Abercrombie River National Park

Fire Management Strategy

Department of
Environment and Conservation (NSW)

NSW NATIONAL PARKS AND WILDLIFE SERVICE

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FIRE MANAGEMENT STRATEGY

ABERCROMBIE RIVER NATIONAL PARK

NSW National Parks and Wildlife Service
Blue Mountains Region
June, 2005

ACKNOWLEDGMENTS

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Erratum: Please note that this Strategy was first drafted in 2001. It has had a minor review to update it in 2004. Some contextual and timing inconsistencies may still exist.

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EXECUTIVE SUMMARY

PLANNING AND CONSULTATIVE PROCESS

This Fire Management Strategy provides direction for fire management activities within Abercrombie River National Park (the Park) to fulfil the Service's obligations under various legislation and Government policy.

Importantly, under the Rural Fires Act, 1997, NPWS is both a fire fighting authority and a public authority and therefore has dual responsibilities for fire fighting and land management. This Fire Management Strategy fulfils NPWS responsibilities under Sections 38 s4 and 44 s3 of the *Rural Fires Act, 1997* and should be implemented accordingly.

Abercrombie River National Park has a number of threatened plants and animals. This strategy will deal with the protection of these species and communities through the implementation of appropriate fire management regimes to promote biodiversity.

In consultation with local Bush Fire Management Committees, volunteer Rural Fire Brigades, Park neighbours and other stakeholders, areas have been prioritised for risk management treatment by assessing bush fire threat to assets.

The co-operation of the community will be critical to the success of the strategy. Neighbours will need to manage fuels near their own assets to complement work undertaken in the Park.

Although every effort has been made to ensure accuracy of details from existing databases, additional information is continually being collected and management concepts and practices evolving. Therefore, it is proposed that this strategy will have a shelf life of five years before a review is undertaken.

FIRE MANAGEMENT OBJECTIVES

The primary NPWS objectives for fire management are:

- To protect from bushfires, persons and property on, or immediately adjacent to the park.
- To suppress unplanned bushfires occurring in the Park.
- To minimise the potential for spread of bushfires on, from, or into the Park.
- To manage bushfires to avoid the extinction of all species which are known to occur naturally within the Park.
- To protect from damage by bushfires all Aboriginal sites, Historic places and culturally significant features known to exist within the Park.

STRATEGIES FOR LIFE AND PROPERTY PROTECTION

Strategies for the protection of life and property from the effects of wildfires included in the strategy are:

- Early detection and rapid suppression of all wildfires posing a threat to infrastructure assets, life and property within and adjoining the Park.
- Implementation of strategic fuel management programs within the Park.
- Promotion of fire safety and fire protection procedures to Park visitors and neighbours.
- Maintenance of a strategic fire trail network within the Park.

STRATEGIES FOR FIRE MANAGEMENT (WILDFIRE SUPPRESSION)

Strategies for the prevention, detection and control of wildfire that are included in the strategy are:

- Emphasis on boundary fuel management measures to protect against direct flame attack on assets on / off Park.
- Aerial surveillance of the Park following severe thunderstorms.
- Maintenance of fire trails and utilities to assist with the suppression of wildfire.
- Early detection and rapid suppression of wildfires where possible.
- Monitoring of fuel levels within Strategic Fire Advantage Zones.
- Strategic fuel management to reduce the potential for large scale wildfires.
- Continued liaison with Bush Fire Management Committees, fire fighting authorities and park neighbours.

STRATEGIES FOR HERITAGE MANAGEMENT

Strategies for the management of the natural and cultural heritage values that are included in the strategy are:

- The use or exclusion of fire to maintain a complex diversity of vegetation communities and age structures, prevent species extinctions and protect specific natural or cultural assets.
- Emphasis on fuel management along boundary areas to allow for ecologically sustainable fire regimes within core Park areas.
- Assessment of environmental impacts prior to any fire management activity.
- Pre-burning surveys for threatened species or Aboriginal / historic relics where possible.
- Monitoring vegetation re-generation following a prescribed burn where possible.
- Compliance with identified fire regime thresholds for all vegetation communities, threatened species and communities.

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1. INTRODUCTION

This Fire Management Strategy applies to the land area dedicated under the *National Parks and Wildlife Act, 1974*, as Abercrombie River National Park (ARNP). This National Park is managed by the Blue Mountains Region (Kanangra Area) of the National Parks and Wildlife Service.

1.1 Scope and Purpose

Under the *Rural Fires Act* 1997, the National Parks and Wildlife Service (NPWS, or the Service) is a prescribed fire organisation and is responsible for the control and suppressing of all fires on areas that it manages. This responsibility also extends to fuel management with the Service being responsible for the implementation of fuel management programs to protect life and property.

Section 50 of the *Rural Fires Act* 1997 sets up provisions for the establishment of District Bush Fire Management Committees (DBFMCs) with the task of developing and co-ordinating co-operative fire management between fire authorities across the state.

Within the scope of this Strategy the NPWS is an active member of the Chifley Zone and Southern Tablelands Zone District Bush Fire Management Committees.

Under Section 52 of the Rural Fires Act, each Bush Fire Management Committee is to prepare two kinds of bush fire management plans for the rural fire District or other part of the state for which it is constituted. These plans are:

- A Plan of Operations, and
- A Bush Fire Risk Management Plan.

This Fire Management Strategy fulfils NPWS requirements under Sections 38 s4 and 44 s3 of the *Rural Fires Act 1997* and should be implemented accordingly.

This Strategy has been prepared in accordance with the policies and procedures detailed in the NPWS Fire Management Manual, NPWS Strategy for Fire Management and the relevant Plan of Management. The Strategy has considered the bush fire environment, bush fire risks and management strategies, prescribed burning program and priorities identified in the Sydney Basin Fire Management Strategy, and cooperative fire fighting agreements outlined in the relevant District Bush Fire Management Committee Risk Management and Operations Plans.

Appendix 1 provides a glossary of terms used in this document.

1.2 Fire Management Objectives and Performance Indicators

Each fire management objective is listed below. Performance indicators complement each objective and will be used as a means of gauging the effectiveness and success of the plan. The data for the performance indicators will be obtained from performance reporting and monitoring as indicated under each objective.

OBJECTIVE 1

To prevent the occurrence of human caused unplanned fires on the Park.

Performance Indicator

i. On reserves with a history of unplanned fire, ignitions caused by humans are progressively reduced over the planning period.

ii. On reserves, with no history of unplanned fire, there is no increase in ignitions caused by humans over the planning period.

Performance Reporting and Monitoring

- Fire causes included in wildfire situation reports by Region.
- Fire Management Unit collates and analyses data and prepares NPWS performance report.

Planning Notes

- Consider causes of human induced unplanned fire ignitions eg. arson, burning off, camping, cooking, railways, powerlines, machinery etc.
- Develop bushfire prevention strategies for reducing the frequency of these fires eg surveillance, investigations, law enforcement, public education, fire bans, closures, access control etc.

OBJECTIVE 2

To suppress unplanned fires occurring on the Park.

Performance Indicator

i. Fires occurring on the Park are suppressed within appropriate control lines on the Park, safely, with minimum environmental damage and cost during the planning period.

Performance Reporting and Monitoring

- Fire suppression response included in wildfire situation reports by Regions.
- Fire suppression and rehabilitation costs included in financial reporting system.
- Assessments of cost effectiveness included in post incident debrief.
- Fire Management Unit collates and analyses data and prepares NPWS performance report.

Planning Notes

- Consider ignition causes, location and frequency.
- Determine bushfire management zones.
- Identify wildfire suppression advantages.
- Identify preferred suppression strategies for bushfire management zones.
- Identify wildfire suppression resource and coordination needs.

OBJECTIVE 3

To minimise the potential for spread of wildfires on, from or into the Park.

Performance Indicator

i. Wildfires starting in the Park are suppressed within the Park and fires starting outside of the reserve are prevented from entering the Park, safely, and with minimum environmental damage and cost during the planning period.

Performance Reporting and Monitoring

- Fire origin and movement is included in wildfire situation reports by Regions.
- Fire Management Unit collates and analyses data and prepares NPWS performance report.

Planning Notes

- Consider ignition causes, location and frequency.
- Determine bushfire management zones.
- Identify wildfire suppression advantages.
- Identify preferred suppression strategies for bushfire management zones.
- Identify wildfire suppression resourcing and coordination needs.
- Develop strategies for preventing fires from leaving or entering the Park.

OBJECTIVE 4

To protect from bushfires occurring on the Park, persons and property on, or immediately adjacent to, the Park.

Performance Indicator

i. No death or injury to persons, or destruction of property, caused by on-park bushfires in the planning period.

Performance Reporting and Monitoring

- Known, or suspected, deaths, injuries and property losses included in wildfire situation reports by Regions.
- Deaths, injuries and property losses verified in post operation analysis by Regions.
- Fire Management Unit collates and analyses data and prepares NPWS performance report.

Planning Notes

- Undertake a bushfire risk analysis.
- Map assets at risk.
- Determine bushfire management zones.
- Develop bushfire risk management options (fire bans, area closures, refuges, evacuation strategies, hazard reduction, siting of facilities, community education, community fireguard etc).
- Identify preferred wildfire suppression resourcing and coordination needs.

OBJECTIVE 5

To manage bushfires to avoid the extinction of all species which are known to occur naturally within the Park.

Performance Indicators.

i. Fire regimes are maintained within specified ecological thresholds across more than 50% of the area of each plant community on the reserve.

ii. No significant decline of species populations (common or endangered) due to inappropriate fire regimes, suppression operations or other fire management works, occurs during the planning period.

Performance Reporting and Monitoring

- The perimeters and intensity of all fires, and the areas affected by suppression operations, are mapped.
- Fire regimes are mapped and evaluated in relation to ecological planning guidelines and a summary report on the state of fire regimes and biodiversity is prepared and submitted to Fire Management Unit annually.
- Region monitoring of the responses of common indicator species, endangered species and key habitat attributes in relation to different fire regimes is undertaken and included in its annual performance report
- Bushfire Research Unit analyses data and prepares a NPWS performance report.
- Regions regularly evaluate the effects of wildfire suppression activities and the results of rehabilitation works.

- The locations of likely future bushfire suppression operations are anticipated and ways of mitigating potential impacts evaluated before each fire season.
- Ecological guidelines are evaluated as results from monitoring and research projects are received.

Planning Notes.

- Map vegetation communities (Identify threatened flora and fauna).
- Map the occurrence of past fires.
- Determine bushfire management zones.
- Determine ecological guidelines for appropriate fire regimes.
- Map and evaluate fire regimes in relation to ecological guidelines - integrate across all management zones.
- Identify areas where fire regimes are likely to be detrimental, or could become detrimental, during the life of the plan.
- Evaluate the overall significance of inappropriate - or potentially inappropriate - fire regimes (see performance indicators above).
- Identify strategies and actions (eg fire suppression, prevention works or prescribed burning) to remedy the significant occurrence of inappropriate fire regimes. (Note: in some instances planned use of fire may be needed to create appropriate fire regimes).
- Identify rehabilitation strategies for the mitigation of adverse effects of fire suppression operations.
- Identify resources and coordination required to implement strategies.
- Implement region monitoring of indicator and endangered species responses to differing fire regimes.

OBJECTIVE 6

To protect from damage by bushfires all Aboriginal sites, historic places and culturally significant features which are known to exist within the Park.

Performance Indicator**.**

i. No damage caused to known Aboriginal sites, historic places and culturally significant features as a result of bushfires during the planning period.

Performance Reporting and Monitoring

- Known or suspected damage included in wildfire situation reports by Regions.
- Damage verified in post operational analysis by Regions.
- Fire Management Unit collates and analyses data and prepares NPWS performance report.

Planning Notes

- Undertake bushfire risk analysis.
- Map assets at risk.
- Determine bushfire management zones.
- Identify hazard reduction and bushfire prevention strategies**.**
- Identify preferred wildfire suppression strategies.
- Identify rehabilitation strategies for the mitigation of the adverse effects of fire suppression operations.
- Identify resources and coordination required to implement strategies.

1.3 The Planning Environment

The National Parks and Wildlife Service requires that a Fire Management Strategy be prepared for each National Park, Nature Reserve and State Recreation Area.

This strategy specifies the fire management objectives and strategies appropriate for Abercrombie River National Park. All fire suppression and fuel management operations must be in accordance with this strategy and other NPWS plans, e.g. weed and pest species management prepared for this Park.

1.3.1 Legislation

The NPWS has statutory obligations under the *Rural Fires Act 1997* to protect life and property on its lands and to prevent fire from leaving its property. Under the *National Parks and Wildlife Act 1974* the Service is empowered with the authority to conserve the natural and cultural heritage of NSW.

This authority extends to the protection of heritage off Park and is given greater legislative backing through the *Threatened Species Conservation Act 1995*. These obligations, though not mutually exclusive, require a flexible approach to fire management.

Burning is considered to be clearing under the Native Vegetation Conservation Act 1997, however, exemptions are made for activities authorised under the Rural Fires Act 1997 (activities on NPWS land are exempt from the Native Conservation Act).

High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition has been listed as a Key Threatening Process on Schedule 3 of the Threatened Species Conservation Act 1995. Desirable fire frequencies (Table 14) and prescribed burning regimes recognised in this strategy have been formulated with regard to the current knowledge of fire ecology for flora and fauna species within the park.

NPWS will assess and consider the environmental impact of activities prescribed within Abercrombie River National Park Fire Management Strategy for local species listed in Schedule 1 or Schedule 2 (Threatened Species Conservation Act 1995).

Under the *Rural Fires Act 1997* the NPWS is a recognised Fire Authority. The Act provides for the authority to undertake appropriate measures to prevent fire from entering or leaving its estate. As a prescribed organisation the NPWS is required to implement the provisions of Bush Fire Management Plans. The NPWS can act to suppress fires up to eight kilometres from its Park boundaries in collaboration with local brigades and park neighbours in accordance with provisions of local Bushfire Management Plans.

The NPWS must give appropriate consideration in its fire management planning to the requirements of protection for both human life and property as well as the protection of the environment. Thus by its fire management policies the NPWS must not only safeguard the direct protection of human life, it must also ensure the protection, for future generations, of the natural and cultural values of NSW.

1.3.2 Fire Management Policies of the NPWS

NPWS policies and procedures for fire management are contained in the *Fire Management Manual (2003).* The major points are summarised as follows:

- the NPWS regards fire as a natural phenomenon; one of the continuing physical processes of the Australian environment
- the NPWS recognises the evolutionary adaptation of the many indigenous species of plants and animals to particular fire regimes
- the NPWS accepts that fire can be a useful management tool
- all NPWS areas will have fire (management) strategies, prescribing the fire protection and control measures to be effected in each area having regard to the primary objective of conserving its natural and cultural values
- the NPWS will take steps to prevent and control bushfires on its lands in accordance with the Rural Fires Act 1997
- where bushfire hazards are assessed as presenting a threat to life, property or natural and/or cultural values fire application may be prescribed to reduce the hazard
- the NPWS will develop and implement co-operative fire suppression and fuel management strategies with other authorities and neighbours
- the NPWS will undertake and encourage natural and cultural resource surveys and research to guide fire management practices on its areas
- the NPWS will seek to raise the level of community understanding and appreciation of fire management practices adopted for NPWS lands.

All prevention and suppression works will, where possible, be pre-planned and co-ordinated with neighbour and other agencies likely to be affected by NPWS activities. The NPWS will undertake fire prevention programs, through public education and through local supervision and enforcement of the Acts and regulations applying to fires.

The strategy is reflected in the NPWS Fire Management Manual, which offers a structure for fire management strategies and provides that:

- Fire management operations will take into account the protection of natural resources
- The NPWS will collect information on the biology of native plants in relation to fire
- Databases on the conservation requirements of species in relation to fire may be established and reviewed as new information is acquired
- Research should provide data that will be of value in making management decisions
- Researchers should make available the practical application of research.

1.3.3 Local-Regional Environmental Plans

Abercrombie River National Park is located within Oberon Shire, Greater Bathurst Shire and Upper Lachlan Shire Local Government Areas. These local governments have Local Environmental Plans (LEPs) which zone land for particular land uses and control different types of development.

All National Parks should be zoned 8(a) within LEPs, a zone reserved for all lands dedicated under the National Parks and Wildlife Act 1974. Although councils have no statutory role or control over activities within this zone, LEP policies should be taken into account at the beginning of the hazard reduction season in order to determine their relative impact on areas earmarked for hazard reduction.

1.3.4 State Environmental Planning Policies

Abercrombie River National Park contains areas covered by the State Environmental Planning Policy (SEPP) 44, 1995, Koala Habitat Protection. This policy aims to protect koala habitat in New South Wales and sets out procedures to achieve this.

Although the above policy does not apply to NPWS estate, it is NPWS policy to consider SEPPs for activities on NPWS lands during their assessment under Part V of the Environmental Planning and Assessment Act 1979.

1.3.5 Fire Management Policies-Regulations of Involved Organisations

The Rural Fires Act 1997 requires each Bushfire Management Committee to prepare and submit a Bushfire Management Plan, comprising a Plan of Operations and a Bushfire Risk Management Plan to coordinate the activities of organisations for the prevention, control and suppression of bushfires.

The Chifley Zone and Southern Tablelands Zone Bushfire Management Committees have adopted coordinated fire-fighting policies based on the Policy Statement of the Coordinating Committee and the Manual of Procedures for Coordinated Fire Fighting.

The Abercrombie River National Park Fire Management Strategy will form part of the NPWS input into the Plan of Operations and a Bushfire Risk Management Plan for the Oberon, Bathurst Regional and Upper Lachlan Shire Local Government Areas.

1.3.6 NSW Biodiversity Strategy

The *NSW Biodiversity Strategy (1999)* was developed by the New South Wales Government and develops a collaborative approach to biodiversity conservation. Its over-riding goal is "to protect the native biological diversity of NSW and maintain ecological processes and systems".

To this end inappropriate fire regimes have been identified as one of the seven key threatening processes that are effecting the biological diversity of NSW.

This document is intended to assist managers in achieving the above goals listed in the NSW Biodiversity Strategy (1999).

2. DESCRIPTION OF THE PARK

2.1 Location

Abercrombie River National Park (ARNP) is located south of the Blue Mountains Region of NSW and occupies an area of 19,000 hectares (Refer to Map 1). It is located approximately 50km southwest from Oberon within the Central Tablelands botanical division of NSW (Harden, 1993). The southern sector of the Blue Mountains National Park lies only 5km to the east of the main sector of Abercrombie River National Park.

The park consists of three sectors; the main sector is approximately 15,000 hectares and is bordered to the southwest by the Abercrombie River and grazing lands to the north and east. A separate sector is located to the west, on the southern side of the Abercrombie River. The Bummaroo Ford camping area is also separate from these sectors, located on the Abercrombie River along the Abercrombie Road.

Abercrombie River National Park is managed by the Blue Mountains Region of NSW National Parks and Wildlife Service through their office in Oberon.

2.2 Terrain

Abercrombie River National Park is centred on an area of deeply incised gully systems in conjunction with prominent ridges and spurlines. There is large altitudinal range within the park from 1128m in the northeast to 500m at the Abercrombie River (southwest). The park includes the catchments of Silent Creek and the Retreat River as well as 42 kilometres of the Abercrombie River.

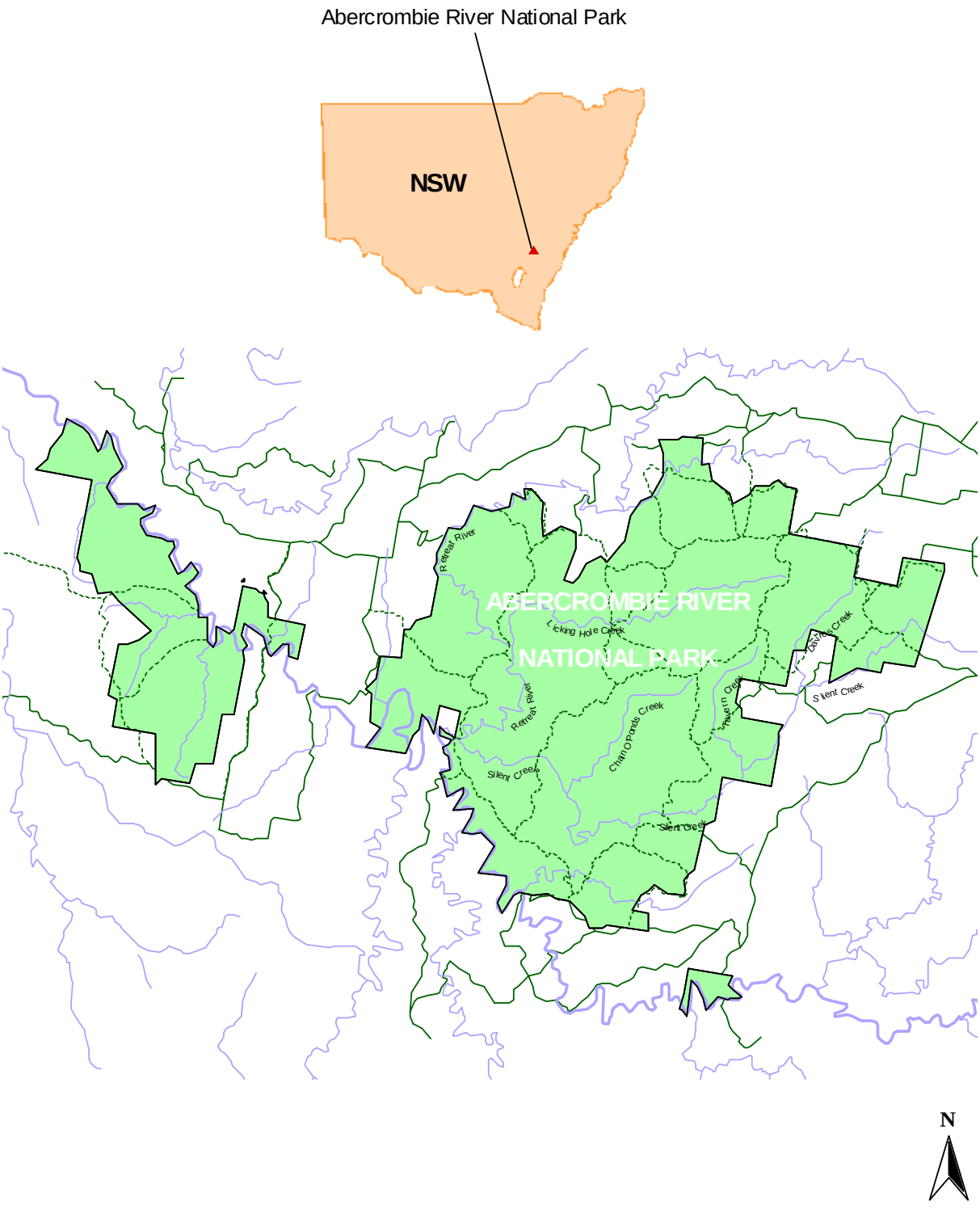
The geology represents a gradual change from Ordovician metasediments - typical of the southern tablelands (in the east), to Ordovician - Silurian metasediments on the western edge which are typical of the central western slopes (NPWS, 1999). There is a progression of older to younger rock sequences from east to west through the park, resulting in soil changes from Orange loam to heavier loams (NPWS, 1999).

The soils are mainly skeletal, highly so on some western ridges and less on the slopes (i.e. Gravel and coarse sands). Major drainage lines represent areas of alluvial soils.

2.3 Biodiversity

The large altitudinal range and diverse geology of the park supports a unique variety of fauna and flora. Vegetation ranges from that typical of the Central Tablelands in the east, to the low altitude open forest species typical for the Central Western Slopes in the western sectors of the park.

Map 1 - Location of Abercrombie River National Park



LEGEND

Study Area
Road
River
Fire Trail

0 2 4 6 8 10 Kilometres

Scale 1:185,000

Generally species diversity increases in areas where there is a large range in geology types and altitudinal range. For example slopes around the 'Governor's Flat' (western) area of the park possess a greater species diversity than those areas around the Silent Creek area (east) (NPWS, 1999).

Abercrombie River National Park conserves a diversity of vegetation communities typical of montane areas, tableland areas and western slopes. The area contains the largest remaining intact patch of low open forest, open woodland and woodland in the region and hence is very significant in species conservation within the area.

The continued presence of the Booroolong Frog (endangered, Schedule 1) in the riparian areas of the Retreat River and the downstream, western (Governors Flat) portion of the Abercrombie River, despite the apparent decline in it's range is of conservation significance.

