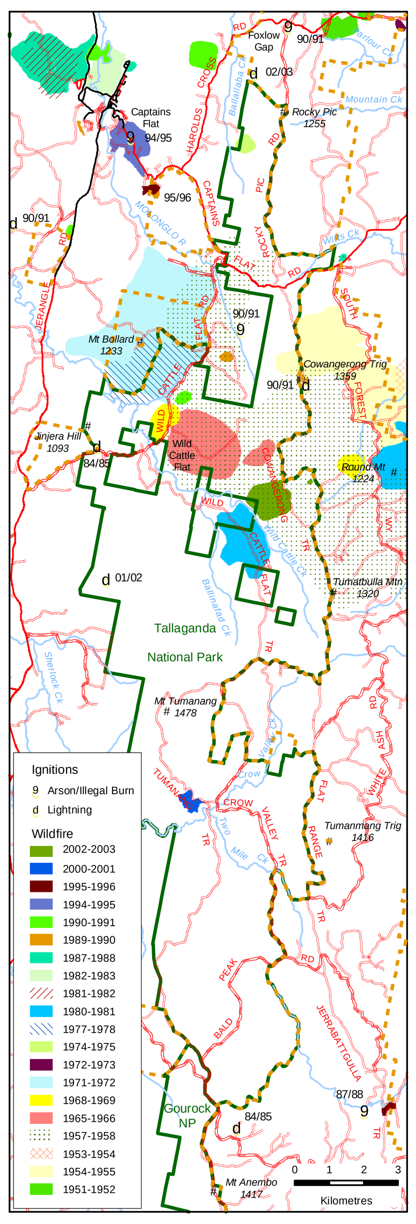
South West Slopes Region
Tallaganda National Park (South)
Fire Management Strategy 2006

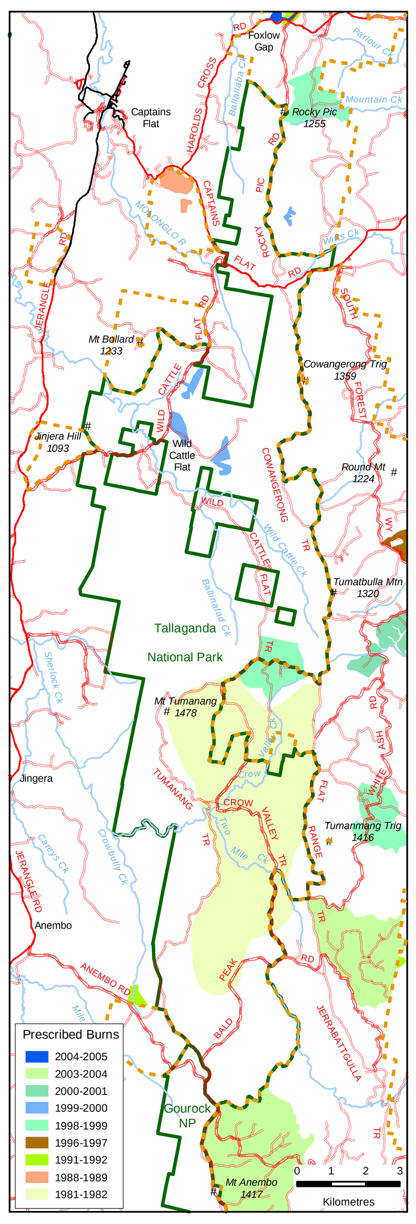
Scale: Works Programme map 1:100000, Location map 1:750000, other maps 1:130000
Version: November 2006 ISBN: 1 74137 457 X DEC: 2006/439

This Map should be used in conjunction with air photos and ground reconnaissance during incidents and the development of incident action plans.

Fire History - Wildfire



Fire History - Prescribed Burns



FIRE HISTORY

Wildfire	There have been 14 recorded wildfires within the this section of park between 1950 and 2001 under its previous tenure as Tallaganda State Forest. Three fires in the 1950s burnt a total of 5192 ha, with 4154 ha burning in two fires in the 1957/58 fire season. Three fires in the 1960s burnt only 445 ha, while two fires in the 1970s burnt a total of 1406 ha. Three fires in the 1980s burnt 366 ha, while a fire in 1990/91 burnt 14 ha. Records since the 1980s show most fires were caused by accidental escape from burn-offs, while one was caused by arson and one caused by lightning. One wildfire caused by lightning and burning 115 ha occurred in January 2003 after the national park was gazetted.
Prescribed burns	A prescribed burn, implemented by Forests NSW in 1981/82, burnt approximately 2508 ha between the Tumanang Cowangerong Trails (see map). A number of small post-logging burns have also occurred in the park area. No prescribed burns for fuel reduction or biodiversity management have been implemented since gazettal of the national park in 2001.
Ignitions	41 ignitions have occurred in the area since 1938, being primarily caused by lightning or arson. Cause of ignition was not recorded prior to the late 1980s.
Fire Frequency	Fire frequency in the park is generally low, with the exception of the area between the Captains Flat - Braidwood Rd and Wild Cattle Flat Creek. Most of these overlapping fires burnt in the 1950s, 60s and 70s and there are only about 300 ha of this section of the park that have burnt in wildfire in the last 30 years.

SOIL STABILITY THRESHOLDS

Slope class	Recommended fine fuel range (t/ha) *	Status of reserve & potential impacts
0-10°	3-5	· Based on modelling of fuel loads and slope classes, 11% (1168 ha) of Tallaganda National Park (south) has fuel cover less than that required to maintain soil stability. · Fine fuel ranges below the recommended levels for each slope class are expected to decrease slope stability, increase erosion potential, reduce water quality and potentially reduce vegetation recovery.
10-15°	4-7	
15-20°	10-12	
20-25°	12-14	
25-30°	16-18	
>30°	>20	

Fire Management Guidelines
- Exclude fire from areas where the fine fuel range does not meet the slope class thresholds, if possible. These areas are associated with steep, north and west facing slopes supporting drier vegetation communities and are thus vulnerable to ignitions to the north-west. However, ignition history is comparatively low in this are (see fire history).
- Avoid trail construction on slopes >25 degrees.
- Ensure prescribed burns are small and disjunct across the landscape so that large areas and steeper slopes are not left exposed.
- Control lines constructed during an incident will include adequate drainage to prevent trail erosion, and will be rehabilitated immediately post-fire.

