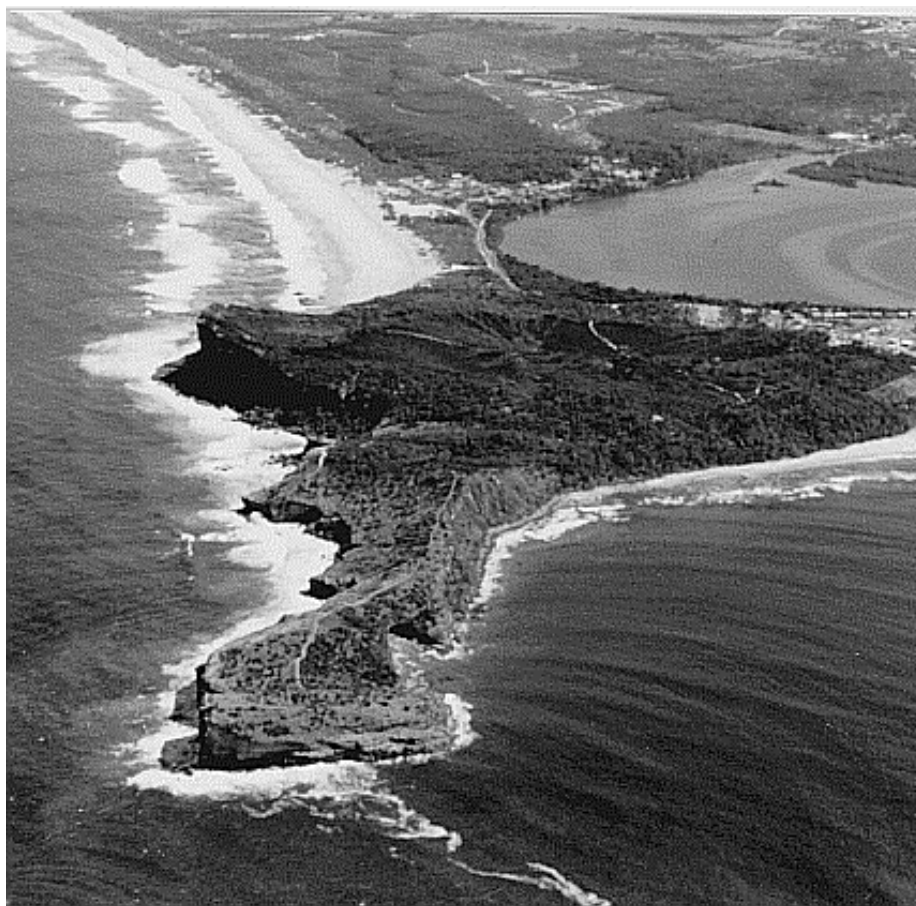




Fire Management Plan



Kattang Nature Reserve

NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE

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EXECUTIVE SUMMARY

PLANNING AND CONSULTATIVE PROCESS

This Fire Management Plan has been developed to provide direction for fire management activities, including wildfire suppression, in Kattang Nature Reserve. The plan will emphasize the protection of life and property as well as providing direction for land managers in the protection of the natural and cultural heritage of Kattang Nature Reserve.

Kattang Nature Reserve has a number of threatened plants and animals, some of which are unique to the area. This plan 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, reserve neighbours and other stakeholders, areas have been prioritised for fuel management treatment by assessing bush fire threat to assets. The Plan is also supported by analysis of fire history, vegetation and fuel patterns, and potential threats to life and assets (including natural and cultural heritage assets).

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

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 plan will have a shelf life of five years before a review is undertaken.

FIRE MANAGEMENT OBJECTIVES

In accordance with Sections 63 & 64 and Part 1, Section 3 of the *Rural Fires Act (1997)* and also in accordance with the *National Parks and Wildlife Act (1974)*; the primary objectives for fire management in Kattang Nature Reserve are:

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

Strategies for the Protection of Life And Property

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

- rapid suppression of wildfires where possible;
- maintenance of trails and fire breaks along reserve boundaries in high threat areas;
- fuel reduction through prescribed burning in strategic areas.

Fire management zones for fire radiation protection are located and managed to protect life and property. Due to the generally uncontrollable nature of wildfire it is critical to the success of the plan that there is community involvement. Neighbours will need to share responsibility for fire management on their own land, with the establishment and maintenance of fire trails and the management of flammable fuels near their own assets.

Strategies for Fire Management

Included in this plan are strategies aimed towards introducing appropriate fire regimes for the conservation of biodiversity within Kattang Nature Reserve, whilst meeting measures to protect life and property. These broad objectives are:

- the establishment of a fire regime consistent with maintaining plant diversity in both heath and woodland areas.
- the reduction of risk of damage by bushfire to life and property both within and immediately adjacent to areas where the NPWS has a statutory responsibility.
- the effective management of bushfire for the protection and conservation of the natural, cultural, scenic and recreational features of the reserve.
- the planning and implementation of fire management in co-operation with other organisations within the region.

Strategies for Wildlife Control and Suppression

Strategies for the prevention, detection and control of wildlife which are included in the plan are:

- ground surveillance of the reserve after severe thunderstorms and periods of high fire risk;
- maintenance of fire trails and utilities to assist in suppression operations;
- rapid suppression of wildfires where possible;
- fuel reduction burning in strategic areas; and
- monitoring of fuel levels within strategic wildfire control zones.

Strategies for Heritage Management

Kattang Nature Reserve has numerous rare and endangered flora and fauna species. This plan deals with the protection of those species, plus cultural heritage, and the establishment of appropriate fire frequencies for conserving native flora and fauna communities.

Strategies for the management of the natural and cultural heritage values which are included in the plan are:

- the use or exclusion of fire to maintain a complex diversity of vegetation communities and age structures, to prevent species extinctions, and to protect specific natural or cultural assets;
- the exclusion of fire from particular community types (ie littoral rainforest, dunes).
- assessment of environmental impacts prior to any fire management activity;
- pre-burning surveys for threatened species or Aboriginal/ Historic relics; and
- monitoring vegetation re-generation following a prescribed burn.

These strategies are based on guiding principles of fire ecology drawn from current ecological research and represent a best practice approach within existing levels of knowledge.

An Environmental Impact Assessment for the activities identified within the plan has also been prepared and placed on public exhibition along with this plan.

1. INTRODUCTION

1.1 SCOPE AND PURPOSE

Under the *Rural Fires Act 1997*, the National Parks and Wildlife Service (NPWS) is a prescribed fire organisation and is responsible for the control and suppression of all fires on areas that it manages. This responsibility also extends to fuel management, with the NPWS being responsible for the implementation of fuel management programs to protect life and property. The NPWS may also under the Act, suppress or assist in the control and suppression of fires within eight kilometres of any land that it manages.

The management of Kattang Nature Reserve, including fire management activities, is undertaken from the NPWS office based at Port Macquarie. This Fire Management Plan (this plan) details fire management activities, including fuel reduction and wildfire suppression, which the NPWS has identified for the protection and ongoing management of Kattang Nature Reserve.

This fire management plan has been prepared in accordance with the policies and procedures detailed in the NPWS Fire Management Manual. This fire plan is designed to be consistent with the policies and actions being prepared for fire management within the (draft) Plan of Management currently in preparation for Kattang Nature Reserve. The fire management plan will be reviewed and updated after five years, or when there are significant changes in the fire management environment of the reserve.

This plan is also supported by maps, documents and computer databases that are maintained at the NPWS Port Macquarie Regional office. Knowledge on the fire history of the reserve will continue to be recorded on these maps, documents and databases over the life of this plan.

The biodiversity conservation guidelines for the management of natural and cultural heritage have been based on current scientific understanding of fire adaptations and responses to fire of native plants and animals. The guidelines describe appropriate fire management regimes to promote biodiversity and to protect threatened species. Guidelines also apply against the threat of fire and fire operations to cultural sites.

The NPWS Mid North Coast Region is an active member of the Hastings Bush Fire Management Committee. This plan is submitted to the Hastings Bush Fire Management Committee as being a “relevant plan” under sec 38 s4 of the *Rural Fires Act 1997* for the management of fire, including wildfire suppression, within Kattang Nature Reserve.

1.2 DEFINITIONS

The following definitions are taken from the Australian Fire Authorities Council's Glossary of Rural Fire Terminology 1997, the NSW Biodiversity Strategy and terminology specific to the operations of the NPWS. Terms marked with an # below are commonly used by the NPWS for fire operations and in fire management planning. Specific fire fighting terms are explained in further detail within the NPWS Fire Management Manual.

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

Arson #: The deliberate ignition of any property or any land with the intent to maliciously destroy or damage it, or with the intent to endanger the life of another person.

Aspect: The direction towards which a slope faces, ie north-east. Slopes on a west to north-westerly aspect are the most hazardous during firefighting 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 (eg 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.

Backing Fire: The part of a fire which is burning back against the wind, where the flame height and rate of spread are minimal.

Biodiversity: The variety of life forms, the different plants, animals and micro-organisms, the genes they contain and the ecosystems they form.

Bush: A general term for forest or woodland, but normally used to describe indigenous forest.

Bush Fire (wild fire): A general term used to describe a fire in vegetation.

Bush Fire Alert: A promulgation by the Commissioner that there is a very high probability of a bush fire occurring in designated area(s) due to extremes of weather and prevailing drought indicators.

Bush Fire Danger Period #: The period defined by the *Rural Fires Act 1997* when restrictions on the lighting of fires apply. This period is from October 1 to March 31 in the following year. Under sec 82 of the *Rural Fires Act 1997*, a local authority (ie local council) may vary this period by notice published in a newspaper circulating generally within the area of the local authority to;

- (a) declare that there is no bush fire danger period for its area or part of its area, or
- (b) specify a different period to that set out in section 81 as the bush fire danger period for its area or part of its area.

Bush Fire Frequency: The average interval between successive bushfires in a given location.

Bush Fire Hazard: The condition of fuel in an area and the associated difficulty of suppression should the fuel ignite.

Bush Fire Hazard Reduction Work: The establishment or maintenance of fire breaks on land. It includes the controlled application of appropriate fire regimes or other means for the reduction or modification of available fuels within a predetermined area to mitigate against the spread of a bush fire but does not involve the construction of trails, tracks and roads.

Bush Fire Intensity: The rate of energy release per unit of fire front. It can be expressed in terms of flame height and the forward rate of spread of the fire front.

Bush Fire Management Committee: Constituted under the *Rural Fires Act 1997* for coordinated fire management and operations within a rural fire district under sec 50 of the *Rural Fires Act 1997* and fire districts as under sec 1(a) of the *Fire Brigades Act 1989*.

Bush Fire Management Plan: A Plan of Operations and/or a Bush Fire Risk Management Plan prepared by a Bush Fire Management Committee.

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 have been developed to mitigate against the threat of a wildfire.

(special note about the above: an 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, in order to achieve a set outcome (such as provide protection or slow the advance of a wildfire).

Bush Fire Risk Management Plan: A plan prepared by a Bush Fire Management Committee for the reduction of bushfire hazards within a rural fire district.

Bush Fire Risk: The probability of an ignition occurring and developing into a wildfire.

Bush Fire Threat: A sum of all factors which affect the ignition, spread and suppression of a wild fire and the damage to assets and natural and cultural heritage which may result.

Class 1: A wildfire under the control of the responsible fire authority, whether or not incident/ low level assistance is provided by other agencies.

Class 2: A fire which by necessity involves more than one agency and where the Bush Fire Management Executive has appointed a person to take charge of firefighting operations.

Class 3: A major bush fire or fires where an appointment has been made or is imminent under the provisions of Section 44 of the *Rural Fires Act 1997*.

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

Controlled Burn #: See Prescribed Fire.

Controlled Burning: See Prescribed Burning.

Critical Habitat: Habitat declared to be critical habitat under the Threatened Species Conservation Act 1995, that is habitat critical to the survival of a species, population or ecological community.

Crown Scorch: Browning of the needles or leaves in the crown of a tree or shrub caused by radiant heat from a fire.

Cultural heritage resources #: Aboriginal places, sites and artefacts as defined by the *National Parks and Wildlife Act 1974*, and historic sites and structures.

Dead fuels: Fuels having no living tissue. The moisture content is governed almost entirely by atmospheric moisture (relative humidity and precipitation), air temperature, and solar radiation.

Detection: The discovery of a fire. Individuals, fire towers, reconnaissance aircraft and automatic devices may be used, either alone or in combination.

Die Back: The progressive dying, from the top downward, of twigs, branches or tree crowns. A variety of agents including insect attack, disease and pollution may be solely or synergistically responsible.

District Incident Procedures #: Procedures prepared annually for Service District to respond to an incident situation.

Districts #: Administrative Districts of the NPWS.

Duff: The mat of undecomposed or partly decomposed vegetation matter on the forest floor, the original vegetative structures still being recognisable.

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

Ecologically Sustainable Development (ESD): Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.

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.

Elevated Dead Fuel: Dead fuel forming part of, or being suspended in, the shrub layer.

Endangered: A species, population or ecological community which is specified within the Threatened Species Conservation Act 1995 as being in danger of becoming extinct.

Environment: All aspects of the surroundings of humans, whether affecting them as individuals or in their social groupings.

Extinct: A species no longer in existence or not located in the wild during the past 50 years.

Extreme Fire Behaviour: A level of wildfire behaviour characteristics that ordinarily precludes methods of direct suppression action. One or more of the following is usually involved:

- high rates of spread
- prolific crowning and/or spotting
- presence of fire whirls
- a strong convective column

Predictability is difficult because such fires often exercise some degree of influence on their environment and behave erratically, sometimes dangerously.

Extreme Fire Danger: The highest fire danger classification.

Fine Fuels: Grass, leaves, bark and twigs less than 6 mm in diameter.

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 these three elements of fuel, oxygen and heat will extinguish a fire.

Fire Advantage: Any natural or built feature which assists in fire suppression activities.

Firefighting authorities #: Organisations vested by the *Rural Fires Act 1997* with the responsibility to suppress fires, including land management authorities.

Fire Behaviour: The manner in which a fire reacts to the variables of fuel, weather and topography. Changes in any of these variables will result in a change to fire 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 Control Center #: A facility established to coordinate firefighting operations, and may be located in the offices or premises of a fire authority.

Fire Control Officer: A Fire Control Officer is, subject to any direction of the Commissioner, responsible for the control and coordination of the activities of the Rural Fire Service in the rural fire district for which he or she has been appointed (s 37 of *Rural Fires Act 1997*). The powers of fire control officers on NPWS managed lands are tempered by s 38(4) of the *Rural Fires Act 1997*.

Fire Danger: The combination of all factors which determine whether fires start, spread and do damage, and whether and to what extent they can be controlled.

Fire Danger Index (FDI)/Fire Danger Rating: A relative number denoting an evaluation of rate of spread, or suppression difficulty for specific combinations of fuel, fuel moisture and wind speed.

Fire District: An area of land recognised as a management unit under the *Fire Brigades Act 1989*.

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).

Fire Fighting Apparatus: All vehicles, equipment and other things used for or in connection with the prevention or suppression of fire or the protection of life or property in the case of fire.

Fire Hazard: Any fuel which if ignited, may be difficult to extinguish.

Fire Hazardous Areas: An area where the combination of vegetation, topography, weather, and the threat of fire to life and property create difficult and dangerous problems.

Fire History #: A map of fire occurrence for an area, or the records of fire occurrence for a site.

Fire Line: A natural or constructed barrier, or treated fire edge, used in fire suppression and prescribed burning to limit the spread of fire.

Fire Management: All activities associated with the management of fire-prone land, including the use of fire to meet land management goals and objectives.

Fire Management and Incident Database #: A computer program used to store data on wildfire occurrence and fuel management programs.

Fire Management Plan: See Reserve Fire Management Plan.

Fire Management Zones: Zones within an area of fire-prone land which each have a specified fire regime for conservation and management purposes.

Fire operations #: Activities associated with the suppression of fires and prescribed burning.

Fire perimeter: The entire outer boundary of a fire area.

Fire Permit: A permit issued under S 89. of the *Rural Fires Act 1997* to conduct hazard reduction burning.

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 suppression activities. 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 dependant upon the prevailing weather conditions, drought indexes and number of wildfires that may already be burning within that area

Fire suppression #: Actions to control a fire from the time of detection to extinguishment.

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 Assessment: The means of calculating total and available fuel present in a given area.

Fuel bed: The arrangement and vertical profile of all readily combustible materials lying on the ground.

Fuel load: The oven dry weight of fuel per unit area. Commonly expressed as tonnes per hectare.

Fuel Moisture Content: The water content of a fuel particle as a percent of the oven dry weight of the fuel particle (% ODW).

Fuel Moisture Differential: A term used to describe the situation where the difference in the moisture content between fuels on adjacent areas results in a noticeably different fire behaviour on each area.

Fuel Profile: The vertical cross section of a fuel bed down to mineral earth.

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.

Fuel Weight: The oven dry weight of fuel per unit area is usually expressed in tonnes per hectare.

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 or the physical environment and fairly close interaction of all biological species involved.

NB: Organisms within the 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.

Key Species #: Key species may be defined as the following:

- (a) Species which are the potential dominants of a community and whose removal will significantly change the structure of the community.
- (b) Species which can be used to indicate the behaviour of a larger group of similar species.
- (c) Threatened species, populations and ecological communities identified under the *Threatened Species Conservation Act 1995*, their habitat, and other species of conservation concern.

Managed Lands: Areas under the care and management of a statutory authority as defined under the *Rural Fires Act 1997*. This includes NPWS parks and reserves.

NPWS #: The National Parks and Wildlife Service of New South Wales.

NPWS parks and reserves #: Areas administered under the *National Parks and Wildlife Act 1974*. For the purpose of this definition, these include national parks, nature reserves, historic sites, state recreation areas managed by Trusts, karst conservation reserves, regional parks and Aboriginal areas. These areas constitute managed lands under the definition of the *Rural Fires Act 1997*, accordingly fire management activities on such lands are the responsibility of the NPWS.