2.3.1 Flora

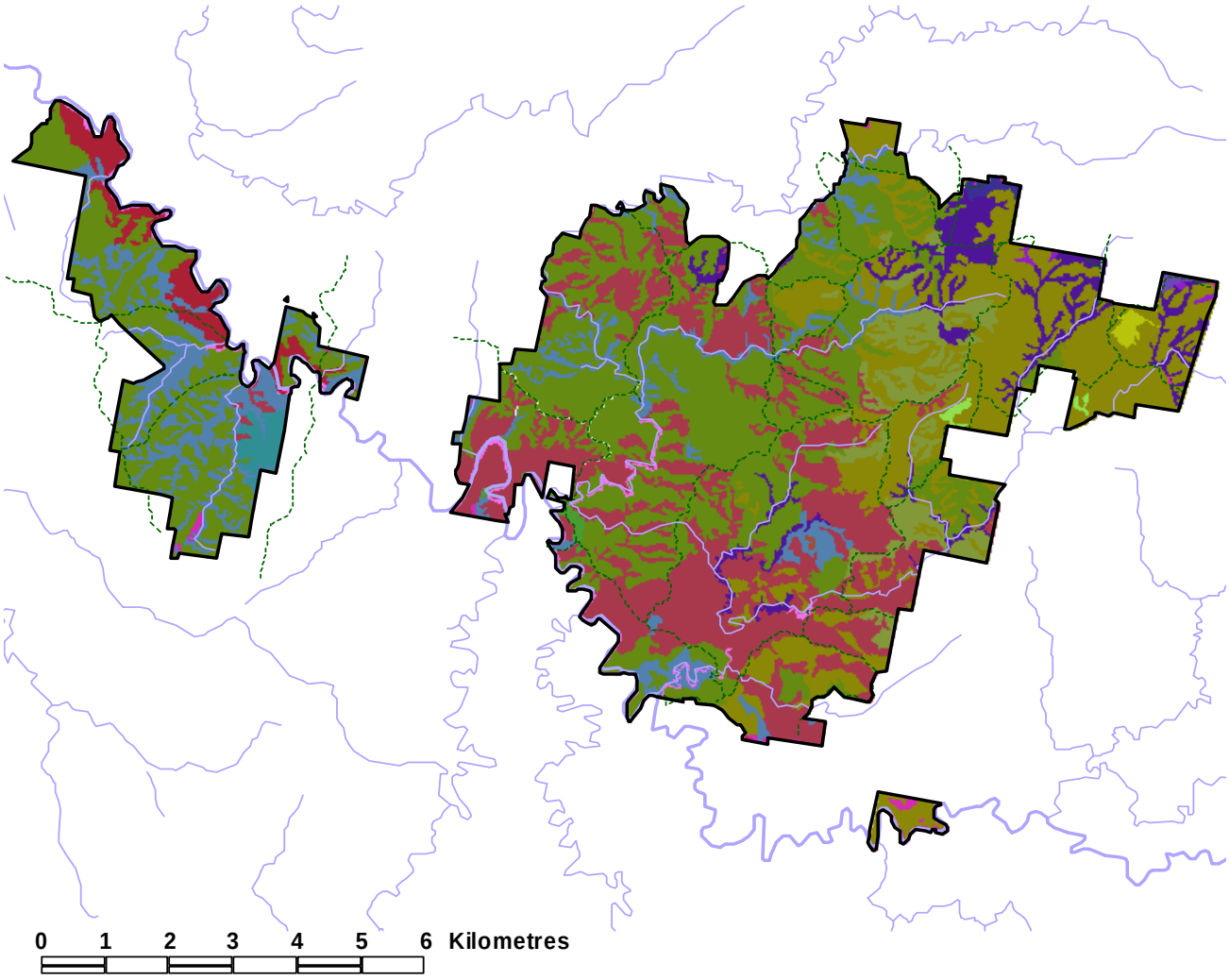
2.3.1.1 Communities

A vegetation survey of Abercrombie River National Park, conducted by the Comprehensive Regional Assessment (CRA) unit of the NPWS, determined 16 distinct plant communities that exist within the Park. These vegetation communities are described below in Table 1 and illustrated in Map 2.

Table 1
Vegetation Communities In Abercrombie River National Park

Community	Species Characteristics of the Community	Area (ha)	% of Total Area	Determining Factors
(53) Riparian Acacia Shrub/Grass/Herb Forest	*Casuarina cunninghamiana*	226.91	1.20	Riparian areas of permanent watercourses at lower altitudes.
(66) Tablelands Shrub/Grass Moist Forest	*E. radiata / E.dalrympleana / Poa sieberiana / Daviesia ulicifolia*	46.03	0.24	Sheltered areas at high altitudes (>850m). North boundary of park.
(67) Northern Plateaux Moist Fern/Herb/Grass Forest	*E. fastigata / E. dalrympleana /Acacia melanoxylon / Pteridium esculentum*	25.87	0.14	Sheltered riparian areas above 1000 metres.
(68) North East Tablelands Shrub /Herb/Grass Dry Forest	*E. radiata / E.viminalis / Lomandra longifolia*	33.89	0.18	Southeast aspects with altitude above 850m. Around Little Bald Hill.
(89) Eastern Tablelands Acacia/Herb/Grass Forest	*E. dalrympleana / E. viminalis / Acacia melanoxylon / Stellaria pungens*	848.98	4.49	Higher altitude (above 650m) riparian areas.
(90) Northern Tablelands Acacia Herb/Grass Dry Forest	*E. bridgesiana / Acacia dealbata / Hydrocotyle laxiflora*	1732.49	9.16	Poorer quality riparian areas. Western areas of the park (younger loams).
(96) Tableland Tussock Grass/Herb Forest	*E.pauciflora / E.dalrympleana / Poa sieberiana*	20.36	0.11	Sheltered SE aspects above 1000 meters. NE of park, Hackets Gully area.
(109) Tablelands Dry Shrub/Tussock Grass Forest	*E. dives / E. mannifera / E. macrorhyncha / Hibbertia obtusifolia / Chionochloa pallida*	3633.11	19.21	Slope areas above 600 meters. Eastern areas of the park (older loams).
(112) Eastern Tablelands Dry Shrub Forest	*E. sieberi / E. dives / Brachyloma daphnoides / Poa sieberiana*	804.86	4.26	Ridge areas above 600 meters. Eastern areas of the park (older loams).

Map 2 - Vegetation Communities Within Abercrombie River National Park



LEGEND

- Eastern Tablelands Acacia/Herb/Grass Forest
- Eastern Tablelands Dry Shrub Forest
- North East Tablelands Dry Shrub/Grass Forest
- North East Tablelands Shrub/Herb/Grass Dry Forest
- Northern Plateaux Moist Fern/Herb/Grass Forest
- Northern Slopes Dry Grass Woodland
- Northern Slopes Dry Grass Woodland
- Northern Tablelands Acacia Herb/Grass Dry Forest
- Northern Tablelands Grass Forest on Basalt
- Northern Tablelands Shrub/Tussock Grass Forest
- Riparian Acacia Shrub/Grass/Herb Forest
- Tableland Tussock Grass/Herb Forest
- Tablelands Dry Shrub/Tussock Grass Forest
- Tablelands Dry Shrub/Tussock Grass Forest
- Tablelands Shrub/Grass Moist Forest
- Western Slopes Grass/Herb Dry Forest
- No Data
- Park Boundary
- Roads
- River
- ---------- Fire Trail

Table 1 Cont.
Vegetation Communities In Abercrombie River National Park

Community	Species Characteristics of the Community	Area (ha)	% of Total Area	Determining Factors
(113) North East Tablelands Dry Shrub/Grass Forest	*E. mannifera / E. dives / Brachyloma daphnoides / Dianella revoluta*	6.13	0.03	Ridges above 800 meters around Chain O Ponds Creek.
(114) Tablelands Dry Shrub/Tussock Grass Forest	*E.macroryncha / E.rossii / E. goniocalyx / Chionochloa pallida*	6755.21	35.71	Gravel and coarse sandy ridges and slopes. Younger loams (SW of park)
(121) Western Slopes Grass/Herb Dry Forest	*E. macrorhyncha / E. goniocalyx / Gonocarpus tetragynus / Poa sieberiana*	4017.73	21.24	Gravel and coarse sandy ridges. Younger loams (SW of park)
(149) Northern Tablelands Shrub/Tussock Grass Forest	*E. dalrympleana*	47.95	0.25	Ridges above 1000 meters. Northeast area of park (older loams).
(159) Northern Slopes Dry Grass Woodland	*E. blakelyi / E.bridgesiana / E.melliodora / Aristida ramosa*	436.8	2.31	Steep slopes with alluvial soils. West area of park (young loams).
(160) Northern Slopes Dry Grass Woodland	*E. blakelyi / E. melliodora / Danthonia racemosa / Austrostipa scabra ssp falcata*	46.08	0.24	Lower altitude (<750m) slopes. Found near the Macks Flat area.
(183) Northern Tablelands Grass Forest on Basalt	*E.polyanthemos*	152.53	0.81	Dry low altitude ridges within the western section of the park (Younger loams).

2.3.1.2 Species

Within NSW there are three levels of significance for flora species. The first of these are species listed under the *Threatened Species Conservation Act 1995*. These species have a legislative requirement for conservation. No flora species listed under this act are known to occur within the Park.

The second level of significance for flora, are the Rare or Threatened Australian Plant (ROTAP) species. This listing is based on academic opinion as to the taxa which are rare in Australia but which are not considered Endangered or Vulnerable under the TSC Act 1995. There are no legislative requirements for ROTAP species.

The third level of significant flora species are species considered to be of regional significance. These species have no legislative requirements, however they may be of importance within Local Environmental Plans. Flora species considered to be of regional significance are determined on the basis of their distribution.

The park encompasses an important area of remnant bushland within the central tablelands botanical division of NSW. Vegetation studies have been conducted in ARNP (NPA, 1995; CRA, 1999) resulting in the recognition of high levels of species richness particularly for bryophytes and liverworts in a comparatively dry area.

Surveys identified major communities, dominant shrub and herb communities as well as some significant species. For example the park contains the northern most protected population of Argyle Apple (*Eucalyptus cinerea*) as well as significant riparian communities.

Table 2 below lists those species found within the Park that are listed as ROTAP species, and describes their individual response to fire. Table 3 lists species classified as being of regional significance.

Table 2
Rare or Threatened Australian Plant (ROTAP) Species Located within Abercrombie River National Park

Species	Growth Form and Habitat Requirements	Conservation Status	Response to Fire
Leptospermum blakelyi	Shrub 1m high. Grows in heath on rocky escarpments near Lithgow (Harden, 1991).	Not currently reserved within its natural distribution. Status - Rare (2R)	Regenerate after fire from seed (storage on plant) and from rootstock (lignotuber).

Table 3
Regionally Significant Flora Species Located Within the Park

Species	Growth Form and Habitat Requirements	Conservation Status	Response to Fire
Argyle Apple *Eucalyptus cinerea*	Tree to 15m high. Grows in grassy or sclerophyll woodland to open forest on shallow relatively infertile soils from Sofala (North) to Tumut (South) (Harden, 1991).	Status - Protected northern limit of distribution. Namadgi NP (<1,000 plants)	Regenerate after fire from seed (on plant), rootstock (lignotuber) and aerial buds (epicormic buds).
Box-leaved Wattle *Acacia furfuraceae*	Shrub 1-3 m high. Grows in dry sclerophyll forest (or woodland) often on rocky outcrops.	Status - Regional conservation significance	Individuals killed by fire. Most acacia species require fire to germinate seeds. Seeds readily stored in soil seed bank for many years. Seedbank depleted after consistent frequent fire regimes.
Pomaderris prunifolia	Shrub 1-3m high. Grows on rocky slopes, often along creeks from south of the Hunter Valley.	Status - Regional conservation significance	Regenerate after fire from aerial buds and rootstock, depending on plant maturity.
Hydrocotyle callicarpa	Slender erect annual herb 1-8cm in height. Grows in dry or moist open sandy areas of gully floors in gravely or loamy soils on granite south from West Wyalong district.	Status - Regional Importance	Likely to be killed by fire. Possibly resprout depending on plant maturity, season and intensity of fire.
Anogramma leptophylla Annual Fern	Delicate fern less than 7.5cm high. Grows in protected sites, often under rocks in areas with a dry summer. Widespread but rare.	Status - Regional Importance	Individuals likely to resprout after fire. Possibly killed depending on plant maturity, season and intensity of fire. Habitat susceptible to fire.
Greenhood Orchid *Pterostylis hamata*	Terrestrial herb. Grows among rocks in sparse forest.	Status - Regional Importance	Individuals likely to resprout after fire, depending on plant maturity.
Enthosthodon subnudus var. gracilis	Moss. Grows on rocks in moist areas.	Status - Regional Importance	No fire tolerance.
Isolepis gaudichaudiana	Small tufted annual sedge that grows in moist, open habitats. Recorded within a swamp in Hoosberry Gully (ARNP).	Most westerly occurrence in the Central Tablelands	Fire unlikely in moist habitat. Individuals likely to be killed by any fire. Regeneration dependent on soil seed bank.
Oreomyrrhis erioipoda	Perennial herb to about 50cm. Occurs in open forest on better soils above 1100 metres in the Park	Status - Regional Importance. Disjunct local population	Likely to be killed by fire. Possibly resprout depending on plant maturity, season and intensity of fire.

2.3.2 Fauna

Throughout Abercrombie River National Park there has been several fauna surveys undertaken by Charles Sturt University (CSU) students, the National Parks Association (NPA) and the NPWS.

These surveys have concluded that there is a wide range of native fauna inhabiting the park including 15 threatened species and 8 Regionally significant species.

The results of these surveys reveal that the majority of arboreal species were associated with co-dominant Eucalypt communities associated with *E. rossii*, followed by *E. dives* and *E. macrorhyncha* respectively (NPWS, 1999).

There has been numerous mammal species recorded, including 4 species that are listed under the Threatened Species Conservation Act, 1995. Over 30 species of reptiles have been recorded including 1 Vulnerable (Schedule 2) species, Rosenberg's Goanna (*Varanus rosenbergi*).

There have been 10 frog species listed including continued presence of the endangered Booroolong frog (Schedule 1) in the riparian areas of the Retreat River and the downstream, western (Goveners Flat) portion of the Abercrombie River. ARNP has been found to be important habitat for at least 90 native bird species including 2 threatened species, and several species with local conservation concern. Also the Abercrombie River and its tributaries provide habitat for 3 fish species which are considered regionally rare.

Table 4 lists those species that are listed under the TSC Act 1995, whilst Table 5 lists those species within the Park that are considered to be of regional significance.

Table 4
Threatened Fauna that Occur or are Likely to Occur Within Abercrombie River National Park

Species	Preferred Habitat	Potential Fire Effects	Status
Koala *Phascolarctos cinereus*	Inhabits both wet & dry eucalypt forests on high nutrient soils containing preferred feed trees.	High intensity fires lead to removal of feed trees. Unaffected by low to medium intensity fires (ie hazard burns).	Status - Vulnerable *Habitat Present*
Spotted-tail Quoll *Dasyurus maculatus*	Dry and moist open forests containing rock caves, hollow logs or trees.	Frequent fire can directly reduce prey numbers. Frequent low intensity burns may reduce habitat quality of prey species. Highest population's known from long unburnt sites (Dickman & Read, 1992). Avoid fire over large areas of the Park.	Status - Vulnerable *Habitat Present*
Eastern False Pipestrelle bat *Falsistrellus tasmaniensis*	Inhabits sclerophyll forests. They prefer wet habitats where the trees are more than 20m high. Prefer hollow trunks of eucalypt trees, caves and old wooden buildings for roosting.	Felling of known roost trees and direct impact of medium to high intensity fires should be avoided, in order to maintain habitat trees.	Status - Vulnerable *Resident*
Common Bent-Wing Bat *Miniopterus schreibersii*	Prefers areas where there are caves, old mines, old buildings, stormwater drains & well timbered areas.	Frequent fires near roosting habitat may impact upon breeding success. Foraging areas affected.	Status - Vulnerable *Habitat*

			Present
Rosenberg's Goanna *Varanus rosenbergi*	Hawkesbury sandstone outcrop specialist. Inhabits woodlands, dry open forests and heathland sheltering in burrows, hollow logs, rock crevices and outcrops.	Fires should not burn entire habitat areas, as this species needs refuge areas. Termite mounds could also be impacted by fire, reducing habitat quality.	Status - Vulnerable *Resident*
Booroolong Frog *Litoria booroolongensis*	Associated with rocky flowing streams in mountainous regions.	Alteration in water quality may influence survival of tadpole larvae. Habitat removal by fire unlikely. Predation may increase in disturbed areas.	Status - Endangered *Resident*
Masked Owl *Tyto novaehollandiae*	Open forest & woodlands with cleared areas for hunting and hollow trees or dense vegetation for roosting.	Frequent fires reduce breeding success, otherwise habitat is maintained by fire.	Status - Vulnerable *Habitat Present*
Powerful Owl *Ninox strenua*	Forests containing mature trees for shelter or breeding & densely vegetated gullies for roosting.	Frequent fires can directly reduce prey numbers. Frequent low intensity burns may reduce habitat quality of prey species.	Status - Vulnerable *Resident*
Glossy Black Cockatoo *Calyptorhynchus lathami*	Open forests with *Allocasuarina* species and hollows for nesting.	Frequent fire in vegetation communities containing *Allocasuarina* species can remove foraging habitat.	Status - Vulnerable *Resident*
Square-tailed Kite *Lophoictinia isura*	Utilises mostly coastal and sub-coastal open forest, woodland or lightly timbered habitats and inland habitats along watercourses and mallee that are rich in passerine birds.	Frequent fires can directly reduce prey numbers. Frequent low intensity burns may reduce habitat quality of prey species.	Status - Vulnerable *Habitat Present*
Australasian Bittern *Botaurus poiciloptilus*	Inhabits shallow freshwater or brackish wetlands with tall dense beds of reeds, sedges or rush species and swamp edges.	Any fire in habitat can temporarily damage habitat quality.	Status - Vulnerable *Habitat Present*
Black Bittern *Ixobrychus flavicollis*	Freshwater & brackish streams & ponds.	Any fire in habitat can temporarily damage habitat quality.	Status - Vulnerable *Habitat Present*
Pink Robin *Petroica rodinogaster*	Found in dense gullies, rainforests and open forests, dispersing into drier more open habitats in winter.	Frequent fires, especially low intensity autumn burns, may reduce the amount of invertebrate feed supplies available during winter.	Status - Vulnerable *Habitat Present*
Swift Parrot *Lathamus discolor*	Inhabits eucalypt forests and woodlands with winter flowering eucalypts.	Intense fires causing tree damage may reduce or interrupt winter flowering of some eucalypt species.	Status - Vulnerable *Habitat Present*
Turquoise Parrot *Neophema pulchella*	Inhabits coastal scrubland, open forest and timbered grassland, especially ecotones between dry hardwood forests and grasslands.	Frequent fire may reduce number of low nesting hollows such as logs, stumps and posts preferred by this species.	Status - Vulnerable *Habitat Present*

Table 5
Regionally Significant Fauna Species Located Within the Park

Species	Preferred Habitat	Potential Fire Effects	Status
Diamond Python *Morelia spilota ssp. spilota*	Shelters in hollow trunks and limbs, disused burrows, caves, rock crevices and beneath boulders. Often found on rafters and ceilings of buildings.	Low intensity fires unlikely to affect the lifecycle of this species. High intensity fire will kill individuals and remove sheltering and foraging habitat. Open to predation following disturbance.	Status - Regionally Significant *Resident*
Gippsland Water Dragon *Physignathus leseuerii ssp. howitti*	Usually encountered on waterside rocks, logs or overhanging branches along the margins of creeks, rivers and lakes on coast, ranges and hinterland of eastern Australia.	Unlikely to be significantly affected by fires. Frequent fires will modify habitat quality. Open to predation in disturbed areas.	Status - Regionally Significant *Resident*
Grey Goshawk *Accipiter novaehollandiae*	Inhabits rainforests, forests, forest gullies and valleys, taller woodlands, timber on watercourses and open country in autumn dispersal.	Frequent fires will modify habitat, affecting prey numbers. Intense fires can remove nesting trees.	Status - Regionally Significant *Resident*
Peregrine Falcon *Falco peregrinus*	Frequents cliffs, gorges, timbered watercourses, and environs of rivers, wetlands, plains, open woodlands, pylons, spires and buildings.	Frequent fires will modify habitat, affecting prey numbers. Intense fires can remove nesting trees.	Status - Regionally Significant *Resident*
Macquarie Perch *Macquaria australasica*	Occurs in lakes and flowing streams, usually in deep holes. Sometimes seen in large shoals near shore.	Burning has the potential to increase nutrients and turbidity within waterways. Long term modification of water quality may influence respiration and breeding success.	Status - Regionally Significant *Resident*
River Blackfish *Gadopsis marmoratus*	Inhabits clear flowing streams with abundant cover. Also found in lakes and reservoirs.	Burning has the potential to increase nutrients and turbidity within waterways. Long term modification of water quality may influence respiration and breeding success.	Status - Regionally Significant *Resident*
Silver Perch *Bidanuss bidyanus*	Inhabits rivers and large tributaries, also lakes and reservoirs. Seen in aggregations near the surface in open water frequently below rapids and weirs.	Burning has the potential to increase nutrients and turbidity within waterways. Long term modification of water quality may influence respiration and breeding success.	Status - Regionally Significant *Resident*
Murray Cray *Euastacus armatus*	Occurs in both large rivers and minor streams in the tributaries of the Murray-Darling system.	Unlikely to be affected by modification in water quality and hence fire activities.	Status - Regionally Significant *Resident*

2.3.3 Introduced Flora and Fauna

Some introduced flora and fauna are considered detrimental to Abercrombie River National Park by being evasive, directly competing with or preying upon native species. Introduced species may also effect soil and water systems and the recreational, cultural and scientific values of the park.

Currently there are three introduced flora species and six vertebrate pest species of concern inhabiting the Abercrombie River National Park Area, these species are; Serrated Tussock (*Nassella trichotoma*), Blackberry (*Rubus fruiticosa*), Willow species, Feral Goats, Feral Pigs, Wild dogs, Fox (*Vulpes vulpes*), Cats and Rabbits.

Consideration must be given to the impacts of fire management prescription on introduced species. Prescribed burning has the potential to increase invasive flora, and increase exposure and predation of native fauna species.

2.4 Cultural Heritage

Cultural heritage includes all Aboriginal heritage sites and all historic places, including buildings and other works together with pertinent contents and surroundings which are valued by us and society and possibly future societies.

2.4.1 Aboriginal

Intense artefact surveys have been conducted within the Macks Flat area and the Sink, The beach and Silent Creek Camping Areas. It is presumed that ARNP would have once been a tribal area for the Gundungurra and/ or Wiradguri Aboriginal Nations. Evidence in the form of chert cores and flakes have been found in areas of permanent water, in particular the Macks Flat area and along the Abercrombie and Retreat rivers (concentrated where the Retreat river meets Licking Hole Creek and in gentle spur areas).

Protection of Aboriginal sites, from fire management activities, will be maintained through applying Operational Guidelines. Research should be conducted to comprehensively map areas of Aboriginal Heritage.

2.4.2 Historic

Abercrombie River National Park has not been systematically surveyed for Historic Sites. Historic structures that remain in the park are associated with gold mining, grazing, and recreational purposes, they include stock holding structures (abandoned), various huts associated with recreational use, mine workings (including a disused tunnel to divert the course of the Retreat River) and water races.

Protection of unknown and known historic sites, from fire management activities, will be maintained through applying Operational Guidelines. Research should be conducted to map areas of Historic Heritage.

2.5 Recreational Use and Facilities

Abercrombie River National Park has been used for recreational pursuits for at least 50 years, including fishing, canoeing, camping, swimming and four wheel driving. The major camping areas are situated at the following locations;

- Bummaroo Ford, on the Abercrombie River along the Abercrombie Road
- Silent Creek, on the Silent Creek
- The Beach, on the Abercrombie River
- The Sink, on the Retreat River

Facilities at some of these sites include; pit toilets, fire rings, information/ interpretative displays and barriers to protect natural qualities. Visitation to ARNP in

the past has been low, the comparative isolation of the park from urban areas and the popularity of walking areas in the nearby Blue Mountains, probably contributed to this low level of use.

There is now increasing visitation in the Park due to its mention in NPWS brochures, 4WD books and Magazines. Busy periods include school holiday times particularly Easter and the October long weekend.

3. BUSHFIRE ENVIRONMENT

Fire is an important part of the Australian environment. It can bring about a sudden change to an ecosystem affecting both the structure and species composition.

Fire is also an important mechanism in regenerating plant species / communities as many native plants are dependent on fire for survival. However in some instances, fire can seriously damage native plant communities, diminish fauna habitat and threaten human life and property. The key to effective fire management is the use of fire regimes that enhance biodiversity and provide protection of assets.

3.1 Fire History and Frequency

Historically the incidence of wildfire in the Oberon district is low (OBFMC, 1999). Little information is available on the occurrence of fire within Abercrombie River National Park. Accurate medium to long term fire records (10-25+ years) have not been well documented.

