
MKHAMBATHI NATURE RESERVE

INTEGRATED FIRE MANAGEMENT PLAN



**A SUBSIDIARY PLAN TO THE MKHAMBATHI NATURE RESERVE STRATEGIC
MANAGEMENT PLAN**

VERSION 2
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(Note: Significant proportions of this document are adapted from Forsyth et al. 2000)

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1 INTRODUCTION

This Integrated Fire Management Plan (IFMP) provides a holistic approach to the management, control and use of fire on Mkhambathi Nature Reserve. This approach includes clear direction on; fire awareness, fire prevention, prescribed burning, resource sharing and co-ordination, detecting fires, suppressing fires, rehabilitating fire damage, monitoring and reporting.

It is a subsidiary plan of the overarching Integrated Reserve Management Plan and is a dynamic document. It should be revised and updated as and when required.

It was originally compiled in February 2008 by reserve management and scientific services staff of the Eastern Cape Parks Board. It was updated in January 2010 by the CSIR as part of the Wild Coast Project. A new section was added outlining the fire management goal, objectives and sub-objectives. The sections on training (see section 5.5) and veldfire management (see section 6) were substantially revised. A new annexure was added listing the practical measures that need to be undertaken if the fire management goal is to be realised (see Annexure A). It sets out all the tasks needed to achieve the goal, objectives and sub-objectives to with their respective deliverables and identifies which managers are responsible. The plan was then further adapted by scientific services staff of the Eastern Cape Parks and Tourism Agency in collaboration with the reserve managers. The final plan was completed in September 2010.

2 FIRE MANAGEMENT GOAL

In setting goals for dealing with fires, two overarching and guiding principles need to be recognised.

- The first is that fire is necessary. It is a natural process which has occurred for millennia in the indigenous vegetation of the Wild Coast, and will continue to do so. The biota of the region are adapted to survive periodic fires, and many species may even require fire for their continued survival. Finally certain combinations of season, frequency, spatial distribution and intensity of fires will ensure the long-term conservation of biodiversity, but that deviations beyond specific thresholds may result in losses of biodiversity. These thresholds may differ between vegetation types and species.
- The second is that fire can be dangerous. This principle recognises that fires can damage crops and infrastructure, and threaten the lives of people and livestock. As human populations grow, and as developments come to predominate more and more of the landscape, pressure will increase to protect lives and property from unwanted wildfires. While such fires may not necessarily have adverse effects on biodiversity, there will be a need to both prevent and contain them.

Ensuring the continued survival of biodiversity, while at the same time protecting lives and property, will require active intervention through fire prevention, fire protection and prescribed burning. In some cases, trade-offs may have to be made, and this will require that stakeholders in the region reach consensus on these trade-offs. The term “biodiversity” refers to all of the species (plant and animal) that occur in a given area, their relative numbers, and the way in which they relate to each other and the environment. Biodiversity conservation therefore aims not only to conserve species, but also to conserve structure and patchiness (for example forest patches in a grassy landscape, or a range of different size classes of trees), and ecosystem functions (for example ensuring that the hydrological cycle is maintained).

The goals listed below take the above into account.

- *Goal 1.* Biodiversity will be conserved through fostering an appropriate fire regime(s) by means of a combination of prescribed burning at appropriate times and under appropriate conditions, and tolerance of wildfires that do not unreasonably threaten lives or property;
- *Goal 2.* Valuable assets that may be at risk will be protected from fires through a combination of fire prevention, suppression and containment, where necessary;
- *Goal 3.* The understanding necessary to conserve the biodiversity of the Wild Coast landscapes will be improved through monitoring, regular assessment, and research; and
- *Goal 4.* To participate meaningfully in the regional Fire Protection Associations, and exert sufficient influence on policies within these FPAs to allow the biodiversity goals of the Wild Coast protected areas to succeed.

The fire management goal in the Mkhambathi Nature Reserve is:

“To conserve biodiversity through fostering an appropriate fire regime(s), while at the same time protecting valuable assets that may be at risk from fires”.

This goal is subdivided into a number of objectives and sub-objectives as indicated in Figure 1.

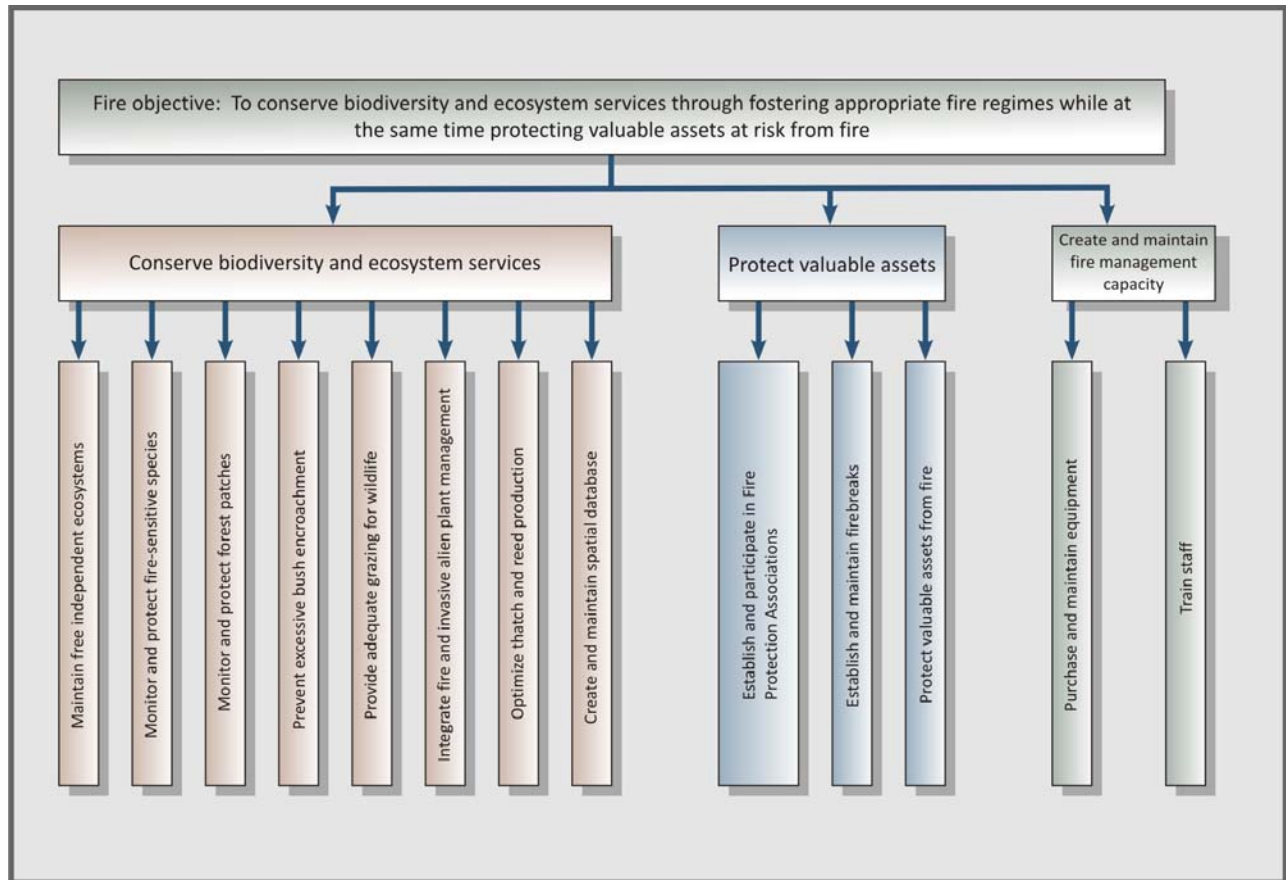


Figure 1. A hierarchy of objectives related to fire management in the Mkhambathi Nature Reserve.

Practical measures to achieve each one of these objectives and sub-objectives, in the form of a list of tasks, deliverables and responsibilities, are presented in **Annexure A**.

3 RELEVANT LEGISLATION

3.1 NATIONAL VELD AND FOREST FIRE ACT (ACT 101 OF 1998)

The National Veld and Forest Fire Act (Act 101 of 1998) (NVFFA) aims at wildfire (an unwanted veld fire) management through the prevention and combating of veld, forest and mountain fires. It defines the expression “veld fire” to include forest and mountain fires. One of the effects of this Act is that different regulations and notices published under the Forest Act remain largely in force. The NVFFA replaces the relevant provisions in the old Forest Act regarding veld fire management, and introduces some important innovations that fill the gaps between diverse statutes affecting veld fire management.

It should be remembered that although the NVFFA’s principal aim is the regulation of wildfires, it also has a role to play in veld fire management generally. This is because the Act aims to control the spread of veld fires by imposing obligations on landowners to prepare and maintain firebreaks. The Act thus applies both to preventing the spread of a veld fire through good management or operational practices, and to extinguishing veld fires through procedure set out in the Act. The NVFFA provides explicitly for compliance with environmental requirements, as well as for the management of risk to life and property. The Act is not an emergency services law. It links natural resource management by property owners collectively or individually to the integrated veld fire management system.

Key Legal Obligations for Eastern Cape Parks and Tourism Agency

- All Eastern Cape Parks and Tourism Agency reserves must join a Fire Protection Association (FPA)
- If such an FPA does not exist the Eastern Cape Parks and Tourism Agency must actively participate in the establishment of an FPA.
- No person (including visitors) may light use or maintain a fire in the open air in a region where the fire danger is high.
- Firebreaks must be prepared and maintained on boundaries where fires may start, burn or spread. Exemption must be applied to either not create firebreaks or to place firebreaks in alternative positions.
- The legislated procedure for burning must be followed.
- All Eastern Cape Parks and Tourism Agency reserves must have sufficient equipment, protective clothing, and trained personnel for fighting fires.
- Eastern Cape Parks and Tourism Agency must ensure that a responsible person is present at all times.
- All fires on reserves are to be reported to neighbours and the FPA.
- Eastern Cape Parks and Tourism Agency may not refuse to assist in fighting a fire if requested.
- Actively prevent fires spreading across reserves to neighbouring land.
- Do not interfere with or obstruct anyone who is fighting a fire.

3.2 FOREST ACT (ACT NO. 122 OF 1984)

Sections of the Forest Act relating to Veld fires are currently still in force because of a savings clause in the National Veld and Forest Fire Act. This Act requires landowners to prevent and control the spread of Veld fires by maintaining firebreaks on their common boundaries, and by taking other appropriate precautions.

The Act empowers the Director-General to declare a prohibition on fires in the open air when required as an extraordinary precaution. During the period of prohibition, no person may make a fire in the open air except within a demarcated picnic or camping area or caravan park or holiday resort, with the further proviso that this type of fire must be properly extinguished when the user is finished with it. Residential and industrial stands within proclaimed townships are excluded from this prohibition, because local authorities have their own permit systems and rules within these areas.

Each year Government Notices are published in the Government Gazette on a regular basis in terms of section 25(1) declaring a prohibition on the making of fires in the open in various districts for certain periods in respect of state forests and private forests. This Act has largely been repealed by the National Forests Act, 1998 (Act No. 84 of 1998) and the National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998).

3.3 NATURE CONSERVATION ORDINANCE (ORDINANCE NO. 19 OF 1974)

In terms of section 6(6)(e) the Minister may make regulations in respect of a Provincial Nature Reserve regulating, restricting or prohibiting the making of fires or the commission or omission of any act which may cause a fire. Regulations 11(a), (b) and (c) of the regulations issued under Provincial Notice 955/1975 regulates the making of fires in nature reserves.

3.4 OCCUPATIONAL HEALTH ACT AND SAFETY ACT (ACT NO. 85 OF 1993)

Eastern Cape Parks and Tourism Agency has its own Safety, Health and Environmental Policy which aims to provide and maintain, as far as is reasonably practical, a workplace that is safe, healthy, environmentally friendly and without risk to its employees, visitors, volunteers and clients. This policy, which seeks to embody the legislative provisions of the Occupational Health and Safety Act, 1993, is applicable to all employees, contractors, visitors, volunteers and professional service providers of Eastern Cape Parks and Tourism Agency. Every employee is expected to identify himself/herself with goals, instructions and policies issued to promote Occupational Health and Safety. The purpose of the Act is "to provide for the health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery; the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work.

