Table Mountain National Park
Fire Management Plan

CSIR ENVIRONMENTEK

South African NATIONAL PARKS

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GLOSSARY

Air Attack Boss	Directs and controls helibucket aerial fire command and fighting system (HAFFS). During a veldfire the Air Attack Boss reports to the Fire Boss.
Back burn	A counter fire ignited with the intention of removing fuel ahead of a wildfire. Back burns are normally set from a firebelt (firebreak) or another control line such as a road.
Bakkie	A light delivery vehicle with open loading area. Typically it is capable of carrying a one-ton load.
Bakkie sakkie	A water tank (600 l) and pump that can easily be slipped onto the back of a bakkie.
Bio-control agents	Insects or pathogens that are used against invasive alien plants.
Compartment	An area of land that is often delineated by linear features such as roads, footpaths, firebelts (firebreaks), coastlines or ridges that serves as a management subdivision of any area.
Control line	An existing feature in the landscape from where a veldfire can be attacked. A road could serve as a control line (also see firebreak).
Crew Leader	Supervises a fire fighting crew of approximately 15 fire fighters.
Drip torch	A hand held device for igniting veldfires. It consists of a fuel tank (50% diesel and petrol mixture) a nozzle through which the burning fuel is “dripped” onto the vegetation.
Endemic	Describes a species whose natural range is restricted to a particular area.
Fire beater	A hand held fire-fighting tool (often home-made) consisting of a wooden handle and a flexible flat rubber head. The rubber head allows the air to pass through as the flames are beaten out.
Firebelt	A strip that is regularly cleared of vegetation and is used for access and as a position of attack in the case of a wildfire.
Firebreak	A natural or man-made feature of low fire hazard (e.g. a sand dune field, the coastline, a cliff or a ploughed or fallow agricultural field (also see control

	line).
Fire Boss	Overall commander of a fire-fighting operation.
Fire Danger	The sum of factors that contribute to veldfire risk, including fuel and weather factors, and assets at risk.
Fire Hazard	The component of fire danger contributed by fuels.
Fire intensity	Rate at which a fire releases energy.
Fire Line Boss	In command of one section of a larger veldfire, normally reporting directly to the Fire Boss.
Fire Regime	The frequency, season, intensity and type of veldfire that characterises a particular area.
Fire Season	That time of the year when most veldfires. On the Cape Peninsula this is roughly between 1 October and 30 April.
Fire Tanker	Tanker of 2000 - 5000 litre capacity with fire pump & hoses.
Fire Tender	A truck equipped with a water tank (3000 l), a pump and a set of hoses.
Fire type	**Head fire**, on surface running with the wind and / or slope. **Back fire**, on surface burning against wind and / or slope. **Crown fire**, in the canopy of trees and scrubs. **Surface fire**, in fuel layers below the canopy of trees and scrubs. **Ground fire**, in fuel layers in the soil.
First Attack Fire Unit	Bakkie-mounted fire fighting unit
Fynbos	Evergreen scrubland vegetation of the South-Western Cape characterised by reed-like Restios, fine leafed Ericas and leather leafed Proteas.
Geophytes	Plants whose major regenerative organs are underground bulbs or tubers.
GEF	Global Environment Facility (GEF) assists developing countries to protect the global environment in four areas: global warming, pollution of international waters, destruction of biodiversity, and depletion of the ozone layer. The United Nations Development Programme, the United Nations Environment Programme, and the World Bank jointly implement the GEF.
Granivores	Animals that eat seeds.
HAFFS	Helibucket Aerial Fire Aerial Attack and Command & Fire Fighting System: Generally includes a control helicopter, and two to three helicopters with attached ‘helibuckets’ to “water bomb” the veldfire.
Invasive Alien Weeds	Invasive woody weeds including Australian Acacias, Hakea, Myrtle, and Eucalypts, European pines and South American stinkbean.
ISO 14001	A series of standards covering a wide range of aspects relating to corporate environmental management. ISO stands for the International Organisation of Standardisation.
Kestrel 3000	A hand held battery operated electronic weather instrument capable of measuring temperature, relative humidity and wind speed.
Knapsack Spray	A hand operated 15-20 litre capacity water pump that is worn on the back by fire fighters.
Logistics Officer	A fire fighter assigned to ensure that supplies and equipment, including food and liquids, are available and distributed during a veldfire.
Mesic	Vegetation types occurring in moist areas.
Protea Atlas	An atlas of the distribution of Proteaceae in South Africa
Radio Repeater	Telecommunications equipment that can relay radio signals. They are often capability of receiving and transmitting signals at different frequencies.

Rake hoe	A hand held tool with a dual-purpose head. Used for clearing control lines during a veldfire.
Rate of spread	Distance that a veldfire travels in a given period.
Red Data Book	Lists of species considered to be endangered, rare or otherwise threatened.
Sprouters	Plants that are not normally killed by veldfire by regenerate from buds after a veldfire. A common feature in the fynbos ecosystem.
Strike Attack Boss	The crew leader of the initial attack on a veldfire.
Tracer	A narrow strip of hoed vegetation typical 2m wide used when preparing a burnt firebelt (firebreak).
Ukuvuka	The Santam / Cape Argus Ukuvuka: Firestop Campaign is a programme to involve the broader community of Cape Town in fire management activities.
Ungulates	Vegetation eating hoofed animals such as antelope, cattle and horses.
Unimog	Specialized 4 x 4 vehicles, equipped with a water tank, pump and hoses, used for fire fighting in forestry plantations and veld.
Urban edge / fringe	The residential (built-up) area of the city (Cape Metropole) immediately adjacent to the wild land of the Cape Peninsula National Park.
Veld	A general term used to refer to natural vegetation in South Africa.
Veldfire	A veldfire burning in natural vegetation or plantations.
Wildfire	A veldfire, started unintentionally, through natural causes (lightning or rolling rocks), or be human ignition but is burning out of control.
Working on Fire	The Working on Fire programme was instituted in 2003 to combat wildfires. It is supported by the Department of Water Affairs and Forestry, the National Treasury, the Department of Provincial and Local Government as well as forestry partners and the private sector.
Working for Water	A community based programme aimed at the eradication of invasive alien weeds.

INTRODUCTION

The Table Mountain National Park (the Park), situated in the Western Cape Province of South Africa, is home to one of the highest concentrations of plant species in any temperate ecosystem in the world. The dominant vegetation is both fire-prone and fire-dependent. The Peninsula has a mosaic of urban and natural areas, leading to problems of veldfire management of areas with a substantial urban fringe. In addition, the area is badly invaded by alien shrubs and trees, which both threaten the remarkable biodiversity and increase biomass and fire intensity.

This document is a revision of the fire management plan compiled in 2000 for the then Cape Peninsula National Park. This revision provides the necessary information for sound veldfire management in a concise and accessible way with an emphasis on the Park's legal obligations.

This plan has been divided into FIVE sections, setting out information on the veldfire management cycle which combines elements of **FIRE PREVENTION**, **FIRE PROTECTION, FIRE SUPPRESSION, FIRE RECOVERY** and the need for **CONTINUOUS IMPROVEMENT**. Management objectives are required for each component of the veldfire management cycle. Prevention objectives are based on an understanding of the cause and impact of veldfires. Preparedness objectives are based on an understanding of veldfire behaviour. Response and suppression objectives are based on an understanding of veldfire behaviour and fire impact. While restoration objectives are based on an understanding of the impact of veldfires.

In order to ensure that both the fire-dependent vegetation and the urban fringe are managed correctly during a veldfire, it is imperative to have a fire management strategy with goals and objectives embedded within this structure of the Park. These strategies and actions to be implemented along with the objectives and goals of the fire management plan as stated in Table 1 and Table 2.

Table 1: Strategic Management Plan to manage veldfire at the Table Mountain National Park (Common Ground Consulting, 2001)

STRATEGIES	ACTIONS	ACTION COMPLETE	DELIVERABLES	INDICATORS	TIME FRAME	RESPONSIBILITY FOR IMPLEMENTATION
1. Plan and implement controlled burns where necessary	a) Review veldfire history records			Mosaic of vegetation of varying ages	Year 1 - 5	Park Operations Manager: Conservation Services
	b) Assess the need and plan for controlled burns					
	c) Identify areas burned too often					
2. Develop and implement a Fire Management Plan (see Table 2)	a) Develop procedures and protocols for		Fire Management Plan Fire-fighting infrastructure Fire Protection Association Biodiversity conservation determinants for Fire Management Plan Firebreaks	Distribution of vegetation ages Fire response times Frequency and extent of wildfires	Year 1 - 5	Park Operations Manager: Conservation Services
	b) Assess maintenance procedures					
	c) Assess and develop staff and volunteer capacity and training					
	d) Develop inter-agency programmes for cooperation for fires					
	e) Collaborate with local authorities and landowners for the removal of alien trees from the urban edge					
	f) Identify biodiversity conservation determinants for control burns					
	g) Determine and meet legal responsibilities					
	h) Assess and enforce recreational fire-free zones for the Park					
	i) Acquire the necessary infrastructure and equipment for fire management					
	j) Implement the fire protection measures for the Park and local authority infrastructure					
	k) Form Fire Protections Association(s)					

STRATEGIES	ACTIONS	ACTION COMPLETE	DELIVERABLES	INDICATORS	TIME FRAME	RESPONSIBILITY FOR IMPLEMENTATION
	l) Explore registration of the Park as a local authority in terms of Act 101 of 1998.					
3. Maintain accurate fire history records for all areas of the park	a) Update fire history records		Fire history		Year 1 – 5	Park Operations Manager: Conservations Services
	b) Develop monitoring programme for post-fire recruitment of aliens					
4. Promote awareness of visitors and general public on the periphery of the Park.	a) Establish and communicate legal responsibility regarding fire to landowners and neighbours		Records of communications	Property damage due to wildfires	Year 1 - 5	Park Operations Manager: Conservation Services Co-ordinator: Social Ecology Manager: Tourism and Marketing
	b) Develop public communication campaign					

Table 2: Objectives and goals of a Fire Management Plan (as discussed in Table 1, Strategy 2)

OBJECTIVE 1:	**To ensure the conservation and continued survival of viable populations of all the indigenous biota in the area**	
OBJECTIVE 2:	**To minimise the potential and actual damage done by fires**	
ACTIVITY 1:	**Establish and maintain the necessary trained human resources to manage fires**	
	(i)	Appoint appropriate numbers of staff
	(ii)	Identify volunteers to assist with fire control
	(iii)	Identify suitable contractors to assist with fire management and control
	(iv)	Design and implement a training programme for all of the above
ACTIVITY 2:	**Purchase and maintain the necessary equipment to manage fires**	
	(i)	Identify equipment needs
	(ii)	Purchase appropriate equipment
	(iii)	Institute appropriate maintenance procedures for equipment
ACTIVITY 3:	**Design, establish, and maintain a network of firebreaks**	
	(i)	Design firebreak network
	(ii)	Establish firebreak network
	(iii)	Maintain firebreak network
ACTIVITY 4:	**Institute a programme of prescribed burning**	
	(i)	Establish and implement a monitoring system to support decisions on whether or not to initiate prescribed burns. This should include the development and implementation of a system for storing, retrieving, and analysing fire-related data to support sound decisions about fire management
	(ii)	Carry out prescribed burns as required from time to time
ACTIVITY 5:	**Develop and implement a co-ordinated capability to respond to and contain wildfires**	
	(i)	Establish and implement a wildfire response system
	(ii)	Establish and implement procedures for liaison and co-operation with other agencies responsible for containing fires on the Peninsula
	(iii)	Collaborate in the establishment of a Fire Protection Agency in terms of the new Veld and Forest Fire Act 101 of 1998
ACTIVITY 6:	**Develop and implement communication procedures to ensure that residents and visitors on the Cape Peninsula remain informed with regard to fire-related issues**	
	(i)	Identify target audiences and the means for communicating with these audiences
	(ii)	Ensure that regular and sufficient communication takes place with the target audiences
	(iii)	Ensure that people whose priorities border on the Park are aware of the risks associated with fire and have taken the necessary precautions to minimise such risk
ACTIVITY 7:	**Develop and implement a system that ensures that the Park meets all of its legal obligations with respect to fire management**	

FIRE PREVENTION

"Activities directed at reducing fire occurrence, including public awareness, law enforcement and the reduction of fire risks"

1. THE NATIONAL VELD AND FOREST FIRE ACT 101 OF 1998

1.1 General discussion of the Act

- The National Veld and Forest Fire Act 101 of 1998 ("the Veldfire Act") aims at wildfire (an unwanted veldfire) management through the prevention and combating of veld, forest and mountain fires. It defines the expression "veldfire" 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 Veldfire Act replaces the relevant provisions in the old Forest Act regarding veldfire management, and introduces some important innovations that fill the gaps between diverse statutes affecting veldfire management.