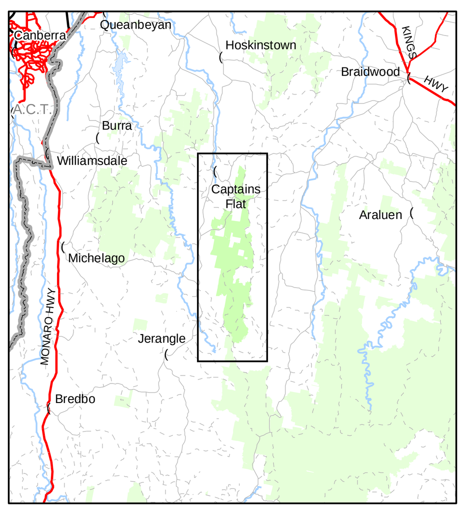
* Recommended fuel range based on Good, R.B. (1994). Fuel Dynamics, Preplan and Future Research Needs. Chapter 23 pp 253 - 266. In: *Fire and Biodiversity. The Effects and Effectiveness of Fire Management.* Biodiversity Series No 8. Dept of Environment, Sport and Territories, Canberra.

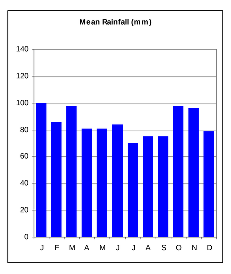
CULTURAL HERITAGE

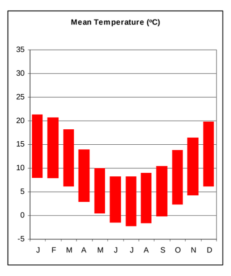
Key Management Guidelines
- Identified sites will be protected.
- DEC Databases for cultural heritage will be accessed during incidents, and in planning for prescribed burning or other works to ensure new records are considered. Aboriginal site information from AHIMS is sensitive and subject to a Memorandum of Understanding. Site data must be used appropriately.
- Protection measures will be addressed in a Review of Environmental Factors and burn plans for prescribed burns.
- Where possible, trained officers will provide advice on site protection measures.

Aboriginal Heritage	Numerous Aboriginal sites are recorded within southern Tallaganda NP, including modified trees and artefact scatters. Other unidentified sites may occur across the landscape, especially in riparian areas, broad valleys, and ridgelines. · The modified tree should be protected from fire, if possible, in both wildfire and any prescribed burning operations. · Artefact scatters should be clearly identified and protected from damage from earth moving equipment during control line construction. · During wildfire operations, efforts will be made to survey for Aboriginal sites ahead of earthmoving operations.
Historic Heritage	A collection of four eucalyptus distilleries at Wild Cattle Flat are important as an example of this industry in the region, and in combination with the eucalyptus distilleries in Tinderry Nature Reserve are of state significance (Pearson, 2003). · Earthworks in these locations should avoid damaging these sites. · Efforts should be made to exclude fire from these sites on park and adjoining private property. The remains of a kitchen are located in Wild Cattle Flat but was assessed as having low significance (Pearson , 2003). · Where possible, efforts should be made to exclude fire from this site.

