD 9.3

Eucalyptus tereticornis, Eucalyptus crebra, Eucalyptus melliodora, Eucalyptus moluccana

Minor associates: *Eucalyptus eugenioides, Eucalyptus punctata, Eucalyptus albens, Angophora floribunda, Allocasuarina littoralis, Brachychiton populneus* subsp. *populneus*

Small Trees/Shrubs: Mean Upper Height 5m. Mean Projected Canopy Cover 15% SD 8.3

Astroloma humifusum, Acacia implexa, Olearia viscidula, Lissanthe strigosa, Bursaria spinosa, Breynia oblongifolia, Exocarpos strictus

Ground Covers: Mean Upper Height 0.6m. Mean Projected Canopy Cover 51% SD 25.4

Dichondra repens, Cheilanthes sieberi subsp. *sieberi, Cymbopogon refractus, Aristida ramosa, Microlaena stipoides, Cheilanthes distans, Desmodium varians, Lomandra multiflora* subsp. *multiflora, Wahlenbergia gracilis, Aristida vagans, Desmodium brachypodum, Hypericum gramineum, Digitaria diffusa, Eragrostis leptostachya, Solanum prinophyllum*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- An open woodland dominated by Forest Red Gum (*Eucalyptus tereticornis*) with White, Grey and Yellow Box (*E. albens; E. moluccana; E. melliodora*). Narrow-leaved Ironbark (*Eucalyptus crebra*) is useful in distinguishing this community from others found on the richer Porphyry Sediments.
- Open understorey characterised by an abundance and diversity of grasses including Barbed Wire Grass (*Cymbopogon refractus*), Speargrasses (*Aristida* spp.), *Microlaena stipoides* and *Digitaria diffusa.*
- Fragmented remnants, regenerating from previous clearing in the Jooriland and lower Wollondilly River Valleys.

❑ *EXAMPLE LOCATIONS*

Beneath Bonnum Pic; Bridge Point; Carlon Point

❑ *CONDITION ASSESSMENT*

Forms a component of the White Box-Yellow Box-Blakely's Red Gum Woodland, an Endangered Ecological Community listed under the Threatened Species Act (1995).

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	40	6
B Medium	317	45
C High	345	49
Total	**701**	**100**

❑ *THREATENED PLANT SPECIES*

Bossiaea oligosperma (V)

❑ *DIAGNOSTIC SPECIES*

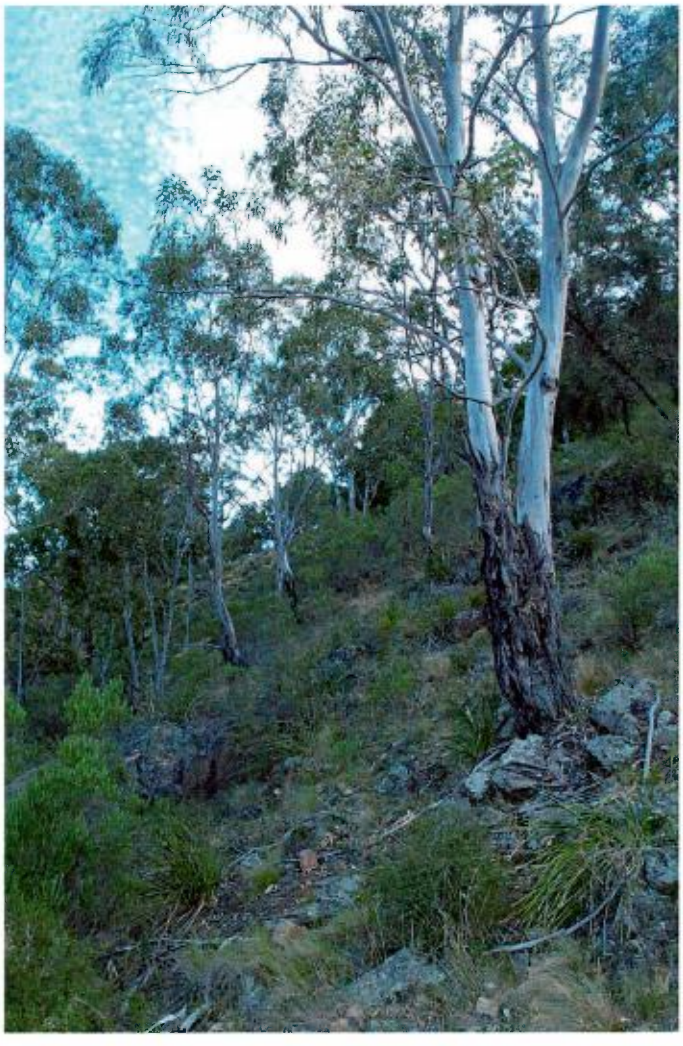
The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia implexa	2	0.85	1	0.14	positive
Aristida ramosa	4	0.85	2	0.08	positive
Aristida vagans	2	0.54	2	0.13	positive
Astroloma humifusum	2	0.92	1	0.06	positive
Bursaria spinosa	3	0.62	2	0.22	positive
Callistemon linearis	1	0.08	0	0.00	positive
Cheilanthes distans	2	0.85	2	0.09	positive
Cheilanthes sieberi subsp. sieberi	3	0.92	2	0.23	positive
Cymbopogon refractus	3	0.85	2	0.10	positive
Cyperus fulvus	1	0.08	0	0.00	positive
Desmodium brachypodum	2	0.69	2	0.08	positive
Desmodium varians	2	0.77	2	0.28	positive
Dichondra repens	3	1.00	3	0.38	positive
Digitaria diffusa	2	0.54	1	0.02	positive
Eragrostis lacunaria	3	0.15	0	0.00	positive
Eucalyptus tereticornis	4	0.77	4	0.16	positive
Exocarpos strictus	2	0.77	2	0.15	positive
Hypericum gramineum	3	0.54	2	0.16	positive
Lissanthe strigosa	2	0.62	2	0.20	positive
Lomandra filiformis subsp. coriacea	2	0.54	2	0.19	positive
Lomandra multiflora subsp. multiflora	2	0.69	2	0.39	positive
Microlaena stipoides	2	0.69	2	0.41	positive
Olearia viscidula	3	0.85	2	0.32	positive
Pratia purpurascens	2	0.62	2	0.32	positive
Pterostylis rufa	1	0.08	0	0.00	positive
Pultenaea spinosa	1	0.08	0	0.00	positive
Stackhousia muricata	2	0.15	0	0.00	positive
Vittadinia dissecta var. hirta	3	0.08	0	0.00	positive
Vittadinia muelleri	2	0.08	0	0.00	positive
Vittadinia pustulata	1	0.08	0	0.00	positive
Wahlenbergia gracilis	2	0.62	1	0.16	positive
Zornia dyctiocarpa var. dyctiocarpa	3	0.15	0	0.00	positive
Lomandra longifolia	1	0.38	2	0.58	negative

MU32 DEVONIAN RED GUM-YELLOW BOX WOODLAND

Number of Sites: 36 No. taxa/plot: 47.8

❑ *DESCRIPTION*



Devonian Red Gum-Yellow Box Woodland is found in the dramatic, rugged landscape of the Wollondilly River Valley at elevations between 300 and 800 metres. Much of the distribution of this community, however, is found outside the boundary of the study area however small areas are found within the Nattai NP additions at Palings Flat.

This community has an open woodland canopy reaching fifteen to twenty metres in height with a grassy and shrubby understorey. *Eucalyptus tereticornis* and *E. melliodora* are the dominant canopy species. *Eucalyptus punctata* and *E. eugenioides* sometimes occur on sheltered slopes. At higher elevations *Eucalyptus bosistoana* may be present in the canopy around the heads of gullies, overlooking steep gorge slopes.

The canopy is generally open, particularly on hill slopes. A shrub layer is clearly visible, with an abundance of thin-leaved species such as *Olearia viscidula, Lissanthe strigosa, Bursaria spinosa* and *Cassinia laevis.* A sparse small tree layer is occasionally present and includes *Brachychiton populneus* subsp. *populneus* and *Acacia implexa.* The ground cover comprises a high diversity of grasses dominated by *Dichelachne micrantha, Microlaena stipoides, Poa labillardierei* var. *labillardierei, P. sieberiana* var. *sieberiana* and *Aristida ramosa.* Also present in the ground stratum is *Dichondra repens, Cheilanthes sieberi* subsp. *sieberi* and *Lomandra longifolia.*

Devonian Red Gum-Yellow Box Woodland is found on soils derived from Bindook Porphyry geology. The soils are shallow, sandy clay loams that retain moderate levels of fertility and moisture, but are also vulnerable to erosion on most slopes. In these locations, soil and surface rock becomes exposed and often unstable, resulting in a sparse shrub cover and structural variation to the ground cover. On the steepest slopes, rock outcrops and scree slopes can be found. Extensive areas have been used for grazing activities with widespread clearing. Dense infestations of Serrated Tussock (*Nassella trichotoma*) are found on cleared land throughout the Wollondilly Valley. This community has been described and mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report. Outside of this area the community extends into the lower slopes of the Shoalhaven Gorge (DEC, in prep.).

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 19m. Mean Projected Canopy Cover 18% SD 7.9

Eucalyptus tereticornis, Eucalyptus melliodora, Eucalyptus eugenioides, Eucalyptus punctata

Minor associates: *Eucalyptus moluccana, Eucalyptus bridgesiana, Eucalyptus agglomerata, Eucalyptus bosistoana, Eucalyptus macrorhyncha, Eucalyptus cypellocarpa, Eucalyptus blakelyi, Angophora floribunda*

Small Trees: Mean Upper Height 5.6m. Mean Projected Canopy Cover 12% SD 11.0

Acacia implexa, Brachychiton populneus subsp. *populneus, Allocasuarina verticillata*

Shrubs: Mean Upper Height 2.5m. Mean Projected Canopy Cover 20% SD 18.0

Olearia viscidula, Lissanthe strigosa, Bursaria spinosa, Cassinia laevis

Ground Covers: Mean Upper Height 0.6m. Mean Projected Canopy Cover 31% SD 22.1

Cheilanthes sieberi subsp. *sieberi, Dichondra repens, Desmodium varians, Dichelachne micrantha, Clematis aristata, Lomandra multiflora* subsp. *multiflora, Glycine clandestina, Hypericum gramineum, Aristida ramosa, Poa labillardierei* var. *labillardierei, Cheilanthes distans, Elymus scaber* var. *scaber, Microlaena stipoides, Hydrocotyle laxiflora.*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- The presence of Yellow Box (*Eucalyptus melliodora*) is an indicative species for this community. Grey Gum (*Eucalyptus punctata*) and Thin-leaved Stringybark (*E. eugenioides*) also occur at a number of locations and are not as frequent in MU31 and MU30.
- A shrubby understorey featuring Wallaby Weed (*Olearia viscidula*) and a diversity of grasses characterised by Tussock Grasses (*Poa* spp.).
- Prominent in many disturbed patches within the Wollondilly River Valley particularly at higher elevation and in more rugged locations.

❑ *EXAMPLE LOCATIONS*

Rileys Flat; Basket Creek; Burnt Flat Creek

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	5	6
B Medium	45	47
C High	45	47
Total	**96**	**100**

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Aristida ramosa	3	0.64	2	0.07	positive
Bursaria spinosa	2	0.64	2	0.20	positive
Cassinia laevis	2	0.51	1	0.03	positive
Cheilanthes distans	2	0.54	1	0.08	positive
Cheilanthes sieberi subsp. sieberi	3	0.97	2	0.20	positive
Clematis aristata	2	0.69	2	0.31	positive
Desmodium varians	2	0.77	2	0.27	positive
Dichelachne micrantha	2	0.77	2	0.11	positive
Dichondra repens	3	0.90	3	0.37	positive
Elymus scaber var. scaber	2	0.54	2	0.04	positive
Eucalyptus melliodora	4	0.56	2	0.03	positive
Eucalyptus tereticornis	4	0.64	4	0.15	positive
Glycine clandestina	2	0.67	2	0.31	positive
Hydrocotyle laxiflora	2	0.51	2	0.20	positive
Hypericum gramineum	2	0.67	2	0.15	positive
Lissanthe strigosa	3	0.77	2	0.18	positive
Lomandra multiflora subsp. multiflora	2	0.69	2	0.38	positive
Microlaena stipoides	3	0.51	2	0.41	positive
Olearia viscidula	3	0.92	2	0.31	positive
Poa labillardierei var. labillardierei	3	0.62	2	0.12	positive
Lomandra longifolia	2	0.77	2	0.57	constant

MU33 ROCK PLATE HEATH-MALLEE

Number of Sites: 10 No. taxa/plot: 31.0

❑ *DESCRIPTION*

Rock Plate Heath-Mallee occurs on massive rock plates and outcrops covered with skeletal sandy soils. The dominant feature of this assemblage is the dense heath layer with dominant species being *Banksia ericifolia* subsp. *ericifolia*, *Leptospermum arachnoides*, with other scattered shrubs such as *Isopogon anemonifolius, Petrophile pedunculata, Hakea dactyloides, Baeckea brevifolia* and *Kunzea capitata* amongst others. A number of mallee species can be found amongst the heath or as low emergent trees. These include *Eucalyptus stricta, E. burgessiana, E. obstans, E. multicaulis* and *E. apiculata*. *Eucalyptus obstans* is unique to this assemblage in the study area and along with the closely related *E. burgessiana*, which is most common between 550 and 700 metres in isolated patches on the Wild Goat Plateau. Cyperaceae species such as *Lepyrodia scariosa, Cyathochaeta diandra, Schoenus imberbis, Caustis flexuosa* and *C. pentandra* are common in the lower stratum amongst other herbs such as *Platysace linearifolia, Actinotus minor, Dampiera stricta* and *Patersonia sericea*.

Rock Plate Heath-Mallee is a feature of the sandstone plateau below 900 metres in elevation. Patches of this community are small though widely distributed within the study area. It is often fringed by MU27 Rocky Sandstone Heath Woodland and may form mosaics with MU26 Exposed Burragorang Sandstone Shrub Woodland where soil is marginally deeper. This community is also found outside the study area in the Lower Blue Mountains and Woronora Plateau (NPWS, 2003b; NPWS, 2003c). Clearing for fire trails has disturbed a number of patches particularly where they dissect the ridgetop rock plates on the Nattai Tableland. This community has been described and mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 3.5m. Mean Projected Canopy Cover 12.5% SD 53.0

Eucalyptus stricta, Eucalyptus apiculata, Eucalyptus burgessiana, Eucalyptus obstans

Minor associates: *Eucalyptus sclerophylla, Eucalyptus sieberi, Angophora costata, Eucalyptus piperita, Corymbia gummifera, Angophora bakeri, Eucalyptus sparsifolia*

Shrubs: Mean Upper Height 2m. Mean Projected Canopy Cover 55% SD 49.5

Banksia ericifolia subsp. *ericifolia, Allocasuarina distyla, Leptospermum trinervium, Isopogon anemonifolius, Hakea dactyloides, Petrophile pedunculata, Banksia serrata, Mirbelia rubifolia, Kunzea capitata, Acacia suaveolens, Lambertia formosa, Epacris microphylla, Boronia floribunda, Leptospermum parvifolium*

Ground Covers: Mean Upper Height 0.5m. Mean Projected Canopy Cover 35% SD 7.1

Dampiera stricta, Patersonia sericea, Platysace linearifolia, Lepyrodia scariosa, Caustis flexuosa, Actinotus minor, Lomandra glauca, Schoenus imberbis, Ptilothrix deusta, Lepidosperma viscidum, Cyathochaeta diandra

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A dense heath dominated by *Banksia ericifolia* subsp. *ericifolia, Leptospermum trinervium, Allocasuarina distyla, A. nana* and *Hakea dactyloides.*
- The presence of mallee Eucalypts such as Mallee Ash (*Eucalyptus stricta*), *E. apiculata* and *E. burgessiana.* Port Jackson Mallee (*E. obstans*) may also be seen and is unique to the Mallee-Heaths at lower elevations.

❑ *EXAMPLE LOCATIONS*

Wild Goat Plateau; Wattle Ridge; Bonnum Pic; Wanganderry Tablelands

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	859	90
B Medium	100	10
C High	0	0
Total	**959**	**100**

❑ *THREATENED PLANT SPECIES*

Persoonia acerosa (V), *Epacris muelleri* (3RC-), *Eucalyptus apiculata* (3RC-), *Eucalyptus burgessiana* (2RCa), *Eucalyptus cunninghamii* (2RCat), *Hakea constablei* (2RCa)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Actinotus minor	1	0.58	0	0.00	positive
Allocasuarina distyla	3	0.50	1	0.00	positive
Banksia ericifolia subsp. ericifolia	4	0.67	2	0.01	positive
Boronia floribunda	2	0.50	3	0.00	positive
Brachyloma daphnoides	2	0.50	1	0.05	positive
Caustis flexuosa	2	0.50	2	0.04	positive
Darwinia fascicularis subsp. oligantha	3	0.42	0	0.00	positive
Epacris microphylla	2	0.50	2	0.03	positive
Eucalyptus stricta	3	0.67	3	0.02	positive
Hakea propinqua	2	0.67	1	0.00	positive
Hemigenia purpurea	1	0.25	0	0.00	positive
Hibbertia circumdans	3	0.08	0	0.00	positive
Isopogon anemonifolius	2	0.83	2	0.06	positive
Leptospermum trinervium	3	0.92	2	0.18	positive
Lepyrodia scariosa	2	0.50	2	0.02	positive
Lomandra glauca	2	0.58	2	0.17	positive
Petrophile pulchella	2	0.92	2	0.03	positive
Tricostularia pauciflora	1	0.08	0	0.00	positive
Xyris bracteata	1	0.08	0	0.00	positive
Lomandra longifolia	2	0.08	2	0.56	negative

MU34 ROSY PAPERBARK HEATH

Number of Sites: 1 No. taxa/plot: 39

❑ DESCRIPTION

Small patches of heath have been observed on the steep escarpment slopes of the Nattai Valley during aerial photograph interpretation. The heath lies on footslopes in deeply inaccessible country and has not yet been sampled or visited to confirm species composition. The surrounding vegetation is typical of dry ironbark woodlands found across the escarpment slopes on exposed aspects. Heath is unusual in these environments with similar patches observed in a small area in the Kedumba Valley during the mapping of the Warragamba Special Area (NPWS, 2003c). Here a low growing heath comprising *Melaleuca erubescens* and *Grevillea kedumbensis* has been described by Smith and Smith (1996). A provisional label of the unidentified heath in the Nattai Valley has been made on the basis of the similar substrate, elevation and surrounding vegetation. Further sampling of this community is required to confirm species composition.