General duties of employers to their employees

Every employer must provide and maintain as far as is reasonably practicable, a working environment that is safe and without risk to the health of its employees. Section 8 of the Act specifies in detail the employer's duties in this regard. If an employee or contractor is injured in the course of any fire management activity and this necessitates hospitalization, the incident should be reported to the Programme Manager: Fire Management. He or she will when necessary conduct an investigation or nominate another suitable person to do so.

General duties of employees at work

In terms of Section 14, the employee also has various duties at work inter alia: to take reasonable care for the health and safety of himself and of other persons who may be affected by his acts of omissions, to carry out a lawful order given to him and obey the health and safety rules and procedures laid down by his employer or by anyone authorized thereto by his employer in the interest of health or safety.

Offences and penalties

Section 38(1) imposes a maximum fine of R50 000 or imprisonment not exceeding one year or both such fine and such imprisonment on any person who contravenes or fails to comply with the provisions of the Act. Should an employer do or omit to do an act thereby causing any person to be injured in the course of his or her employment will be liable to a maximum fine of R100 000 or to imprisonment not exceeding two years or to both such fine and such imprisonment.

Regulations

The General Administrative Regulations and General Safety Regulations have been issued in terms of Section 43 of the Act and all Managers should be familiar with these regulations. A fine or imprisonment may be imposed for failure to comply with the regulations.

3.5 CRIMINAL PROCEDURE ACT (1977)

The purpose of the Act is "to make provision for procedures and related matters in criminal proceedings." All Managers should be familiar with sections 19 to 24 which relate to the seizure of articles and searches with and without a warrant. Note that these sections of the Act are not applicable where a search or seizure is conducted in terms of section 27 and 28 respectively of the National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998).

The provisions of the Criminal Procedure Act, 1977 are applicable where common law crimes have been committed or suspected to have been committed. Arson and malicious damage to property are common law crimes.

3.6 FIRE BRIGADE SERVICES ACT (Act No. 99 of 1987)

The purpose of the Act is “to provide for the establishment, maintenance, employment, co-ordination and standardization of fire brigade services”. The head of such a fire service is the Chief Fire Officer (CFO).

This Act allows for the establishment, co-ordination and standardization of fire brigade services throughout South Africa. Local authorities are allowed to establish a fire brigade service.

3.7 CONSERVATION OF AGRICULTURAL RESOURCES ACT (ACT NO. 43 OF 1983)

This Act regulates the conservation and use of soil, vegetation and to some extent, water, outside declared mountain catchment areas and urban areas. It provides for the control over the utilization of natural agricultural resources in order to promote the conservation of the soil, the water resources, and the vegetation and the combating of weeds and invader plants. New regulations on invasive alien plants are stringent and affect Veld fire management.

The Act contains specific provisions dealing with the prevention and control of viliifis. Land users are prohibited from burning Veld or grazing burnt Veld without the written authorization of the executive officer. An application for such permission must set out the burning or grazing motivation and be accompanied by an acceptable management plan.

Regulation 12 of this Act contains provisions dealing with prevention and control of Veld fires, preventing land users from burning or grazing burnt Veld without the written permission from the executive officer. The rules of the FPA for burning Veld (firebreaks and controlled burns) should not contradict the procedures set out in this Act.

3.8 DISASTER MANAGEMENT ACT (ACT NO. 57 OF 2002)

This Act establishes a National Disaster Management Centre, with the objective of promoting an integrated and co-ordinated system of disaster management, with special emphasis on prevention and mitigation, by organs of state in different spheres, statutory functionaries, and other role-players involved in disaster management and communities.

Other relevant duties and requirements are that it must:

- Operate within the national disaster management framework guide disaster management plans and strategies.
- Manage the coordination and management of national disasters.

Sectoral departments must develop strategies and plans for disaster management within their spheres of competence. It establishes provincial and local disaster management centres, the latter in Districts, whose purpose and function are similar to those of the National Centre, but with the obvious difference of geographical scope. They are to develop disaster management frameworks, as well as strategies and plans, on the same lines as those of the National Centre,

and consistent with the national disaster management framework. The Act defines 'disaster management' to mean a continuous and integrated multi-sectoral, multi-disciplinary process of planning and implementation of measures aimed at:

- preventing or reducing the risk of disasters
- mitigating the severity or consequence of disasters
- emergency preparedness
- a rapid and effective response to disasters; and
- post-disaster recovery and rehabilitation.

This means that disaster management is the integrated organization of the whole cycle, from prevention to recovery. Disaster management centres are required to assess and to invoke the contingency and emergency plans in the local disaster management plan if any emergency becomes or threatens to become disaster. Note that disaster management plans can and often must take effect before a disaster happens, that is, when the authorities judge that there is a threat of a disaster. Veld fire management strategies and plans will need to contain these contingency and emergency plans for Veld fires.

Note also that the disaster management centre will not fight fires. Its job is to ensure that disaster management plans are in place, to set the plans in motion, and to co-ordinate operations.

The Department of Provincial and Local Government, which administers the Disaster Management Act, has not yet deployed the Act fully. A key step is to formulate the National Disaster Management Framework, which will give consistency to the deployment of the disaster management function. Without this, there is for example no consistency between municipalities in the assessment of Veld fire risk in each Municipality's Integrated Development Plan (IDP). In the meantime, provinces and district municipalities are in different stages in the deployment of disaster management, some quite far advanced. In certain regions, a close working relationship between disaster management, fire services and the Department of Water Affairs and Forestry has been established and has led to substantial progress in the early steps for the institutionalization of Veld fire management, especially stimulating and guiding the formation of FPA's.

3.9 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT NO. 107 OF 1998)

This Act lays down 20 principles and eight constituents of the principle of sustainable development, which must be considered when making any decision concerning the protection of the environment and must guide the interpretation, administration and implementation of any law concerned with the protection and management of the environment (section 2 of NEMA). Clearly, this includes the National Veld and Forest Fire Act, 1998.

Of these principles, those requiring special attention in Veld fire management include those that:

- require avoiding, minimizing or remedying:

- disturbance to ecosystems or loss of biodiversity,
- pollution or degradation of the environment,
- disturbance of landscapes and sites that constitute the nation's cultural heritage and
- require caution when negative impacts on the environment and on people's environmental rights are possible.
- require integrated management of the environment
- require responsibility for the environmental health and safety consequences of a policy, programme or project
- require participation by stakeholders in environmental governance
- require special attention to sensitive, vulnerable highly dynamic or stressed ecosystems

Section 30 deals with emergency incidents, which are defined as “an unexpected sudden occurrence...including a fire... leading to serious danger to the public...” Obligations are imposed on the person responsible for an incident and he or she is strictly liable for taking measures to contain or minimize the effects of the incident, undertaking clean-up procedures and remedying the effects of the incident. It requires public authorities to authorize or oblige the taking of specific measures to reduce, minimize or rehabilitate harm caused. It provides for a hierarchy of persons who can act to respond to an emergency. Therefore, NEMA charges the municipality with jurisdiction as the principal public agency responsible for directing measures to remedy the effects of an emergency incident, such as a fire. This is subject to two provisos: first, that the local authority has jurisdiction over that area and second, if it is necessary to do so in the circumstances and no other public agency has yet taken such steps to avoid jurisdictional conflict.

However, the relevant authority may remedy the effects of the incident only under certain circumstances. These include failure of the responsible person to comply with a directive ordering him or her to do so, or if there is uncertainty as to who the responsible person is or if any immediate risk of serious danger to the public or of potentially serious detriment to the environment arises because of the incident. In these circumstances, the relevant authority is entitled to claim reimbursement of all reasonable costs incurred. Relevant authorities are also required to prepare comprehensive reports on the incident and these must be made available to several role-players, including the relevant fire prevention service and the provincial Head of Department or municipality.

NEMA gives effect to the environmental right in the Constitution. It codifies principles of sustainable development, which must be considered in any official decision; the Minister must apply these principles when applying the National Veld and Forest Fire Act, 1998.

3.10 NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT (ACT NO. 10 OF 2004)

To provide for inter alia the management and conservation of biodiversity, the protection of species and ecosystems, the sustainable use of indigenous biological resources.... and matters connected therewith.

Biodiversity planning

The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), has a key place in determining the way the National Veld and Forest Fire Act, 1998 is implemented. Both Eastern Cape Parks and Tourism Agency and the Department of Water Affairs and Forestry will need to ensure that biodiversity planning (Chapter 3 of the Act) takes account of Veld fire management requirements, and that the Veld fire management strategies of FPA's and the Veld fire management elements of disaster management frameworks, strategies and plans comply with biodiversity planning.

3.11 THE EASTERN CAPE PARKS AND TOURISM AGENCY ACT (ACT NO. 2 of 2010)

According to section 12(1) of the Act, the Eastern Cape Parks is responsible for biodiversity conservation through the effective management of the protected areas in accordance with applicable national and provincial environmental legislation. In section 12(2) of the Act states that ECPTA is responsible for:

- control and management of provincial protected areas
- development of inventories as well as the assessment, monitoring and protection of natural resources
- ensure security of animal and plant life
- conduct appropriate ecological management
- perform duties and functions according to relevant national legislation and prepare and submit management plans as required by the Protected Areas Act
- manage and control the numbers and spread of alien and invasive species

The Act requires the ECPTA to comply with existing legislation which includes all legislation listed in paragraphs 3.1 to 3.11. It also makes provision for proper planning, management and monitoring of fire as well as fire security in the protected areas.

4 FIRE MANAGEMENT AGREEMENTS

4.1 FIRE PROTECTION ASSOCIATIONS

Chapter 2 of the NVFFA regulates the establishment, registration, duties and functioning of Fire Protection Associations. In terms of the NVFFA the owners of all state land must belong to a Fire Protection Association (FPA) if it exists in their area. If a FPA does not exist the Reserve Manager should actively participate in the establishment of a FPA as this is one of the sub-objectives of the fire management goal (see Figure 1). This is the Reserve Manager's responsibility.

The Ngquza Municipality has submitted an application (Form 1) to the Department of Agriculture, Forestry and Fisheries (previously the Department of Water Affairs and Forestry) to form a FPA in an area that includes the Mkhambathi Nature Reserve and the surrounding communities of Thale, Khanyayo and Cele (Hlabati). The business plan for this FPA is currently being compiled.

The duties of FPAs are listed below:

DUTIES OF AN FIRE PROTECTION ASSOCIATION

- Develop and apply a veldfire management strategy for its area
- Provide in strategy agreed mechanisms for coordinating actions with adjoining FPA's
- Make rules to bind members
- Identify ecological conditions that affect fire danger
- Regularly communicate the fire danger rating to its members
- Organise and train its members in fire fighting, management and prevention
- Inform members of equipment and technology available for preventing and fighting veldfires.
- Provide management services, training and support for communities in their efforts to manage and control veldfires.
- Supply minister every 12 months with statistics about veldfires in the area.
- Furnish any information requested by the Minister in order
- Exercise the powers and perform the duties delegated to it by the Minister; and
- Appoint a fire protection officer, unless a municipality is a member.

4.1.1 *Practical achievement of protecting valuable assets by establishing and participating in Fire Protection Associations*

Ensure that a fire protection association is established and maintained in support of achieving the fire management goal (see Figure 1) will be dependent on:

- Assist in the compilation of a Fire Protection Association business plan together with prospective members;
- Assist in the compilation of rules for the FPA to ensure that prescribed burning is accommodated ;
- Participate in the activities of the FPA; and
- Compile and submit annual fire reports to the FPA.

Typical tasks, deliverables and responsibilities are listed in **Annexure A** (Objective 2, Sub-objective 1).

4.2 WORKING ON FIRE PROGRAMME

Mkhambathi Nature Reserve is currently negotiating with Working on Fire Programme regarding the establishment one of their fire teams at the reserve. Presently a team of 18 fire fighters from the programme is stationed at Silaka Nature Reserve, near Port St Johns.

4.3 MUNICIPALITIES

Mkhambathi Nature Reserve has no contractual obligations with the O.R. Tambo District Municipality. It is recommended that agreements should be facilitated through a fire protection association.

