

# 1 INTRODUCTION

## 1.1 PROJECT AIMS

The Central Directorate Parks and Wildlife Division (PWD) of the NSW Department of Environment and Conservation (DEC, formerly NSW National Parks and Wildlife Service (NPWS)) has for the first time established a biodiversity survey priorities program for all NPWS managed estate within the Directorate. This program recognises that the Nattai and Bargo Reserves are characterised by very low levels of information on both flora and fauna (NPWS 2003a). The decision to sample these areas first was enhanced by the opportunity of integrating new survey work into a broader study examining the biodiversity values of the Warragamba and Metropolitan Special Areas (DEC in prep.). This study will amongst other things generate habitat maps for all of the threatened fauna species known to occur in the region.

The fauna survey program seeks to address the shortfall in information on vertebrate fauna within and adjoining the Nattai and Bargo Reserves. Improved information will enable park managers to better integrate local information into planning decisions and to become more active in promoting the values of the reserve. It will provide the opportunity to develop more focused strategies on threatened species management, monitoring programs and community education. Importantly it will expand the ability of park managers to understand the role the reserves play in conserving fauna within the greater Sydney Region.

Specific objectives of this report are to:

1. Document, review and collate existing fauna data
2. Identify and profile threatened fauna species and other regionally significant fauna that are known or likely to occur
3. Identify broad-scale patterns in fauna occurrence and habitat use across the reserves and identify habitats of particular conservation significance
4. Highlight areas where further survey work should to be carried out.

## 1.2 BACKGROUND

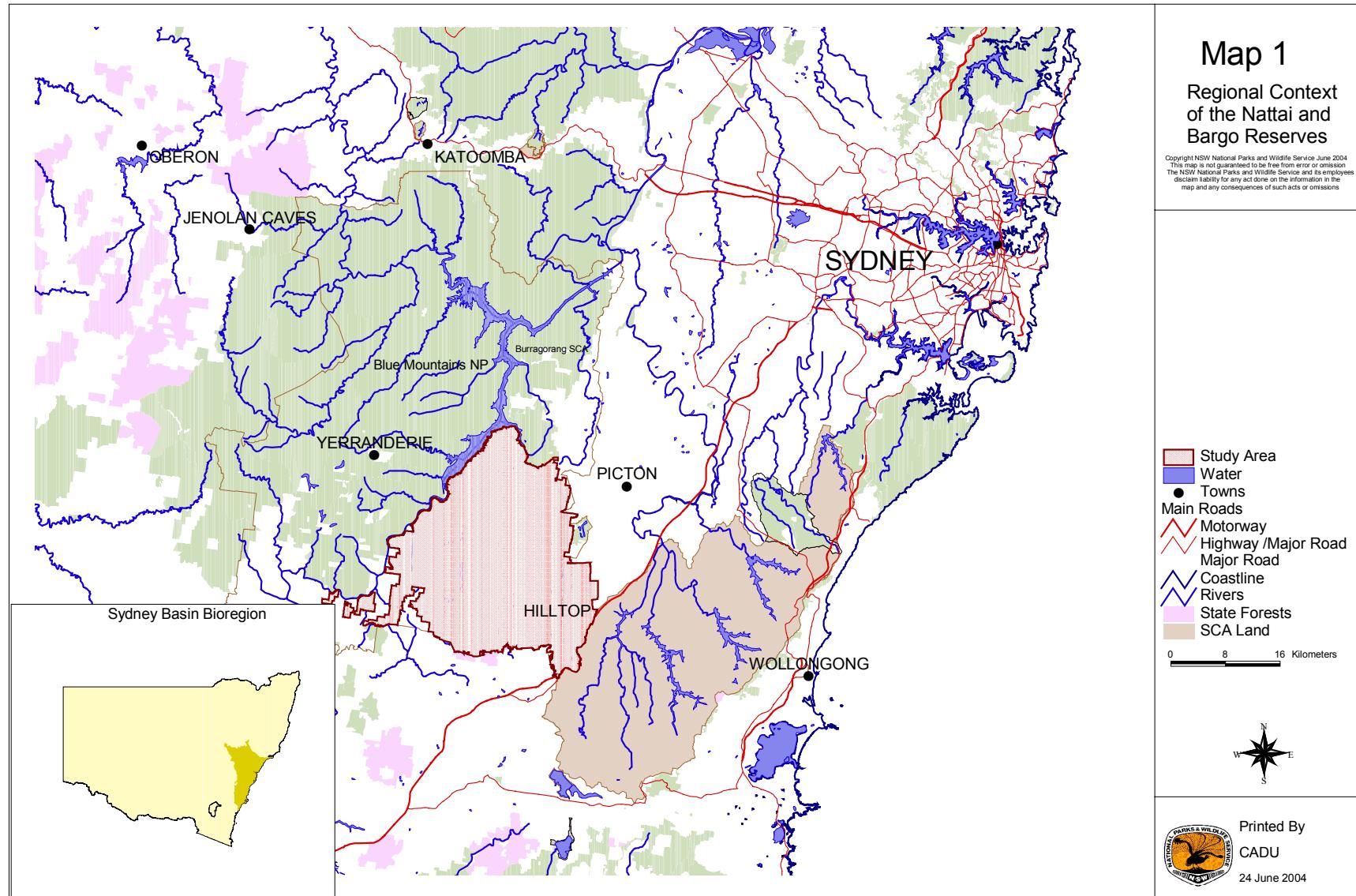
The Nattai Reserves lie between the south eastern rim of the Sydney metropolitan area and the northern arm of the Southern Highlands (Map 1). Located between Oakdale and Mittagong in the east and Bullio in the west these reserves cover an uninterrupted expanse of native vegetation.