- It should be remembered that although the Veldfire Act's principal aim is the regulation of wildfires, it also has a role to play in veldfire management generally. This is because the Act aims to control the spread of veldfires by imposing obligations on landowners to prepare and maintain firebreaks. The Act thus applies

both to preventing the spread of a veldfire through good management or operational practices, and to extinguishing veldfires through procedure set out in the Act.

- The Veldfire Act 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 veldfire management system (see section 8.4).

1.2 Offences, penalties and enforcement

In this section we discuss the relevant offences in terms of the Veldfire Act and the penalties applicable.

Offences and penalties:

1st Category Offence

Offence:
Any person who lights, uses or maintains a fire in the open air in contravention of section 10(2) is guilty of a first category offence
Penalty:
A person who is guilty of a first category offence may be sentenced on a first conviction for that offence to a fine or imprisonment for a period of up to two years, or both.

1st Category Offence

Offence:
Any owner, occupier or person in control of land on which a fire occurs who fails to take reasonable steps to extinguish the fire or to confine it to that land or to prevent it from causing damage to property on adjoining land, is guilty of a first category offence.
Penalty:
A person who is guilty of a first category offence may be sentenced on a first conviction for that offence to a fine or imprisonment for a period of up to two years, or both.

2nd Category Offence

Offence:
Any person who in the open air-
(i) leaves a fire unattended (ii) lights a fire without permission of owner and which spreads (iii) throws a burning match which causes fire to spread and cause injury (iv) lights a fire in a road reserve (which is not a designated fireplace or for the purpose of burning a firebreak) (v) smokes where smoking is prohibited, is guilty of a second category offence.
Penalty:
A person who is guilty of a second category offence may be sentenced on a first conviction for that offence to a fine or imprisonment for a period of up to one year, or both.

2nd Category Offence

Offence:
Any person who (i) fails to prepare a firebreak when obliged to do so (ii) Fails to give notice of intention to burn a firebreak (iii) burns a firebreak when Fire Protection Association has objected (iv) fails to inform adjoining owners of matters pertaining to burning firebreaks, is guilty of a second category offence.
Penalty:
A person who is guilty of a second category offence may be sentenced on a first conviction for that offence to a fine or imprisonment for a period of up to one year, or both.

2nd Category Offence

Offence:
Any person who (i) fails to meet the standards of readiness for fire fighting (ii) fails to notify a Fire Protection Officer (FPO) and adjoining land owners of a fire on his/her property (iii) refuses to assist a FPO (iv) hinders or obstructs any person or FPO or forest officer is guilty of a second category offence.
Penalty:
A person who is guilty of a second category offence may be sentenced on a first conviction for that offence to a fine or imprisonment for a period of up to one year, or both.

3rd Category Offence

Offence:
Any person who prevents a Fire Protection Officer, forest officer or police officer from acting in terms of the Fire Brigade Services Act (99 of 1987), or resists power to enter and search, power to seize, or power to arrest or interferes with him or her performing the duties mentioned above, is guilty of a third category offence.
Penalty:
A person who is guilty of a third category offence may be sentenced on a first conviction for that offence to a fine or community service for a period of up to six months, or to both.

Enforcement:

- A Fire Protection Officer (FPO) has the power to enforce the Veldfire Act if he or she is registered in the prescribed manner. In addition, a Forest Officer, Police Officer and an officer appointed by the Fire Brigade Services Act have the power to enforce the Act.
- A FPO has power to enter and search, power to seize and power to arrest in terms of section 27, 28 and 29 of the Veldfire Act.

2. THE NATIONAL FIRE DANGER RATING SYSTEM

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

2.1 Legal requirements

Chapter 3 of the Veldfire Act provides for the prevention of veldfires through a fire danger rating system. At the time of writing this was not enforce. 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**.

CHAPTER 3: SECTION 9
▪ Chapter 3 provides for the prevention of veldfires through a Fire Danger System. ▪ When the fire danger is rated **HIGH** in any region, the Minister must publish a warning at the earliest opportunity in all the main languages used in that region. ▪ When a warning has been published, no person may light, use or maintain a fire in the open air in the region where the fire danger is **HIGH**.

CHAPTER 3: SECTION 9
(3) The Minister must divide the country into separate regions, each region being one in which the fire danger usually sufficiently uniform to allow for a single rating which is meaningful for the entire region.

Ratings and permissible activities per rating level

A Fire Danger Rating (FDR) is a description of the range of elements of veldfire behaviour, the degree of difficulty in controlling a veldfire, and other relevant parameters of fire danger for each of several ranges or classes of fire index values. Table 3 denotes the permissible activities per rating level while expected veldfire behaviour, suppression difficulty, and recommended actions are given in Table 12.

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

2.2 Implementation of the National Fire Danger Rating System at the park scale

A National Fire Danger Rating System (NFDRS) should be up and running by September 2004. The NFDRS will be based on the United States NFDRS which utilises 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 veldfire 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 Park will have to ensure all visitors and staff are aware of the prevailing **HIGH** or **HIGH**-**EXTREME** fire weather conditions and encourage appropriate behaviour.

- The fire danger rating system within the Park will best be used for:
- Providing a general forecast of fire danger for a particular region
- Providing the basis for fire warnings to the public
- Judging readiness levels within the fire fighting agencies
- Comparing the severity of veldfires and fire weather
- Predicting veldfire behaviour within certain fuel types

2.3 Agreements with South African Weather Service

At the time of writing no formal agreements are in place between the South African Weather Service (SAWS) and the Park but it is recognised that close collaboration with SAWS is desirable.

Table 3: Five fire danger rating classes proposed to 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).

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 authorised 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 Disaster Management Centre. (Section 49 of the Disaster Management Act, 57 of 2002).	The threat of disastrous wildfires at provincial level exists under these conditions. Provincial Disaster Management Centre must invoke contingency plans and inform the National Disaster Management Centre. (Section 49 of the Disaster Management Act, 57 of 2002).

3. VELD MANAGEMENT

3.1 Fire dependent ecosystems

A great deal has been written about the vegetation of the Park (box below) and the extraordinarily rich variety of plant species that occur there, many of them being found nowhere else. From a management perspective, the vegetation of the Cape Peninsula can be divided into four major types:

- Forest and thicket;
- renosterveld;
- wetland and vlei vegetation; and
- fynbos with different types of communities distinguished by their habitats, structure and composition.

Recommended reading on the Cape Peninsula vegetation and veldfire

(i) Cowling, RM, Macdonald, IAW & Simmons, MT, 1996
(ii) Le Maitre, DC & Marais, C, 1995
(iii) Michell, MR, 1922
(iv) Picker, MD & Samways, MJ, 1996
(v) Richardson, DM, Van Wilgen, BW, Le Maitre, DC, Higgins, KB & Forsyth, GG, 1994
(vi) Richardson, DM, van Wilgen, BW, Higgins, SI, Trinder-Smith, TH, Cowling, RM & Mckelly, DH, 1996
(vii) Van Wilgen, BW & Richardson, DM, 1985a
(viii) Van Wilgen, BW, Higgins, KB & Bellstedt, DU, 1990
(ix) Van Wilgen, BW, Le Maitre, DC & Kruger, FJ, 1985
Ecological principles of fynbos management using fire

3.2 Ecological principles of fynbos management using fire

The application of fire is the major management practice in fynbos ecosystems. This section presents some broad principles to guide planning and to determine annual priorities for management actions (See box below for recommended reading. The information dealt with in this section will ensure that Objective 1 and 2 of Table 2 are met by the Park.

- Fynbos requires fire to maintain its diversity, to maintain ecosystem processes and to maintain its plant and animal communities in a healthy condition.

- If fynbos is left unburnt for too long, typically 25 or more years, it will become moribund. There is a tendency to believe that there is an "ideal" time to burn, and that all fires should occur at this time, but this is not so.
- Fynbos ecosystems require variation between successive fires in order to maintain the diversity of species because different fires favour different species.
- These species have survived and coexisted because they are adapted to a particular fire regime.

Recommended reading on fire ecology

Primary Reference:
Van Wilgen, BW, Bond, WJ & Richardson, DM, 1992

Bond, WJ, 1989
Bond, WJ, le Roux, D & Erntzen, R, 1990
Brits GJ & Van Niekerk MN, 1986
Brown, NAC, 1993
Brown, NAC, Prosch, DS & Botha, PA, 1998
Cocks, MP & Stock, WD, 1997
Cowling, RM, 1987
Cowling RM & Gxaba T, 1990
De Lange, JH & Boucher C, 1990
Juhnke, SR & Fuggle, RF, 1987
Keeley, JE, 1993
Keeley, JE, Morton, BA, Pedrosa, A & Trotter, P, 1985
Le Maitre, DC, 1988
Le Maitre, DC, 1992
Le Maitre, DC & Brown, PJ, 1992
Le Maitre, DC, Van Wilgen, BW & Richardson, DM, 1993
Maze, KE & Bond, WJ, 1996
Moll, EJ & Gubb, AA, 1981
Van Wilgen, B.W, Richardson, D.M & Seydack , AWH, 1994

Key components of a FIRE REGIME involve at least the following:

- **Fire frequency** - a probability distribution of the intervals between successive veldfires;
- **Fire season** - a probability distribution of veldfires in each month of the year; and
- **Fire intensity** - a range of veldfire intensities.

If the natural fire regime in an area is well understood, then management actions that mimic this regime are highly likely to result in the maintenance of the biodiversity of plant communities.

3.2.1 Fire frequency

- Research over a number of years suggests that, under natural conditions, fires in fynbos in the Western Cape should occur somewhere between 8 and 20 years after

the previous veldfire; the ideal interval between veldfires being between 12 and 18 years after the last veldfire (see Figure 1).

- Veldfires at intervals greater than about 25 years will result in the fynbos becoming senescent and the loss of species. Veldfires at intervals of less than about 8 years, particularly at 3-6 years, will result in the loss of species which have not matured and produced seeds.