5 RISK MANAGEMENT

Veld fire risk is defined as the chance (likelihood) of a veld fire igniting, spreading and causing damage to assets of economical, social and environmental value to the community. Veld fire risk management involves identifying the level of risk posed by veld fires to assets, as the organization and establishing strategies to protect these assets from the adverse effects of veld fires. It is the responsibility of the Reserve Manager to manage and minimize risk due to fire.

5.1 FIRE RISK MAPPING

Fire risk was assessed for the Mkhambathi Nature Reserve in 2008 by staff of Scientific Services in collaboration with the reserve manager. In this context risk is a combination of the flammability of the area and the consequences (loss of life, loss of nature reserve infrastructure, litigation due to loss of other parties' infrastructure, financial) of an uncontrolled fire spreading into an area. This map shows the different levels of fire risk across the reserve, and allows for appropriate and targeted planning and intervention. High risk levels were determined based on a combination of vegetation type, local knowledge and fire history.

Risk is broadly assessed in the context of flammability and potential loss.

Flammability/Loss	High	Medium	Low
High	High	High	Medium
Medium	High	Medium	Low
Low	Medium	Low	Low

A map was prepared showing areas considered as having a high fire risk and that need to be protected by fire breaks (Annexure B and section 5.2.1).

Veldfire risks are dynamic and change from year to year. They therefore need to be considered and mapped annually before the start of each fire season.

5.1.1 Practical achievement of protecting valuable assets

The protection of life, property and the environment forms part of achieving the fire management goal and will be dependent on:

- Determining before the fire season which assets are exposed and vulnerable to veldfire;
- Creating defensible spaces around buildings and other vulnerable infrastructure in fire prone vegetation;
- Taking fire protection measures beneath power and telecommunication lines; and inspection and maintenance of the fire break network; and
- Taking precautions when the fire danger rating is high or extreme to prevent accidental ignitions.

Typical tasks, deliverables and responsibilities are listed in **Annexure A** (Objective 2, Sub-objective 3).

5.2 FIRE BREAKS

Fire breaks are prepared areas where most if not all inflammable material has been removed, designed to stop less intense fires and to serve as a line from which to directly attack a fire, to facilitate back burning, and allow for the movement of fire fighters and equipment.

The Veld and Forest Fire Act, 101 of 1998 only uses the term fire break (a natural feature) synonymously with fire belt (a man-made feature). In the plan the term fire break includes both features.

Chapter 4 of the NVFFA places a duty on owners to prepare and maintain fire breaks on property boundaries. This is also a sub-objective of the fire management goal (see Figure 1). The annual veld fire mapping exercise should be used to determine the placement and extent of firebreaks required.

5.2.1 Location

Due to the presence of the two large rivers with deep gorges i.e. Mtentu River on the northern boundary and the Msikaba River on the southern boundary, as well as the ocean forming the eastern boundary, the only boundary that needs a firebreak is the northern boundary (Annexure B). This boundary borders community land to the east of the reserve. Due to the high fire risk fire breaks also need to be made around all infrastructure. In addition all grass inside the boundaries of the infrastructure fire breaks must be slashed at all times. This excludes gardens and garden features.

5.2.2 Preparation

Two tracer belts ("skoffelbane") need to be prepared 30 meters apart of which one is on the border fence. These tracer belts must be cleared of all vegetation. When the tracer belts are completed a 30m fire break should be burned between the two tracer belts. When the FPA is formed it is recommended that the firebreak alternate annually inside and outside the reserve. The fence line should always be cleared of vegetation.

Note: Where fire is utilized for preparing firebreaks, the legal requirements of section 12 of the NVFFA must be adhered to.

5.2.3 Timing

Firebreaks should be prepared in autumn (March-May) or even earlier when grass is burnable.

In order to determine whether it is safe to burn, refer to the Fire Danger Rating System (Annexure C).

5.2.4 *Inspection and Maintenance*

Throughout the fire season the reserve manager should be aware of the state of the firebreaks. Due to the high rainfall grass productivity is high and clearing of the trace lines might be needed more than once a year.

5.2.5 *Guidelines to the Design, Location, Preparation, Inspection and Maintenance of Firebreaks*

Guidelines – the information below is to assist the manager in considering options available when constructing fire breaks.

Criteria used to design firebreaks.

- Maintain costs at a reasonable level without jeopardizing good veld fire management and protection.
- The provisions of the NVFFA that specify in section 12(1) that a firebreak must be prepared on the boundary of the property.
- Align firebreaks to avoid known populations of rare and endangered plants.
- Align firebreaks to avoid sensitive habitats such as wetlands.
- No firebreaks are to be prepared along ridges, as rare and endangered plants are known to prefer these features.
- Firebreaks should not be designed with sharp angles.
- Placement of firebreaks on a slope must be determined by access to the break and by topography.
- Use existing features of the landscape where possible, such as cliffs, tracks and roads as control lines.
- Firebreak preparation and maintenance
- Firebreaks need to be well positioned and regularly maintained to be effective.

Ecological Considerations

The following should be kept in mind:

- When preparing firebreaks, the protected area must avoid known populations of rare and endangered plants.
- The protected area must align firebreaks to avoid sensitive habitats such as wetlands.
- Firebreaks should not be aligned along ridges which are favourable habitats of rare and endangered plants.
- The firebreak does not cause erosion (NVFFA).

Planning considerations:

- A decision as to what firebreaks to maintain in any particular year should be taken in the early autumn of each year.
- Information on the spatial distribution of fire hazard should be used in prioritizing the preparation and maintenance of firebreaks.

Design considerations:

- Advantage of preparing brush cut breaks is that unlike rotation of firebreaks of the past, a single break, typically 30 m wide, will be maintained in a permanent position.
- 30 m width for firebreaks should be used as a guide and in circumstances of high risk consideration should be given to creating wider firebreaks.
- Breaks should have significantly reduced fuel loads, and the height of vegetation within the break must be kept as low as possible.
- Waste material from firebreak preparation must be disposed of into the veld on the protected area side of the firebreak.
- The protected area has undertaken to establish and maintain a system of firebreaks in accordance with the provisions of the NVFFA.

Climatic Considerations:

Basic weather and veld fire monitoring should be done on site when applying prescribed burns. Since site conditions can be significantly different from general weather patterns, it is strongly recommended that portable electronic weather monitoring instruments be used to measure basic weather parameters during the burn. The following parameters need to be measured, calculated and observed:

By instrument:

- Ambient temperature
- Relative humidity and
- Wind speed

By observation:

- Head or back burn
- Rate of spread
- Ease of control, based on Fire Danger Rating categories

Procedure

The Manager will obtain detailed weather forecasts and will also make use of synoptic charts to predict the most suitable weather for burning. This will enable fire teams to start burning as soon as the right weather conditions arrived. Once a decision is taken to burn, the Incident Commander will immediately inform the following organizations:

- District Disaster Manager
- Neighbouring communities
- Tourism operators within the reserve

The Incident Commander will keep the abovementioned organizations informed on the progress of the burn and will immediately contact them should the prescribed burn escape and become a wildfire.

While a prescribed burn is generally carried out under carefully selected conditions, it remains essential that the burnt area be made safe and fully extinguished.

5.2.6 Practical achievement of protecting valuable assets by establishing and maintaining fire breaks

Ensure that a fire break network is established and maintained in support of achieving the fire management goal will be dependent on:

- Construction of external fire breaks on the boundary of the nature reserve to limit the entry of wildfires;
- Establishing an internal fire break network (if necessary) with the aim of containing large fires and protecting vulnerable infrastructure;
- Regular inspection and maintenance of the fire break network; and
- Constructing temporary internal belts to facilitate prescribed burning.

Typical tasks, deliverables and responsibilities are listed in **Annexure A** (Objective 2, Sub-objective 2).

5.3 OTHER MANAGEMENT INTERVENTIONS

During the actual burning of firebreaks no public will be allowed in the general area of the firebreak. And tourist might be denied access to certain areas of the reserve according to the manager's discretion.

5.4 EQUIPMENT

It is essential that reserves have adequate and properly maintained equipment to deal with both emergency and controlled fires. This is also a sub-objective of the fire management goal (see Figure 1).

5.4.1 Protective clothing

All staff working with fire should have adequate protective clothing according to national standards.

5.4.2 Equipment needs

Reserve managers must prioritize the purchase of any outstanding equipment (see Table 1 below).

Table 1: Current equipment and equipment required

Equipment	Minimum requirements	Currently in possession ¹	Urgently required	Long term acquisition
Bakkie sakkies	2	2	0	
Beaters	40	30	10	40
Handheld Radios	10	12	0	15
Base station Radios	4	1	1	0
Radio repeater	1	0	1	1
Vehicles	2	3	0	1
Back pack sprayers	10	6	4	15
Drip torches	3	2	1	4
Tractor and water trailer	1	1	0	0
GPS	3	1	2	0

¹ September 2010

5.4.3 Equipment maintenance

The following guidelines apply to the use and maintenance of the fire fighting equipment:

- Fire fighting equipment should only be used for that purpose.
- A maintenance schedule for fire fighting equipment should be compiled by the reserve manager. This schedule must assign direct responsibility to specific individuals/positions.
- Tools to be checked once a week and checklist to be signed.
- Motorized, electrical or mechanical equipment should be checked daily.
- Any defects or damages to vehicles or equipment must be reported to the Reserve Manager.

5.4.4 Practical achievement of creating and maintaining fire management capacity through obtaining and maintaining equipment

Ensuring that suitable and sufficient equipment is available to support achieving the fire management goal (see Figure 1) will be dependent on:

- Annual review of present types and levels of equipment;
- Establish and maintain an equipment register;
- Allocating sufficient budget to purchase necessary equipment if and when needed;
- Repair or replace broken equipment after each fire;
- Service mechanical equipment such as pumps and vehicles as specified;
- Checking of mechanical equipment to ensure that it is reliable when needed; and
- Ensure that equipment is correctly stored so that it is available when needed.

Typical tasks, deliverables and responsibilities are listed in **Annexure A** (Objective 3, Sub-objective 1).

5.5 STAFF, TRAINING AND RESPONSIBILITIES

A well-trained and practiced veld and mountain fire-fighting force is an essential component of any veld fire management operation. This is one of the sub-objectives of the fire management goal (see Figure 1). Where insufficient staff exists, alternative suitably trained manpower needs to be secured through mutually beneficial agreements (neighbours, through FPA, Working for Fire). Currently most of the staff is experienced but none of them received formal fire fighting training

The use of untrained casuals is not recommended.

5.5.1 Staff

A breakdown of the permanent staff complement at Mkhambathi Nature Reserve by post is given in Table 2. Not all staff would necessarily be involved in fire management duties (e.g. housekeepers). (see section 5.5.2).

Table 2: Permanent staff

Position	Filled ^{1 & 2}	Vacant	Total
Reserve Manager	1	0	1
Nature Conservator	1	0	1
Admin Clerk	1	0	1
Principal Foreman	1	0	1
Senior Field Ranger	2	0	2
Field Ranger	8	6	14
General Foreman	2	0	2
General Assistant	7	5	12
Tractor operator	1	0	1
Hospitality supervisor	0	0	1
Housekeepers	9	0	9
Gate keepers	2	2	4
Total	35	3	51

¹ September 2010

² The reserve manager must identify additional manpower requirements by the end of January each year and to motivate to fill these posts.

5.5.2 Training and experience

Fire management involves has many facets including planning and preparedness, wildfire prevention, wildfire protection, wildfire suppression, application of prescribed burns, communication and awareness. Minimum skill requirements are dependent on the tasks that an individual will perform during a fire. For example, it is prudent that all fire management staff have the appropriate basic fire fighting and first aid training. However, not all staff require advanced fire management training and only senior staff, such as protected area managers, will be expected to be responsible for the overall management of a fire.

The Mkhambathi Nature Reserve has 23 staff available for fire management duties (see Table 3). Many of the staff members are experienced in fighting veldfires but none have received accredited fire management training (see Table 3). The level of training is insufficient especially in the light of the regular fires occurring there. Nine staff members have had First Aid (Level 1) training that is still valid but this was not reported by job category.