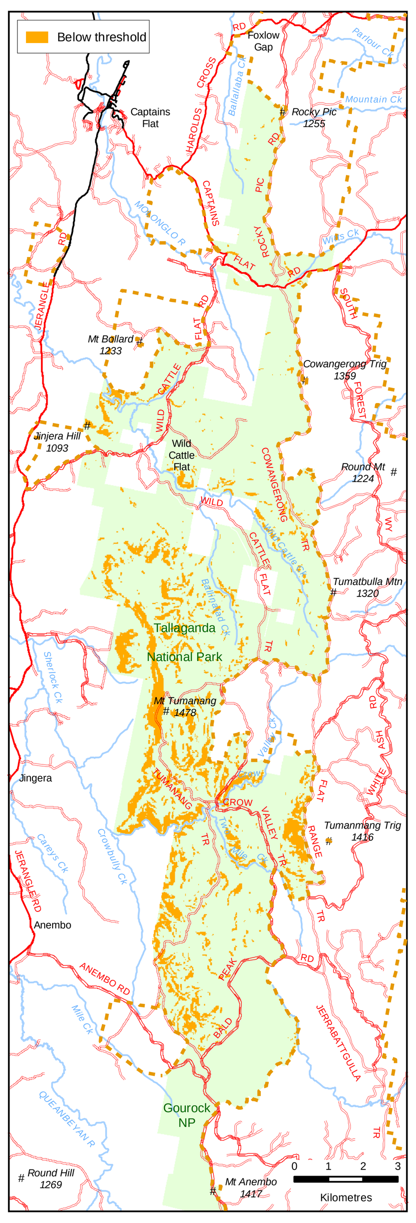
Location



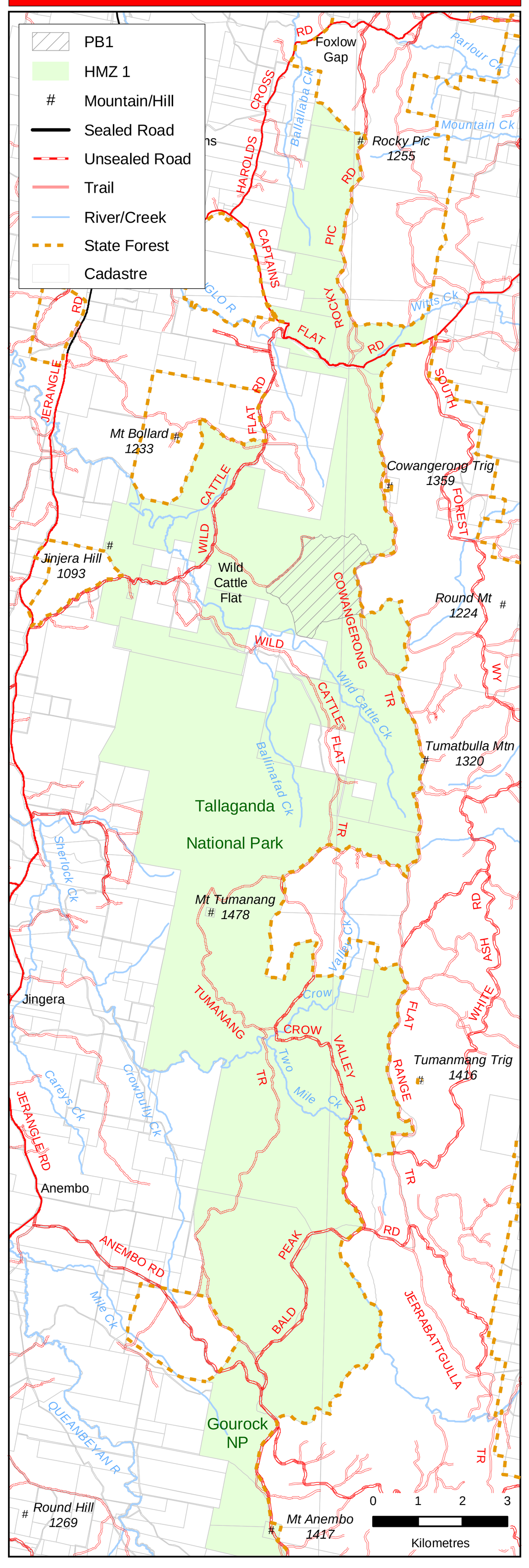




Soil Stability



WORKS PROGRAMME



RESOURCE INFORMATON

The southern section of Tallaganda National Park (10 315 ha) is located on the Great Dividing Range south-east of Captains Flat - Braidwood Rd). This comprises approximately 89% of the total area of land dedicated as Tallaganda National Park (total size 16 658 ha).

The park was gazetted on 1 st January 2001, and is located within a largely rural community with some rural residential development.

This section of the park forms the headwaters of the Molonglo and Shoalhaven Rivers. The reserves lie within the area of Captains Flat, Farringdon, Anembo and Krawaree Volunteer Bushfire Brigades.

Department of Environment and Conservation	Queanbeyan Area, South West Slopes Region, Parks and Wildlife Division	Government Areas	Eden-Monaro Federal Electorate Monaro State Electorate Palerang Council
Rural Fire Service	Lake George Bush Fire Management Committee Cooma - Monaro Bush Fire Management Committee	Other Organisations	Mogo Local Aboriginal Land Council Cobowra Local Aboriginal Land Council Murrumbidgee Catchment Management Authority Southern Rivers Catchment Management Authority

BUSH FIRE MANAGEMENT ZONES - DEFINITIONS

Asset Protection Zone (APZ)	Stringent fuel management standards are applied in areas immediately adjoining assets to protect life and property.
Strategic Fire Management Zone (SFMZ)	Fuel levels are controlled to reduce fire intensity, rate of spread & spotting distance. May be strategically placed areas in areas of high ignition potential, to consolidate asset management zones, to break up areas of higher bushfire behaviour potential or limit the spread of fire. Recommended fuel levels (BFCC) are between 8-15 t/ha for 60-80% of zone (except near a watercourse or in rainforest).
Heritage Management Zone (HMZ)	Defines management strategies for the protection of areas with important natural or cultural values. Focus on conserving biodiversity.

RESERVE BUSH FIRE MANAGEMENT ZONES

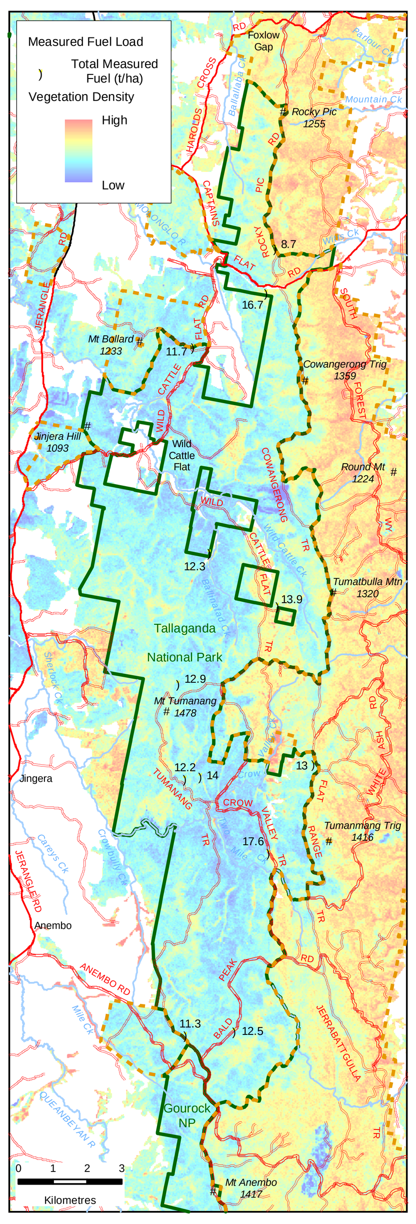
Zone	Strategy	Guidelines
HMZ 1 All of park	· Don't introduce fire to zone except for the identified strategic prescribed burn. · Minimise size and intensity of wildfires. · Exclude fire from at least part of each vegetation type, where possible.	· Implement small (330 ha - 3% of southern Tallaganda) strategic burn adjoining the 2003 burn to assist in containing fires north of this area. Lightning strikes are common in this part of the park (refer to fire history map). · Wildfires will be suppressed by effective means · Attempts will be made to increase burn patchiness by use of incendiaries, retardant, water bombing etc.