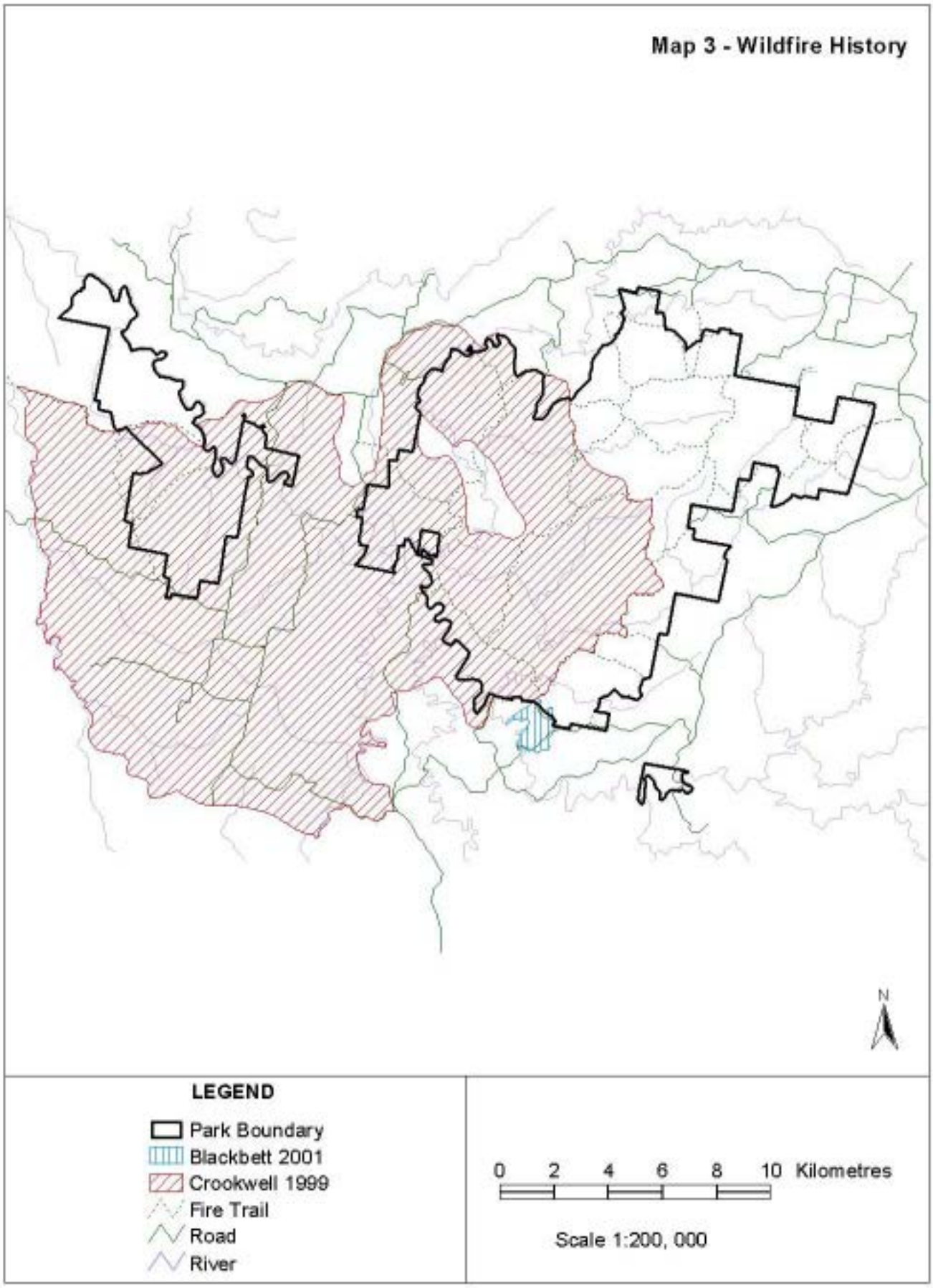
To date, only one wildfire has been accurately recorded and mapped within the Park. This fire occurred in February 1999 and impacted 9872.1 hectares of the Park. A large fire (3900 hectares) in 1985 occurred to the north of the park within the Jeremy area. All other fire records within the Park are purely anecdotal and accuracy of detail is unknown.

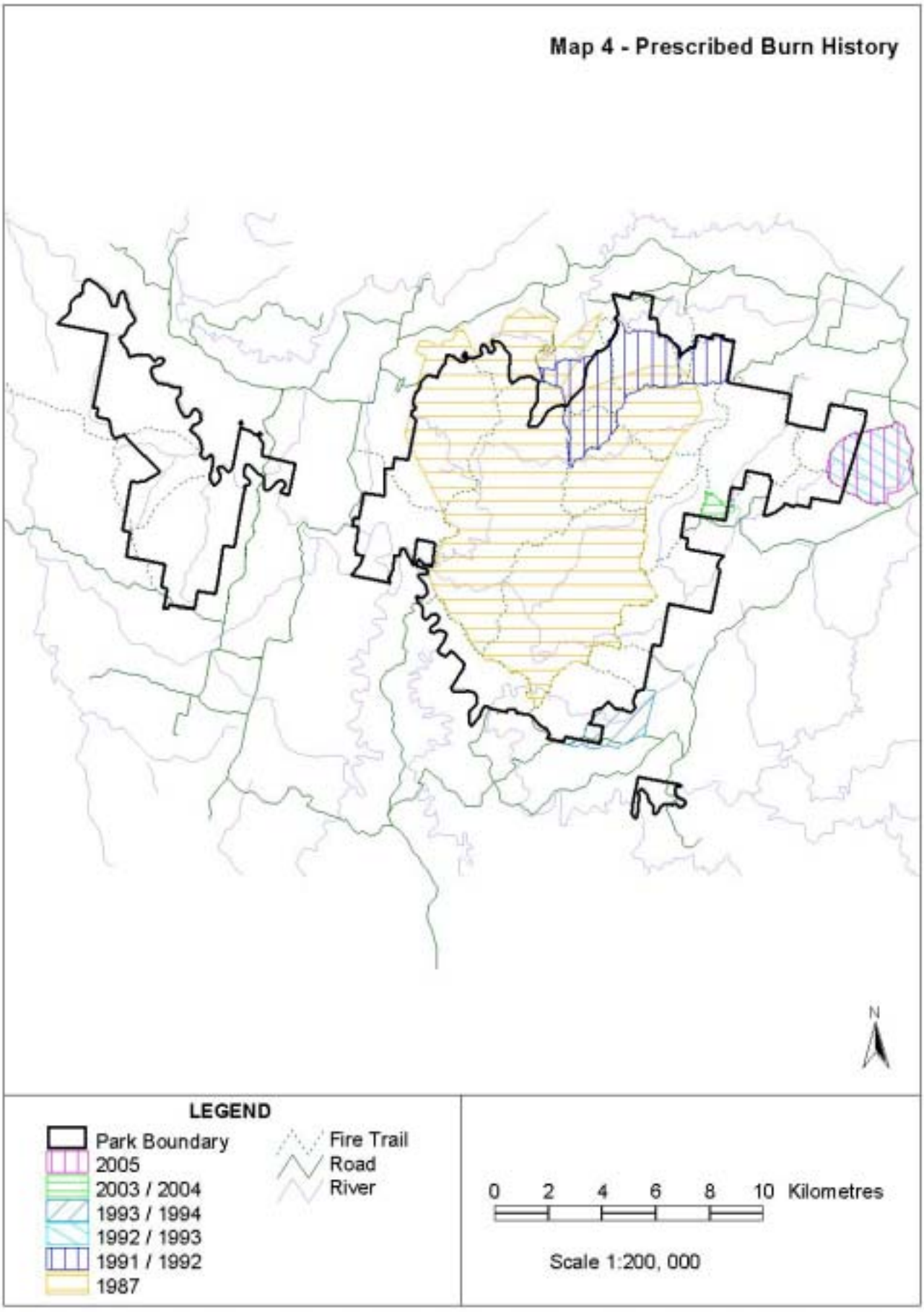
3.1.1 Unplanned Fires

Until 1995, Abercrombie River National Park was managed by Forests NSW (Formerly State Forests of NSW). This area has a history of wildfires, which are typically ignited by lightning activity. Major wildfires have occurred on these lands in the following years; 1942, 1944, 1957, 1962/ 3, 1985, 1999 (BFMC, 1997, Pers. Comm. BFMC, 1999).

Prior to 1999 the most significant wildfire event in the area was the 1985 ‘Jeremy’ fire which was driven by south westerly winds and destroyed fences, stock, rural dwellings and plantation forests. The ‘Crookwell’ wildfire at the beginning of 1999 (17/2/99) could be considered a very significant wildfire event affecting the park, with approximately 52% of the parks vegetation affected. Map 3 illustrates the available wildfire history within the Park.

Specific weather patterns have been observed affecting the area. Of most concern to fire management, is the existence of a lightning corridor running along the east-west section of the Abercrombie River from Wyangala Dam. This lightning activity has been observed as being very concentrated during El Nino periods.


Map 3 - Wildfire History
N
LEGEND
Park Boundary
Blackbett 2001
Crookwell 1999
Fire Trail
Road
River
0 2 4 6 8 10 Kilometres
Scale 1:200, 000


Map 4 - Prescribed Burn History
N
LEGEND
Park Boundary
2005
2003 / 2004
1993 / 1994
1992 / 1993
1991 / 1992
1987
Fire Trail
Road
River
0 2 4 6 8 10 Kilometres
Scale 1:200, 000

3.1.2 Prescribed Burning

Prescribed burning is a tool used under specified environmental and weather conditions to attain planned resource management objectives. For example, fuel reduction for asset protection. Prescribed burning can also help reduce the intensity of a wildfire and provide for suppression advantage.

Recorded prescribed burn history for Abercrombie River National Park is limited. The previous manager of the land, Forests NSW, conducted a number of prescribed burns within the Park. Records for these burns have been passed onto NPWS and have been compiled in Map 4. These prescribed burns were carried out in 1987, 1992, 1993 and 1994. The NPWS have also conducted prescribed burns since the establishment of Abercrombie River National Park. The extent of these burns have also been compiled in Map 4. Prescribed burns were carried out by NPWS in 2004 and 2005.

Historically the majority of prescribed burning within the park has been conducted by local residents, for both hazard reduction and stock grazing. In general these hazard reduction burns have been conducted in Autumn along boundaries and ridgelines with a regime of around 4 to 5 years, where the common practice is to ignite along creeks and let to burn up slope. Fire of this nature are generally left to self extinguish over night.

3.1.3 Fire Frequency

Fires within the Park are not well documented. Verbal accounts of previous wildfires will be investigated, and if accurate can be included in future planning documents. Two large fires have been recorded over the last 17 years. The first occurring in 1987, when Forests NSW conducted a prescribed burn. The second was a wildfire during 1999. This information is useful when undertaking suppression activities and planning hazard reduction burns. With information on fires limited to only a small timeframe an accurate historical fire frequency guideline for the park can not be made, but will continue to be accurately developed over time.

3.2 Fire Weather

Fire weather is the term used to describe the way climatic events affect bush fire behaviour. Fire weather is also impacted by the shape and aspect of the physical terrain e.g. west facing lands with a steep slope cause significant fire intensity to occur.

Fire behaviour is assessed by the way a fire gains intensity and the way a fire's rate of spread can be increased. The use of climate indices such as air temperature, rainfall, relative humidity and wind (both speed and direction) allow predictions of likely fire behaviour.

If these factors are high during the bushfire danger period (usually October to March) it can be expected that significant fire intensity may occur in areas where hazardous fuels are located. Thus climatic conditions are a key feature in the assessment of the bush fire behaviour potential.

Whilst the Bush Fire Danger Period extends from 1st October to 31st March, it is sometimes brought forward or extended given the prevailing weather conditions. These conditions may limit NPWS conducting prescribed burning activities.

Late summer / early Autumn to early winter is the preferred period for prescribed burning. Dry summer periods usually require the implementation of prescribed burning to be held back to late Autumn. Spring burning is acceptable in periods when the precedent rainfall has been sufficient to allow fires to extinguish overnight.

Spring burns are also important ecologically. A variation in season for prescribed burns is important for ecological reasons. Strip burning at appropriate times in strategic locations may be useful to slow or stop the movement of large fires spreading into or through the Park area and are a potential management consideration.

3.2.1 Climate

Abercrombie River National Park experiences a climate characterised by hot summers and cold winters. The hottest month is January and the coldest month is July. Frosts usually occur from mid-April to mid-October and can be heavy at times. Light to heavy snowfalls may also occur during winter, although they seldom remain on the ground.

Climatic data for the park is not recorded. Instead, extrapolation is made from Oberon, Crookwell and Taralga climatic data. Oberon climatic data is representative of the north eastern end of the Park (Table 6), while data from Crookwell and Taralga has been used to represent the remaining areas (Table 7). Rainfall data collected by the owners of the inholding within the Park for the past 6 years, has been combined with the Crookwell and Taralga data.

An analysis of this data from the broader area shows a mean daily maximum temperature of 26.1 ^{o}C in summer and 8.8 ^{o}C in winter. Average annual rainfall recorded at Oberon is 845.7 millimetres and 831.9 millimetres from combined Taralga/Crookwell data. Rainfall trend is towards a marginally lower monthly average during Autumn months, but remains at a monthly average between 48-81mm year round. The mean relative humidity for the area at 3pm ranges from 46% in December to 69% in June (Bureau of Meteorology, 1999 & 2005).

Table 6
Climatic Records for Oberon

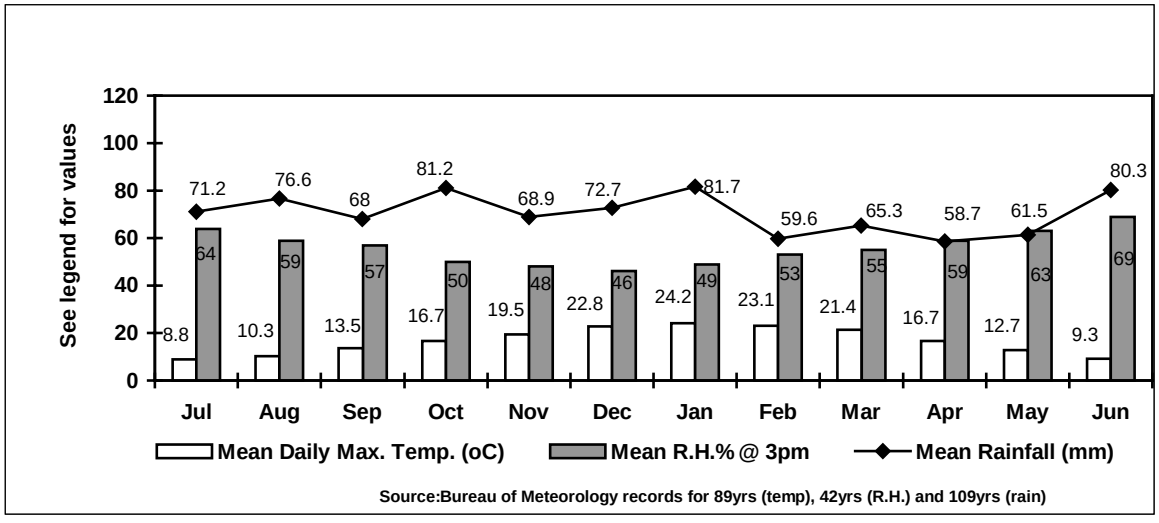
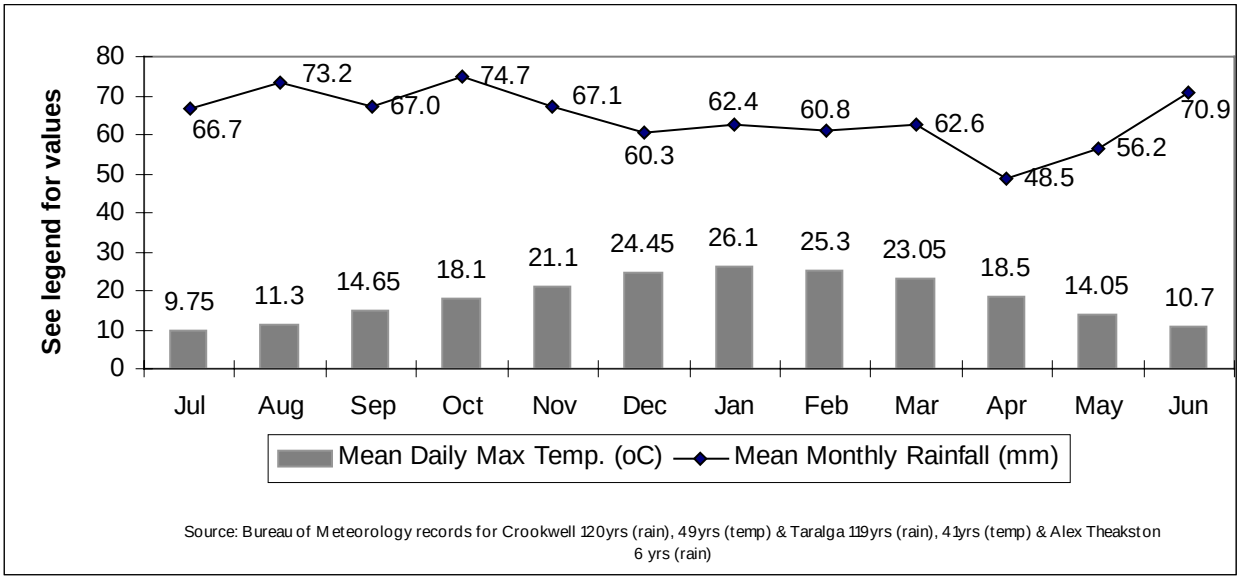


Table 7
Climatic Records for Taralga and Crookwell



Wind direction and wind strength are significant elements affecting fire behaviour and are an essential component in considering bush fire threat potential. Table 8 depicts wind direction, and specifically, reviewing the records of wind strength from north to southwest, north to southeast and southwest to southeast.

3.2.2 Conditions Associated With Bush Fires

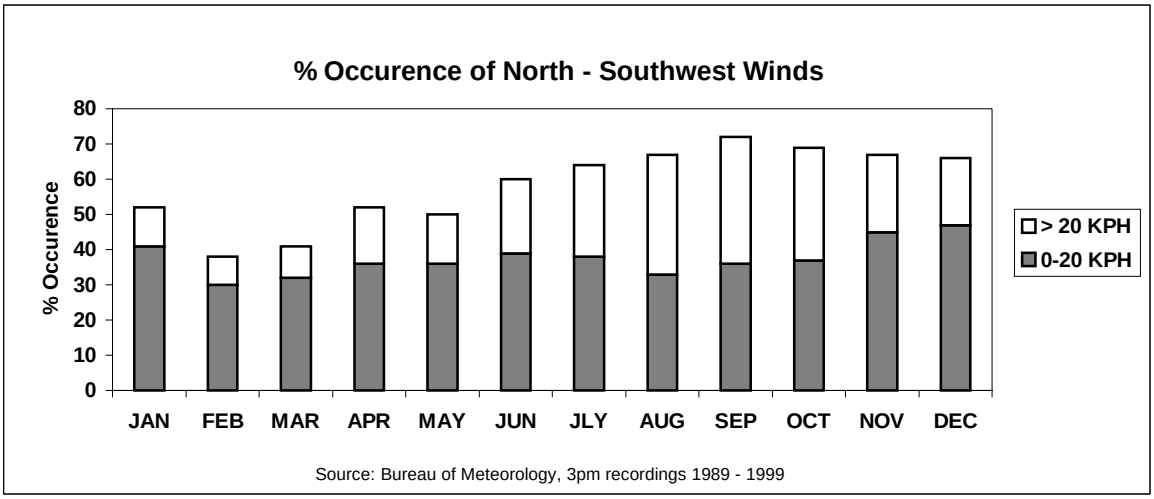
Bushfires are caused by a number of natural and cultural acts. Natural acts include lightning, with cultural acts including arson and accidental fire ignition. Both these events are capable of starting a large bushfire such as those that occurred within NSW during the past 60 years (1939, 1968, 1983, 1991, 1994 & 1997).

The major factors that enable fire to develop into large events are topography and weather conditions.

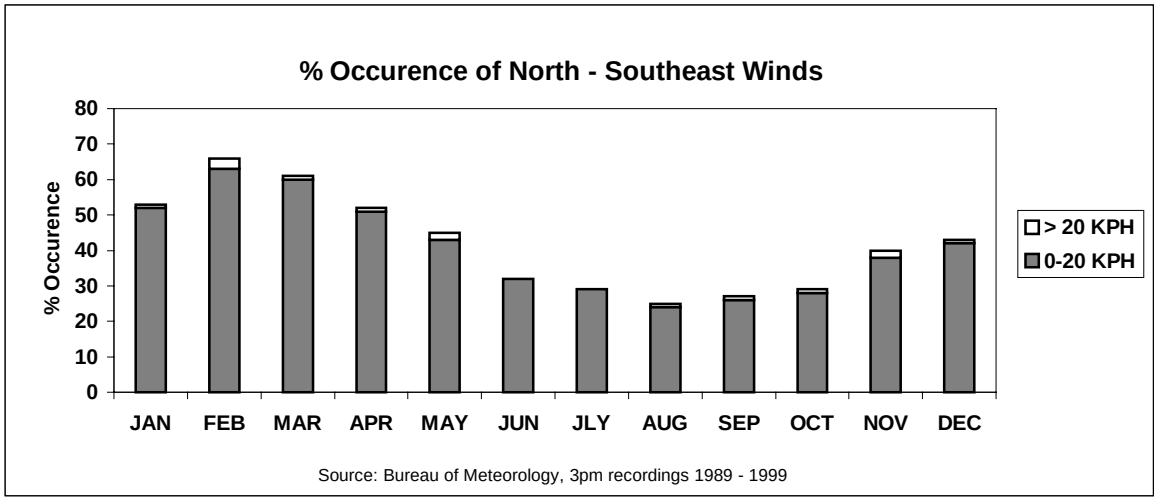
Uphill slopes give an advancing fire the opportunity to pre heat fuel, as a general rule of thumb, the rate of spread of fire doubles for every 10^{o} increase in slope. Different aspects are exposed to different climatic conditions and different levels of solar radiation, typically west to northwest aspects are the driest. Together with appropriate climatic conditions (low humidity, strong winds) a fire event can increase significantly when exposed to the west on slopes greater than 5 degrees.

A weather pattern known for the creation of more extreme fire conditions is commonly referred to as El Nino. The El Nino effect imposes extensive periods of dry conditions on the Australian east coast by directing warm inland winds onto the coast during summer. El Nino events usually occur every three to seven years. A period of two to three months without rain is not uncommon during an El Nino episode.

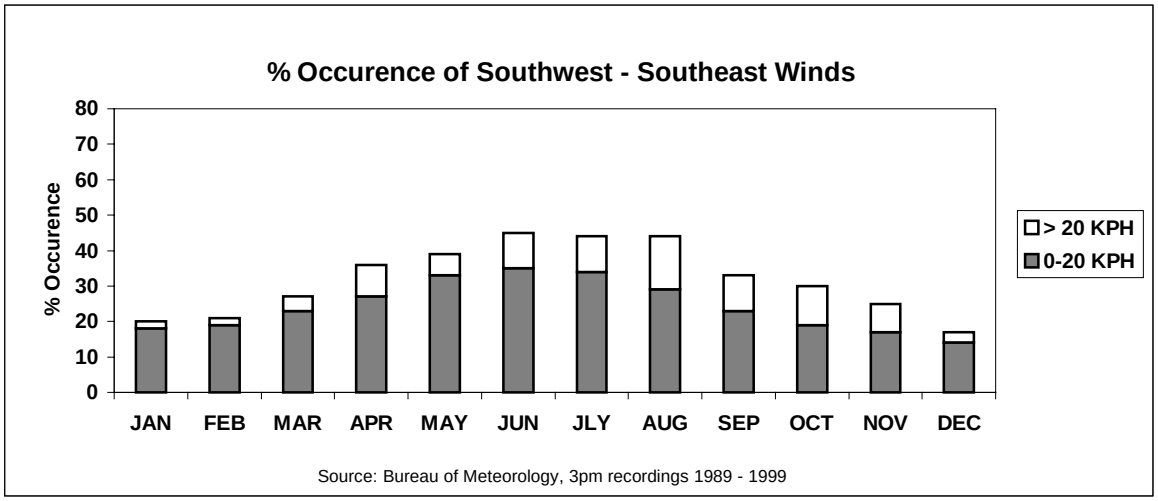
Table 8
Variable Wind Direction Showing Percentage Occurrence



Source: Bureau of Meteorology, 3pm recordings 1989 - 1999



Source: Bureau of Meteorology, 3pm recordings 1989 - 1999



Source: Bureau of Meteorology, 3pm recordings 1989 - 1999

During periods of La Nina (opposite to El Nino) there is increased lightning activity further south towards Yass and Crookwell but activity along the Abercrombie River remains intense. The majority of lightning activity occurs after 5pm (daylight savings time).

The southern Oscillation Index is an indicator of the movement of wind patterns in the Pacific Ocean. This index is used by forecasters as a general indicator of El Nino events. When the index is negative, weather patterns are generally void of rain with the prevailing conditions consistent with drought events.

A characteristic of shorter–term typical bushfire weather in eastern New South Wales is a stationary or slow moving high pressure system over the Tasman Sea causing hot, dry strong north and west winds and rising temperatures, usually during summer from October to March.

The Keetch-Byram Drought Index (KBDI) is an index used by fire managers to gauge the prevailing fire potential at a given time. The index measures moisture loss in soils. The index varies between 0-200. The KBDI provides the necessary warning signals that allow fire managers to be prepared. When used in combination with other indices such as wind direction and wind speed, the KBDI can be used to gain an insight into the potential fire danger.

North-westerly winds usually bring dry and hot conditions which in turn increases the KBDI. The result is an increased chance of fire occurrence and damage potential to life and property. Therefore the KBDI is particularly useful as an ongoing chart, or indicator, of fuel dryness. It is therefore valuable in planning for the implementation of prescribed burning operations.