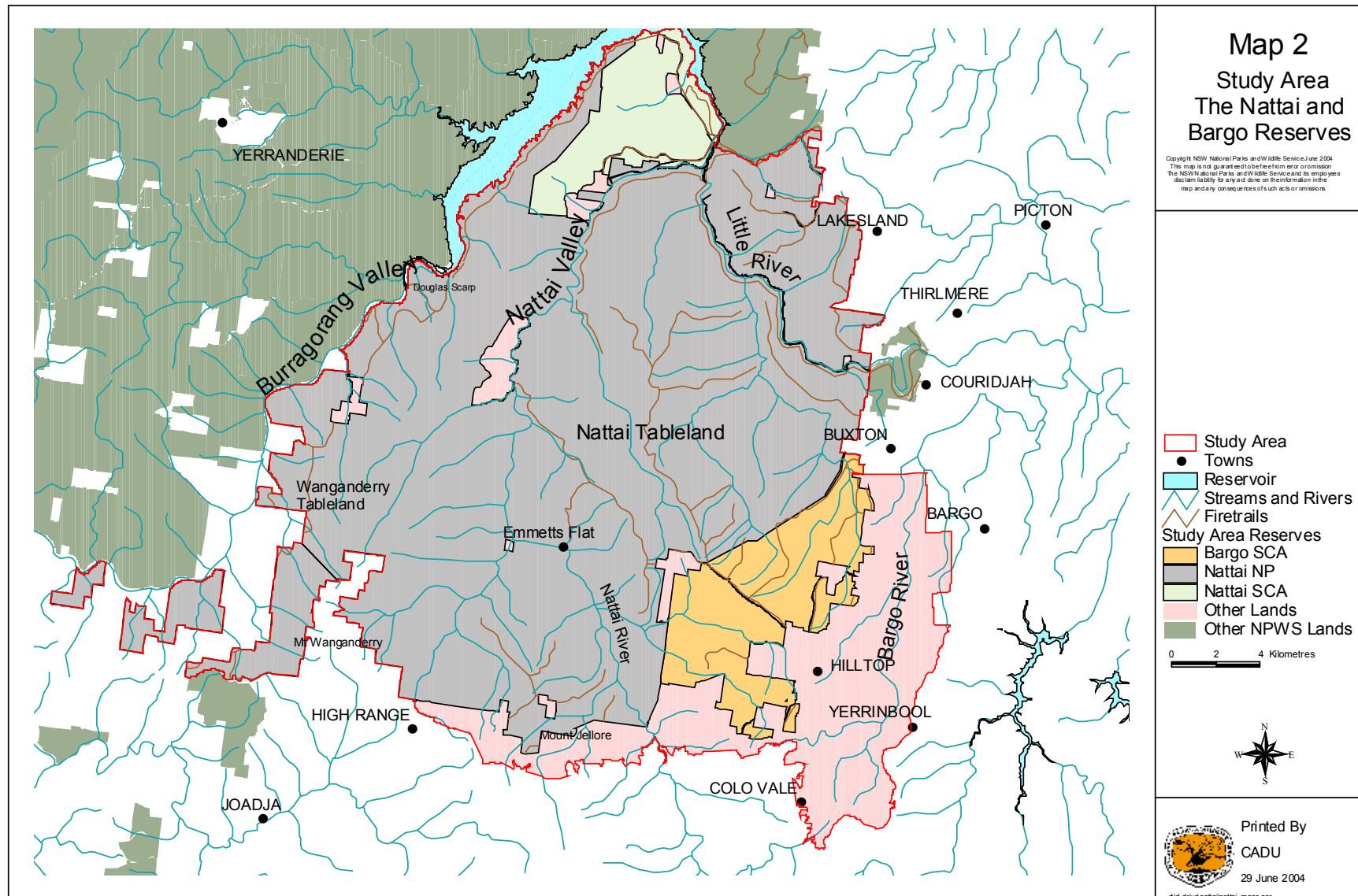
The study area comprises three reserves and adjoining crown lands (Map 2). Nattai National Park (NP) (55000 hectares), Nattai State Conservation Area (SCA) (3383 hectares) and Bargo SCA (5660 hectares) were gazetted in 1991. There are currently 1900 hectares of crown land that have been proposed as extensions to Bargo SCA, while the remaining areas adjoining the Bargo River are crown lands or freehold tenures. The villages of Colo Vale, Hilltop, Buxton, Balmoral and Thirlmere form a ribbon of development along the eastern boundary of the Bargo SCA. Nattai National Park includes the gazetted Nattai Wilderness Area (under the NSW Wilderness Act, 1997) and forms part of the recently inscribed Blue Mountains World Heritage Area.