WORKS PROGRAMME

Activity	Category	Name	Proposed Works	Schedule
Prescribed burning	PB1	West of Cowangerong Trail	· Implement prescribed burn if fuel levels exceed 15t/ha for much of area.	When required
Reserve trails maintenance	Key management trails	Anembo Road(SF) Bald Peak Road(SF) Rocky Pic Road(SF) Cowangerong Trail (SF) Flat Range Trail(SF)) Tumanang Trail Crow Valley Trail (SF) Wild Cattle Flat Trail	· Chemical fuel reduction 1m each side of trail · Removal of saplings and trimming of canopy of mature trees to Cat 1 tanker height for 1m each side of trail · Finalise track head and intersection signage · Install additional turning or passing bays · Maintain Bald Peak and Anembo Roads to RFS primary trail standard · Maintain carriageway of other trails to RFS secondary trail standard	Ongoing Ongoing 2006-07 Ongoing Routine Routine
	Other trails	Mt Bollard Trail(SF) Management Trail	· Maintain as required for general management purposes - will potentially need touching up for fire activities.	Routine
Research & Monitoring	Fuel monitoring	PB1	· Visual assessment of peak loadings · Quantitative assessment pre- and post -burning	Biennially As required
		Long unburnt and any new fire age classes.	· Quantitative assessment of surface and elevated fuels, estimation of overall fuel hazard	Every 7-10 yrs & with change.
	Fire history	Dendrochronology	· Encourage continuing research by Monash University to assess the long-term fire history of the reserves	Ongoing
Cooperative fire management	Fire field days	Neighbour and volunteer orientation	· Reserve orientation, discussion re goals & strategies in conjunction with local RFS	Ongoing

(SF) Trails managed co-operatively with Forests NSW

Landscape Fuels



FUEL LANDSCAPE

MEASURED FUEL DATA - April 2004

	Vegetation type	Average t/ha	Fuel Ranges (number of sites assessed)
55	Brown barrel fern/herb/grass moist forest	10.5	Fine fuels (litter, grass <6mm thick and shrub<6mm thick, <1.5m high) ranged between 8.5 and 14.4 t/ha (n=4)
56	Narrow-leaved peppermint - ribbon gum herb/fern moist forest	14.8	Fine fuels ranged between 13.9 and 15.7 t/ha (n=2).
59	Narrow-leaved peppermint - silvertop ash shrub/fern dry forest	11.6	Fine fuels ranged between 10.5 and 12.6 t/ha (n=2)
61	White ash moist shrub forest	15.2	N/a (n=1)
66	Mountain gum - narrow-leaved peppermint shrub/grass forest	14.4	Fine fuels ranged between 12.2 and 16.7 t/ha (n=2)
89	Mountain gum - ribbon gum - acacia herb/grass forest	13.1	Fine fuels ranged between 8.1 and 17.6 t/ha (n=5)
95	Snow Gum - mountain gum - acacia moist herb forest	12.4	Fine fuels ranged between 11.3 and 13.0 t/ha (n=4)
107	Mountain gum - broad-leaved peppermint dry shrub forest	12.7	Fine fuels ranged between 11.7 and 14.0 t/ha (n=3)
112	Silvertop ash - broad-leaved peppermint dry shrub forest	9.2	Fine fuels ranged from 8.8 and 9.6 t/ha (n=2)

ANALYSIS OF LANDSCAPE FUELS

Fuel loadings are variable across the planning area. The fuel levels recorded above are likely to represent peak loadings as they were recorded after successive years of drought and after a dry late summer and autumn. Extended dry periods increase leaf drop and inhibit decomposition of fuels. Lower fuel loads could be expected after periods of higher rainfall enabling decomposition of leaf litter. The above map displays measured fuel loads combined with vegetation density *(satellite image December 2003 & January 2004 - quantitative & visual sampling March-April 2004)* to indicate fuel level variability across timbered areas in the landscape.

The western fall of the range supports extensive areas of dry forest of mountain gum with narrow-leaved or broad-leaved peppermint. These communities have moderate fine fuel loads, however the presence of a flammable shrub layer will potentially increase fire behaviour even at lower intensities. In sub-alpine environments a low forest of snow gum with occasional mountain gum and a sparse shrub layer occurs over a dense tussock grass layer. Fine fuel and bark fuel levels in this community are comparatively low. Small areas of tall moist forests on sheltered aspects have higher litter loadings, but often have a comparatively sparse, less volatile shrub layer. However, ribbon bark fuels suspended in the canopy may contribute significantly to spotting behaviour during high intensity fires.

The above data demonstrate that fuel loads across the reserves generally conform to levels prescribed for strategic wildfire management zones (8-15t/ha for 60-80% of zone) and are thus at an appropriate level.

BUSHFIRE BEHAVIOUR POTENTIAL CLASSES

Bushfire Behaviour Potential is modelled for Tallaganda National Park, Tallaganda State Conservation Area and surrounding timbered lands using vegetation, aspect and slope ratings, as shown below. Ratings apply to the entire planning area, and thus bushfire behaviour potential can be directly compared between the northern and southern sections of this reserve system (displayed on two separate posters). However, comparisons cannot be made with models displayed in other fire management strategies.

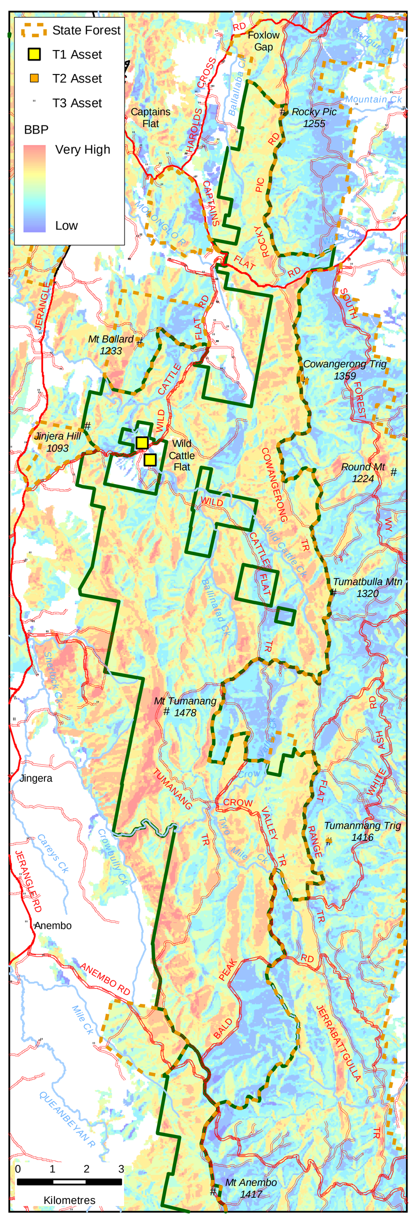
Vegetation Fuel Hazard Rating
(under moderate weather conditions and fire danger indices)