NSWFB: The New South Wales Fire Brigades.

Natural resources #: All elements of the natural environment.

Neighbours #: Landholders with properties adjoining or adjacent to NPWS parks and reserves.

Notifiable fire #: A fire that must be reported according to the requirements of s 64 of the *Rural Fires Act 1997*.

Patch Burning: Prescribed burning for the purpose of forming a barrier to subsequent burning or for conservation management.

Plan of Management: The document required by the *National Parks and Wildlife Act 1974* for the management of individual national parks, nature reserves and other protected areas under the control the NPWS.

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.

Prescribed Fire: See Prescribed Burning.

RFS: The Rural Fire Service.

Radiation zones #: The area where fuel levels are actively managed to protect adjoining assets.

Rare flora #: Species listed in the latest revised edition of Rare or Threatened Australian Plants, by J.D. Briggs and J.H. Leigh. Also includes flora species listed within Sch 1 and 2 of the *Threatened Species Conservation Act 1995*.

Rate of Spread: The forward progress per unit time of the head of the fire or another specified part of the fire perimeter.

Recovery Plan: A document which identifies the actions to be taken to promote the recovery of a threatened species, population or ecological community.

Region #: Administrative Region of the NPWS, which is comprised of a number of Districts.

Regional Incident Procedures #: Procedures prepared annually by Service Regions to coordinate incident response within those Regions.

Reserves #: See NPWS parks and reserves. Areas managed by the National Parks and Wildlife Service, which are known as managed lands under the *Rural Fires Act 1997*.

Reserve Fire Management Plans #: A document which details the desirable fire management regimes and objectives for a NPWS managed land. It assesses wild fire threats within the area, the type and nature of natural and cultural heritage, assets and other facilities within the reserve, and guidelines for any suppression activities or hazard reduction work to be undertaken within that area.

Rural Fire District: An area proclaimed under the *Rural Fires Act 1997* for administration and management by District Fire Management Committee and Rural Fire Brigades. These are proclaimed over, or over part of, Local Government areas. NPWS parks and reserves may be included in these Districts.

Rural Fire Officers: Collective term for Fire Control Officers and Rural Fire Brigade Officers.

Scorch Height: The height above ground level up to which foliage has been browned by a fire.

Species: A group of organisms which are biologically capable of breeding and producing fertile offspring with each other but not with members of other species.

Stag: A large, old tree either dead or with significant dead upper branches. Often hollow with an opening at ground level. Once alight, a stag represents a major hazard. However stags often present high habitat value to native fauna, particularly to endangered groups of owls and gliders

Strip Burning: Setting fire to a narrow strip of fuel adjacent to a fireline and then burning successively wider adjacent strips as the preceding strip burns out.

Threat Abatement Plan: A document under the Threatened Species Conservation Act 1995 which identifies the action to be taken to abate, ameliorate or eliminate the adverse impacts of threatening processes on threatened species, populations or ecological communities.

Threatening Processes: Processes such as habitat disturbance or destruction or pollution that threaten the survival, abundance or evolutionary development of a species, population or ecological community. Inappropriate fire regimes, whether too frequent or infrequent, may threaten specific threatened species, populations or ecological communities.

Topography: The surface features of a particular area or region. It may include mountains, rivers, populated areas, roads and railways and fuel types, ie the lay of the land.

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.

Water Point: Any natural or constructed supply of water that is readily available for fire control operations.

Wildfire: An unplanned fire. A generic term which includes grass fires, forest fires and scrub fires.

Wildlife #: Native fauna and flora.

2. THE PLANNING ENVIRONMENT

2.1 FIRE MANAGEMENT LEGISLATION

Rural Fires Act 1997 and Rural Fires Regulations 1997

The NPWS has statutory obligations under the *Rural Fires Act 1997* and the *Rural Fires Regulation 1997* to protect life and property on its lands and to prevent fire from leaving its property. Under the *Rural Fires Act 1997* the NPWS is a recognised Fire Authority. The Act provides for the responsible 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 reserve boundaries in collaboration with local brigades and park neighbours, in accordance with provisions of local Bushfire Management Plans.

Section 50 of the *Rural Fires Act 1997* sets up provisions for the establishment of Bush Fire Management Committees (BFMCs) with the task of developing and co-ordinating co-operative fire management between fire authorities across the state. The NPWS is a member of these committees where it has fire prone reserves. BFMCs are responsible for the development of both co-operative fire-fighting and programs for the reduction of bushfire hazards.

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.

In addition to the above, under the *Rural Fires Act 1997* the Fire Control Officer for a Rural Fire District, when a fire occurs on 'prescribed land', must comply with the conditions set out by the agency for that prescribed land. These conditions may be represented in any relevant bush fire management plan or "other relevant plan" agreed to by the authority responsible for the prescribed land (Section 38 s4) and to which the Fire Control Officer is aware of. This fire management plan for Kattang Nature Reserve is such a plan under Section 38 s4 of the *Rural Fires Act 1997*.

National Parks and Wildlife Act 1974 & National Parks and Wildlife (Land Management) Regulations 1995 – Amendments 1997.

Under the *National Parks and Wildlife Act 1974* the NPWS is empowered with the authority to conserve the natural and cultural heritage of NSW. This includes protected areas (national parks, nature reserves, regional parks, state recreation areas, identified wilderness areas, karst conservation reserves, marine parks, and joint management areas). The general objectives of the NPWS for management of lands under its control are:

- the protection and preservation of scenic and natural features
- the conservation of biodiversity
- the maintenance of natural processes as far as possible

- the preservation of Aboriginal and historic features
- the provision of appropriate recreation opportunities
- the encouragement of scientific and educational research into environmental features and processes, prehistoric and historic features and park use patterns.

The management of a protected area (whether it be a national park or other form of reserve) requires the preparation of a Plan of Management, under sec 72 of the Act, with a written scheme of operations against the impact of fire on the reserve. The preparation of a fire management plan, in line with the guidelines of the Plan of Management, fulfills this requirement.

The authority and responsibility of the NPWS extends to the protection of heritage off reserve 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.

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. Hence the NPWS fire management policies must not only safeguard the direct protection of human life, they must also ensure the protection of the natural and cultural heritage values of NSW.

The *National Parks and Wildlife (Land Management) Regulation 1995* and the *Amendment Regulation 1997*, regulate the lighting of fires within protected lands and authorise the prohibition of lighting of fires and/ or closure of areas to prevent bushfires during periods of high fire danger, where deemed necessary.

Environmental Planning and Assessment Act 1974 & Threatened Species Conservation Act 1995

Under the *Environmental Planning and Assessment Act 1974*, environmental assessment procedures must be conducted before undertaking fire management activities. The (draft) Environmental Planning and Assessment Manual (1994) details the principles and procedures for the assessment of environmental impacts relating to NPWS activities under Part V of the Act, such as hazard reduction, the construction and maintenance of fire trails, and other fire management activities.

In addition, environmental impacts must be assessed in relation to potential impacts on threatened species. The Threatened Species Policies and Procedures Manual (1996) details the policies and procedures for the management of threatened species, endangered ecological communities and endangered populations and their habitat. Inappropriate bushfire regimes are recognised as being a critical threatening process in the conservation of threatened species, endangered ecological communities and endangered populations and their habitat.

To meet the environmental legislative requirements contained within the Environmental Planning and Assessment Manual and the Threatened Species Policies and Procedures Manual, an Environmental Impact Assessment for the activities identified within the draft plan has been prepared and placed on public exhibition along with this plan.

2.1.1 Local & Regional Environmental Plans

The Hastings - Camden Haven Local Environment Plan recognises Kattang Nature Reserve as Zone 8(a). This zone is reserved for lands dedicated under the *National Parks and Wildlife Act 1974*.

Local councils have no statutory role or control over activities conducted within this zone.

2.1.2 State Environmental Planning Policies

The management of Kattang Nature Reserve complies with relevant State Environment Planning Policies.

In particular this plan aims to protect littoral rainforest under SEPP 26.

2.1.3 Regulations of involved organisations

The development of this fire plan has been undertaken with assistance from Bushfire Management Committee members, Volunteer Rural Fires Brigades, neighbours and individuals of professional and non-professional backgrounds. There will be consultation with the community through various committees and groups on an on-going basis.

As part of the NPWS commitment to protect assets, the NPWS has adopted the principles of “Community Fire Guard”. This program will promote interaction with the community to gain neighbour co-operation, to assist park neighbours and community members in providing protection for their own properties from wildfire, through self reliance gained by training.

Neighbouring properties identified as high risk areas will receive the first stage of “Community Fire Guard” training. Such neighbours generally possess assets located in areas isolated from immediate Bush Fire Brigade assistance. Other levels of “Community Fire Guard” training will be provided as needed.

This fire management plan has been placed on public display and modified to reflect community input. It will be used for fuel management planning by the NPWS, and submitted for adoption by the Hastings Bush Fire Management Committee, who will monitor and evaluate its implementation.

2.2 FIRE MANAGEMENT POLICIES OF THE NPWS

The fire management policies and procedures of the NPWS are contained in the NPWS Fire Management Manual, which is currently under internal review to reflect changes to legislation and co-ordinated fire fighting arrangements between the NPWS and Rural Fire Service (RFS).

The primary NPWS fire management objectives are:

- to prevent the occurrence of human caused unplanned bushfires on NPWS parks and reserves;
- to suppress unplanned bushfires occurring on NPWS reserves;
- to minimise the potential for spread of bushfires on, from, or into NPWS reserves;
- to protect from bushfires, persons and property on, or immediately adjacent to, NPWS parks and reserves;
- to manage bushfires to avoid the extinction of all species which are known to occur naturally

within NPWS parks and reserves; and

- to protect from damage by bushfires all Aboriginal sites, historic places and culturally significant features known to exist within NPWS parks and reserves

In addition, the NPWS Fire Management Manual also recognises the following fire ecology principles of the Australian environment:

- that fire is a natural phenomenon; one of the continuing physical factors of the Australian environment.
- that there is an evolutionary adaptation of many native species of plants and animals to fire regimes.
- that fire can be a useful management tool in promoting biodiversity conservation.

Fire is also used as a fuel reducing agent where this does not conflict with management objectives. Where life and property are directly threatened by fuel conditions, all steps will be taken to minimise risks, with other management needs regarded as secondary considerations.

The NPWS supports the principle of co-operative approach to fire suppression to most effectively use fire-fighting resources within the community. The 1995/96 - 1997/98 NPWS Corporate Plan identifies fire management as a priority corporate issue (fire management is covered within Priority Corporate Issue No.3: Park and Reserve Management).

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

2.3 NSW BIODIVERSITY STRATEGY

The *NSW Biodiversity Strategy (1999)* was prepared 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 is affecting the biological diversity of NSW. This issue is targeted within the Biodiversity Strategy by Objective 3.4 'Improve fire management regimes', and requires the following actions;

Action 72: Identify and implement fire management regimes that promote the recovery and survival of native flora and fauna.

Action 75: Encourage and assist land managers to include biodiversity as a consideration in the development of Fire Management Plans.

The NSW Biodiversity Strategy is intended to assist managers in achieving the above goals for implementing biodiversity conservation practices in fire management activities. The strategy requires that the results of applied fire research and the principles for biodiversity conservation be incorporated into all fire management plans. The strategy is also reflected in revisions to the NPWS

Fire Management Manual, which offers a structure for fire management plans 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.

2.3.1 Guiding principles for biodiversity conservation

Biodiversity conservation aims to prevent the extinction of species, particularly extinctions introduced by the actions of humans. The leading conservation objective of this fire management plan is:

- to manage fire to retain (avoid extinction of) all species known to occur naturally within Kattang Nature Reserve.

Contemporary ecological research in Australian fire prone ecosystems has established some general principles about the fire regimes needed to prevent species extinctions.

These principles are as follows:

- groups of plant and animal 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. An overview of the requirements of broad groups of species is needed. Requirements for most plant species can be summarised on the basis of a small number of groups representing the variation in fire regenerative strategies. Less is known about the requirements for groups of animals.
- animals and plants are interrelated. Plants form an important component of habitat for animals. Animals are important post-fire dispersal agents for plants. Fire management must consider these important interactions.
- a diversity of fire regimes may be needed to maintain biodiversity. This means that over time there is a place for fires of high, moderate and low intensity, frequency, different seasonal occurrence and size. Extinctions may be likely when fire regimes of relatively fixed intensity, frequency, season and size prevail without interruption.
- for some groups of species, thresholds separating desirable and undesirable fire regimes can be defined. Management should therefore be targeted towards the desirable fire regimes using these thresholds as a guide. The manipulation of fire regimes needs to be incorporated into management strategies, taking into account the occurrence of unplanned fires.
- the recording and mapping of fire locality and characteristics is required so that strategies manipulating fire regimes can be regularly reviewed and adjusted. Depending on circumstances

there may be a role for both prescribed fire or fire exclusion in areas of a given conservation reserve at different times in the future.

The management of fire for the conservation of biodiversity in Kattang Nature Reserve will be based on the above principles of fire ecology.

2.4 MANAGEMENT OBJECTIVES OF THE RESERVE

The management of Kattang Nature Reserve is prescribed by objectives stated in the *National Parks and Wildlife Act, 1974*. It is a requirement under the Act that no operations and actions are undertaken that are contrary to the Plan of Management prepared for the reserve.

A Draft Plan of Management for Kattang Nature Reserve is currently being developed. The following fire management issues are likely to be explored within the Plan of Management:

- * The establishment of a fire regime consistent with maintaining plant diversity in both heath and woodland areas.
- * The reduction of risk of damage by bushfire to life and property both within and immediately adjacent to areas where the NPWS has a statutory responsibility.
- * The effective management of bushfire for the protection and conservation of the natural, cultural, scenic and recreational features of the reserve.
- * The planning and implementation of fire management in co-operation with other organisations within the region.

As a nature reserve dedicated primarily for the conservation of natural heritage, and for the scientific and education values represented within the area, there are restrictions on the provision of recreation activities and facilities provided within the nature reserve. Specifically in relation to fire management, recreational fires (ie open fire places, wood fire barbecues) are not permissible within Kattang Nature Reserve.

Additionally, other specific fire management actions are likely to be set for the (draft) Plan of Management during its preparation:

- to exclude fire from littoral rainforest and dune vegetation
- villages, neighbours and facility areas within and adjacent to Kattang Nature Reserve will be protected by fire trails, fire radiation zones and areas of hazard reduction
- wherever practical wildfires within Kattang Nature Reserve will be suppressed with the aim of re-establishing extensive areas of native plant and animal communities which are free of an unacceptable level of fire.
- a program of prescription burning will be progressively introduced within Kattang Nature Reserve to establish a mosaic of vegetation communities of different fire age classes.
- the pattern of the mosaic will be on compartments bounded by existing public roads, internal management tracks and naturally occurring firelines such as streams and wetlands.

- new tracks will be constructed where necessary for fire control or other emergency operations. All new tracks constructed for emergency operations will be closed and rehabilitated as soon as possible after each emergency.
- research into fire behaviour, fire hazard and risk assessment and the impact of fire on the biodiversity represented within the nature reserve will be encouraged.

3. DESCRIPTION OF THE RESERVE

3.1 LOCATION

Kattang Nature Reserve covers about 68 hectares of coastal lands on the Mid North Coast of New South Wales. The reserve is located south of the coastal town of Port Macquarie and is contiguous with the village of Dunbogan which is immediately to the east of Laurieton.

The reserve incorporates the coastal headlands of Perpendicular Point and Camden Head, and the immediate lands behind. The reserve adjoins suburban lands to the west.

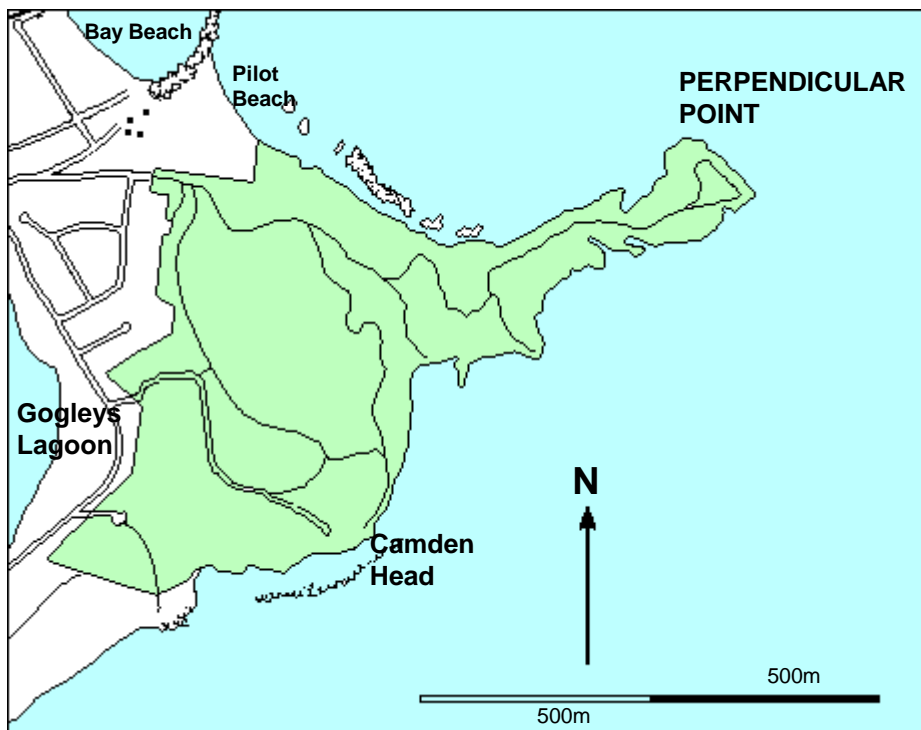
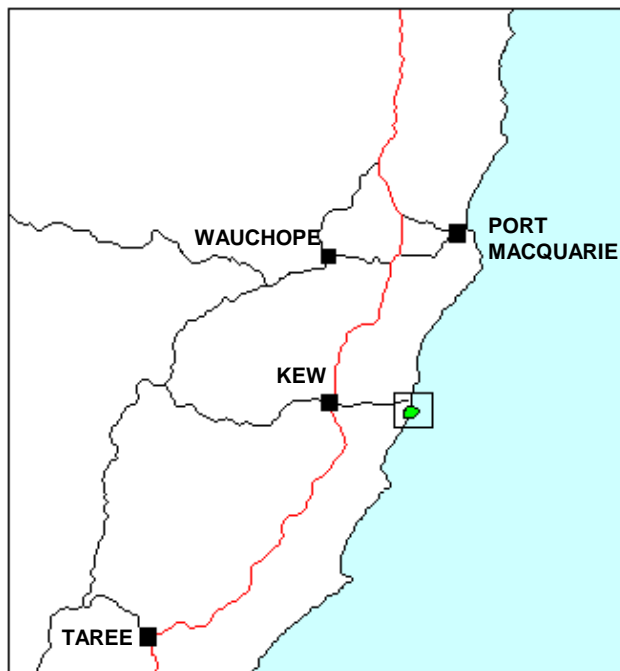
Within the reserve there is a diversity of natural environments, the main features include:

- a wide range of landforms which are evidence of past and present coastal processes;
- habitats which support a diverse range of wildlife communities including endangered flora, fauna and birds protected under international agreements;
- a wide range of coastal vegetation communities including wet and dry heath land, littoral rainforest, and headland complexes.