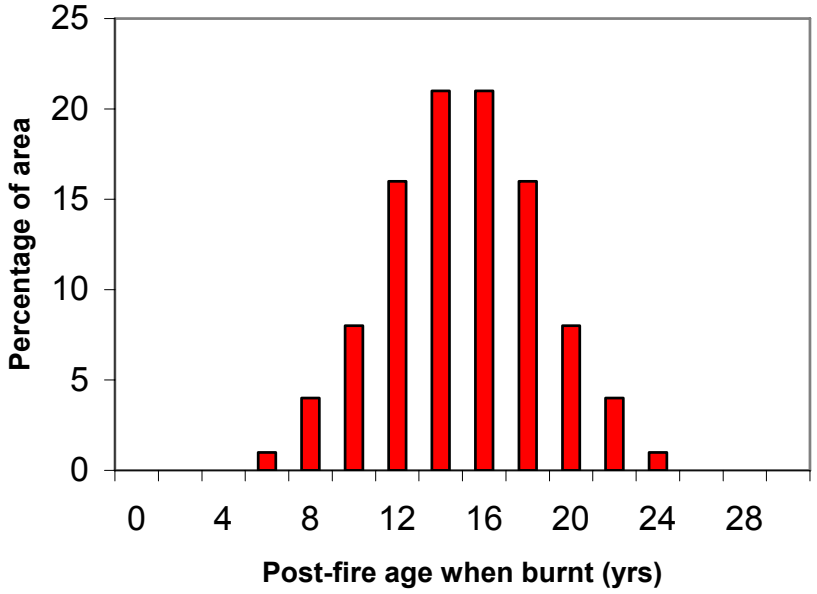


Figure 1: Frequency distribution of post-fire ages that would be acceptable for the age at which fynbos should burn

- The frequency distribution of post-fire ages in fynbos (Figure 1) is used to develop **"thresholds of potential concern"** to aid decisions about whether or not an area should be burnt.
- These thresholds define upper and lower limits of post-fire age, where management intervention should only be considered if these limits are exceeded.
- Decisions about the interval between veldfires should also recognise that fynbos vegetation requires variation between successive veldfires in order to maintain the diversity of species.
- The minimum veldfire intervals required by indicator species can be determined by applying the following rule of thumb:

If 50% or more of the population(s) of the slowest maturing species has flowered for three or more seasons then the vegetation is mature enough to burn.

3.2.2 Fire season

- Studies of the natural occurrences of veldfires show that veldfires can occur at any time of the year in fynbos, but most veldfires happen in summer and early autumn (see Figure 2).

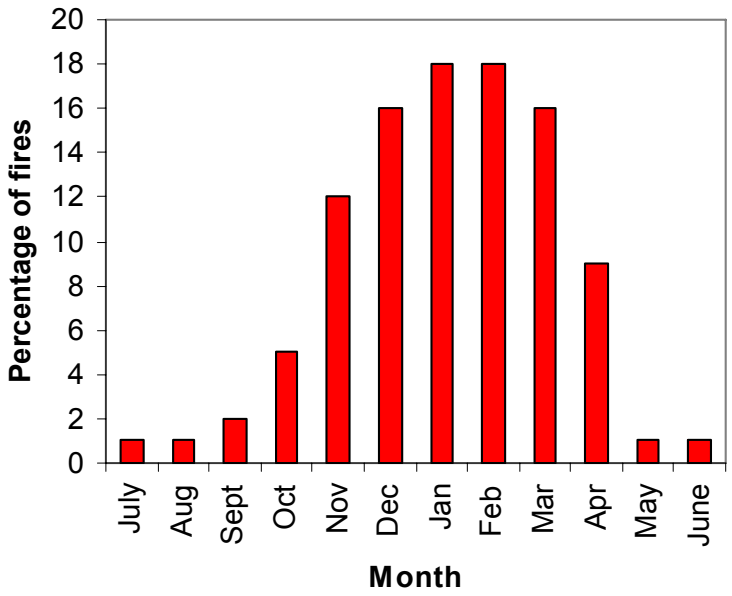


Figure 2: Frequency distribution of the month in which veldfires could burn in fynbos vegetation without losing diversity

- Veldfires in winter and spring result in poor regeneration of plants with canopy-stored seeds (e.g. proteas, leucadendrons) compared with veldfires in summer and early autumn. Veldfires in summer and autumn also seem to enhance the regeneration of species with soil-stored seeds compared with veldfires in other seasons.

- From an ecological point of view, the **recommended** period for prescribed burning on the Cape Peninsula is from mid-November to mid-April as summer and autumn burns result in the best regeneration of species with canopy-stored seeds.

3.2.3 Fire intensity

- Fire intensity plays a large role in the selective survival and recovery of species after veldfire, thereby enhancing coexistence of species and hence diversity. Conversely, it is also known that high intensity veldfires can have adverse effects on sprouting species. Fire intensity may also be important in determining the relative abundance of small and large seeded species in a community. Thus, a variation in veldfire intensity is important within fynbos communities.
- The **provisional guideline** is that veldfires should be lit under conditions which will result in mean flame lengths of 2-5 m which can be achieved within a range of fuel moisture contents and mean wind speeds.

3.2.4 Fire size

- Regeneration of many fynbos species is very sensitive to the extent to which seeds are consumed by rodents, insects and other seed-eaters (granivores). Small burnt patches attract granivores, grazers and browsers from the surrounding unburnt veld, so it is important to ensure that burnt patches are a reasonable size.

- The **provisional guideline** is that it is recommended that the minimum area ever burnt in a veldfire should be at least 25 ha to minimise the impacts of herbivores and granivores.

On the Peninsula the major factors determining veldfire size will be:

- the need to combine veldfire with alien plant control operations;
- the availability of features that provide safe-boundaries for igniting the veldfire;
- the need to maintain a post-fire age mosaic; and
- the manpower available to control and contain the veldfire.

3.3 How much latitude do we have? (Thresholds of Potential Concern)

Because of the complexity involved in measuring biodiversity (e.g. Noss 1990), an approach of using surrogate measures has been proposed for use in fynbos and savanna ecosystems (Van Wilgen et al. 1994; 1998). Surrogate measures would track changes in measurable components of the ecosystem, and identify thresholds of potential concern in terms of impact on biodiversity. While biodiversity in all of its forms is complex to measure or monitor, the progress of a veldfire management plan towards stated goals will be easier to monitor.

The concept of "**Thresholds of Potential Concern**" (TPC) has been developed for the Kruger National Park (Van Wilgen et al. 1998), and could be equally useful in the Table Mountain National Park. TPCs have been defined as "those upper and lower levels along a continuum of change in 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". Such thresholds are being defined for a wide range of biotic and abiotic ecosystem descriptors in the Kruger National Park, and will underpin a comprehensive monitoring system in the park.

The term fire regime is used to describe the combination of frequency, season and intensity of veldfires that characterise a particular area. Fire type (sometimes regarded as an additional element of the fire regime) will also affect fire intensity. Fire type distinguishes between headfires (fire burning in organic layers of the soil), surface fires (fires burning against the wind, or downslope), as well as between ground fire (fires burning in organic layers of the soil), surface fires (fires in the lower vegetation strata) and crown fires (fires in the canopies of trees). For practical purposes, fynbos shrubland fires are all "crown" fires, burning in the canopies of shrubs, but they vary as head or backfires. The size and spatial arrangement of fires is another important aspect that should be considered, as it has ecological implications.

None of the above measures is a constant; they vary at the same place in or between successive veldfires. Such variation is important in maintaining biodiversity and the co-existence of species (Van Wilgen et al. 1994; Yeaton and Bond 1991). The mean and the distribution around the mean, for the frequency, season, intensity and size of veldfires in an area would be needed to provide a complete picture of a fire regime. This distribution, rather than a fixed value for each measure, would constitute the surrogate measure of biodiversity that could serve as a goal for veldfire management programmes. Limits to this distribution that would signal the potential elimination of any species from the community (or undesirable shifts in community structure) would constitute thresholds of potential concern. The various potential TPCs for veldfire management are discussed below.

(A) Fire frequency

A long-term assessment of fire frequency can be obtained from a curve of fire probability, derived from successive veldfire records for an area. Shifts in the shape of a curve will indicate either an increase or decrease in the mean, median and maximum veldfire return period. Provisional thresholds for acceptable limits for both of these variables are shown in Figure 3. In addition, these curves can indicate whether or not an acceptable degree of variation is being achieved with regard to fire frequency. Here, targets can be set for the proportion of the area that escapes veldfire for longer than a given time. For example, small proportions of any area may need to escape veldfire for longer periods so that trees can establish.

(B) Fire season

Targets can be set for the proportion of area burnt in spring, summer and autumn (defined as September to November, December to February, and March to May respectively). These proportions should be approximately 10:50:40 (in other words, veldfires in summer and early autumn should dominate, but some veldfires in spring could be tolerated). The thresholds of potential concern would be in the form of minimum and maximum acceptable levels, and can be preliminarily set at 5 – 15%, 50 – 90% and 30 – 80% for spring, summer and autumn veldfires respectively. This proportion is based on the positive biotic responses to veldfire in summer and early autumn.

(C) Fire intensity

Most wildland fires would have burned under a range of intensities if they were ignited as point fires. They would have spread in all directions, thus burning as head, back and flank fires, and they would have burned both during the day (under hot, dry conditions) and at night (under cool, moist conditions), producing a range of intensities. Fire intensity plays a large role in the selective survival and recovery of species after a veldfire, and a range of intensities will therefore enhance co-existence of species and hence diversity. For each veldfire, the proportion that burns in low, moderate, and high intensity veldfires should be established. When the area burnt in any one of these classes is less than one quarter or more than half of the total area, then a TPC would have been reached. These thresholds are proposed to provide a range of intensities, which in turn should promote diversity.

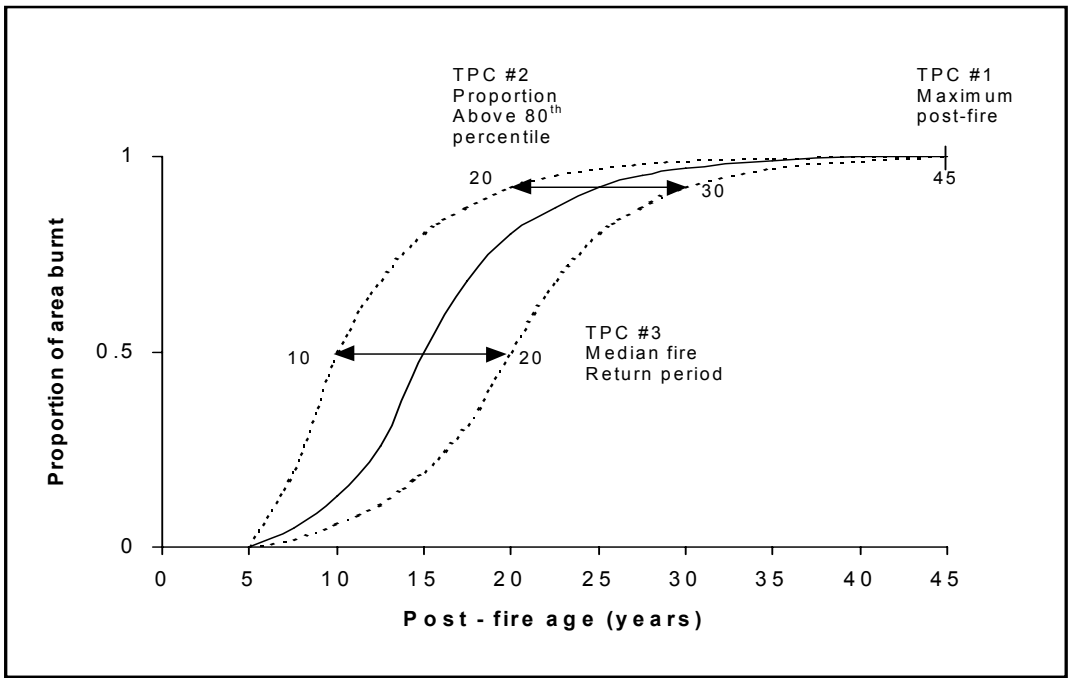


Figure 3: The cumulative probability of veldfire, showing proposed thresholds of potential concern relating to the pattern over 30 years prior to evaluation. Shifts of the curve outside of the envelope of the TPC will indicate that corrective interventions should be considered.