Table 3: Mkhambathi Nature Reserve fire management training requirements in January 2010. Numbers refer to staff per job category. Grey-shaded cells represent recommended training per job category with numbers indicating staff needing training and bold numbers in brackets showing staff already trained. Un-shaded cells show where training is not applicable.

DESIGNATION	STAFF PER JOB CATEGORY	CURRENT and RECOMMENDED TRAINING						
		Wildfire Suppression: Basic	Wildfire Suppression: Advanced (P team)	Wildfire Suppression: Crew Boss	Wildfire Suppression: Fire Boss Level 1	Wildfire Suppression: Logistics	Unimog / fire truck handling	First Aid ¹
General Worker	7	7	7					7
Field Ranger	8	8	8					8
Senior Field Ranger	2	2	2	2			1	1
Foreman	2	2	2	2				2
Principal Foreman	1	1	1	1				1
Driver	Vacant							
Storeman	Vacant							
Office Administrator	1	1				1		1
Nature Conservator	1	1	1	1	1	1	1	1
Reserve Manager	1	1	1	1	1	1	1	1

¹ Nine staff members have had First Aid (Level 1) training but this was not reported by job category.

It is important to provide senior field rangers with the same level of fire management training as is expected from a reserve manager as this will ensure continuity if there is a high turn-over of management staff.

5.5.3 Practical achievement of creating and maintaining fire management capacity through the training of staff

Ensuring that nature reserve staff is competent to support achieving the fire management goal (see Figure 1) will be dependent on of a combination of:

- Identifying fire management training needs, appropriate training courses and accredited service providers;
- Ensuring the staff receive the required level of training for the tasks that they are requested to perform at a veldfire;
- Allocating sufficient budget for staff to attend training courses; and
- Practicing skills to ensure a heightened state of readiness in fire season;

Typical tasks, deliverables and responsibilities are listed in **Annexure A** (Objective 3, Sub-objective 2).

5.5.4 Fire management roles and responsibilities

Mkhambathi Nature Reserve needs to establish a fire management team and individuals need to have clearly assigned responsibilities (see Table 4). The typical roles in any fire management team include the following:

- **Incident Commander:** Overall commander of a fire-fighting operation
- **Fire Boss:** In command of a small veld fire or a section of a large veld fire, normally reporting directly to the Incident Commander.
- **Crew Leaders, Foreman or Supervisors:** Supervise crews on standby, supervise crews deployed at a veld fire, respond to instructions from the Fire Boss, respond with minimum delay to a veld fire, compliance with restrictions applicable to helicopter teams, radio communication with Control Centre and/or Fire Boss regarding response in the event of a call out and all information pertaining to the situation. The Foreman/Supervisor must also keep an attendance register for the period on standby.
- **Fire-Fighter:** Responsible for ensuring that they remain physically fit, have all personal fire fighting equipment in good working order, adhere to all safety procedures and ensure availability according to the duty roster.
- **Driver:** Responsible for the condition of vehicles and equipment, completion of checklists for tankers, professional handling of vehicles and equipment, compliance with traffic regulations, radio communication with Control Centre and/or Fire Boss relating to movement of vehicles, acquaintance with the road network in the protected area.

Table 4: Designation of roles and functions for reserve

Name	Rank	Role
Mr V. Mapiya	Reserve Manager	Incident commander Fire boss Veld fire management
Nikelwa Tom	Conservator	Fire boss / Crew boss
Sipho Ntsombathi (Leader) Richard Metuso (Assistant Leader) Harris Jico (First Aider) Ndoda Dubula (First Aider) Mbuyiseli Mzayiwa (First Aider) Siyabulela Wangaza Thandeka Mhlaba Pazamile Qekele Goodman Deyi Sonwabile Jack Dalumzi Sileji	Field Rangers	Crew boss
Mkhalelwa Mkhongo Mlandulwa Ntobela George Bobosana Zaminkosi Makhinayisi Thembinkosi Mandlakapheli Pheneas Hlityalwa Ngcungane Dlamini	General Assistants	Fire fighters

5.6 FIRE READINESS

The level of preparedness during the fire season should be based on the daily Fire Danger Rating (see Annexure C).

However, basic preparedness levels that should be maintained throughout the fire season, irrespective of the Fire Danger Rating include:

- Equipment should be correctly maintained (see Equipment Maintenance).
- Standby crews must, at all times be ready to depart immediately in event of a veld fire reported. On the alarm being given, all crew must immediately proceed to the point of assembly with their respective equipment.
- Where there are radio blind spots, measures must be taken to ensure that fire crews are in contact with the Control Room.
- Vehicles used for fire fighting must be equipped with basic fire response tools so that fire fighters are in a position to immediately respond to a wildfire. The driver and the fire boss must check tools at least once a week and both the duty officer and the driver must sign the checklists provided.
- Motorized, electrical or mechanical equipment should be checked daily to ensure that it is operational, e.g. radio batteries should be kept charged and fuel tanks should be kept above half a tank and filled before each weekend.
- Any defects or damages to vehicles or equipment must immediately be reported to the Section Manager.
- Standby crews must, at all times be ready to depart immediately in event of a wildfire reported. On the alarm being given, the crew must immediately proceed to the point of assembly, taking with them all the equipment that will be required during the initial stage of the wildfire.

Responsibility of fire boss on standby duty:

- Regular roll calls to determine whether all crew members are present.
- Check the readiness of the standby crews.
- Check the condition of equipment to ensure good working use.
- Complete equipment checklist with tanker drivers at the beginning of the standby period.
- Ensure that portable radios are fully charged, available and that the applicable radio channel is switched on to ensure proper communication.

Pre Fire Season Planning:

- Immediately before each fire season a meeting should be convened to set up contingency plans in the event of a wildfire.
- The veld fire risk map should be modified to reflect any prescribed burns that have taken place in the late summer or early autumn.

- Contingency plans should be developed for areas identified as high veld fire hazard areas so that appropriate staff and equipment are available immediately, should a veld fire occur in these areas.
- High levels of preparedness should be maintained in these areas of high veld fire danger throughout the fire season.

5.7 EMERGENCY PROCEDURE

5.7.1 *Fire Incident*

When there is fire in the reserve, it reported to the Reserve Manager / Principal Foreman. The Assistant Manager / Nature Conservator acts as second in charge during Reserve Manager's absence. If it is not clear where the fire is in the reserve, The Reserve Manager will go and check the fire with a t least one field ranger.

Labour staff and equipment is organized through the Assistant manager or Principal foreman in case the Reserve Manager is not there. Labour staff includes water pump operators, knapsacks sprayers and fire beaters.

5.7.2 *Transport*

Depending on the extent of fire, the truck or vehicles with fire fighting equipment, or a tractor with a trailer are used.

5.7.3 *Communication*

Communication is through two-way radios. While fighting fire two-way radios are available to communicate with staff at the base station. Always there is a person that is left at the base station to communicate with in case additional assistance is needed.

5.7.4 *Health & Safety*

Usually a first aid box is carried when going to fire in case there is mishap during fire fighting. Protective clothing is compulsory when fighting fire. All the instructions during fire fighting are from one person, the person in charge of the operation in order to prevent confusion.

5.7.5 *Fire fighting*

After the fire has been extinguished, monitoring of the burnt area is done to check for flare-ups. Burnt areas need to be assessed to establish the extent of damage caused by fire.

5.7.6 *Reporting*

The burnt area is mapped manually. Two reports are done, one report to the office of the Executive Director Conservation through the Regional Manager. This is done within 24hours the fire has been experienced. The second report if for scientific services information with the full details of the fire incident which includes maps.

5.7.7 *Additional assistance*

If the fire is beyond our control, seek assistance from the nearby Saw Mill (Trponza). If the fire becomes more serious, approach the local municipality for assistance.

Each management section should maintain a “DUTY ACTION FILE”, in which the following can be kept:

- Contact numbers and radio frequencies for all relevant sections/authorities.
- Standby duty rosters, and contact numbers for staff
- Any other information and documents relevant to emergency veld fire management

5.8 AWARENESS

It is the responsibility of the reserve manager to ensure that all individuals who need to be aware of the fire management approach and activities have been informed. An awareness strategy needs to be developed to make sure this happens.

6 VELD MANAGEMENT

6.1 ECOLOGICAL PRINCIPLES OF FIRE MANAGEMENT

An overview of the role of fire and its management in the Wild Coast region is provided by van Wilgen and Forsyth (2010), and this management plan is aligned with the principles and approaches outlined in that document.

When considering fire management in fire-prone and fire-dependent protected areas, two overarching and guiding principles need to be recognised (see Section 2):

- Firstly fire is necessary for the maintenance of biodiversity
- Secondly fire can be dangerous.

The term “biodiversity” refers to all of the species (plant and animal) that occur in a given area, their relative numbers, and the way in which they relate to each other and the environment. Biodiversity conservation therefore aims not only to conserve species, but also to conserve structure and patchiness (for example forest patches in a grassy landscape, or a range of different size classes of trees), and ecosystem functions (for example ensuring that the hydrological cycle is maintained). Ensuring the continued survival of biodiversity, while at the same time protecting lives and property, will require active intervention through fire prevention, fire protection and prescribed burning. In some cases, trade-offs may have to be made, and this will require that stakeholders in the region reach consensus on these trade-offs.

6.2 OBJECTIVES OF FIRE MANAGEMENT AND THEIR ACHIEVEMENT

6.2.1 *Practical achievement of objectives*

The achievement of the various fire-related ecological (biodiversity and ecosystem services) objectives (see Figure 1), which will be dependent on of a combination of:

- prescribed burning at appropriate times and under appropriate conditions;
- tolerance of wildfires that do not unreasonably threaten lives or property;
- fire prevention, suppression and containment, where necessary; and
- improving the understanding of the role and effects of fire that will be necessary to conserve the biodiversity of the Wild Coast landscapes through monitoring, regular assessment, and research.

Typical tasks, deliverables and responsibilities are listed in Annexure A (Objective 1, Sub-objectives 1 to 8).

6.3 DESIRED FIRE REGIME AND BURNING PRESCRIPTIONS

The fire regime needed to achieve the goals outlined above will be regular (2 -3 year) fires in winter in grasslands, but with enough variation spatially, and in intensity, to ensure the survival of embedded vegetation patches (forest) and fire-sensitive species (e.g. shrubs in the genera *Erica*, *Protea*, *Leucadendron*, *Leucospermum*, *Stoebe*, *Athanasia*, *Calopsis*, *Agathosma* and *Muraltia*). Previous fire management plans called for the burning of grasslands in Mkhambathi Nature Reserve on fixed blocks at a 2 – 3 year return period in winter (July and August). However, the frequency of unplanned fires made the system unworkable. The basic prescription remains valid, however, and will be catered for under a system of adaptive management (see below).

6.4 ADAPTIVE FIRE MANAGEMENT

Adaptive ecosystem management is an approach that integrates research, planning, management and monitoring in repeated cycles of learning about how to better define and achieve objectives. Adaptive management implies that changes will often be necessary as understanding improves. It is built on the assumption that natural systems are complex, that understanding is imperfect, and that the logical way to proceed is to “learn by doing”, and to adapt as new understanding emerges. It also recognises that effective management cannot be achieved by acting in isolation, and that a partnership involving researchers, managers, administrators and society at large is required.

The concept of thresholds of potential concern is central to the implementation of a system of adaptive management. Thresholds of potential concern have been defined as “those upper and lower levels along a continuum of change of a selected environmental indicator which, when reached prompts an assessment of the causes which led to such an extent of change, and results in either (a) management action to moderate such causes or (b) re-calibration of the threshold to a more realistic or meaningful level”.

This management plan adopts an adaptive approach, with a focus on thresholds of potential concern regarding fire management.

6.5 THRESHOLDS OF POTENTIAL CONCERN

Thresholds of potential concern for the Mkhambathi Nature Reserve are divided into operational and ecological thresholds (Table 5). The operational thresholds describe desired fire patterns in terms of areas burnt at different return periods and seasons. By using these thresholds, managers can easily assess whether and where fire is necessary, and where fires should be prevented. The ecological thresholds assess the responses of indicator or rare species or other ecosystem attributes or processes to fire and grazing. The ecological thresholds will be monitored by the ecologist with the assistance of the managers. In cases where these thresholds are exceeded, the appropriate management action, or recalibration of the threshold, would

typically be agreed on by both researchers and managers, and may even require further research.