Recreational activities include: fishing, picnicking, bushwalking, birdwatching and photography. Recreational facilities within the reserve are low key walking tracks, rustic seating and a hang-gliding platform.

MAP 1 LOCATION OF RESERVE

MAP 1 LOCATION OF RESERVE



3.2 TERRAIN

Kattang Nature Reserve is a rocky headland rising to about 80m above sea level, the often sheer cliffs being derived from the overflow of volcanic rhyolitic lava during the Tertiary period and others from Triassic sedimentary rock. There are small peat areas in the lowland swamps that have the potential of forming acid sulphate soils when fire exposes the subsoil to air. There are also significant areas of quaternary aeolian sand deposits.

3.3 BIODIVERSITY AND FIRE ECOLOGY

3.3.1 Flora

The vegetation of Kattang Nature Reserve is rich in both individual species and structural diversity. Ten broad vegetation units have been defined in the reserve, ranging from herbland communities on the coastal slopes through to heath, shrubland and low closed forest including broad-leaved paperbark swamps (*Melaleuca quinquenervia* dominated), and a small section of headland dry rainforest dominated by brush box *Tristania conferta*. The heath communities are found across the interior of the reserve and produce a profusion of wildflowers during the spring. Banksias, in particular *Banksia serratifolia*, are very common in this community. The heath areas of Camden Head are locally referred to as the “Flower Bowl”.

Of particular significance on Point Perpendicular headland is the presence of the Horsetail she-oak *Casuarina equisetifolia* ssp. *incana*. This is the southern natural limit of this plant. An endangered parasitic plant, Austral Toadflax *Thesium australe* is also located on Point Perpendicular, found in association with Kangaroo Grass *Themeda australis* communities.

Two small patches of littoral rainforest occur at the northern and southern end of the reserve. A leading biodiversity conservation objective of this plan is to exclude fire from these communities.

The vegetation of the areas where asset protection and strategic wildfire control zones require fuel management mainly consist of dry sclerophyll forest dominated by *Angophora floribunda* - *E. intermedia*/*Banksia serrata* and dry sclerophyll shrubland communities dominated by *Banksia aemula* - *Allocasuarina littoralis*. These treatment areas consist of approximately 5 hectares of these floral communities within the reserve.

The following table provides details on the existing vegetation communities of the park.

Table 1 - Broad Vegetation Categories-Complexes

Plant Complexes
Littoral Rainforest
Dry Sclerophyll Shrubland
Swamp Sclerophyll Shrubland

Dry Heathland
Dry Sclerophyll Forest & Woodland
Swamp Sclerophyll Forest and Woodland
Tussock Grassland
Sod Grassland
Headland
Foredune Complex Acacia Spinifex

The following table defines fire regime thresholds for several major plant communities (Table 2) represented within Kattang Nature Reserve. These groups contain aggregations of communities as outlined in Steve Griffith's "Vegetation of Crowdy Bay". To ensure that the specified thresholds are not crossed, fire regimes will be manipulated where necessary within the reserve. This will occur within constraints imposed by commitments to other objectives, such as protection of assets, life and property.

Fire regimes beyond these thresholds will result in the decline of plant species and will cause changes in structure and vegetation cover adverse to native animal species. It is also likely that adverse fire regimes may influence the distribution of pest animals and weed species within the park, thus again affecting the biodiversity attributes of the reserve.

TABLE 2 Fire regimes for plant communities

(Pers. Com. Dr. R. Bradstock 1996)

Number Code	Plant Community	Threshold
1	Littoral rainforest	No fire acceptable
2	Dry Forest complex	Decline predicted if more than two successive fires occur at less than 5 years apart. Decline predicted if there are no fires for more than 30 years. Decline predicted if successive fires occur which totally scorch or consume the tree canopy.
3	Shrubland/heath complex	Decline expected if more than two fires in succession occur at less than 8 years apart. Decline expected if more than two successive fires occur at intervals of more than 15 years apart
4	Grassland/herbfield complex	Decline expected if more than two fires in a row occur at less than 5 years apart. Decline expected if more than two fires in a row occur at intervals of more than 15 years apart

One endangered flora species listed under the *Threatened Species Conservation Act 1995* is known to occur within Kattang Nature Reserve, being Austral Toadlax *Thesium australe*. Three other endangered plants are likely to occur; *Durringtonia paludosa*, *Acronychia littoralis* and *Cynanchum elegans*. Two vulnerable plant species, *Gononocarpus salsoloides* and *Allocasuarina defungens*, are also likely to occur within the reserve.

Thesium australe is known to occur within grassland communities on coastal headlands. This species is known to have a wide distribution but is considered as an endangered species because of its rarity across its range. A small population of this species is found in association with *Themeda*

australis on Point Perpendicular, while the remaining grassland communities of the headland are potential habitat areas for this species.

Durringtonia paludosa occurs north from Laurieton and grows in closed sedgeland communities within coastal swamps. A small area of potential habitat is represented for this species within the reserve, though more representative habitat occurs within the nearby Crowdy Bay National Park. *Acronychia littoralis* is known to occur within littoral rainforest communities. *Cynanchum elegans* is a rainforest climber. It has a rare occurrence between Wollongong to Cape Hawke, and within Port Macquarie District other populations are known from Smoky Cape, Crescent Head (Delicate Nobby), Sea Acres Nature Reserve, Manning Point and Hallidays Point.

The following table provides information on the known fire ecology of these species:

TABLE 3 Fire regimes for threatened plant species

(Pers.Com. Dr R. Bradstock 1996)

Number Code	Species	Common Name	Community	Fire Regime
1	3.3.1.1.1.1.1 <i>Thesium australe</i>	Austral Toadflax	Grassland-Herbfield	Plant species promoted by fires less than 10 years apart.
2	<i>Durringtonia paludosa</i>	Unknown	Closed Sedgelands	Fire regime specified in Table 2 is compatible with conserving this species.
3	<i>Acronychia littoralis</i>	Scented Acronychia	Littoral rainforest and margins	Fire regime specified in Table 2 is compatible with conserving this species.
3	<i>Cynanchum elegans</i>	Unknown	Littoral rainforest and margins	Fire regime specified in Table 2 is compatible with conserving this species.
4	<i>Gonocarpus salsoloides</i>	Nodding Raspwort	Shrubland-Heath Complex	Fire regime specified in Table 2 is compatible with conserving this species.
5	<i>Allocasuarina defungens</i>	Unknown	Shrubland-Heath Complex	Fire regime specified in Table 2 is compatible with conserving this species.

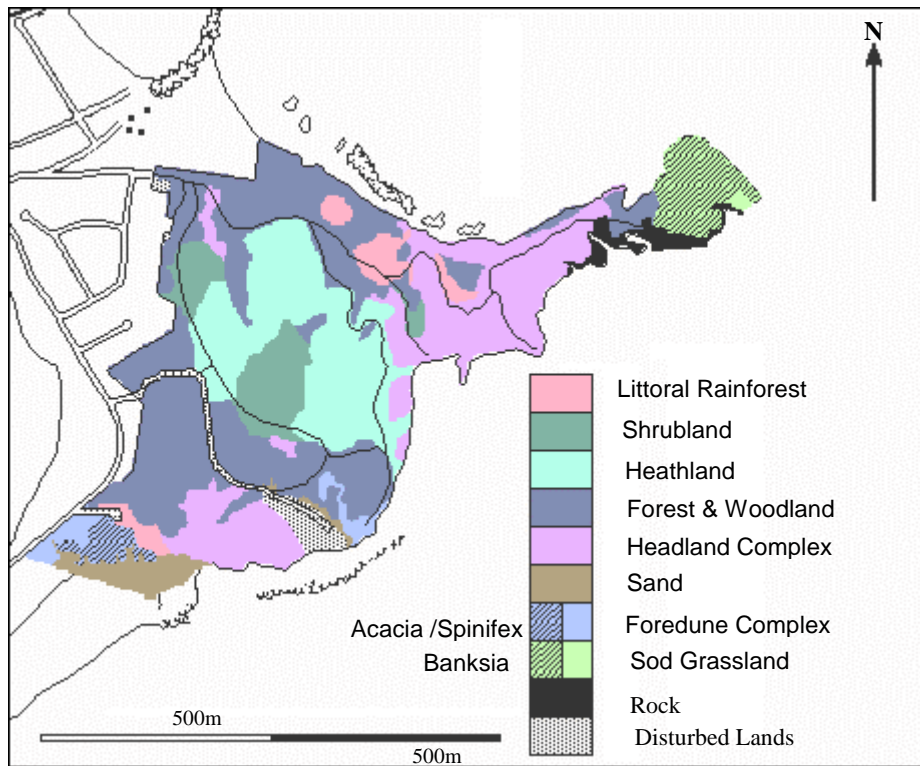
In addition to threatened flora, there are other significant plant species which occur in Kattang Nature Reserve which also require consideration within this plan, and within the wider conservation planning of the reserve. These species are detailed below:

TABLE 4 Plant species near the limit of their distribution

Southern Limit		
Species	Common Name	Habitat
<i>Ccasuarina equisetifolia</i>	Horse-tail Oak	Headlands
<i>Eucalyptus planchoniana</i>	Needlebark Stringybark 1 tree known HAMZ1 ref 845987	Dry Sclerophyll Forest/ Woodland
<i>Persoonia virgata</i>	Narrow-leaved Geebung	Dry-wet heaths and forests
Northern Limit		
<i>Gonocarpus salsoloides</i>	Nodding Raspwort	Shrubland/heath
<i>Persoonia katerae</i>	A geebung	Dry Sclerophyll forest

In addition, an isolated very small population of *Banksia ericifolia* occurs within the reserve, at HAMZ1 Map reference Laurieton 1:25,000 GR E845 N990.

MAP 6 VEGETATION COMPLEXES



3.3.2 Fauna

To date, a comprehensive fauna survey has not been conducted across Kattang Nature Reserve, though the reserve is known to support a rich diversity of native fauna. Additionally, the reserve contains habitat likely to provide value to some threatened migratory species.

TABLE 5 Endangered and vulnerable animals

(after - Schedules 1,2 &3 *Threatened Species Conservation Act 1995* - 31/10/97 Update)

Specific name	Common name	Known in reserve
Endangered species		
Birds		
<i>Burhinus magnirostris</i>	Beach Thick-Knee	Yes
<i>Sterna albifrons</i>	Little Tern	Yes
Vulnerable species		
Amphibians		
<i>Crinia tinnula</i>	Wallum Froglet	
Reptiles		
<i>Hoplocephalis stephensii</i>	Stephens' Banded-snake	
Birds		
<i>Caldis alba</i>	Sanderling	
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	Yes
<i>Coracina lineata</i>	Yellow-eyed Cuckoo-shrike	
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	
<i>Haematopus longirostris</i>	Pied Oystercatcher	
<i>Lophoictinia isura</i>	Square-tailed Kite	
<i>Ninox strenua</i>	Powerful Owl	
<i>Pachycephala olivacea</i>	Olive Whistler	
<i>Pandion haliaetus</i>	Osprey	
<i>Ptilinopus magnificus</i>	Wompoo Fruit-dove	
<i>Tyto novaehollandiae</i>	Masked Owl	
<i>Xenus cineris</i>	Terek Sandpiper	
Mammals		
<i>Miniopterus australis</i>	Little Bent-wing Bat	
<i>Miniopterus schreibersii</i>	Common Bent-wing Bat	
<i>Myotis adversus</i>	Large-footed or Fishing Bat	
<i>Petaurus norfolcensis</i>	Squirrel Glider	
<i>Phascogale tapoatafa</i>	Brushed-Tailed Phascogale	
<i>Phascolarctos cinereus</i>	Koala	
<i>Planigale maculata</i>	Common Planigale	
<i>Pseudomys gracilicaudatus</i>	Eastern Chestnut Mouse	
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	
<i>Syconycteris australis</i>	Queensland or Common Blossom Bat	

The following table describes the known fire ecological response and potential fire effects on threatened fauna known or likely to occur within Kattang Nature Reserve. The fire regimes of these species is considered to be related to the fire regime threshold for the preferred vegetation community in which they occur.

Table 6: Threatened Fauna – Potential Fire Effects:

Threatened Fauna	Scientific name	Preferred Habitat (Occurrence within reserve)	Potential Fire Effects (Ayers et al (1996), Bradstock, R. A. & authors knowledge/ opinion)
Schedule 1 Endangered			
Beach Thick-Knee	<i>Burhinus magnirostris</i>	Beach and swale areas. Open woodlands with a grassy understorey. <i>Predicted - vagrant</i>	Habitat represented along beaches unlikely to be impacted by fire. Frequent fire in open woodland temporarily reduces food item density and greatly reduces density of fallen timber (prime shelter).
Little Tern	<i>Sterna albifrons</i>	Beach and swale areas <i>Predicted - vagrant</i>	Habitat unlikely to be impacted by fire
Regent Honeyeater	<i>Xanthomyza phrygia</i>	Open forest and woodland. Coastal heath <i>Predicted vagrant</i>	Frequent fires may reduce feed shrub species. Long absence of fire may cause declines in food shrub species. Intense fire may cause tree damage interrupting winter flowering of feed species and reducing bark availability for nesting.
Schedule 2 Vulnerable			
Wallum Froglet	<i>Crinia tinnula</i>	Paperbark swamps <i>Predicted</i>	Any fire in habitat could damage habitat quality.
Stephen's Banded Snake	<i>Hoplocephalus stephensi</i>	Rainforest and wet sclerophyll forest <i>Predicted</i>	Frequent fire may reduce habitat/ foraging cover, and may reduce prey diversity and density.
Black necked Stork	<i>Ephippiorhynchus asiaticus</i>	Wetlands, swamps and estuaries. Predicted	Fires in wetlands reduce the available habitat area for this species.
Osprey	<i>Pandion haliaetus</i>	Tall Forest (nesting sites) Estuaries and oceans. <i>Resident</i>	Fire poses a risk to suitable nesting sites, while frequent fires may consume the available nesting material.

Square tailed Kite	<i>Lophoictinia isura</i>	Open forest, woodlands and heath <i>Predicted</i>	Frequent fires may reduce prey numbers. Frequent low intensity burns may reduce habitat quality of prey species. Fire poses a risk to suitable nesting sites, while frequent fires may consume the available nesting material.
Pied Oystercatcher	<i>Haematopus longirostris</i>	Beach and swale areas <i>Resident</i>	Habitat unlikely to be impacted by fire
Sooty Oystercatcher	<i>Haematopus fuliginosus</i>	Rock platforms, beaches and swale areas <i>Resident</i>	Habitat unlikely to be impacted by fire
Terek Sandpiper	<i>Tringa terek</i>	Beach and swale areas <i>Predicted</i>	Habitat unlikely to be impacted by fire
Sanderling	<i>Caldis alba</i>	Beach and swale areas <i>Predicted</i>	Habitat unlikely to be impacted by fire
Powerful Owl	<i>Ninox strenua</i>	Old growth Open Forest and Woodlands, moist gullies <i>Predicted</i>	Frequent fires may reduce prey numbers. Frequent low intensity burns may reduce habitat quality of prey species.
Olive Whistler	<i>Pachycephala oliveacea</i>	Littoral rainforest, open forest <i>Predicted</i>	Frequent fires may reduce feed shrub species. Long absence of fire may cause declines in food shrub species. Intense fire may cause tree damage interrupting winter flowering of feed species and reducing bark availability for nesting.
Wompoo fruit-dove	<i>Ptilinopus magnificus</i>	Littoral rainforest <i>Predicted vagrant</i>	Frequent fires may reduce feed shrub species. Long absence of fire may cause declines in food shrub species.
Yellow eyed Cuckoo-shrike	<i>Coracina lineata</i>	Littoral rainforest <i>Predicted</i>	Frequent fires may reduce feed shrub species. Long absence of fire may cause declines in food shrub species. Intense fire may cause tree damage interrupting winter flowering of feed species and reducing bark availability for nesting.