## 1.3 ENVIRONMENT

### *Biogeography*

The Nattai and Bargo Reserves lie almost entirely within the Sydney Basin Bioregion. However, the western boundary of the Nattai National Park borders the South Eastern Highlands Bioregion. These Bioregions are two of 85 that have been delineated in the interim Biogeographic Regionalisation of Australia (IBRA) (Thackway and Cresswell 1995). The purpose of these regions is to establish a framework for conservation planning using broad landscape characteristics to highlight similar influences on landscapes and native biota. 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. While designed with a review of reservation adequacy in mind, they are a useful regionalisation that may be used to examine and compare species composition and distribution patterns. Map 1 also illustrates the location of the Sydney Basin Bioregion in NSW.

### *Geomorphology*

Much of the Nattai and Bargo reserves are composed of rugged and inaccessible landscapes. The main geographic features of the reserves are the extensive sandstone tablelands and the rivers and the tributaries that dissect them. The tablelands are comprised of Hawkesbury Sandstone that is from the Triassic age. This includes the Nattai Tableland, the southern portion of the Burragorang Tableland, and the Wanganderry Tableland as well as the Wildgoat 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, however, generate coarse-grained sandy soils that are quite infertile and often shallow and rocky.

Impressive escarpments occur above the main river valleys, and pronounced clifflines indicate changes in geology. These valleys are predominantly comprised of Permian Sediments mostly from the Shoalhaven Group. These sediments have a depositional origin, which lead to sedimentary rocks of varying grain size, including sandstone, shale and siltstone. The sandstone produces an infertile sandy soil similar to those found on the overlying Hawkesbury Sandstone. The shale and siltstone material tends to occur in flatter locations such as footslopes or escarpment benches. A clay loam soil tends to develop in these areas, which is of slightly higher fertility and has better water holding capacity.

Higher fertility soils are found in a number of restricted locations in the study area and are mostly of volcanic origin. The Burragorang Valley east of the river as well as south west from Bonnum Pic is comprised of porphyritic material of Devonian age. A small amount of this material is found within Nattai NP, where it develops into a rocky clay soil of moderate depth and fertility. Even higher fertility soils are found in areas derived from shale, basalt and trachyte. Basalt outcrops are found at Mts. Wanganderry and Flora, although they are mostly outside Nattai NP. Shale soils are exposed in aureole like formations on caps where the basalt has been eroded. Wianamatta Shale soils are also found to the north east of the reserves in the Thirlmere area and these influence the Oakdale and Blue Gum Creek areas where transitional soils of a mixture of shale and sandstone develop. Mt. Jellore is an igneous intrusion of trachyte and this has produced a higher fertility soil where a rocky clay loam has developed.

Alluvial soils occupy the larger river flats along the Wollondilly, Nattai and Little Rivers. The material found in these locations is a mixture of siltstone, shale and sandstone. 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 evident on the undulating country, such as near the town of Hilltop. This soil is a coarser sandy alluvium with some forming a swamp like habitat where organic material is periodically inundated with water. A number of hanging swamps also occur.

### *Elevation*

There is a moderate elevational range within the Nattai and Bargo reserves. 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 located on the sandstone tablelands that range between 500 and 700 metres ASL. There is decline in elevation towards the north east. Below the sandstone tablelands, the valley environment of the Nattai, Wollondilly and Little Rivers ranges between 200 and 400 metres, again with a decrease in elevation as the former river drains toward the Warragamba gorge.