❑ FLORISTIC SUMMARY

Low Trees / Shrubs: Upper Height 6m. Mean Projected Canopy Cover 2%

Eucalyptus crebra, Eucalyptus tereticornis, Bursaria spinosa

Shrubs: Upper Height 1m. Mean Projected Canopy Cover 40%

Melaleuca erubescens

Ground Covers / Low Shrubs: Upper Height 0.4m. Mean Projected Canopy Cover 60%

Hibbertia cistoidea, Lepidosperma viscidum

❑ KEY IDENTIFYING FEATURES

Easily recognisable features to assist in identifying this map unit are:

- A low heath dominated by Rosy Paperbark (*Melaleuca erubescens*) with a scattered occurrence of trees such as Narrow-leaved Ironbark (*Eucalyptus crebra*), Forest Red Gum (*E. tereticornis*) and Blackthorn (*Bursaria spinosa*).
- Restricted to low-lying ridges of the Kedumba and Nattai Valleys.

❑ EXAMPLE LOCATIONS

Rucksack Ridge (Kedumba Valley); Wanganderry Creek; Nattai River

❑ CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	3	100
B Medium	0	0
C High	0	0
Total	**3**	**100**

❑ *THREATENED PLANT SPECIES*

None recorded

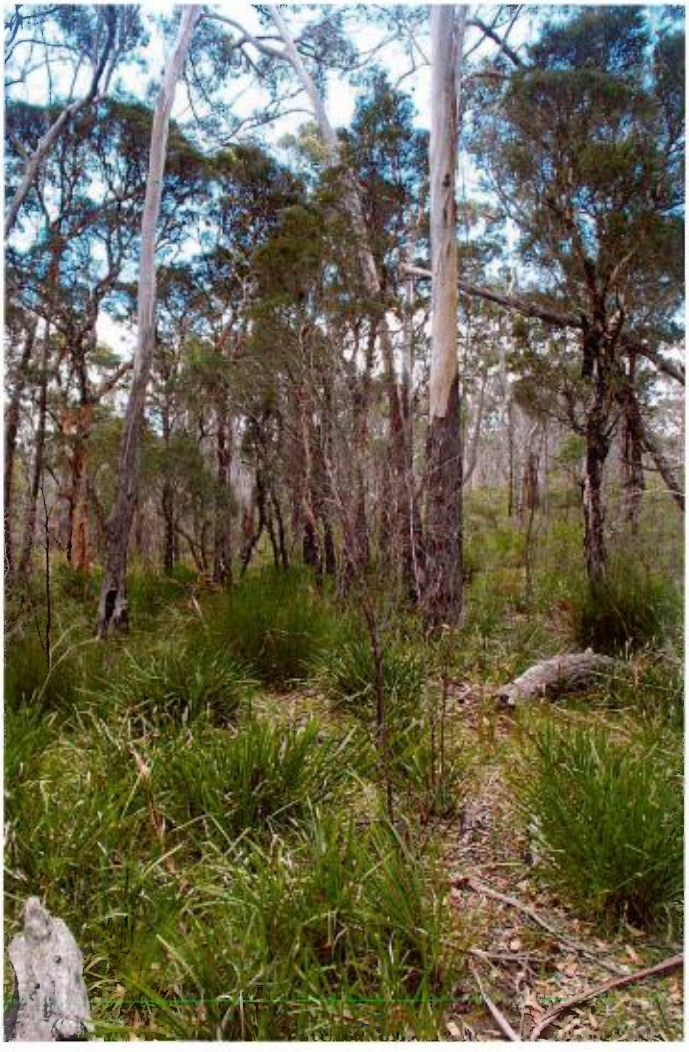
❑ *DIAGNOSTIC SPECIES*

Diagnostic species list is not available for this community.

MU35 HIGHLANDS SWAMP GUM-TEA-TREE HEATH-WOODLAND: FORM A AND B

Number of Sites: 4 No. taxa/plot: 37.5

❑ *DESCRIPTION*



Highlands Swamp Gum-Tea-Tree Heath-Woodland is a swamp complex found across the Southern Highlands. While the structural form of this community is variable, the understorey is characterised by combinations of sedges, rushes, grasses and herbs. Species present depend on the degree of moisture within the soil at each site.

On water-logged quaternary alluvium found within the larger swamps and drainage lines, dense thickets of Tea-tree and/or Paperbark are present. *Melaleuca linariifolia*, *Leptospermum polygalifolium* subsp. *polygalifolium* or *L. continentale* are prominent. The former species can attain heights of six metres that form narrow ribbons along drainage lines. Where identifiable using aerial photo interpretation, the larger Tea-tree and Paperbark scrubs have been mapped separately as Form B.

Emergent Eucalypts are common on the fringes of the scrub, and grade into a woodland of *Eucalyptus ovata* with *E. sclerophylla*. The damper the soil the more sedge and rush species that can be found. *Lepyrodia anarthria*, *Schoenus melanostachys* and *Juncus continuus* are common in these areas. Where the soil is drier, an open fringing woodland is marked by an abundance of *Lomandra longifolia* along with *Poa sieberiana* var. *sieberiana*, *Dichondra repens* and *Entolasia stricta*. Highlands Swamp Gum-Tea Tree Heath-Woodland occurs in two small areas one near Hilltop and the other along Martins Creek near Wattle Ridge. It has been described and mapped in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report. It is also more widely distributed across the southern Highlands (DEC, in prep.).

❑ *FLORISTIC SUMMARY*

Trees: Mean Upper Height 21m. Mean Projected Canopy Cover 9% SD 5.1

Eucalyptus ovata, Eucalyptus sclerophylla

Shrubs: Mean Upper Height 5m. Mean Projected Canopy Cover 23% SD 31.7

Melaleuca linariifolia, Leptospermum continentale, Leptospermum polygalifolium subsp. *polygalifolium, Callistemon citrinus*

Ground Covers: Mean Upper Height 0.9m. Mean Projected Canopy Cover 77% SD 26.7

Gonocarpus tetragynus, Microlaena stipoides, Lomandra longifolia, Dichondra repens, Helichrysum scorpioides, Hypericum gramineum, Pratia purpurascens, Poa sieberiana var. *sieberiana, Lepyrodia anarthria, Austrodanthonia* spp., *Schoenus apogon*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Dense Tea-tree and or Paperbark scrub along drainage lines or permanent soaks.
- An open woodland fringing the drainage line or soak with Swamp Gum (*Eucalyptus ovata*) and Scribbly Gum (*E. sclerophylla*) and Narrow-leaved Peppermint (*E. radiata* subsp *radiata*)
- An understorey of sedge and rush species (*Juncus continuus, Lepyrodia anarthria* and *Schoenus apogon*) that quickly grades into grass and herb species away from the swamp (*Gonocarpus tetragynus, Microlaena stipoides, Lomandra longifolia* and *Poa sieberiana* var. *sieberiana*).

❑ *EXAMPLE LOCATIONS*

Rocky Waterholes Creek and Martins Creek

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)*	Proportion Extant (%)*
A Low	99	89
B Medium	0	0
C High	12	11
Total	**111**	**100**

*Area and proportion of extant are a combined total for all forms

❑ *THREATENED PLANT SPECIES*

Acacia jonesii (3RCa)

❑ *DIAGNOSTIC SPECIES*

The diagnostic species presented below have been derived from NPWS (2003b).

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Centella asiatica	3	0.50	2	0.02	positive
Dichondra repens	3	0.75	3	0.39	positive
Epacris pulchella	2	0.50	2	0.04	positive
Eucalyptus ovata	4	0.75	5	0.00	positive
Gonocarpus tetragynus	3	1.00	2	0.24	positive
Goodenia bellidifolia subsp. bellidifolia	3	0.50	2	0.04	positive
Goodenia hederacea subsp. hederacea	2	0.50	2	0.27	positive
Helichrysum scorpioides	3	0.50	2	0.14	positive
Hydrocotyle peduncularis	2	0.75	2	0.08	positive
Hypericum gramineum	3	0.50	2	0.17	positive
Juncus continuus	3	0.50	2	0.00	positive
Leptospermum continentale	3	1.00	2	0.01	positive
Leptospermum polygalifolium subsp. polygalifolium	4	0.75	2	0.12	positive
Lepyrodia anarthria	4	0.50	4	0.01	positive
Lepyrodia scariosa	2	0.50	3	0.02	positive
Lomandra filiformis subsp. coriacea	2	0.50	2	0.19	positive
Microlaena stipoides	3	1.00	2	0.41	positive
Poa sieberiana var. sieberiana	4	0.75	3	0.19	positive
Poranthera microphylla	2	0.50	2	0.20	positive
Schoenus apogon	4	0.50	1	0.01	positive
Schoenus maschalinus	2	0.50	1	0.00	positive
Viola betonicifolia	3	0.50	2	0.09	positive
Lomandra longifolia	3	1.00	2	0.57	constant

MU36 UPLAND SWAMPS: CYPEROID HEATH

Number of Sites: 1 No. taxa/plot: 13

❑ *DESCRIPTION*

Upland Swamps: Cyperoid Heath otherwise known as 'hanging swamps' are commonly found on the Hawkesbury Sandstone Plateaux of the Sydney Basin . These areas are periodically waterlogged sites that mark underground water discharge often at the junction of different geological substrates. The vegetation forms a dense cover of sedges from the Cyperaceae family dominate including *Baumea rubiginosa*, *Lepidosperma limicola* and *Chorizandra sphaerocephala.* A number of other species common to Restioid Heaths such as *Empodisma minus* and *Gleichenia dicarpa* are also present. Scattered shrubs can include *Epacris obtusifolia, Leptospermum juniperinum* and *Acacia rubida.* The perennial grass *Amphipogon strictus* var. *strictus* occurs in dense clumps on the margins of the swamp.

Keith and Benson (1988) describe the correlation of these sedge swamps with an underlying claystone rim that surrounds the upslope area of the swamp. Water gathers downslope to form the hanging swamp. This rim is often clearly visible with a corresponding change in vegetation (Keith and Benson, 1988). There are only six small patches of this community in the study area and they are located between Hilltop and Colo Vale. All are located outside of the reserves. Elsewhere the community is widespread across the Blue Mountains National Park and is also closely related to similarly named communities found across the Woronora Plateau (NPWS, 2003c). This community was described in the Warragamba Special Area (NPWS, 2003b) and this profile has been adapted from that report.

❑ *FLORISTIC SUMMARY*

Shrubs: Mean Upper Height 2m. Mean Projected Canopy Cover 50%

Baeckea linifolia, Leptospermum juniperinum, Epacris obtusifolia, Acacia rubida

Ground Covers: Mean Upper Height 1m. Mean Projected Canopy Cover 90%

Baumea rubiginosa, Amphipogon strictus var. *strictus, Lepidosperma limicola, Empodisma minus, Gleichenia dicarpa, Lepyrodia anarthria, Sprengelia sprengelioides*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Dense sedge layer dominated by Soft-twig Rush (*Baumea rubiginosa*) and Razor Sedge *Lepidosperma limicola.*
- Often treeless swamps at the head of gullies with a sparse layer of Tea-trees (*Leptospermum* spp.)

❑ *EXAMPLE LOCATIONS*

Rocky Waterholes Creek, behind Hilltop

❑ *CONDITION ASSESSMENT*

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	14	100
B Medium	0	0
C High	0	0
Total	**14**	**100**

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Amphipogon strictus subsp. strictus	5	1	0	0	positive
Baumea rubiginosa	5	1	3	0.01	positive
Empodisma minus	3	1	3	0.01	positive
Gleichenia dicarpa	2	1	2	0.01	positive
Lepidosperma limicola	3	1	2	0.00	positive
Leptospermum juniperinum	2	1	3	0.00	positive
Sprengelia sprengelioides	3	1	0	0.00	positive
Lomandra longifolia	0	0	2	0.55	negative

MU37 HIGHLANDS *MELALEUCA* THICKET

Number of Sites: 1 No. taxa/plot: 52

❑ *DESCRIPTION*

Highlands *Melaleuca* Thicket is a feature of the shale and basalt plateau dominated Southern Highlands. It is most often observed as remnant vegetation on drainage lines and depressions. These sites are often permanently waterlogged restricting the species that grow to those that tolerate poorly drained soils. *Melaleuca styphelioides* tends to form dense low growing thickets. In the study area the largest areas are present on Mt Wanganderry. The community marks a major water discharge site at the junction of the residual basalt cap and underlying shale soil. Other small trees and shrubs sometimes occur including *Acacia melanoxylon, Hymenanthera dentata* sometimes with scattered Eucalypt species on drier sites. A dense blanket of grass and sedges cover the ground surface. Common species include *Microlaena stipoides* var. *stipoides, Eragrostis benthamii, Poa meionectes, Lomandra longifolia, Euchiton gymnocephalus, Carex breviculmis* and *Juncus gregiflorus.*

Highlands Melaleuca Thicket is not well sampled as it primarily occurs outside of the Nattai and Bargo reserves. It is poorly described in broader regional studies as it is often overlooked as patches are too small and disturbed to be mapped. However, like other vegetation occurring on flat fertile soils, it is likely to have been extensively cleared for agriculture.

❑ *FLORISTIC SUMMARY*

Small Trees and Shrubs: Mean Upper Height 12m. Mean Projected Canopy Cover 30%

Melaleuca styphelioides, Acacia melanoxylon, Eucalyptus blaxlandii

Minor associates: *Hymenanthera dentata, Pittosporum undulatum, Rapanea howittiana, Cassinia laevis, Rubus parvifolius*

Ground Covers: Mean Upper Height 0.4m. Mean Projected Canopy Cover 90%

Microlaena stipoides var. *stipoides, Epilobium billardiereanum* subsp. *cinereum, Eragrostis benthamii, Lomandra longifolia, Poa meionectes, Acaena novae-zelandiae, Adiantum aethiopicum, Euchiton gymnocephalus, Lepidosperma elatius, Ranunculus lappaceus, Carex breviculmis, Gahnia radula, Juncus gregiflorus, Dichelachne rara*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A dense thicket of Prickly-leaved Paperbark (*Melaleuca styphelioides*) found on drainage depressions or damp areas of basalt and shale soils in the Highlands Region.
- Moisture loving herbaceous plants, sedges and rushes are found such as Smooth Willow-herb (*Epilobium billardiereanum* subsp. *cinereum*), *Acaena novae-zelandiae*, Common Buttercup (*Ranunculus lappaceus*) and sedges (*Carex* spp., *Gahnia* spp. and *Juncus* spp.)
- A mixture of species cover the ground surface but is dominated by an abundance of the grasses *Microlaena stipoides* var. *stipoides, Eragrostis benthamii, Poa meionectes,* and Forest Hedgehog Grass (*Echinopogon ovatus*).

❑ *EXAMPLE LOCATIONS*

Mt Wanganderry, north of "Ben Har"; Stockyard Creek, Mt Flora

❑ CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Low	22	29
B Medium	0	0
C High	55	71
Total	**78**	**100**

❑ THREATENED PLANT SPECIES

None recorded

❑ DIAGNOSTIC SPECIES

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acaena echinata	2	1.00	2	0.01	positive
Acaena novae-zelandiae	3	1.00	1	0.02	positive
Adiantum aethiopicum	3	1.00	2	0.14	positive
Austrodanthonia pilosa	2	1.00	1	0.02	positive
Austrostipa rudis subsp. nervosa	2	1.00	2	0.06	positive
Bracteantha bracteata	2	1.00	2	0.01	positive
Carex breviculmis	2	1.00	2	0.04	positive
Dichelachne rara	2	1.00	1	0.02	positive
Echinopogon ovatus	2	1.00	2	0.15	positive
Epilobium billardiereanum subsp. cinereum	4	1.00	0	0.00	positive
Eragrostis benthamii	4	1.00	4	0.00	positive
Euchiton gymnocephalus	3	1.00	2	0.04	positive
Gahnia radula	2	1.00	0	0.00	positive
Geranium solanderi var. solanderi	2	1.00	2	0.08	positive
Hypericum gramineum	2	1.00	2	0.13	positive
Juncus australis	1	1.00	0	0.00	positive
Juncus gregiflorus	2	1.00	2	0.00	positive
Lepidosperma elatius	3	1.00	3	0.01	positive
Lomandra longifolia	4	1.00	2	0.43	positive
Melaleuca styphelioides	5	1.00	2	0.05	positive
Microlaena stipoides var. stipoides	5	1.00	2	0.42	positive
Poa labillardierei var. labillardierei	2	1.00	2	0.11	positive
Poa meionectes	4	1.00	2	0.02	positive
Pratia purpurascens	2	1.00	2	0.28	positive
Pteridium esculentum	2	1.00	2	0.40	positive
Ranunculus lappaceus	3	1.00	2	0.01	positive
Rubus parvifolius	2	1.00	2	0.09	positive
Wahlenbergia stricta subsp. stricta	2	1.00	1	0.04	positive
Entolasia stricta	0	0.00	2	0.55	negative
Persoonia linearis	0	0.00	2	0.50	negative

OTHER FEATURES

MU38 CLEARED-MODIFIED LAND

Area: 3364 hectares

Removal of native vegetation cover has occurred mainly over the higher fertility soil types to the south and west of the mapping area. Agricultural activities past and present account for the bulk of this disturbance however rural/urban dwellings are also common in the townships of Colo Vale, Hilltop, Balmoral and Buxton. The feature code tables in Appendix B and C can be used to identify the nature of cleared or modified lands. These include features such as pastures and paddocks, transmission lines, roads, former cleared areas, residential areas etc.