Glossy Black Cockatoo	<i>Calyptrorhynchus lathami</i>	Tall dry sclerophyll with hollows in mature trees for nesting. Foraging grounds found in Casuarina/ Allocasuarina woodland/ headland complexes. <i>Resident</i>	Frequent fire in vegetation communities with Casuarine/ Allocasuarina spp can remove foraging habitat. Long absence of fire in woodlands/ forests may cause a reduced regeneration of nest hollows.
Brush tailed Phascogale	<i>Phascogale tapoatafa</i>	Dry sclerophyll open forest with open understorey <i>Predicted</i>	Long absence of fire may cause a lack of nesting hollow regeneration. Intense or frequent fires may directly damage foraging sites and reduce invertebrate prey numbers.
Koala	<i>Phascolarctus cinereus</i>	Open forest and woodland containing food trees on higher nutrient soils <i>Resident</i>	Intense fires may cause injury to individual animals. Intense fires may affect food tree diversity.
Squirrel Glider	<i>Petaurus norfolcensis</i>	Open forest and woodlands <i>Predicted</i>	Long absence of fire may cause a lack of nesting hollow regeneration. Intense fires may affect foraging sites.
Eastern Chestnut Mouse	<i>Pseudomys gracilicaudatus</i>	Coastal heath, open forest with grassy understorey, rushlands <i>Predicted</i>	Frequent fires may reduce cover and feed availability, while a long absence of fire may result in too dense a cover, which reduces food species diversity.
Common Planingale	<i>Planingale maculata</i>	Coastal heath, open forest with grassy understorey, rushlands <i>Predicted</i>	Frequent fires may reduce cover and feed availability, while a long absence of fire may result in too dense a cover, which reduces food species diversity.
Queensland Blossom Bat	<i>Syconycteris australis</i>	Littoral rainforest, with foraging areas in coastal heath, eucalypts in blossom <i>Predicted vagrant</i>	Intense fires may affect foraging sites.
Eastern Little Mastiff Bat	<i>Mormopterus norfolkensis</i>	Wet sclerophyll forest, creeklines, forest canopy and in roofs <i>Predicted</i>	Intense fires may affect foraging sites.
Little Bent wing Bat	<i>Miniopterus australis</i>	Dry/ wet sclerophyll forest as foraging grounds. <i>Predicted vagrant</i>	Intense fires may affect foraging sites.

Large Bent wing Bat	<i>Miniopterus schreibersii</i>	Dry/ wet sclerophyll forest as foraging grounds. <i>Predicted vagrant</i>	Intense fires may affect foraging sites.
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	Dry/ wet sclerophyll forest as foraging grounds. <i>Predicted vagrant</i>	Intense fires may affect foraging sites.
Large-footed or Fishing Bat	<i>Myotis adversus</i>	Dry/ wet sclerophyll forest as foraging grounds. <i>Predicted vagrant</i>	Intense fires may affect foraging sites.

It should also be noted that fire may introduce or increase pest animal densities within the nature reserve, if the general fire regime encourages the establishment of such pest species (ie becomes too frequent). This may in turn introduce indirect impacts on threatened fauna within the reserve, eg habitat displacement, predation etc.

Kattang Nature Reserve also contains habitat for many wader species, who utilise estuaries, coastal beaches and rock platforms within the reserve as foraging grounds and/or roosting points. These waders are covered by international agreements, including between Australia, Japan and China. Fire management activities are unlikely to affect such species.

To date there is little information available on the invertebrate fauna represented within the reserve. However, it is considered that fire is likely to have some impact on invertebrate populations of the reserve.

3.4 CULTURAL HERITAGE

3.4.1 European

There are no significant cultural heritage items within the reserve.

3.4.2 Aboriginal

There are four aboriginal middens located within the reserve. There are additional middens located the foreshores of Gogleys Lagoon and one is recorded beneath a home in Bergalia Street. All middens within the reserve are within heritage zones of this plan.

It is likely that intense fires may impact on midden sites, scorching the shell material within such middens if exposed or if close to the soil surface.

Kattang Nature Reserve lies wholly within the Purfleet-Taree Land Council area.

3.5 RECREATIONAL USE AND FACILITIES

Headlands and walking tracks are the most used areas of the reserve. Hameys Lookout, which is accessible by a short gravel road, is also a locally popular attraction.

Day use includes fishing from rock platforms, picnicing, sightseeing, bushwalking, birdwatching

and photography. These activities are catered for by park signs, walking tracks, bench seats and lookout structures. A picnic site is located nearby but off the reserve. A car park within the reserve is located on the floor of a disused quarry.

4. BUSHFIRE ENVIRONMENT

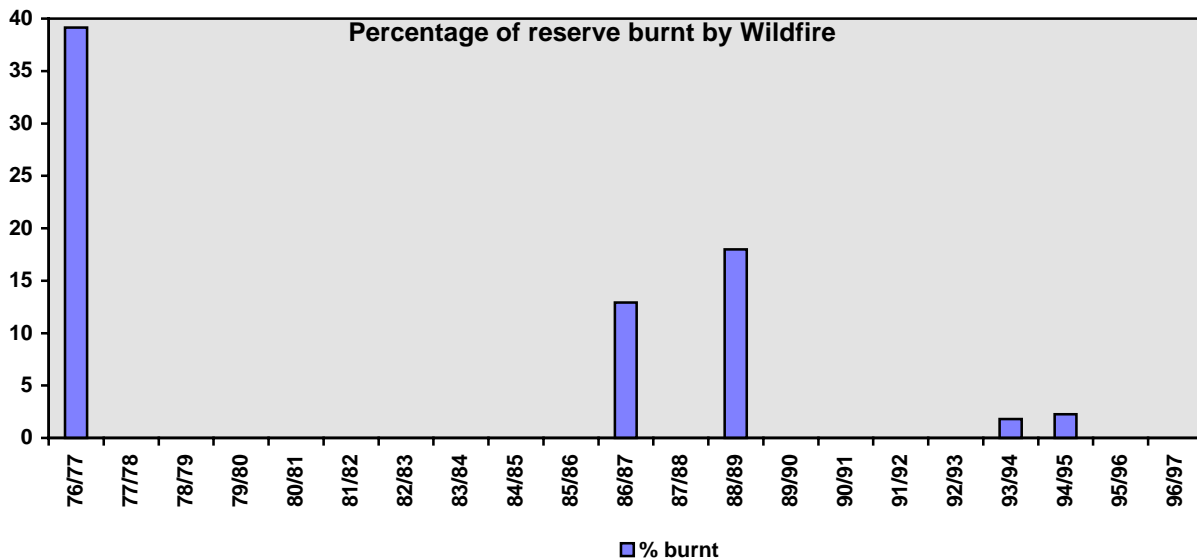
4.1 FIRE HISTORY AND FREQUENCY

4.1.1 Wildfires

4.1.1.1 Severity of wildfires

The fire history for Kattang Nature Reserve over the past twenty years show that there have been a total of five fires during this period. Apart from the 1976/77 fire, these have been of low intensity and usually associated with escapes from picnic fires and arson

GRAPH 1 Percentage of reserve burnt by wildfires



Because of the lack of fire advantages within the reserve system, fires are difficult to contain and generally spread rapidly. The upgrading of walking tracks to make fire advantages (eg. by gravelling the surface of walking trails and slashing a fire radiation protection zone) will greatly assist in controlling fires.

4.1.1.2 Ignition sources

The fire history of the reserve show fire ignition points are related to both internal access routes and nearby roads and are illegally lit (arson). **Error! Reference source not found.** indicates that all fire ignitions from 1976 to 1997 have occurred within the reserve. Approximately eighty percent of ignitions occurred close to the reserve's western boundary.

There may be a need to restrict access to the reserve to reduce the occurrence of fire ignitions in periods of high to extreme fire danger.

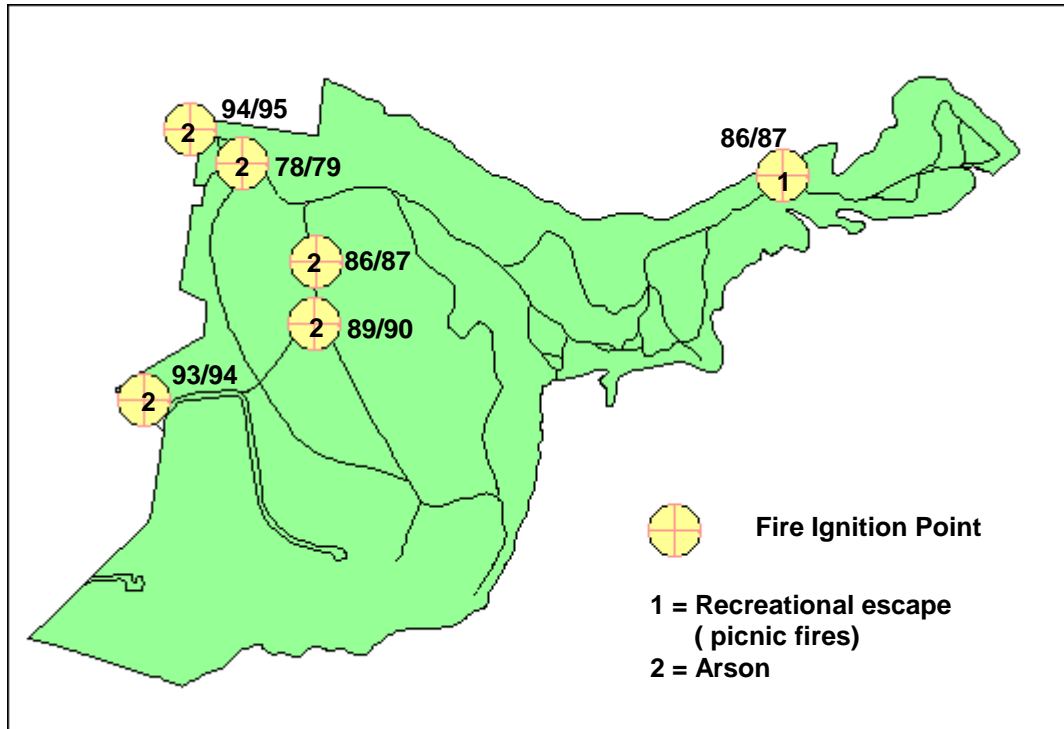
Kattang Nature Reserve is a coastal reserve which is dominated by coastal heath and woodland communities. These plant communities in adverse fire weather conditions can burn intensely. The

fire potential of the reserve area would be considered high to extreme depending on the weather and fuel loadings.

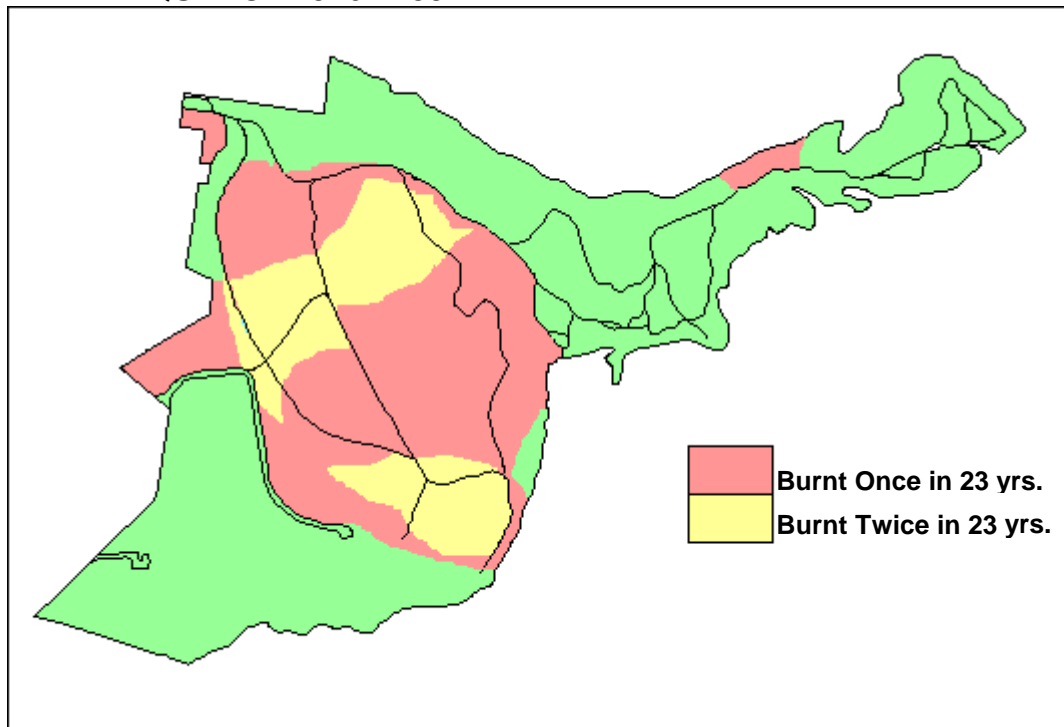
The major fire paths mapped over the past twenty years (**Error! Reference source not found.**) suggests that it is the heath and woodland areas of Kattang Nature Reserve that are most susceptible to fire. The prevailing weather conditions determine the major fire runs and can make fire suppression very difficult.

MAP 3 FIRE IGNITION POINTS and FIRE FREQUENCY

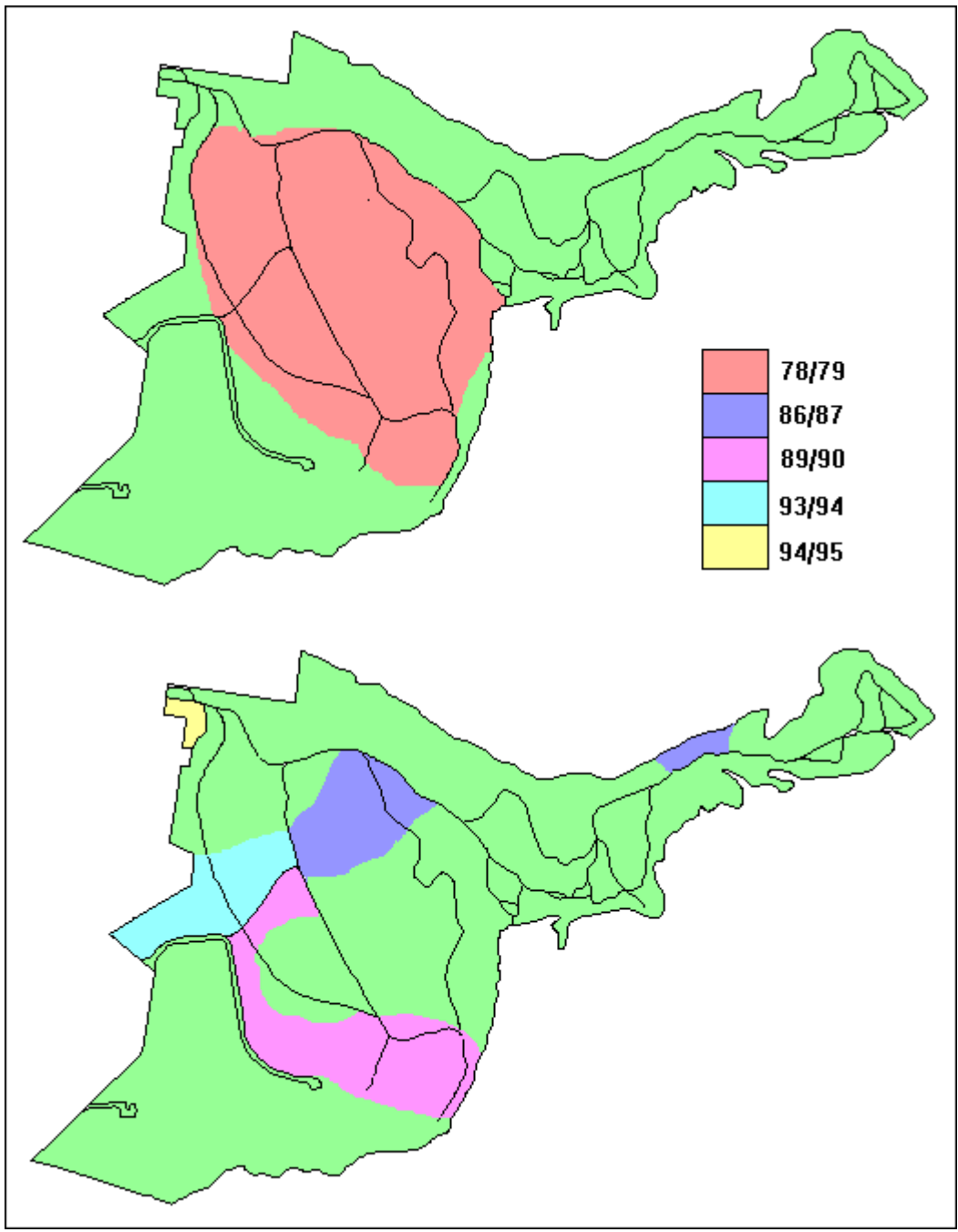
FIRE IGNITION POINTS 1976-1997



FIRE FREQUENCY 1976 - 1997



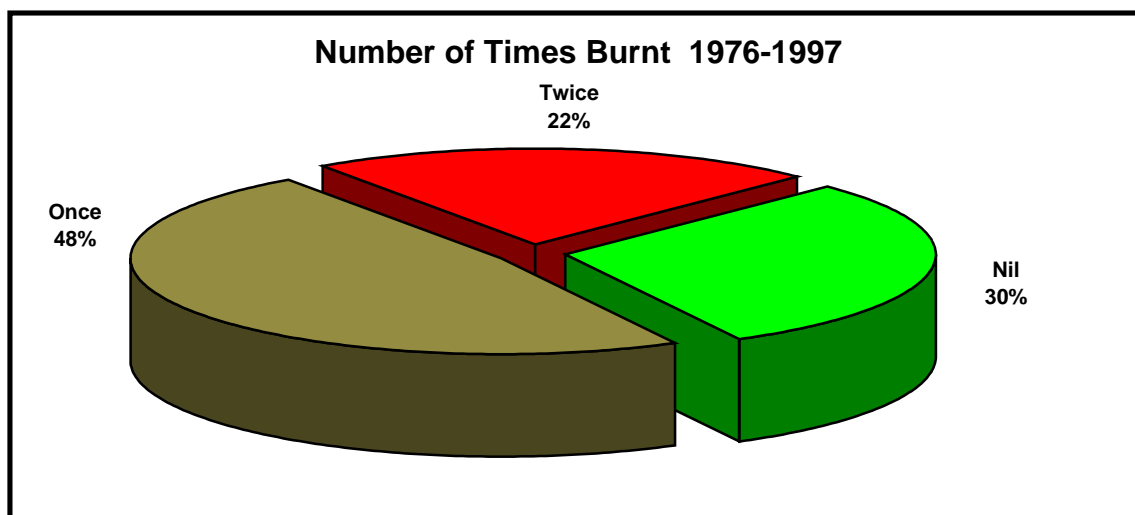
MAP 4 FIRE HISTORY 1976-1997



4.1.1.3 Fire frequency

Error! Reference source not found. provides an indication of the areas affected by wildfires from 1976 to 1997. The following chart has been generated using available fire history information.