Fireground weather information for wildfire events in the park, is generally not available or too incomplete to derive conclusions regarding the effect of weather on the fire behaviour during an incident.

The majority of wildfires in Abercrombie River National Park have been caused by lightning. Weather associated with lightning activity is varied. The majority of ignitions are accompanied by rainfall and higher humidities, which limit the spread of any resulting fire. Some lightning events, however, are not associated with rainfall and can be followed by dry gusty northwesterly winds that may cause a fire to develop quickly. Forests NSW manage fire towers in the area (Burraga, Shooters Hill and Pennsylvania (located approximately 10 km NNE from Wyangala Dam along Bugs Ridge) during the annual fire danger period.

3.2.3 Conditions Suitable for Prescribed Burns

Late summer to early winter is the preferred period for prescribed burning. Spring burning is acceptable in periods when the precedent rainfall has been sufficient to allow fires to extinguish overnight, occasional spring burns may also be important for ecological reasons.

The most stable weather conditions in Abercrombie River National Park occur during autumn to early spring. Fuel moisture levels are higher in spring than autumn, however, the highest levels of moisture recovery in fine fuels at night will occur during the autumn.

There is a high probability for fire to be self-extinguishing during this period (autumn to early spring), minimising the risk of prescribed burns breaching containment lines. Moisture levels through winter are generally too high to carry out an effective burn. Dry northwesterly winds occur mainly in spring to mid summer. Prescribed burns undertaken during this period carry a larger risk of escaping control lines.

3.3 Fire Behaviour Potential

Bushfire behaviour potential is a term used to describe the behaviour of a fire under given conditions for a specific location. Fire behaviour potential is a measurable value derived from the combination of the following parameters:

- Elevation
- Slope
- Aspect
- Fuel

Elevation, Slope and aspect surfaces have been derived from a digital elevation model supplied by the NPWS. The knowledge of a specific area and its bushfire behaviour potential is a valuable tool in the assessment, containment and suppression of bushfire.

Strategies to reduce the impact of wildfire events can be greatly assisted by an accurate understanding of the bushfire behaviour potential. The following sub-sections will detail each of the identified parameters. Overlays of these individual assessments will identify areas of low to high bushfire behaviour potential, which will then be subject to specific management procedures to reduce the potential for damaging fire events.

3.3.1 Elevation

Abercrombie River National Park ranges in elevation from 1,128 metres ASL in the Felled Timber Creek catchment (north east), to only 500 metres ASL at the Abercrombie River in the south (refer to Map 5).

The elevation in the Park rises steeply resulting in a rugged landscape that creates difficulties for access and ongoing fire management activities. Fire trails in the Park have required significant earth works (swales) and ongoing management for soil retention.

3.3.2 Slope

Bushfire behaviour potential is strongly influenced by degree of slope. Gradual increments in slope increase the potential severity of a unplanned fire.

Steep slopes allow for the ‘pre-heating of fuels’ by means of hot winds fanning unburnt materials ahead of the fire front. A large percentage of Abercrombie River National Park is comprised of steep slopes (Map 6).

The term convection current is a phenomenon relating to a localised wind created by a change in temperature - such as the changes in local temperature experienced during a wildfire. Convection currents become stronger with increases in slope.

Stronger convection currents enhance the spread of a wildfire by aiding in the dispersal of hot embers into unburnt bushland.

Slope has been classified into 3 separate categories to aid in the prediction of potential fire behaviour within the Park. Table 9 defines the categories used for the modelling of potential fire behaviour.

Table 9
Slope Categories

Slope (degrees^{o})	Rating Used
0-10^{o}	Low
10-20^{o}	Moderate
20-90^{o}	High

3.3.3 Aspect

Bushfire behaviour potential is influenced by aspect. Aspect determines the type of vegetation community present and the moisture content of that community.

Slopes receiving limited sunlight (easterly to southerly aspects) often result in moist environments and vegetation of lower combustion capability. Slopes receiving high quotas of sunlight and dry winds (westerly to northerly aspects) often result in drier environments and vegetation of high combustion capability.

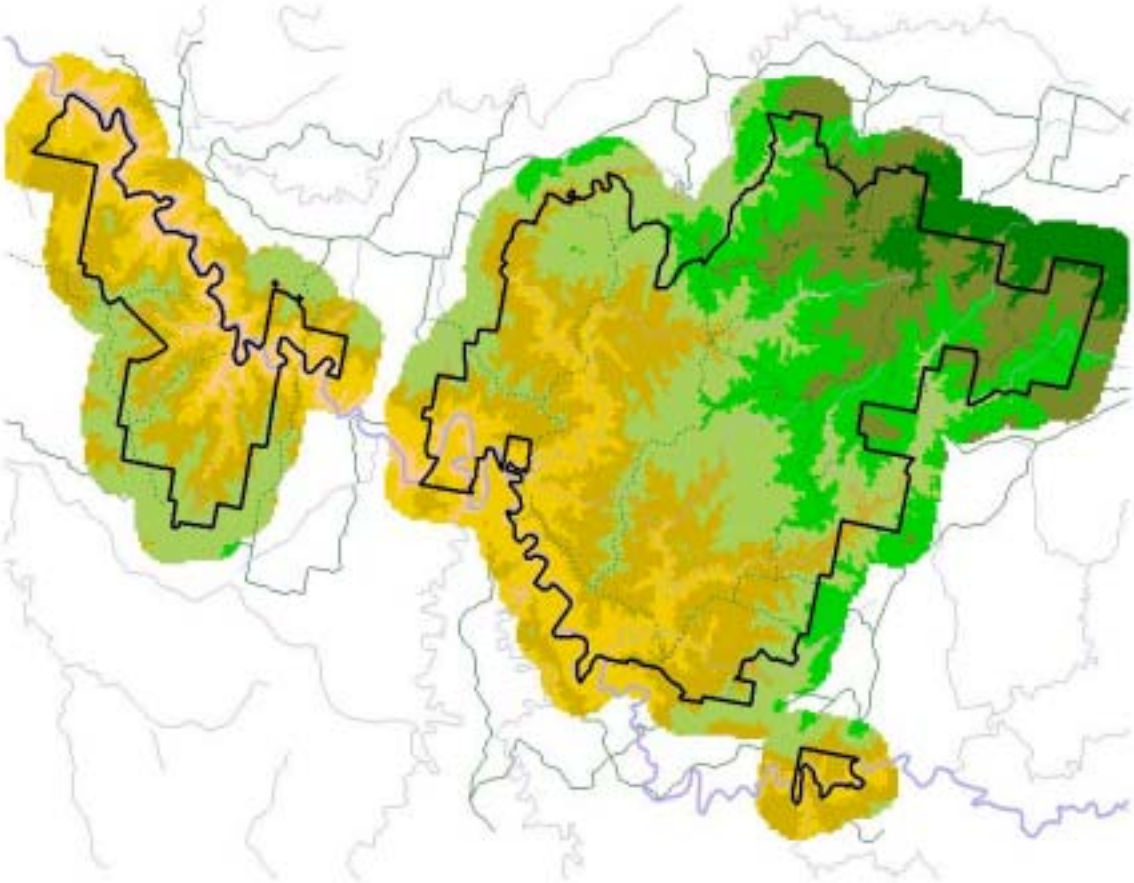
Aspect has been classified into 3 separate categories to aid in the prediction of potential fire behaviour within the Park. Table 10 defines the categories used for the modelling of potential fire behaviour.

Table 10
Aspect Categories

Aspect (degrees^{o})	Rating Used
0-170^{o}	Low
170-220^{o}	Moderate
220-360^{o}	High

The predominant ridge line direction in the park is roughly north east - south west, therefore the general aspects of deeply incised gullies within ARNP are south east or north west.

Map 5 - Elevation Analysis



N

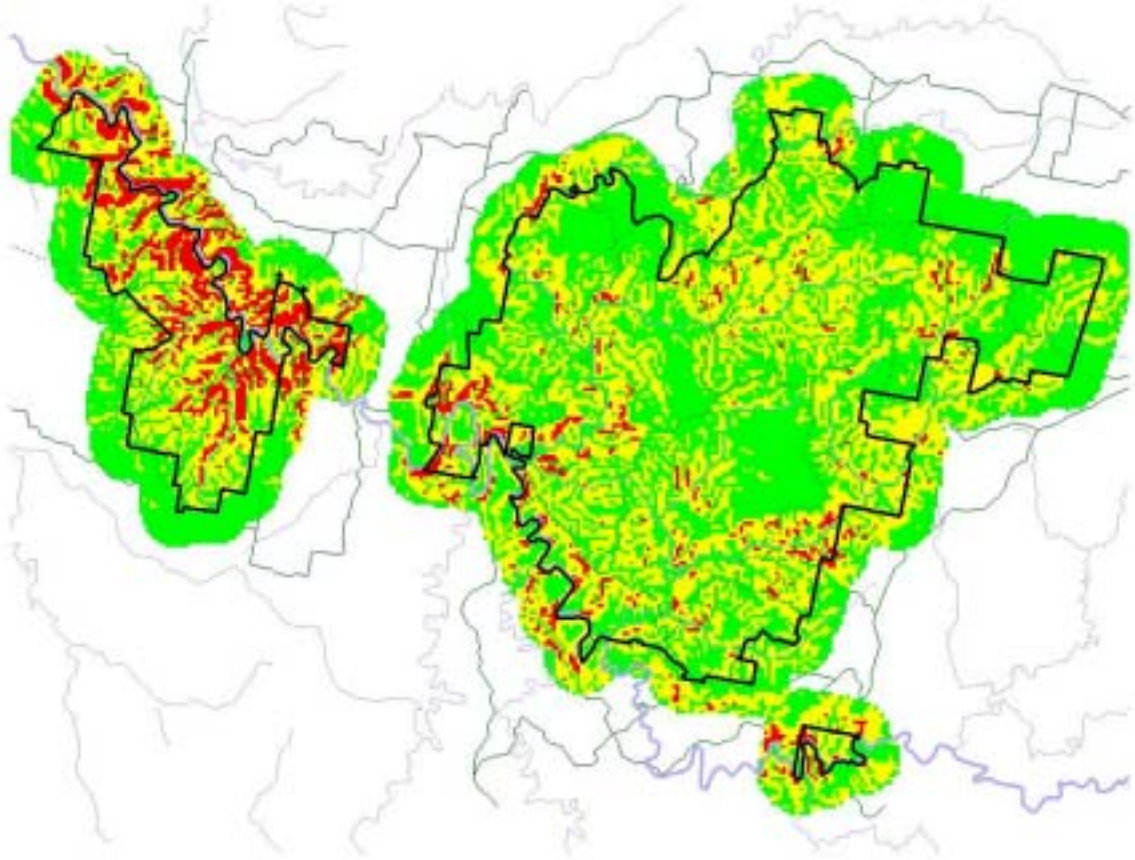
LEGEND

- 400 - 500 metres
- 501 - 600 metres
- 601 - 700 metres
- 701 - 800 metres
- 801 - 900 metres
- 901 - 1000 metres
- 1001 - 1100 metres
- 1101 - 1200 metres
- 1201 - 1300 metres
- Study Area
- Road
- River
- Fire Trail

0 2 4 6 8 10 Kilometres

Scale 1:185,000

Map 6 - Slope Categories



N

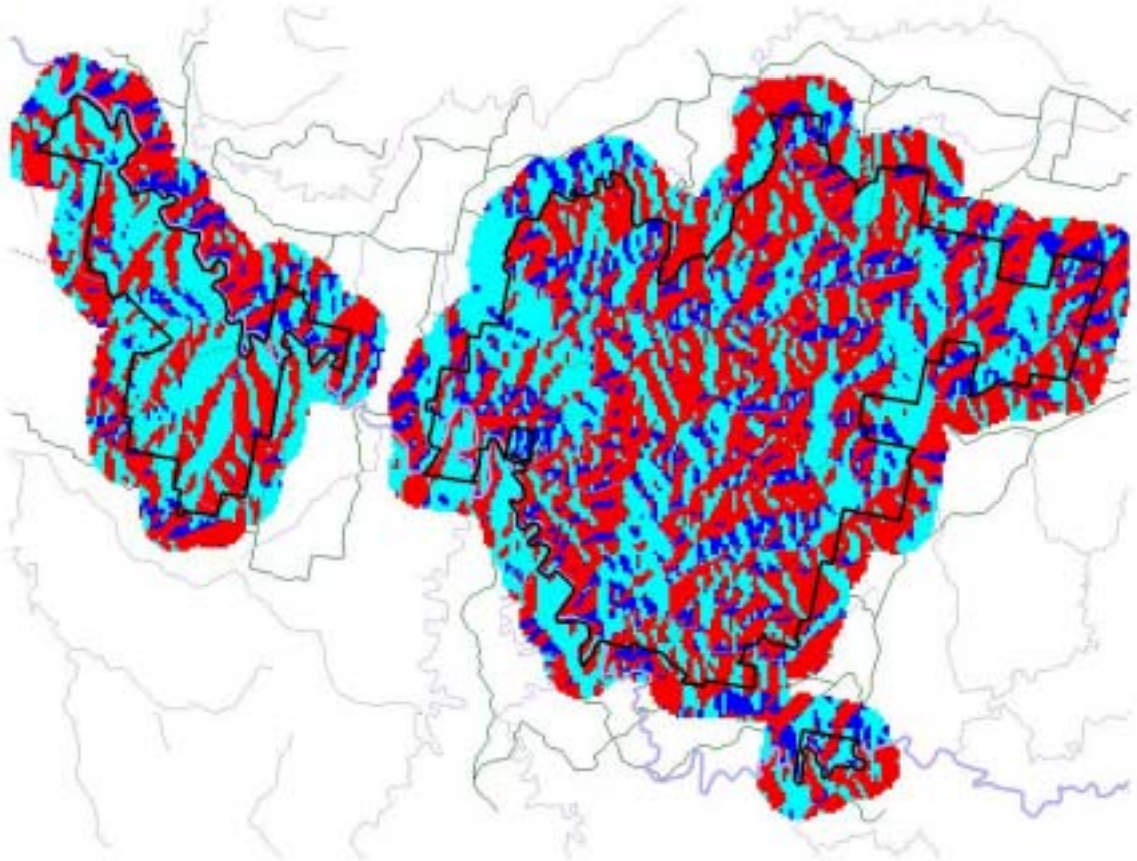
LEGEND

- 0 - 10 Degrees
- 10 - 20 Degrees
- > 20 Degrees
- Study Area
- Road
- River
- Fire Trail

0 2 4 6 8 10 Kilometres

Scale 1:185,000

Map 7 - Aspect Categories



N

LEGEND

- 360 - 170 Degrees
- 170 - 220 Degrees
- 220 - 360 Degrees
- Study Area
- Road
- River
- Fire Trail

0 2 4 6 8 10 Kilometres

Scale 1:185,000

3.3.4 Fuel

Fuel for wildfires can be characterised within four groupings. These are represented by the location of the fuels within the vegetation present. These are as follows:

- *Sub - Ground* - This fuel source refers to combustible materials found beneath the soil surface. Two common examples of this fuel type include tree roots and peat. Ground fires have the ability to burn for long periods of time and burn into areas that have escaped the initial path of the wildfire. These fires are troublesome to locate and extinguish and pose significant threats to fire re-ignition.
- *Ground* - This fuel source refers to combustible material found on the soil surface. This fuel source is commonly referred to as leaf litter. This layer is defined as a mixture of leaves and branches residual from the surrounding vegetation. This fuel source often determines the sustainability of a fire. Heat produced from the combustion of surface layer pre-heats aerial fuels and often determines how severe a wildfire can become.
- *Elevated* - This fuel source refers to the combustible material found in the shrub layer. This layer is often a mixture of live and dead vegetation, producing a volatile mix for a sustainable fire. Many volatile oils are present within this layer and become powerful fuel exponents in warm to hot fires. The successful burning of this layer results in the pre-heating of the vegetation canopy.
- *Canopy* - This fuel source refers to combustible material found within the canopy of the vegetation community. Canopy fuels are characterised by Eucalyptus leaves, a fuel source rich in volatile phenolic compounds. Successful pre-heating of fuel within the canopy layer from both the surface and aerial fuel layers, canopy ignition will result in the most devastating form of wildfire called a crown fire. Fires of this nature are largely responsible for loss of life and property, and are the principle mode for the creation of spot fires. Table 11 provides a description and characteristics of these fuel groups, whilst Table 12 lists the fuel categories used to calculate the bush fire behaviour potential for the Park. Map 8 illustrates these fuel group categories.

Fuel characteristics that create varying fire behaviour are dependent on;

- The *frequency* that the vegetation community provides ‘available fire fuel’
- The *structure* of the vegetation and the ability of ground level fuels to carry fire into higher vegetation levels e.g. from understorey into crown fire
- The *arrangement* of the fuel within the vegetation type, e.g. fine fuels that are elevated such as in heath contribute more to fire intensity than a similar quantity of leaf litter fuel
- The *amount* of fuel that accumulates after a long period without fire.

Fuel or combustible material is the most important factor influencing fire behaviour. The *total fuel* is the maximum quantity of fuel that is burnt under the most extreme conditions. It includes all combustible material, from decomposed organic material on the soil surface through to that proportion of the living forest canopy that burns in the most intense fire. When fuel and weather conditions are less than extreme only a portion of the total fuel is consumed. This is the *available fuel*. Because the available fuel depends on how the fuel is arranged, the distribution of moisture within

the fuel bed and the intensity of the fire created by the prevailing weather, it cannot be measured in advance of the fire. It has to be estimated from current and antecedent weather and presents a major problem in quantifying fuels for fire behaviour predictions (Tolhurst & Cheney, 1999).

The fuel group ratings listed in Table 12 are based on total fuel, the available fuel shall depend on the current weather conditions.

By applying the fuel group rating descriptions within Table 11, the fuel groups within the majority of the Park would be considered to be moderate to high. Table 12 lists the fuel categories used to calculate the bush fire behaviour potential for the Park.

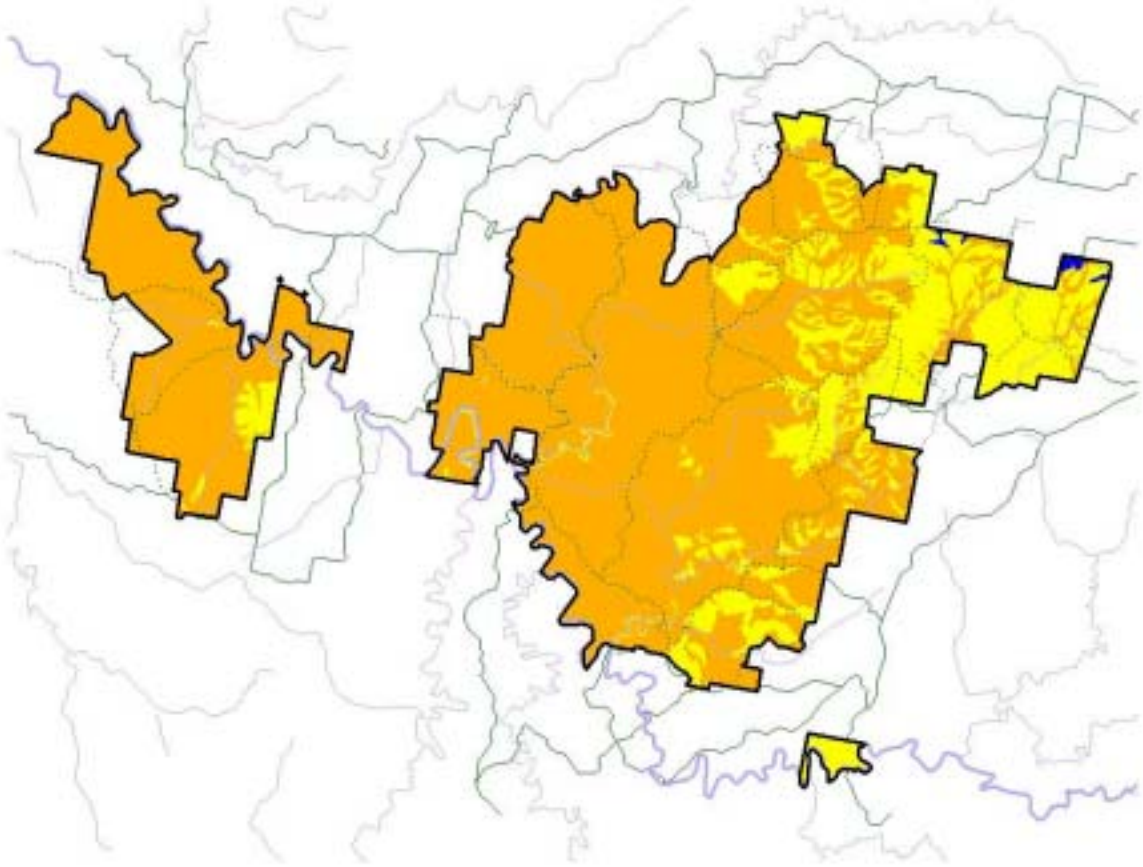
Table 11
Fuel Group Ratings

Fuel Group Rating	Description
High	Continuous fuels, higher quantity, available to burn during average seasons (higher fire intensity expected)
Medium	Less continuous fuels, low-medium fuel quantity, available to burn during average seasons but may be less often than high (medium or high fire intensity expected)
Low	Possibly discontinuous fuels, low-medium fuel quantity, moister fuels unlikely to contribute to high intensity fires in average season, fuel structure facilitates easier control, (fire intensities expected range from low-high and generally regarded as easier to control)
Negligible	Unlikely to burn or always burns within controllable limits

Table 12
Fuel Group Ratings for Vegetation Communities

Community	Fuel Categories
Riparian Acacia Shrub/Grass/Herb Forest (53)	Moderate
Tablelands Shrub/Grass Moist Forest (66)	Moderate
Northern Plateaux Moist Fern/Herb/Grass Forest (67)	Low
North East Tablelands Shrub/Herb/Grass Dry Forest (68)	Moderate
Eastern Tablelands Acacia/Herb/Grass Forest (89)	High
Northern Tablelands Acacia Herb/Grass Dry Forest (90)	High
Tableland Tussock Grass/Herb Forest (96)	Low
Tablelands Dry Shrub/Tussock Grass Forest (109)	Moderate
Eastern Tablelands Dry Shrub Forest (112)	High
North East Tablelands Dry Shrub/Grass Forest (113)	High
Tablelands Dry Shrub/Tussock Grass Forest (114)	High
Western Slopes Grass/Herb Dry Forest (121)	High
Northern Tablelands Shrub/Tussock Grass Forest (149)	Moderate
Northern Slopes Dry Grass Woodland (159)	High
Northern Slopes Dry Grass Woodland (160)	High
Northern Tablelands Grass Forest on Basalt (183)	Moderate

Map 8 - Fuel Categories



N

LEGEND

- Low Fuel Category
- Moderate Fuel Category
- High Fuel Category
- Park Boundary
- Road
- River
- Fire Trail

0 2 4 6 8 10 Kilometres

Scale 1:185,000

3.3.5 Analysis of Likely Fire Behaviour (with a view to potential risk to fire fighters & the effectiveness of refuge areas)

Bushfire behaviour potential is calculated by combining slope, aspect and fuel factors according to Table 13a. Abercrombie River National Park is centred on an area of deeply incised gully systems, in conjunction with prominent ridges and spur lines. The available fuels are considered to be moderate to high and the predominant winds during the fire danger season are from the west to northwest.

These characteristics create a likely fire behaviour consisting of medium to high intensity, high rate of spread that would typically progress in a northeast to southeast direction. These characteristics create a potential risk to fire fighters particularly on slope areas. Potential refuge areas include major watercourses and adjacent grazing land.

The proportion of each bushfire behaviour class is listed below in Table 13 and illustrated in Map 9.

Table 13
Bushfire Behaviour Potential Classes and Percentage Area

Bushfire Behaviour Potential	% of Park
High	69.91
Moderate	25.71
Low	4.37

Table 13a
Bushfire Behaviour Potential Class Determination

Slope	Aspect	Fuel	Bushfire Potential
0-10^{o}	0-170^{o}	Low	Low
10-20^{o}	0-170^{o}	Low	Moderate
20-90^{o}	0-170^{o}	Low	Moderate
0-10^{o}	170-220^{o}	Low	Moderate
0-10^{o}	220-360^{o}	Low	Moderate
0-10^{o}	0-170^{o}	Moderate	Low
0-10^{o}	0-170^{o}	High	Moderate
0-10^{o}	170-220^{o}	Moderate	Moderate
20-90^{o}	170-220^{o}	Moderate	High
10-20^{o}	0-170^{o}	Moderate	Moderate
10-20^{o}	220-360^{o}	Moderate	High
10-20^{o}	170-220^{o}	Low	Moderate
10-20^{o}	170-220^{o}	High	High
10-20^{o}	170-220^{o}	Moderate	Moderate
0-10^{o}	220-360^{o}	High	High
10-20^{o}	220-360^{o}	High	High
20-90^{o}	0-170^{o}	High	High
20-90^{o}	170-220^{o}	High	High
20-90^{o}	220-360^{o}	Low	High
20-90^{o}	220-360^{o}	Moderate	High
20-90^{o}	220-360^{o}	High	High

3.4 Damage Potential

Damage potential is a term used to describe the likelihood of a bushfire to cause damage to an asset. The greatest potential for a bushfire to cause damage occurs where areas of high fire behaviour potential and high ignition potential are closely

located to assets. The identification of such areas in close proximity to assets form the basis and priorities for the bushfire risk management activities identified in this strategy. NPWS will seek co-operation from adjoining landholders to manage areas of high fire behaviour potential on private property in a manner that complements the actions undertaken on the Park.