MU39 SCATTERED TREES AND REGENERATING VEGETATION

Area: 834 hectares

Clearing of the native vegetation for agriculture, grazing and urban development has resulted in highly fragmented and disturbed vegetation cover in some environments. These are most apparent between the small villages between Colo Vale and Picton and in the Burragorang Valley. Areas that support a very low cover of trees (Less than 5% crown cover with a polygon) have been assigned an attribute tag of "scattered trees". The species composition of these scattered trees has been delineated where possible. These trees are often clumps of paddock trees or are sites marking rocky knolls or less fertile soils that are unfavourable to agricultural pursuits. Regenerating scrubs and regrowth trees are also present in sites that are exhibiting signs of regeneration following cessation of agricultural pressures. Commonly these are pioneering species that are fast growing recolonisers such as *Allocasuarina* and *Acacia* species.

MU40 EXOTIC TREES

Area: 45 hectares

Exotic Trees includes plantations, orchards, gardens and large areas of weeds.

MU41 EXPOSED ROCK

Area: 434 hectares

Exposed rock includes rock outcrops, rock plates, cliff lines, landslips and riverbeds.

MU42 WATER BODY

Area: 83 hectares

This Map Unit comprises the area of water within various lakes, dams, rivers and permanent water bodies.

MU43 UNASSESSED VEGETATION

Area: 134 hectares

A total of 19 polygons with an area of 134 hectares where assigned to Unassessed Vegetation. These polygons lie outside the boundary of the Nattai and Bargo reserves and were not assigned a feature code during the aerial photo interpretation process. They have been retained to provide a context of vegetation cover but allocation to a vegetation community will be addressed in future mapping projects.

APPENDIX B: MAP UNIT ALLOCATION - NATTAI AND BARGO MAPPING AREA

The following table outlines the allocation of Map Units (vegetation communities and other landscape features) to the feature codes developed during the API process for the Nattai and Bargo Mapping Area (Section 2.8 and Map 9). Conditions for separating a feature code into multiple Map Units are provided (were used) and include understorey, geology and structural attributes. The dominant group of typically co-occurring species is presented for each feature code along with indicative understorey characteristics. An additional table follows Appendix B showing habitat and other distinguishing characteristics for each feature code.

Codes:

- *E.* – replaces Eucalyptus;
- (*) – indicates the dominant species;
- (+/-) – indicates that the species may or may not be found;
- Understorey codes refer to those listed in Section 2.8.

Feature Code	Dominant Species	Understorey	Map Unit Allocation	Conditions
Exposed Sandstone Shrub Forests and Woodlands				
23	*E. sclerophylla, E. sieberi, E. globoidea, Corymbia gummifera*	*Banksia serrata*	**26**	
23A	*E. globoidea, E. sieberi, Corymbia gummifera, E. sclerophylla*	*Leptospermum trinervium*	**15** **21**	MU15 when on sandstone; MU21 when on shale or Mittagong Sediments
23G	*E. sclerophylla, E. mannifera, E. globoidea*		**26**	
10A	*E. sclerophylla*	Open low shrub layer, with grasses and sedges	**26**	
23K	*E. sclerophylla, E. sieberi, E. globoidea, Corymbia gummifera*	Sandstone shrubs	**27**	
Sheltered Sandstone Forests-mostly ridgetops				
23M	*E. sieberi, E. piperita, E. sclerophylla, E. punctata, E. agglomerata, E. globoidea*		**13**	
22B	*E. piperita* (*), *E. sieberi, E. globoidea, E. radiata*		**21**	
22M	*E. piperita* (*), *E. punctata, E. globoidea, E. radiata* (+/-)	Dense ferns (*Blechnum* spp.) with *Banksia serrata*	**13**	
25	*Angophora costata, E. punctata, E. piperita, E. sieberi, E. globoidea, Angophora floribunda*	*Allocasuarina littoralis* (often in dense thickets)	**16**	
25A	*E. piperita, E. agglomerata, Angophora costata* (+/-)		**16**	
25K	As 25A but with prominent rocky outcrops		**26**	

Feature Code	Dominant Species	Understorey	Map Unit Allocation	Conditions
22J	As 25 in Jellore State Forest		16	
25J	As 25A in Jellore State Forest		16	
Highlands Enriched Forests-mostly shale influenced				
9R	*E. tereticornis, E. punctata, E. eugenioides, E. elata* (+/-), *E. bosistoana* (+/-), *Angophora floribunda, E. crebra* (+/-)	Grassy and herbaceous with dominance of *Olearia* spp.	8b	
9V	*E. viminalis, E. elata, E. tereticornis, Angophora floribunda, E. radiata, E. blaxlandii, E. eugenioides*	As 9R but drainage lines can have dense *Melaleuca linariifolia*	8a	
9RS	*E. punctata, E. eugenioides/globoidea*	Grassy to some sands·one species. Mostly dense cover of *Lomandra* spp.	22	
9YH	*E. blaxlandii, Allocasuarina littoralis, Allocasuarina verticillata, E. punctata*		28	
9YK	Mix of 9YH and open rock		28 41	MU28 where scattered trees are present; Code the remainder to MU41
9Y	*E. blaxlandii*		22	
Sheltered Sandstone Slopes and Gullies				
36	*E. piperita, E. globoidea, E. sieberi, E. agglomerata, Corymbia gummifera*	*Banksia serrata, Banksia spinulosa*	13	
35C	*E. agglomerata, E. piperita, E. sieberi, E. punctata* (+/-)		13	
35A	*E. agglomerata, E. elata, E. piperita, E. cypellocarpa, E. punctata*	Mesic shrubs or ferns	6 7 13	MU6 where understorey=A; MU7 where understorey=B, F or "not recorded"; MU13 where understorey=C, G or H
35M	*E. deanei, E. elata, E. agglomerata*	Mesic shrubs or ferns	6	
35K	*E. piperita, E. sieberi, E. agglomerata, E. punctata, E. elata* (lower slopes)		13	
40	*E. sclerophylla, E. radiata, E. piperita*	*Melaleuca linariifolia, Banksia serrata*	35a	
40A	*E. piperita, E. radiata, E. cypellocarpa* (+/-), *E. punctata*	*Melaleuca linariifolia, Banksia serrata*	15	
Shale Forests and Woodlands				
9B	*E. crebra, E. punctata, E. moluccana, E. globoidea*		19	
9Q	*E. quadrangulata, E. punctata, E. elata, E. radiata, E. cypellocarpa*	Grassy and shrubby	8c	
9H	*E. globoidea, E. punctata, E. sieberi, Corymbia gummifera, E. sclerophylla*	Sandstone shrubs to grasses	21	
9S	*E. globoidea* (*), *E. punctata, Corymbia gummifera*	Sandstone shrubs to grasses	21	
Swamps and Scrubs				

Feature Code	Dominant Species	Understorey	Map Unit Allocation	Conditions
F	*Melaleuca linariifolia*		**35b** **37**	MU35b when on sandstone; MU37 when on shale or basalt
E34A	*E. ovata, E. radiata, E. mannifera, E. amplifolia*		**35a**	
H8	Sedgelands on sandstone		**36**	
Rocky Woodlands, Heaths and Mallees				
H28	Rock Plate with *Kunzea* spp.		**33**	
37	*E. apiculata, E. piperita, E. sieberi*		**27**	
17	*E. apiculata, E. burgessiana*		**33**	
L	Exposed rock		**41**	
L7	Exposed rock with some shrubs or heath		**41**	
L8	Woodland around sandstone tors		**27**	
G	Thickets of *Allocasuarina littoralis*		**39**	
Rainforests				
R1A	Riparian Scrub		**3**	
R7	Warm Temperate Rainforest		**1**	
R3	Short, bright green rainforest (possibly *Backhousia myrtifolia*)		**1** **2**	MU1 when on sandstone; MU2 when on Permian sediments
Forests and Woodlands on Permian Sediments				
K2	*Casuarina cunninghamiana*		**17**	
45	*E. elata, E. tereticornis, Angophora floribunda, E. eugenioides*	*Microlaena stipoides, Melaleuca linariifolia* (+/-)	**9**	
43A	*E. tereticornis, E. moluccana, E. bosistoana, E. eugenioides, E. punctata, E. crebra, E. fibrosa*	Grassy open forest	**18**	
43	*E. fibrosa, E. eugenioides, E. punctata, E. sclerophylla*		**24**	
41	*E. punctata, E. eugenioides, E. tereticornis, E. fibrosa*	*Allocasuarina torulosa*	**11**	
42	*E. sclerophylla, Angophora bakeri, Corymbia eximia, E. punctata, Corymbia gummifera, E. fibrosa*	Sandstone shrubs	**25**	
44	*E. hypostomatica, E. bosistoana, E. punctata, E. tereticornis*	Dry and grassy (moist ferns, rainforest and mesic shrubs sometimes occur)	**1** **6** **12**	MU1 where understorey=R3; MU6 where understorey=A; Code the remainder to MU12
44A	*E. deanei, E. agglomerata, E. cypellocarpa* (+/-) with a distinctive grey/green colour	Dry to mesic shrubs (occasional rainforest understorey)	**13**	
49	Permian heath	Low heath	**34**	
Additional Codes				
X	Cleared		**38**	

Feature Code	Dominant Species	Understorey	Map Unit Allocation	Conditions
XU	Cleared with urban landuse		38	
XR	Cleared with rural landuse		38	
XC	Cleared with cultivated land		38	
XQ	Cleared with exotic grasses		38	
XH	Cleared with heathy shrubs		38	
XD	Cleared with native shrubs and grasses		38	
XE	Cleared with native grasses		38	
TX	Scattered trees		39	
TXR	Scattered trees within rural Landuse		39	
TXU	Scattered trees within urban Landuse		39	
TXC	Scattered trees within cultivated land		39	
TXQ	Scattered trees with exotic Grasses		39	
V	Plantation-exotic trees		40	
W	Water bodies		42	
NL	Unassessed vegetation		43	

Habitat and Other Distinguishing Characteristics

Feature Code	Map Unit Allocation	Habitat and Other Distinguishing Characteristics
Exposed Sandstone Shrub Forests and Woodlands		
23	26	Lower open woodland, generally with shallow soils, numerous rock outcrops and rock plates. On knolls and exposed slopes
23A	15 21	Taller woodland and forest found on broad flat ridges with orange soil
23G	26	Very open woodland dominated by Scribbly Gum on drainage discharges. Very low shrub layer and grasses (*Poa* spp.)
10A	26	Open woodland on colluvial footslopes and shallow valleys of sandstone sediments. Found on footslopes into deeper sandy soil
23K	27	Exposed sandstone slopes with distinctive exposed rock benches (over 30%) and very dry
Sheltered Sandstone Forests-mostly ridgetops		
23M	13	Occurs on broad flat ridges. *Corymbia gummifera* absent and heaps of *Stypandra glauca*
22B	21	Ridgetop locations
22M	13	Shallow drainage lines in the south east corner of Bargo SCA, and Jellore State Forest
25	16	Slightly taller, less shrubby and on deeper ridgetop soils
25A	16	Upper slopes and gullies
25K	26	An open canopy with rocky outcrops prominent in the understorey. On dry slopes with rock benches, and on ridgelines with rock plates
22J	16	Jellore State Forest
25J	16	Jellore State Forest
Highlands Enriched Forests-mostly shale influenced		
9R	8b	Exposed slopes, ridges and crests with enriched soil
9V	8a	Gully lines and sheltered slopes with enriched soil
9RS	22	Southern Highlands shale/sandstone transition (high sandstone). Sandstone rocks are exposed on surface
9YH	28	Low open scrub of *Allocasuarina* spp. with scattered low trees on exposed aspects of Mount Jellore
9YK	28 41	
9Y	22	Taller forest version of 9YH on protected slopes (not visited)
Sheltered Sandstone Slopes and Gullies		
36	13	Drier upper slopes and gully heads on Hawkesbury Sandstone
35C	13	Drier upper slopes and into gullies where they are shallow and more exposed. Mesic shrubs are rare
35A	6 7 13	Tall forest on gully floors and sheltered slopes. Confined to deeper gullies and gorges, generally narrow and often adjoining rainforest
35M	6	Tall forest on gully floors and sheltered slopes. Confined to deeper gullies and gorges
35K	13	Dry forest on protected aspects with a large component of exposed sandstone (benches and boulders)
40	35a	Very deep sandy alluviums that occur on shallow incisions of Hawkesbury Sandstone. Swampy thickets of Paperbark occur along stream banks
40A	15	Similar niche to 40 but with a taller forest and Scribbly Gums sparse to absent

Feature Code	Map Unit Allocation	Habitat and Other Distinguishing Characteristics
Shale Forests and Woodlands		
9B	19	"Bargo Brush"
9Q	8c	Very tall open forest found on shales of the Mittagong Formation
9H	21	Taller open forests, on flat ridgetops with sandstone influence
9S	21	Similar to 9H but with Stringybarks tall and dominant
Swamps and Scrubs		
F	35b 37	Along drainage lines of alluvial flats
E34A	35a	Taller open forest associated with poorly drained soils near the margins of shale and sandstone soil. Often has 23G in close proximity
H8	36	Sedgelands on sandstone
Rocky Woodlands, Heaths and Mallees		
H28	33	
37	27	Very low open woodland on distinctive rock plates, with isolated Mallees and rock pavement heath
17	33	Rock plates with trees very sparse to absent. Low sparse shrubs and an abundance of exposed rock
L	41	
L7	41	
L8	27	Similar to 37. Woodland around sandstone tors
G	39	Only mapped as a component of some understoreys. Associated with Mittagong Formation Sandstones on ridgetops in the south of the area
Rainforests		
R1A	3	
R7	1	Ribbons of Coachwood and Sassafras in deeply incised gorges
R3	1 2	Occasionally mapped on drier upper slopes
Forests and Woodlands on Permian Sediments		
K2	17	Major riparian feature with R1A and sometimes R7 with understorey of A
45	9	Secondary floodplain alluviums. River flats, often with understorey of E or EG
43A	18	Modelled on lower footslopes with colluvial sediments and exposed shales. Understorey often E or D and sometimes attached to 45
43	24	Exposed steep slopes on Permian escarpments
41	11	Modelled on semi-sheltered aspects and gully lines of escarpment slopes. Understorey often D or C
42	25	Exposed sandstone woodland on Permian Sediments (restricted distribution)
44	1 6 12	Very tall forest in protected aspects underneath clifflines
44A	13	Very tall forest in protected aspects underneath clifflines. Often even-aged fire regrowth. Likely to be a Stringybark fire response more than Blue Gum
49	34	Not visited

APPENDIX C: MAP UNIT ALLOCATION - WARRAGAMBA MAPPING AREA

The following table outlines the allocation of Map Units (vegetation communities and other landscape features) to the feature codes developed during the API process for the Warragamba Mapping Area (Section 2.8 and Map 9). Conditions for separating a feature code into multiple Map Units are provided (where used). The broad complex, dominant species and associate species are shown for each API feature code. This table has been taken from NPWS (2003b) with only minor editorial and formatting changes.

Codes:

- *E.* – replaces Eucalyptus;
- (+/-)-indicates that the species may or may not be found;
- (+?)-indicates that other species may also occur but were not known;
- Us (Understorey), Cover, Rock and Confidence refer to the polygon codes developed during the API procedure as discussed in Section 2.8 and presented in NPWS (2003b). "" refers to an uncoded polygon for that particular variable.