CHART 1 Reserve fire frequency 1976-1997



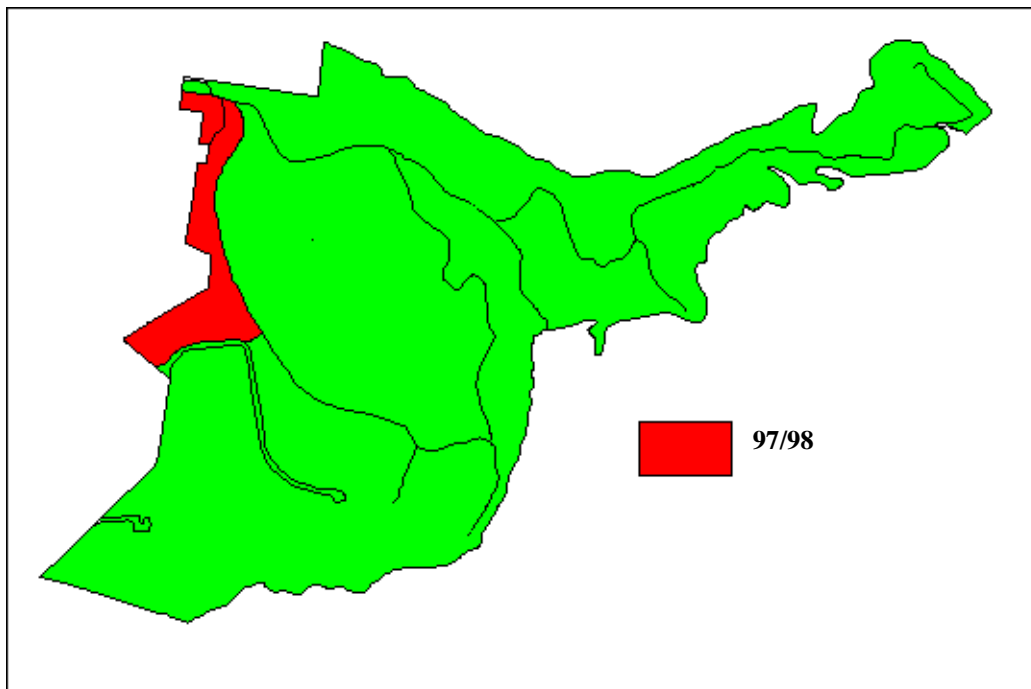
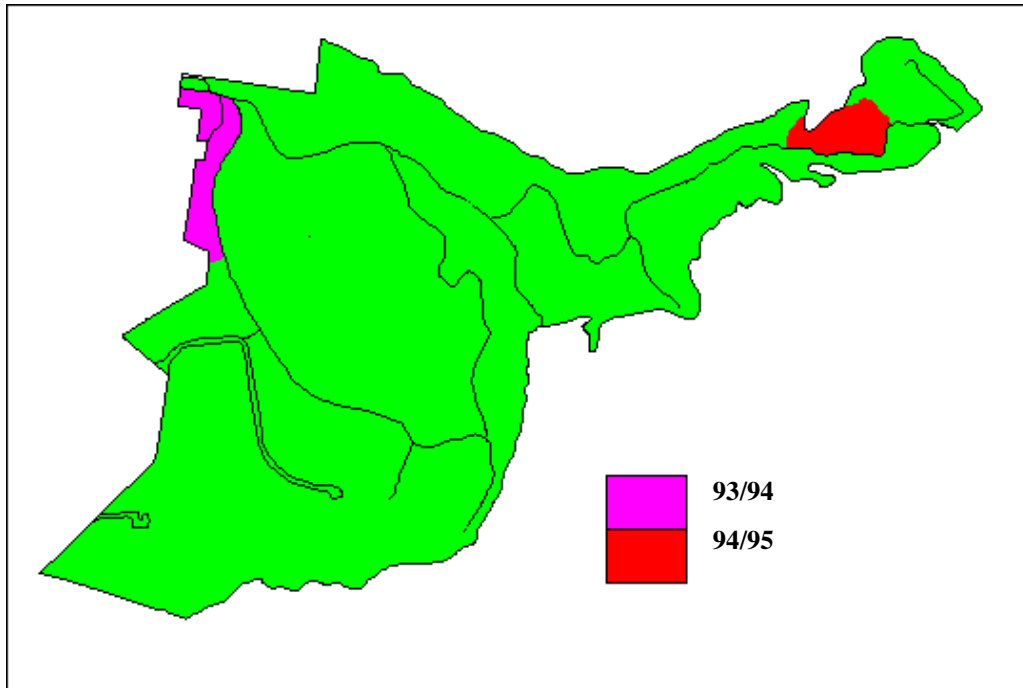
The following prescribed burning has been carried out in the reserve:

TABLE 7 Prescribed burning 1984-1998

Fire Year	Total Area
1993/94	1.13
1994/95	1.53
1997/98	3.30

This table excludes slashing and other fuel modifications which may be carried out from time to time in the nature reserve.

MAP 5 PRESCRIBED BURNING



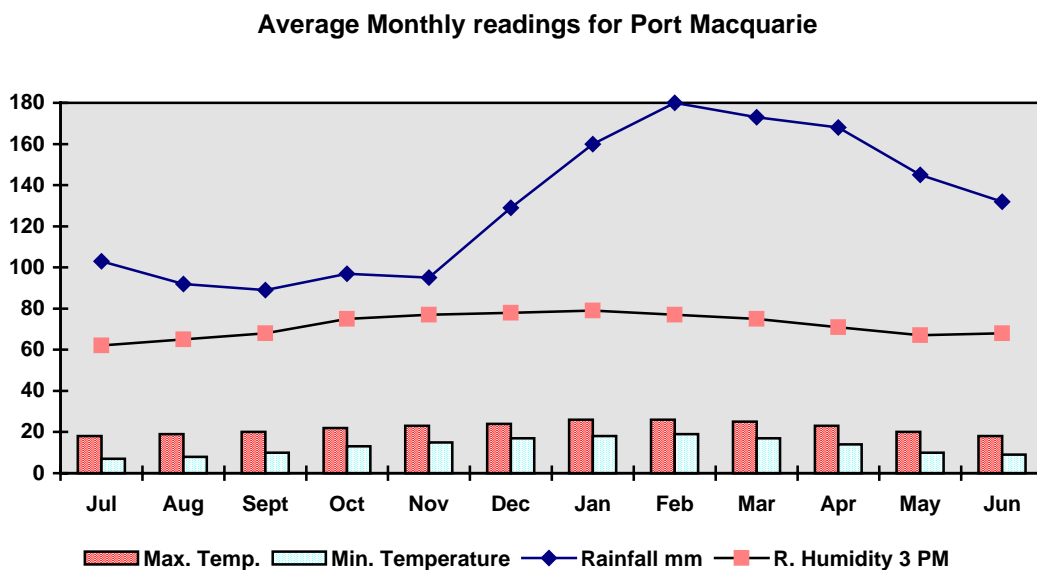
FIRE WEATHER

4.2.1 Climate

4.2.1.1 General

Kattang Nature Reserve is located to the south of Port Macquarie, which experiences a subtropical climate, with warm to hot summers and afternoon sea breezes. Winters are characterised by mild days and cool nights. Frosts are infrequent and usually not severe.

GRAPH 2 Temperature, relative humidity and rainfall



4.2.1.2 Temperature - Port Macquarie

The records obtained from the Port Macquarie weather station show that the average maximum temperature occurs in February (25.7°C). The average minimum temperature occurs in July (7.0°C).

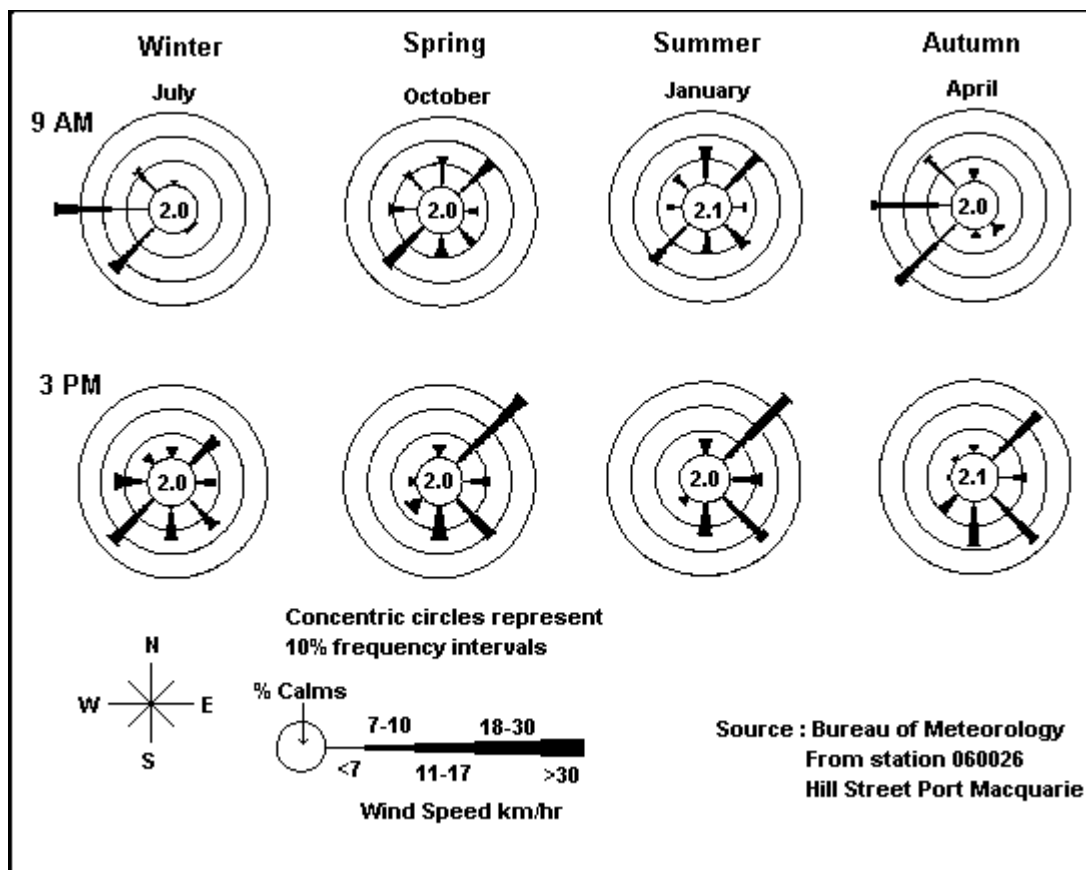
4.2.1.3 Relative humidity - Port Macquarie

The relative humidity is high throughout the year. January to March is generally the most humid period. The influence of westerly winds in the summer months can however cause relative humidity to fall to the mid thirties.

4.2.1.4 Rainfall - Port Macquarie

The average annual rainfall for the area is 1550 mm. The highest rainfalls occur from January to April, and the lowest between August and November.

CHART 2 Wind - Port Macquarie



The Wind Roses for 4 typical seasonal months illustrated show the preponderance of NE afternoon sea breezes, particularly in spring and summer. The October and January roses show the infrequent, though often strong, NW and SW winds that are typical of a blocking High Pressure system in the Coral Sea or Northern Tasman Sea.

4.2.2 Conditions associated with bush fires

The Southern Oscillation Index, when negative, frequently causes prolonged periods of drought. A period of two to three months without rain is not uncommon during such episodes.

Summer temperatures vary significantly about the average. The influence of hot, and often strong, NW and SW winds which may continue for several days during summer elevates the temperature into the high thirties. This phenomena is usually associated with the slow W or SW movement of a high pressure system off the coast of Queensland.

These high temperatures in summer are frequently followed by southerly winds due to the passage of a cold front. The front may be very weak with a rapid return to westerly winds. It may be dry and blustery causing rapid expansion of a northern fire flank, and occasionally it may be very cold and accompanied by rain.

4.2.3 Conditions suitable for prescribed burns

The conditions under which fire behaviour for a prescribed burn is most likely to remain under control are as follows:

- moist soil conditions;
- stable weather conditions;
- surface fuel moisture levels of 12 – 20 %;
- a high level of moisture recovery in fine fuels at night; and
- a low probability of strong winds, in particular dry north – westerly winds.

The most stable weather conditions in Kattang Nature Reserve occur during late 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 late autumn to early spring. There is a high probability for fire to become self extinguishing under these conditions, minimising the risk of prescribed burns becoming wildfires. Moisture levels during winter are generally too high to carry an effective burn.

The promotion of biodiversity and protection of species is favoured by prescribed burning in the late autumn months, as the likelihood of escape from a prescribed fire carried out in spring as described above is much diminished. Autumn burns are also likely to be cooler, reducing the intensity of the burn and likelihood of scorch damage to habitat attributes.

Due to the presence of peat beds within Kattang Nature Reserve, spring burns are generally not considered as being suitable, as spring burns may not receive follow-up rains to extinguish smouldering stumps or peat. Spring burning is acceptable in periods when the preceding rainfall has been sufficient to allow fires to extinguish overnight, or a fire is contained within reasonably secure fire lines.

Prescribed burning is reliant on the weather conditions operating over that period, such as changes to the southern oscillation index. During the planning for, and the actual conduct of prescribed burning, weather conditions are always monitored to ensure that relative humidity, temperature and wind speed and direction are within acceptable limits.

Prescribed burning is also reliant on conditions suitable to maintain and slash appropriate fire advantages and trails prior to undertaking the burning. The NPWS aims to improve the access across such points as part of general fire maintenance activities across the park.

Appropriate trails will have been prepared and neighbours will be notified prior to operations.

4.3 FIRE BEHAVIOUR POTENTIAL

Bushfire behaviour potential is based factors known to affect and influence the passage of a wildfire at a given location. Factors which influence intensity and rate of spread include fuel characteristics, slope, aspect, climate and fire weather conditions. An assessment of the likely bushfire behaviour potential of an area can assist in the preparation of suppression strategies, and the identification of bushfire risk management priorities.

Highest bushfire behaviour potential occurs in areas containing heavy loads of elevated fuels on steep, dry, north to north – westerly facing slopes or exposed plateaux which are subject to periods of hot, dry, windy weather. Under extreme conditions, particularly those associated with prolonged or severe drought, it must be emphasised that any area containing flammable fuels may enter a state of high fire behaviour potential.

Major fire paths mapped over the past twenty years within Kattang Nature Reserve show that most

areas of the reserve are susceptible to fire. The whole coastal strip is similarly very fire prone, having highly flammable fuels and limited access. Thus there is potential for spot overs from other fires in the nearby locality to ignite fires within the reserve.

There are few fire advantages (both natural and constructed), that run in an east west direction within Kattang Nature Reserve. This can make wildfire containment difficult when southerly or north east winds are strong. The potential for large wildfires in these situations is high depending on the fuel loadings and fire weather.

The reserve consists mainly of heath, melaleuca forest and woodland plant communities. These plant communities in adverse fire weather can burn intensely. In particular, wetland and coastal heath contains fine fuels, which are high in oil content and very volatile.

4.4 DAMAGE POTENTIAL

4.4.1 Historical damage

The threat to life and property is from fires escaping from the reserve, and moving to properties adjoining to the west. Properties to the south west are unlikely to be threatened due to the low topographic relief and fuel types adjoining those properties.

There has been no damage to property due to fires originating in the reserve in the past, however residential development adjoining the reserve is relatively recent.

Fires may threaten human lives, property and other heritage valued by the community. The control of these fires often involves considerable public expenditure and risks to firefighters.

Fire from natural causes and at a frequency and intensity that is consistent with the management of the native plant and animal communities does not take place within Kattang Nature Reserve. The overwhelming priority in fire management therefore is to reduce and if possible eliminate the occurrence of fires escaping from arson. Not until this is achieved can a practical, socially responsible and scientifically based fire regime be implemented.

4.4.2 Economic

Reserve visitation is almost wholly for the enjoyment of the heath flowers, birds and headlands. It is not expected that visitation would decline as a result of fires, as the walk to the headlands is popular in itself. Track blockages will be quickly cleared by field staff as part of normal park management activities, or as part of a rehabilitation program following the passage of a wildfire.

As a consequence little or no impact would be felt by nearby tourist reliant communities.

4.4.3 Damage to Life and Property

The greatest potential for 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 within this plan, such the maintenance of fire management zones. NPWS will seek co-

operation from adjoining landholders to manage areas of high fire behaviour potential on private property in a manner which complements the actions undertaken on the reserve.

Severe fire weather in Kattang Nature Reserve occurs on hot dry days with a strong north to north westerly winds or southerly winds, indeed the major fires of the past twenty years were influenced heavily by such conditions. Under such conditions fires will generally move south to north, or north to south. Properties most at risk from damage by fire include those bordering the reserve to the west.

The greatest potential threat to human life within Kattang Nature Reserve is during fire fighting and suppression operations. Under extreme fire weather conditions this risk is greatest, placing ground attack crews in high danger of sudden shifts in the fire front. Guidelines for fire fighter safety are contained in section 5.7.1. Actions for the management of bushfire risks are contained in section 5.7.1.