Rating	Vegetation Type	% of Reserve
Low	Cleared (with patches of native vegetation) 126: Montane wet sedgeland 148: Poa tussock grassland /sedgeland	<1
Medium	55: Brown barrel fern/herb/grass moist forest 56: Narrow-leaved peppermint - ribbon gum herb/fern moist forest 61: White ash moist shrub forest 89: Mountain gum - ribbon gum - acacia herb/grass forest 95: Snow gum - mountain gum - acacia moist herb forest 146: Snow gum - black sally dry herb/grass woodland	38.9
High	59: Narrow-leaved peppermint - silvertop ash shrub/fern dry forest 66: Mountain gum - narrow-leaved peppermint shrub/grass forest 73: Snow gum - ribbon gum dry shrub/grass forest 74: Apple box - snow gum - candlebark dry shrub/grass/herb forest 76: Candlebark - snow gum shrub/grass dry forest 107: Mountain gum - broad-leaved peppermint dry shrub forest 109: Brittle gum - broad-leaved peppermint - red stringybark dry shrub/ tussock forest 112: Silvertop ash - broad-leaved peppermint dry shrub forest	60.4
Very high	Pine Plantation (>15 years of age)	<1

Topographic Hazard

Aspect Behaviour Rating *(reflects likely aspect dryness and fire wind direction)*		Slope Behaviour Rating		
Rating	Aspect (°)	Rating	Slope (°)	% of Reserve
Low	65 - 190°	Low	0 - 10°	43.4
Medium	10 - 65°	Medium	10 - 20°	46.9
High	190 - 250° and 340 - 10°	High	20 -30°	9.2
Very High	250 - 340°	Very High	>30°	0.5

Bushfire Behaviour Potential & Assets at Risk



ANALYSIS OF BUSHFIRE BEHAVIOUR POTENTIAL

Bushfire behaviour at any position on the landscape reflects
- site attributes such as vegetation type, slope, aspect (can affect fuel levels, structure and moisture content); and
- fire weather attributes such as temperature, relative humidity, wind direction and wind speed. While these characteristics are difficult to predict, analysis of local weather data shows that bad fire weather days are generally associated with winds from the north- west to west. These winds have thus been incorporated into the fire behaviour potential model.

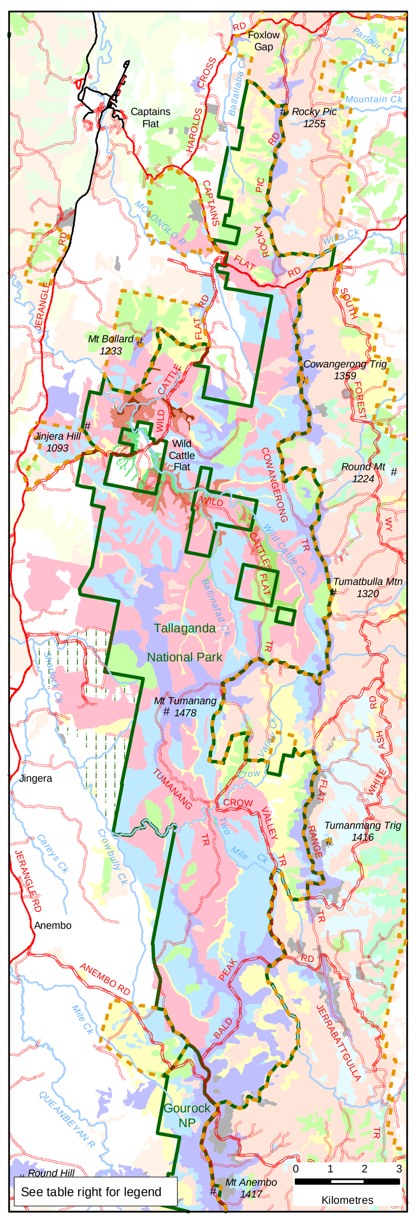
The western slopes of the Great Dividing Range and its subsidiary ridges have the highest fire behaviour potential due to their steepness and exposure to both afternoon sun and drying north-westerly to westerly winds through summer.The highest fire behaviour potential occurs on the steep, west-facing slopes of Mount Tumanang.

On more sheltered aspects, the shrub layer is not as flammable and fuel moisture levels are generally higher, thus mitigating fire behaviour under moderate conditions. However, after extended drought periods or severe fire weather conditions, these forests will support extreme fire behaviour, exacerbated by the ribbony bark of many of the tree species. Dry forests of mountain gum with narrow-leaved or broad-leaved peppermint on these slopes contain a flammable shrub layer, increasing fire behaviour even at lower intensities.