Feature Code	Complex (Level 2)	Dominant Species	Associate Species	Map Unit Allocation	Conditions
2002	Sandstone Warm Temperate Rainforest Complex			1	
3002	Sandstone Warm Temperate Rainforest Complex	*Ceratopetalum apetalum, Acmena smithii, Doryphora sassafras, Callicoma serratifolia* (+/-), *Acacia elata* (+/-), *Backhousia myrtifolia* (+/-)	*E. deanei, E. cypellocarpa*	1	
3274	Dry Rainforest Complex	*Backhousia myrtifolia, Ficus rubiginosa* (+/-), *Rapanea howittiana* (+/-), *Alectryon subcinereus* (+/-)	*Melaleuca styphelioides*	2	
3286	Dry Rainforest Complex	*Ficus rubiginosa, Alectryon subcinereus*		2	
3005	Dry Rainforest Complex	*Backhousia myrtifolia*	*Ficus rubiginosa*	2	
3006	Dry Rainforest Complex	*Backhousia myrtifolia, Brachychiton populneus, Ficus rubiginosa*		2	

Feature Code	Complex (Level 2)	Dominant Species	Associate Species	Map Unit Allocation	Conditions
3200	Dry Rainforest Complex	*Backhousia myrtifolia* and components of Sandstone Warm Temperate Rainforest		1 2	MU1-deep sandstone gullies; MU2-escarpment slopes
3007	Dry Rainforest Complex	*Backhousia myrtifolia, E. tereticornis, E. punctata* (+/-), *E. eugenioides* (+/-)	*E. crebra* (Lake edge)	2	
3264	Sheltered Escarpment Blue Gum Forest	*E. deanei*	*E. hypostomatica, E. punctata, Syncarpia glomulifera*	10	
3039	Escarpment Sydney Peppermint Smooth barked Apple Complex	*E. piperita, Angophora costata, Syncarpia glomulifera, E. eugenioides, E. punctata*	*E. deanei*	11	
3184	Escarpment Sydney Peppermint Smooth-barked Apple Complex	*E. piperita, Angophora costata, E. eugenioides/sparsifolia, E. punctata, E. agglomerata* (+/-)	*Syncarpia glomulifera, Corymbia gummifera*	11	
3040	Escarpment Sydney Peppermint Smooth barked Apple Complex	*E. piperita, Angophora costata*	*Angophora floribunda, E. tereticornis*	11	
3379	Sheltered Escarpment Grey Gum Forest	*E. punctata, Allocasuarina torulosa, E. tereticornis, Syncarpia glomulifera, E. deanei*	*E. hypostomatica, E. bosistoana, E. moluccana*	6 7 12 11	MU6-Wanganderry Creek & Us=A; MU7-Wanganderry Creek & Us<>A; MU12-remainder & Us=D or "" (except in Blue Gum Creek); MU11-remainder & Us<>D or <>"" (including Blue Gum Creek);
3049	Sheltered Escarpment Grey Gum Forest	*E. punctata, Syncarpia glomulifera, E. eugenioides* (+/-), *E. agglomerata* (+/-)	*E. deanei, E. fibrosa*	11	
3060	Permian Stringybark - Grey Gum - Red Gum Complex	*E. eugenioides, E. punctata, E. tereticornis* (+/-)	*E. fibrosa, E. crebra, Angophora floribunda, Syncarpia glomulifera*	11	
3052	Permian Stringybark - Grey Gum - Red Gum Complex	*E. eugenioides*	*E. fibrosa*	11	
3244	Permian Stringybark - Grey Gum - Red Gum Complex	*E. tereticornis, E. eugenioides* (+/-)	*E. punctata, E. melliodora, Angophora floribunda*	18	

Feature Code	Complex (Level 2)	Dominant Species	Associate Species	Map Unit Allocation	Conditions
3247	Permian Stringybark - Grey Gum - Red Gum Complex	*E. tereticornis, E. melliodora* (+/-)	*E. crebra*	18	
3245	Permian Stringybark - Grey Gum - Red Gum Complex	*E. tereticornis*		18	
3185	Permian Stringybark - Grey Gum - Red Gum Complex	*E. punctata*	*Acacia binervia*	11	
3227	Sheltered Sandstone Blue-leaved Stringybark Complex	*E. agglomerata, E. punctata, E. eugenioides, E. piperita* (+/-)	*Angophora floribunda, E. sclerophylla*	15	
3411	Escarpment Slopes Dry Ironbark Woodland Complex	*E. fibrosa, E. punctata, E. eugenioides, E. crebra* (+/-)	*Allocasuarina littoralis, Angophora bakeri, E. ralla, Callitris endlicheri* (Bonnum Pic area)	24	
3032	Escarpment Slopes Dry Ironbark Woodland Complex	*E. fibrosa, E. punctata, E. crebra* (+/-), *E. eugenioides* (+/-), *E. agglomerata* (+/-)	*E. tereticornis, Angophora floribunda* (Lake edge), *E. ralla*	24	
3294	Escarpment Slopes Dry Ironbark Woodland Complex	*E. fibrosa, E. punctata, Callitris endlicheri*		24	
3285	Escarpment Slopes Dry Ironbark Woodland Complex	*E. fibrosa, E. punctata*	*Callitris endlicheri*	24	
3282	Escarpment Slopes Dry Ironbark Woodland Complex	*E. fibrosa, E. punctata*	*Callitris endlicheri, E. ralla*	24	
3284	Escarpment Slopes Dry Ironbark Woodland Complex	*E. fibrosa, E. punctata*	*E. ralla*	24	
3287	Escarpment Slopes Dry Ironbark Woodland Complex	*E. fibrosa, Corymbia eximia*	*Angophora bakeri, E. sclerophylla*	25	
3288	Permian Sandstone Yellow Bloodwood Complex	*Corymbia eximia*	*Angophora bakeri*	25	
3278	Permian Sandstone Yellow Bloodwood Complex	*Corymbia eximia*	*E. piperita*	25	
3246	Footslopes Grassy Grey Box Complex	*E. moluccana, E. tereticornis, E. fibrosa* (+/-), *E. crebra* (+/-)		31	
3172	Footslopes Grassy Grey Box Complex	*E. fibrosa, E. moluccana*	*E. tereticornis, E. eugenioides*	18	

Feature Code	Complex (Level 2)	Dominant Species	Associate Species	Map Unit Allocation	Conditions
3173	Footslopes Grassy Grey Box Complex	*E. moluccana, E. tereticornis*	*E. fibrosa, E. eugenioides, E. melliodora*	18 31	MU18-polys in Nattai River area; MU31-remainder
3249	Footslopes Grassy Grey Box Complex	*E. tereticornis, E. melliodora*	*E. eugenioides*	31	
3177	Footslopes Grassy Grey Box Complex	*E. tereticornis*	*E. fibrosa, E. crebra*	18	
3239	Footslopes Grassy Grey Box Complex	*E. tereticornis, E. eugenioides*	*E. punctata, E. moluccana*	18	
3283	Douglas Scarp Complex	*E. crebra, Callitris endlicheri* (+/-), *Acacia binervia*	*Angophora floribunda, E. moluccana, E. eugenioides, E. punctata, E. tereticornis*	29	
3055	Douglas Scarp Complex	Ridges and Slopes: *E. crebra, Callitris endlicheri, Acacia binervata, E. moluccana* (+/-)	*E. tereticornis, E. sparsifolia, E. punctata, Angophora floribunda*	29	
3281	Douglas Scarp Complex	Ridges and Slopes: *E. crebra, E. moluccana, E. tereticornis, Acacia binervata*	*Callitris endlicheri*	29	
3054	Douglas Scarp Complex	Gullies and Flats: *E. tereticornis, E. moluccana*	*Callitris endlicheri, E. crebra, Acacia binervata, E. punctata*	23	
3057	Permian Sandstone Scribbly Gum Complex	*E. sclerophylla, Angophora bakeri, E. sparsifolia* (+/-), *Corymbia gummifera* (+/-)	*E. piperita, Angophora costata, E. punctata, E. fibrosa, E. crebra, E. ralla*	25	
3276	Permian Sandstone Scribbly Gum Complex	*E. sclerophylla, Corymbia eximia*		25	
3412	Permian Sandstone Scribbly Gum Complex	*Acacia* spp.	*E. crebra* (?), *E. sparsifolia* (?), *E. punctata* (?)	29	
3413	Permian Allocasuarina Complex	Thickets of *Allocasuarina* spp.		39	
3198	Rosy Paperbark Heath Complex	*Melaleuca erubescens*	*Grevillea kedumbensis*	34	
3248	Permian Dry Scrub Complex	*Kunzea ambigua*		39	

Feature Code	Complex (Level 2)	Dominant Species	Associate Species	Map Unit Allocation	Conditions
2008	Sandstone Moist Blue Gum Complex-Mesic			5 6 7	MU5-north Wanganderry Tablelands & Blue Gum Creek; MU6-south Wanganderry Tablelands & Wild Goat Plateau where Us=A; MU7-south Wanganderry Tablelands & Wild Goat Plateau where Us<>A;
3450	Sandstone Moist Blue Gum Complex	*E. deanei, Syncarpia glomulifera, E. cypellocarpa, Angophora floribunda, Angophora costata, E. piperita, E. punctata, Acacia elata, Corymbia apetalum, Acmena smithii*	Deep protected gullies of sandstone plateaux. Very sheltered sites beneath sandstone escarpments	5 6 7	MU5-north Wanganderry Tablelands & Blue Gum Creek; MU6-south Wanganderry Tablelands & Wild Goat Plateau where Us=A; MU7-south Wanganderry Tablelands & Wild Goat Plateau where Us<>A;
2014	Sheltered Sandstone Turpentine Round-leaved Gum Complex			15	
3144	Sheltered Sandstone Turpentine Round-leaved Gum Complex	*Syncarpia glomulifera*	*E. deanei*	2 5 6 7	MU2-escarpment slopes; MU5-Couridjah area; MU6-remainder where Us=A; MU7-remainder where Us<>A
3156	Sheltered Sandstone Turpentine Round-leaved Gum Complex	*E. deanei, Angophora costata, Syncarpia glomulifera* (+/-), *E. punctata* (<600m)	*E. agglomerata, E. piperita, E. cypellocarpa* (elevated), *E. oreades* (elevated)	5 14 7	MU5-deep gullies (Couridjah area); MU14-slopes (Couridjah area); MU7-remainder (outside Couridjah area)
3403	Highlands Sandstone Dry Shrub Forest Complex	*E. agglomerata, E. punctata, E. sieberi, Angophora costata, E. piperita, E. sclerophylla*		16	

Feature Code	Complex (Level 2)	Dominant Species	Associate Species	Map Unit Allocation	Conditions
3401	Highlands Sandstone Dry Shrub Forest Complex	*E. agglomerata, E. punctata, E. radiata, E. globoidea*		37 22	Mu37-manual allocation of 3 polys after field checking; MU22-remainder
3300	Highlands Sandstone Dry Shrub Forest Complex	*E. sieberi, E. sclerophylla, E. agglomerata, E. punctata*	*Angophora costata*	16	
3305	Highlands Sandstone Dry Shrub Forest Complex	*E. sieberi*	*E. agglomerata*	16	
3301	Highlands Sandstone Dry Shrub Forest Complex	*E. agglomerata, E. punctata*	*Angophora costata*	16	
3019	Highlands Sandstone Dry Shrub Forest Complex	*E. sieberi, E. piperita*	Ridges: *E. globoidea*	22	
3020	Highlands Sandstone Dry Shrub Forest Complex	*E. sieberi, E. piperita*	Slopes: *E. agglomerata*	16	
3022	Highlands Sandstone Dry Shrub Forest Complex	*E. sieberi, E. piperita, E. radiata*	Poor Drainage or Shallow Soils: *E. sclerophylla*	16	
3023	Highlands Sandstone Dry Shrub Forest Complex	*E. smithii, E. cypellocarpa, E. elata, E. globoidea*		7	
3402	Highlands Sandstone Dry Shrub Forest Complex	*E. cypellocarpa*, (+?)	Requires Field Sampling	7	
3026	Sandstone Smooth Barked Apple Complex	*E. piperita, Angophora costata, Syncarpia glomulifera, E. agglomerata* (+/-)	*E. deanei*	15	
3280	Sheltered Sandstone Blue-leaved Stringybark Complex	Intermediate-Moist: *E. agglomerata, Syncarpia glomulifera, E. piperita, E. punctata* (+/-), *E. sparsifolia/eugenioides*	*E. deanei, Corymbia gummifera*	13 14	MU13-outside Couridjah area; MU14-Couridjah area
3431	Sheltered Sandstone Blue-leaved Stringybark Complex	Dry-Intermediate: *E. agglomerata, E. piperita, E. punctata* (+/-)	*E. sparsifolia, Corymbia gummifera, Syncarpia glomulifera*	15 13 14	MU15-Us=C, B or "", when Cover=3; MU13-remainder (outside Couridjah area); MU14-remainder (Couridjah area)

Feature Code	Complex (Level 2)	Dominant Species	Associate Species	Map Unit Allocation	Conditions
3028	Sheltered Sandstone Blue-leaved Stringybark Complex	Dry-Intermediate: *E. agglomerata, Angophora costata, E. piperita, E. punctata* (+/-)	*E. sparsifolia, Corymbia gummifera, Syncarpia glomulifera, E. cypellocarpa*	13	
3233	Sheltered Sandstone Blue-leaved Stringybark Complex	Dry-Rocky: *E. agglomerata, E. piperita, E. punctata* (+/-), *E. sparsifolia* (+/-)	*E. sclerophylla, Corymbia gummifera*	15 13 14	MU15-Cover=4, Rock=4 or 5; MU13-remainder (outside Couridjah Area); MU14-remainder (Couridjah Area)
3163	Sheltered Sandstone Blue-leaved Stringybark Complex	Dry-Rocky: *E. agglomerata, Angophora costata, E. piperita, E. punctata* (+/-), *E. sparsifolia* (+/-)	*E. sclerophylla, Corymbia gummifera*	13	
3237	Sydney Peppermint Forest/Woodland Complex	*E. piperita*	*E. gummifera, E. sclerophylla, E. sparsifolia. E. agglomerata*	15	
3238	Sydney Peppermint Forest/Woodland Complex	*E. piperita, E. sparsifolia* (+/-)	*E. sclerophylla, E. punctata*	15	
3291	Sydney Peppermint Forest/Woodland Complex	*E. piperita, E. agglomerata* *E. sieberi* (+/-), *E. sclerophylla* (+/-)	*E. punctata, Corymbia eximia*	27 26	MU27-Cover=4, Rock=4 or 5; MU26-remainder
3292	Sydney Peppermint Forest/Woodland Complex	*E. piperita, Corymbia eximia* (+/-)		26	
3279	Sheltered Sandstone Grey Gum-Stringybark Complex	*E. eugenioides, E. punctata, Syncarpia glomulifera*	*E. piperita*	13 14	MU13-outside Couridjah area; MU14-within the Couridjah area
3119	Warragamba Sandstone Dry Shrub Complex	*E. sieberi, E. piperita, E. sparsifolia, Corymbia gummifera*	*Angophora costata, E. sclerophylla* (No *E. punctata*)	15	
2035	Nattai Tablelands Dry Shrub Complex			26	
3253	Nattai Tablelands Dry Shrub Complex	*E. piperita, Corymbia gummifera, E. agglomerata, E. sparsifolia, E. eugenioides*	*Syncarpia glomulifera, Corymbia eximia, E. punctata, E. sieberi, E. sclerophyl'a, E. fibrosa, Angophora bakeri*	15 26	MU15-Cover=2; MU26-Cover=3
3273	Nattai Tablelands Dry Shrub Complex	*E. piperita*	*Corymbia gummifera, E. sparsifolia, E. sclerophylla, E. eugenioides* (+/-)	15	

Feature Code	Complex (Level 2)	Dominant Species	Associate Species	Map Unit Allocation	Conditions
2044	Exposed Sandstone Plateau Shrub Open Forest/Woodland Complex			26	
3252	Exposed Sandstone Plateau Shrub Open Forest/Woodland Complex	*E. piperita, Corymbia gummifera, E. sparsifolia*, (+/-: *E. sieberi, E. agglomerata, Angophora costata* - Kings Tableland)	*E. burgessiana, E. consideniana, E. globoidea, E. punctata, E. resinifera* (?), *E. rossii* (?), *E. stricta, Corymbia eximia, E. sclerophylla, Syncarpia glomulifera*	15 26	MU15-Cover=2; MU26-Cover=3
3290	Exposed Sandstone Plateau Shrub Open Forest/Woodland Complex	*E. piperita, Corymbia gummifera, Angophora costata, E. agglomerata* (+/-), *E. sieberi* (+/-), *E. sclerophylla* (+/-)	*E. punctata, E. stricta, Corymbia eximia, Syncarpia glomulifera*	26	
2045	Rocky Sandstone Heath Woodland Complex			27	
3260	Rocky Sandstone Heath Woodland Complex	*E. sieberi, E. piperita, Angophora costata* (+/-), *Corymbia eximia* (+/-), *E. sclerophylla* (+/-)	*E. agglomerata*	11 15 26 27	MU11-escarpment slopes; MU15-Cover<=2; MU26-Cover=3; MU27-Cover=4
3029	Rocky Sandstone Heath Woodland Complex	*E. piperita*	*E. punctata, Corymbia eximia, E. sparsifolia, E. agglomerata* (edges)	26 27	MU26-Cover<=3; MU27-Cover=4
3257	Rocky Sandstone Heath Woodland Complex	*E. eximia, Angophora costata, E. agglomerata* (+/-), *E. piperita* (+/-)	*E. sparsifolia*	26 27	MU26-Cover<=3; MU27-Cover=4
2043	Rocky Sandstone Scribbly Gum Heath Complex			26	
3030	Rocky Sandstone Scribbly Gum Heath Complex	*E. sclerophylla, E. sieberi, E. piperita* (+/-), *Corymbia gummifera*	*E. sparsifolia, E. punctata, Angophora costata*	26	
3234	Rocky Sandstone Scribbly Gum Heath Complex	*E. sclerophylla, E. piperita, Corymbia gummifera* (+/-), *E. sparsifolia* (+/-)		26 27	MU26-Rock<4; MU27-Rock=4
3243	Rocky Sandstone Scribbly Gum Heath Complex	*E. sclerophylla, E. piperita, E. agglomerata* (+/-)	*E. sieberi, E. punctata*	26	