4.4.4 Natural heritage

There are a number of flora and fauna species listed as threatened under the *Threatened Species Conservation Act 1995* which have either been recorded or are considered likely to occur based on habitat resources available in the reserve. A single wildfire event may not cause significant damage to these natural heritage assets, however an inappropriate fire regime may cause permanent damage. In extreme cases, the local extinction of species could also result. Guidelines for the protection of natural heritage are contained within section 5.7.2. Careful fire planning will be required to reduce the impact of fire on these communities.

Fire and biodiversity conservation planning principles within this plan are also aimed to minimise the potential impacts on these species by management of fire frequency, intensity, timing and extent within their associated habitats.

In addition, the NPWS will encourage research into the biodiversity represented within the reserve, and into examining the relationship between the distribution of biodiversity and fire regimes of Kattang Nature Reserve.

4.4.5 Cultural heritage

Known aboriginal sites are unaffected or little affected by wildfire. None of these sites is likely to be affected by proposals under this plan and such sites are within Special Heritage Areas which will afford increased fire protection.

However fire suppression operations could constitute a threat. This threat is recognised by the keeping of a register of sites. During wildfire suppression the presence of such sites is examined for in the area of operations by checking the Sites Register.

As the reserve is predominately situated on a coastal headland, where the primary means of access is via internal walking trails, it is highly unlikely that heavy earth moving equipment or other heavy machinery would be required within the reserve for wildfire suppression, indeed for any maintenance activity beyond the grading of Hameys Lookout road. If the construction of a new fire break is required, or the use of heavy machinery is required for a similar task, the design of the trail is planned to avoid sites of cultural significance. Such a decision would be made by a senior NPWS only.

4.5 EVALUATION OF THE EFFECTS OF EXISTING FIRE REGIMES ON BIODIVERSITY

4.5.1.1 Evaluation of Current Fire Regimes

The following table outlines the level of fire frequency experienced within each fire management zone of the reserve.

TABLE 8 Fire frequency by fire management zone type

Zone	Fire Frequency						Totals ha
	0		1		2		
	%	ha	%	ha	%	ha	
HAMZ1	1.60	0.26	65.34	10.65	33.01	5.38	16.30
HAMZ2	100.00	13.00	0.00	0.00	0.00	0.00	13.00
HAMZ3	24.86	1.93	39.46	2.77	35.68	2.77	7.75
HAMZ4	51.94	3.68	43.01	3.05	5.05	0.36	7.09
HAMZ5	100.00	3.05	0.00	0.00	0.00	0.00	3.05
	46.45	21.92	34.90	16.47	18.65	8.80	47.19
SHAMZ1	96.98	5.27	3.02	0.16	0.00	0.00	5.43
SHAMZ2	92.15	9.65	7.85	0.82	0.00	0.00	10.47
	93.84	14.92	6.16	0.98	0.00	0.00	15.90
Heritage	58.39	36.84	27.67	17.45	13.95	8.80	63.09
SWCZ1	37.79	0.72	45.74	0.87	16.47	0.32	1.91
BAMZ1	100.0	2.70	0.00	0.00	0.00	0.00	2.70
Strategic	74.19	3.42	18.87	0.87	6.94	0.32	4.61
FROZ1	39.40	0.37	60.60	0.58	0.0	0.00	0.95
							68.65

TABLE 9: PRESCRIBED BURNING BY FIRE MANAGEMENT ZONE TYPE

Fire Year	Asset Prot.	Strategic	Heritage	Total Area
1993/94			*SHAMZ1 1.3	1.13
1994/95	FROZ1 0.9	SWCZ1 0.63		1.53
1997/98	FROZ1 0.9	SWCZ1 2.2		3.30

* An area of SHAMZ1 (1ha) control burnt for Bitou Bush control

The following table outlines the level of fires (fire frequency) that have occurred in particular plant communities over the last twenty years (1976-1995).

TABLE 10 Vegetation communities burnt 1976-1997 by wildfire

Plant Complexes	Times Burnt (ha)			% of Complex Burnt		
	0	1	2	0	1	2
Littoral Rainforest	2.94	0	0	100	0	0
Shrubland	0	5.51	0	0	100	0
Heathland	0	7.78	4.19	0	65	35
Forest & Woodland	18.69	5.34	2.67	70	20	10
Headland	10.43 *	1.96	0.65	80	15	5
Foredune Complex Acacia Spinifex	2.04	0	0	100	0	0
Sod Grassland Banksia/ Sod Grassland	3.09	0	0	100	0	0

* An area of SHAMZ1 (1ha) control burnt for bitou Bush control

In relation to the above tables and the guidelines for “Fire Regimes for Flora Communities” (Table 2), it is possible to make the following evaluations of previous fire regimes:

- Littoral rainforest has not been subjected to fire, this situation should be maintained.
- The majority of forest and woodland communities have not been burnt beyond appropriate thresholds. The maintenance of low fuel levels in SWCZ1 may reduce species diversity in that zone but will assist in protection of the remainder of the communities some of which have experience fire frequency of a concern for the long term viability of plant species. Appropriate thresholds to maintain this community suggests that a decline in species is predicted if more than one fire occurs every fifty years.
- The shrubland and heath complexes have experienced the level of fire frequency necessary to maintain species diversity. The fire regime guidelines suggest the “shrubland-heath complex” community is best suited to a fire frequency of no more than two fires in a row at intervals of eight years. Although it may be desirable to burn these communities in the near future to maintain diversity, the problem of bitou bush invasion following fire is thought to be of greater concern.
- Unless intensive bitou bush control follow-up is implemented the deliberate use of fire in these species assemblages is not desirable. The control of bitou within the reserve is undertaken by NPWS field staff, the Camden Haven Protection Society, Mid North Coast branch of the National Parks Association, and by Greencorps programs.
- The headland and sod grassland complexes similarly have received a low fire frequency, to the extent that *Banksia integrifolia* is replacing much of the sod grassland and invading the headland complexes. Again bitou bush control follow-up must be implemented if fire is to be deliberately used to promote diversity in these complexes. Any fire used in these complexes must be of low intensity in the vicinity of the stands of *Allocasuarina equisetifolia*.

- The foredune areas are heavily infested with bitou bush and unlikely to be burned due to the low combustibility of this plant. Bitou control in these areas is a prerequisite to any other management for species diversity.

4.5.1.2 Desirable fire regimes

Flora

The above analysis reveals that the greater proportion of all plant communities are currently experiencing fire regimes that are compatible with conservation objectives. There are, however, two exceptions that require active fire management to ameliorate exposure to fire regimes that are adverse to conservation.

1. The shrubland / heathland will suffer if fire is not used to maintain diversity.
2. The sod grassland will suffer from Banksia invasion if fire frequency is not increased.

Although this is stated in recognition of the fact that it is considered the use of fire without adequate bitou control will be detrimental to the conservation of these community types. Bitou control is undertaken within the reserve through both internal programs, the efforts of community groups, and the release of biological control agents.

Fauna

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. However, maintenance of vegetative cover and structure within plant communities in the reserve is essential for conserving viable animal populations, particularly for ground based fauna as the New Holland Mouse. The information in Table 2 is not only a guide to conserving plant species in their own right, but is also a guide to maintaining animal habitat. Thus the table serves as a guide to conserving plant and animal species resident in various plant communities.

It is desirable that any individual fire (or set of fires at or about the same time - e.g. within a year), should not completely burn the whole of a particular community type, or to the extreme, the whole reserve. Unburnt areas act as a refuge for animal species that suffer habitat loss during and soon after fire. This includes patches not burnt within the area of the wildfire.

Refuge 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 also critical to avoid intense fires which can damage habitat features, such as consuming fallen hollow timber, cause scorch damage to tree crowns, and even cause direct injury to some wildlife. Frequent fires may also lead to declines in local populations of native fauna, by influencing the shrub layer diversity, which may affect the distribution of some food sources for some groups of animals.

A particular concern is for the protection of habitat for rare and threatened animals. These species are of major concern because of their vulnerability to extinction and the need to ensure that their chances of long-term survival are maximised.

Contained within the following section “Proposed Fire Management Actions” Table 11 details a list of fire management guidelines for rare and threatened animals that are known or likely to occur within Kattang Nature Reserve. These guidelines are intended to augment the management of fire regimes for plant communities

Table 11 is based in those restricted localities where these species are known to occur. As sightings of additional rare and threatened species are recorded within the reserve, or as the fire ecology of specific fauna species becomes known, there may be a need to modify these fire management guidelines accordingly.

Table 11 Threatened animals – Management Guidelines

No.	Species	Common Name	Preferred Habitats	Management Guide
Amphibians				
1	<i>Crinia tinnula</i>	Wallum Froglet	Wetlands	* Protect wetland from all burning in one fire event.
Birds				
3	<i>Sterna albifrons</i>	Little Tern	Open sands and estuaries islands	* Vehicles excluded from beaches in nesting season. - Coastal bird not affected by fires. Nesting on beach areas.
4	<i>Haematopus longirostris</i> <i>Haematopus fuliginosus</i>	Pied Oystercatcher Sooty Oystercatcher	Sand dunes beaches and muddy bays	* Vehicles excluded from beaches in nesting season. - Coastal birds not affected by fires. Nesting on beach areas.
5	<i>Xenorhynchus asiaticus</i>	Black-necked Stork	Breeding March-June nests in trees	* Pre-burn check for nests. * Do not burn in nesting season near active nests. * Protect nest sites and potential nest sites (large trees near swamps) when burning outside nesting season.
6	<i>Pandion haliaetus</i>	Osprey	Nesting in tall trees	* Protect known nest sites. * Protect recruitment nest trees (large senescent trees close to estuaries). * No burn at nest sites in breeding season.
8	<i>Calyptorhynchus lathamii</i>	Glossy Black Cockatoo	Dry forest complex and some Complex units	* Protect potential nest sites (old hollow-bearing trees). * Protect significant stands of she-oaks from all burning in one fire, particularly where evidence of feeding (chewed cones) is present. * Keep fire out of canopy.
9	<i>Lophoictinia isura</i>	Square Tailed Kite	Tall and Mallee forests	* Pre-burn check for nests. * Keep fire out of canopy. * Do not burn at nest site during breeding season. * Protect nest sites.
10	<i>Ptilinopus magnificus</i>	Wompoo fruit-dove	Littoral rainforest	An itinerant species restricted to no-burn littoral rainforest.
12	<i>Burhinus neglectus</i> <i>Calidris alba</i>	Beach Thick-knee Sanderling	Sand dunes and beaches	* Vehicles excluded from beaches in nesting season. Coastal birds not affected by fires. Nesting on beach areas.
14	<i>Coracina lineata</i>	Yellow-eyed Cuckoo-shrike	Littoral rainforest	*Habitat almost entirely within Heritage Zone. Restricted to rainforest no-burn areas.
15	<i>Pachycephala olivacea</i>	Olive Whistler	Littoral rainforest	*Habitat almost entirely within Heritage Zone. Restricted to rainforest no-burn areas

17	<i>Tringa terek</i>	Terek Sandpiper	Mangroves Saltmarsh Beaches	* Vehicles excluded from beaches in nesting season. Coastal birds not affected by fires. Nesting on beach areas. *Mangrove roosting sites unaffected by proposals.
18	<i>Pluvialis dominica</i>	Lesser Sand Plover	Mangroves Saltmarsh	*Mangrove feeding sites unaffected by proposals.
Mammals				
19	<i>Phascolarctos cinereus</i>	Koala	Dry forest complex	* Pre-burn inspection for Koalas. * Protect Koala location from fire. * Keep fire out of canopy. *Mosaic burn in areas of likely habitat
20	<i>Syconycteris australis</i>	Blossom Bat	Littoral Rainforest dry forest complex and shrubland heathland complex	*Roosting areas in Littoral rainforest. * Protect significant stands of Banksias and Paperbarks from all burning in one fire event.
21	<i>Miniopterus australis</i>	Little Bent-wing Bat	Potential all habitats	* Mosaic burn.
22	<i>Miniopterus schreibersii</i>	Common Bent-wing Bat	Potential all habitats	* Mosaic burn.
23	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	Potential all habitats	* Mosaic burn.
24	<i>Myotis adversus</i>	Large-footed Myotis (Fishing Bat)	Potential all habitats	* Mosaic burn.
28	<i>Planigale maculata</i>	Common Planigale	Most forests and woodlands	* Mosaic burn.
29	<i>Pseudomys gracilicaudatus</i>	Eastern Chestnut Mouse	Potential most habitats excl. wetlands	* Mosaic burn.
30	<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	Most tall forests and woodlands	* Keep fire out of canopy. * Protect hollow logs. * Protect old hollow bearing trees. * Mosaic burn.
31	<i>Petaurus norfolcensis</i>	Squirrel Glider	Most forests and woodlands	* Keep fire out of canopy. * Protect significant stands of Banksia/Acacia from all burning in one fire event. * Protect old hollow bearing trees.

Prior to undertaking any prescribed burning, the NPWS Atlas will be checked for records of any threatened species within the area to be burnt, with appropriate steps to be undertaken to minimise any likely impact on such species. This will form part of the Burn Plan for the prescribed burning.

The following guidelines will also be of benefit to other native species. For example, fire management guidelines for koalas will most likely benefit other arboreal mammals. It is also expected that these regimes will not encourage the establishment of pest animals within the reserve, though such pest species as the fox *Vulpes vulpes* are likely to already occur within the reserve.

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

The development of Recovery Plans is a requirement under the Act to ensure the appropriate management and planning for the conservation of threatened species. Recovery Plans will investigate the ecological requirements of a threatened species and make management recommendations for the recovery of individual species based on an understanding of its response to

such threatening processes as inappropriate fire regimes. As these Recovery Plans are developed on a species by species basis, there may be a need to adjust the fire management guidelines provided in this plan as this knowledge is gradually acquired.

4.5.1.3 Proposed actions

To ensure that measures are undertaken to manage these species and communities, details regarding the guidelines for the appropriate management of species will be outlined in this plan (see Table 2, 3, and 6). The details outlined in the plan will provide direction and time frames to undertake specific actions necessary to maintain fire management requirements for Kattang Nature Reserve.

These details will also provide management directions to reduce the level of impact on the biodiversity whilst managing fuels to protect neighbours and reserve assets.

5. FIRE MANAGEMENT

Fire has been an important factor influencing the environment of Kattang Nature Reserve for many tens of thousands of years. Fire is regarded by the NPWS as a natural process, one of the established physical factors of the Australian environment to which native plant and animal communities have become adapted. The correct management of fire is essential to avoid the extinction of native plant and animal species.

There are two primary aims of fire management in Kattang Nature Reserve, these are:

- * to protect and ensure the safety of human life and property within and adjacent to the reserve.
- * to maintain the species and biodiversity of the reserve by managing fire so that fire regimes stay, where possible, within the thresholds appropriate to the native plant communities.

The following strategies are considered necessary to support the above aims:

- The implementation of “Community Fire Guard“.
- The maintenance of reduced fuel levels in strategic locations adjacent to neighbouring properties.
- The retention of the network of fire management/walking trails within the reserve and maintaining or increasing slashing in fire radiation zones where considered necessary.
- The management of low intensity fires in areas where necessary, to reduce the impact of wildfire on arboreal mammals.
- The monitoring of fire sensitive plant communities identified within the reserve.
- The undertaking of studies to determine the level of impact of fire on endangered and threatened fauna populations.

5.1 FIRE MANAGEMENT ZONES

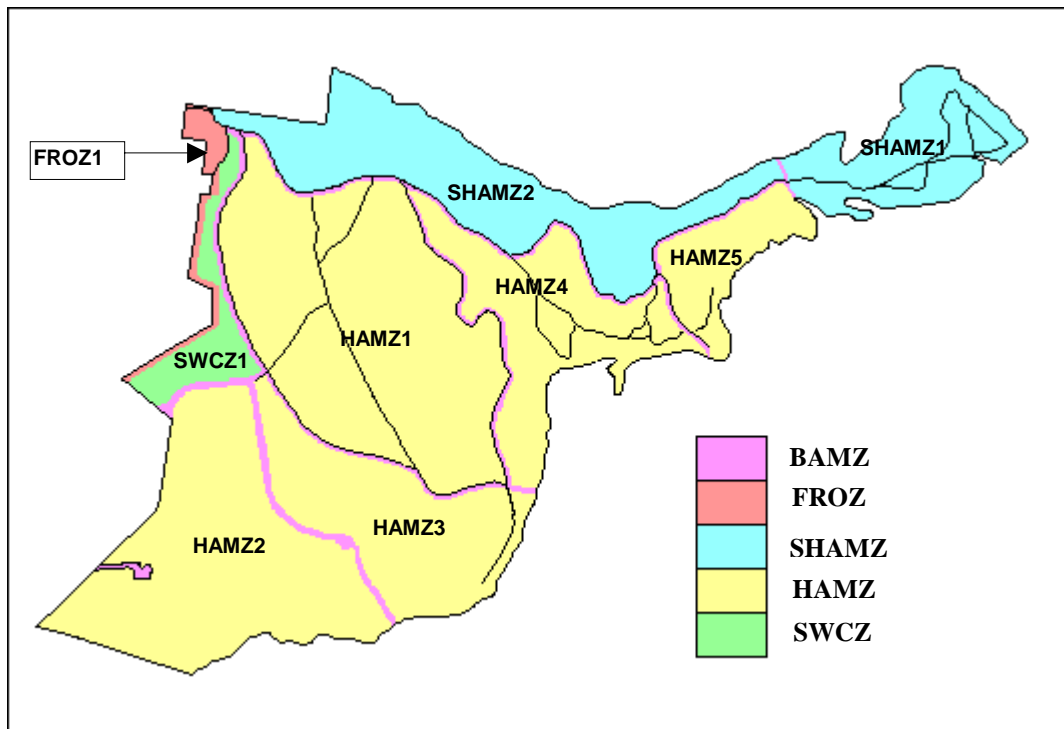
5.1.1 Fire management zones - definition

The following table identifies the zone purpose and method of management.