The damage potential from wildfires can be mapped by reviewing the bushfire behaviour potential (fuel, slope, aspect) and the likely locations of property and/or fire sensitive features that can be potentially affected. The mapping provides a useful comparison of areas, indicating sites of comparatively higher and lower damage potential. This information is essential in the development of strategies to manage life and property and other areas of biological significance.

The fire weather and fire history analysis indicates that potentially damaging fires are most likely to occur in spring. Fires that do occur in summer have a higher intensity and damage potential.

Significant assets within the Park and near the boundary of the Park have been identified on Map 10. Some of the highest damage potential will come from the following scenario. The main drainage lines of the Park (Silent Creek, Licking Hole Creek, Chain-o-ponds Creek and the Retreat River) flow from the north-east to the south-west. A wildfire either starting in the Park or entering the Park with a north, north-west or south-west wind will push the fire up the drainage lines and towards the north-east end of the Park. This will put pressure on the north-east section of the Park and the land beyond the boundary of the Park, which includes pine plantations of Forests NSW.

Three groups at risk from wildfire are considered in the study area, these are:

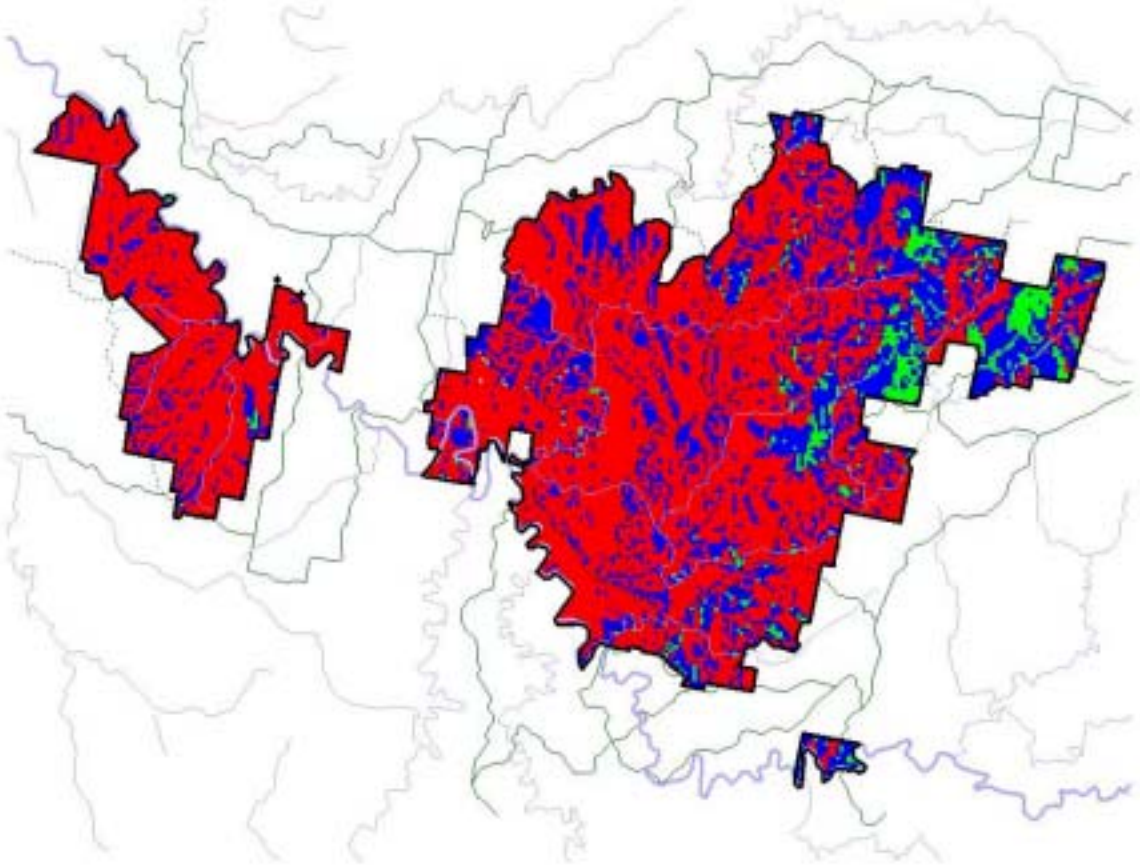
i) Human life; including residents, visitors and fire-fighters.
ii) Rural and residential property (including crops, feed, livestock, fences etc); Park infrastructure; cultural sites / relics; and pine plantations
iii) Flora and fauna species / communities that are sensitive to fire.

The threat to human life is the most important of these three groups. It has the highest priority for protection and is implicit within every strategy within this Strategy. The threat to the life of residents is considered in the assessment of the damage potential to their property or houses. Through association, if property is threatened, then human life is threatened (residents, visitors or fire-fighters).

The threat to visitors and fire-fighters is less easy to define as their use of the Park is not concentrated on a single location such as a residential property. The Strategy considers the threat to visitors and fire-fighters as higher in areas where visitor use and fire-fighter activity is higher and where these locations occur in areas of higher bushfire behaviour potential.

The second group of potentially threatened features are assets. The areas of greatest damage potential are located at the interface between bushland and dwellings. Where the number of dwellings or the number of people is higher the damage potential is higher, and where these sites occur in areas of higher bushfire behaviour potential the damage potential is highest.

Map 9 - Bushfire Behaviour Potential Classes



N

LEGEND

- Low Bushfire Behaviour Potential
- Moderate Bushfire Behaviour Potential
- High Bushfire Behaviour Potential
- Park Boundary
- Road
- River
- Fire Trails

0 2 4 6 8 10 Kilometres

Scale 1:185,000

Pine plantations are situated within 1km of the Park boundary (Map 10). These plantations are a large economic asset to the region, and have been considered in this strategy.

The greatest potential for bushfire to cause damage to life and property within Abercrombie River National Park is at the inholding situated on the Retreat River near 'The Sink' Camping Area. Assets within the park including toilets, picnic areas, huts, historic stock yards and fences, are also considered to be susceptible to fire damage.

The third group of features at risk are fauna and flora. Inappropriate fire regimes, including fire exclusion, fire frequency, time of year burnt and fire intensity, can have a negative impact on biodiversity within the Park. To reduce the risk on biodiversity an appropriate fire regime will be planned for.

3.4.1 Historical Damage

The Crookwell fire at the beginning of 1999 burnt significant areas of the park and caused significant damage to fencelines and grazing / pastoral lands. The use of hazard reduction burning and burning to promote fresh, green feed for livestock in the Park has occurred continuously since European occupation of the area. The impact of these fires is predominantly from the introduction of inappropriate fire regimes and the resultant negative effect on biodiversity.

3.4.2 Economic Damage

Wildfire within the Park has caused damage to assets including fences and structures. Fires leaving the Park have the potential to impact on agricultural assets including private and State pine forests and grazing land. Wildfires also have the potential to reduce the biodiversity, conservation and tourism values of ARNP.

3.4.3 Natural Heritage Damage

Due to the past land use of the Park (forestry and grazing), fire has been used frequently to enhance the growth of fodder for stock and to reduce the potential threat to nearby pine plantations.

A number of significant vegetation communities, as well as plant and animal species are known to occur in the Park. Guidelines for the protection of natural heritage within ARNP are contained in 4.6 Biodiversity Conservation.

3.4.4 Cultural Heritage Damage

The incidence of high intensity fires is an extremely destructive force on Aboriginal and European sites of historical importance. Aboriginal paintings and rock carvings can be damaged by smoke and exfoliating rock respectively (the cracking and weathering of rock surfaces from temperature extremes). European sites such as bridges, structures and farmland are equally subject to damage from high intensity fires.

The Park contains evidence of Aboriginal occupation and significant gold mining sites. Sites that are of Aboriginal origin, are at most risk during operational activities particularly during the use of heavy machinery during trail construction and fire fighting events. It is unlikely that low to medium intensity fires will impact upon all but the most exposed Aboriginal Sites.

4. FIRE MANAGEMENT

4.1 Bushfire Management Zones

Bush Fire Management Zones have been developed by the National Parks and Wildlife Service to facilitate broad and specific fire management objectives within its conservation reserves.

Fire managers allocate varying and quite often different management practices to parts of a Park. They do this to identify factors or characteristics of the land that may contain different values that require protection. Upon the identification of these factors, Bushfire Management Zones (BFMZ's) are determined.

Thirty (30) Bushfire Management Zones have been identified for Abercrombie River National Park (refer to Map 10). BFMZ's define operational activities to best mitigate against fire threat and to help assist in preventing species loss and damage to assets and property. Three categories of fire management zones (refer to Appendix 2) have been adopted for use within this strategy, these are:

- Asset Protection Zones
- Strategic Fire Advantage Zones
- Heritage Management Zones

Each zone has a fire management objective, strategy, action and performance criteria specific to the area within its boundary. For example, zones with fire sensitive communities such as littoral rainforest will have fire exclusion objectives and a zone on the fire prone side of the residential development will have objectives that specifically provide for protection of life and property e.g. Asset Protection Zones.

Fire management zones can also be designed to potentially 'contain' a fire e.g. Strategic Fire Advantage Zone. They may be based on vegetation types, or a physical feature that may assist containment of a fire.

Although each zone has management prescriptions reflecting its emphasis (Appendix 2), all zones will be treated on an individual basis depending on the characteristics of the zone and desired outcomes.

This management flexibility is essential for achieving conservation of biodiversity in situations such as the isolated occurrence of rare plant and animal species. The boundary of fire management zones are delineated by one or more of a combination of:

- Topography and/or geographic features
- Potential operational burn units
- Vegetation structure classes/communities
- Fire history
- Tracks/trails

There is a small section of crown land adjoining the Park to the north of Heritage Management Zones 3 and 5. NPWS will liase with the Department of Lands

regarding fire management over this portion of land. If this area becomes part of the Park, then its inclusion in the Fire Management Strategy will be revised.

4.2 Asset Protection Zones

Asset protection zones provide direct protection for assets including roads, residential, industrial and agricultural (including pine plantations) areas, camping and picnic areas and areas of special use such as schools and other community facilities. An Asset Protection Zone (APZ) is a buffer zone located between bushland and a dwelling (or some other defined value at risk). The APZ aims to reduce heat radiation and direct flame contact (two of the three causes of bush fire damage).

Three (3) Asset Protection Zones have been identified for Abercrombie River National Park. Details on this zone are summarised in Section 4.5 and detailed in Appendix 2 and Map 10.

Management of Asset Protection Zones located on private land, will be the responsibility of the individual land owner.

Neighbours and Stakeholders should be introduced to the Community Fireguard Program or to Community Fire Units, an awareness program empowering the land manager of techniques to minimise fire risk to their properties.

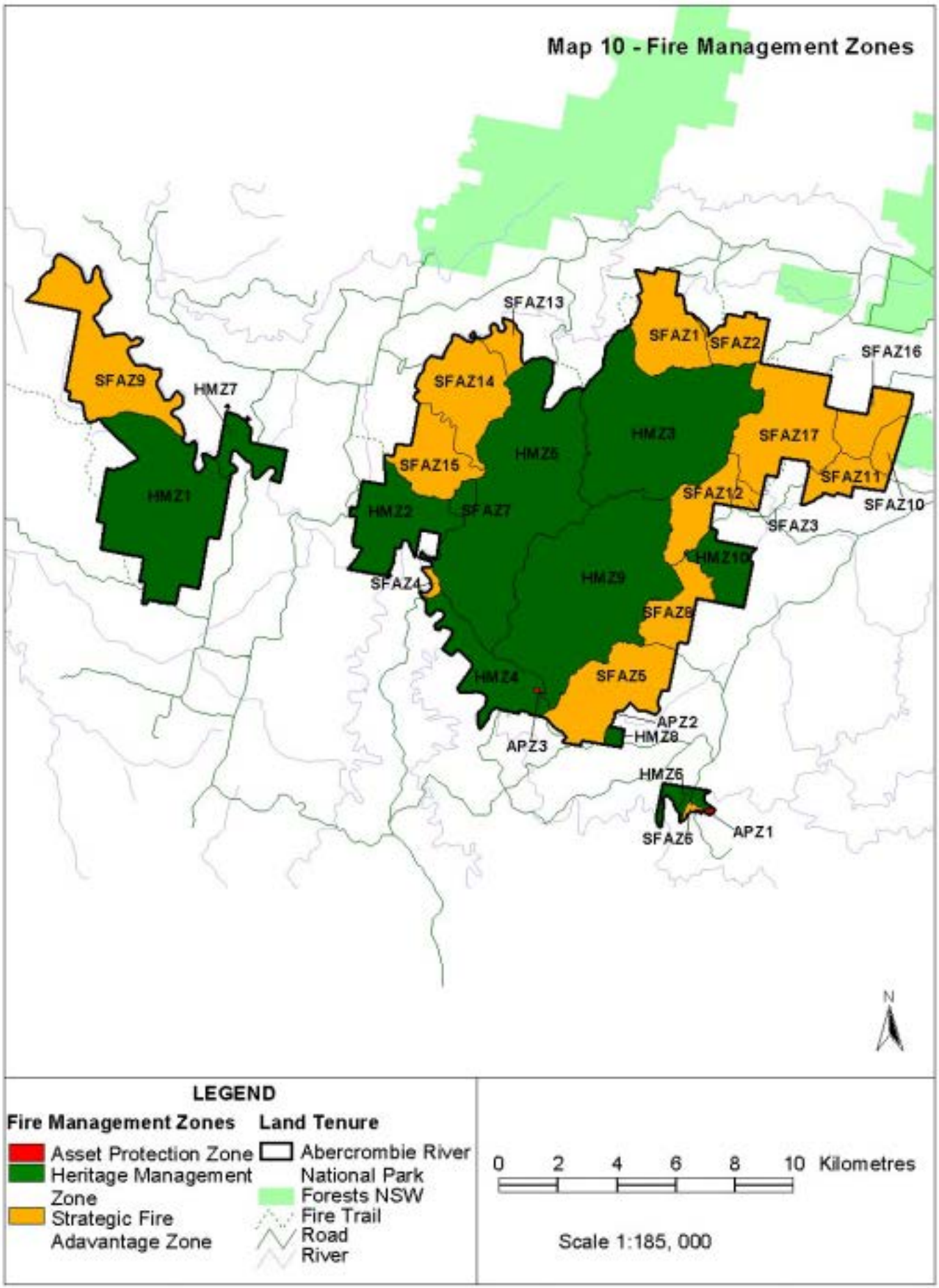
Only the proximity of adjacent vegetation can be addressed directly by this strategy. Other factors including the preparedness of private property owners and the ongoing management of fuels on private property are outside the direct scope of the Strategy but can be influenced by the NPWS in the Community Fireguard programs of the Rural Fire Service and the NSW Fire Brigade, in association with the Chifley Zone and Southern Tablelands Zone Bush Fire Management Committees.

4.3 Strategic Fire Advantage Zones

Strategic Fire Advantage Zones (SFAZ) assist in the containment of wildfire to provide safe access and egress to bushfire fighters and to assist with preventing wildfire leaving or entering the Park estate. These zones are typically located in an area which is effective in creating buffers in higher fuel areas to reduce the spread of fire into and from the Park and across whole landscapes.

Strategic Fire Advantage Zones provide protection for a wide range of assets including roads, residential and industrial areas, camping and picnic areas and areas of special use such as schools and other community facilities.

Generally strategic fire management will be based on improving and/or maintaining the capability of control lines within and bordering the Park. Seventeen (17) Strategic Fire Advantage Zones have been recognised within Abercrombie River National Park, which are detailed in Appendix 2 and Map 10.


Map 10 - Fire Management Zones
SFAZ13
SFAZ1
SFAZ2
SFAZ16
SFAZ9
HMZ7
SFAZ14
HMZ3
SFAZ17
HMZ5
SFAZ15
SFAZ11
HMZ1
SFAZ12
SFAZ10
HMZ2
SFAZ7
SFAZ3
HMZ10
HMZ9
SFAZ4
SFAZ8
HMZ4
SFAZ5
APZ2
HMZ8
APZ3
HMZ6
SFAZ6
APZ1
N
LEGEND
Fire Management Zones
Asset Protection Zone
Heritage Management Zone
Strategic Fire Adavantage Zone
Land Tenure
Abercrombie River National Park
Forests NSW
Fire Trail
Road
River
0 2 4 6 8 10 Kilometres
Scale 1:185, 000

4.4 Heritage Management Zones

Heritage Management Zones are those areas where assets are not at threat by wildfire and therefore management can concentrate on the ecological values of the zone. The purpose of Heritage Management Zones (HMZ) is to prevent / limit the damage of wildfire events on sensitive areas within and adjacent to the Park.

For the purposes of this Strategy, HMZ's have been designed to protect the natural and cultural heritage items within the Park. Definitions for the two types of heritage items identified within the Park are provided below.

Natural Heritage is defined as the biodiversity of the Park. Natural Heritage can be defined at specific levels, often focusing on the conservation of individual species, populations and communities. HMZ's provide for the focus of fire management on specific ecological goals of individual species, populations and communities.

Cultural Heritage is defined as the anthropogenic characteristics of the Park. The sources contributing to Cultural Heritage are of Aboriginal and European (Historical) origin.

Heritage items are often irreversibly damaged or lost to inappropriate fire events. The management of HMZ's are often undertaken in accordance with other previously determined conditions for the conservation of heritage items, including NPWS Recovery Plans, NPWS / Council Plans of Management, Conservation Plans etc.

Ten (10) Heritage Management Zones have been identified within the Park. Details on these zones are detailed in Appendix 2 and Map 10.

4.5 Summary of Bushfire Management Zones

The general objectives and strategies for Asset Protection Zones are;

Objectives
- To protect properties and residents from fire.
- Reduce the potential for unplanned fires to spread into and from the Park.
- To assist in the reduction of wildfire intensity and spotting intensity within the zone.
- To provide safe and rapid firefighting access into the zone.

Strategies
- Implement a fuel free slash zone that reduces fire intensity, reduces fire spread and provides safe access and egress.
- Maintain roads and trails.
- Educate land owners in fuel management techniques for private properties.
- Undertake pre activity check to ascertain habitat zone for threatened species.

The general objectives and strategies for Strategic Fire Advantage Zones are;

Objectives
- To protect properties and residents from fire.
- To assist in the strategic control and containment of wildfires.

- Reduce the potential for unplanned fires to spread into and from the Park.
- To assist in the reduction of wildfire intensity and spotting intensity within the zone.
- To provide safe and rapid firefighting access into the zone.
- To protect threatened species.

Strategies

- Implement burn program that reduces fire intensity, reduces fire spread and provides safe access and egress.
- Avoid activities within riparian area of Felled Timber Creek.
- Avoid burning the entire zone in one activity, creating a mosaic of age classes within zone.
- Prescribed burning frequency and location will be determined by annually reviewing fuel loads, fire history and desirable ecological fire regimes for different vegetation communities within zone.
- Maintain roads and trails.
- Educate land owners in fuel management techniques for private properties.
- Undertake pre burn-area check to ascertain habitat zone for threatened species.

The general objectives and strategies for Heritage Management Zones are;

Objectives

- Fire regimes of 10 to 20 years are to be maintained within the A category communities.
- Fire regimes of 10 to 30 years are to be maintained within the B category communities.
- Fire regimes of at least 20 years are to be maintained within the C category communities.
- To protect threatened species as per NPWS Operational Guidelines for Abercrombie River National Park (Table 21).
- To avoid a decline in biodiversity by excluding fire from the zone for sufficient periods to allow for recovery from past fire regimes.

Strategies

- Suppress fire within zone if acceptable ecological regime has not been reached.
- Fire should not exceed more than 20-25% of the zone at any one time where practicable.
- Maintain roads and trails.

4.6 Biodiversity Conservation

In practical terms conservation is about the prevention of the extinction of species, especially extinctions brought about by the actions of humans. One of the main aims of fire management within the Park is to maintain species and community diversity.

This is supported by the objective of keeping the fire regimes of each plant community within the appropriate thresholds for ongoing maintenance of biodiversity. Basically these require the management of fire to retain (avoid extinction of) all native species known to occur within the Park.

4.6.1 Principles and Thresholds

Contemporary ecological research in fire-prone ecosystems of the kind represented in the Park has established some general principles in relation to the fire regimes required to conserve biodiversity. Management of fire for conservation in the Park will be guided by the following general principles (NPWS).

1. Groups of flora and fauna species respond similarly to fire according to characteristics of their life history. Therefore it is not necessary to individually specify fire regimes for the conservation of every species. Rather an overview is needed of the requirements for broad groups of species. Requirements for most plant species can be summarised on the basis of a small number of groups. The knowledge of requirements for groups of animals is less advanced.
2. Flora and fauna are interrelated. Flora forms an important component of habitat for fauna. Fire management must consider this important interaction.
3. A diversity of fire regimes may be required in order to maintain native biodiversity. This means that over time there may be a need to implement fires of high, moderate and low intensity, frequency and size throughout the Park. Extinctions may be likely when fire regimes of relatively fixed intensity, frequency and extent prevail without interruption.
4. Bradstock et al, 1998 contend that there is a threshold in fire regime variability that marks a critical change from high species diversity to low species diversity. For some groups of biota these thresholds separating desirable and undesirable fire regimes can be defined. Management should therefore be targeted toward desirable fire regimes using these thresholds as a guide. The advantage of using thresholds to determine fire regimes is that it is not directing an ecosystem to a single state but maintaining it in a range of states within the threshold (Walker, 1989).
5. Management strategies involve the manipulation of fire regimes. While information may be lacking about important elements in this strategy, fire management using this framework can progress while further knowledge is accumulated. Assessment of fire regimes through mapping of the locality and characteristics of all fires will be ongoing so that strategies (manipulation of fire regimes) can be regularly reviewed, refined and adjusted. Depending on the circumstances (a function of community type and prevailing fire regimes) there may be a role for both prescribed fire and/or fire-exclusion in parts of a given Reserve in the future.

Knowledge of the fire-ecology on resident animal species is currently insufficient to formulate comprehensive fire-regime-thresholds for the management of fauna species as outlined for plant communities.

Maintenance of vegetative cover and structure within flora communities in the Park is essential for conserving viable fauna populations. The information in Table 14 is not only a guide to conserving flora species in their own right, but is also a guide to maintaining fauna habitat. Thus the table serves as a guide to conserving flora and fauna species resident in various flora communities.

Table 14 lists the biodiversity thresholds and desirable ecological fire frequency, whilst Table 16 indicates the thresholds to be used for each vegetation community within the Park. Map 11 shows the location of each of the thresholds within the Park.

Table 14
Desirable Fire Frequency for Varying Vegetation Communities

Vegetation Community	Desirable Ecological Fire Frequency	Regime Type
Riparian (Acacia) Forest	Decline expected if more than two fires occur within a 10 year interval. Decline expected if more than two fires occur at intervals of more than 20 years apart. Fires should be Moderate to High intensity to regenerate Acacia spp. (Variable fire regime between 10 and 20)	A
Dry Open Forests and Woodland	Decline predicted if more than two successive fires occur at less than a 10 years interval. Decline predicted if greater than 30 year interval between consecutive fires. Decline predicted if successive fires occur which totally scorch or consume the tree canopy. (Variable fire regime between 10 and 30)	B
Moist / Sheltered / High Altitude Forest	Variable fire frequency, no more than two fires within a 20 year period. Decline expected if more than two fires occur at intervals of more than 40 years apart. (Variable fire regime between 20 and 40)	C
Rainforest	No fire acceptable	D

(Adapted from Abercrombie River National Park, Plan Of Management, NPWS 1999 and NPA, 1985)

It is desirable that any individual fire (or set of fires at about the same time - e.g. within a year) should not completely burn the whole of a particular community type or at the most, the whole Park. Unburnt areas act as a refuge for fauna species that suffer habitat loss during and soon after fire.

These areas then become extremely important for the recolonisation and protection of species. However, it is not possible at present to define and quantify guidelines concerning the size of unburnt areas required for critical fauna habitat. It is possible to provide guiding influences by the appropriate creation of Heritage Zones and management guidelines.

The guidelines provided for the management of animal species within this strategy will be subject to the *Threatened Species Conservation Act, 1995* (TSC Act). This Act provides the framework to protect and encourage the recovery of threatened species, populations and ecological communities.

High frequency fire and inappropriate fire regimes have been recognised within the TSC Act, 1995 as a Key Threatening Process. The Act recognises that the development of threat abatement plans in NSW for the threat of high fire frequency is both desirable and achievable.

The development of ‘Recovery Plans’ is a requirement under the Act to ensure the appropriate management and planning for the conservation of threatened species. As these Recovery Plans are developed there may be a need to adjust the fire management guidelines provided in this strategy.