Feature Code	Complex (Level 2)	Dominant Species	Associate Species	Map Unit Allocation	Conditions
3271	Rock Plate Heath Mallee	Various Mallees with *Banksia ericifolia, Leptospermum trinervium, Allocasuarina nana, Allocasuarina distyla*	*E. sclerophylla, E. sieberi, Angophora costata, E. piperita, Corymbia gummifera, E. sparsifolia, Angophora bakeri*	33	
3272	Rock Plate Heath Mallee	Various Mallees with *Banksia ericifolia, Leptospermum trinervium, Allocasuarina nana, Allocasuarina distyla*	*E. sclerophylla, E. sieberi, E. piperita, Corymbia gummifera, E. sparsifolia, Angophora bakeri, Angophora costata* (+/-)	33	
3230	Upland Swamps Tea Tree Thicket Complex	*Leptospermum juniperinum, Banksia linifolia, Empodisma minus, Baumea* spp.	*Leptospermum linariifolia, Leptospermum polygalifolium, E. sclerophylla*	10	
2023	Cumberland Plain Shale Sandstone Transition Complex			20	
3088	Porphyry Red Gum-Box Shrub Complex	*E. tereticornis, E. moluccana, E. melliodora* (+/-), *E. albens* (+/-)	*Brachychiton populneus, Angophora floribunda, Allocasuarina verticillata*	30	
3089	Rocky Fig-Kurrajong-Drooping Oak Complex	*Allocasuarina verticillata*		39	
3314	Rocky Fig-Kurrajong-Drooping Oak Complex	*Allocasuarina verticillata, Brachychiton populneus, Ficus rubiginosa*	*E. tereticornis, E. melliodora*	32	
3312	Porphyry Red Gum Stringybark Complex	*E. tereticornis, E. eugenioides, E. melliodora*	*Angophora floribunda*	32	
3317	Porphyry Red Gum Stringybark Complex	*E. tereticornis, E. agglomerata*	*E. melliodora*	32	
3308	Wollondilly Valley Red Gum Yellow Box Complex	*E. tereticornis, E. melliodora, E. eugenioides, E. punctata*	*E. moluccana, E. bridgesiana, E. agglomerata, E. albens, E. bosistoana, E. macrorhyncha, E. cypellocarpa, E. blakelyi, Angophora floribunda* (+/-: *Brachychiton populneus, Allocasuarina verticillata*)	32	

Feature Code	Complex (Level 2)	Dominant Species	Associate Species	Map Unit Allocation	Conditions
3315	Wollondilly Valley Red Gum Yellow Box Complex	*E. tereticornis, E. melliodora, E. eugenioides, E. punctata,* (+/-) *Brachychiton populneus, Angophora floribunda, Allocasuarina verticillata*)	*E. moluccana, E. bridgesiana, E. agglomerata, E. albens, E. bosistoana, E. macrorhyncha, E. cypellocarpa, E. blakelyi, Angophora floribunda*	32	
3309	Wollondilly Valley Red Gum Yellow Box Complex	*E. moluccana, E. tereticornis, Brachychiton populneus*	*E. melliodora, E. eugenioides, E. albens, Angophora floribunda, Allocasuarina verticillata, Backhousia myrtifolia, Acacia falciformis, Melaleuca styphelioides, Ficus rubiginosa*	30	
3331	Wollondilly Valley Red Gum Yellow Box Complex	*E. moluccana, E. tereticornis, Callitris endlicheri*		29	
3310	Porphyry Red Gum Ironbark Complex (Jooriland)	*E. crebra, E. tereticornis, E. melliodora, E. moluccana*	*E. eugenioides, E. punctata, E. albens, Angophora floribunda, Allocasuarina littoralis, Brachychiton populneus*	31	
3311	Porphyry Red Gum Rough-barked Apple Complex	*E. tereticornis, Angophora floribunda, E. bridgesiana* (+/-)	*E. melliodora, E. eugenioides, Backhousia myrtifolia*	30	
3347	Porphyry Red Gum Rough-barked Apple Complex	*E. tereticornis, Angophora floribunda*	*E. melliodora, E. eugenioides, Backhousia myrtifolia*	30	
2107	Porphyry Red Gum Rough-barked Apple Complex			23	
3265	Porphyry Red Gum Rough-barked Apple Complex	*Casuarina cunninghamiana*	*Backhousia myrtifolia, E. tereticornis, Angophora floribunda, E. eugenioides, E. deanei, E. crebra, E. punctata, E. quadrangulata*	17	
3096	Porphyry Red Gum Rough-barked Apple Complex	*Casuarina cunninghamiana*	*Angopnora floribunda, E. moluccana, E. eugenioides, E. punctata, E. tereticornis*	17	
3097	River Oak Red Gum Rough-barked Apple Complex	*Casuarina cunninghamiana, Angophora floribunda, E. tereticornis* (+/-)		17	

Feature Code	Complex (Level 2)	Dominant Species	Associate Species	Map Unit Allocation	Conditions
3316	River Oak Red Gum Rough-barked Apple Complex	*Angophora floribunda, E. tereticornis, E. bridgesiana* (+/-), *Casuarina cunninghamiana* (+/-)	*E. melliodora, E. moluccana, E. albens*	17	
3098	River Oak Red Gum Rough-barked Apple Complex	*Angophora floribunda*		18	
3138	River Oak Red Gum Rough-barked Apple Complex	*E. tereticornis, Angophora floribunda, E. eugenioides*		23 18	MU23-Us=D, creeklines; MU18-remainder
3094	Round-leaved Gum Red Gum Rough-barked Apple Complex	*E. deanei, E. tereticornis, Angophora floribunda*	*Casuarina cunninghamiana*	9	
3093	Nattai Valley Flats Complex	*E. elata, E. tereticornis* (+/-), *E. deanei* (+/-)		7 9 11	MU7-sandstone slopes; MU9-river flats; MU11-escarpment slopes
2109	Dry Alluvial Paperbark Complex			23	
3140	Dry Alluvial Paperbark Complex	*Melaleuca linariifolia*		23	
3196	Dry Alluvial Paperbark Complex	*Melaleuca styphelioides/linariifolia*		23	
3261	Sandstone Alluvium Round-leaved Gum Sydney Peppermint Complex	*E. deanei, E. piperita*	*Angophora floribunda*	14	
3295	Kedumba Alluvial White Gum Complex	*Angophora costata, E. punctata* (+/-)		11	
2129	Riparian Structural Complex	>10% vegetation cover comprising exposed gravel/rock beds intermixed with sparse trees/shrubs		17	
3433	Highlands Shale Forest	*E. globoidea, E. radiata*		22	
3422	Wollondilly Valley Red Gum Yellow Box Complex	*E. tereticornis, E. melliodora, E. eugenioides, E. punctata*	*Brachychiton populneus* (+/-)	31	
3423	Wollondilly Valley Red Gum Yellow Box Complex	*E. tereticornis, E. melliodora, E. eugenioides, E. punctata*	*Brachychiton populneus* (+/-)	30	
3425	Porphyry Red Gum-Box Shrub Complex	*E. tereticornis, E. moluccana, E. melliodora* (+/-), *E. albens* (+/-)	*Brachychiton populneus, Angophora floribunda, Allocasuarina verticillata*	31	

Feature Code	Complex (Level 2)	Dominant Species	Associate Species	Map Unit Allocation	Conditions
3427	Devonian Rocky Red Gum	*E. tereticornis*		30	
3205	Cleared-Modified Lands	Infrastructure	Mining	38	
2124	Cleared-Modified Lands	Cleared Lands (Crown Separation Ratio>4)	Various Disturbance	37 38 39	MU37-Confidence=3; MU38-Cover=6, 7 or ""; MU39-Cover=5
3208	Cleared-Modified Lands	Cleared Lands (Crown Separation Ratio>4)	Regeneration/Pioneering Shrub/Scrub	39	
2125	Cleared-Modified Lands	Arboretum/Exotics		40	
3270	Cleared-Modified Lands	Arboretum/Exotics	Various Species	40	
2126	Water Bodies	Open Water		42	
2127	Exposed Rock	Exposed Rock/Gravel Beds	Riparian Gravel/Rock Beds (Vegetation Cover<10%)	41	
3209	Exposed Rock	Rock	Precipitous Rockface: Cliff etc	41	
3210	Exposed Rock	Rock	Rock Flatform/Outcrop	41	
3212	Exposed Rock	Rock	Landslip/Scree Slope	41	
2128	Cleared-Modified Lands	Pioneering Species		39	
3213	Cleared-Modified Lands	Pioneering Species	Pioneering Shrub/Scrub	39	
3275	Cleared-Modified Lands	Pioneering Species	Pioneering Species	39	

APPENDIX D: SITES BY STRATA ANALYSIS

Following is an analysis of the performance of the survey sites collated for this project. A subset of the analysis dataset of only those sites contained within the study area (a total of 256 sites) were analysed against a derived environmental stratification, such that potential shortfalls in survey effort could be examined. The stratification was based on an amalgamation of landscapes, through the combination of classifications describing broad vegetation, elevation and rainfall. These classes are shown below in the "Key to Strata Codes" table, and are combined in the "Strata Code" field of the "Sites by Strata" table. The strata code field is a combination of broad vegetation group, elevation group and rainfall group all separated by a comma. Strata smaller than 20ha have been excluded. Those strata where the difference between the proportion of sites to the proportion of area is less than negative 1 have been highlighted. A higher number in the "Difference in %" field, indicates that the strata has received more adequate survey effort or may have been oversampled. A total of 97 strata combinations where derived with 22 of these being less than 20ha.

KEY TO STRATA CODES

Code	Broad Vegetation Groups	Code	Elevation Groups	Code	Annual Rainfall Groups
1	Sheltered Sandstone Forests	1	<350m	1	<845mm
2	Other Features	2	350-600m	2	845-876mm
3	Highland Scrubs	3	>600m	3	>876mm
4	Sandstone Shrub Woodlands				
5	Heath Woodland and Mallee				
6	Transitional Shale Grassy Forests				
7	Swamp Woodland and Heath				
8	Dry Woodlands (non-Sandstone)				
9	Shale/Sandstone Shrub Forests				
10	River Oak Forest				
11	Sandstone Moist Forest/Rainforest				
12	Sheltered Permian Forests				
13	Porphyry Woodlands				

SITES BY STRATA

Strata Unit	Strata Code	Area of Strata (ha)	% of Strata	Sites by Strata	% of Sites	Difference in %	Difference in % <-1.0
1	2, 1, 2	20	0.0	0	0.0	0.0	
2	13, 1, 2	112	0.2	1	0.4	0.2	
3	12, 1, 1	1429	2.0	11	4.3	2.3	
4	2, 1, 1	1359	1.9	2	0.8	-1.1	n
5	12, 1, 2	1112	1.6	3	1.2	-0.4	
6	8, 1, 2	1911	2.7	8	3.1	0.4	
7	8, 1, 3	560	0.8	0	0.0	-0.8	
9	12, 1, 3	698	1.0	9	3.5	2.5	
10	4, 1, 3	126	0.2	1	0.4	0.2	
11	4, 1, 2	535	0.8	3	1.2	0.4	
13	5, 1, 3	25	0.0	0	0.0	0.0	
14	5, 2, 3	1080	1.5	2	0.8	-0.7	
15	8, 1, 1	3609	5.1	7	2.7	-2.3	n
16	12, 2, 3	90	0.1	0	0.0	-0.1	
17	4, 2, 3	7501	10.5	22	8.6	-1.9	n
18	1, 2, 3	2888	4.1	8	3.1	-0.9	
19	1, 1, 3	102	0.1	0	0.0	-0.1	
20	11, 2, 3	106	0.1	0	0.0	-0.1	
21	2, 2, 3	558	0.8	0	0.0	-0.8	
24	4, 3, 3	3169	4.5	8	3.1	-1.3	n
25	6, 1, 1	695	1.0	6	2.3	1.4	
26	6, 1, 2	197	0.3	3	1.2	0.9	

Strata Unit	Strata Code	Area of Strata (ha)	% of Strata	Sites by Strata	% of Sites	Difference in %	Difference in % <-1.0
27	13, 1, 1	1327	1.9	5	2.0	0.1	
28	5, 3, 3	915	1.3	5	2.0	0.7	
29	1, 3, 3	2065	2.9	9	3.5	0.6	
30	12, 2, 2	439	0.6	2	0.8	0.2	
31	6, 2, 3	173	0.2	1	0.4	0.1	
32	10, 1, 2	49	0.1	0	0.0	-0.1	
33	10, 1, 1	234	0.3	1	0.4	0.1	
34	11, 2, 2	379	0.5	1	0.4	-0.1	
35	1, 2, 2	4719	6.6	14	5.5	-1.2	n
36	4, 2, 2	6045	8.5	19	7.4	-1.1	n
37	9, 2, 3	717	1.0	5	2.0	0.9	
38	2, 2, 2	147	0.2	0	0.0	-0.2	
39	8, 2, 2	80	0.1	0	0.0	-0.1	
42	9, 2, 2	589	0.8	6	2.3	1.5	
43	9, 1, 2	284	0.4	1	0.4	0.0	
44	11, 1, 2	307	0.4	2	0.8	0.4	
45	5, 1, 2	45	0.1	0	0.0	-0.1	
46	5, 2, 2	1049	1.5	2	0.8	-0.7	
47	8, 3, 3	152	0.2	2	0.8	0.6	
48	1, 1, 2	155	0.2	0	0.0	-0.2	
51	4, 1, 1	230	0.3	0	0.0	-0.3	
52	6, 2, 2	33	0.0	0	0.0	0.0	
53	12, 3, 2	39	0.1	1	0.4	0.3	
54	12, 2, 1	1745	2.5	7	2.7	0.3	
55	8, 2, 1	1967	2.8	8	3.1	0.4	
56	5, 2, 1	446	0.6	0	0.0	-0.6	
57	8, 3, 2	109	0.2	3	1.2	1.0	
58	5, 3, 2	524	0.7	1	0.4	-0.3	
59	11, 1, 1	61	0.1	0	0.0	-0.1	
60	1, 2, 1	4219	5.9	19	7.4	1.5	
61	4, 2, 1	1325	1.9	1	0.4	-1.5	n
62	2, 3, 2	281	0.4	0	0.0	-0.4	
63	2, 3, 3	1801	2.5	0	0.0	-2.5	n
64	2, 2, 1	597	0.8	0	0.0	-0.8	
65	4, 3, 2	1900	2.7	2	0.8	-1.9	n
66	1, 3, 2	2584	3.6	10	3.9	0.3	
67	5, 3, 1	108	0.2	0	0.0	-0.2	
68	11, 2, 1	181	0.3	4	1.6	1.3	
69	12, 3, 1	100	0.1	0	0.0	-0.1	
70	4, 3, 1	536	0.8	0	0.0	-0.8	
71	2, 3, 1	120	0.2	0	0.0	-0.2	
73	8, 3, 1	93	0.1	0	0.0	-0.1	
74	1, 1, 1	54	0.1	0	0.0	-0.1	
77	13, 2, 1	680	1.0	7	2.7	1.8	
78	1, 3, 1	1921	2.7	8	3.1	0.4	
79	7, 2, 1	72	0.1	2	0.8	0.7	
80	6, 2, 1	504	0.7	3	1.2	0.5	
81	7, 2, 2	42	0.1	3	1.2	1.1	
83	3, 3, 3	60	0.1	3	1.2	1.1	
84	13, 3, 1	23	0.0	0	0.0	0.0	
86	6, 3, 3	547	0.8	2	0.8	0.0	
87	6, 3, 2	193	0.3	1	0.4	0.1	
90	6, 3, 1	193	0.3	0	0.0	-0.3	

APPENDIX E: NATIVE SPECIES LIST

Following is a list of the native species recorded within the Nattai and Bargo reserves. The list is sorted by the scientific name of the species, and a common name is provided where one has been recognised in existing literature.