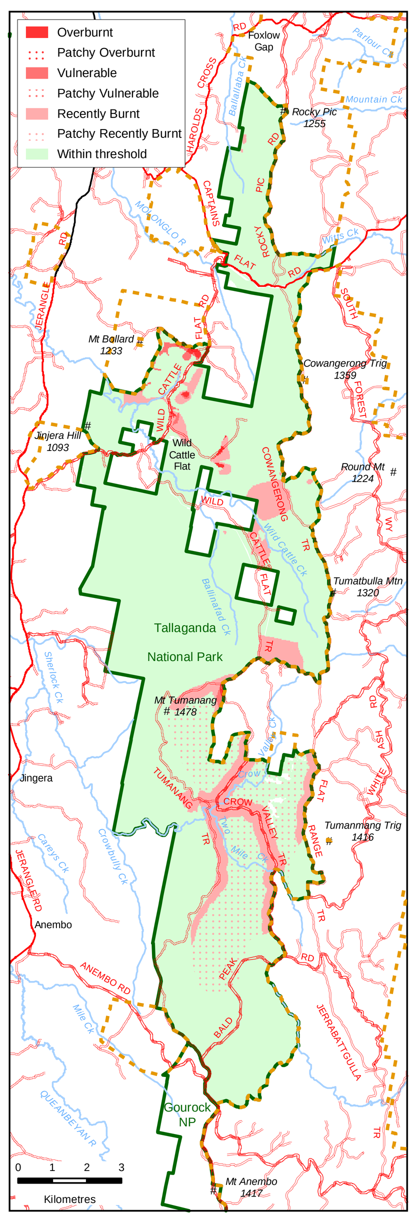
RISK ASSESSMENT - LIFE & PROPERTY

Assets	Vulnerability	Risk Mitigation
T1 Private property in the Wild Cattle Flat Rd area.	· Many of these assets are located in a narrow valley surrounded by bushland and are thus vulnerable to fire (see Bushfire Behaviour Potential map). · This area is also prone to lightning strikes. · Particularly vulnerable to fire coming from the reserve under the influence of north-westerly winds.	· Participate in the development, and where appropriate, the implementation, of fire management proposals for asset protection. The RFS and property owners have primary responsibility for asset protection off-park. · Maintain access trails within the reserves for use in fire fighting operations, particularly the Tumamang, and Cowangerong Trails (see bushfire management zones map and works programme). · Maintain jointly managed roads with state forests, including the Crow Valley, Bald Peak, Rocky Pic and Cowangerong Trails. · Implement works identified for strategic zones to assist in fire management operations. · Contain all unplanned fire events as soon as possible by rapidly responding to reported ignitions.
T2 Forests NSW hardwood forests	· Hardwood forests located to the east of the park are vulnerable to fire leaving the park.	
T3 Other private property in area	· Assets may be damaged by bushfire, particularly when located in bushland. · Assets to the east of the Tallaganda State Forest are vulnerable to fires affecting both park and forest in this area.	

Vegetation Communities



Vegetation Threshold Analysis



VEGETATION COMMUNITIES

Veg Group	Vegetation Description	Ha	% of Reserve
107	Mountain gum - broad-leaved peppermint dry shrub forest	3436	33.3
66	Mountain gum - narrow-leaved peppermint shrub/grass forest	2514	24.3
95	Snow gum - mountain gum - acacia moist herb forest	1550	15.0
89	Mountain gum - ribbon gum - acacia herb/grass forest	939	9.0
56	Narrow-leaved peppermint - ribbon gum herb/fern moist forest	787	7.6
55	Brown barrel fern/herb/grass moist forest	650	6.3
76	Candlebark - snow gum shrub/grass dry forest	212	2.0
146	Snow gum - black sally dry herb/grass woodland	77	<1
126	Montane wet sedgeland	40	<1
148	Poa tussock grassland /sedgeland	36	<1
61	White ash moist shrub forest	5	<1
73	Snow gum - ribbon gum dry shrub/grass forest	6	<1
59	Narrow-leaved peppermint - silvertop ash shrub/fern dry forest	N/A	N/A
109	Brittle gum - broad-leaved peppermint - red stringybark dry shrub/ tussock forest	N/A	N/A
112	Silvertop ash - broad-leaved peppermint dry shrub forest	N/A	N/A
74	Apple box - snow gum - candlebark dry shrub/grass/herb forest	N/A	N/A
0	Cleared	57	<1
998	Pine Plantation	11	<1
999	Unmapped Vegetation Communities	11	<1

VEGETATION MANAGEMENT CONSIDERATIONS

This section of Tallaganda National Park occupies the western fall of the range. Vegetation ranges from moist tall forests dominated by brown barrel or mountain gum and narrow-leaved peppermint to drier low forests dominated by mountain gum with broad-leaved peppermint or candlebark. Higher altitudes support snow gum forests (refer to map). Small patches of other vegetation communities occur and it is assumed their fire history and fire management guidelines are similar to the more extensive vegetation communities.

A high proportion of plant species in the reserves regenerate primarily through resprouting (from buds in the stem, trunk or roots), often combined with some seedling germination. A small number of plant species in the reserve are obligate seeders, which die after complete leaf scorch but regenerate from seed. These characteristics affect how the plants in the reserve respond to the different elements of a fire regime, as outlined below.

Response to aspect of fire regime	Impact
Repeated short interval fires · reduce the number of seeding species by killing the plants before seed set occurs. · deplete the energy in the buds of resprouting plants, leading to plant death.	Depending on the length of the interval, repeated fires might lead firstly to the loss of long-lived shrubs, short-lived shrubs and finally herbs and perennial grasses.
Long fire intervals · fail to provide fire as a trigger to stimulate resprouting, or germination of species - adult plants may then die of old age · however, germination and resprouting may be triggered by drought, frost and animal disturbance.	Long fire intervals may reduce biodiversity unless other triggers initiate germination and resprouting.
Moderate to high intensity fire · causes significant damage to resprouting plants, enabling the germination and establishment of seedlings.	Moderate to high intensity fire may cause domination by seeder species.
Low intensity fire · causes little damage to resprouting species that then out-compete germinating seedlings for water and nutrients.	Low intensity fire may cause domination by resprouting shrub species.
Spring fire · may reduce germination due to moisture stress · may be followed by death of seedlings in the hot, dry summers experienced in the area.	Spring burning may lead to a dominance of resprouting species.
Autumn fire · moisture levels may be sufficient to enable successful resprouting and germination of plants. · Seedlings may be killed by subsequent frosts	Autumn prescribed burning may maintain a mix of seeder and resprouting species, depending on frost severity.
Drought · May delay germination of plants after a fire until over 50 mm of rainfall. · Recovery of resprouting plants will also be slowed.	Fire applied in a drought cycle may lead to local extinctions of seeders. Slower rates of germination and resprouting will also contribute to erosion and nutrient losses.
A small fire · may lead to selective overgrazing of plants by herbivores.	A small fire may lead to the local extinction of palatable species.