TABLE 12 Zone purpose and management

Zone	Purpose	Methods
<p>Asset Protection</p> <p>(FROZ)</p>	<ul style="list-style-type: none"> — To protect residential areas, crops, plantations, utilities, camping areas, day use areas 	<ul style="list-style-type: none"> — <i>Fire Radiation (Inner Protection)</i> — Fuel managed by slashing, selective shrub clearing, construction of radiation barriers, trail construction or burning — <i>Fire Radiation(Outer Protection)</i> — Fuel managed by burning or selective shrub clearing — <i>Protection in depth</i> — Fuel managed by burning block area
<p>Strategic Fire Management</p> <p>(BAMZ) (SWCZ)</p>	<ul style="list-style-type: none"> — To reduce wildfire intensity and spotting intensity — To manage fuels for the strategic containment of wildfire — To reduce risk of ignition in identified high rate of ignition locations 	<ul style="list-style-type: none"> — Burning — Suppress or contain fires inconsistent with the fire prescription
<p>Heritage Management</p> <p>(HAMZ) (SHAMZ)</p>	<ul style="list-style-type: none"> — To prevent permanent damage or destruction of heritage items by an inappropriate fire regime. — To apply fire prescriptions consistent with the management objectives of the area. — Consistent with broad area objectives or relevant statutes. 	<ul style="list-style-type: none"> — Burning — Suppress fires inconsistent with the fire prescription

MAP 5 FIRE MANAGEMENT ZONES



5.1.2 Fire management areas

The following table lists the location, purpose and area of the Fire Management Zones

TABLE 13 Location and reserve percentage of fire management zones

ZONE	LOCATION	PROTECTION	AREA ha	AREA %	Zone Type %
FROZ 1	Western boundary	Life and property	0.95	1.38	1.38
BAMZ 1	Walking trails and Car park access	Fire access	2.70	3.93	
SWCZ 1	Adjacent to Western boundary	Property	1.91	2.78	6.62
SHAMZ 1	Perpendicular Point headland	Headlands	5.43	7.91	
SHAMZ 2	Northern aspect	Littoral rainforest	10.47	15.25	23.16
HAMZ 1	Central “ <i>Flower Bowl</i> ”	Flora and fauna	16.30	23.74	
HAMZ 2	Southern low relief areas	Flora and fauna	13.00	18.94	
HAMZ 3	Southern slopes	Flora and fauna	7.75	11.29	
HAMZ 4	Woodlands and Camden Head	Flora and fauna	7.09	10.33	
HAMZ 5	Southern cliffs and grasslands	Flora and fauna	3.05	4.44	68.74

5.2 ASSET PROTECTION

There is one Asset Protection Zone, this western zone protects dwellings adjoining the reserve from fire radiation.

5.3 STRATEGIC FIRE MANAGEMENT

There is one Strategic Wildfire Control Zone, which again assists in the protection of properties on the western boundary

5.4 HERITAGE MANAGEMENT

There are seven Heritage Management Zones within the reserve and these occupy approximately 70% of the reserve. It is these areas that the plan aims to protect from excessively severe and uncontrolled fires. Of these zones two are Special Heritage areas, these are located to protect littoral rainforest and headland areas.

5.4.1 Biodiversity management

In practical terms, conservation is about the prevention of the extinction of species, especially extinctions brought about by the action of humans. The biodiversity conservation objective of this plan is to:

“Manage fire to retain (avoid extinction of) all native species known or considered likely to occur within Kattang Nature Reserve”.

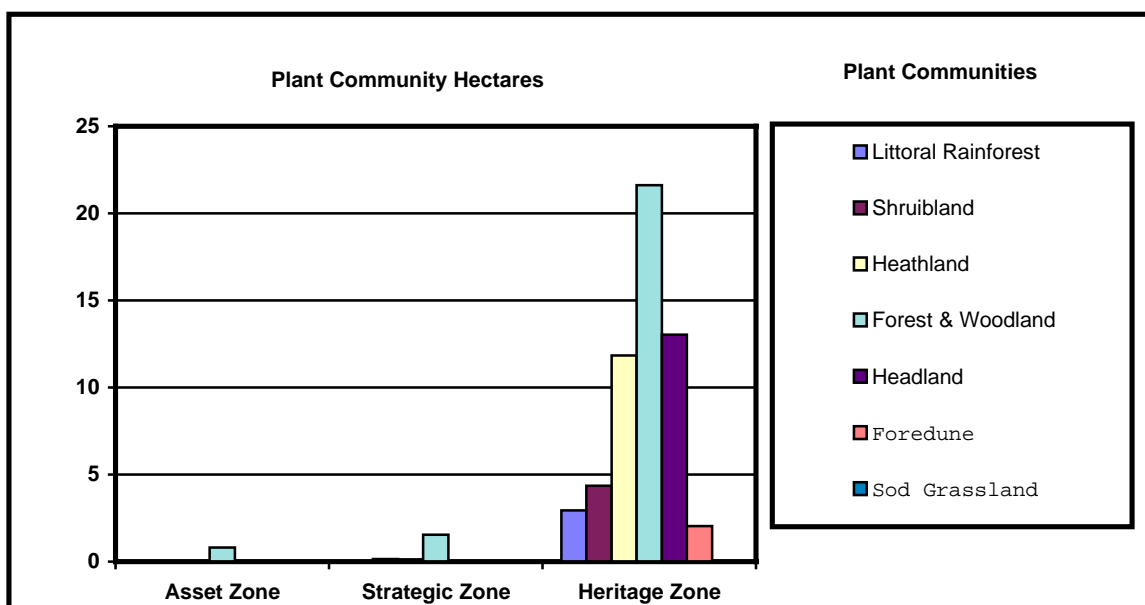
It is considered that the importance of mosaic burning to preserve parts of the vegetation community and habitat resource for species refuge and recovery is important to maintaining diversity. It is also necessary to ensure that the general fire regime of Kattang Nature Reserve is kept within tolerable thresholds for the conservation of biodiversity.

Guidelines for the conservation of the reserve’s biodiversity are contained within Tables 2, 3, 6 and 11 of this plan. Section 4.5.1.2 also details desirable fire regimes which are aimed to be introduced and maintained within the heritage management zones of the reserve, for the conservation of biodiversity, particularly threatened species, through fire management activities of this plan.

5.4.2 Significance of impacts on biodiversity

To gain an understanding of impact of these activities it is useful to consider the type and area of vegetation community which exists within particular fire management zones. The following GRAPH 3 indicates the area (ha) of vegetation communities represented in each of three major fire management zones.

GRAPH 3 Representation of plant communities per fire zone



As it appears from the above graph, that there is an extremely good representation of a full range of floristic communities present within the reserve which are safely located with Heritage Management Zones.

Whilst management activities in the Asset Protection and the Strategic Fire Management Zones

have been designed primarily for the protection of life and property, consideration has also been given to minimising impact on the environment and protecting biodiversity.

This level of protection should ensure that plant and animal communities are appropriately maintained and the modification of assets and strategic zones is acceptable.

However, the possible loss of any threatened plant or animal species or complete plant communities is unacceptable. To ensure that consideration is given to the protection of these species activities will only be undertaken after checking environmental considerations as outlined in this plan.

By following these guidelines, there will be a much higher level of protection for species when implementing works plans and thus a reduction of impact on species.

5.4.3 Mitigation of adverse effects

It will be essential to work within the management guidelines set out in the to reduce even further impact on these species when undertaking fire management activities. In strategic and asset protection zones however it could be necessary to exceed impact thresholds in order to make possible management for biodiversity on heritage zone possible.

To also reduce impacts further, the prescribed burning of strategic and assets zones will be undertaken on the basis of mosaic burning to ensure that zones are not entirely burnt in one season. This can be achieved by not treating adjoining zones during the same year. Some of the larger zones may also be divided into smaller areas and burnt in sections over a number of years. Most treatment areas will be less than five hectares.

The NPWS will seek the assistance of the relevant fauna protection group with any injured or smoke effected native animal, such groups are listed in the Fire Action Plan.

5.4.4 Fire Management Research

The two main issues of environmental concern are for vegetation slashing and prescription burning. The issue of slashing of vegetation will create the highest level of environmental concern because of the annual regime of disturbance that is required. However, as these slashed areas have been treated over many years it is difficult to now determine which species have been affected. It is likely that woody species of plants will decline in density in response to this level of activity.

Prescription burning undertaken on a higher level of fire frequency will change the density of many species and therefore the composition of some communities. Changes may be slow and will need to be assessed, as identified in the research section. The development of a research program to monitor the changes in biodiversity will be necessary so that changes in management techniques can be considered.

The effects of high frequency fire on the floristic communities will be variable depending on the particular plant community and it's response to fire. Table 2 details the levels of acceptable fire frequency necessary to maintain floristic diversity.

5.4.4.1 Further research

In the process of developing this plan it has become apparent that there are major deficiencies in knowledge that must be addressed if fire is to be managed to conserve the biodiversity within the reserve. Briefly these are:

- knowledge of animal/ fire responses, particularly the lower vertebrates and invertebrates, especially in relation to habitat characteristics;
- a basis for classifying the responses of animals to fire as a function of life history attributes;
- a basis for predicting the long-term responses of animal populations to regimes, not just a single fire, based on direct interactions of fire regime components with demographic processes;
- a better understanding of 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.

These knowledge deficiencies apply across many protected lands, and are being addressed through the efforts of such research programs as Project Vesta, the research conducted cumulatively through universities, government bodies as the NPWS, and through the preparation of Recovery Plans for individual threatened species.

5.4.5 Aboriginal Heritage

As pointed out in section 2.4 the majority of Aboriginal heritage items are located in areas afforded the greatest protection by this plan. Maintenance of fire trails and the prescriptions which apply to the fire management zones in which these sites occur should ensure protection of all known sites, and particularly middens which may be affected by any proposed trail construction.

A register of sites is maintained at the NPWS District office at Port Macquarie and during suppression operations, including coordinated fire fighting, incident management personnel will be aware of midden locations.

5.4.6 Historic Heritage

There are no notable items of non aboriginal historic heritage known in the reserve.

5.5 SPECIAL PURPOSES MANAGEMENT

There are no Special Purpose Management areas within the Reserve other than those areas set apart in the SHAMZ fire management zones and car parking facilities.

5.6 FIRE MANAGEMENT ACCESS

Map 7 Fire Advantages illustrates the walking trail network and car parking access within the reserve.

Table 12 below details the length, surface and vehicular/ pedestrian access features of the trails within Kattang Nature Reserve. There is a total of 5.6 kilometres of fire trails within the reserve.

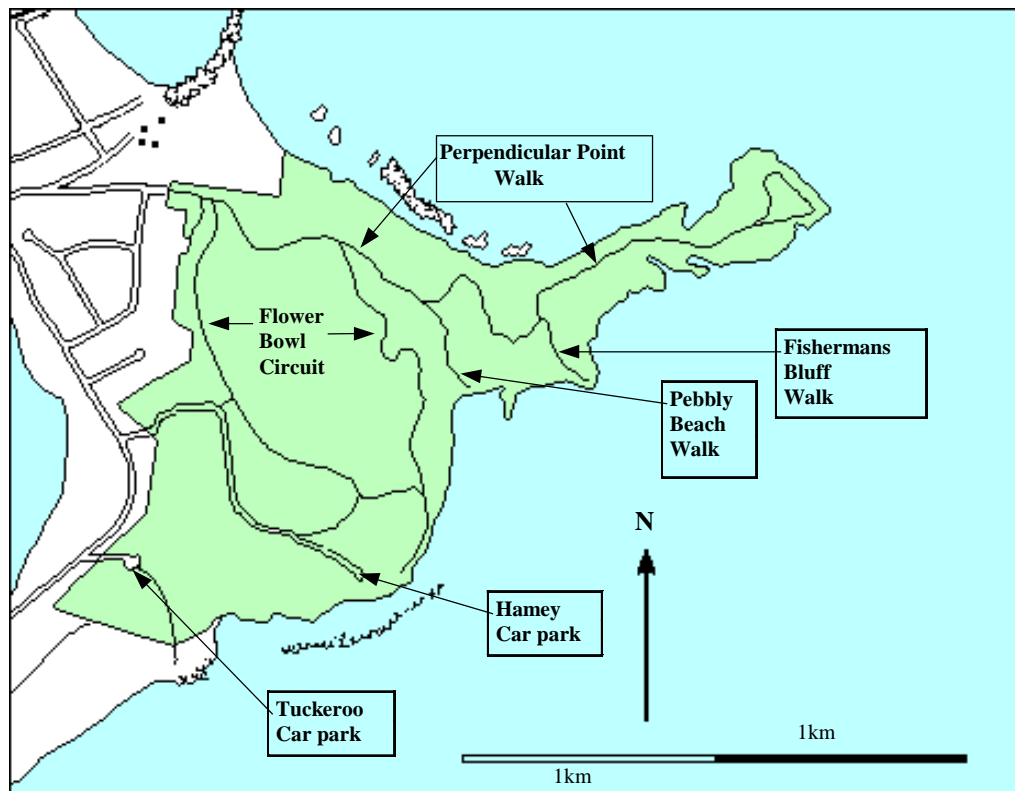
TABLE 14 Fire Management Access Trails

TRAIL NAME	LENGTH (metres)	SURFACE	Type
Hamey Car park	1000	Gravel	Vehicular
Tuckeroo Car park	75	Gravel	Vehicular
Perpendicular Point	2000	Gravel/Natural	Walking
Flower Bowl	1500	Gravel/Natural	Walking
Pebbly Beach	200	Natural	Walking
Fishermans Bluff	150	Natural	Walking

5.6.1 Water points

Mains water is available close to the reserve, and sea water may be used if necessary.

MAP 7 FIRE ADVANTAGES



SMOKE MANAGEMENT

Main roads adjacent to the reserve include Dunbogan road, and residential streets around Dunbogan. These roads are bitumen sealed and vehicles may travel at speeds up to 50 km/hr. These roads may be subject to smoke drift during fuel reduction burning and during wildfires. During these events Smoke Hazard road warning signs will be exhibited at appropriate locations. NPWS firefighting staff and NSW Police may also be required to slow traffic, or to halt vehicles, during extreme fire suppression periods.

It is anticipated that fuel reduction burns would not generate sufficient smoke to cause problems to aircraft operating within the area.

The village of Dunbogan is located in close proximity to the park, and nearby are the slightly larger centers of Laurieton and North Haven. These small villages do contain retirement homes and villas, whose residents may suffer from smoke generated by bushfire. Smoke from controlled fires however will be minimal and unlikely to prevail for any long period of time. In particular, residents shall be advised of prescribed burning by a letter drop prior to burning, and “Smoke on Road” warning signs shall be on hand and displayed on Camden Head Road if weather conditions warrant.

Details to minimise the generation of smoke are contained within the NPWS Fire Management Manual.

6. WILDFIRE CONTROL AND SUPPRESSION

6.1 PREVENTION AND DETECTION

Fire prevention will be achieved through the following actions:

- public education programs and participation in Community Fire Guard;
- appropriate location and construction of picnic facilities;
- the implementation of fuel reduction programs.

The primary means of detection in the past has been through the vigilance of neighbours and Rural Fires Brigades. NPWS field based staff are also responsible for fire detection. These methods of detection will continue.

In addition, fire towers manned by State Forests have been located on a triangulation wall map within the Port Macquarie District office and tied to State Forest supplied bearings. This will supplement normal patrol observation conducted throughout the fire season.

Aircraft will be used as considered necessary during periods of high fire danger or when a number of fires are burning. Regular fire patrolling will be undertaken in park areas during periods of high fire danger. The level of surveillance will take into account the co-operative arrangements made with State Forests and the Shire Fire Control Officers.

6.2 WILDFIRE SUPPRESSION

All NPWS fire operations will be conducted within the framework of the Incident Control System. The control of all fires will be in accordance with NPWS Fire Management Policies, the policies of the State Coordinating Committee and arrangements identified within the Hastings Bush Fire Management Plan.

Upon report and confirmation of a fire, every effort will be made by NPWS to stage a rapid first attack. However, it is accepted that due to distance and time factors, other fire fighting authorities may be under some circumstances, be more effectively located for first response to a fire within the park. Under these circumstances the first response must be in accordance with the arrangements adopted in the local Bush Fire Management Plan. NPWS will also provide assistance with fire fighting on adjoining land tenures where possible and especially if the fire poses a threat to the reserve.

Wildfire control strategies within the reserve will be developed according to the circumstances of the fire. Fire control techniques involving direct, parallel and indirect attack will be considered. The use of aircraft and fire control chemicals will be considered as fire control tools when determining control strategies. The risk of damage to the environment of the park will be assessed prior to utilising aircraft and fire control chemicals, and their use within the park could be restricted from areas where cultural sites occur, or where sensitive environments could receive unacceptable impact from their use.

It is highly unlikely that earth moving equipment or other machinery would be required for wildfire

suppression activities within Kattang Nature Reserve, or that access to the fire ground would be available for such machinery. However, heavy machinery could be utilised for clearing breaks along the western boundary of the reserve for neighbour protection, or for other activities associated with wildfire suppression along Hamey Lookout road. The use of heavy machinery within the reserve would be at the discretion of the senior NPWS officer in charge of wildfire suppression operations.

Irrespective of the amount of prescribed burning undertaken, under severe weather and prolonged drought conditions, it may not be possible to safely control a wildfire from within the reserve. During these conditions, fire fighting activities will of necessity, focus on the boundaries of the reserve and protecting individual assets.

Wildfire suppression presents many safety hazards to fire fighters. In addition to the obvious hazards of fatigue, dehydration, accidents etc, areas of high bushfire potential under some burning conditions may present a significant risk to fire fighter safety. Some areas which may be considered as particularly hazardous for fire fighters within the reserve include heath communities represented within the reserve.

Under extreme fire danger conditions (FDI > 50) and severe fire weather forecasts, a direct or close parallel attack in such risky vegetation communities, where the fire is within, or predicted to enter such communities in a short period, may not be an appropriate strategy for the safety of firefighters.