Family	Scientific Name	Common Name
Malvaceae	Abutilon oxycarpum	Flannel Weed
Fabaceae (Mimosoideae)	Acacia binervia	Coast Myall
Fabaceae (Mimosoideae)	Acacia bynoeana	Bynoe's Wattle
Fabaceae (Mimosoideae)	Acacia deanei subsp. deanei	Deane's Wattle
Fabaceae (Mimosoideae)	Acacia decurrens	Black Wattle
Fabaceae (Mimosoideae)	Acacia elata	Mountain Cedar Wattle
Fabaceae (Mimosoideae)	Acacia falciformis	Broad-leaved Hickory
Fabaceae (Mimosoideae)	Acacia fimbriata	Fringed Wattle
Fabaceae (Mimosoideae)	Acacia floribunda	White Sally
Fabaceae (Mimosoideae)	Acacia implexa	Hickory Wattle
Fabaceae (Mimosoideae)	Acacia jonesii	
Fabaceae (Mimosoideae)	Acacia linearifolia	Narrow-leaved Wattle
Fabaceae (Mimosoideae)	Acacia linifolia	Flax-leaved Wattle
Fabaceae (Mimosoideae)	Acacia longifolia	
Fabaceae (Mimosoideae)	Acacia longissima	Narrow-leaved Wattle
Fabaceae (Mimosoideae)	Acacia mearnsii	Black Wattle
Fabaceae (Mimosoideae)	Acacia melanoxylon	Blackwood
Fabaceae (Mimosoideae)	Acacia myrtifolia	Red-stemmed Wattle
Fabaceae (Mimosoideae)	Acacia obtusifolia	
Fabaceae (Mimosoideae)	Acacia paradoxa	Kangaroo Thorn
Fabaceae (Mimosoideae)	Acacia parramattensis	Parramatta Wattle
Fabaceae (Mimosoideae)	Acacia parvipinnula	Silver-stemmed Wattle
Fabaceae (Mimosoideae)	Acacia rubida	Red-leaved Wattle
Fabaceae (Mimosoideae)	Acacia spp.	
Fabaceae (Mimosoideae)	Acacia stricta	Straight Wattle
Fabaceae (Mimosoideae)	Acacia suaveolens	Sweet Wattle
Fabaceae (Mimosoideae)	Acacia terminalis	Sunshine Wattle
Fabaceae (Mimosoideae)	Acacia ulicifolia	Prickly Moses
Rosaceae	Acaena novae-zelandiae	
Rosaceae	Acaena spp.	
Orchidaceae	Acianthus fornicatus	Pixie Caps
Orchidaceae	Acianthus spp.	
Myrtaceae	Acmena smithii	Lilly Pilly
Epacridaceae	Acrotriche divaricata	
Apiaceae	Actinotus helianthi	Flannel Flower
Adiantaceae	Adiantum aethiopicum	Common Maidenhair
Adiantaceae	Adiantum formosum	Giant Maidenhair
Adiantaceae	Adiantum hispidulum var. hispidulum	Rough Maidenhair
Lamiaceae	Ajuga australis	Austral Bugle
Casuarinaceae	Allocasuarina littoralis	Black Sheoak
Casuarinaceae	Allocasuarina torulosa	Forest Oak
Casuarinaceae	Allocasuarina verticillata	Drooping Sheoak
Fabaceae (Faboideae)	Almaleea paludosa	
Euphorbiaceae	Amperea xiphoclada var. xiphoclada	
Poaceae	Amphipogon strictus var. strictus	Greybeard Grass
Loranthaceae	Amyema cambagei	
Loranthaceae	Amyema miquelii	
Loranthaceae	Amyema pendulum subsp. pendulum	
Myrtaceae	Angophora bakeri	Narrow-leaved Apple

Family	Scientific Name	Common Name
Myrtaceae	Angophora costata	Sydney Red/Rusty Gum
Myrtaceae	Angophora floribunda	Rough-barked Apple
Poaceae	Anisopogon avenaceus	Oat Speargrass
Cunoniaceae	Aphanopetalum resinosum	Gum Vine
Poaceae	Aristida ramosa	
Poaceae	Aristida vagans	Threeawn Speargrass
Anthericaceae	Arthropodium milleflorum	Vanilla Lily
Anthericaceae	Arthropodium minus	Small Vanilla Lily
Anthericaceae	Arthropodium species B	
Anthericaceae	Arthropodium spp.	
Rubiaceae	Asperula conferta	Common Woodruff
Rubiaceae	Asperula gunnii	Mountain Woodruff
Rubiaceae	Asperula scoparia	Prickly Woodruff
Aspleniaceae	Asplenium flabellifolium	Necklace Fern
Epacridaceae	Astroloma humifusum	Native Cranberry
Araliaceae	Astrotricha latifolia	
Araliaceae	Astrotricha ledifolia	
Araliaceae	Astrotricha longifolia	
Poaceae	Austrodanthonia fulva	
Poaceae	Austrodanthonia laevis	
Poaceae	Austrodanthonia pilosa	Small-flowered Wallaby Grass
Poaceae	Austrodanthonia racemosa var. racemosa	
Poaceae	Austrodanthonia spp.	Wallaby Grass
Poaceae	Austrostipa pubescens	
Poaceae	Austrostipa ramosissima	Stout Bamboo Grass
Poaceae	Austrostipa rudis subsp. nervosa	
Poaceae	Austrostipa rudis subsp. rudis	
Poaceae	Austrostipa spp.	
Poaceae	Austrostipa verticillata	
Myrtaceae	Babingtonia densifolia	
Myrtaceae	Babingtonia pluriflora	
Myrtaceae	Backhousia myrtifolia	Grey Myrtle
Myrtaceae	Baeckea brevifolia	
Myrtaceae	Baeckea linifolia	
Proteaceae	Banksia ericifolia subsp. ericifolia	
Proteaceae	Banksia serrata	
Proteaceae	Banksia spinulosa var. spinulosa	
Baueraceae	Bauera microphylla	
Baueraceae	Bauera rubioides	
Cyperaceae	Baumea rubiginosa	
Pittosporaceae	Billardiera scandens var. scandens	Appleberry
Blechnaceae	Blechnum ambiguum	
Blechnaceae	Blechnum cartilagineum	Gristle Fern
Blechnaceae	Blechnum nudum	Fishbone Water Fern
Blechnaceae	Blechnum patersonii subsp. patersonii	
Rutaceae	Boronia floribunda	Pale-pink Boronia
Rutaceae	Boronia ledifolia	Sydney Boronia
Rutaceae	Boronia polygalifolia	
Rutaceae	Boronia rigens	
Fabaceae (Faboideae)	Bossiaea buxifolia	
Fabaceae (Faboideae)	Bossiaea ensata	
Fabaceae (Faboideae)	Bossiaea heterophylla	
Fabaceae (Faboideae)	Bossiaea neo-anglica	
Fabaceae (Faboideae)	Bossiaea obcordata	

Family	Scientific Name	Common Name
Fabaceae (Faboideae)	Bossiaea oligosperma	
Fabaceae (Faboideae)	Bossiaea prostrata	
Fabaceae (Faboideae)	Bossiaea rhombifolia subsp. rhombifolia	
Fabaceae (Faboideae)	Bossiaea scolopendria	
Fabaceae (Faboideae)	Bossiaea spp.	
Poaceae	Bothriochloa macra	Red Grass
Sterculiaceae	Brachychiton populneus subsp. populneus	Kurrajong
Epacridaceae	Brachyloma daphnoides	
Asteraceae	Brachyscome angustifolia var. angustifolia	
Asteraceae	Brachyscome angustifolia var. heterophylla	
Asteraceae	Brachyscome spathulata	
Asteraceae	Brachyscome spp.	
Euphorbiaceae	Breynia oblongifolia	Coffee Bush
Acanthaceae	Brunoniella australis	Blue Trumpet
Acanthaceae	Brunoniella pumilio	Dwarf Blue Trumpet
Asphodelaceae	Bulbine bulbosa	Bulbine Lily
Colchicaceae	Burchardia umbellata	Milkmaids
Pittosporaceae	Bursaria calcicola	
Pittosporaceae	Bursaria longisepala	
Pittosporaceae	Bursaria spinosa	Native Blackthorn
Pittosporaceae	Bursaria spp.	
Anthericaceae	Caesia parviflora	Pale Grass-lily
Orchidaceae	Caladenia carnea var. carnea	
Orchidaceae	Caladenia species B	
Orchidaceae	Caleana major	Large Duck Orchid
Cunoniaceae	Callicoma serratifolia	Black Wattle
Myrtaceae	Callistemon citrinus	Crimson Bottlebrush
Myrtaceae	Callistemon linearis	Narrow-leaved Bottlebrush
Myrtaceae	Callistemon sieberi	River Bottlebrush
Cupressaceae	Callitris endlicheri	Black Cypress Pine
Orchidaceae	Calochilus paludosus	Red Beard Orchid
Orchidaceae	Calochilus spp.	
Dicksoniaceae	Calochlaena dubia	Common Ground Fern
Asteraceae	Calomeria amaranthoides	Incense Plant
Asteraceae	Calotis lappulacea	Yellow Burr-daisy
Convolvulaceae	Calystegia marginata	
Myrtaceae	Calytrix tetragona	
Brassicaceae	Cardamine paucijuga	
Cyperaceae	Carex appressa	
Cyperaceae	Carex breviculmis	
Cyperaceae	Carex brunnea	
Cyperaceae	Carex inversa	Knob Sedge
Cyperaceae	Carex spp.	
Asteraceae	Cassinia aculeata	Dolly Bush
Asteraceae	Cassinia cunninghamii	
Asteraceae	Cassinia denticulata	
Asteraceae	Cassinia laevis	Cough Bush
Asteraceae	Cassinia longifolia	
Asteraceae	Cassinia spp.	
Asteraceae	Cassinia trinerva	
Lauraceae	Cassytha glabella forma glabella	
Lauraceae	Cassytha pubescens	
Casuarinaceae	Casuarina cunninghamiana subsp. cunninghamiana	River Oak

Family	Scientific Name	Common Name
Cyperaceae	Caustis flexuosa	Curly Wig
Vitaceae	Cayratia clematidea	Slender Grape
Celastraceae	Celastrus australis	Staff Vine
Poaceae	Cenchrus caliculatus	Hillside Burrgrass
Apiaceae	Centella asiatica	Pennywort
Apiaceae	Centella cordifolia	
Cunoniaceae	Ceratopetalum apetalum	Coachwood
Cunoniaceae	Ceratopetalum gummiferum	Christmas Bush
Adiantaceae	Cheilanthes austrotenuifolia	Rock Fern
Adiantaceae	Cheilanthes distans	Bristly Cloak Fern
Adiantaceae	Cheilanthes sieberi subsp. sieberi	
Adiantaceae	Cheilanthes spp.	
Chenopodiaceae	Chenopodium pumilio	Small Crumbweed
Chenopodiaceae	Chenopodium spp.	
Orchidaceae	Chiloglottis spp.	
Chloanthaceae	Chloanthes stoechadis	
Poaceae	Chloris ventricosa	Tall Chloris
Santalaceae	Choretrum candollei	White Sour Bush
Santalaceae	Choretrum pauciflorum	Dwarf Sour Bush
Santalaceae	Choretrum species A	
Cyperaceae	Chorizandra cymbaria	
Cyperaceae	Chorizandra sphaerocephala	
Asteraceae	Chrysocephalum apiculatum	Common Everlasting
Vitaceae	Cissus antarctica	Water Vine
Vitaceae	Cissus hypoglauca	Giant Water Vine
Euphorbiaceae	Claoxylon australe	Brittlewood
Poaceae	Cleistochloa rigida	
Ranunculaceae	Clematis aristata	
Ranunculaceae	Clematis glycinoides var. glycinoides	Headache Vine
Ranunculaceae	Clematis spp.	
Verbenaceae	Clerodendrum tomentosum	
Polygalaceae	Comesperma ericinum	
Polygalaceae	Comesperma volubile	
Commelinaceae	Commelina cyanea	Native Wandering Jew
Proteaceae	Conospermum ericifolium	
Proteaceae	Conospermum longifolium subsp. angustifolium	
Proteaceae	Conospermum longifolium subsp. mediale	
Convolvulaceae	Convolvulus erubescens	
Goodeniaceae	Coopernookia barbata	
Rutaceae	Correa lawrenceana	
Rutaceae	Correa reflexa var. reflexa	Native Fuschia
Orchidaceae	Corybas spp.	
Myrtaceae	Corymbia eximia	Yellow Bloodwood
Myrtaceae	Corymbia gummifera	Red Bloodwood
Asteraceae	Cotula australis	Common Cotula
Asteraceae	Craspedia variabilis	
Crassulaceae	Crassula sieberiana	Australian Stonecrop
Rutaceae	Crowea exalata subsp. exalata	
Rhamnaceae	Cryptandra amara var. amara	
Rhamnaceae	Cryptandra species A	
Rhamnaceae	Cryptandra spinescens	
Lauraceae	Cryptocarya glaucescens	Jackwood
Orchidaceae	Cryptostylis erecta	Tartan Tongue Orchid
Orchidaceae	Cryptostylis spp.	

Family	Scientific Name	Common Name
Orchidaceae	Cyanoleuca caerulea	Blue Fingers
Cyatheaceae	Cyathea australis	Rough Treefern
Cyperaceae	Cyathochaeta diandra	
Orchidaceae	Cymbidium suave	Snake Orchid
Asteraceae	Cymbonotus lawsonianus	Bear's Ear
Poaceae	Cymbopogon refractus	Barbed Wire Grass
Boraginaceae	Cynoglossum australe	
Cyperaceae	Cyperus gracilis	
Cyperaceae	Cyperus lucidus	
Cyperaceae	Cyperus spp.	
Orchidaceae	Cyrtostylis reniformis	Gnat Orchid
Goodeniaceae	Dampiera purpurea	
Goodeniaceae	Dampiera stricta	
Apiaceae	Daucus glochidiatus	Native Carrot
Davalliaceae	Davallia solida var. pyxidata	Hare's Foot Fern
Fabaceae (Faboideae)	Daviesia acicularis	
Fabaceae (Faboideae)	Daviesia corymbosa	
Fabaceae (Faboideae)	Daviesia latifolia	
Fabaceae (Faboideae)	Daviesia mimosoides subsp. mimosoides	
Fabaceae (Faboideae)	Daviesia squarrosa	
Fabaceae (Faboideae)	Daviesia ulicifolia subsp. ulicifolia	Gorse Bitter Pea
Orchidaceae	Dendrobium linguiforme	Tongue Orchid
Orchidaceae	Dendrobium speciosum	Rock Lily
Orchidaceae	Dendrobium striolatum	
Urticaceae	Dendrocnide excelsa	Giant Stinging Tree
Loranthaceae	Dendrophthoe vitellina	
Fabaceae (Faboideae)	Desmodium brachypodum	Large Tick-trefoil
Fabaceae (Faboideae)	Desmodium gunnii	
Fabaceae (Faboideae)	Desmodium rhytidophyllum	
Fabaceae (Faboideae)	Desmodium varians	Slender Tick-trefoil
Poaceae	Deyeuxia innominata	
Poaceae	Deyeuxia quadriseta	
Phormiaceae	Dianella caerulea	
Phormiaceae	Dianella caerulea var. assera	
Phormiaceae	Dianella caerulea var. caerulea	
Phormiaceae	Dianella caerulea var. producta	
Phormiaceae	Dianella caerulea var. protensa	
Phormiaceae	Dianella longifolia	
Phormiaceae	Dianella longifolia var. longifolia	
Phormiaceae	Dianella prunina	
Phormiaceae	Dianella revoluta var. revoluta	
Phormiaceae	Dianella tasmanica	
Poaceae	Dichelachne inaequiglumis	
Poaceae	Dichelachne micrantha	Shorthair Plumegrass
Poaceae	Dichelachne parva	
Poaceae	Dichelachne rara	
Poaceae	Dichelachne sieberiana	
Poaceae	Dichelachne spp.	
Convolvulaceae	Dichondra repens	Kidney Weed
Convolvulaceae	Dichondra species A	
Anthericaceae	Dichopogon strictus	Chocolate Lily
Poaceae	Digitaria parviflora	Small-flowered Finger Grass
Poaceae	Digitaria ramularis	
Poaceae	Digitaria spp.	

Family	Scientific Name	Common Name
Fabaceae (Faboideae)	Dillwynia floribunda	
Fabaceae (Faboideae)	Dillwynia juniperina	
Fabaceae (Faboideae)	Dillwynia parvifolia	
Fabaceae (Faboideae)	Dillwynia phylicoides	
Fabaceae (Faboideae)	Dillwynia ramosissima	
Fabaceae (Faboideae)	Dillwynia retorta	
Orchidaceae	Diuris spp.	
Orchidaceae	Diuris sulphurea	Tiger/Hornet Orchid
Sapindaceae	Dodonaea boroniifolia	
Sapindaceae	Dodonaea multijuga	
Sapindaceae	Dodonaea triquetra	
Sapindaceae	Dodonaea truncatiales	
Sapindaceae	Dodonaea viscosa subsp. angustifolia	
Sapindaceae	Dodonaea viscosa subsp. angustissima	
Blechnaceae	Doodia aspera	Prickly Rasp Fern
Blechnaceae	Doodia spp.	
Monimiaceae	Doryphora sassafras	Sassafras
Epacridaceae	Dracophyllum secundum	
Droseraceae	Drosera auriculata	
Droseraceae	Drosera binata	
Droseraceae	Drosera peltata	
Droseraceae	Drosera spatulata	
Solanaceae	Duboisia myoporoides	Corkwood
Poaceae	Echinopogon caespitosus var. caespitosus	Tufted Hedgehog Grass
Poaceae	Echinopogon mckiei	
Poaceae	Echinopogon ovatus	Forest Hedgehog Grass
Chenopodiaceae	Einadia hastata	Berry Saltbush
Chenopodiaceae	Einadia nutans subsp. nutans	Climbing Saltbush
Chenopodiaceae	Einadia polygonoides	
Chenopodiaceae	Einadia trigonos	Fishweed
Elaeocarpaceae	Elaeocarpus reticulatus	Blueberry Ash
Cyperaceae	Eleocharis pusilla	
Poaceae	Elymus scaber var. scaber	Common Wheatgrass
Restionaceae	Empodisma minus	
Poaceae	Entolasia marginata	Bordered Panic
Poaceae	Entolasia spp.	
Poaceae	Entolasia stricta	Wiry Panic
Epacridaceae	Epacris coriacea	
Epacridaceae	Epacris microphylla var. microphylla	
Epacridaceae	Epacris muelleri	
Epacridaceae	Epacris obtusifolia	
Epacridaceae	Epacris pulchella	
Poaceae	Eragrostis brownii	Brown's Lovegrass
Poaceae	Eragrostis leptostachya	Paddock Lovegrass
Rutaceae	Eriostemon australasius	
Myrtaceae	Eucalyptus agglomerata	Blue-leaved Stringybark
Myrtaceae	Eucalyptus albens	White Box
Myrtaceae	Eucalyptus apiculata	
Myrtaceae	Eucalyptus benthamii	Nepean River Gum
Myrtaceae	Eucalyptus blaxlandii	
Myrtaceae	Eucalyptus bosistoana	Coast Grey Gum
Myrtaceae	Eucalyptus burgessiana	
Myrtaceae	Eucalyptus crebra	Narrow-leaved Ironbark
Myrtaceae	Eucalyptus cunninghamii	