3.4 How can we achieve good veldfire management?

3.4.1 Meeting environmental management objectives of the Park

Important environmental management objectives of a Fire Management Plan are specified in Table 2 of this document. The objectives are; **"TO ENSURE CONSERVATION AND CONTINUED SURVIVAL OF VIABLE POPULATIONS OF ALL THE INDIGENOUS BIOTA IN THE AREA" and "TO MINIMISE THE POTENTIAL AND ACTUAL DAMAGE DONE BY FIRES".**

The ability to achieve biodiversity conservation objectives during wildfire operations is significantly determined by the veldfire management activities undertaken before and after a veldfire. Seven of these veldfire management activities are specified in Table 2. If these activities are undertaken thoroughly and with sound logic then the environmental management objectives of the park will be met.

Fynbos requires veldfire to maintain is diversity, to maintain ecosystem processes and to maintain its plant and animal communities in a healthy condition. If the natural veldfire regime of an area is well understood (see section 3.3 - Thresholds of Potential Concern), then management actions or activities that mimic this regime are highly likely to result in the maintenance of the biodiversity of plant and animal communities.

3.5 Benchmarks to determine whether Table Mountain National Park is achieving the veldfire management goals

Certain benchmarks have been put in place that operate as measurables which are quantifiable in order to ensure that the veldfire management goals are being achieved (Table 2). The measurables are as follows:

- Monitoring vegetation and indicator species – The items that are measured must be consistent, repeatable and provide a standard for comparisons when necessary. The monitoring should include (i) surveys of indicator species to determine whether the vegetation is mature enough to burn, (ii) surveys to measure regeneration success of suitable indicator species. This will determine whether or not the indicator species have been restored in their correct ratios.

- Monitor alien plant clearing – The measures of the success of control operations will depend on the nature of the species and the treatment. In addition, the implementation of surveys that detect any new invasions.

- Thresholds of Potential Concern (section 3.3) 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”

3.6 Risk management

3.6.1 What is meant by veldfire risk management?

Veldfire risk is defined as the chance (likelihood) of a veldfire igniting, spreading and causing damage to assets of economical, social and environmental value to the community

- Veldfire risk management involves identifying the level of risk posed by veldfires to assets, and establishing strategies to protect these assets from the adverse effects of veldfires.
- The purpose of veldfire risk management is to protect the community and its values, which could be social, economic or environmental, from the adverse affects of veldfire.
- The risk management strategies must be appropriate to the level of risk determined within an FPA, and must match the options available for managing the risk.
- In order for there to be a risk there must be some asset that is exposed to a hazard. The level of risk faced by the asset depends on the likelihood that the hazard will eventuate, and the vulnerability of the asset to loss or damage arising from the asset, i.e. the consequence should the hazard eventuate.

So,

RISK = function of (LIKELIHOOD OF HAZARD) and (CONSEQUENCE)
Risk management is the logical and systematic method of:

- establishing the strategic context to veldfire risk management within the area of the Fire Protection Association (FPA),
- identifying the veldfire hazards that they face,
- identifying the assets exposed to the hazards, and;
- identifying, analysing, evaluating, treating, monitoring and communicating risks so that members and the FPA can minimise losses and maximise opportunities.

3.6.2 Steps in veldfire risk management

There are a number of steps involved when carrying out a veldfire risk assessment (DWAF 2003), the most important of these steps for the Park is STEP 5:

STEP 1: Establish your strategic context
This is an analysis of your current situation regarding veldfire management within the area of the FPA

STEP 2: Identify hazards
On the basis of the known history of veldfires, their origins and causes, identify, list and describe the hazards in your area in general.

STEP 3: Identify and describe assets that are exposed to risk.
The assets may be social, economic or environmental.

STEP 4: Identify which hazards each asset is exposed to.

STEP 5: Identify, describe and rate veldfire risks within the Fire Protection Association area

The objective of Step 5 is to rate and describe the veldfire risks in such a way that risk management options can be objectively assigned to the risks and drawn together in overall veldfire management strategies. The process is as follows:

- Assess and describe the likelihood that an asset or an asset group will be subject to a wildfire originating from a given hazard. Your description will help you to choose an appropriate rating in Step 2.
- Assign a rating to the likelihood, using Table 4 below as a guide.
- Assess and describe the consequence to the asset should the veldfire event associated with the hazard come to occur; assume the scenario that you need to plan for; this might be the average impact of a wildfire typically associated with the hazard, or it might be the worst historical case. The description will help you to assign a rating in Step 4.
- Assign a rating to the consequence, using Table 5 below as a guide.
- Use your ratings in Steps 2 and 4 to classify the levels of veldfire risk associated with the exposure of the asset to the hazard, following Table 6 below. Bear in mind the descriptions of risk levels in Table 7.
- List the assets or assets groups in descending order of risk level, thus ranking their priorities.

Table 4: Qualitative and quantitative indicators of likelihood

LIKELIHOOD RATING	LIKELIHOOD INDICATIVE FREQUENCY	DESCRIPTION
Almost certain	1 in 2 years	Is expected to occur
Likely	1 in 5 years	Will probably occur
Possible	1 in 10 years	Might occur at some time
Unlikely	1 in 20 years	Could occur at some time
Rare	1 in 100 years	May only occur in exceptional circumstances

Table 5: Qualitative measures of consequence

LEVEL OF CONSEQUENCE	LIFE VULNERABILITY CRITERIA	ECONOMIC VULNERABILITY CRITERIA	ENVIRONMENTAL AND ECOLOGICAL VULNERABILITY CRITERA
1. Catastrophic	Death	Depressed economy of the FPA. Extensive and widespread loss of assets. Major impacts across a large part of the community and region. Long-term external assistance required to recover.	Permanent loss of species or habitats within the area of water catchment value.
2. Major	Extensive injuries, evacuation required	Serious financial loss, affecting a significant portion of the community. Requires external funding (e.g. from Disaster Management Funds) to recover.	Habitat destruction, temporary loss of species, or temporary loss of catchment values, requiring several

LEVEL OF CONSEQUENCE	LIFE VULNERABILITY CRITERIA	ECONOMIC VULNERABILITY CRITERIA	ENVIRONMENTAL AND ECOLOGICAL VULNERABILITY CRITERA
			years to recover.
3. Moderate	Medical treatment required	Localised damage to property. Short-term external assistance required to recover.	Serious impact on the environment that will take a few years to recover.
4. Minor	Minor injuries only – first aid treatment required	Minor financial loss. Short-term damage to individual assets. No external assistance required to recover.	Discernable environmental impact. Assets recover rapidly.
5. Insignificant	No injuries	Inconsequential or no damage to property.	Minor impact on the environment.

Table 6: Levels of risk, assessed as the product of likelihood and consequence

LIKELIHOOD RATING	CONSEQUENCE RATING				
	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
Almost certain	M	M	H	E	E
Likely	L	M	H	E	E
Possible	L	M	H	H	E
Unlikely	L	L	M	H	E
Rare	L	L	L	M	H

Table 7: Descriptions of risk levels

DESCRIPTION		
E	Extreme Risk	Must receive first priority for management, will require involvement of the local Disaster Management Centre.
H	High Risk	Must receive second priority management.
M	Medium Risk	Routine management required.
L	Low Risk	No management required.

3.6.3 Veldfire risk map of the Table Mountain National Park

- After each fire season (during July) of each year a meeting between all relevant authorities concerned with veldfire on the Cape Peninsula should be convened to plan for the next fire season. A veldfire risk map represents an important tool for this planning meeting, as it reflects fuel conditions that affect fire danger (see risk assessment process mentioned in section 3.6.2). The veldfire risk map presented at this meeting would need to reflect prescribed burns that have taken place in the late summer or early autumn.
- Immediately before each fire season (late September), a second meeting should be convened to set up contingency plans in the event of a wildfire.

4. AWARENESS PROGRAMMES

4.1 Tailoring awareness programmes to address core issues

A major communication and awareness challenge for the Park is to get across two facts that at first appear in conflict with one another. These are that fynbos vegetation is **fire-prone** and requires periodic burning to maintain ecological health, and that wildfires need to be **suppressed** because of the damage that they can cause.

Communication and awareness must be focussed to be effective, and so, to be effective we need to know ***WHO*** we want to raise awareness with and ***HOW*** does one do this.

The information in this section will ensure that **ACTIVITY 6** of Table 2 will be met by the Park.

4.1.1 Target audiences

Target audiences would include groups such as:

- Neighbouring landowners and regular visitors
- The broader community of Cape Town
- The national and international communities

4.1.2 Suitable media types

Different types of media have different needs. The most suitable types of media include:

- Print
- Television
- Radio
- Website
- Posters and notice boards
- Public Relations Consultants

4.1.3 Communication strategy

The principles of a communication strategy are who is the target audience, what message will they be given and when will the message be given? There are four steps to implementing this strategy:

Step 1:	Understand your audiences and the wildfire prevention problems that have to be addressed. Focus on the problem issues.
Step 2:	Determine the people who can help solve the problem, as this is the target audience. Then decide what they need to know about veldfire – that's your message.

Step 3: Establish what newspapers or magazines your target audience read, what radio stations they listen to and what TV channels they watch – the media you need to work with.

Step 4: Determine the best time to deliver your message to the target audiences. And remember that wildfire messages can be linked to a number of other events such as Heritage Day (24th September). Heritage Day also coincides roughly with the beginning of the fire season on the Cape Peninsula.

A logical sequence of typical messages in the different fire season is as follows:

In **SPRING** (beginning of the fire season):

- What causes veldfire?
- Veldfire behaviour
- How to interpret the FDR system
- What the FPA and Ukuvuka are and how to get involved?

In **SUMMER** (height of fire season):

- The day to day fire danger
- What is dangerous behaviour?
- How to report veldfires
- How to assist in the event of a wildfire
- What clothes to wear when fighting a wildfire
- The dangers of dehydration
- The hazards of blocking access roads

In **AUTUMN** (end of fire season):

- Prescribed burning
- Fynbos ecology
- Managing fuel

In **WINTER** (out of fire season):

- Preparations (measures to protect your property)
- How to be involved in volunteer work

5. LAW ENFORCEMENT

5.1 What are the specific duties of a Park Ranger in this regard?

It will be the responsibility of the Park Ranger to notify the relevant authorities and Fire Protection Association of a person who is committing an offence in terms of the Veldfire Act.

In addition the following duties that pertain to the enforcement of the Veldfire Act will have to be undertaken:

- Duty to prepare and maintain firebreaks.
- Ensure firebreak requirements are met.
- Ensure readiness for fire fighting.
- Have a full understanding of the penalties and offences discussed in Chapter 1 of this guideline.
- Have a full understanding of the powers set out in the Veldfire Act in order to police the Act effectively.

6. VELDFIRE REPORTING

6.1 Legal requirements

As stated in the Veldfire Act, it is imperative that records of veldfires are kept and these details are furnished to the FPA of the area. The legal snippet below emphasises this:

CHAPTER 2: SECTION 5

- It is the duty of a Fire Protection Association to:
  - (i) Supply the Minister at least once every 12 months with statistics about veldfires in its area.

6.2 Importance of good information to underpin sound veldfire management

In order to ensure improvement of veldfire management techniques and methods within the Park, it is essential that data are collected on a regular basis and monitoring is continuous.

6.2.1 Spatial data to be collected

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

- **Post-fire age of vegetation**: Obtained from maps of all veldfires
- **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 (firebelts):** Obtained from management maps.

6.2.2 Fire weather and fire danger rating

It is also necessary to collect, curate and interpret data on fire weather and fire danger issues. This requires the establishment and maintenance of a database on fire weather and fire danger indices. The Department of Water Affairs and Forestry will soon be adopting the United States National Fire Danger Rating System as a national system for South Africa, as required in terms of the Veldfire Act.