4.6.2 Distribution of Biodiversity in Bushfire Management Zones

The vegetation classification system used for the preparation of the Park was derived from CRA (Comprehensive Regional Assessment, 1999) data. The composite vegetation map has been used as the foundation for the preparation of the biodiversity conservation strategies for the Park.

The composite map identified 16 vegetation communities / formations within the Park as shown in Map 2. The percentage area covered by each community for the Park is shown in Table 1. The percentage of each vegetation community within fire management zones is shown in Table 15.

Table 15
Distribution of Vegetation Types in Bushfire Management Zones Within Abercrombie River National Park

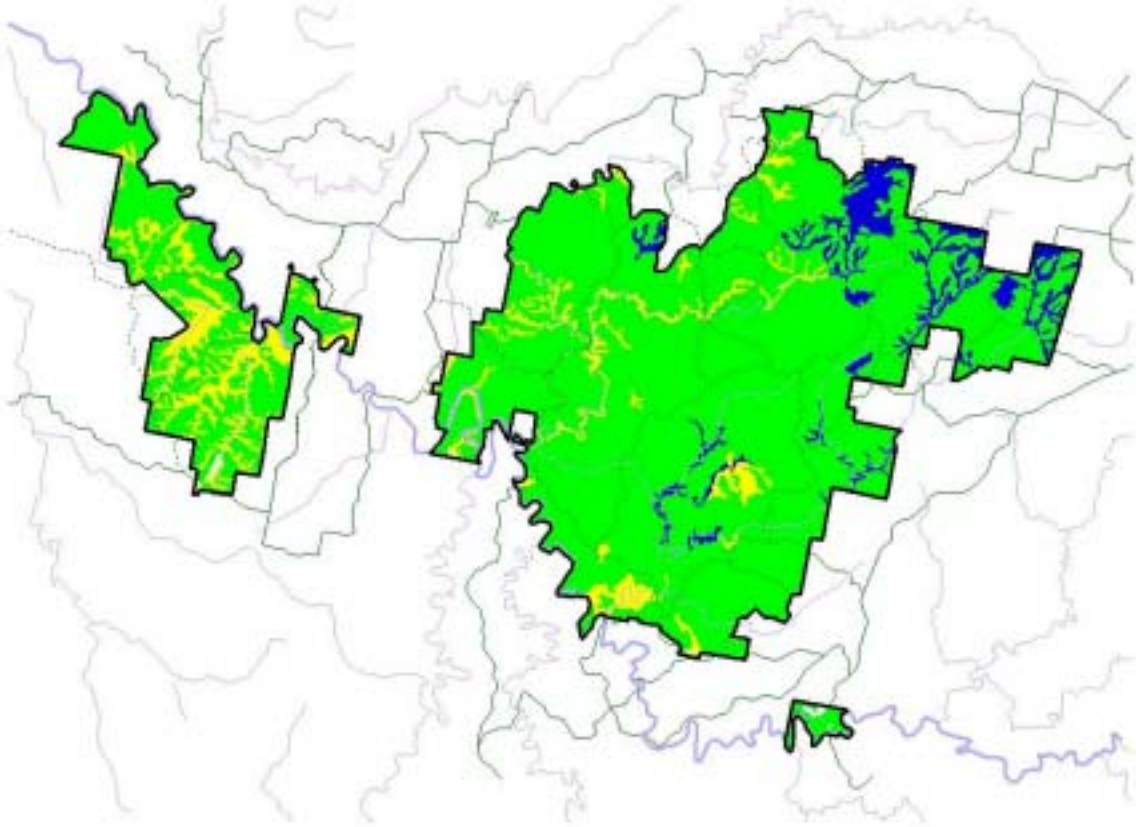
Vegetation Community	Percentage of Vegetation Type in Each Zone		
	Heritage Management	Strategic Fire Management	Asset Protection
Riparian Acacia Shrub/Grass/Herb Forest (53)	91.41	8.76	0.02
Tablelands Shrub/Grass Moist Forest (66)	0.00	98.12	3.67
Northern Plateaux Moist Fern/Herb/Grass Forest (67)	48.93	50.73	0.77
North East Tablelands Shrub/Herb/Grass Dry Forest (68)	100.00	0.00	0.00
Eastern Tablelands Acacia/Herb/Grass Forest (89)	57.36	42.76	0.29
Northern Tablelands Acacia Herb/Grass Dry Forest (90)	91.41	8.76	0.02
Tableland Tussock Grass/Herb Forest (96)	100.00	0.00	0.00
Tablelands Dry Shrub/Tussock Grass Forest (109)	66.73	33.37	0.07
Eastern Tablelands Dry Shrub Forest (112)	91.58	8.43	0.00
North East Tablelands Dry Shrub/Grass Forest (113)	100.00	0.00	0.00
Tablelands Dry Shrub/Tussock Grass Forest (114)	91.67	8.39	0.03
Western Slopes Grass/Herb Dry Forest (121)	89.58	10.49	0.06
Northern Tablelands Shrub/Tussock Grass Forest (149)	100.00	0.00	0.00
Northern Slopes Dry Grass Woodland (159)	89.34	10.54	0.00
Northern Slopes Dry Grass Woodland (160)	100.00	0.00	0.00
Northern Tablelands Grass Forest on Basalt (183)	100.00	0.00	0.00

Table 16 provides the broad prescription for fire regimes (thresholds) within the Park. The thresholds are not regarded as absolutes rather they indicate a requirement for managers to carefully review the fire management requirements of a site where fire regimes exceed the thresholds.

Table 16
Fire Thresholds for Vegetation Communities within Abercrombie River National Park

Vegetation Community	Area (ha)	Percentage of Total Area	Threshold
Riparian Acacia Shrub/Grass/Herb Forest (53)	226.91	1.20	A
Tablelands Shrub/Grass Moist Forest (66)	46.03	0.24	C
Northern Plateaux Moist Fern/Herb/Grass Forest (67)	25.87	0.14	C
North East Tablelands Shrub/Herb/Grass Dry Forest (68)	33.89	0.18	C
Eastern Tablelands Acacia/Herb/Grass Forest (89)	848.98	4.49	C
Northern Tablelands Acacia Herb/Grass Dry Forest (90)	1732.49	9.16	A
Tableland Tussock Grass/Herb Forest (96)	20.36	0.11	C
Tablelands Dry Shrub/Tussock Grass Forest (109)	3633.11	19.21	B
Eastern Tablelands Dry Shrub Forest (112)	804.86	4.26	B
North East Tablelands Dry Shrub/Grass Forest (113)	6.13	0.03	B
Tablelands Dry Shrub/Tussock Grass Forest (114)	6755.21	35.71	B
Western Slopes Grass/Herb Dry Forest (121)	4017.73	21.24	B
Northern Tablelands Shrub/Tussock Grass Forest (149)	47.95	0.25	C
Northern Slopes Dry Grass Woodland (159)	436.8	2.31	B
Northern Slopes Dry Grass Woodland (160)	46.08	0.24	B
Northern Tablelands Grass Forest on Basalt (183)	152.53	0.81	B

Map 11 - Fire Regimes for Vegetation Communities within the Park



N

LEGEND

Park Boundary
Road
River
Fire Trail

A Threshold
B Threshold
C Threshold

0 2 4 6 8 10 Kilometres

Scale 1:185,000

The use of thresholds is particularly useful in providing fire management guidelines for managers of the Park. They allow conservation of floristic diversity while also providing some management flexibility for annual fire management programs. In fact, this management flexibility is essential to accommodate the complex and dynamic decision making processes associated with prescription burning and wildfire suppression.

For example, the prescription burning process includes preliminary planning, budgeting and approval processes, environmental impact appraisal, fire history review, evaluation of biodiversity issues, weather prediction, fire behaviour prediction, lighting patterns, resource availability, neighbour notification, fire reporting, etc.

The processes also mean that a single fire management prescription for conservation of biodiversity (rather than thresholds) is often impossible to implement. During fire suppression such strict prescriptions are very difficult to accommodate.

On the other hand the use of biodiversity thresholds provides sound management of fire ecology and a pragmatic method of including biodiversity conservation into fire management decision making. The fire regimes listed in Table 14 have been further refined for its application within the study area.

This involved the following process;

- Study of the attributes of each of the 16 vegetation communities / formations and the effects of local site conditions on the fire tolerance of each community
- Partial review of land outside the Park in the Study Area
- Review of the fire history and likely future fire management within the Park so as to understand the impact of fire regimes over a relatively wide area
- The selection of appropriate fire regimes for the Park and their regional setting.

4.6.3 Evaluation of Current Fire Regimes

The lack of accurate long-term fire history for Abercrombie River National Park makes it impossible for an accurate scientific analysis of past fire regimes.

The majority of burning within the Park has been conducted by local residents, for both hazard reduction and stock fodder promotion. In general these hazard reduction burns have been conducted in autumn along boundaries and from creeks to ridgelines with a regime of around 4 to 5 years. The past frequency of these fuel management burns has resulted in the modification of biota to that which is observed today.

4.6.4 Effects of Management for Human Protection and Strategic Wildfire Control on Biodiversity

Areas affected by management within Strategic Fire Advantage Zones represent 39% of the Park. Prescribed burning in these areas will be strategically staged to provide sufficient time between fire events to prevent species decline. This may not be achievable if fuel loads become high, thus making it difficult to achieve the aims of life and property protection.

Most vegetation communities are represented in Heritage Management Zones that will be managed to conserve biodiversity, following the guidelines within Table 14, Desirable Fire Frequency for Varying Vegetation Communities.

The total 46 hectares of vegetation community No. #66 - Tablelands Shrub/Grass Moist Forest within the Park is located on the northern boundary of Tea Tree Strategic Fire Advantage Zone 2. Strategic Fire Advantage Zones will be prescription burnt based on the accumulation of fuel, potentially impacting this community with an inappropriate fire regime. Hazard reduction burns conducted within SFAZ 2 will be encouraged to avoid vegetation community No. #66 - Tablelands Shrub/Grass Moist Forest.

4.6.5 Fire Regime Strategies for Biodiversity Conservation

Having regard to the strategies required to conserve the threatened flora and fauna species, the overall fire management strategies for Abercrombie River National Park should be to:

- Limit the extent of all wildfires by responding quickly to all fire events with sufficient suppression resources
- Where possible initiate burning regimes that allow fire thresholds to be maintained for each vegetation community and/or species
- Encourage and assist where possible fuel reduction in appropriate Off-Park areas to allow effective property protection
- Consider mitigation works that do not involve burning
- Monitor weed occurrence.

Where possible, the above mentioned guidelines should be implemented in combination with species specific guidelines (outlined below) designed for the management of threatened flora and fauna species in a landscape influenced by fire. The implementation of integrated guidelines is encouraged whenever the occurrence of a threatened species, population or community is concurrent with a planned fire related activity.

4.6.5.1 Flora

The information provided in Table 16 is not only a guide to the conservation of flora communities in their own right, it also serves as a guide to the maintenance of fauna habitat. Table 17 outlines the fire management regimes for particular significant flora species.

Table 17
Fire Regimes / Strategies for Conservation of Flora Species

Status	Species	Community	Management Guide
Rare	*Leptospermum blakelyi*	Rocky Escarpments In Heath	Interval of 10 to 15 years should allow adequate seed storage on plant and adequate rootstock resistance. Should also allow adequate fuel levels to initiate seeding.
Rare	Box-leaved Wattle *Acacia furfuraceae*	Rocky outcrops in Woodland	Interval of at least 10 years should allow adequate seed storage in soil also adequate fuel levels to produce mod to high fire intensity needed to break seed dormancy.

Rare	*Pomaderris prunifolia*	Rocky slopes to Riparian	Interval of at least 8 years should allow adequate seed storage in soil
Regionally Significant	Argyle Apple *Eucalyptus cinerea*	Infertile soils within Grassy woodland	Interval of 15 to 30 years should allow adequate seed storage and bud resistance.
Regionally Significant	*Hydrocotyle callicarpa*	Riparian to wet closed forest	Not Known. Species probably killed by fire.
Regionally Significant	*Anogramma leptophylla*	Rocky areas in wet sclerophyll to closed forest	Not Known. Species probably tolerant of fires 8 - 12 years apart.
Regionally Significant	Greenhood Orchid *Pterostylis hamata*	Rocky areas in grassy open woodland.	Not Known. Species probably tolerant of fires 8 - 12 years apart.
Regionally Significant	*Enthosthodon subnudus var. gracilis*	Rocks in riparian areas	Not Known. Species probably killed by fire.
Regionally Significant	*Isolepis gaudichaudiana*	Grows in moist, open habitats.	Not Known. Annual plant. Reliant on seed bank and Susceptible to fire before seeding .
Regionally Significant	*Oreomyrrhis erioipoda*	Occurs in open forest on better soils above 1100 metres in the Park	Not known. Adults likely to resprout therefore fires should be at least 5 - 8 years apart.

4.6.5.2 Fauna

The major long-term impact that fire has on fauna is the reduction of population size through changes in vegetation structure and floristics (habitat). Fire diminishes shelter / breeding sites and reduces or eliminates natural foraging resources for some fauna species.

Of additional importance is the post-fire period. This is when most individual animals are under greatest threat for survival, as many animals and invertebrates have developed avoidance behaviour to survive the most intense of wildfires (Whelan, 1994).

The key characteristics of a fire regime which impacts upon animals includes frequency, season and extent / patchiness. Table 18 outlines the key characteristics of fire regime that may impact upon fauna within the Park.

Table 18
Key Characteristics of Fire Regime which Impact on Fauna

Frequency	The frequency of fires will determine the complexity and therefore the habitat value of the understorey, with frequent fires increasing exposure to predation and climatic influences, and promoting the potential loss of food and shelter resources.
Season	Fires occurring during the breeding season could adversely affect some species by killing offspring or preventing breeding. Reduction of vegetation density may increase the exposure of the young of some species to predation.
Extent and Patchiness	Burns which are limited or patchy will provide a range of ages of vegetation which will provide a greater variety of food and shelter sources, enabling utilisation of an area by a greater number of animal species. Areas not burnt also act as important refuges for wildlife to congregate in, providing shelter and food sources for survivors, from which recolonisation of the burnt areas can occur.

The basic management regime for all animals is to ensure that the maintenance of vegetative cover and structure (habitat) within plant communities in the Park is essential for conserving viable fauna populations.

Of particular concern is the protection of habitat for rare and threatened fauna. Threatened species are of major concern as their vulnerability to extinction and the need to ensure their chances of long-term survival are maximised.

Table 19 is a list of fire management guidelines for threatened fauna species that are known or expected to occur within the Park. These guidelines are intended to augment the management of fire regimes for flora communities in those restricted localities where these species are known to occur.

As sightings of additional rare and threatened species are recorded, there may be a need to modify these fire management guidelines accordingly. Before undertaking any activities outlined in the Works Plan it will be necessary to refer to this table when completing the Fire Management Works and Environmental Planning Proposal Form. The guidelines will also be of benefit to other native species.

Table 19
Fire Management Guidelines for the Conservation of Threatened Fauna Species

Status	Species	Community	Management
Vulnerable	Koala *Phascolarctos cinereus*	All forests with suitable feed trees	Pre-burn inspection for Koalas. Protect Koala locations from fire. Keep fire out of canopy.
Vulnerable	Spotted-tail Quoll *Dasyurus maculatus*	Woodlands to closed forests	Prescribed burns in core habitat (closed forest and tall open forests) restricted to threshold levels.
Vulnerable	Eastern False Pipestrelle bat *Falsistrellus tasmaniensis*	Potential all habitats	Protect trees with hollows or caves and structure, Mosaic burn. Maintain vegetation community burn thresholds.
Vulnerable	Common Bent-Wing Bat *Miniopterus schreibersii*	Potential all habitats	Protect trees with hollows or caves and structure, Mosaic burn. Maintain vegetation community burn thresholds.
Vulnerable	Rosenberg's Goanna *Varanus rosenbergi*	Open woodland to heath	Maintain vegetation community burn thresholds. Maintain mosaic burn pattern. Avoid burning termite mounds in habitat areas.
Endangered	Booroolong Frog *Litoria booroolongensis*	Riparian Community around Macks Flat	Avoid burning riparian areas. Maintain mosaic burn pattern.
Vulnerable	Masked Owl *Tyto novaehollandiae*	Open Forests and woodlands	Protect potential nest sites (old hollow bearing trees). Mosaic Burn. Avoid burning near active nest sites. Keep fire intensity low and out of the canopy.
Vulnerable	Powerful Owl *Ninox strenua*	Tall Forests	Protect potential nest sites (old hollow bearing trees). Mosaic Burn. Avoid burning near active nest sites. Keep fire intensity low and out of the canopy.
Vulnerable	Glossy Black Cockatoo *Calyptorhynchus lathami*	Woodlands and forests	Protect potential nest sites (old hollow bearing trees). Protect significant stands of She-oaks from all burning in one fire event. Keep fire intensity low and out of the canopy.
Vulnerable	Square-tailed Kite *Lophoictinia isura*	Riparian	Maintain vegetation community burn thresholds. Avoid burning within riparian areas. Mosaic burn. Keep fire intensity low and out of the canopy.
Vulnerable	Australasian Bittern *Botaurus poiciloptilus*	Riparian	Maintain vegetation community burn thresholds. Avoid burning within riparian areas. Mosaic burn. Keep fire intensity low and out of the canopy.
Vulnerable	Black Bittern *Ixobrychus flavicollis*	Riparian	Maintain vegetation community burn thresholds. Avoid burning within riparian

			areas. Mosaic burn. Keep fire intensity low and out of the canopy.
Vulnerable	Pink Robin *Petroica rodinogaster*	Open Woodlands / forests	Winter visitor. Maintain vegetation community burn thresholds. Mosaic burn. Keep fire intensity low and out of the canopy.
Vulnerable	Swift Parrot *Lathamus discolor*	Open Forests/ Woodlands	Winter visitor. Maintain vegetation community burn thresholds. Mosaic burn. Keep fire intensity low and out of the canopy.
Vulnerable	Turquoise Parrot *Neophema pulchella*	Riparian to grassy open woodland	Maintain vegetation community burn thresholds. Avoid burning within riparian areas. Mosaic burn. Keep fire intensity low and out of the canopy

4.7 Aboriginal Heritage

Aboriginal heritage has not been comprehensively mapped for ARNP. Aboriginal evidence has been found around the Macks Flat area and within riparian areas of permanent water (Retreat and Abercrombie Rivers).

- Aboriginal sites within the Park do not require fire regimes to maintain their status. Damage to significant sites will occur through the use of heavy machinery, fire fighting efforts and inappropriate fire. Damage to sites can be avoided by adhering to procedures outlined in the *Fire Management Manual* and within operational guidelines.

4.8 Historic Heritage

Historic heritage values have not been comprehensively mapped for ARNP. Historic heritage is present in the form of stockyards and Huts, located near Licking Hole Creek and on the Retreat River. Impacts to these areas will be avoided by adhering to procedures outlined in the *Fire Management Manual* and within operational guidelines.

The following management strategies will be followed in any future wildfire suppression or prescribed burning operation and will apply to both historic and Aboriginal heritage sites;

- No access trail, management trail or helicopter pad construction (heli-pad) will be constructed over any known heritage site
- Any known heritage site that exists within a prescribed burn area will be assessed and where necessary protection measures taken to minimise any possible adverse effects from fire on that site
- During wildfire suppression operations in the Park, any trail or heli-pad construction activity will be assessed by a Service Officer, and the Incident Control Team will be made aware of any heritage sites within close proximity to the construction area
- Operations staff on ground at any construction area, whether a trail or heli-pad, will be instructed to avoid damaging heritage sites.

4.9 Smoke Management

The generation of smoke from fire events can cause impacts on the community (road hazard, health) and the environment. It is intended that all controlled fire events should endeavour to minimise exposing the community to smoke.

Hazard reductions should be undertaken in compliance with Smoke Management Guidelines with the *NPWS Fire Management Manual, 2003* (i.e. during climatically favourable periods where fuel moisture levels are low enough for rapid combustion and to allow for the swift dispersal of smoke from the vicinity of the fire).

4.10 Summary of Operational Guidelines

A recognised incident control system will be used in all incidents within the Park, including fire. ICS is based on the Australian Inter-agency Incident Management System (AIIMS). ICS has been adopted by many other fire management authorities to ensure that a uniform method of management is attained. Issues such as determining the chain of command, sphere of responsibility and language usage is consistent prior to the start of any fire.

The high priority given to fire management in the National Parks and Wildlife Service is evident in the detail of policies and plans as well as the substantial allocation of resources for equipment, staff training, and staff commitment to undertake fire management. Fire related duties take precedence over all other management activities during the fire season.

Table 20 below outlines the operation guidelines to be used for prescribed burning and wildfire suppression within Abercrombie River National Park.

Table 20
Operational Guidelines for Prescribed Burning and Wildfire Suppression within Abercrombie River National Park

Area / Resource	Operational Guidelines *
Threatened Flora Species	• Brief all fire fighting personnel involved in control line construction on the exact location and route • Exclude all sites containing threatened flora where the fire free interval has not reached the lower threshold level
Threatened Fauna Species	• Consider baiting after a fire event to minimise the effect of feral predators upon native fauna species
Vegetation Communities where the inter fire period is below the lower threshold limit	• Prevent / minimise burns within this area
Vegetation Communities where the inter fire period is near or above the upper threshold limit	• Undertake burns within these areas, taking into consideration: 1. The fire is to be contained within specified boundaries 2. Maintain burning to create a mosaic in similar vegetation communities 3. Consult neighbours and stakeholders prior to conducting a fire
Aboriginal Site Locations	• Brief all fire fighting personnel on the location and maximum intensity of fire permitted within a specified distance of the site
Earth Moving Machinery	• Restrict use on slopes greater than 25% • Generally rehabilitate all re-opened tracks during a fire event immediately after the fire • Incorporate erosion control measures

	• Restrict use in areas containing Aboriginal / Cultural heritage sites
Fire Fighting Chemicals	• Restrict use in and surrounding wetlands, waterways and sensitive areas • Restrict use where alternate methods are available (See Fire Management Manual)
Visitor Safety	• The Park may be closed to the public in the event of fire fighting activities being carried out within the Park or in extreme fire danger periods • Notification will be given to the public before any proposed hazard reduction activities.

* - Carried out in accordance with NPWS Fire Management Manual 2003.

The NPWS Fire Management Manual 2003 details the policy framework that should be addressed, along with Operational Guidelines, during Fire Suppression Events;

Table 21.
Policies for Wildfire Suppression within the Park

Activity	Policy Guidelines
Priorities	• Wildfire suppression will be achieved by the most suitable strategies taking into account the prevailing seasonal conditions and forecast weather, predicted fire behaviour, fire fighter safety, assets and values at risk and the impact of strategies on biodiversity, cultural heritage and the social and economic environment. • The priorities of the NPWS in wildfire suppression are: – the safety of all incident personnel – the effective protection of human life and community assets – the conservation of biodiversity – the conservation of cultural heritage – the cost effectiveness of strategies – the achievement of community support. • Selected suppression strategies will be cost effective, will protect human life and community assets and aim to minimise environmental disturbance.
Safety	• The safety of personnel engaged in wildfire suppression must be the primary consideration at all times. • The incident controller has the overall responsibility for the safety of firefighting personnel but all commanders and leaders are responsible for those under their supervision
Access	• Where temporary access for firefighting vehicles is required, wherever possible existing tracks will be used and the construction of new trails avoided. • Where access into remote areas is necessary for personnel and equipment, wherever possible aircraft should be used for transport and support in preference to new fire trail construction.
Control Line Construction	• Wherever possible existing built and natural fire advantages will be used instead of the construction of new control lines. • Where construction of control lines is required, wherever possible use of heavy earth moving equipment will be avoided. Handtools, air blowers or slashers will be preferentially employed. • Where construction by heavy earth moving equipment is necessary, wherever possible side cutting should be avoided, a NPWS approved operator should be used and construction work should be under the direct supervision of an NPWS officer at all times.
Backburning	• Where backburning and burning out are necessary the area burnt will be the minimum necessary to achieve wildfire suppression objectives. • Backburning will be conducted in such a way that the danger of the fire escaping pre-determined boundaries is minimised and the safety of firefighters is not compromised.
Rehabilitation	• The need for post fire rehabilitation will be assessed by the incident Controller as part of the incident management process. • Where necessary urgent rehabilitation works should be undertaken during incident de-escalation, particularly the closure and drainage requirements of temporary access trails. • Where necessary a detailed rehabilitation plan will be prepared by the Regional Manager of the area in which the fire suppression operation occurred, and will address issues such as: – animal welfare – soil stability – water quality – pest and weed species invasion – impact on native flora and fauna – impact on cultural heritage sites – damage to assets eg. Roads, gates, buildings and signs

	– damage to neighbours' assets eg. Fencing, pasture, plantations, crops – need for post fire monitoring eg. Retardant - foam used in specific areas – need for aerial or satellite photography of the fire ground.

4.10.1 Guidelines for Co-operative Fire Fighting Arrangements

Chifley Zone and Southern Tablelands Zone Bushfire Management Committees have adopted co-ordinated fire fighting policies based on the Policy Statement of the Co-ordinating Committee and the Manual of Procedures for Co-ordinated Fire Fighting. Any authority may make the first response to an observed bushfire within the Park, in accordance with the Bushfire Management Committee's Operational Plans.