For the safety of visitors and the prevention of bushfire the park may be closed or subject to park fire bans under extreme fire danger conditions. Any closures or bans will be advertised through the local media.

6.3 OPERATIONAL GUIDELINES

The following table lists operational guidelines to be implemented during all bushfire operations, including wildfires and prescribed fires. These guidelines aim to protect the natural and cultural heritage values of Kattang Nature Reserve.

Table 15: Operational guidelines for Kattang Nature Reserve

Area / Resource	Operational guidelines
Vegetation communities where the fire frequency threshold is exceeded by high fire frequency	If practical, minimise burn area
Vegetation communities where the fire frequency threshold is exceeded by low fire frequency.	If practical maximise the burn area with consideration given to: <ul style="list-style-type: none"> • maintaining a mosaic of burnt and unburnt areas • the risk of bushfire developing to a level where suppression efforts would fail • consultation with neighbours and the Executive Committee of the appropriate Bush Fire Management Committee
Aboriginal and historic sites	<ul style="list-style-type: none"> • brief all personnel involved in control line construction on the location of sites and required control line route • if possible, protect the sites from damage • check for unknown sites during operations

Threatened flora	<ul style="list-style-type: none"> • brief all personnel involved in control line construction or in vehicle based fire suppression on the location of sites and required control line route or vehicle based suppression activity • if possible, protect populations or individuals from burn area if the fire frequency thresholds are exceeded or the fire response category of the species is either an obligate re-seeder or unknown • check for unknown locations of threatened flora during operations
Threatened fauna	<ul style="list-style-type: none"> • brief all personnel involved in control line construction or in vehicle based fire suppression on the location of sites and required control line route or vehicle based suppression activity • if possible, protect habitat area from burn if the effects of the resulting fire frequency, season and/ or intensity will have a significant impact or are unknown • check for unknown locations of threatened fauna during operations
Fire fighting Activity	Operational Guidelines
Earth moving machinery	<ul style="list-style-type: none"> • restrict use to existing or previous trail or control line route • exclude machinery from slopes greater than 18⁰ • close and rehabilitate all new tracks constructed for emergency operations immediately after the incident • incorporate remedial works for erosion control • brief all personnel involved in control line construction / maintenance on the location of Aboriginal or historic sites and threatened species
Fire fighting chemicals	<ul style="list-style-type: none"> • wetting and foaming agents are permitted for use in bushfire control • exclude the use of wetting and foaming agents within 50 metres of a watercourse, dam or swamp • the use of retardants will be avoided where reasonable alternatives are available and if used will follow the procedures in the NPWS Fire Management Manual
Backburning	<ul style="list-style-type: none"> • brief all personnel involved on the location of Aboriginal or historic sites and threatened species and protect from burning
Smoke management	<ul style="list-style-type: none"> • prescribed burning and backburning operations will have regard to the best practice guidelines in the NPWS Fire Management Manual
Visitor control	<ul style="list-style-type: none"> • the reserve may be closed to the public when it is considered necessary due to conditions which create an extreme fire danger or during fire fighting operations.

6.4 FIRE CONTROL ADVANTAGES

Fire control advantages include all natural or constructed items which may assist with the suppression of a fire. These include fire trails, fire breaks, helipads, water points, fuel reduced areas, cliff lines and areas of moist vegetation.

There are approximately 5.6 kilometres of fire trails within or along the boundary of Kattang Nature Reserve providing a good system for fire containment (see Map 7). It is not considered necessary for additional trails to be constructed during the period of this plan. Additional fire trails would further dissect this relatively small nature reserve, and cause disturbance to the natural heritage sites within the reserve. There are also significant problems associated with illegal tracks forming within the nature reserve, additional trails could exacerbate this problem.

Many of the small watercourses and wetlands within the reserve may intermittently carry water, and hence should not be regarded as reliable passive control lines during wildfire suppression. Such water bodies also contain rushes, ferns and grasses which may carry fire in dry conditions, and often peat beds occur below the surface of these waterbodies. A general fire control strategy for these waterbodies within and adjacent to the reserve would be to prevent, where possible, the spread of wildfire into these areas, rather than utilise these as fire control advantages. Such areas could also be likely to experience fire frequencies in excess of their thresholds if utilised as fire control advantages.

Under above average rainfall, higher moisture contents may be found in vegetation along drainage lines which may enable their use as control lines in wildfire suppression and prescribed burning. However, an assessment at the time of operations must be undertaken to confirm adequate moisture content.

Reliable water points exist at mains water points located at Dunbogan, Laurieton and North Haven. Additionally, sea water could be utilised in an emergency until a supply of fresh water could be obtained. Bulk water supplies may require carting to the fire ground during fire operations in drought conditions, or in areas close to major assets.

6.5 FIRE MANAGEMENT FACILITIES

6.5.1 Fire room

Port Macquarie District has a dedicated fire room equipped with radio, remote weather monitoring equipment, telecommunications, and reserve maps including fire tower triangulation.

6.5.2 Radio network

All vehicles are equipped with radios which have access to Brigade and State Forest networks. Hand held radios are available to all staff and these can access Port Macquarie base via radio repeaters.

6.5.3 Weather monitoring

Apart from weather kits used by field staff on the fire ground, remote weather monitoring stations

are located at Harrington, Spokes Mountain, Yarrahappini and Port Macquarie which can give early warning of weather changes. The Port Macquarie District also has an Internet access code to obtain special up to date weather forecasts from the Bureau of Meterology.

6.5.4 Maintenance of plant

Maintenance of plant, including fire fighting vehicles and apparatus, is conducted from the NPWS Port Macquarie District workshop, a NPWS workshop located at Kempsey, and the workshop/ subDistrict depot located at Arakoon SRA.

All plant shall have a pre-fire season check to ensure its maximum reliability and the preparedness of ancillary equipment. Advantage will be taken of crew training days to further check equipment, particularly personnel issue fire fighting gear.

6.6 OPERATIONAL GUIDELINES

The following table provides an overview of plants and animals of special concern that need to be considered when preparing work plans for the undertaking fire management activities within Kattang Nature Reserve.

TABLE 16 Management zone guidelines for burn plans

Fire Management Zone	Fire Regimes for Plant Communities (Error! Reference source not found.)	Threatened Plant Species (Error! Reference source not found.)	Threatened Animals Known or Likely to Occur (Error! Reference source not found.)
Asset Protection			
Fire Radiation 1	N.A.		N.A.
Strategic Fire Management Zones			
Bush Fire Advantage 1			N.A.
Strategic Control 1		3	7,11,12,14,15,17,21,22,23,24,25,26,27,28,29,30,31,32,33
Heritage Fire Management Zones			
Heritage Area 1		3	1,2,3,7,11,12,14,15,17,21,22,21,24,25,26,27,28,29,30,31,32,33
Heritage Area 2		1	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,21,22,23,24,25,26,27,28,29,30,31,32,33
Heritage Area 3		3	5,6,7,9,10,11,12,14,17,18,19,21,22,23,24,25,26,27,28,29,30,31,32,33
Heritage Area 4		1,2	1,2,3,4,7,8,11,12,12,14,15,16,17,20,21,22,23,24,25,26,27,28,29,30,31,32,33
Heritage Area 5		2	22,31
Special Heritage 1		2	22,31
Special Heritage 2		1,2	1,2,3,4,7,8,11,12,13,14,16,17,20,21,22,23,24,25,26,27,28,29,30,31,32,33

7. WORKS SCHEDULE

7.1 FIRE MANAGEMENT FACILITIES

There are no immediate plans to alter the existing fire management facilities beyond the gradual improvement to plant and equipment as the need arises.

7.2 BUSH FIRE RECORDS SYSTEM

Written records will be kept in the NPWS Port Macquarie District office of all bushfires occurring within Kattang Nature Reserve. The bushfire records system will comprise of situation reports, incident action plans, maps, relevant weather data, miscellaneous incident documentation, an incident summary database, prescribed burning proposals and environmental impact assessments.

7.3 FIRE MANAGEMENT ACCESS AND UTILITIES

On an annual basis (before the fire season), the condition of fire trails will be assessed, and maintenance will be undertaken as required to bring fire trails up to NPWS standards as outlined in the access section of the NPWS Fire Management Manual. Priorities for maintenance will depend on annual evaluation of the condition and accessibility of each trail. Highest priority will be directed towards fire trails and fire breaks associated with Asset Protection and Strategic Wildfire Control Zones.

Over time there will also be regular patrols throughout the park to assess condition of trails, maintain all track and road drainage and to clear fallen trees from trails and roads.

NPWS will provide assistance where possible with fire trail maintenance on private property for those trails which contribute to the fire management of the park and are identified as a component of a Strategic Wildfire or Asset Protection Zone.

7.4 FUEL HAZARD ASSESSMENT

7.4.1 Fuel reduction areas

Bush fire risk assessment is a major strategy of this plan in Asset Protection and Strategic Wildfire Control Zones. The fuel management actions identified within the plan aim to prevent wildfires, minimise their intensity and potential to damage assets. It is essential therefore, to have a system of fuel hazard assessment which would identify when fuels in these zones are reaching a level that would make fire control difficult.

The objectives of fuel hazard assessment are as follows:

- to detect when the fuel within relevant fire management zones are reaching a state where the objective of the zone will not be realised;
- to refine current fuel management approaches to achieve increased cost effectiveness and to

determine priorities for fuel management.

During the five year operational period of this plan, asset protection and strategic wildfire control zones will be priorities for work. A fuel assessment methodology is currently being adopted by NPWS based on a model recently developed by the Department of Natural Resources and Environment in Victoria, which will indicate when fuels within these zones may require treatment.

As a part of the annual fuel management program, those areas identified as having a projected high fuel level will be field inspected. After inspection of zones, those areas which require treatment will be scheduled for works. Regular inspections of all assets and strategic zones will undertaken to ensure that consideration is given to all areas.

The 'Overall Fuel Hazard Assessment Guide' developed by the Victorian Department of Natural Resources and Environment provides guidelines for the assessment of surface, elevated and bark fuels. It has been tested against approximately 300 fires in Victoria and has proven to be a more accurate fuel assessment tool for the prediction of fire control outcomes.

The use of this technique has the following advantages:

- rapid and cost effective to implement;
- includes a more comprehensive assessment of the fuel contribution made to fire behaviour than methodologies based on surface fuel weight;
- relates assessment of fuel hazard to strategies of wildfire control and probabilities of success;
- has practical applications for wildfire control, prescribed burning, safety of fireline personnel and protection of assets.

This approach will be used until the findings of 'Project Vesta' (a current CSIRO project investigating the relationship between fuel characteristics and fire behaviour, and testing a variety of fuel sampling techniques) are published sometime over the following few years.

The suitability of the approach for the fuel types in Kattang Nature Reserve will be evaluated through a pilot program to be conducted during 1999/ 2000 and will be modified for local conditions if necessary.

7.4.2 Heritage management areas

These areas will be managed as per the guidelines provided in Tables 2,3, 6 and 11, and the desirable fire regimes identified within sections 4.5.1.1 and 4.5.1.2. As pointed out under section 4.5.1.2, due regard must be taken of the invasive potential of bitou bush in conducting fire management activities.

7.4.3 Fire Radiation Zones

The Fire Radiation Zone included in this plan is positioned to protect residences in the adjoining Camden Head village.

7.5 PRESCRIBED BURNING

There are two main issues associated with the implementation of the works program outlined in this fire plan:

- Prescription Burning
- Slashing of vegetation

7.5.1 Prescription burning

Prescription burning will be undertaken within Asset Protection and Strategic Wildfire Control zones. To maintain low levels of available fuels within these zones, there will be a need to implement burning programs on a higher level of frequency than would be normally acceptable in terms of conserving biodiversity. Vegetation regeneration following all prescribed burns will be monitored to detect any significant environmental impact and to record individual species fire response categories.

The frequency of burning within asset and strategic zones will be determined by the particular vegetation community and its ability to generate flammable fuels.

The need for asset protection and strategic wildfire control zones is extremely important for the protection of both the community and for the wider conservation of biodiversity.

Assets zones have only been utilised where necessary near picnic areas and where residential dwelling adjoin the reserve boundary to the west.

Strategic zones have been designed to restrict and slow the movements of wildfires. These zones have been located in areas to prevent fires from entering or leaving the reserve system and to also restrict the development of major fires.

The implementation of such burns will be subject to appropriate weather and fuel moisture conditions and any constraints identified within the environmental impact assessment.

7.5.2 Slashing vegetation

The slashing of vegetation is an issue because of the frequency of the activity and the complete removal of above ground plant species. However, unlike the issue of prescription burning, slashing of vegetation is undertaken over a relatively small area of the reserve (fire trails and picnic areas).

Slashing of areas will be undertaken in asset and bushfire advantage zones to protect structures and provide safe areas to manage approaching wildfires. The frequency of slashing will vary but is usually undertaken prior to the fire season.

In some respects the slashing of vegetation is of more importance than prescription burning from a safety perspective. The majority of slashing is carried out along fire trails where fire fighters are at most risk from approaching wildfires.

The slashing of fire trails is of particular importance, as it allows fire crews quick access to the reserve, thus reducing the impact of unplanned fires on biodiversity.

There are a number of other environmental issues related to the implementation of the works plan which are also important, but have a lower level of impact. These matters are considered within this fire plan and will be re-assessed before activities are undertaken.

8. PLAN ADMINISTRATION

8.1 MANAGEMENT OF WORKS

This plan will be used as the basis to program fire management activities within Kattang Nature Reserve. The works plan will be developed from the need to consider three main factors:

8.1.1 Maintenance of trails

The fire management trails will be traveled and inspected prior to each fire season and maintenance works, clearing and slashing will be undertaken as required.

8.1.2 Fuel reduction in asset protection & strategic wildfire control zones

The reduction of fuels in the asset protection zones will be undertaken as a part of the normal annual maintenance program which will consist of the slashing of grassed areas around assets.

The reduction of fuels within strategic wildfire control zones will be undertaken using and number of criteria. Annually, fire history databases will be checked to determine the last time strategic wildfire control zones were burnt, this detail will be related to fuel accumulation rates. If this information suggests that there is a high build up of fuel, an inspection of the area will be made to determine if fuel reduction is to be carried out.

8.1.3 Management and protection of heritage area management zones.

There are no heritage area management zones which require treatment during the life of this fire plan. However, two communities will soon approach thresholds where prescribed burning for biodiversity conservation of these communities will be required.

8.2 ENVIRONMENT ASSESSMENT OF SCHEDULED WORKS

Before any activity outlined in the works plan can commence, there must be a further check made of the site and databases to ensure that environmental considerations have not changed. To assist in this process an environmental check list will need to be completed and endorsed.

8.2.1.1 Monitoring fuel and fire effects

The implementation of this plan will be driven by the need to manage fuel accumulations at prescribed levels to protect assets and maintain biodiversity within the reserve.

Bush Fire Management Committees meet on a regular basis to plan annual fuel management programs with each Council area. This plan will provide the guidelines and details necessary to determine the appropriate areas needing fuel reduction annually within Kattang Nature Reserve for the Hastings Bush Fire Management Committee.

District staff will monitor the fire frequency and forest fuel levels of the reserve area and in particular the asset and strategic fire management zones to assist with the protection of life and

property and to reduce the occurrence of major wildfires within the reserve.

As indicated in section 4.5, the success of this plan will be measured by the maintenance of biodiversity and threatened species populations. Also, it would be anticipated that the implementation of this plan over time will reduce the occurrence of wildfires moving on and off the reserve.

There are a number of ways to evaluate the effectiveness of this plan. The monitoring of the following matters will assist in determining the level of plan implementation and how effectively the impact of adverse fire management has been reduced by the introduction of this plan;

- The maintenance of fire advantages.
- The maintenance of reduced fuel levels in prescribed areas.
- The development and implementation of research programs.
- NPWS involvement with community fire guard program.
- The maintenance of appropriate fire regimes.

8.3 MONITORING FIRE MANAGEMENT RESEARCH

As identified in the section 5.4.4.1 Further research, there is a need to continue further research to provide details where major deficiencies in knowledge occur in understanding how to managed and conserve the biodiversity within the reserve. Briefly these are;

- knowledge of animal fire responses, particularly the lower vertebrates and invertebrates, especially in relation to habitat characteristics;
- a basis for classifying the responses of animals to fire as a function of life history attributes;
- a basis for predicting the long term responses of animal populations to fire regimes, not just a single fire;
- a better understanding of 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.

The NPWS Head Office Bush Fire Research Section will design an appropriate monitoring system to manage the above research projects. The Port Macquarie District staff will assist by providing staff and resources to implement the projects. District staff will also seek the assistance of appropriate volunteer groups, such as university students, to aid in the collection of research data.

8.4 PLAN REVIEW

This fire plan has been produced with the assistance of the Port Macquarie District, Northern Region and Head Office NPWS staff. The staff input has mainly been towards the management of plant and animal species and fire management within the reserve and general area.

Consultation with the Hastings Bush Fire Management Committee has provided details on a broader fire management issues and has maintained a focus on co-ordinated approach to fuel management within the Hastings Shire Council areas.

Local Bush Fire Brigades have provided details on local fire matters including fire histories and

areas of concern where assets are close to the reserve and may be affected by wildfires. The plan will also be placed on public display for a period of three months for community comment.

There may be a need to review fire management strategies as further research into the management of native flora and fauna in response to fire regimes develops. To ensure that regular reviews are undertaken this fire plan has a currency period of five years. At the end of the operational life of this plan, the plan will be reviewed via a similar process as outlined above.

8.4.1.1 Performance evaluation

Ongoing information is required to judge whether management strategies based on the biodiversity conservation guidelines contained in this plan are successful in terms of achieving conservation objectives. The conservation guidelines (Tables 2, 3, 6 and 11) are a summation of current knowledge relevant to the biodiversity contained within the reserve.

As this 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 reserve.

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 in this reserve, and will seek whatever assistance it needs to develop and implement a program that takes account of species dynamics and fire regimes.

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