The fire danger indices that are recorded in any particular region should be related to the historic occurrence veldfires. Examples of the type of questions that would be asked by those charged with the interpretation of fire danger indices, and the data needed to answer the questions, are given in Table 8 below.

Fire danger indices can be divided into categories for the purpose of making management decisions. The range of fire danger indices that constitute the different categories will vary from one region to another, and the actual placing of the cut-off values for each of the categories should be determined by the historical occurrence of veldfires and fire weather in any one region.

6.2.3 Chronological record of actions and events

It is essential that an accurate chronological record of the fire, weather and actions taken be maintained. This ensures that management has a record of the deployment of resources, it facilitates debriefing and can be of major importance in the event of legal action after a veldfire. The main location for maintaining these records should be at the Newlands Control Room, to provide an overall picture of events and actions.

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
- The Fire Action Plan, completed with information applicable to that section
- Blank copies of the Chronological Record
- Any other information and documents relevant to emergency veldfire management

Table 8: Typical questions asked by veldfire managers, the nature of answers required, and the data needed to support answers

TYPICAL QUESTIONS ASKED BY FIRE MANAGERS	TYPE OF ANSWER NEEDED	DATA NEEDED TO DERIVE ANSWER	SIGNIFICANCE FOR FIRE MANAGEMENT
What level of fire activity could I expect for any particular level of fire danger index?	The number of fires and their size (area burnt)	The number and size of fires that occurred in the area The dates of fire	Level of preparedness
At what fire danger	Cut-off levels of the	The number and size of	Level of preparedness,

TYPICAL QUESTIONS ASKED BY FIRE MANAGERS	TYPE OF ANSWER NEEDED	DATA NEEDED TO DERIVE ANSWER	SIGNIFICANCE FOR FIRE MANAGEMENT
index level can I expect that fires will become difficult to control?	danger where fires will not occur, will occur but can easily be controlled, will be difficult to control, and will become a major problem	fires that occurred in the area, and an estimate of their ease of difficulty of control The dates of fire	and institution of measures to reduce risk (e.g. a ban on open-air fires)
If a fire occurs under current conditions, how long can I expect it to burn?	The average number of days that fires burnt in the past under similar conditions, and the range	The dates and duration of fires	Planning for long-term logistics of fire-fighting operations
Under these fire danger conditions, what are the most likely sources of ignition that will cause fires?	The relative condition of different sources of ignition to fires in the past	Cause of each fire on record	Planning to reduce the risk associated with certain types of ignition
What levels of damage have been associated with fires that occurred under similar Fire Danger Rating conditions in the past?	The types of damage done, the extent of the damage, and the cost	Damage to structures and crops, and estimates of losses suffered (in Rands) Fire danger Rating for each fire on record	Motivation for expenditure on prevention measures
Under current conditions, which vegetation types are most likely to burn?	The relative areas of different vegetation types burnt in fires in the past under similar conditions	Areas (in ha) of vegetation types burnt in each fire	Preparedness
How easy of difficult will a fire be to control in one was to break out now, and what level of resources would I need to combat the fire?	Estimates of the manpower and equipment that will be needed and their likely effectiveness in containing the fire	Number of staff deployed on each fire Equipment deployed on each fire The success rate of each approach in containing or extinguishing the fire	Decision on when to deploy certain approaches
If a fire should break out now, how much would it cost to control?	The average cost of fires, and the range	Cost of manpower, equipment hire, and running costs of each fire Costs of overheads (equipment purchase, training)	Budgeting
At what level of fire danger would prescribed burns be expected to go out of control?	Cut off levels of fire danger when prescribed burns have been known to escape	The date when prescribed fire got out of control	Decisions on whether or not to allow prescribed burns

6.2.4 The use of data to support veldfire management decisions

The essence of good veldfire management is the ability to make decisions based on a sound understanding of the ecosystem responses to veldfire, and having good information available to inform decisions within the framework of a sound understanding. The most important decisions that fire managers have to make can be divided into:

- Whether or not to burn;
- Whether or not to combat wildfires
- What actions to be take between veldfires to minimise both the risk of accidental veldfires and the potential damage they can cause; and
- How to deal with uncertainty and the need for variation in dynamic ecosystems (see section 3.3).

6.2.5 Procedure to be followed

Most veldfires that occur in the Table Mountain National Park will not be confined to compartments, but will often burn across the boundaries of these. Once any veldfire has been extinguished or burnt out, its extent should be mapped at a scale of 1:10 000 and captured on a Geographical Information System (GIS), together with relevant information on the veldfire. Ideally this should be done soon after the veldfire but if this is not possible it should at least be done prior to the next fire season. The relevant information should include:

- The **date(s)** of the veldfire;
- The cause, divided into lightning, prescribed burns, escaped veldfires from burning operations, veldfire caused by unauthorised people, other known causes, or veldfires of unknown cause;
- An **estimate of the range of intensities** of the veldfire (high, moderate or low), based on the efficiency of fuel consumption in the burnt areas; and
- An **estimate of the percentage** of the vegetation that remained unburnt within the area recorded. This estimate is needed to allow for the fact that many veldfires are very patchy, leaving “islands” of unburnt vegetation behind. If relatively large areas within the perimeter of a veldfire did not burn, they should be excluded from the area map as having burnt.

The GIS-based databases should be updated at lease **once a year**, but preferably continually as information becomes available. It is also important that data collected as part of other monitoring exercises be assessed against the background of a good database of veldfire occurrence. Monitoring data are notoriously unhelpful in showing the causes of recorded changes, and the veldfire records may help to address this problem by providing a casual backdrop.

7. AGREEMENTS

7.1 Inter-organisational agreements

7.1.1 Agreement for the allocation of local authority land in the Cape Peninsula Protected Natural Environment for the purpose of establishing the Table Mountain National Park

An agreement was entered into in 1998 between South African National Parks (SANParks), Cape Metropolitan Council (now City of Cape Town) and South Peninsula Municipality (now South Peninsula Administration) in terms of which the local authorities made available to the SANP "as much as possible of the land owned by them and located within the Cape Peninsula Protected Natural Environment for the purpose of establishing a national park".

The primary object of the agreement was the transfer, by the local authorities which are parties to the agreement, to SANParks of their respective conservation management functions (but not only these functions) on the land that forms the subject-matter of the agreement. It is recorded that from the effective date of the agreement (1 May 1998) SANParks would exercise control over that land. In addition and where possible, ownership in the land would also vest in SANParks.

7.1.2 Contractual obligations with the City of Cape Town

A Memorandum of Agreement between the South African National Parks and the City of Cape Town regarding veld fire management was at the time of writing in the process of being concluded (see Appendix 1).[1]

7.1.3 Aerial fire fighting

SANParks has a leasing agreement with the Forest Fire Association to make available one Mi8-MTV helicopter for aerial fire fighting within the Park. The agreement is that the helicopter will be on stand-by at Newlands form the 1 December to end April each year. The current agreement runs until end April 2005. Additional aerial support will be cover by the Memorandum of Agreement with the City of Cape Town, the National Department of Provincial and Local Government, the Forest Fire Association and KwaZulu-Natal Fire Protection Association.

7.1.4 Working on Fire Programme

At the time of writing (May 2004) a Memorandum of Agreement is being discussed between SANParks and the Working on Fire Programme for the provision of fire fighters, equipment, standby facilities and additional aerial support to the Park.

[1] This Memorandum of Agreement between the Park and the City of Cape Town became effective in January 2005.

FIRE PROTECTION

"All activities designed to protect an area (including life, property, assets and values) from damage by fire"

8. FIRE PROTECTION ASSOCIATIONS

8.1 Legal requirements

Chapter 2 of the Veldfire Act regulates the establishment, registration, duties and functioning of Fire Protection Associations. The duties of Fire Protections Associations (FPAs) are noted 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.

8.2 Relationship with the Cape Peninsula Fire Protection Association

At the time of writing the formation of the Cape Peninsula Fire Protection Association (Cape Peninsula FPA) is advanced.[2] It is crucial that the Park be considered an important member of the Cape Peninsula FPA as a result of its large land holdings. Furthermore, the Park's Manager Fire and Technical Services, has valuable veld

[2] The Cape Peninsula Fire Protection Association (Cape Peninsula FPA) was established on 18th October 2004 and the Manager of Fire and Technical Services has been appointed as the Fire Protection Officer (FPO).

expertise in integrated veldfire management and thus it would be advantageous if he assumed the role of the Fire Protection Officer (FPO) for the Cape Peninsula FPA.

8.3 Mutual agreements with neighbours

It would be most convenient if Mutual Assistance Agreements could be concluded through the offices of the Cape Peninsula FPA, but in the interim the Park should continue their negotiations with the City of Cape Town to agree on a mutual assistance in the area of fire fighting.

8.4 Integrated Veldfire Management Plan

Integrated veldfire management is the systematic management of veldfires by the combination of ecological veldfire management and management of the wildfire risk cycle. This includes ecological veldfire management, mainly prescribed burning, which is used to;

- maintain ecological functioning and biodiversity of the relevant fire-ecology type by imitating the natural fire regime.
- Maintain or develop the under-storey and ground-layer cover for soil and water conservation
- Reduce fuel loads to facilitate wildfire management, mainly veldfire prevention and suppression.
- Control encroachment of undesirable and alien plant species.

A key function as set out in the duties of a FPA would be to apply a veldfire management strategy for its area. The key elements to include in such a plan are:

► Standardised incident command and control whereby;
   a) there are clear rules by which the commander is identified
   b) the rules for escalation of management of the incident are clear;
   c) there is effective transfer of command as the incident escalates.

► Centralised radio communications whereby;
   a) there is a radio trunking system in operation throughout the Cape Metro that enables subscribers (including the Park) to communicate with each other.

► Standardised methods of working

   Standard procedures for veldfire management need to be drawn up by the FPA and the FPO would need to ensure that these are implemented. Aspects that should be standardised are:
   a) Management of fynbos vegetation
   b) Method of veldfire attack
   c) Method of veldfire reporting
   d) Dealing with the media.

- Pooled resources with compatible equipment wherever possible

  It may become important to try to keep teams and their associated equipment together while fighting wildfires. In addition, a set of standards should be drawn up for future equipment purchases for all fire management agencies.

- Policies on cost sharing

  It will be particularly important to establish charge-out agreements and policies for use of helicopters for fighting wildfires. A set of clear cost-sharing policies is therefore imperative, as is the maintenance of a comprehensive fire-log during a wildfire incident. The fire-log would serve as a useful source of information for later invoicing.

9. FIREBREAKS

9.1 Points to consider

It is important to note that in this section the term firebreak (which has replaced the term firebelt) has been used in order to remain synonymous with the Veldfire Act.

The firebreak network proposed in the Fire Management Plan of 2000 is now in place. To a large extend the cost for preparing these firebreaks was sponsored by the Ukuvuka programme. However the Ukuvuka programme will end by mid 2004 and it will be the responsibility of the Park to make financial provision to ensure that the firebreak network is maintained (see Figure 4). Furthermore once the Cape Peninsula FPA is established the Park will need to reach agreement with them to the positioning of common firebreaks. The following section will ensure that ACTIVITY 3 of Table 2 will be met by the Park.

Photo courtesy of Bruce Sutherland

9.2 Design, location, preparation, inspection and maintenance

9.2.1 Criteria used to design firebreaks

- Establish a good distribution of veld area age classes that reflect the ecological management objectives.
- Extensive use of brush-cut breaks because the preparation of breaks by burning is a hazardous operation that has often been the source of wildfire.
- Maintain costs at a reasonable level without jeopardizing good veldfire management and protection.
- The provisions of the Veldfire Act 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.

Photo courtesy of Bruce Sutherland

- 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, sand dunes, tracks and roads as control lines.