Family	Scientific Name	Common Name
Myrtaceae	Eucalyptus cypellocarpa	Monkey Gum
Myrtaceae	Eucalyptus dawsonii	Slaty Gum
Myrtaceae	Eucalyptus deanei	Mountain Blue Gum
Myrtaceae	Eucalyptus elata	River Peppermint
Myrtaceae	Eucalyptus eugenioides	Thin-leaved Stringybark
Myrtaceae	Eucalyptus fibrosa	Red Ironbark
Myrtaceae	Eucalyptus globoidea	White Stringybark
Myrtaceae	Eucalyptus hypostomatica	
Myrtaceae	Eucalyptus melliodora	Yellow Box
Myrtaceae	Eucalyptus moluccana	Grey Box
Myrtaceae	Eucalyptus oblonga	Stringybark
Myrtaceae	Eucalyptus obstans	Port Jackson Mallee
Myrtaceae	Eucalyptus oreades	Blue Mountains Ash
Myrtaceae	Eucalyptus ovata	Swamp Gum
Myrtaceae	Eucalyptus parramattensis subsp. parramattensis	Parramatta Red Gum
Myrtaceae	Eucalyptus piperita	Sydney Peppermint
Myrtaceae	Eucalyptus punctata	Grey Gum
Myrtaceae	Eucalyptus radiata subsp. radiata	Narrow-leaved Peppermint
Myrtaceae	Eucalyptus sclerophylla	Hard-leaved Scribbly Gum
Myrtaceae	Eucalyptus sideroxylon	Mugga Ironbark
Myrtaceae	Eucalyptus sieberi	Silvertop Ash
Myrtaceae	Eucalyptus sparsifolia	Narrow-leaved Stringybark
Myrtaceae	Eucalyptus spp.	
Myrtaceae	Eucalyptus tereticornis	Forest Red Gum
Myrtaceae	Eucalyptus viminalis	Ribbon Gum
Asteraceae	Euchiton gymnocephalus	Creeping Cudweed
Asteraceae	Euchiton involucratus	Star Cudweed
Asteraceae	Euchiton sphaericus	
Asteraceae	Euchiton spp.	
Scrophulariaceae	Euphrasia collina subsp. paludosa	
Myrtaceae	Euryomyrtus ramosissima subsp. ramosissima	
Luzuriagaceae	Eustrephus latifolius	Wombat Berry
Santalaceae	Exocarpos cupressiformis	Native Cherry
Santalaceae	Exocarpos strictus	Dwarf Cherry
Moraceae	Ficus coronata	Creek Sandpaper Fig
Moraceae	Ficus rubiginosa	Port Jackson Fig
Cyperaceae	Gahnia aspera	
Cyperaceae	Gahnia clarkei	
Cyperaceae	Gahnia melanocarpa	
Cyperaceae	Gahnia microstachya	
Cyperaceae	Gahnia sieberiana	
Cyperaceae	Gahnia spp.	
Rubiaceae	Galium binifolium	
Rubiaceae	Galium gaudichaudii	Rough Bedstraw
Rubiaceae	Galium liratum	
Rubiaceae	Galium migrans	
Rubiaceae	Galium propinquum	Maori Bedstraw
Rubiaceae	Galium spp.	
Rutaceae	Geijera salicifolia var. latifolia	
Luzuriagaceae	Geitonoplesium cymosum	Scrambling Lily
Geraniaceae	Geranium homeanum	
Geraniaceae	Geranium potentilloides var. potentilloides	
Geraniaceae	Geranium solanderi var. solanderi	Native Geranium
Geraniaceae	Geranium spp.	

Family	Scientific Name	Common Name
Gleicheniaceae	Gleichenia dicarpa	
Gleicheniaceae	Gleichenia microphylla	
Gleicheniaceae	Gleichenia rupestris	
Orchidaceae	Glossodia major	Waxlip Orchid
Orchidaceae	Glossodia minor	Small Waxlip Orchid
Asteraceae	Glossogyne tannensis	Cobbler's Tack
Fabaceae (Faboideae)	Glycine clandestina	
Fabaceae (Faboideae)	Glycine microphylla	
Fabaceae (Faboideae)	Glycine spp.	
Fabaceae (Faboideae)	Glycine tabacina	
Asteraceae	Gnaphalium spp.	
Fabaceae (Faboideae)	Gompholobium glabratum	Dainty Wedge Pea
Fabaceae (Faboideae)	Gompholobium grandiflorum	Large Wedge Pea
Fabaceae (Faboideae)	Gompholobium huegelii	Pale Wedge Pea
Fabaceae (Faboideae)	Gompholobium latifolium	Golden Glory Pea
Fabaceae (Faboideae)	Gompholobium spp.	
Fabaceae (Faboideae)	Gompholobium virgatum subsp. aspalathoides	Leafy Wedge Pea
Haloragaceae	Gonocarpus longifolius	
Haloragaceae	Gonocarpus micranthus	
Haloragaceae	Gonocarpus spp.	
Haloragaceae	Gonocarpus tetragynus	
Haloragaceae	Gonocarpus teucrioides	
Goodeniaceae	Goodenia bellidifolia subsp. bellidifolia	
Goodeniaceae	Goodenia hederacea subsp. hederacea	
Goodeniaceae	Goodenia heterophylla	
Goodeniaceae	Goodenia ovata	
Goodeniaceae	Goodenia paniculata	
Goodeniaceae	Goodenia spp.	
Grammitaceae	Grammitis billardierei	Finger Fern
Scrophulariaceae	Gratiola peruviana	
Proteaceae	Grevillea arenaria subsp. arenaria	
Proteaceae	Grevillea aspleniifolia	
Proteaceae	Grevillea baueri subsp. baueri	
Proteaceae	Grevillea buxifolia subsp. buxifolia	
Proteaceae	Grevillea juniperina	
Proteaceae	Grevillea longifolia	
Proteaceae	Grevillea mucronulata	
Proteaceae	Grevillea phylicoides	
Proteaceae	Grevillea ramosissima subsp. ramosissima	Fan Grevillea
Proteaceae	Grevillea sericea	
Proteaceae	Grevillea sphacelata	
Proteaceae	Grevillea spp.	
Haemodoraceae	Haemodorum corymbosum	
Haemodoraceae	Haemodorum planifolium	
Proteaceae	Hakea constablei	
Proteaceae	Hakea dactyloides	
Proteaceae	Hakea laevipes subsp. laevipes	
Proteaceae	Hakea salicifolia	Willow-leaved Hakea
Proteaceae	Hakea sericea	
Proteaceae	Hakea spp.	
Haloragaceae	Haloragis heterophylla	
Haloragaceae	Haloragis serra	
Fabaceae (Faboideae)	Hardenbergia violacea	False Sarsaparilla
Monimiaceae	Hedycarya angustifolia	Native Mulberry

Family	Scientific Name	Common Name
Asteraceae	Helichrysum elatum	
Asteraceae	Helichrysum leucopsideum	Satin Everlasting
Asteraceae	Helichrysum scorpioides	Button Everlasting
Asteraceae	Helichrysum spp.	
Poaceae	Hemarthria uncinata var. uncinata	Matgrass
Lamiaceae	Hemigenia purpurea	
Dilleniaceae	Hibbertia acicularis	
Dilleniaceae	Hibbertia aspera subsp. aspera	
Dilleniaceae	Hibbertia circumdans	
Dilleniaceae	Hibbertia dentata	Twining Guinea Flower
Dilleniaceae	Hibbertia diffusa	
Dilleniaceae	Hibbertia empetrifolia subsp. empetrifolia	
Dilleniaceae	Hibbertia monogyna	
Dilleniaceae	Hibbertia obtusifolia	
Dilleniaceae	Hibbertia pedunculata	
Dilleniaceae	Hibbertia riparia	
Dilleniaceae	Hibbertia scandens	Climbing Guinea Flower
Dilleniaceae	Hibbertia serpyllifolia	
Malvaceae	Hibiscus sturtii	Hill Hibiscus
Fabaceae (Faboideae)	Hovea linearis	
Fabaceae (Faboideae)	Hovea longifolia	
Fabaceae (Faboideae)	Hovea purpurea	
Violaceae	Hybanthus monopetalus	Slender Violet-bush
Apiaceae	Hydrocotyle acutiloba	
Apiaceae	Hydrocotyle algida	
Apiaceae	Hydrocotyle geraniifolia	Forest Pennywort
Apiaceae	Hydrocotyle laxiflora	Stinking Pennywort
Apiaceae	Hydrocotyle peduncularis	
Apiaceae	Hydrocotyle spp.	
Apiaceae	Hydrocotyle tripartita	Pennywort
Violaceae	Hymenanthera dentata	Tree Violet
Hymenophyllaceae	Hymenophyllum cupressiforme	Common Filmy Fern
Clusiaceae	Hypericum gramineum	Small St John's Wort
Clusiaceae	Hypericum japonicum	
Dennstaedtiaceae	Hypolepis muelleri	Harsh Ground Fern
Hypoxidaceae	Hypoxis hygrometrica var. villosisepala	
Poaceae	Imperata cylindrica var. major	Blady Grass
Fabaceae (Faboideae)	Indigofera australis	
Cyperaceae	Isolepis inundata	
Proteaceae	Isopogon anemonifolius	
Proteaceae	Isopogon anethifolius	
Lobeliaceae	Isotoma axillaris	Showy Isotome
Fabaceae (Faboideae)	Jacksonia scoparia	Dogwood
Poaceae	Joycea pallida	Silvertop Wallaby Grass
Juncaceae	Juncus australis	
Juncaceae	Juncus filicaulis	
Juncaceae	Juncus gregiflorus	
Juncaceae	Juncus planifolius	
Juncaceae	Juncus usitatus	
Fabaceae (Faboideae)	Kennedia rubicunda	Red Kennedy Pea
Myrtaceae	Kunzea ambigua	Tick Bush
Myrtaceae	Kunzea cambagei	
Asteraceae	Lagenifera gracilis	Slender Lagenophora
Asteraceae	Lagenifera spp.	

Family	Scientific Name	Common Name
Asteraceae	Lagenifera stipitata	Blue Bottle-daisy
Proteaceae	Lambertia formosa	Mountain Devil
Sterculiaceae	Lasiopetalum ferrugineum var. ferrugineum	
Sterculiaceae	Lasiopetalum parviflorum	
Anthericaceae	Laxmannia gracilis	
Brassicaceae	Lepidium pseudohyssopifolium	Peppercress
Cyperaceae	Lepidosperma concavum	
Cyperaceae	Lepidosperma elatius	
Cyperaceae	Lepidosperma filiforme	
Cyperaceae	Lepidosperma gunnii	
Cyperaceae	Lepidosperma laterale	
Cyperaceae	Lepidosperma limicola	
Cyperaceae	Lepidosperma urophorum	
Cyperaceae	Lepidosperma viscidum	
Santalaceae	Leptomeria acida	Sour Currant Bush
Myrtaceae	Leptospermum arachnoides	
Myrtaceae	Leptospermum continentale	Prickly Teatree
Myrtaceae	Leptospermum juniperinum	
Myrtaceae	Leptospermum morrisonii	
Myrtaceae	Leptospermum parvifolium	
Myrtaceae	Leptospermum polygalifolium subsp. polygalifolium	
Myrtaceae	Leptospermum spp.	
Myrtaceae	Leptospermum trinervium	
Restionaceae	Lepyrodia anarthria	
Restionaceae	Lepyrodia scariosa	
Epacridaceae	Leucopogon appressus	
Epacridaceae	Leucopogon ericoides	
Epacridaceae	Leucopogon fletcheri subsp. brevisepalus	
Epacridaceae	Leucopogon juniperinus	
Epacridaceae	Leucopogon lanceolatus var. lanceolatus	
Epacridaceae	Leucopogon muticus	
Epacridaceae	Leucopogon setiger	
Epacridaceae	Leucopogon spp.	
Iridaceae	Libertia paniculata	
Lindsaeaceae	Lindsaea linearis	Screw Fern
Lindsaeaceae	Lindsaea microphylla	Lacy Wedge Fern
Orchidaceae	Liparis reflexa	
Epacridaceae	Lissanthe sapida	Native Cranberry
Epacridaceae	Lissanthe strigosa	Peach Heath
Lobeliaceae	Lobelia alata	Angled Lobelia
Lobeliaceae	Lobelia dentata	
Loganiaceae	Logania albiflora	
Loganiaceae	Logania pusilla	
Lomandraceae	Lomandra confertifolia subsp. pallida	
Lomandraceae	Lomandra confertifolia subsp. rubiginosa	
Lomandraceae	Lomandra cylindrica	
Lomandraceae	Lomandra filiformis subsp. coriacea	
Lomandraceae	Lomandra filiformis subsp. filiformis	
Lomandraceae	Lomandra glauca	Pale Mat-rush
Lomandraceae	Lomandra gracilis	
Lomandraceae	Lomandra longifolia	Spiny-headed Mat-rush
Lomandraceae	Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush
Lomandraceae	Lomandra obliqua	

Family	Scientific Name	Common Name
Proteaceae	Lomatia ilicifolia	
Proteaceae	Lomatia myricoides	River Lomatia
Proteaceae	Lomatia silaifolia	Crinkle Bush
Juncaceae	Luzula flaccida forma B	
Juncaceae	Luzula spp.	
Asclepiadaceae	Marsdenia flavescens	Hairy Milk Vine
Asclepiadaceae	Marsdenia rostrata	Common Milk Vine
Asclepiadaceae	Marsdenia suaveolens	Scented Marsdenia
Celastraceae	Maytenus silvestris	Narrow-leaved Orangebark
Myrtaceae	Melaleuca linariifolia	
Myrtaceae	Melaleuca quinquenervia	Paperbark
Myrtaceae	Melaleuca spp.	
Myrtaceae	Melaleuca styphelioides	Prickly-leaved Tea Tree
Myrtaceae	Melaleuca thymifolia	
Epacridaceae	Melichrus urceolatus	Urn Heath
Lamiaceae	Mentha diemenica	Slender Mint
Euphorbiaceae	Micrantheum ericoides	
Euphorbiaceae	Micrantheum spp.	
Poaceae	Microlaena stipoides var. stipoides	
Orchidaceae	Microtis unifolia	Common Onion Orchid
Fabaceae (Faboideae)	Mirbelia rubiifolia	
Loganiaceae	Mitrasacme polymorpha	
Epacridaceae	Monotoca ledifolia	
Epacridaceae	Monotoca scoparia	
Epacridaceae	Monotoca spp.	
Rubiaceae	Morinda jasminoides	
Polygonaceae	Muehlenbeckia gracillima	
Polygonaceae	Muehlenbeckia rhyticarya	
Loranthaceae	Muellerina eucalyptoides	
Myoporaceae	Myoporum floribundum	
Rutaceae	Nematolepis squamea subsp. squamea	Satinwood
Solanaceae	Nicotiana suaveolens	Native Tobacco
Oleaceae	Notelaea longifolia forma longifolia	Large Mock-olive
Oleaceae	Notelaea microcarpa var. microcarpa	
Oleaceae	Notelaea neglecta	
Oleaceae	Notelaea ovata	
Oleaceae	Notelaea spp.	
Oleaceae	Notelaea venosa	Veined Mock-olive
Poaceae	Notodanthonia longifolia	Long-leaved Wallaby Grass
Amaranthaceae	Nyssanthes diffusa	Barbwire Weed
Olacaceae	Olax stricta	
Asteraceae	Olearia argophylla	Native Musk
Asteraceae	Olearia asterotricha	Rough Daisy Bush
Asteraceae	Olearia erubescens	Silky Daisy Bush
Asteraceae	Olearia microphylla	
Asteraceae	Olearia ramosissima	
Asteraceae	Olearia ramulosa	
Asteraceae	Olearia spp.	
Asteraceae	Olearia viscidula	Wallaby Weed
Santalaceae	Omphacomeria acerba	
Rubiaceae	Opercularia aspera	Coarse Stinkweed
Rubiaceae	Opercularia diphylla	
Rubiaceae	Opercularia hispida	Hairy Stinkweed
Rubiaceae	Opercularia varia	Variable Stinkweed