Table 5. Proposed thresholds of potential concern relating to fire management in the Mkhambathi Nature Reserve. Thresholds are divided into operational thresholds (for the guidance of managers) and ecological thresholds (that would be assessed by scientists and used to adjust operational thresholds if necessary).

Area of concern	Reason for concern	Measure	Thresholds
Operational thresholds			
Large areas will go without fire for too long.	Sour grasslands are adapted to frequent fire, and species will be lost if fires do not occur regularly	Proportion of the area > 3 years post-fire.	Proportion of the area > 3 years post-fire should be < 15%.
Large areas will burn too frequently	Very frequent fire will be detrimental for some species.	Fire return intervals assessed over the past 10 years.	Fire return intervals should not be < 2 years on > 20% of the area.
Fires will occur in ecologically unacceptable seasons	Some species may be disadvantaged by unseasonal fires	The proportion of the area that burns in summer (November – January inclusive) over the last 5 years.	Should be > 0.5%, but < 5%.
		The proportion of the area that burns in autumn (February - April inclusive) over the last 5 years.	Should be > 1%, but < 10%.
		The proportion of the area that burns in winter (May – August inclusive) over the last 5 years.	Should be > 75%, but < 90%
		The proportion of the area that burns in spring (September and October) over the last 5 years.	Should be > 1% but < 10%.
Ecological thresholds			
Frequent or intense burning will penetrate forest margins.	Forest cover will decline, resulting in a loss of landscape diversity or even species.	Change in the extent of selected forest patches as determined by either remote sensing or ground surveys at 5 year intervals.	An increase or decrease in the extent of individual forest patches of > 20%.
Rare or threatened species may be negatively affected by fires.	The existence of disadvantageous fire regimes (especially excessively frequent burning) could lead to population declines or local extinction.	Population counts on fixed areas.	Population declines of > 25% between successive fires, or increases of > 200%.
Bush	Insufficient burning could lead to	Change in the cover of	An increase of >

Area of concern	Reason for concern	Measure	Thresholds
encroachment will reduce value of grazing and thatch harvesting	thickening of bush	woody plants on monitoring sites	10% in cover of woody plants
Ecosystems could become invaded by alien species	Lack of control could be exacerbated by unplanned fires or failure to apply appropriate pre-fire treatments to populations of invasive alien plants. Increasing levels of invasion will lead to loss of biodiversity, changes in fire intensity, and post-fire erosion.	Area occupied by each species in four density categories (dense, > 50% cover, moderate, 20 – 50% cover, scattered, 1 – 20% cover, and rare, occasional individuals only).	For each species, any increase in cover in the densest category ¹

¹Footnote: Invasive alien species thresholds are not upper and lower levels, but zero tolerance limits.

6.6 OPERATIONAL IMPLEMENTATION

The implementation of an adaptive approach should follow a logical, and repetitive, process, as indicated in Figures 2 and 3 for the operational and ecological thresholds respectively. If thresholds are exceeded, the real difficulty is to assess whether or not the thresholds are achievable under the current circumstances. The idea is that if thresholds are chronically exceeded, then they need to be carefully assessed against reality, and re-calibrated if either the logic for their creation was flawed, or they will simply not be achievable if current conditions persist.

Managers face the choice of implementing either block burns (on fixed areas), or patch mosaic burns (on variable areas). Both have advantages and drawbacks. Fire management systems based on fixed blocks make management easier in terms of scheduling where and when to burn, but the scheduled burns may be pre-empted by wildfires, fail to burn the whole block, or jump to adjacent blocks, thus upsetting the burning plans. This plan proposes that the reserve be divided into 10 burning sections of roughly equal size, and that three to four of these be scheduled for burning each year, in rotation. The burning sections should as far as possible align with natural fire barriers (rivers, cliffs etc.) in order to simulate the natural situation and make management burning easier. The burning schedules can then be adjusted to take wildfires and longer-term thresholds into account.

An essential component of initiating a system of adaptive fire management will be to develop and maintain a spatial database that records the cause, extent and dates of all fires that occur in the protected area. This must serve as a basis for the interpretation of observed changes or trends in ecosystem states or thresholds, as well as a basis for supporting ongoing research into the management and effects of fire. All fires that occur must be mapped and captured onto a spatial (GIS) database. Minimum information includes the date(s), extent (boundaries), and cause of all fires.

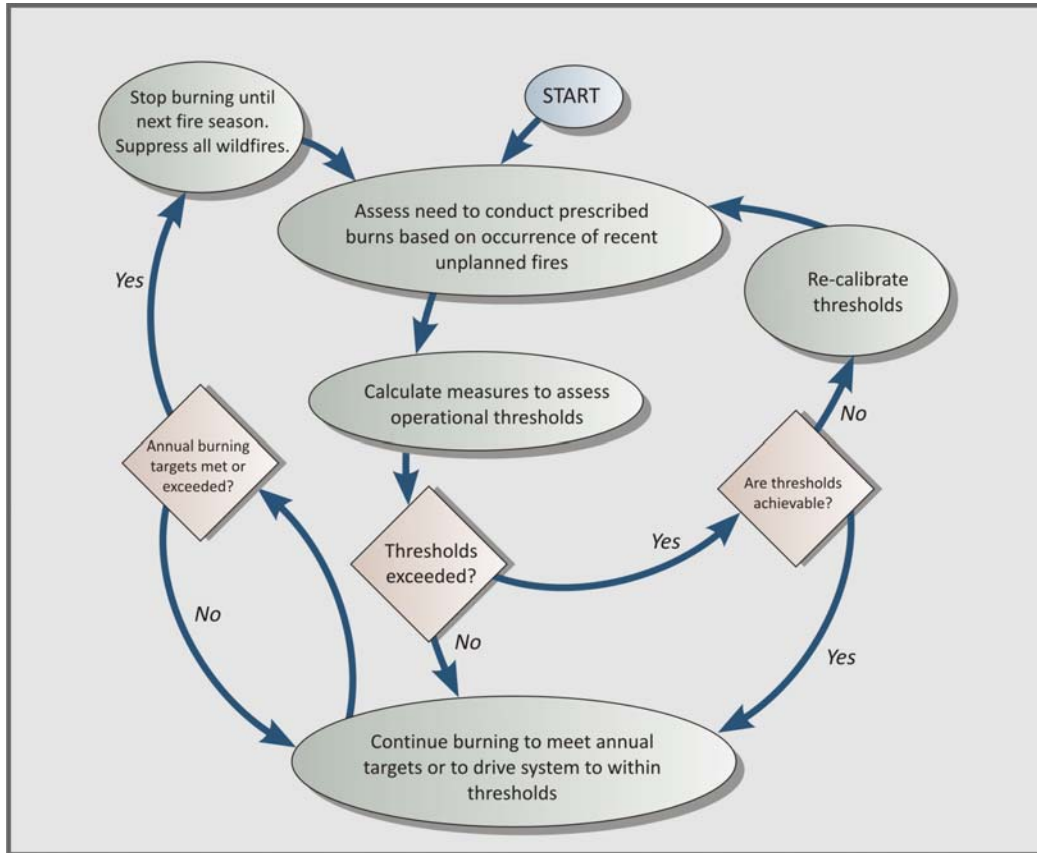


Figure 2. Flow diagram to indicate the sequence of events for implementing burning and assessing operational thresholds of the adaptive fire management system.

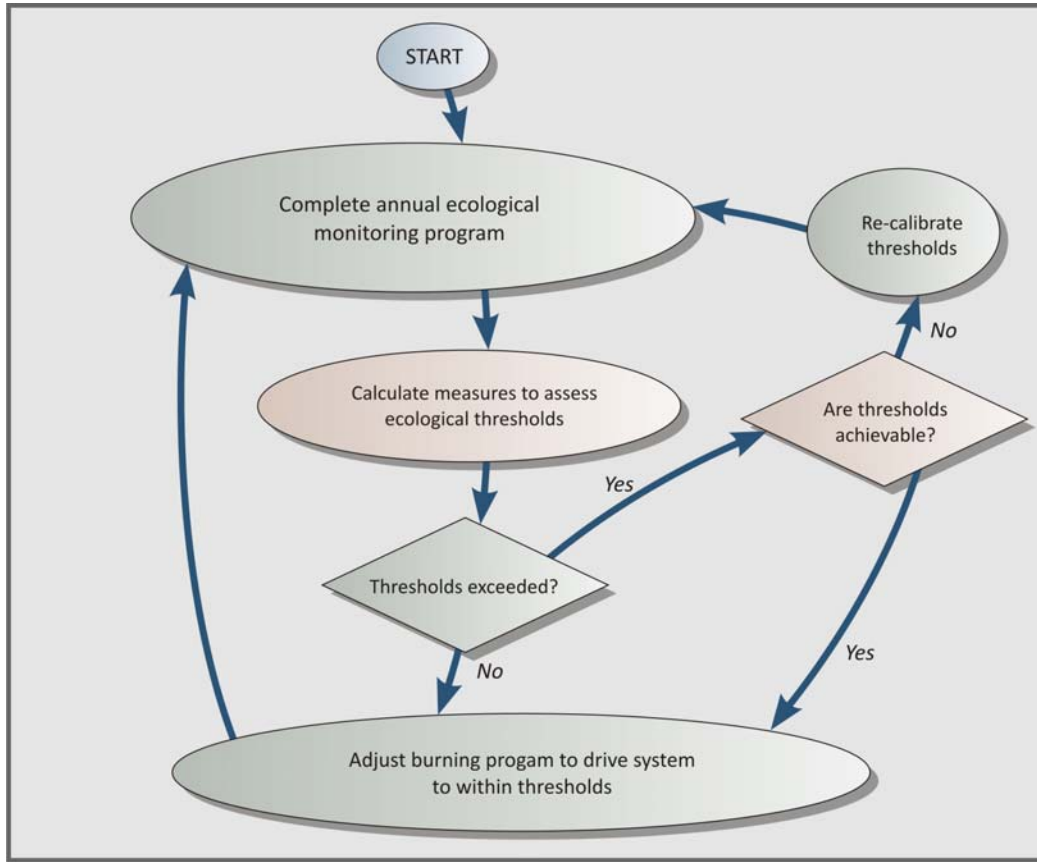


Figure 3. Flow diagram to indicate the sequence of events for implementing burning and assessing ecological thresholds of the adaptive fire management system.

6.7 ALLOWABLE DEVIATIONS FROM THE THRESHOLDS IN THE ADAPTIVE FIRE MANAGEMENT PLAN

In some areas, exceeding thresholds could be allowable in the interests of safety, provided that they are limited to an acceptably small proportion of the Nature Reserve. For example, firebreaks could be burnt annually around buildings or other infrastructure at risk from unplanned fires.

6.8 FIRE AND INVASIVE ALIEN PLANT CONTROL

Fire can be used, often in conjunction with other methods (mechanical clearing, chemical control, and biological control) to control invasive alien plants. On the other hand, fire can also be a major driver of invasive alien plant spread. The response of invasive alien plant species to fire, and the use of fire in their control, is therefore highly species-specific (Table 6). Managers must take cognisance of the species present, and the appropriate treatment, when planning to carry out management fires in areas in which invasive alien plant species occur. For more information on the control of invasive alien plants in the Mkhambathi Nature Reserve see the reserve's strategic subsidiary management plan for invasive alien plants.

Table 6. Invasive alien plant species present in the Mkhambathi Nature Reserve, and appropriate approaches regarding the use of fire in their management.