9.2.2 Firebreak preparation and maintenance

- Firebreaks need to be well positioned and regularly maintained to be effective. Appendix 2, gives details on responsibility, dimensions and the methods of clearing for all the firebreaks on the boundary of the Park while this information is summarised in Appendix 3.

Photo courtesy of Bruce Sutherland

Specific considerations with respect to firebreak preparation and maintenance are listed in the box below:

Ecological considerations:

- As mentioned in section 9.2, when preparing firebreaks, the Park must avoid known populations if rare and endangered plants.
- The Park 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 (Veldfire Act).

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 prioritising 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 15 m wide, will be maintained in a permanent position.
- 15 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 park side of the firebreak.

The Park has undertaken to establish and maintain a system of firebreaks in accordance with the provisions of the Veldfire Act (see section 9.3). The veldfire season usually starts towards the beginning of November; and all firebreaks shall be completed by not later than the end of December.

The current position of the firebreaks network within the Park is given in Figure 4. Specifications for these firebreaks are given in Appendix 2.

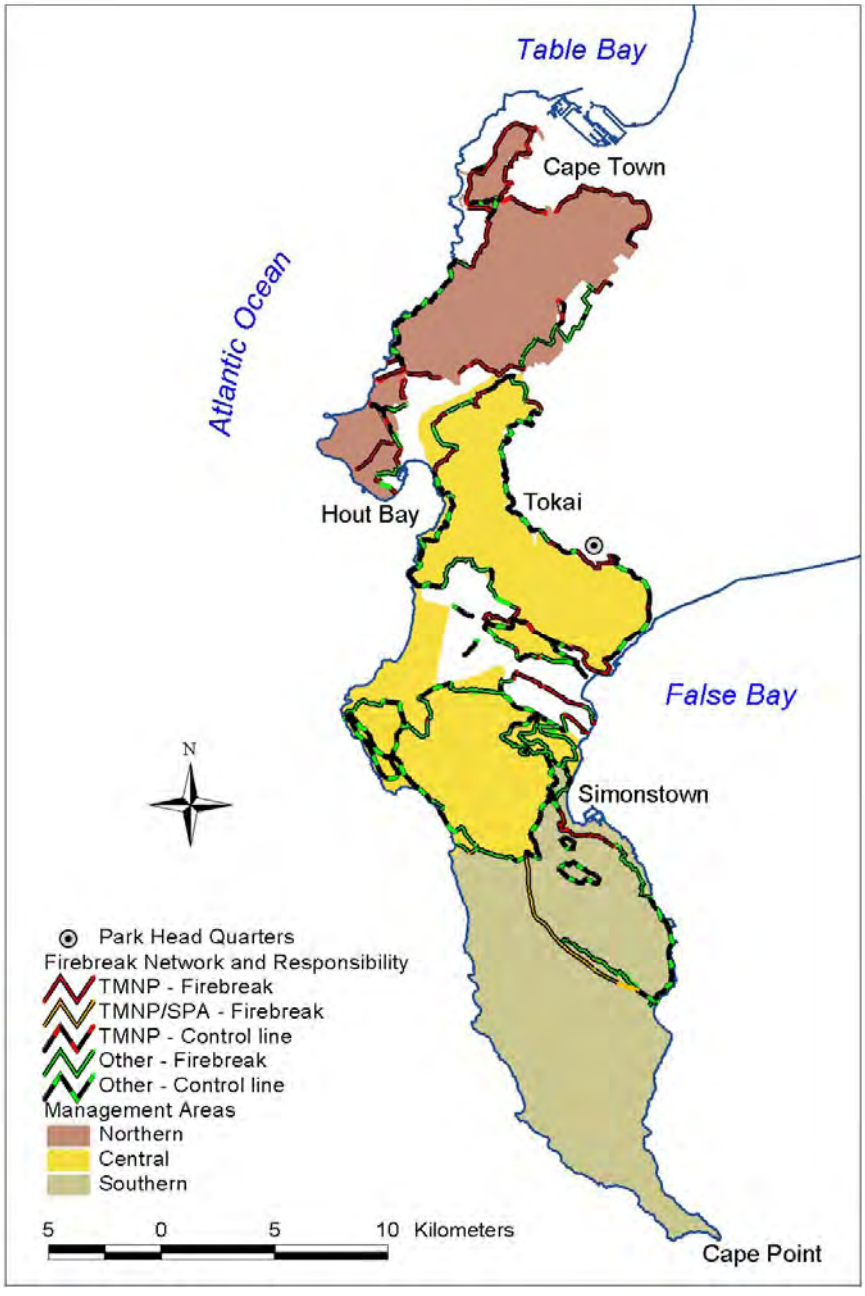


Figure 4: Generalised view of the Table Mountain National Park (TMNP) firebreak network showing firebreaks to be prepared, control lines and indicating the responsible authority.

9.3 Legal requirements and agreements

It is important that adjacent landowners, both public and private, share responsibility and costs for preparation of breaks as provided for in the Veldfire Act. This will also be addressed by the Cape Peninsula FPA. Written agreements between the Park and these landowners should be concluded with respect to cost and preparation of the firebreaks.

Legal requirements as stipulated in the Veldfire Act are noted in the legal snippet boxes below:

CHAPTER 4: SECTION 12

- Every owner on whose land a veldfire may start or burn or from whose land it may spread must prepare and maintain a fire break…see section 12(1)-(10) of the Veldfire Act.

CHAPTER 4: SECTION 13

- An owner who is obliged to prepare and maintain a firebreak must ensure that, with due regard to the weather, climate, terrain and vegetation of the area –
- The firebreak must be –
  - Wide enough and long enough to have a reasonable chance of preventing a veldfire from spreading;
  - Does not cause soil erosion; and
  - It is reasonably free of inflammable material.

CHAPTER 4: SECTION 15

(1) The Minister may exempt any owner or group of owners from the duty to prepare and maintain a firebreak or firebreaks for good reason

(2) The exemption may be subject to conditions…

UNDER WHAT SITUATION WILL NO EXEMPTION BE GRANTED?

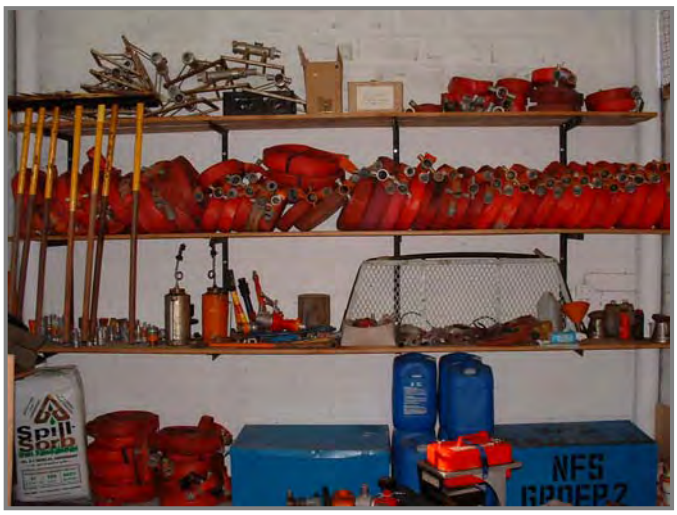
- For blanket requests.
- When there is no or little measure in place to mitigate fire.
- Where there is no or little risk of a fire arising on the property.
- Where there is a risk of a veldfire and no FPA exists.
- Where there is a risk of a veldfire and the land owner is not a member of an FPA.

EXEMPTION FROM PROHIBITION ON DAMAGING PLANTS – CHAPTER 4: SECTION 16

- The right or duty to prepare and maintain a firebreak prevails over any other prohibition in any other law on the cutting, disturbance, damage, destruction or removal of any plant or tree, except the owner must:
  - (a) where possible, transplant any plant which is protected in terms of any law; or
  - (b) where it is safe and feasible, position the firebreak so as to avoid such plant or tree.

10. EQUIPMENT AND FACILITIES

The details mentioned in this section will ensure that ACTIVITY 2 of Table 2 is met by the Park.



10.1 What equipment and facilities have we got and where is it located?

See Appendix 4 (Table of fire fighting equipment and facilities currently in possession by the Park)

10.2 What is the minimum equipment and facilities that is required during the fire season?

10.2.1 Vehicles, Equipment and protective clothing and infrastructure

See Appendix 4 (Table of fire fighting equipment and facilities currently in possession by the Park)

10.3 Who is responsible for the maintenance?

Veldfire management equipment should, as a general rule, only be used for that purpose.

10.3.1 Recommended routine maintenance levels

See Appendix 5 (recommended routine maintenance schedule for fire fighting equipment)

10.4 What procedures are necessary to ensure a level of preparedness?

The level of preparedness during the fire season should be based on the daily Fire Danger Rating. However, basic preparedness levels that should be maintained throughout the fire season, irrespective of the Fire Danger Rating include:

- Vehicles to be used for fire fighting to be equipped with basic veldfire response tools. Tools to be checked once a week and checklist to be signed.
- Motorised, electrical or mechanical equipment should be checked daily.
- Any defects or damages to vehicles or equipment must be reported to the Manager Fire and Technical Services.

- Standby crews must, at all times be ready to depart immediately in event of a veldfire reported. On the alarm being given, all crew must immediately proceed to the point of assembly with their respective equipment.
- During the fire season a helicopter crew should also be on standby.
- Where there are radio blind spots, measures must be taken to ensure that fire crews are in contact with the Control Room.
- A standby crew should be maintained after hours, throughout the fire season. When fire danger is exceptionally high, crews of volunteers may also be kept on standby.

10.5 Legal requirements

10.5.1 Veld and Forest Fire Act 101 of 1998

CHAPTER 5: SECTION 17.(1)(a)
▪ Every owner on whose land a veldfire may start or burn, or from whose land it may spread must have: o Equipment, protective clothing and trained personnel for extinguishing fires.

CHAPTER 2: SECTION 5.(1)(g)
▪ FPA's must inform members of equipment and technology available for preventing and fighting veldfires.

10.5.2 Occupational Health & Safety Act 85 of 1993

This Act specifies that employees need to provide and maintain a safe working environment for their staff. See details in the legal snippet box below.

SECTION 8: 1 & 2 (a-j)
(1) Every employer shall provide and maintain, as far as is reasonably practicable, a working environment that is safe and without risk to the health of its employees (2) Without derogating from the generality of an employer's duties under subsection (1), the matters to which those duties refer include in particular – - (a) the provision and maintenance of systems of work, plant and machinery that, as far as is reasonably practicable, are safe and without risks to health;…

10.5.3 Recommended standards in terms of best practice

The maintenance schedule which is attached as Appendix 5 is the most appropriate measure to ensure that best practice methods are being employed by the Park.

11. STAFF

A well-trained and practiced veld and mountain fire-fighting force is an essential component of any veldfire management operation. The details discussed in this section will ensure that **ACTIVITY 1** of Table 2 is met by the Park.

11.1 Permanent staff, volunteers and contractors

- The Park has a total of 76 field staff but at any given time only a limited number of them are available for fire fighting duties. This is due to their other operational duties.
- In most cases the Park's field staff have basic training in the combating of veldfires and the application of prescribed burns.
- During the fire season the Park hire the services of a contractor who provides 70 trained fire fighters to augment Park staff in the event of a veldfire. At any given time during the fire season 30 of these fire fighters are on 24-hour stand-by duty. They are located in two teams of 12 each at Kloof Nek and Newlands, and one team of 6 at Klaasjagersberg. Each team is supervised by a crew leader. Any fire-fighting contractor engaged by the Park, should as a requirement, meet the same level of experience and training recommended for Park staff.
- In addition, there are 120 members in the volunteer fire fighting corps of which 80 are active. The volunteers are mainly deployed as fire fighters. In cases of high veldfire risk days occurring over weekends and public holidays a team of 10 volunteers are on 24-hour stand-by duty at Newlands.