Family	Scientific Name	Common Name
Poaceae	Oplismenus aemulus	
Poaceae	Oplismenus imbecillis	
Poaceae	Oplismenus spp.	
Oxalidaceae	Oxalis chnoodes	
Oxalidaceae	Oxalis exilis	
Oxalidaceae	Oxalis perennans	
Oxalidaceae	Oxalis radicosa	
Oxalidaceae	Oxalis spp.	
Asteraceae	Ozothamnus diosmifolius	White Dogwood
Asteraceae	Ozothamnus obcordatus subsp. major	
Bignoniaceae	Pandorea pandorana subsp. pandorana	Wonga Wonga Vine
Poaceae	Panicum effusum	Poison or Hairy Panic
Poaceae	Panicum simile	Two-colour Panic
Apocynaceae	Parsonsia brownii	Mountain Silkpod
Apocynaceae	Parsonsia spp.	
Apocynaceae	Parsonsia straminea	Common Silkpod
Poaceae	Paspalidium spp.	
Passifloraceae	Passiflora cinnabarina	Red Passionfruit
Iridaceae	Patersonia glabrata	
Iridaceae	Patersonia longifolia	
Iridaceae	Patersonia sericea	
Geraniaceae	Pelargonium australe	Native Storksbill
Geraniaceae	Pelargonium inodorum	
Adiantaceae	Pellaea falcata	Sickle Fern
Polygonaceae	Persicaria praetermissa	
Polygonaceae	Persicaria spp.	
Proteaceae	Persoonia acerosa	
Proteaceae	Persoonia glaucescens	
Proteaceae	Persoonia hirsuta subsp. evoluta	
Proteaceae	Persoonia laurina	
Proteaceae	Persoonia laurina subsp. intermedia	
Proteaceae	Persoonia laurina subsp. laurina	
Proteaceae	Persoonia levis	Broad-leaved Geebung
Proteaceae	Persoonia linearis	Narrow-leaved Geebung
Proteaceae	Persoonia mollis	
Proteaceae	Petrophile pedunculata	
Proteaceae	Petrophile pulchella	
Proteaceae	Petrophile sessilis	
Proteaceae	Petrophile spp.	
Rutaceae	Philotheca hispidula	
Rutaceae	Philotheca myoporoides subsp. myoporoides	
Rutaceae	Philotheca scabra	
Euphorbiaceae	Phyllanthus gunnii	
Euphorbiaceae	Phyllanthus hirtellus	
Euphorbiaceae	Phyllanthus similis	
Thymelaeaceae	Pimelea curviflora var. gracilis	
Thymelaeaceae	Pimelea curviflora var. subglabrata	
Thymelaeaceae	Pimelea linifolia	
Thymelaeaceae	Pimelea linifolia subsp. linifolia	
Pittosporaceae	Pittosporum multiflorum	Orange Thorn
Pittosporaceae	Pittosporum revolutum	Rough Fruit Pittosporum
Pittosporaceae	Pittosporum undulatum	Sweet Pittosporum
Plantaginaceae	Plantago debilis	
Plantaginaceae	Plantago gaudichaudii	

Family	Scientific Name	Common Name
Plantaginaceae	Plantago spp.	
Plantaginaceae	Plantago varia	
Apiaceae	Platysace ericoides	
Apiaceae	Platysace lanceolata	
Apiaceae	Platysace linearifolia	
Orchidaceae	Plectorrhiza tridentata	Tangle Orchid
Lamiaceae	Plectranthus parviflorus	
Poaceae	Poa affinis	
Poaceae	Poa labillardierei var. labillardierei	Tussock
Poaceae	Poa meionectes	
Poaceae	Poa sieberiana var. sieberiana	Snowgrass
Poaceae	Poa spp.	
Poaceae	Poa tenera	
Fabaceae (Faboideae)	Podolobium ilicifolium	Prickly Shaggy Pea
Caryophyllaceae	Polycarpaea corymbosa var. minor	
Convolvulaceae	Polymeria calycina	
Araliaceae	Polyscias sambucifolia subsp. C	Ferny Panax
Dryopteridaceae	Polystichum australiense	Harsh Shield Fern
Rhamnaceae	Pomaderris andromedifolia subsp. andromedifolia	
Rhamnaceae	Pomaderris aspera	Hazel Pomaderris
Rhamnaceae	Pomaderris discolor	
Rhamnaceae	Pomaderris elliptica subsp. elliptica	
Rhamnaceae	Pomaderris ferruginea	
Rhamnaceae	Pomaderris intermedia	
Rhamnaceae	Pomaderris lanigera	
Rhamnaceae	Pomaderris ledifolia	
Rhamnaceae	Pomaderris spp.	
Rubiaceae	Pomax umbellata	
Euphorbiaceae	Poranthera corymbosa	
Euphorbiaceae	Poranthera ericifolia	
Euphorbiaceae	Poranthera microphylla	
Potamogetonaceae	Potamogeton tricarinatus	Floating Pondweed
Lobeliaceae	Pratia purpurascens	Whiteroot
Lamiaceae	Prostanthera cineolifera	
Lamiaceae	Prostanthera incisa	Cut-leaved Mint-bush
Lamiaceae	Prostanthera lanceolata	
Lamiaceae	Prostanthera lasianthos	Victorian Christmas Bush
Lamiaceae	Prostanthera ovalifolia	
Lamiaceae	Prostanthera spp.	
Acanthaceae	Pseuderanthemum variabile	Pastel Flower
Dennstaedtiaceae	Pteridium esculentum	Bracken
Pteridaceae	Pteris tremula	Tender Brake
Orchidaceae	Pterostylis curta	Blunt Greenhood
Orchidaceae	Pterostylis longifolia	Tall Greenhood
Orchidaceae	Pterostylis longipetala	
Orchidaceae	Pterostylis nutans	Nodding Greenhood
Orchidaceae	Pterostylis pedunculata	Maroonhood
Orchidaceae	Pterostylis spp.	
Cyperaceae	Ptilothrix deusta	
Fabaceae (Faboideae)	Pultenaea daphnoides	
Fabaceae (Faboideae)	Pultenaea dentata	
Fabaceae (Faboideae)	Pultenaea elliptica	
Fabaceae (Faboideae)	Pultenaea flexilis	
Fabaceae (Faboideae)	Pultenaea hispidula	

Family	Scientific Name	Common Name
Fabaceae (Faboideae)	Pultenaea retusa	
Fabaceae (Faboideae)	Pultenaea spp.	
Fabaceae (Faboideae)	Pultenaea villosa	
Polypodiaceae	Pyrrosia rupestris	Rock Felt Fern
Escalloniaceae	Quintinia sieberi	Possumwood
Ranunculaceae	Ranunculus lappaceus	Common Buttercup
Ranunculaceae	Ranunculus plebeius	
Myrsinaceae	Rapanea howittiana	Brush Muttonwood
Myrsinaceae	Rapanea variabilis	Muttonwood
Pittosporaceae	Rhytidosporum procumbens	
Euphorbiaceae	Ricinocarpos pinifolius	Wedding Bush
Brassicaceae	Rorippa gigantea	
Rosaceae	Rubus moluccanus var. trilobus	Molucca Bramble
Rosaceae	Rubus parvifolius	Native Raspberry
Sterculiaceae	Rulingia dasyphylla	Kerrawang
Polygonaceae	Rumex brownii	Swamp Dock
Menispermaceae	Sarcopetalum harveyanum	Pearl Vine
Goodeniaceae	Scaevola aemula	
Goodeniaceae	Scaevola albida	
Goodeniaceae	Scaevola ramosissima	
Uvulariaceae	Schelhammera undulata	
Cyperaceae	Schoenus brevifolius	
Cyperaceae	Schoenus ericetorum	
Cyperaceae	Schoenus imberbis	
Cyperaceae	Schoenus maschalinus	
Cyperaceae	Schoenus melanostachys	
Cyperaceae	Scleria mackaviensis	
Lamiaceae	Scutellaria humilis	Dwarf Skullcap
Selaginellaceae	Selaginella uliginosa	
Asteraceae	Senecio diaschides	
Asteraceae	Senecio glomeratus	
Asteraceae	Senecio gunnii	
Asteraceae	Senecio hispidulus	Hill Fireweed
Asteraceae	Senecio hispidulus var. hispidulus	
Asteraceae	Senecio lautus	Variable Groundsel
Asteraceae	Senecio linearifolius	
Asteraceae	Senecio minimus	
Asteraceae	Senecio quadridentatus	Cotton Fireweed
Asteraceae	Senecio species E	
Asteraceae	Senecio spp.	
Malvaceae	Sida corrugata	
Asteraceae	Sigesbeckia orientalis subsp. orientalis	Indian Weed
Smilacaceae	Smilax australis	Sarsaparilla
Smilacaceae	Smilax glyciphylla	Sweet Sarsparilla
Solanaceae	Solanum aviculare	Kangaroo Apple
Solanaceae	Solanum brownii	Violet Nightshade
Solanaceae	Solanum cinereum	Narrawa Burr
Solanaceae	Solanum opacum	Green-berry Nightshade
Solanaceae	Solanum prinophyllum	Forest Nightshade
Solanaceae	Solanum pungetium	Eastern Nightshade
Solanaceae	Solanum spp.	
Solanaceae	Solanum vescum	
Asteraceae	Solenogyne gunnii	
Asteraceae	Solenogyne spp.	

Family	Scientific Name	Common Name
Poaceae	Sorghum leiocladum	Wild Sorghum
Fabaceae (Faboideae)	Sphaerolobium minus	
Fabaceae (Faboideae)	Sphaerolobium vimineum	
Epacridaceae	Sprengelia sprengelioides	
Stackhousiaceae	Stackhousia monogyna	Creamy Candles
Stackhousiaceae	Stackhousia spp.	
Stackhousiaceae	Stackhousia viminea	Slender Stackhousia
Caryophyllaceae	Stellaria flaccida	
Caryophyllaceae	Stellaria pungens	Prickly Starwort
Proteaceae	Stenocarpus salignus	Scrub Beefwood
Menispermaceae	Stephania japonica var. discolor	Snake Vine
Gleicheniaceae	Sticherus flabellatus var. flabellatus	Umbrella Fern
Poaceae	Stipa spp.	
Stylidiaceae	Stylidium graminifolium	Grass Triggerplant
Stylidiaceae	Stylidium laricifolium	Tree Triggerplant
Stylidiaceae	Stylidium lineare	Narrow-leaved Triggerplant
Stylidiaceae	Stylidium productum	
Stylidiaceae	Stylidium spp.	
Phormiaceae	Stypandra glauca	Nodding Blue Lily
Epacridaceae	Styphelia spp.	
Myrtaceae	Syncarpia glomulifera subsp. glomulifera	Turpentine
Proteaceae	Telopea speciosissima	Waratah
Tremandraceae	Tetratheca ericifolia	
Tremandraceae	Tetratheca thymifolia	Black-eyed Susan
Orchidaceae	Tholymitra ixioides var. ixioides	Dotted Sun Orchid
Poaceae	Themeda australis	Kangaroo Grass
Poaceae	Themeda spp.	
Anthericaceae	Thysanotus juncifolius	
Anthericaceae	Thysanotus tuberosus subsp. tuberosus	
Osmundaceae	Todea barbara	King Fern
Apiaceae	Trachymene incisa	
Ulmaceae	Trema tomentosa var. viridis	Native Peach
Anthericaceae	Tricoryne elatior	Yellow Autumn-lily
Myrtaceae	Tristania neriifolia	Water Gum
Myrtaceae	Tristaniopsis laurina	Kanuka
Moraceae	Trophis scandens subsp. scandens	Burny Vine
Asclepiadaceae	Tylophora barbata	Bearded Tylophora
Urticaceae	Urtica incisa	Stinging Nettle
Scrophulariaceae	Verbascum spp.	
Asteraceae	Vernonia cinerea var. cinerea	
Scrophulariaceae	Veronica plebeia	Trailing Speedwell
Scrophulariaceae	Veronica spp.	
Violaceae	Viola betonicifolia	
Violaceae	Viola caleyana	Swamp Violet
Violaceae	Viola hederacea	Ivy-leaved Violet
Violaceae	Viola sieberiana	
Asteraceae	Vittadinia cuneata var. cuneata	Fuzzweed
Asteraceae	Vittadinia spp.	
Campanulaceae	Wahlenbergia communis	Tufted Bluebell
Campanulaceae	Wahlenbergia gracilis	Sprawling or Australian Bluebell
Campanulaceae	Wahlenbergia spp.	
Campanulaceae	Wahlenbergia stricta subsp. stricta	Tall Bluebell
Lamiaceae	Westringia longifolia	

Family	Scientific Name	Common Name
Xanthorrhoeaceae	Xanthorrhoea arborea	
Xanthorrhoeaceae	Xanthorrhoea concava	
Xanthorrhoeaceae	Xanthorrhoea media	
Xanthorrhoeaceae	Xanthorrhoea resinifera	
Xanthorrhoeaceae	Xanthorrhoea spp.	
Apiaceae	Xanthosia pilosa	
Apiaceae	Xanthosia tridentata	
Asteraceae	Xerochrysum bracteatum	Golden Everlasting
Proteaceae	Xylomelum pyriforme	
Xyridaceae	Xyris operculata	
Rutaceae	Zieria pilosa	
Rutaceae	Zieria smithii	Sandfly Zieria

APPENDIX F: EXOTIC SPECIES

Following is a list of the exotic species recorded within the Nattai and Bargo reserves. The list is sorted by the scientific name of the species, and a common name is provided where one has been recognised in existing literature.

Family	Scientific Name	Common Name
Polygonaceae	Acetosella vulgaris	Sorrel
Asteraceae	Ageratina adenophora	Crofton Weed
Simaroubaceae	Ailanthus altissima	Tree of Heaven
Poaceae	Aira caryophyllea	Silvery Hairgrass
Primulaceae	Anagallis arvensis	Scarlet/Blue Pimpernel
Asclepiadaceae	Araujia sericifera	Moth Vine
Asparagaceae	Asparagus asparagoides	
Rubiaceae	Asperula arvensis	Blue Woodruff
Asteraceae	Aster novi-belgii	Michaelmas Daisy
Poaceae	Briza minor	Shivery Grass
Poaceae	Bromus catharticus	Prairie Grass
Asteraceae	Carduus nutans subsp. nutans	Nodding Thistle
Gentianaceae	Centaurium tenuiflorum	
Caryophyllaceae	Cerastium glomeratum	Mouse-ear Chickweed
Asteraceae	Cirsium vulgare	Spear Thistle
Asteraceae	Conyza spp.	
Asteraceae	Conyza sumatrensis	
Malaceae	Cotoneaster franchetii	
Poaceae	Dactylis glomerata	Cocksfoot
Poaceae	Ehrharta erecta	Panic Veldtgrass
Poaceae	Eragrostis curvula	African Lovegrass
Asteraceae	Erigeron karvinskianus	Bony-tip Fleabane
Myrtaceae	Eucalyptus globulus	
Euphorbiaceae	Euphorbia lathyrus	Caper Spurge
Euphorbiaceae	Euphorbia peplus	Petty Spurge
Asteraceae	Facelis retusa	
Fumariaceae	Fumaria bastardii	Bastards Fumitory
Asteraceae	Gamochaeta americana	
Asteraceae	Gamochaeta calviceps	
Asclepiadaceae	Gomphocarpus fruticosus	Narrow-leaved Cotton Bush
Brassicaceae	Hirschfeldia incana	Buchan Weed
Poaceae	Holcus lanatus	Yorkshire Fog
Asteraceae	Hypochaeris glabra	Smooth Catsear
Asteraceae	Hypochaeris radicata	Catsear
Asteraceae	Hypochaeris spp.	
Juncaceae	Juncus articulatus	
Verbenaceae	Lantana camara	Lantana
Asteraceae	Leontodon taraxacoides subsp. taraxacoides	Lesser Hawkbit
Brassicaceae	Lepidium africanum	
Oleaceae	Ligustrum sinense	Small-leaved Privet
Malvaceae	Modiola caroliniana	Red-flowered Mallow
Asteraceae	Onopordum acanthium subsp. acanthium	Scotch Thistle
Caryophyllaceae	Paronychia brasiliana	Chilean Whitlow Wort
Passifloraceae	Passiflora edulis	Common Passionfruit
Poaceae	Pennisetum clandestinum	Kikuyu Grass
Phytolaccaceae	Phytolacca octandra	Inkweed
Pinaceae	Pinus radiata	Radiata Pine
Plantaginaceae	Plantago lanceolata	Lamb's Tongues
Plantaginaceae	Plantago major	Large Plantain

Family	Scientific Name	Common Name
Poaceae	Poa annua	Winter Grass
Salicaceae	Populus spp.	
Lamiaceae	Prunella vulgaris	Self-heal
Amygdalaceae	Prunus cerasifera	Cherry Plum
Amygdalaceae	Prunus spp.	
Brassicaceae	Raphanus raphanistrum	Wild Radish
Rubiaceae	Richardia stellaris	
Brassicaceae	Rorippa microphylla	One-rowed Watercress
Rosaceae	Rosa rubiginosa	Sweet Briar
Rosaceae	Rubus discolor	Blackberry
Rosaceae	Rubus fruticosus sp. agg.	Blackberry complex
Rosaceae	Rubus ulmifolius	Blackberry
Asteraceae	Senecio madagascariensis	Fireweed
Poaceae	Setaria gracilis	Slender Pigeon Grass
Rubiaceae	Sherardia arvensis	Field Madder
Caryophyllaceae	Silene gallica var. gallica	French Catchfly
Asteraceae	Silybum marianum	Variegated Thistle
Brassicaceae	Sisymbrium officinale	Hedge Mustard
Solanaceae	Solanum chenopodioides	Whitetip Nightshade
Solanaceae	Solanum nigrum	Black-berry Nightshade
Solanaceae	Solanum pseudocapsicum	Madeira Winter Cherry
Solanaceae	Solanum radicans	
Asteraceae	Soliva sessilis	Bindyi
Asteraceae	Sonchus asper subsp. glaucescens	Prickly Sowthistle
Asteraceae	Sonchus oleraceus	Common Sowthistle
Caryophyllaceae	Stellaria media	Common Chickweed
Asteraceae	Taraxacum officinale	Dandelion
Poaceae	Themeda quadrivalvis	Grader Grass
Fabaceae (Faboideae)	Trifolium dubium	Yellow Suckling Clover
Fabaceae (Faboideae)	Trifolium repens	White Clover
Fabaceae (Faboideae)	Trifolium spp.	
Verbenaceae	Verbena hispida	Rough Verbena
Verbenaceae	Verbena quadrangularis	
Scrophulariaceae	Veronica arvensis	Wall Speedwell

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