<i>Species</i>	Area invaded (ha)	Use of fire in control
<i>Acacia baileyana</i>	0.003	Fire can be used to stimulate seed germination for follow-up
<i>Acacia longifolia</i>	59.030	Fire can be used to stimulate seed germination for follow-up
<i>Acacia mearnsii</i>	30.290	Fire can be used to stimulate seed germination for follow-up
<i>Agave sisalana</i>		Can be killed by fire
<i>Ageratum conyzoides</i>	0.018	Unknown
<i>Caesalpinia decapetala</i>	37.370	Resprouts vigorously, can be used to clear thickets to facilitate entry
<i>Callistemon spp.</i>	0.003	Resprouts vigorously, not recommended
<i>Canna indica</i>	0.018	Resprouts vigorously, not recommended
<i>Chromolaena odorata</i>	5.330	Resprouts vigorously, can be used to clear thickets to facilitate entry, annual fires can prevent seedling recruitment but fires at longer intervals facilitate establishment; can be a fire hazard
<i>Cortaderia spp.</i>	0.003	Resprouts vigorously, can be used to clear thickets to facilitate entry
<i>Datura spp.</i>	0.001	Unknown, persistent seedbank
<i>Eucalyptus spp.</i>	93.440	Resprout vigorously, not recommended
<i>Hedychium spp.</i>	0.218	Resprout vigorously, not recommended
<i>Ipomoea spp.</i>	8.980	Unknown
<i>Lantana camara</i>	17.120	Resprouts, can be used to clear thickets to facilitate entry
<i>Leptospermum laevigatum</i>		Killed by fire which releases seeds
<i>Melia azederach</i>	0.025	Resprouts, not recommended
<i>Montanoa hibiscifolia</i>	0.180	Unknown
<i>Pinus spp.</i>	0.280	Fire tolerant, releases seeds, not recommended
<i>Plectranthus comosus</i>	0.127	Resprouts?
<i>Plumeria spp.</i>	0.003	Unknown
<i>Psidium guajava</i>	2.530	Resprouts vigorously, can be used to clear thickets to facilitate entry
<i>Ricinus communis</i>	0.020	Fire can be used to stimulate seed germination for follow-up
<i>Rubus spp.</i>	0.360	Resprouts vigorously, can be used to clear thickets to facilitate entry
<i>Sesbania punicea</i>	1.520	Killed by fire, seeds not stimulated by fire
<i>Solanum mauritianum</i>	10.820	Fire can be used to stimulate seed germination for follow-up
<i>Solanum spp.</i>	0.050	Unknown

6.9 PROMOTING RESEARCH

If at all possible, the reserve's management should establish weather recording stations that record daily values of those weather variables that have an influence on fire, particularly daily rainfall, maximum temperature, minimum relative humidity, and total daily wind run. These should be used to calculate fire danger indices, and all of this information should be stored on an electronic database.

The reserve's management should also promote research into the management and effects of fire, with a particular focus on assessing the validity of the ecological thresholds described in this plan, determining the underlying drivers of any trends that are detected, and evaluating whether operational thresholds are achievable. This would include providing permission to external researchers to work inside of the Nature Reserve, providing access to databases, and if possible providing limited accommodation facilities.

6.10 RESPONSE TO A WILDFIRE

Wildfires will be suppressed or contained under the following circumstances:

- (1) When burning targets for the year have been met, and additional burning will cause a threshold to be exceeded;
- (2) When the fire danger is high, and a fire ban is in place in terms of the Veld and Forest Fire Act; or
- (3) When the wildfire poses a threat to infrastructure or people.

Wildfires that do not meet any of these conditions can be allowed to burn, but must not be ignored or treated lightly. All wildfires must be monitored continuously, and plans should be made to contain the wildfire based on the amount of burning that has already been done in the year.

7 FIRE SUPPRESSION

Fire suppression: “All the work and activities connected with fire-extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished”.

7.1 RESPONSE TO A WILDFIRE

Response to a wildfire should be related not only to the situation immediately after ignition, but also to the potential size and controllability of the veld fire.

- REMEMBER: Fire Response must be based on the potential threat not the immediate size of the veld fire.
- The daily Fire Danger Rating (Annexure C) is a useful guide for predicting the potential behaviour of the veld fire after ignition. It should be used on a DAILY basis to determine the appropriate level of preparedness, as well as the required response should a veld fire break out.
- No report of a wildfire may be ignored or treated lightly. Once the approximate location of the wildfire has been determined, action must be taken promptly. Every veld fire should be treated as dangerous, and when the fire alarm is given, immediate and effective action is imperative.

Guidelines for veld fire behaviour are provided in Annexure D.

7.2 PROCEDURE

When receiving a wildfire call, the protected area manager must immediately dispatch a team to the wildfire taking with them the necessary equipment.

7.3 IMPLEMENTATION OF WILDFIRE CONTROL

As an overall strategy, the response to a wildfire should be related not only to the situation immediately after ignition, but also to the potential size and controllability of the wildfire. It is thus important to emphasize that the wildfire response must be based on the potential threat not the immediate size of the wildfire.

The Fire Danger Rating should therefore be used on a daily basis to determine the appropriate level of preparedness, as well as the required response should a wildfire start.

7.4 FIRE FIGHTING SAFETY RULES

Fire suppression is only one part of veld fire management. Fire prevention is the most important component and combined with this is safety of all personnel during fire fighting operations. The TEN GOLDEN RULES are as follows:

- Keep informed of fire weather conditions and forecasts
- Know what your veld fire is doing at all times
- Base all actions on the current and expected veld fire behaviour
- Plan and make known escape routes for everyone on the ground and in the air
- Post a lookout for danger and safety aspects
- Be alert, keep calm, think clearly, make clear decisions and act decisively
- Maintain prompt communications with the Fire Boss, Sector Bosses, crew leaders and fire fighters under your control
- Give clear instructions and have them repeated to ensure that they are understood
- Maintain control of your men and fire fighting operations
- Fight veld fire aggressively but put the safety of your fire fighters first

7.5 COMMAND STRUCTURE

Regardless of the size of the veld fire, certain basic management actions are required to establish rapid and efficient control, and minimize risk, damage and costs. To meet this requirement, it is essential to set up positive and clear lines of authority quickly, and launch a dependable and rapid response to instructions.

See Risk Management / Staff / Responsibilities for more detail.

7.6 COMMUNICATION DURING A WILDFIRE

Issues to communicate to the public

During major veld fires, the key requirement for people is to know what is happening and how the veld fires might affect them. Much of this is about reassuring the public that the protected area has the situation under control. There is far more “immediacy” to the needs for information, that needs to include prescribed burns as well.

- Is there a developing threat to people and property and where is the veld fire headed?
- Is the weather forecast good or bad for controlling the veld fire?
- Is the veld fire under control or dangerously out of control?
- How many people are fighting the veld fire, what equipment is being used and are reinforcements required?
- Are reinforcements on the way?

- What roads should be avoided?
- Who to contact in an emergency?
- How large an area has been burnt?
- What is being burnt and is this good or bad?

Implement the emergency communications if the situation demands it such as in the event of serious injury or death.

The Protected area has designated the Director: Conservation as spokesperson to deal with the media during or after a veld fire. During a veld fire, the Incident Commander (or Reserve Manager) must ensure that all the detail is communicated regularly to the designated spokesperson as to enable him or her to deal effectively with the media. In the case of smaller veld fires, the Incident Commander will act as the designated alternative spokesperson and will deal with the media.

8 POST FIRE PROCEDURE

8.1 SHORT TERM ACTION

Prescribed fire post-burn actions:

- After the prescribed burn has been completed, patrolling and inspections should continue until the Incident Commander is satisfied that the veld fire has been extinguished.
- During the patrolling phase, hazardous situations where a veld fire could most likely reignite (for example smouldering stumps and marshes especially if close to the perimeter of the veld fire) should be identified. These areas should be carefully guarded, and not left unattended until the risk of flare-up has passed.
- The frequency of patrolling the perimeter should be decided by the Incident Commander, and could decrease over time. The weather forecast should be obtained and patrols should be stepped up should hot, dry or windy weather conditions come about.
- Once a veld fire has been extinguished, all equipment should be returned to storage facilities, where it should be inspected and repaired or replaced where necessary. Batteries should be recharged and pumps serviced if necessary.
- In case of large veld fires where damage has occurred to property a press statement should be issued to inform the public what the consequences of the veld fire were, and to avoid negative perceptions amongst the public.
- The Fire Log Sheet must be completed (Annexure E)

Uncontrolled fire post-burn actions:

- After a veld fire has been brought under control, patrolling and inspections should continue until the Fire Boss is satisfied that the veld fire has been extinguished. Veld fires are only really considered to be “under control” once they are extinguished.
- The extent of the veld fire should be mapped on a 1:10 000 orthophoto and a Fire Report Form completed.
- During the patrolling phase, hazardous situations where a veld fire could most likely reignite should be identified.
- The frequency of patrolling the perimeter should be decided by the Fire Boss, and could decrease over time. Weather forecasts should be obtained and carefully studied.
- Once a veld fire has been extinguished, all equipment should be returned to the correct storage facilities and inspected.
- All infrastructure within the perimeter of the veld fire should be inspected for damage and repaired or replaced if necessary.

- When damage has occurred to property a press statement should be issued to inform the public.
- Restrict public access to the recently burnt areas if dangerous or ecological sensitive.

The secondary effects of removal of vegetation by intense veld fires can pose a danger to people, infrastructure and vegetation situated down slope, and include:

- increased danger of rock and mudslides
- blocked storm water drains
- loose sand on roads, and
- increased erosion

8.2 LONGER TERM ACTION

Actions approximately three months after veld fires:

- The burnt area should be inspected and assessed in terms of these effects and contingency plans, in conjunction with the local authority should be made to deal with these issues, if necessary.
- Contingency plans should be made to deal with any animals that may have been displaced by wildfires, especially if these animals are of particular conservation importance.
- The impact of wildfires on the plans for prescribed burns should be assessed, and necessary changes should be made to the burning schedule if necessary.
- Thresholds of Potential Concern should be recalculated after significant veld fires, to assess whether or not any significant thresholds have been reached.
- After all major veld fires, a formal debriefing should be held involving all relevant agencies. At this debriefing, the cause of the veld fire should be identified and the discussion should focus on the cooperation of all relevant agencies in the extinguishing of the veld fire.

9 FIRE MONITORING AND REPORTING

As stated in the NVFFA, it is imperative that records of veld fires are kept and these details are furnished to the FPA of the area. Creating and maintaining a spatial database of all fires occurring at Mkhambathi is a sub-objective of the fire management goal (see Figure 1 and Annexure A, Objective 1, sub-objective 8).

It is essential that during any veld fire, an accurate chronological record of the veld fire, weather and actions be maintained. This will ensure that the protected area has a record of the deployment of the resources; it facilitates debriefing and can be of major importance in the event of legal action after a veld fire.

In order to ensure improvement of veld fire management techniques and methods within the Protected Area, it is essential that spatial and ecological data are collected on a regular basis and monitoring is continuous.

The essence of good veld fire management is the ability to make decisions based on a sound understanding of the ecosystem responses to veld fire, and having good information available to inform decisions within the framework of a sound understanding.

The spatial data that is needed to support veld fire management decisions are outlined below:

- Post-fire age of vegetation: Obtained from maps of all veld fires
- Presence of alien vegetation: Obtained from distribution maps of alien plant species.
- Rare and special species, and indicator species: Obtained from localities of species.
- Vegetation type and associated fuel properties: Obtained from maps of vegetation types and fuel models for a range of post-fire ages for each vegetation type.
- Compartments (vegetation management units): Obtained from management maps.
- Firebreaks (fire belts): Obtained from management maps.
- Fire weather and fire danger rating

Note: The primary location for maintaining these records should be on the protected area but copies should be sent to Scientific Services within two weeks of any fire.