VEGETATION MANAGEMENT THRESHOLDS & EVALUATION

Threshold	Definition
Overburnt	The last two consecutive inter-fire intervals have been too short. *· Protect from fire as far as possible.*
Vulnerable	The area will be overburnt if it burns this year. *· Protect from fire as far as possible.*
Recently Burnt	Time since fire is less than the optimum interval, but before that it was within threshold. *· Avoid fires if possible.*
Within Threshold	Fire history is within the threshold for vegetation in this area. *· A burn is neither required nor should one necessarily be avoided.*

Analysis of the fire responses (recorded in the NPWS fire response database) of key plant species in each vegetation community suggests that species decline may occur if fire is repeatedly applied to large proportions of each community outside the intervals detailed below.

Description		Vegetation Description	Fire Thresholds: Minimum interval (yrs)	Fire Thresholds: Maximum interval (yrs)	Fire history evaluation
Moist Forests	55	Brown Barrel - Fern, Herb, Grass Moist Forest	40	200	89 % is within threshold 5 % may be within threshold, but may have recently burnt in patches* 6 % is recently burnt
Intermediate Moist Forests	56	Narrow-leaved Peppermint & Manna Gum - Herb, Fern Moist Forest	30	200	77 % is within threshold 14 % may be within threshold, but may have recently burnt in patches* 6 % is frequently burnt 3 % is recently burnt
	66	Mountain Gum & Narrow-leaved Peppermint - Shrub, Grass Forest	25	150	72 % is within threshold 28 % may be within threshold, but may have burnt in patches* (4 % frequently burnt, 24 % recently burnt)
	89	Mountain Gum & Manna Gum - Acacia, Herb, Grass Forest	30	150	62 % is within threshold 36 % may be within threshold, but may have recently burnt in patches* 1 % is frequently burnt 1 % is recently burnt
Dry Forests	107	Mountain Gum & Broad-leaved Peppermint - Dry shrub Forest	25	150	82 % is within threshold 15 % may be within threshold, but may have recently burnt in patches* 3 % is recently burnt
	76	Candlebark & Snow Gum - Shrub Grass Dry Forest	30	150	79 % is within threshold 2 % is frequently burnt 19 % is recently burnt
	95	Snow Gum & Mountain Gum - Acacia, Moist Herb Forest	40	200	82 % is within threshold 16 % may be within threshold, but may have recently burnt in patches* 1 % is recently burnt 1 % is frequently burnt

These thresholds provide a broad framework for assessing the biodiversity status of the reserve, as mapped above. However, these thresholds are based on life cycles of a limited number of species, and given the lack of knowledge on ecosystem functioning without fire, the upper limits are untested. Some variability in fire regimes may be desirable to allow for unconsidered needs of some species. The following biodiversity management guidelines provide additional detail.

*Data is unreliable for broad areas shown as having had prescribed burns implemented, as the depth of these burns from trail ignition points is unknown, and in moister forests likely to be narrow.

FAUNA MANAGEMENT CONSIDERATIONS

Species	TSC Act Schedule	Management Considerations
Spotted-tailed quoll ®	Vulnerable	Even low intensity burns may impact on use of den sites such as fallen trees and boulder fields, and fire should thus be excluded from large rock outcrops where possible, particularly during the May to August breeding period. Efforts should be made to increase patchiness and reduce intensity of wildfires in these areas. Frequent fire may reduce structural diversity of vegetation, diminishing its habitat value for quolls. High intensity fires that limit food resources (mostly arboreal prey and carrion) are detrimental.
Eastern false Pipestrelle ®	Vulnerable	Generally utilise moister gullies, roosting in eucalypt hollows and under bark. Hibernate in winter, females pregnant in late spring and summer, and are vulnerable to fire at these times. Higher intensity fires that burn moist gullies may destroy roosting sites.
Powerful owl®	Vulnerable	Powerful owls are strongly associated with long unburnt forest. Widespread, high intensity fires that reduce prey numbers (particularly greater gliders) and destroy the large, old eucalypts that provide nesting sites are detrimental (but may form new hollows). Powerful owls are highly sensitive to nest disturbance and will readily abandon the nest. Thus fires near known nesting trees should be avoided between mid May and mid October.
Olive whistler®	Vulnerable	Mostly inhabit wet forests above 500m. Forage in trees and shrubs and on the ground, feeding on berries and insects. Vulnerable to fire that is too intense, widespread or frequent, changing vegetation structure and composition. They nest in low forks of shrubs between September and January and are particularly vulnerable to fire at this time.
Masked owl(SF)	Vulnerable	Live in dry eucalypt forests and woodlands, hunting on ecotones such as edges of forests, roadsides, or patchy areas within forests. Thus show a preference for more frequently burnt areas. Mosaic burning improves foraging opportunities. Feed primarily on rodents and other ground mammals. Widespread intense or frequent fires that reduce numbers of prey directly or through simplification of the understorey will be detrimental. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows. Nests vulnerable between March and October when fledging occurs.
Broad-toothed rat	Vulnerable	Live in runways through wet grass, sedge or heath environments. Sheltering nests of grass are built in the understorey or under logs, where two or three young are born in summer. The diet is comprised of grass and sedge stems, supplemented by seeds and moss spore cases. Thus widespread or repeated fires, particularly if followed by drought, may compromise population viability.
Eastern pygmy-possum	Vulnerable	Too frequent fires that reduce the abundance of flowering myrtaceous shrubs, particularly banksias, will be detrimental. Fires between late spring and early autumn that impact on nesting sites in tree hollows, under the bark of eucalypts and in tree forks are detrimental.
Pink Robin(SF)	Vulnerable	Inhabits rainforest and tall, open eucalypt forest, especially densely vegetated gullies. Catches prey by the perch-and-pounce method, foraging on the ground for insects and spiders. Thus fires removing logs is detrimental. Breeds between October and January in a moss nest in a fork from 30cm to 6m above the ground, in deep undergrowth. Vulnerable to fire at this time.
Small mammals	N/A	Numbers of small mammals generally take a few years to recover after fire, but this process is slower if more than 80% of the habitat is burnt.
Invertebrates	N/A, but some regarded as vulnerable globally	The Tallaganda range supports relatively high densities of velvet worms, flatworms, funnel web spiders and springtails, which have evolved a high degree of species diversity and endemism through successive glaciation episodes along this comparatively isolated part of the GDR. As different catchments and even sub-catchments contain genetically separate species of these invertebrate groups, it is important that disturbance events such as fire are kept to a small scale to avoid potential extinction of species within a separate catchment. For velvet worms, logs are capable of supporting large populations only after a minimum of 45 years of decay (Barclay et al 2000). Presence and abundance are positively linked to log moisture, thus repeated fires that cause drying are detrimental.
Other	N/A	Long fire intervals may result in shrub senescence, impacting on species that utilise shrubs for feeding and nesting. However, hollow logs, litter and variable shrub patches develop in long unburnt areas, which can be occupied by a diverse range of fauna.