The responding authority will take immediate steps to advise the NPWS of the fire and what action is to be taken. All bush fire suppression activities will, as far as practicable, be carried out in consultation with a senior officer from the NPWS.

4.10.2 Public Welfare and Safety

Proper notification to the public must be given for any proposed hazard reduction burning activity. NPWS Fire Management policy requires that each region maintain a register of contact details for reserve neighbours. Direct notification should be provided to the landholders directly affected by the activity – i.e. neighbours adjacent to the part of the reserve that will be burnt. Furthermore, details of co-operative arrangements with neighbours and other agencies (including utility providers) should be listed in any incident procedure documentation (with neighbours' approval). Wherever possible the NPWS should keep neighbours well informed of the fire situation during fire suppression (NPWS, 2001b). Wider public notification should take place through local print media and NPWS offices, with regards to time, date, road closures and duration of the burn. All burn areas must be thoroughly inspected prior to ignition, and should include details such as locations of powerlines, railway lines etc. Post fire safety checks should be conducted during and after 'mop-up' and any closures that may be necessary should be approved and advertised *in situ* and through local media as soon as possible**.**

5. FIRE MANAGEMENT ASSETS

5.1 Fire Management Access

Fire management trails include all roads, vehicular trails and walking tracks that can be used for fire management and fire control operations. The current classification system for trails is summarised in Table 22 and Table 23 provides a classification of the fire trails within Abercrombie River National Park. The classifications released by the Bushfire Coordinating Committee, Policy No.1/03, are included as a draft format. These will be finalised, in consultation with the District Bushfire Management Committees, during the district wide classification process. Map 12 illustrates the location of the fire trails within Abercrombie River National Park.

There are twenty seven (27) recognised fire trails within Abercrombie River National Park. In general there is a need for improvement and maintenance of trail signs. A trail numbering system should be developed in conjunction with existing fire trail registers held by Oberon Rural Fire Service and the NPWS.

Access into the Park can be attained via two main roads. Firstly, access via Brass Walls Fire Trail, which leads off the Abercrombie Road, provides access into the northeastern portion of the Park. This access is for dry weather only and, currently, sections may pose difficulty to large tankers.

Secondly, access on Abercrombie River Fire Trail via Arkstone Road, provides access into the western portion of the main Park area. This is the ‘easiest’ way into the Park and is suitable for public 4WD and light (strikers, slip on units) and heavy (tankers) fire units.

Access to the southwestern portion of the Park (via Levels Road) is associated with private property and a locked gate which is not fitted with standard BF3 locks. Eastern fire trails leading off Abercrombie Road provide access into the eastern portion of the Park. These trails are also within private property, all trails associated with private property should be considered as emergency access and egress only.

No public vehicle access is available within the western section of the Park. There are three trails in this section of the Park, all of which are very steep. These are used for management purposes and are not suitable for fire fighting vehicles such as Cat 1 or Cat 7 tankers.

The NPWS has closed a 100m section of Robinsons Fire Trail, where it joins Brass Walls Fire Trail. This section is very steep and has the potential to cause erosion problems. The rest of the trail will remain open and a turn around has been established where the trail has been closed.

An alternative fire fighting access will be investigated for the steep section of Little Bald Hill Fire Trail.

The Licking Hole Heritage Trail is currently unmaintained by NPWS. This trail shall be gated and locked at both ends for use as a management trail only.

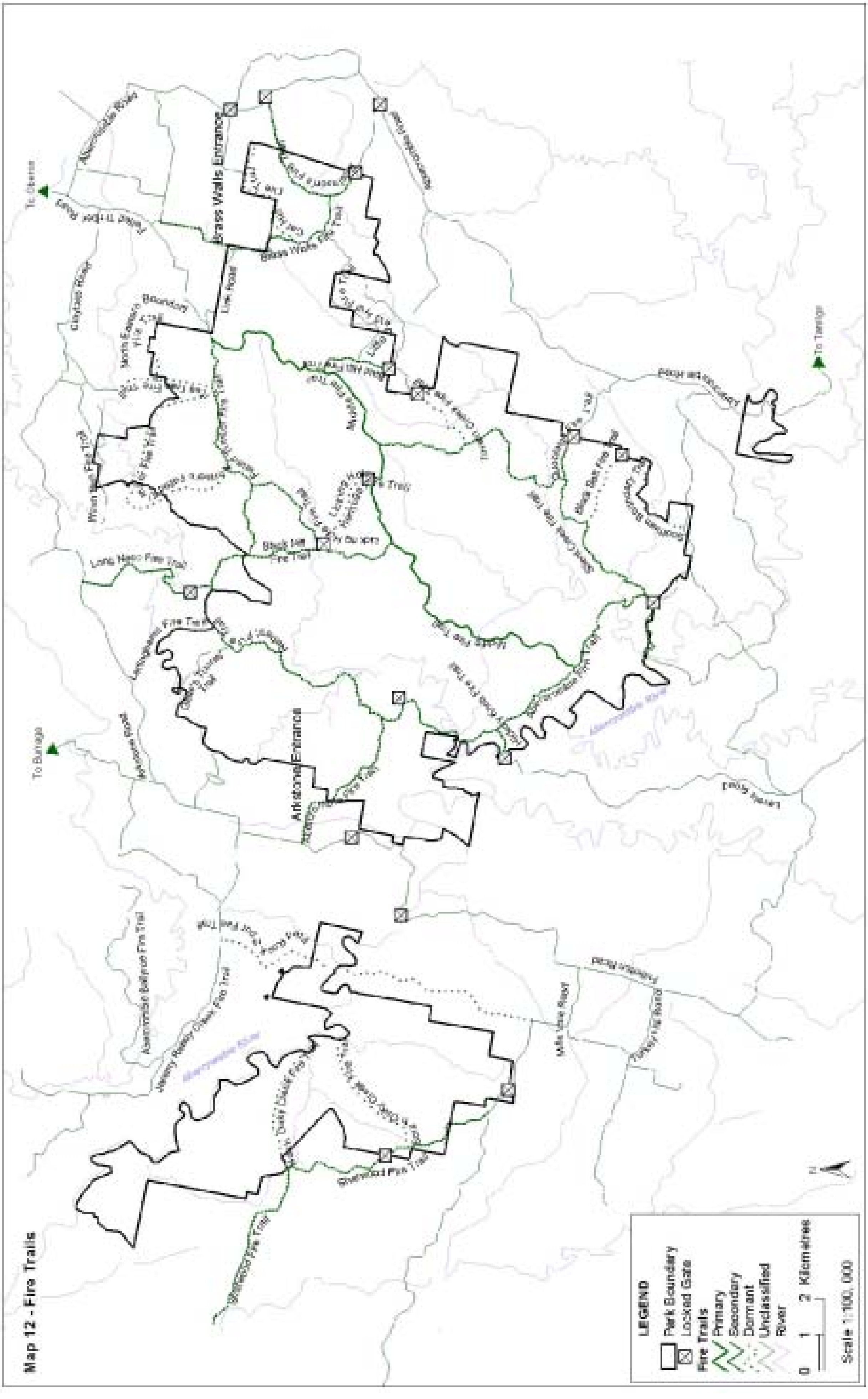

Map 12 - Fire Trails
LEGEND
Park Boundary
Locked Gate
Fire Trails
Primary
Secondary
Dormant
Unclassified
River
0 1 2 Kilometres
Scale 1:100, 000
Brass Walls Entrance
Arkstone Entrance
To Oberon
To Taralga
Long Neck Fire Trail
Sherwood Fire Trail

Table 22
Trail Classification

Track Classification	Description
1	Highway
2	Sealed Major public Road
3	Sealed Minor Public Road
4	Unsealed Public Road
5	4WD Public Road
6	Walking Track (off Park)
7	(Park) Sealed Road
8	(Park) Unsealed Road
9	(Park) 4WD Road
10	(Park) 2WD Management Access
11	(Park) 4WD Management Access
12	(Park) Walking Track
13	Closed Track
14	Horse Trail
15	Other Authorities Access
16	Private Access
Track Category	**Description**
R1	Average grade </= 7
R2	8 - 14 % grade
R3	15 % or greater grade
Draft Trail Classification (BFCC Policy No. 1/03)	***Description***
Primary	*Suitable for 4WD Cat 1 tankers*
Secondary	*Generally suitable for Cat7/9 Slipons/Strikers*
Dormant	*Not maintained but could be reopened*

Table 23
Trails Within and Adjacent to Abercrombie River National Park

Trail	Section	Length (m)	Maintained	Classification	Category	*Draft Classification*
Abercrombie	Main Access in to Park. Runs along Abercrombie River off Arkstone Road and enters the Park along the western boundary. Retreat, Middle and Silent Creek fire trails run off this trail.	15,508	NPWS	8-9	R1 - R3	*Secondary*
Bald Hill	Joins Middle and Little Bald Hill fire trails. Extended around eastern boundary to join Tavern Hill Fire Trail	3,010	NPWS/ Private	9	R1 - R3	*Secondary*
Black Bett	Joins Goulburn Road to Silent Creek fire trail. Follows the SE boundary of the Park.	5,856	NPWS	9	R1 - R3	*Dormant*
Black Hill	Joins Retreat and Licking Hole Fire Trails.	2,425	NPWS	9	R1 - R3	*Secondary*
Brass Walls	Main NE access. Joins Public link road and Little Bald Hill fire trail. The NE boundary fire trail runs off this trail.	6,013	NPWS	9	R1 - R3	*Secondary*
Cat Hill	Leads off Brass Walls Fire Trail. Follows the north east boundary of the Park.	4,122	NPWS	9	R1 - R3	*Dormant*
Felled Timber	Joins Retreat and Licking Hole fire trails to Public link road and Middle fire trail.	4,664	NPWS	9	R1 - R3	*Secondary*
Freds Rock Spur	Runs north - south along the eastern boundary of the western section of the Park from Arkstone Road.	724 in Park	NPWS Council	8-9	R1	*Dormant*
Gaite's Tunnel	Leads from the Retreat Fire Trail down to the edge of the Park on the Retreat River	1,950	NPWS	9	R1 – R3	*Unclassified*

Hickory Knob	Leads off Abercrombie fire trail out of the western portion of the Park and runs south to Taralga via Levels road	955 in Park	NPWS/ Council	9, 16	R1 - R3	*Secondary*
Ledinghams	Leads off Retreat FT to the NW boundary of the Park.	1,995	NPWS	9	R1 - R3	*Dormant*
Licking Hole	Joins Middle fire trail and Felled Timber Fire Trail. Black Hill FT and Retreat Fire Trail run off this trail.	5,422	NPWS	9	R1 - R3	*Secondary*
Licking Hole Heritage	Joins Licking Hole and Middle Fire Trails. Joins onto Black Hill Fire Trail. Track has been CLOSED.	2,232	NPWS	13	R1 - R3	*Dormant*
Little Bald Hill	Joins Bald Hill and Brass Walls fire trails. Runs adjacent to the north eastern boundary of the Park.	5,158	NPWS	9, 16	R1 - R3	*Unclassified*
Long Nose	Leads off Retreat FT and follows the NW boundary of the Park.	2,120	NPWS	9	R1 - R3	*Secondary*
Middle	Joins Public Link Road and Abercrombie fire trails. Runs through the central region of the Park. Licking Hole, Bald Hill and Silent Creek fire trails run off this trail.	17,963	NPWS	9	R1 - R3	*Primary*
North Eastern Boundary	Joins Tea Tree Fire Trail and Public Link Road following the North East boundary of the Park.	3,309	NPWS	9	R1 - R3	*Dormant*
North Oaky Creek	Leads off Sharwood FT and goes to the Abercrombie River. Western section of Park.	3,457	NPWS	9	R2 - R3	*Dormant*
Northern Felled Timber	Leads off Felled Timber fire Trail and joins back to Felled Timber fire Trail. Goes outside Park and follows boundary.	7,864	NPWS	9	R1 - R3	*Dormant*
Public Link Road	Joins Brass Walls FT (Main NE access) to Middle, Felled Timber and North eastern boundary fire trails	2,647	NPWS	9	R1 - R3	*Unclassified*
Quobleigh	Runs off Goulburn Road into the southeastern portion of the Park. Leads onto Silent Creek fire Trail. Follows NE boundary.	1,297	NPWS/ Private	9-16	R1 - R3	*Secondary*
Retreat	Joins Felled Timber and Abercrombie fire trails. Leadinghams, Long Nose and Black Hill fire Trail run off this trail.	9,542	NPWS	9	R1 - R3	*Secondary*
Robinsons	Eastern end begins at Oberon-Goulburn Road, in Forestry lease. Leads into the park and joins Brass Walls Fire Trail at Silent Creek. Part of track has been CLOSED (100m). Turnaround established	3,340	NPWS/ Forests NSW	8-9 (100 m = 13)	R1-R3	*Secondary/PFL*
Sharwood	Leads off Freds Rock Spur FT and follows the southern boundary of the western section of the Park.	11,745	NPWS Council	8-9	R1 - R2	*Secondary*
Silent Creek	Joins Middle and Abercrombie Fire Trails in the SE of the Park. Tavern Hill, Quobleigh and Black Bett Fire Trails run off this trail.	14,029	NPWS	9	R1 - R3	*Secondary*
South Oaky Creek	Leads off Sharwood FT and goes to the Abercrombie River. Western section of Park. No turning.	3,685	NPWS	9	R2 - R3	*Dormant*
Southern Boundary	Follows the southern boundary of the Park from Black Bett Fire Trail and then into private property		NPWS	11	R1 – R3	*Dormant*
Tavern Creek	Leads from Silent Creek Fire trail to the boundary near bald	2,093	NPWS	9	R1 - R3	*Dormant*

	hill. Will join Bald Hill fire trail to Silent Creek Fire trail with Bald Hill fire trail extension.					
Tea Tree	Leads from Felled Timber FT to private property north of the Park.	2,723	NPWS	9	R1 - R3	*Dormant*

5.2 Fire Management Utilities

Fire management utilities include infrastructure that assists in the detection and control of wildfires, and assists in fire management operations. This includes fire towers, dams and maintained watering points and helipads.

Fire towers surrounding ARNP are maintained by Forests NSW during wildfire danger periods. Most properties adjacent to the Park provide suitable dams and areas for helipads and water access. There is a dam located within the Park (on Licking Hole Fire Trail) and water access can be obtained from the Abercrombie River (Bummaroo Ford) and the Retreat River (Macks Flat and the Inholding) during most seasons.

Fire equipment is a NPWS shared resource across the state. Table 24 lists the fire management utilities available for use within Abercrombie River National Park by the Kanangra Area of the NSW NPWS. It should be noted that additional NPWS equipment could be sourced from across the state.

Table 24
Utilities and Equipment Held by the Kanangra Area of the National Parks and Wildlife Service

Utility	Location
Aviation	
Helipads	Blackheath Workshop, Govetts Leap Road Yerranderie airstrip, adjacent Yerranderie township Jensens, Jensens Swamp adjacent Boyd River camping area Kanangra-Boyd National Park.
Emergency Helipads	Oberon Fire Control Centre , Rural paddocks
Communications	
VHF Radio System	Channel 7 in all vehicles
Mobile Radios	Issued to all staff
Mobile Phones	Area Managers Vehicle, 1 * satellite phone held in Oberon office
GRN / PMR Mobile	Area Managers Vehicle
Watering Points	
For helicopters	Dams - Freehold properties. Abercrombie River, Retreat River
For Vehicles	ARNP - Retreat River (Wattle n daub hut, two Retreat fire trail river crossings) Abercrombie River (Buummaroo Ford, The Beach camping area), Dam located along Licking Hole Fire Trail.
Resources of Kanangra Area	
Fire Fighting Personnel	14
Toyota Slip-on Units 4WD (400L capacity)	2
Toyota 4WD Tray top (Field)	4
Remote area equipment	1 set
4WD Twin cab	1
Station Wagon Pajero 4WD	1
Isuzu 4WD Tipper	1
Tractor 4WD	1
Quad bike	1
Remote radio kit	1

*For a list of resources held by the Blue Mountains Region, see the Blue Mountains Region Incident Procedures (updated annually).

In the event of a wildfire within Abercrombie River National Park, Chifley Zone and Southern Tablelands Zone Rural Fire Service (RFS) Brigades may be deployed to aid in the suppression of fires. Table 25 provides details of utilities and equipment held by the respective RFS.

Table 25
Utilities and Equipment Held by the Chifley Zone Rural Fire Service

Utility	Location
Fire Equipment	
6 - Category 1 tankers	Various Locations
6 - Category 7 tanker	Various Locations
2 - Category 9 tanker	Various Locations
Numerous - Slip on units	Various Locations
Communications	
UHF talk through repeater System with car to car capacity	Used by NSWRFS. Not compatible with VHF systems, NPWS, Oberon Council and State Forests.
	Contact; Randall Ferrington FCO Oberon Council 02 6336 0493

A number of 'fire readiness levels' in Blue Mountains Region (BMR) have been developed, based primarily on the Macarthur Fire Danger Index. These fire readiness levels indicate the extent to which the Region will be in a 'state of preparedness' for initial response to a wildfire incident.

Fire Readiness Level 1 **HIGH FIRE DANGER**

When the Fire Danger Index at any monitored location in BMR is 15 – 20.

Action to be taken includes:

- A Regional and Catchment Duty Officer will be rostered and contactable during their duty period,
- Before 1630 hrs daily the Fire Danger Index will be monitored for the following day by the Region/Catchment Duty Officer and required state of fire readiness will be forwarded to all catchment works depots and Flight DO
- slip-on units within each work unit will be fitted to identified vehicles,
- appropriate numbers of staff in the 5 functional groups of BMR will be identified by the Area Managers and the Regional Operations Coordinator, as per the 'Fire Crew and IMT Readiness Schedule' and their work programmed so that they are contactable by radio and are within 10 -15 minutes of a fire fighting unit whilst at work.

Fire Readiness Level 2 **VERY HIGH FIRE DANGER**

When the Fire Danger Index at any monitored location in BMR is 20 – 50.

Action to be taken includes all the above and:

- aerial surveillance to be considered following the passage of thunderstorm activity,

- distribution of routine weather forecasts from Bureau of Meteorology and regular checks of local weather will be coordinated by the Fire Technical Officer,
- slip-on units within the 5 functional groups of BMR will be filled with water and strategically located,
- Area Managers and the Regional Operations Coordinator will identify the location of staff nominated in the 'Fire Crew and IMT Readiness Schedule' and relevant fire equipment, while the Asset Coordinator will identify the location of Regional plant. All this information will be forwarded to the Regional Duty Officer by 1000 hours Monday to Friday.

Fire Readiness Level 3 **EXTREME FIRE DANGER**

When the Fire Danger Index at any monitored location in BMR is >50,
a TOBAN is declared, or there is an intra or inter-Branch commitment of firefighting resources.

Action to be taken includes all the above and:

- consideration to be given by Area Managers, to the potential temporary closure of some single access recreation precincts,
- Regional members of the District Bushfire Management Committee Operations Group to maintain close liaison with the relevant Executive Officer,
- aerial surveillance to be initiated by the Regional Duty Officer on high risk days,
- Area Managers and the Asset Coordinator will deploy plant and equipment to strategic locations within the Region and notify the Regional Duty Officer accordingly by 1000 hours Monday to Friday,
- the Regional Duty Officer to be available at a Blue Mountains Region office, from 1000 – 1800 hours and contactable during their duty period,
- after hours and on weekends, appropriate numbers of staff in the 5 functional groups of BMR, as per the 'Fire Crew and IMT Readiness Schedule', will be at home on stand-by for the period specified by the Regional Duty Officer, contactable, and available for immediate response within 5 minutes of notification,
- a helicopter to be based at Blackheath, with a Remote Area Firefighting Team 'on duty' at the Blackheath helipad, available for immediate deployment.

Fire Readiness Level 4 **EXTREME FIRE DANGER**

When the Fire Danger Index at any monitored location in BMR is >50
or there is a Section 44 in a local or neighbouring Fire District.

Action to be taken includes all the above and:

- on weekends and where necessary after hours, appropriate numbers of staff in each of the 5 functional groups of BMR, as per the 'Fire Crew and IMT Readiness Schedule', will be 'on duty' with plant and equipment at strategic locations.

5.3 Fire Management Facilities

5.3.1 Control Room (Southern Tablelands Zone and Chifley Zone)

The Oberon Fire Control Centre has a dedicated Control Room as part of the Incident Control System for Abercrombie River National Park. All RFS centres can be utilised as control rooms if required.

5.3.2 Radio Network (Southern Tablelands Zone and Chifley Zone)

Presently there is an incompatibility between communication systems of the Oberon Council, Forests NSW, NPWS and the communication systems of the Rural Fire Service, and NSW Fire Brigade (NPWS, 1999). Due to the topographical nature of Abercrombie River National Park, communication blackspots may exist in some areas. For this reason, the NPWS VHF network is augmented with mobile and satellite phone services and portable repeaters.

All fire fighting agencies cooperatively discuss strategies to ensure that communications are maintained even with incompatible radio networks.

5.3.3 Detection

Records indicate lightning strikes are the primary cause of ignition in Abercrombie River National Park. Electrical events corresponding with high fire danger prompt careful scrutiny of internet based lightning detection technology. When appropriate, ground crews and/or surveillance aircraft are despatched to investigate possible ignitions.

Aircraft may be deployed under a number of circumstances including:

I. In the event of dry storms and lightning strikes
II. Where fires are burning in inaccessible country
III. At times of poor visibility coupled with very high to extreme fire danger
VII. During major fire suppression activities

Fires in and near Abercrombie River National Park may also be detected by Forests NSW fire towers located at Burraga, Shooters Hill and Pennsylvania. Under established cooperative fire fighting arrangements Forests NSW report any sightings to NPWS for action.

5.3.4 Preparation Measures for Fire Suppression

A summary of some of the key actions to ensure preparedness are listed below.

- Continual maintenance and improvement of all NPWS fire fighting equipment is undertaken. Cleaning and maintenance of fire equipment is carried out weekly during the fire season (October to March) and monthly during the remainder of the year. All equipment is maintained after use on a fire, with lost or damaged items replaced.

- Regular training of personnel in fire fighting techniques and equipment usage is carried out by the NPWS. The annual Fire Works program, and activities such as hazard reduction, prescribed burns, and trail and equipment maintenance are used as training sessions for staff. Annual fire preparation days are held by NPWS for staff to prepare personal and other equipment before the fire season.

- The NPWS liaises with the local Rural Fire Service Brigades, NSW Fire Brigades, Councils, Police, Forests NSW and other Government Departments, private organisations and individuals, to obtain the highest level of co-operation and assistance in the prevention and suppression of wildfires.

6. WORKS SCHEDULE

6.1 Biodiversity Works Schedule

Where prescribed burning is necessary within the Park, a comparison of fire history with the objectives for each zone (Section 4) will determine the pattern of burn required. Thus the selection of annual works programs and priorities is largely determined through a review of fire history and its relevance to the objectives and strategies within this Strategy.

6.1.1 Fire Management Research

At present there is little information available on the response of the Parks flora and fauna to fire. Considerable research is required in those areas where major deficiencies occur in understanding how to manage and conserve the biodiversity within the Park. Research and monitoring into the following areas is required for Abercrombie River National Park;

- The responses of individual flora species and vegetation communities to fire
- The responses of fauna to fire - research is especially needed within the realm of invertebrates and lower vertebrates, especially in relation to their habitat requirements
- The long term responses of both individuals and populations of fauna species to specific fire regimes over a period of time
- The requirements for refuge, post-fire dispersal and re-colonisation of animal species which may have been depleted by a fire in the short term, with an outcome of creating fire thresholds of fire size and shape they may require for conservation purposes
- The development of a computer-based system for the continual updating of all fires that occur within the Park and the effects these fires have upon biodiversity thresholds and prescribed burning requirements
- Analysis of trends in fire ignition points and wildfire paths in order to aid the creation of strategies that will help prevent and mitigate wildfires
- Investigation of the need to burn those areas that are currently not within the biodiversity thresholds of that area
- Creation of a fuel accumulation curve / graph for the vegetation communities within the Park in order to aid fuel reduction activities.

6.1.2 Fire Mapping and Database Management

Fire history data for the Park will be stored and maintained in the Regions Geographical Information System (Arcview) and Excel databases at the Blue Mountains Region Office of the NSW National Parks and Wildlife Service.

6.1.3 Monitoring Fuel

Fuel sampling will be required to occur pre and post fuel reduction activities and recorded into a database for future reference. Fuel sampling will be carried out according to the current method used by the NPWS. Objectives of the fuel-monitoring program will be to:

- Measure and record the effectiveness of prescribed burns
- Allow for prioritisation of prescribed burns to take place
- Determine the accumulation rate and distribution of fuels within different fuel groups.

Fuel sampling techniques are to be reviewed as new research is undertaken within this area of fire management.

6.1.4 Monitoring Fire Regimes and Changes to Biodiversity

Mapping of all fires, both planned and unplanned will be required to ensure that information is available for effective analysis. The involvement of research agencies other than the NPWS may be required due to resource deficiencies. The cooperation of universities should be assessed for their capability to contribute to the research and analysis of fire regimes and or changes to biodiversity.

6.2 Operations Works Schedule

This works schedule specifies the program for prescribed burning for Strategic Fire Management and Land (heritage) management. The ability of the NPWS and assisting organisations to implement each planned burn will be influenced by seasonal conditions and wildfires.