### *Climate*

Elevation and distance from coast influence the climate of the Nattai and Bargo reserves. Mean annual rainfall levels decrease from around 920 millimetres per annum near Hilltop to less than 700 millimetres in the rainshadow of the Burragorang Valley. Rainfall rises to around 950 millimetres on Mt. Wanganderry, just south of the reserve on the Wombeyan Caves Rd. Mean annual temperatures

more closely follow elevation trends with dry warm conditions prevalent in the deep gorges of the Nattai and Little Rivers and, most distinctively, the Burragorang Valley.

## 1.4 VEGETATION

The vegetation of the reserves has recently been comprehensively documented in DEC (2004b) and NPWS (2003b) and is summarised below. Older studies such as Fisher *et al.* (1995) also provide a regional overview of the vegetation present. The vegetation patterns in the study area are influenced by three distinctive landsystems: the sandstone tableland; the deeply incised valleys and flats; and the broad Burragorang Valley.

The sandstone plateau includes the Wildgoat, Nattai and Wanganderry Tablelands. These form a combination of broad ridges and numerous gullies, gorges and creeklines that form part of the Hawkesbury-Nepean Catchment. The broad ridges feature shallow to skeletal soils that support open woodlands and forests with a distinctively sclerophyllous shrub and heath layer (Plate 1). Common tree species include Red Bloodwood (*Corymbia gummifera*), Sydney Peppermint (*Eucalyptus piperita*), White Stringybark (*E. globoidea*) and Scribbly Gum (*E. sclerophylla*). The understorey is generally covered in low growing shrubs that includes Banksia spp. (*B. ericifolia* subsp. *ericifolia* and *B. serrata*), *Leptospermum trinervium* and Mountain Devil (*Lambertia formosa*). A variation of the sandstone ridgeline woodlands occurs on the rim of the eastern and southern limits of the reserves. Here the sandstones are underlain by Mittagong Formation Sandstones and Shale and are marginally more fertile than the soils derived from Hawkesbury Sandstone. The vegetation is noticeably taller and features higher abundance of Grey Gum (*Eucalyptus punctata*). In the south near High Range the community can include Smooth-barked Apple (*Angophora costata*).



Plate 1: Sandstone Woodland on Yabbies Road Fire Trail

Exposed rock is common on some of the narrow ridges and cliff edges. In these locations, the community grades into a more open heath with mallees (*Eucalyptus stricta*, *E. oblonga* and *E. burgessiana*) sometimes present along with other stunted tree species that are common within the sandstone ridgeline communities.

Residual shale caps are present on a number of ridgelines and knobs in the north east and south of the reserve. These produce more fertile soils that have different levels of sandstone and shale influence. The forest is taller, generally includes a grassy understorey with rushes such as Spiny-headed Mat-rush (*Lomandra longifolia*) and an abundance of Sheoaks (*Allocasuarina* spp.). Easterly forms of the community also feature tall Grey Gums, Stringybarks and Mountain Blue Gums (*Eucalyptus deanei*) with a dense small tree layer of Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*).

Vegetation growing on sheltered slopes and gullies on the sandstone plateaux changes with the degree of shelter. The slopes feature a dry shrubby forest with plenty of rock outcropping and benches. The forest is primarily comprised of Sydney Peppermint and Blue-leaved Stringybark (*Eucalyptus agglomerata*) with Grey Gum less frequent. At the base of the gully a tall open forest develops above a fern covered floor (Plate 2). Trees most commonly recorded in this environment are River Peppermint (*Eucalyptus elata*), Sydney Peppermint, Blue-leaved Stringybark, Mountain Grey Gum (*E. cypellocarpa*) and, in the far south at higher elevations, Blue Mountains Ash (*E. oreades*). Mesic shrub species develop in this community including Blueberry Ash (*Elaeocarpus reticulatus*). In the most protected gorges a well-developed rainforest subcanopy can develop and can include Coachwood (*Ceratopetalum apetalum*) and Black Wattle (*Callicoma serratifolia*). Narrow ribbons of rainforest form a luxuriant strip along gorges and feature tall Coachwood, Sassafras (*Doryphora sassafras*) and Lilly Pilly (*Acmena smithii*).