® indicates species recorded in reserve, (SF) indicates species recorded in adjoining State Forest

TSC Act = Threatened Species Conservation Act

Barclay S, Ash JE, Rowell DM (2000) Environmental factors influencing the presence and abundance of a log-dwelling invertebrate, *Euperipatoides rowelli* (Onychophora: Peripatopsidae). Journal of Zoology, 250, 425-436.

Garrick RC, Sands CJ, Rowell DM, Tait NN, Greenslade P & Sunnucks P. (2004) Phylogeography recapitulates topography: very fine-scale local endemism of a saproxylic 'giant' springtail at Tallaganda in the Great Dividing Range of south-east Australia. Molecular Ecology, 13, 3329-3344.

BIODIVERSITY MANAGEMENT GUIDELINES

Guideline 1: Consecutive fires should not generally be applied more frequently than the thresholds
- These minimum thresholds are based on the time required to allow the post-fire maturation and reproduction of most perennial components and obligate seed regenerators.
- Ensure post-fire maturity and reproduction of many fauna species.
- Ensures that much of the reserves' soil will have fully restored nutrient levels to sustain vegetation. In sub alpine areas 10-12 years post-fire is needed to restore nitrogen to pre-fire levels, and phosphorus replacement may take 20 years (Raison, Khanna and Woods, 1985). Doherty (1997) considered that these effects would be exaggerated on soils with a lower nutrient status, such as those in the northern section of the reserves. Frequent burns will thus constantly deplete nutrient levels, hindering regeneration of healthy vegetation and limiting food resources for herbivores.
- In the moister forests within the adjoining state forest, the presence of white ash indicates a historic relatively low occurrence of high intensity fires. White ash is killed by 100% canopy scorch, and as seed storage is only on the canopy it is vulnerable to high intensity fire.
- Presence and abundance of velvet worms are positively linked to log moisture, thus frequent fires, that cause drying of the environment, are detrimental.
- Dispersal of invertebrates such as funnel web spiders and velvet worms is linked to the presence of a litter layer, thus frequent fires are detrimental.

Guideline 2: A range of post- fire ages within the recommended fire intervals should be present in each of the reserves' vegetation types.
- Ensures a range of age classes for a diversity of flora and fauna species.

Guideline 3: At least 50% of the each of the reserves' vegetation types should be unburnt for more than 60 years.
- Extended period since fire enables development of a diversity of vegetation and habitat types for fauna. The moister communities are thought to experience infrequent, high intensity fire as the norm, possibly between 70 & 150 years apart (England et al 2004). Structural elements of these forests are slow growing and long-lived.

Guideline 3: Where prescribed burns are undertaken they should be at low frequencies, generally of low-moderate intensity and applied over comparatively small areas
- The presence of some areas that have burnt more frequently than recommended may not be detrimental in the context of a widespread ecosystem, and may provide opportunities for disturbance loving species to germinate.
- Small, recently burnt patches may provide ecotonal areas that some fauna species prefer.
- High intensity fires < 45 years apart will reduce populations of velvet worms, which utilise fallen logs between 35 and 55 years of decay.

KEY BIODIVERSITY MANAGEMENT PROVISIONS

The various responses of reserve flora and fauna to fire suggest that, for biodiversity management;
- Wildfires should be kept as small as possible and managed to reduce fire intensity where possible to limit both direct and indirect impacts on threatened fauna.
- Fire should be excluded from rocky outcrops for protection of quoll habitat.
- High intensity burns should be avoided closer than 45 years apart, allowing time for fallen logs to decay and provide habitat for velvet worms.
- Where possible, fire should be prevented from burning entire catchments or sub catchments to avoid potential extinction of geographically restricted species of invertebrates. As these log-dependent invertebrates are part of the system that creates soils, their presence is critical to enhancing the productivity of these forest systems through nutrient cycling.
- Patchiness in wildfires should be promoted to maintain prey numbers and diverse habitat for the range of owls, quoll and other threatened fauna.
- Frequent fires that dry out logs should be avoided as the presence and abundance of velvet worms are positively linked to log moisture.
- Frequent fires that reduce litter levels should be avoided, as litter beds assist the dispersal of these and other invertebrates. Litter beds also stabilise soils, reducing erosion.
- Infrequent fires may enhance understorey habitat complexity, providing habitat for a range of fauna for a minimum of 10-40 years post fire. Frequent fires that reduce structural diversity of habitat should be avoided.
- Monitoring of floristic and structural diversity should be conducted in the long-unburnt age classes to monitor changes in floristic diversity and habitat quality occurring with time since fire.
- Fire should only be applied in response to a demonstrated loss of biodiversity.
- Any burning implemented for strategic purposes should be applied between mid March and late May, where possible, to minimise impacts on threatened species.
- Strategic burns should be restricted in area, low-moderate in intensity and at a low enough frequency to maintain understorey habitat components for the range of threatened fauna in the reserve.