6.2.1 Prescribed Burning

Prescribed burning will be undertaken on an annual basis, subject to appropriate weather conditions, to achieve bushfire risk management objectives and in accordance with identified priorities (see section 6.4 Summary of Works).

Prescribed burning may be undertaken in Heritage Management Zones to maintain vegetation communities within fire frequency thresholds subject to zone guidelines. Following the large ‘Crookwell’ fire at the beginning of 1999 most vegetation communities will not require land (heritage) management burning within the life of this strategy.

Pre-burning fuel assessments will be undertaken to confirm the need for re - burning units within Strategic Fire Advantage Zones. Pre-burning surveys for threatened species and Aboriginal sites will be undertaken.

6.2.2 Hazard Reduction

Hazard reduction on private lands will need to be carried out by private landholders and should be in accordance with recommendations outlined by the Rural Fire Service and the NSW Fire Brigades, refer to Section 4.2. Methods such as mowing and slashing, burning or raking should be used. Boundary slash zones will be maintained along the northern and south eastern boundaries of the Park for asset protection.

6.3 Infrastructure Works Schedule

This works schedule specifies the proposed activities primarily involved with access and management. The ability of the NPWS and assisting organisations to implement each activity will be predominantly influenced by seasonal conditions, wildfire events, research and finance.

6.3.1 Fire Management Access

Trail maintenance within Abercrombie River National Park will be undertaken by the NSW NPWS Plant Crew or by contractors allocated by the NPWS. Table 26 outlines the maintenance works required and time frame for each of the trails within the Park.

In general the trails within ARNP are well maintained and of good quality, suitable for most 4WD vehicles in most weather conditions. Trails are only suitable for 4WD vehicles; this is due to their steep nature and the potential slip of clay soils in some areas. Due to the steep slope, NPWS have implemented erosion control in the form of swales on steep trails. Swales could create potential problems in the movement of long wheel based vehicles especially tankers.

Trail maintenance shall also be influenced by the new trail classification system (Bush Fire Coordinating Committee Policy No: 1/03). When trail classifications are finalised, any additional maintenance requirements will be included in the maintenance program.

Table 26
Trail Maintenance Work within Abercrombie River National Park

Return Period for Maintenance	Works to be Conducted	Authority	Track Name
Annually	Regular inspection, clear timber and vegetation, check drainage.	NPWS	All trails
Bi-Annually	Slashing / Grading	NPWS	Any trail recognised as degraded.

6.3.2 Fire Management Utilities

Prior to the fire season each year, NPWS staff will need to ensure that access to and extraction from suitable watering points is possible.

Radio coverage can be relatively poor at times within the Park due to the geology and topography of the area. Maintenance of radio systems should be carried out prior to the fire season each year and communications equipment should be kept in good working order throughout the fire season.

Staff should familiarise themselves with radio coverage by way of radio coverage maps. This will depict the span of coverage from as many points as can be covered by the checking process.

Communication equipment will need to be inspected, repaired where necessary and maintained at all times. At present there is an incompatibility between the communications of fire agencies, this needs to be rectified. The installation of a repeater tower to the east south east of the Park should be examined to boost radio signals within valley areas of the Park.

6.3.3 Fire Management Facilities

Prior to each fire season, the incident management facility will be reviewed. Staff will be required to participate in training exercises, to ensure that all staff and personnel are familiar with the current incident procedures and facilities.

6.4 Summary Table of Works to be Undertaken Annually

During the life of this strategy the NPWS should aim to review prescribed burning and other fuel management programs prior to each fire season in accordance with the objectives and policies outlined in the NPWS Plan of Management. Table 27 below

provides a summary of works that are to be undertaken within Abercrombie River National Park. Table 28 provides a detailed prescribed burning annual works schedule.

Table 27
Summary Table of Priority Works to be undertaken in Abercrombie River National Park.

Year	Works to be Undertaken	Priority
Ongoing	Liaise with the adjoining landholders on the issues of fire management, scientific investigation, and access (BF3 locks,).	Moderate
Ongoing	Liaise with the Oberon Rural Fire Service (fire suppression, prevention, trail sign register)	Moderate
2004 onwards	Maintain all fire trails within the Park to a standard suitable for 4WD access at all times of the year. Works should be undertaken in accordance with Table 26.	High
2004 – 2009	Undertake botanical research into fuel levels and the initiation of appropriate ecological fire thresholds.	High
2004 – 2009	Undertake slashing / burning of Asset Protection Zones.	High
2004 – 2009	Prescribe burn Strategic Fire Advantage Zones.	High

Table 28
Abercrombie River National Park Annual Works Schedule

Name	Zone	Proposed Prescribed Burning Works						
		2004	2005	2006	2007	2008	Botanical Research Required *	Outside life of strategy **
Felled Timber	SFAZ 1					✓	✓	
Tea Tree	SFAZ 2		✓				✓	
Little Bald Hill west	SFAZ 3	✓					✓	
The Beach	SFAZ 4						✓	✓
Black Bett	SFAZ 5						✓	✓
Bummaroo	SFAZ 6			✓			✓	
The Sink	SFAZ 7	✓					✓	
Silent Creek west	SFAZ 8			✓				
Hells Hole	SFAZ 9				✓		✓	
Cat Hill	SFAZ 10		✓				✓	
Little Bald Hill east	SFAZ 11	✓					✓	
Tavern Creek	SFAZ 12				✓		✓	
The Glen west	SFAZ 13						✓	✓
Retreat North	SFAZ 14						✓	✓
Retreat south	SFAZ 15						✓	✓
Brass Walls	SFAZ 16						✓	✓
Bobs Creek	SFAZ 17						✓	✓
Bingham	HMZ 1						✓	✓
Macks Flat	HMZ 2						✓	✓
Davies Creek	HMZ 3						✓	✓
Abercrombie	HMZ 4							✓
Licking Hole	HMZ 5						✓	✓
Paling Yards Creek	HMZ 6						✓	✓
Freds Rock	HMZ 7						✓	✓
Black Bett	HMZ 8						✓	✓
Silent Creek	HMZ 9						✓	✓
Bald Hill South	HMZ 10						✓	✓

* Botanical research is to establish the botanical fire history so as to identify the correct initiation of fire thresholds to be applied.

** Outside the life of strategy refers to dates that burning should be targeted for and thus they are outside the scope of the current strategy.

Note: In some cases (within each zone) there may be more than one burn implemented within the one year.

7. STRATEGY ADMINISTRATION

7.1 Management of Works

The works programmed for the next five years will be identified in the NPWS Regions Operation Plan, which lists all Park management works to be conducted in all conservation reserves in the NPWS Blue Mountains Region.

The Blue Mountains Region Manager and Fire Management Officer will monitor works performance. An annual report on the works will be completed, which will be submitted to:

- NPWS Regional Manager and Director of Central Branch
- Chifley Zone Bushfire Management Committee

7.2 Environmental Assessment of Scheduled Works

Environmental assessments for all scheduled works will be undertaken by NPWS, for asset protection and Strategic Fire Advantage Zones. This will comply with the RFS Bushfire Environmental Assessment Code, July 2003. Otherwise, NPWS will conduct a full Review of Environmental Factors (REF) for each activity.

7.3 Strategy Review

There may be a need to review fire management strategies as further research into the management of animals and plants develops. A complete review and updating of the Strategy will occur after 5 years.

7.4 Implementation and Evaluation

There are a number of ways to evaluate the effectiveness of this strategy. The monitoring of the issues outlined below will determine to what level the implementation of this strategy has been successful.

It will also prove how effectively the actions recommended by this strategy have reduced the impact of adverse fire events and management. The issues, which will govern this strategy's success, are:

- The instigation of a visitor usage monitoring program to establish current usage rates in the Park

- Increased surveillance in days of very high to extreme fire danger either through patrols, neighbourhood assistance or other direct methods

- The need to promulgate *suppression policies* that can be implemented by the local fire fighting organisation in the absence of the NPWS staff

- The maintenance of reduced hazardous fuel levels in strategic locations along the eastern and northern boundary, and around inholdings

- The management of existing fire trails as strategic fire breaks. It is recognised that medium to high intensity fires or high wind driven fires will jump these trails prior to extinguishment.

In taking note of the above issues there are factors beyond the control of any fire manager which will always put pressure on fire management in any area. These are:

- Adverse weather conditions leading to a period of extreme fire weather

- Inability to complete trail maintenance, slashing or prescribed burning operations due to prolonged periods of wet weather during the non-fire danger period

- The carelessness of some individuals in use of fire for campfires and burning of vegetation and refuse, thereby causing fire to escape into the Park

- Ongoing information is required to judge whether management strategies based on the guidelines contained in this strategy are successful in terms of achieving conservation objectives. The conservation guidelines are a summation of current knowledge relevant to the biodiversity contained within the Park.

7.5 Life and Property Protection

The achievement of these objectives will be evaluated by:

- Successful registration of the Strategy with the Chifley Zone Bushfire Management Committee

- In co-operation with the Chifley Zone Bushfire Management Committee the provision of public education on fire prevention, preparedness and response for residents of the study area

- Collection and maintenance of accurate fire history records and an evaluation of trends

- Upgrading and maintenance of the tracks within the Park to the identified standard.

7.6 Maintenance of Biodiversity

The achievement of these objectives will be evaluated by:

- Accurate recording of all planned and unplanned fires

- The incidence of fire in the fire sensitive vegetation and or locations

- The recovery of other recently burned vegetation communities

- The installation of fire advantages where identified in this strategy

- As the knowledge base evolves, these guidelines could change. Performance evaluation must therefore be an exercise in scrutiny of these guidelines aimed at pinpointing where they are invalid and in need of improvement. This being the case, it is vital that performance evaluation, where possible, is not solely directed at describing the state of fire regimes within the Park

- Thorough performance evaluation must be directed at assessing changes in species populations in relation to fire regimes so that the predictions implicit in the guidelines are tested and verified. The NPWS is committed to performance evaluation of its conservation guidelines and strategies and will seek whatever assistance it needs to develop and implement a program that takes account of species dynamics and fire regimes.

7.7 Further Research

In the process of developing this strategy it has become apparent that there are major deficiencies of knowledge that must be addressed if fire is to be managed to conserve the biodiversity within the Park.

The fire management research priorities for the Park includes the following;

- Mapping of Cultural Heritage Sites (Aboriginal and Historic sites).
- Knowledge of animal / fire responses to varying fire regimes, particularly the lower vertebrates and invertebrates, especially in relation to habitat characteristics and threatened species such as,

The ROTAP species - *Leptospermum blakelyi;*

And the threatened fauna species:

Booroolong Frog - *Litoria booroolongensis*
Koala - *Phascolarctos cinereus*
Spotted-tail Quoll - *Dasyurus maculatus*
Eastern False Pipestrelle bat - *Falsistrellus tasmaniensis*
Common Bent-Wing Bat - *Miniopterus schreibersii*
Rosenberg's Goanna - *Varanus rosenbergi*
Masked Owl - *Tyto novaehollandiae*
Powerful Owl - *Ninox strenua*
Glossy Black Cockatoo - *Calyptorhynchus lathami*
Square-tailed Kite - *Lophoictinia isura*
Australasian Bittern - *Botaurus poiciloptilus*
Black Bittern - *Ixobrychus flavicollis*
Pink Robin - *Petroica rodinogaster*
Swift Parrot - *Lathamus discolor*
Turquoise Parrot - *Neophema pulchella*

It is yet to be determined whether or not these species / communities are decreasing or increasing their abundance and or distribution. To assist this understanding it will be necessary to carry out the following;

- Classify the responses of animals to fire as a function of life-history attributes.

- Predict the long-term responses of animal populations to fire regimes, (not just a single fire), based on direct interactions of fire regime components with demographic processes.

- Predict the requirements for refuge, post-fire dispersal and recolonisation of animal species which are depleted by fires in the short-term with a view to defining the thresholds of fire size and shape needed for conservation and maintenance of biodiversity.

- Monitor the Southern Oscillation Index and review past association of El Nino episodes with severe fire seasons to improve prediction of future severe fire seasons.

- Compile a locally prepared fuel accumulation curves for the major vegetation communities.

- Upgrade fire history records for each vegetation community for the period since last fire using a professional geographic information system.

- Analyse of trends shown by fire ignition point data and wildfire paths to determine site specific fire prevention and mitigation strategies.

- Establish long term monitoring sites of the response of biota and landscape processes to fire.

- Obtain further understanding of the fire regime requirement of *Leptospermum blakelyi.*

- Obtain further understanding of the abundance and fire impacts of the *Booroolong Frog.*

8. REFERENCES

Allen, G.R. (1989) *Freshwater Fishes of Australia*. T.F.H. Publications, Brookvale NSW.

Australian Fire Authorities Council, March 1996. *Glossary of Rural Fire Terminology*. Information handout for Fire Managers, produced by AFAC. Mount Waverly, Vic.

Bradstock et al (1998). *Bushfire risk at the Urban interface estimated from historical weather records: consequences for the use of prescribed fire in the Sydney Region of South-eastern Australia*. Journal of Environmental Management 1998, 52, 259-271.

BFMC (1997) *Oberon District Bush Fire Management Plan of Operations*. (Oberon District Bush Fire Management Committee)

Briggs, J.D. and Leigh, J.H. (1995) *Rare or Threatened Australian Plants. Revised Edition* (CSIRO: Melbourne).

BOM, Bureau of Meteorology (1999). *Climatic data supplied for Oberon*.

BOM, Bureau of Meteorology (2005). *Climatic data supplied for Crookwell and Taralga*.

Conroy B (1996) *Bushfire Management Zones - Draft 06/96*. (NSW National Parks and Wildlife Service: unpublished).

CRA (1999) *Abercrombie and Environment Vegetation Map*. Comprehensive Regional Assessment.

Department of Bush Fire Services (1991). *Planning for Bush Fire Protection: a guide for land use planners, fire authorities, developers and home owners, Discussion Document*. (NSW Government: Sydney).

Dovey, S. (1994) *Improving bushfire management for Southern New South Wales*, Southern Regional Fire Association. (AR McLean Printers: Canberra).

Gill, A.M. and Bradstock, R.A. (1992) A national register for the fire responses of plant species. *Cunninghamia* 2(4): 653-660.

Harden, G. (1993) *Flora of New South Wales* University NSW Press

Jones, D.S. and Morgan, G.J. (1994) *A Field Guide to Crustaceans of Australian Waters*. (Imago Productions: Singapore)

NPA (1985) *Proposed Silent Creek National Park*. (National Parks Association of NSW)

NPWS (1990) *Fire Management Manual*. (NSW National Parks and Wildlife Service).

NPWS (1999) *Abercrombie River National Park Draft Plan of Management* (NSW National Parks and Wildlife Service).

Oberon BFMC (1999) *Oberon Diatrict Bushfire Management Plan Operations* (Oberon Bush Fire Management Committee)

Tolhurst, K.G. and Cheney, N.P. (1999) *Synopsis of the Knowledge Used in Prescribed Burning in Victoria*. Department of Natural Resources and Environment, Fire Management, East Melbourne.

Walker, J. (1984) Fuel Dynamics in Australian Vegetation - In: Fire and the Australian Biota. A.M. Gill, Groves, R. and Noble I.R. (eds) Australian Academy of Science, Canberra.

APPENDIX 1 Definitions and Principles

Most definitions described below come from the Australian Fire Authorities Council (AFAC) ***Glossary of Rural Fire Terminology*** *(May 1996).*

Aerial Detection The discovering, locating and reporting of fires from aircraft.

Aerial Fuels The standing and supporting combustibles not in direct contact with the ground and consisting mainly of foliage, twigs, branches, stems, bark and creepers.

Aspect The direction towards which a slope faces, e.g. northeast. Slopes on a west to north-westerly aspect are the most hazardous during fire fighting operations.

Assets at Risk The natural resources or improvements that may be jeopardised if a fire occurs. Examples include: threatened species habitat, rainforests, forestry coups, human built structures or infrastructures, Park information signs, transmission poles etc. and may also include scenic values. For the fire manager it may also include natural values that may be threatened by a fire (e.g. water catchment quality).

Backburning A fire started intentionally along the inner edge of a fireline to consume the fuel in the path of a wildfire.

Buffer A strip or block of land on which the fuels are reduced to provide protection to surrounding lands.

Burning Programme All the prescribed burns scheduled for a designated area over a nominated period of time.

Bush Fire Management Unit (FMU) Management areas of a variable size that define containment blocks in the event of a wildfire. Alternatively they have also been designated as areas of specific ecosystem types defined by management authorities in order to monitor the long term effects of fire upon those areas.

Bush Fire Management Zone (BFMZ) Management areas (usually sub-sets of fire management units) where a specified fire management operational objective, strategy and performance indicator has been developed to mitigate against the threat of a wildfire.

***Special note about the above: FMU** is usually a monitoring and containment block whilst a **BFMZ** is a sub-unit of an **FMU** where fire managers undertake activities such as prescribed burning to achieve a set outcome (including the protection of life and property or slow the advance of a wildfire).*

Coarse Fuels Dead woody material, greater than 25mm in diameter, in contact with the soil surface (fallen trees and branches).

Controlled Burning *see Prescribed Burning*.

Crown Fire A fire burning in the crowns of trees and usually

supported by fire in ground fuels. Its is a fast travelling fire that usually consumes all available fuels in its path.

Drought Index A numerical value, such as the Keetch Byram Drought Index, reflecting the dryness of soils, deep forest litter, logs and living vegetation.

Ecosystem The interacting system of a biological community, both plant and animal, and its non living surroundings

Edge Burning A term used to describe perimeter burning of an area in mild conditions prior to large scale prescribed burning. This practice is used to strengthen buffers and to reduce mop-up operations.

Fine Fuels Generally all fuels less than 6mm in diameter, comprised of surface litter and aerial shrub layer.

Fire The chemical reaction between fuel, oxygen and heat. Heat is necessary to start the reaction and once ignited, fire produces its own heat and becomes self-supporting. Removal of any one of the three elements of fuel, oxygen and heat will extinguish a fire.

Fire Behaviour The manner in which a fire reacts to the variables of fuel, weather and topography. Changes in any of these variables with result in a change in the fires behaviour.

Fire Break Any natural or constructed discontinuity in a fuel bed used to segregate, stop and control the spread of a wildfire, or to provide a fireline from which to suppress a fire.

Fire Extent The area burnt by a wildfire, measured in hectares. Within that area there will be “islands” of unburnt vegetation (these islands are generally included in the total fire extent).
NB: it is preferable that fire affect only part of a vegetation community at any one time so that nearby areas of more mature plants may provide a seed source for recolonisation and animals will have suitable unburnt habitat in order to seek shelter and forage.

Fire Front The part of a fire where the rate of spread, flame height and intensity are greatest, usually when burning downwind or upslope.

Fire Intensity The rate of energy released per unit length of fire front. This is usually expressed as kilowatts per metre (kW/m).

Fire Management	All activities associated with the management of fire-prone land, including the use of fire to meet Heritage Management goals and objectives.
Fire Perimeter	The entire outer boundary of a fire area.
Fire Regime	The history of fire in a particular vegetation type or area including the frequency, intensity and season of burning (season in this context refers to the time of the year in which the fire occurred). It may also include proposals for the use of fire in a given area.
Fire Season	The period(s) of the year during which fires are likely to occur, spread and do sufficient damage to warrant organised fire control. In New South Wales the core fire season is from 1st October to the 31st March of the following year. *NB: At the regional scale, the season may be introduced or extended by one month dependent upon the prevailing weather conditions, drought indexes and number of wildfire's that may already be burning within that area.*
Fire Storm	Violent convection caused by a large continuous area of intense fire; often characterised by destructively violent surface indrafts, a towering convection column, long distance spotting, and sometimes by tornado-like whirlwinds.
Fire Suppression	Actions to control a fire, from the time of detection to extinguishment.
Flame Height	The vertical distance between the tip of the flame and ground level, excluding higher flame flashes. Expressed in vertical metres.
Fuel	Any material such as grass, bark, leaf litter and living vegetation which can be ignited and sustains a fire. Fuel is usually measured in tonnes per hectare of dry weight.
Fuel Arrangement	A general term referring to the spacing and arrangement of fuel in a given area.
Fuel Load	The oven dry weight of fuel per unit area. Commonly expressed as tonnes per hectare.
Fuel Bed	The arrangement and vertical profile of all readily combustible materials lying on the ground.
Fuel Management	Modification of fuels by prescribed burning, manual removal, slashing, grazing, or other means. The

	objective is to reduce the fuel thereby reducing the risk posed by unplanned fires.
Fuel Type	An identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause predictable rate of spread or difficulty of control under specified weather conditions.
Habitat	A physical portion of the environment that is inhabited by an organism or population of organisms. A habitat is characterised by a relative uniformity of the physical environment and fairly close interaction of all the biological species involved. *NB Organisms within a given habitat will express a level of co-dependency upon one-another. The loss of the physical characteristics of a given habitat can have severe and long term detrimental effects upon the organisms living in that habitat.*
Hazard Reduction	*see Fuel Management*
Island	An unburnt area within a fire perimeter. Islands are critical for species survival and recruitment after a wildfire event.
Keetch Byram Drought Index	A numerical value reflecting the dryness of soils, deep forest litter, logs and living vegetation, and expressed as a scale from 0 - 200 points. When 100 points has been reached in an area, that area is said to be in drought
NPWS	The National Parks and Wildlife Service of New South Wales.
NSWFB	The New South Wales Fire Brigades
Prescribed Burning	The controlled application of fire under specified environmental and weather conditions to a predetermined area and at the time, intensity, and rate of spread required to attain planned resource management objectives.
RFS	The New South Wales Rural Fire Service.
Rate of Spread	The forward progress per unit time of the head of the fire or another specified part of the fire perimeter.
Service, the	The National Parks and Wildlife Service of New South Wales.
SF .	Forests NSW (Formerly State Forests of New South

	Wales)
Scorch Height	The height above ground level up to where foliage has been browned by a fire.
Slip-on Unit	A fire fighting unit that can be placed on to the back of a four wheel drive vehicle to convert it to a fire tanker. *Depending upon the units water carrying capacity, a four wheel drive tray top vehicle could be converted to Category 2,7 or 9 fire tankers in a very short space of time.*
Spot Fire	Isolated fires started ahead of the main fire by sparks, embers or other ignited material, sometimes to a distance of several kilometres.
Striker	A small four wheel drive fire tanker capable of carrying from 400 to 600 litres of water for fire fighting purposes. Also known as a Category 9 Fire Tanker.
Strip Burning	Setting fire to a narrow strip of fuel adjacent to a fire line and then burning successively wider adjacent strips as the preceding strip burns out.
Structure Fire	A fire burning part, or all of any building, shelter, or other human made construction.
Tanker	A mobile firefighting vehicle equipped with a water tank, pump, and the necessary equipment for spraying water and/or foam on unplanned fires. *NB Under NSW Rural Fire Service guidelines, bushfire fighting tankers have been designated into nine 'Categories' delineating water carrying capacity and whether the unit is two or four wheel drive capable.*
Topography	The surface features of a particular area or region, i.e. the lay of the land, and includes mountains, rivers etc.
Unplanned Fire	*see Wildfire*
Urban/Rural Interface	The line, area, or zone where structures and other human development adjoin or overlaps with undeveloped bushland. Also known as the urban/bush interface, urban interface or just the interface.
Wildfire	An unplanned fire. A generic term which includes grass fires, forest fires and scrub fires.

APPENDIX 2 Fire Zone Specifications

ZONE	PURPOSE	SUPPRESSION OBJECTIVE(S)	FINE FUEL LIMIT	ZONE WIDTH
1 Asset Protection	To protect human life, property and highly valued public assets and values.	• To enable the safe use of Direct Attack suppression strategies within the zone • To minimise wildfire impacts on undefended property / assets	In accordance with guidance detailed in **Planning for Bushfire Protection**	In accordance with guidance detailed in **Planning for Bushfire Protection** [1]
2 Strategic Fire Management	To provide strategic areas of fire protection advantage which will reduce the speed and intensity of bushfires, and reduce the potential for spot fire development	• To enable the safe use of **Parallel Attack** suppression strategies within the zone • To enable the safe use of **Indirect Attack** (back burning) in high to very high fire weather conditions within the zone • To prevent crown fire development within the zone • To minimise spot fire ignition potential from the zone	Calculate appropriate levels from recognised fire behaviour models – as a general guide : ✸ 8 – 15 tonnes per hectare ✸ 60 – 80% area coverage It is recognised that fuels be burnt in a mosaic pattern	Zone width dependant upon : • Topography • Aspect • Spotting propensity • Location of adjacent firebreaks
3 Heritage Management	To meet relevant land management objectives in areas where life and property are not directly at risk	As per the land management and fire protection objectives of the responsible land management agency	As appropriate to achieve land management / fire protection objectives	Variable
4 Fire Exclusion	To exclude bush fires	N/A	N/A	Variable dependant on size of fire sensitive area requiring protection

Note The width, maximum fuel objectives and the percentage of area to be treated within each zone, will be et by the BFMC after consideration of the hazard, asset vulnerability and physical constraints of the land.

[1] **Planning for Bush Fire Protection requires aspect to be taken into account when determining the dimensions of the Bushfire Protection Zones**.

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