11.2 Team structure: Roles and Responsibilities

The basic functions and responsibilities within a team structure are outlined in the boxes below:

FUNCTIONS IN A TEAM STRUCTURE

(i) **Fire Fighting**: Involves suppression at the fire line, which includes attacking the fire directly with hand tools and water hoses or indirectly by bombing flames with water from helicopters.

(ii) **First Aid:** Every fire fighting team should include a member trained in basic First Aid. It is the Park's policy to have 1 per 15 members trained in First Aid so as to meet the provisions of the Occupational Health & Safety Act of 1993.

(iii) **Veldfire management:** Involves senior or specialised staff typically working away from the fire front.

RESPONSIBILITIES OF STAFF IN A TEAM STRUCTURE

Incident Commander: Overall commander of a fire-fighting operation

Fire Boss: In command of a small veldfire or a section of a large veldfire, normally reporting directly to the Incident Commander.

Crew Leaders, Foreman or Supervisors: Supervise crews on standby, supervise crews deployed at a veldfire, respond to instructions from the Fire Boss, respond with minimum delay to a veldfire, 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 rooster.

Driver: Responsible for the condition of vehicles and equipment, completion of checklists for Unimogs and 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 Park.

11.3 Training staff

11.3.1 Accreditation

Staff are able to obtain accreditation for different fire-fighting activities from the following institutions:

- SAFCOL – Concordia Training Centre
  - # Basic Fire Fighting
  - # Advanced Fire Fighting
  - # UNIMOG Fire Tender Driver
  - # Fire Foremanship
  - # Fire Suppression Management
- SAFCOL – Platorand Training Centre
  - # Fire Simulation Management Training
- St John's Ambulance
  - # First Aid Course

11.4 Procedures

11.4.1 Standby

Standby and fire fighting duties have been outsourced under the following conditions:

- Standby will be for a seven day period starting at 15:30 on Friday and ending at 07:18 the following Friday.
- In addition to the standby crew, the contractor will be required to supply 12 additional crew members during work hours.
- These crew members are to be trained by the Park as an initial strike attack team and will be accommodated at Newlands Forest.
- Crews on standby must at all times be ready to depart immediately in an event of a veldfire reported.
- On the alarm being given, the crew must proceed immediately to the appointed assembly point taking with them all equipment they will require during the initial stages of veldfire.

The responsibilities of a standby duty officer are given in the box below:

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.
- On returning to base after a veldfire has been extinguished; all equipment should be inspected and repaired or replaced where necessary.
- Complete equipment checklist with unimog and 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.

11.4.2 Fire fighting

(see Chapter 15)

11.5 Legal requirements

11.5.1 Occupational Health & Safety Act 85 of 1993

As noted in this Act, there is a duty imposed on employees to ensure that their employees are informed of the hazards related to their job function and the general duties to be performed at work. The legislation snippets are noted in boxes below.

SECTION 13 a

- Every employer has the duty to inform his employees:
  - As far as is reasonably practicable, cause every employee to be made conversant with the hazards to his health and safety attached to any work which he has to perform, any article or substance which he has to produce, process, use, handle, store or transport and any plant or machinery which he is required or permitted to use, as well as with the precautionary measures which should be taken and observed with respect to those hazards.

SECTION 14 a - e

General duties of employees at work

- Every employee shall at work-

  (a) take reasonable care for the health and safety of himself and of other persons who may be affected by his acts or omissions;

  (b) as regards any duty or requirement imposed on his employer or any other person by this Act, co-operate with such employer or person to enable that duty or requirement to be performed or complied with.

12. VELDFIRE MANAGEMENT PARTICULAR TO VELDFIRE PROTECTION

12.1 Prescribed burning

The information discussed in this section will ensure that ACTIVITY 4 of Table 2 will be met by the Park.

12.1.1 Legal requirements

Prescribed (controlled burns) will be regulated by the FPA of the area. The Veldfire Act provides for this, see legal snippet in the box below.

CHAPTER 2: SECTION 5.(4)(c)
▪ It is the duty of FPA to make rules which bind its members. o These rules must provide for: ▪ Controlled burning to conserve ecosystems and reduce the fire danger

12.1.2 Ecological considerations

Prescribed burning is one of a set of necessary interventions in the management of any fire-prone and fire-adapted vegetation type. The reasons for burning fynbos are:

- To reduce fuel loads, and therefore hazard
- To rejuvenate the fire-adapted and fire- dependent vegetation.
- To form an essential part of control operations aimed at eliminating invasive plants.
- Fire managers should aim to burn fynbos vegetation at intervals of between 12 and 15 years.

Problems with implementing such a programme include:

- Plan may be upset by occasional unplanned wildfire.
- Burning on a fixed rotation is undesirable and variations in the intervals between veldfires are necessary to promote biodiversity.
- Any plan needs to take account of risks associated with the urban fringe.

The ecological criteria that need to be met when implementing a prescribed burn are noted in Figure 5.

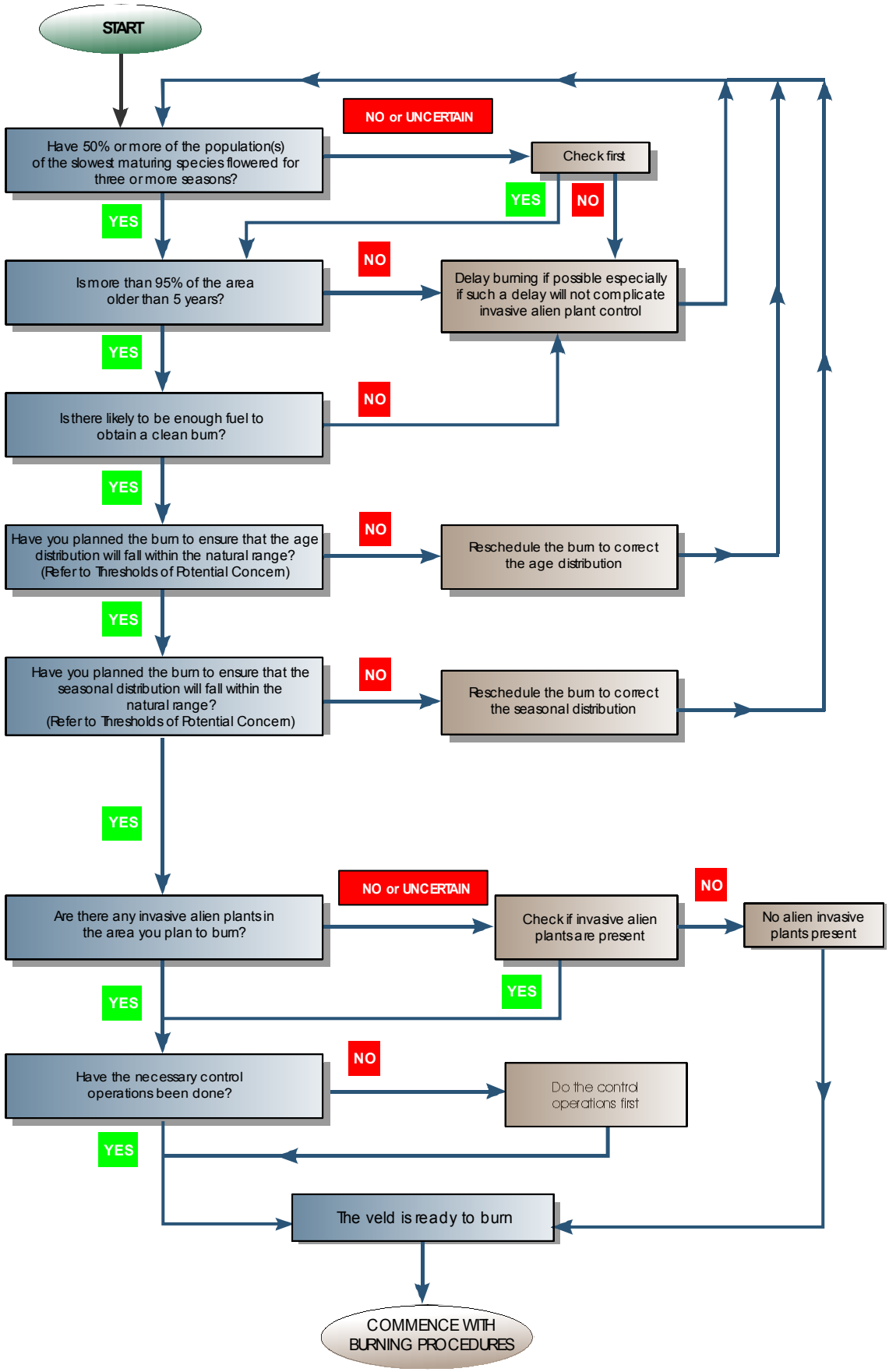


Figure 5: Flow chart for the ecological criteria that must be met for a prescribed burn

12.1.3 Climatic considerations

Basic weather and veldfire 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

12.1.4 Staff and equipment

It will be imperative to plan the allocation of suitable staff and equipment required to implement the prescribed burn, including any rations that may be needed.

12.1.5 Clearing of alien vegetation and burning of stacks

A large percentage of the fynbos on the Cape Peninsula has been invaded by alien plants to some degree. Wildfires or poorly planned prescribed burns can severely set back alien plant control operations, both ecologically and financially. Therefore, it is essential that

prescribed burns be fully integrated with alien plant control operations.

For more detailed background reading on alien plant control see the box below:

Recommended Reading - Integrating alien plant control and veldfire

Holmes, P, 1996
Holmes, PM, Macdonald, IAW and Juritz, J, 1987
Macdonald, IAW, Clark, DL and Taylor, HC, 1989
Olckers, T & Hill, MP, 1999
Richardson, DM, Macdonald, IAW. & Forsyth, GG, 1989
Richardson, DM, Macdonald, IAW, Holmes, PM and Cowling, RM, 1992
Van Wilgen, BW, Bond, WJ & Richardson, DM, 1992

12.2 Use of veldfire in alien plant control

- Old stands of alien plants retain seedbanks of fynbos species but the longer the alien plants are present, the more depleted these seedbanks become.
- Felling and clearing of dense stands of alien plants can result in the accumulation of large quantities of fuel in the form of dead brush. If prescribed burns are not carefully executed under these circumstances it could result in an intense veldfire that could sterilise the soil and result in poor fynbos recovery.
- Dense brush should be burnt under moderate conditions, and preferably after allowing the fuel to decay for one or two years first.
- Alien plant control operations involving burning need to be planned in such a way so as to ensure that any fynbos present is mature enough to burn (see section 3.2.1).
- Veldfire planning also needs to take into account the ecology and biology of each particular invasive species, e.g. the longevity of the alien plant's seedbanks.

12.3 Urban - Park interface constraints

Any plan to implement prescribed burning needs to take account of risks associated with the urban edge. The orientation of the Peninsula mountain chain results in an extensive Urban – Park interface so that any prescribed burn that escapes can result in expensive damage to neighbouring properties and infrastructure. Therefore it is essential to minimise chances of a prescribed burn escaping and becoming a wildfire.

12.3.1 Practical constraints

There are several practical constraints to veldfire management. The most important ones are:

- **Controlling a prescribed burn** – (see section 13.4)
- **Safe boundaries** – Before any veldfire is deliberately lit the manager must be sure that (a) veldfires can be safely lit along the boundaries and (b) that even if the

weather changes these boundaries will remain reasonably secure. Theses constraints will affect the size and shape of management compartments.