The descent into the dramatic Nattai and Little River valleys exposes the underlying sandstones, shales and sediments that were laid down during the Permian period. The vegetation growing on these landforms responds to the different soils that erode from the different parent materials as well as degree of shelter from sun and wind. Exposed slopes are covered in an open woodland that is dominated by Red Ironbark (*Eucalyptus fibrosa*) and a sparse shrub layer. Sheltered aspects are commonly dominated by tall Grey Gum (Plate 3) with the most protected slopes underneath the dramatic Nattai Walls featuring tall Mountain Blue Gum. An unusual box species, *Eucalyptus hypostomatica*, grows in protected positions in a narrow band underneath the sandstone clifflines. As with all protected forests on the escarpment, the ground cover is generally grassy with multitudes of low growing herbaceous species. On the escarpment foothills an open forest of Forest Red Gum (*Eucalyptus tereticornis*) and Grey Box (*E. moluccana*) is prominent.



Plate 2: Sheltered Forest west of Wattle Ridge.

Dry rainforest develops on the escarpments of the major valleys. Common in the gully lines and amongst rock outcrops and boulders on escarpment benches, Grey Myrtle (*Backhousia myrtifolia*) forms dense thickets. Less frequently sprawling Port Jackson Figs (*Ficus rubiginosa*) and Giant Stinging Trees (*Dendrocnide excelsa*) grow in deeper soils in very narrow niches.

The river flats associated with the Nattai and Little Rivers also support some distinctive vegetation communities. On the banks of the rivers, tall River Oaks (*Casuarina cunninghamiana* subsp. *cunninghamiana*) occupy the floodzones. On the first terraces Rough-barked Apple (*Angophora floribunda*) is common, sometimes with the rare Nepean River Gum (*Eucalyptus benthamii*) in the upper reaches of the Nattai Valley. Elsewhere, tall River Peppermint, Mountain Blue Gum, Forest Red Gum and Thin-leaved Stringybark (*Eucalyptus eugenoides*) feature. The alluvial flats are very grassy, due to high soil fertility.



Plate 3: Exposed Escarpment Forest near Middle Flat.

The Burragorang Valley represents the final land system of the reserves. Located in a distinct rainshadow, the valley is the driest area in the reserves. The geology is also different, with a granite-like rock, known as Porphyry, intruded into the bedrock during the Devonian period. This rock erodes to produce a fertile clay loam. The richer soils and the dry climate produce a vegetation community that is closely related to those found on the central western slopes of NSW. Tall grassy woodlands feature combinations of Forest Red Gum, Grey Box, Yellow Box (*Eucalyptus melliodora*), Narrow-leaved Ironbark (*E. crebra*) and White Box (*E. albens*). One of the more unusual communities also occurs in this area, an open dry woodland on a scarp above the Wollondilly River near Murphys Crossing. It includes Black Cypress Pine (*Callitris endlicheri*), Narrow-leaved Ironbark and the distinctive blue-leaved Coast Myall (*Acacia binervia*).

## 1.5 FIRE

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

Fire history information for the area is of varying quality and usually only consists of the final extent of the fire; this has been recorded from 1975 to present (NPWS 2001a). Large fires in March 1965 burnt downstream of the junction of the Nattai and Wollondilly Rivers. This was followed by an extensive fire in November 1968, which burnt much of the reserves between Wanganderry Tableland and Lakesland (NPWS 2001a). A number of smaller fires have occurred since that time and within the last ten years there have been a further two large fires in the reserves. In 1997/98 a fire burnt the northern half of the Wanganderry Tableland and another large and intense fire burnt the majority of the reserves in the summer of 2001/02.

The majority of wildfires are started by lightning strikes (NPWS 2001a) although 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 incorporating Little River and the southern Burragorang Tableland. The northern portion of the Wanganderry Tableland has also received more frequent fire events than other areas, which may indicate that it is more prone to lightning strikes than other areas, though its inaccessibility means that once fires start they are difficult to suppress.

## **1.6 DISTURBANCE**

The impacts of human activities on the natural landscape of Nattai Reserves are concentrated on fertile soils on flat to undulating country. Most of the disturbance has been associated with grazing and pastoral pressures in the Burragorang Valley and the larger gorges associated with the Nattai and Little Rivers. A large powerline easement dissects the Bargo SCA. Map 3 illustrates the intensity of disturbance in the landscape. Clearing of the native vegetation has affected extensive areas of the Burragorang Valley. Natural regeneration has resulted in extensive areas of pioneering shrub growth that includes Drooping Sheoak (*Allocasuarina verticillata*), Native Blackthorn (*Bursaria spinosa*), Sticky Daisy Bush (*Olearia elliptica*) and Sticky Cassinia (*Cassinia uncata*).

Within the Nattai Valley a number of coal seams have been mined, and pit heads and tunnels mark some of the escarpment slopes. Disturbance of native vegetation is present around these sites. These mines are supported by some significant infrastructure such as roads, powerline easements, bridges and conveyors.