10 LAW ENFORCEMENT

It will be the responsibility of the Reserve Manger to:

- Notify the relevant authorities and Fire Protection Association of a person who is committing an offence in terms of the NVFFA.
- Have a full understanding of the offences and penalties under NVFFA
- Have a full understanding of his/her powers under NVFFA

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ANNEXURE A – Tasks, Deliverables and Responsibilities associated with achieving the Fire Management Goal

OBJECTIVE 1: CONSERVE BIODIVERSITY AND ECOSYSTEM SERVICES

Tasks, deliverables and responsibilities associated with objective 1 of the fire management goal. RM = reserve manager, SM = senior manager, SS = scientist from Scientific Services

Tasks	Deliverables and outcomes for evaluation	Responsible person	Verification	
			Quarterly	Annually
FIRE MANAGEMENT GOAL : TO CONSERVE BIODIVERSITY AND ECOSYSTEM SERVICES THROUGH FOSTERING APPROPRIATE FIRE REGIMES WHILE AT THE SAME TIME PROTECTING VALUABLE ASSETS AT RISK FROM FIRE				
Objective 1: Conserve biodiversity and ecosystem services				
Sub-objective 1: Maintain fire-dependent ecosystems				
Check fire patterns against operational thresholds	Assessment of fire patterns against thresholds. Record of assessment filed.	RM	n/a	SM, SS
If prescribed burning is necessary, check whether the necessary pre-fire treatment of invasive alien plants has taken place (see sub-objective 6).	Record of alien plant treatments carried out.	RM	n/a	SM, SS
Conduct prescribed burning, if necessary	Burn completed and data captured	RM	n/a	SM, SS
Sub-objective 2: Monitor and protect fire-sensitive species				
Establish sites to monitor populations of fire-sensitive species	Established sites and monitoring protocols	SS	n/a	SM, SS
Collect field monitoring data (enumerate at 3-yr intervals)	Data appropriately filed.	RM		SM, SS
Assess data against ecological thresholds	Outcome of assessment, and any decisions.	RM, SS		SM, SS

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Tasks	Deliverables and outcomes for evaluation	Responsible person	Verification	
			Quarterly	Annually
Sub-objective 3: Monitor and protect forest patches				
Establish sites to monitor forest edges	Established sites and monitoring protocols	SS	n/a	SM, SS
Collect field monitoring data, either ground-based or remotely-sensed (enumerate at 3-yr intervals)	Data appropriately filed.	RM		SM, SS
Assess data against ecological thresholds	Outcome of assessment, and any decisions.	RM, SS		SM, SS
Sub-objective 4: Prevent excessive bush encroachment				
Establish sites to monitor cover of woody plants	Established sites and monitoring protocols	SS	n/a	SM, SS
Collect field monitoring data (enumerate at 3-yr intervals)	Data appropriately filed.	RM		SM, SS
Assess data against ecological thresholds	Outcome of assessment, and any decisions.	RM, SS		SM, SS
Sub-objective 5: Provide adequate grazing for wildlife				
No tasks necessary, covered by sub-objectives 2 and 5.				
Sub-objective 6: Integrate fire and invasive alien plant management				
Identify any invasive alien plant species in areas scheduled for burning, and ensure that any necessary pre-burning treatment has taken place.	Record of treatments on file (se alien plant management plans)	RM		SM, SS
Sub-objective 7: Optimise thatch and reed production				
Reach agreement with local communities on areas where pre-fire harvests will be permitted	Records of agreement	RM		SM, SS
Maintain records of amounts harvested	Records on file	RM		SM, SS
Sub-objective 8: Create and maintain a spatial database				
Map all fires at a scale of 1:10 000	Physical fire maps	RM	RM, SS	RM, SS
Data capture	Maps captured on database, with perimeter of fire, identification of unburnt patches, date(s) of fire, cause of fire	RM	n/a	SM, SS

OBJECTIVE 2: PROTECT VALUABLE ASSETS

Tasks, deliverables and responsibilities associated with objective 2 of the fire management goal. RM = reserve manager, SM = senior manager, SS = scientist from Scientific Services

Tasks	Deliverables and outcomes for evaluation	Responsible person	Verification	
			Quarterly	Annually
FIRE MANAGEMENT GOAL : TO CONSERVE BIODIVERSITY AND ECOSYSTEM SERVICES THROUGH FOSTERING APPROPRIATE FIRE REGIMES WHILE AT THE SAME TIME PROTECTING VALUABLE ASSETS AT RISK FROM FIRE				
Objective 1: Protect valuable assets				
Sub-objective 1: Establish and participate in Fire Protection Associations (FPA)				
Initiate the establishment of a FPA in the proximity of the nature reserve.	Completed “Form 1” request for establishing a FPA submitted to Dept. of Agriculture, Forestry and Fisheries.	RM	n/a	SM
Assist in the compilation of a FPA business plan together with prospective members.	“Form 2” and FPA business plan submitted to Dept. of Agriculture, Forestry and Fisheries.	RM	n/a	SM
	Registration by Dept. of Agriculture, Forestry and Fisheries of the FPA.			
Assist in the compilation of rules for the FPA to ensure that prescribed burning is accommodated.	Rules of FPA accommodate the need for prescribed burning.	RM, SS	n/a	SM,SS
Participate in the activities of the FPA.	Copies of FPA meeting minutes keep on file.	RM	n/a	SM
Compile and submit annual fire reports to the FPA.	The FPA incorporates these in their annual report to Dept. of Agriculture, Forestry and Fisheries.	RM	n/a	SM

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Tasks	Deliverables and outcomes for evaluation	Responsible person	Verification	
			Quarterly	Annually
Sub-objective 2: Establish and maintain fire breaks (belts)				
Compile prescriptions for firebreak construction and maintenance.	Register containing prescriptions for width, preparation method, placement and maintenance that are known to be adequate under local conditions. Map of their location.	RM	n/a	SM
Construct external firebreaks on the boundary of the nature reserve to limit the entry of wildfires and to comply with the National Veld and Forest Fire Act.	Firebreaks conforming to local best practice established on the boundaries of the nature reserve where needed (e.g. If a large perennial river forms the boundary this would serve as a firebreak).	RM	Inspect before every fire season	SM, SS
Establish an internal firebreak network (if necessary) with the aim of containing large fires and protecting vulnerable infrastructure.	Record details in the fire break register including a map showing their location.	RM	n/a	SM
Construct temporally internal belts to facilitate prescribed burns	Temporary fire breaks constructed when needed and not maintained after the prescribed burn.	RM,SS	Shortly before a prescribed burn	SM,SS
Maintain the fire break network.	Firebreaks assessed one to two months prior to the fire season and where necessary treated in accordance with prescriptions. Treatments to be recorded in fire break register.	RM	Before fire season	SM
Inspect fire breaks during the season to ensure that they are still adequate.	Record inspections in fire break register and take action where necessary.	RM	Regularly during the fire season	SM
Sub-objective 3: Protect economic and environmental assets				
Determine the environmental and property assets that need protection from fire.	Inventory of assets plotted on a map of the nature reserve.	RM, SS	n/a	SM, SS
Determine which assets are exposed and	Revised fire risk map.	RM, SS	Before fire season	SM

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Tasks	Deliverables and outcomes for evaluation	Responsible person	Verification	
			Quarterly	Annually
vulnerable to fire and assess the risks every year before the fire season.				
Create defensible spaces around buildings and other vulnerable infrastructure in fire prone vegetation.	A cleared area around buildings with all dead vegetation removed within the perimeter. Record treatments in the fire break register.	RM	Before fire season	SM
Protect transmission and telecommunication lines	Clear vegetation under transmission and telecommunication lines. Record treatments in the fire break register.	RM	n/a	SM
Take precautions when fire danger is high or extreme to prevent accidental ignitions.	Obtain daily fire weather forecasts, restrict activities that could cause a fire, and adjust preparedness levels accordingly.	RM	When required	SM

OBJECTIVE 3: CREATE AND MAINTAIN FIRE MANAGEMENT CAPACITY

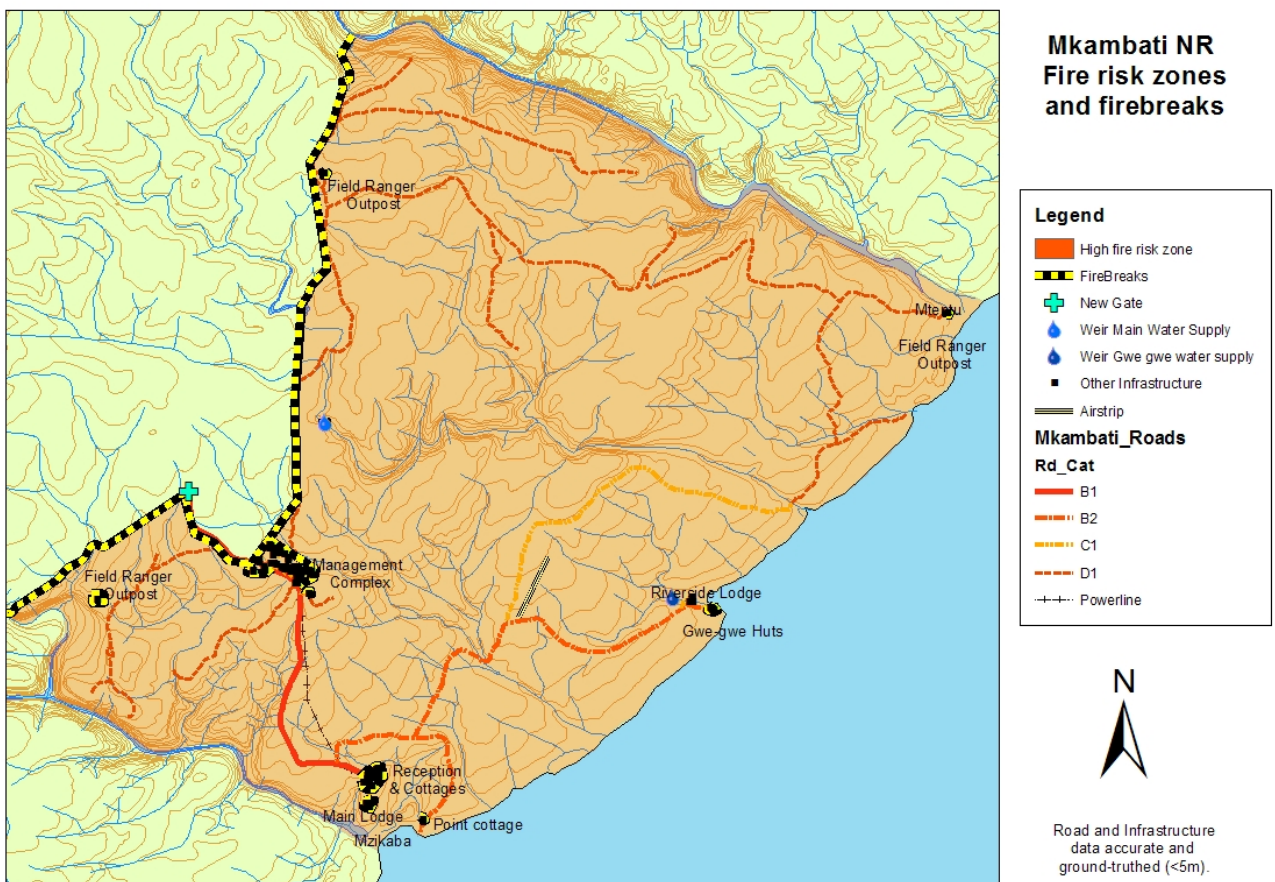
Tasks, deliverables and responsibilities associated with objective 3 of the fire management goal. RM = reserve manager, SM = senior manager, SS = scientist from Scientific Services

Tasks	Deliverables and outcomes for evaluation	Responsible person	Verification	
			Quarterly	Annually
FIRE MANAGEMENT GOAL : TO CONSERVE BIODIVERSITY AND ECOSYSTEM SERVICES THROUGH FOSTERING APPROPRIATE FIRE REGIMES WHILE AT THE SAME TIME PROTECTING VALUABLE ASSETS AT RISK FROM FIRE				
Objective 3: Create and maintain fire management capacity				
Sub-objective 1: Purchase and maintain equipment				
Annual review of present types and levels of equipment; and establish and maintain an equipment register	Inventory of existing equipment needed to suppress “normal” wildfires and to conduct safe prescribed burning.	RM	n/a	SM
If equipment is insufficient or inappropriate, obtain new equipment.	Budget for obtaining additional equipment and maintaining existing equipment.	RM	n/a	SM
If equipment is insufficient or inappropriate, obtain new equipment.	Budget for obtaining additional equipment and maintaining existing equipment.	RM	n/a	SM
Repair or replace broken equipment after each fire	Record repairs or replacement in the equipment register	RM	As required	SM
Service mechanical equipment such as pumps and vehicles as specified	A record of servicing of equipment.	RM	Prior to fire season	SM
Checking of mechanical equipment to ensure that it is reliable when needed.	Completed checklist of equipment noting its condition.	Foreman	Weekly but daily in times of high fire danger	RM
Ensure that equipment is correctly stored so that it is available when needed.	A designated and secure storage area for fire equipment	RM	n/a	SM
Sub-objective 2: Train staff				
Establish fire management training programme.	Fire management training programme document.	RM	n/a	SM

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Tasks	Deliverables and outcomes for evaluation	Responsible person	Verification	
			Quarterly	Annually
Review present levels of training against what is needed to suppress “normal” wildfires and to conduct safe prescribed burning.	Document with the actual and required levels of training. Budget to complete annual training provided by accredited service providers	RM, TO	n/a	TO, SM
Establish and maintain a well trained and effective staff complement.	Record of actual training compared with the training programme specified above.	RM, TO	n/a	SM
Monitor training process of each individual.	Record of Improvements in individual level of competence.	RM, TO	n/a	SM
Hold “in-house” fire drills to practice skills and ensure a heightened state of readiness in fire season.	Record of fire drills completed including measure taken to address deficiencies.	RM	A month pre-fire season and monthly during the fire season	SM
Hold fire ecology and behaviour awareness workshops with staff and community representatives	Record of workshops aimed at achieving a better understanding of fire ecology and behaviour, and why veld burning is necessary	RM, TO, SS	Occasional	SM.SS
Purchase a copy of the Fire Managers Handbook on Veld and Forest Fires (South African Edition)	At least one copy is available in the office of the reserve manager.	RM	n/a	SM

ANNEXURE B – Fire Breaks on Mkhambathi Nature Reserve



ANNEXURE C - The National Fire Danger Rating System

Chapter 3 of the NVFFA provides for the prevention of veld fires through a fire danger rating system. A prohibition on the lighting of fires in the open air comes into force when the Minister warns the media that the fire danger is HIGH.

A Fire Danger Rating System gives a broad measure of anticipated veld fire behaviour for a particular fuel type under specific weather conditions.

Ratings and permissible activities per rating level

A Fire Danger Rating (FDR) is a description of the range of elements of veld fire behaviour, the degree of difficulty in controlling a veld fire, and other relevant parameters of fire danger for each of several ranges or classes of fire index values. Permissible activities per fire danger rating are shown in Table 7 while expected veld fire behaviour, suppression difficulty, and recommended actions are listed in Table 8.

The Fire Danger Index will be relayed on a daily basis to the protected area's management offices in the western, central and southern sections. Section managers should use this fire danger information so as to understand veld fire behaviour, veld fire control and the actions required for each fire danger level.

Implementation of the National Fire Danger Rating System

The National Fire Danger Rating System (NFDRS) will be based on the United States NFDRS which utilizes FireFamily Plus software. The United States NFDRS was chosen as the most appropriate model for South African conditions based on the fact that the model provides a range of indicator values (daily and seasonal planning) that will be useful for different aspects of integrated veld fire management. The South African Weather Services will be the custodians of the system and will run a forecast of fire danger for every fire danger region of the country on a daily basis. If the fire danger rating is HIGH or HIGH-EXTREME, then the warnings will be published in appropriate media to warn the public against lighting fires indiscriminately.

Once the NFDRS is in operation the protected area will have to ensure all visitors and staff is aware of the prevailing HIGH or HIGH-EXTREME fire weather conditions and encourage appropriate behaviour.

The fire danger rating system is best used for:

- Providing a general forecast of fire danger for a particular section / protected area
- Providing the basis for fire warnings to the public
- Judging readiness levels within the fire fighting agencies
- Comparing the severity of veld fires and fire weather
- Predicting veld fire behaviour within certain fuel types

Table 7: Five fire danger rating classes proposed by the Department of Water Affairs and Forestry to meet the requirements of Chapter 3 of the National Veld and Forest Fire Act, Section 9(4)(c) and 9(4)(d) (Forsyth 2000).

FIRE DANGER RATING	INSIGNIFICANT (Blue)	LOW (Green)	MODERATE (Yellow)	HIGH (Orange)	HIGH – EXTREME (Red)
FIRE PREVENTION AND PREPAREDNESS MEASURES	No precautions are needed.	Fires including prescribed burns may be lit, used or maintained in the open air on condition that persons making such fires take reasonable precautions against their spreading. Keep a watch out for unexpected changes in wind speed and direction.	No fires may be allowed in the open air except in designated fireplaces, if authorized by the Fire Protection Officer where a Fire Protection Association exists, or elsewhere by the Chief Fire Officer of the local fire service. Extreme caution should be taken when prescribed burning is done.	No fires may be allowed under any circumstances in the open air. Fire Protection Associations and Municipal Disaster Management Centres must invoke contingency fire emergency and disaster management plans.	No fires may be allowed under any circumstances in the open air. All operations likely to ignite fires must be halted and householders placed on alert. Fire Protection Associations and municipal Disaster Management Centres must invoke contingency fire emergency and disaster management plans including extraordinary readiness and response plans.
APPLICATION OF THE NATIONAL VELD AND FOREST FIRE ACT, 101 of 1998			Above precautionary measures to be prescribed and made applicable nationally on days rated moderate.	Section 10(1)(b) of the Act applies: no person may light, use or maintain a fire in the open air.	Section 10(1)(b) of the Act applies: no person may light, use or maintain a fire in the open air.
RELATIONSHIP WITH DISASTER MANAGEMENT				The threat of disastrous wildfires exists at municipal level under these conditions. Municipal Disaster Management Centres must invoke contingency plans and inform the Provincial	The threat of disastrous wildfires at provincial level exists under these conditions. Provincial Disaster Management Centre must invoke contingency plans and inform the

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FIRE DANGER RATING	INSIGNIFICANT (Blue)	LOW (Green)	MODERATE (Yellow)	HIGH (Orange)	HIGH – EXTREME (Red)
				Disaster Management Centre. (Section 49 of the Disaster Management Act, 57 of 2002).	National Disaster Management Centre. (Section 49 of the Disaster Management Act, 57 of 2002).

Table 8: Expected veld fire behavior, suppression difficulty, and recommended and prescribed actions for different fire danger rating levels.

FIRE DANGER RATING	Insignificant (Blue)	Low (Green)	Moderate (Yellow)	High (Orange)	Extremely High (Red)
FIRE BEHAVIOUR	Veld fires are not likely to ignite but if they do, they are likely to go out without suppression action. There is little flaming combustion. Flame lengths generally lower than 0.5 metre. Rates of forward spread less than 2 metres per minute.	Veld fires likely to ignite readily but spread slowly. Flame lengths generally lower than 1.2 metres. Rates of forward spread less than 5 metres per minute.	Veld fires ignite readily and spread rapidly. Flame lengths between 1.2 and 2 m metres. Rates of forward spread between 5 and 25 metres per minute.	Veld fires ignited readily and spread very rapidly, Local crowning and short-range spotting. Flame lengths between 2 and 5 metres. Rates of forward spread between 25 and 35 metres per minute.	Conflagrations are likely in grassland, stands of alien invasive trees and plantation forests together with long range fire spotting. Flame lengths between 5 and 15 metres or more. Rates of forward spread of head fires can exceed 60 metres per minute.
FIRE SUPPRESSION DIFFICULTY	Veld fires easily approached and suppressed using hand tools.	Veld fires can safely be approached on foot and suppression is readily achieved by direct manual attack methods.	Direct attack constrained as veld fires are not safe to approach on foot for more than very short periods. Back burning from fire control lines can be undertaken if prevailing conditions are safe.	Serious control problems where direct attack is not always feasible. Control through a combination of direct attack and indirect measures such as aerial water bombing. Back burning should only be used after careful consideration.	Any form of fire control is likely to be precluded until weather conditions become more favourable. Fire-fighting equipment should be used to protect properties on the urban edge. Back burning is dangerous and should be avoided.
RECOMMENDED ACTIONS	None	None, other than prudent care to ensure that any open-air fires do not escape.	Prescribed burning permissible. Open-air fires should only be permitted in authorized fireplaces. Prescribed burning should be conducted with care,	All efforts should be made to bring any veld fires under control. Areas should be put on standby for evacuation in the event of a veld fire, should the fire danger	Dangerous areas to be evacuated in the event of a veld fire. Equipment such as water tankers should concentrate efforts on the protection of houses and other structures.

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FIRE DANGER RATING	Insignificant (Blue)	Low (Green)	Moderate (Yellow)	High (Orange)	Extremely High (Red)
			and any prescribed veld fires should be extinguished should the forecast fire danger-rating become high.	conditions be forecast become worse.	
PRESCRIBED ACTIONS	None	None	Any wildfires should be extinguished.	No outdoor fires permitted.	No outdoor fires permitted.

ANNEXURE D - Veld Fire Behaviour Guideline

The behavior of a veld fire is governed by fuel, topography and weather. Small variations in any of these factors can lead to significant changes in veld fire behavior.

Fuels

Knowledge of fuels is fundamental to understanding veld fire behavior. The important elements are:

- Fuel type (e.g. grasslands, grassland, plantations)
- Fuel quantity – Increases in the amount of fuel influences:
- Rate of spread
- Rate of energy release
- Flame lengths
- Fuel moisture content – The moisture content of fuels affects:
- Ease of combustion
- Combustion rates
- Rate of spread
- Radiation efficiency of flames
- Probability of spotting

These factors together affect the difficulty of veld fire suppression.

Fuel arrangement

The arrangement of fuel will affect the probability of ignition and subsequent rate of spread.

Weather

Weather factors that have a major influence on veld fire behavior include temperature, relative humidity, wind speed and wind direction. Weather and veld fire behavior in general:

- Strong and gusty, hot, dry winds generally precede a cold front. Such conditions favour the spread of veld fires.
- Under unstable atmospheric conditions:
- Veld fires will develop strong convection columns
- Longer spotting distances may occur
- Winds tend to be gusty which make veld fire behavior erratic
- Thunderstorms may develop and the resultant lightning could start more veld fires

Prediction

The ability to predict veld fire behavior is vital in the planning of wildfire suppression, and the application of prescribed burning.

Fire intensity is a useful means of comparing veld fires in the same fuel type but should not be used to compare fuels in different fuel types. Different fuel bed structures can result in vastly different veld fire behavior for the same fire intensity value. Flame height is an indicator of fire intensity and in general the longer the length of the flame the greater the fire intensity.

Fire danger and veld fire behaviour: Fire danger is the combination of all the factors that determine whether a veld fire starts, spreads and does damage, and whether and to what extent veld fires can be brought under control.

Veld Fire Behaviour in General (adapted from Forsyth *et al.* 2000):

- Spread faster uphill than downhill
- Spread with the wind rather than against it
- Spread faster where the vegetation contains quantities of dead plant material
- Spread faster in fine fuels
- Spread faster where the vegetation canopy is intertwined
- Doubling the fuel load will double the rate of spread, resulting in the intensity of the veld fire increasing fourfold.
- Halving the fuel load will decrease the rate of spread fourfold.

Veld fire Behaviour “Watch Out” Situations For Fire Fighters:

- Be careful when working downwind of a veld fire
- Be careful when working up-slope of a veld fire
- Be careful when fighting a veld fire on a slope
- Be careful when working near heavy fuels, or where there is un-burnt fuel between you and the veld fire
- Remember that terrain or vegetation impedes travel

[illegible]

- ADD ADDITIONAL SHEETS OF PAPER IF NEEDED
- YOU MAY COMPLETE THE LOG SHEET DIGETALLY OR BY HAND
- REMEMBER TO ADD THE MAP OF THE FIRE EXTENT TO THIS LOG SHEET
- MAKE THREE COPIES
- FILE A COPY ON THE RESERVE IN A "FIRE HISTORY" FILE
- SEND A COPY TO THE AREA MANAGER WITHIN SEVEN DAYS AFTER THE FIRE
- SEND A COPY TO THE SCIENTIFIC SERVICES SECTION WITHIN SEVEN DAYS AFTER THE FIRE

DATE: _____