- **Combining with alien plant control operations** – (see section 12.2)
- **Provision of grazing** – Introduction of ungulates had led to problems. Fynbos vegetation does not provide good grazing and regular burning is necessary to provide sufficient young growth to keep these animals alive. Thus there may be a conflict of interest between the provision of grazing (frequent burning) on the one hand and the conservation of flora that may require longer intervals between veldfire.

12.4 Monitoring vegetation and indicator species in response to veldfire

The purpose of monitoring is to be able to detect changes from a desired standard or norm in order to support management decisions.

Fynbos is highly variable both in time and in space. Most plants regenerate from seed and appear to be very sensitive to factors such as veldfire intensity, which are hard to predict and measure accurately. The following methods for determining vegetation and indicator species response to veldfire prove useful:

- Monitoring plant communities – Detect change at this scale by taking photograph in the same season.
- Monitoring veldfires – Crucial information about each veldfire should be collected during and after a veldfire.
- Monitoring fynbos population – Three types of population records in each vegetation type are needed, namely:
  - Records of populations in permanently marked plots
  - Surveys of indicator species to determine when vegetation is mature enough to burn
  - Surveys to measure regeneration success of suitable indicator species
- Monitoring alien plant clearing – Three key aspects of alien plant control are:
  - Success of clearing and biocontrol operations
  - Ongoing detection and control of new invasions
  - Indigenous vegetation regeneration and rehabilitation

13. PROCEDURES FOR PRESCRIBED BURNING

13.1 Table Mountain National Park Procedure Code

13.1.1 Planning phase

Either in February or March the Manager Fire and Technical Services will call a second meeting to discuss prescribed burning of compartments and to identify and prioritise stack burning areas (although stack burning takes place during the winter months under cool moist conditions).

In particular the aims of this meeting are to:

(a) re-evaluate the proposed prescribed burning compartments, to accommodate any wildfires that may have occurred in these areas.

(b) ensure that all key ecological criteria have been met for a prescribed burn as per Figure 5

(c) prepare a map of the proposed prescribed burning area.

(d) decide on the location of control lines using existing firebreaks, young veld and other features in the landscape such as jeep tracks. Where none of these exist, temporary firebreaks can be prepared prior to prescribed burning.

(e) notify other fire authorities of the prescribed burning plans, and seek agreement for their assistance, especially with regard to the burning of blocks on the urban edge.

(f) inform all adjacent property owners that may be affected by the prescribed burn, and their approval should be obtained in writing where applicable.

(g) plan the allocation of suitable staff (including the services of the Volunteer Wildfire Services) and equipment required to implement the burn.

(h) determine actual ignition lines, and direction of ignition and indicate these on a map.

(i) identify potential hazards and develop contingency plans to deal with these if they should occur.

(j) integrate the prescribed burn with alien plant control operations.

The procedures to be carried out before executing a prescribed burn are summarised in Figure 6.

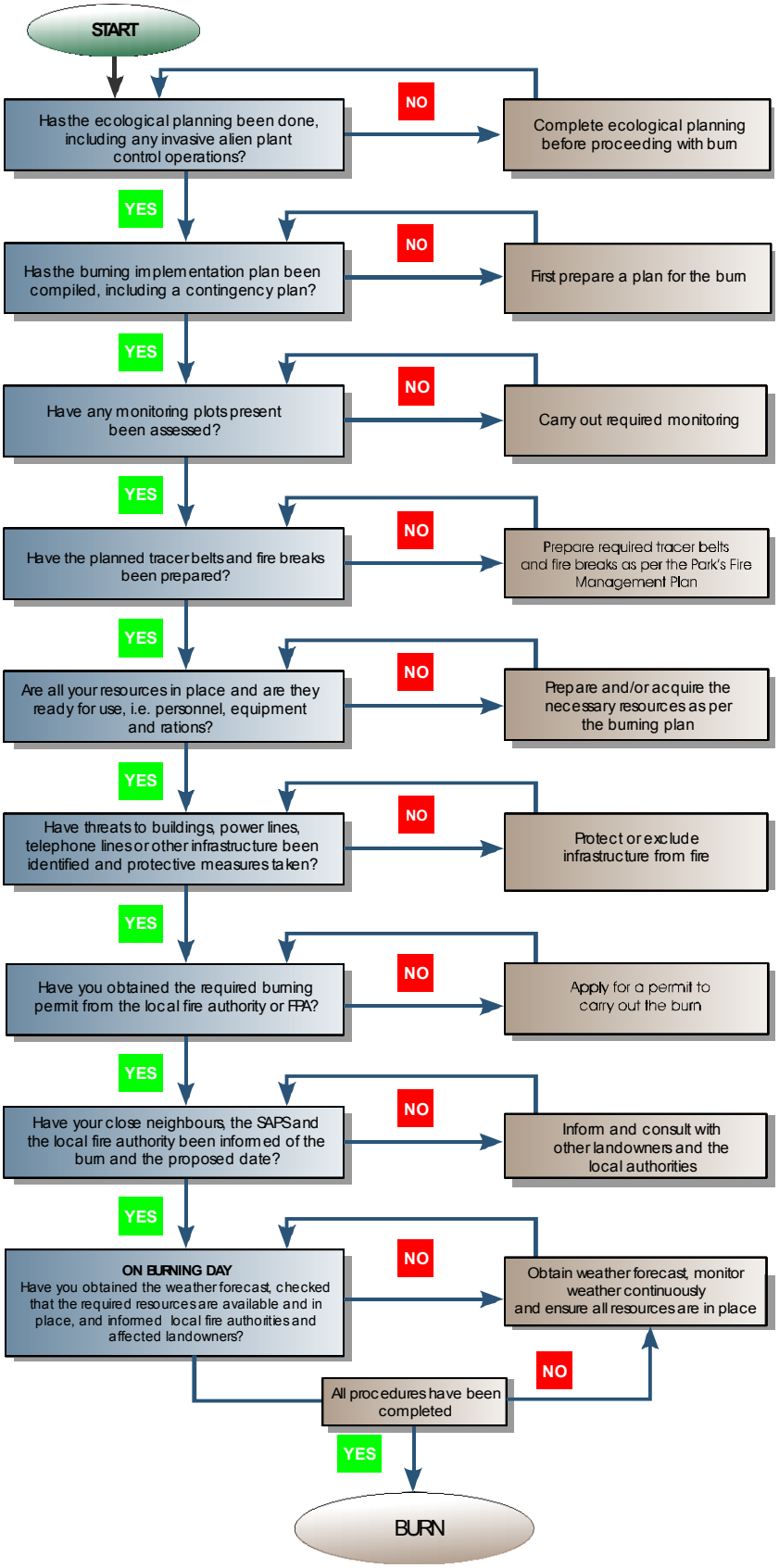


Figure 6: Procedures to be carried out before executing a prescribed burn in an area

13.2 Implementation of a prescribed burn

- Once planning is complete, the most important aspect to monitor will be the weather. The number of ideal burning days is limited and priority must be given to making good use of them. Days with mild conditions (< 25º C), moderate wind speeds (< 20 km/h) and 2-3 days after light rains provided the best conditions for prescribed burnings to be carried out safely (there should be about 12 such days during March and April in the Western Cape).

- The Manager Fire and Technical Services will be responsible for obtaining the necessary permits from the City of Cape Town Air Pollution Control Officer and the Department of Water Affairs and Forestry in advance of a prescribed burn (including stack burning).

- The final decision whether to burn or not to burn will be with the Manager Fire and Technical Services. The Manager Fire and Technical Services will also act as the Incident Commander and the actual application of the burn will be under his control. The responsibility of the Incident Commander will be to monitor the burn and to make appropriate decisions in time.

- The Manager Fire and Technical Services 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 organisations:

    1. Cape Peninsula Fire Protection Association
    2. The Park's Communications Manager
    3. Fire and Emergency Services – Cape Town Administration (Fire Control)
    4. Fire and Emergency Services – South Peninsula Administration (Ottery)
    5. Parks and Open Spaces - South Peninsula Administration (Houtbay or Noordhoek)
    6. City of Cape Town Radio Trunking Control Centre
    7. Cape Town Administration Air Pollution Control

- The Incident Commander will keep the abovementioned organisations 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.

13.3 Post burn issues (prescribed and stack)

- After the prescribed burn has been completed, patrolling and inspections should continue until the Incident Commander is satisfied that the veldfire has been extinguished.
- During the patrolling phase, hazardous situations where a veldfire could most likely reignite (for example smouldering stumps and marshes especially if close to the perimeter of the veldfire) 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 veldfire 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 veldfires where damage has occurred to property a press statement should be issued to inform the public what the consequences of the veldfire were, and to avoid negative perceptions amongst the public. The Park's Communication Manager, in consultation with the Manager Fire and Technical Services, should make a judgement call as to whether or not a press statement is warranted.
- The Veldfire Report Form must be completed indicating that the proposed action was a prescribed burn/stack burn (see Appendix 6).

13.4 Determining whether it is safe to undertake a prescribed burn

Determinants in deciding whether a prescribed burn including stack burn may be safely undertaken are listed below:

1. Wind speed and fuel moisture:
The provisional guideline is that veldfires should be lit under conditions which will result in mean flame lengths of 2-5 m which can be achieved with a range of fuel moisture contents and mean wind speeds. See Table 9 on the limits on the combination of wind speed and fuel moisture conditions for prescribed burning in tall, proteoid fynbos.

2. The amount of fuel (accumulated biomass):
This is directly related to post-fire age of vegetation and differs for the different structural types of fynbos. The predicted flame length for each age class of different vegetation types is seen in Table 10. The ability to control a veldfire as a result of flame length is stated in Table 11.

Table 9: Predicted flame lengths based on a fynbos fuel model for tall, proteoid shrubland and a veldfire behaviour model (van Wilgen et al. 1992)

Moisture content of fine dead fuel (%)	Wind speed (km/hr)						
	0	5	10	15	20	25	30
2	1.1	**3.4**	5.3	7.0	8.4	9.8	11.1
5	1.0	**3.0**	**4.8**	6.3	7.6	8.8	10.0
8	0.9	**2.7**	**4.2**	5.6	6.8	7.9	8.9
11	0.7	**2.2**	**3.5**	**4.6**	5.5	6.4	7.3
14	0.4	1.2	1.8	**2.4**	**2.9**	**3.4**	**3.8**
17	0.3	1.1	1.7	**2.2**	**2.7**	**3.1**	**3.5**
20	0.3	1.0	1.6	**2.1**	**2.6**	**3.0**	**3.4**

Table 10: Predicted flame lengths (m) for different vegetation types of the Table Mountain National Park.

Vegetation type	Age class (yrs)											
	0-2	3-5	6-8	9-11	12-14	15-17	18-20	21-23	24-26	27-29	30-32	.33
Mesic & wet proteoid	0.0	0.0	0.4	1.1	2.3	4.2	5.1	6.1	6.8	7.3	8.2	8.5
Sandplain proteoid	0.0	0.2	0.3	0.6	1.0	1.2	2.1	2.1	2.1	2.3	5.2	6.3
Ericaceous	0.0	0.2	1.0	1.8	2.1	2.3	2.4	2.5	2.6	2.7	2.7	2.7
Wetland	0.0	1.1	3.2	4.9	13.3	15.8	17.1	18.0	18.8	19.2	19.5	19.7
Cliff communities	0.0	0.3	0.5	0.6	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.0
Asteraceous	0.0	0.0	0.1	0.7	1.9	3.5	3.6	3.7	3.7	3.8	3.8	3.8
Renosterveld	0.0	0.5	1.5	3.2	5.7	6.6	6.8	6.9	7.0	7.1	7.2	7.3
Invaded by aliens (wattles)	0.0	0.0	0.6	1.6	3.3	5.3	12.4	14.0	15.4	16.6	16.8	16.9

Table 11: Relationship between the mean flame length in metres, fire hazard class and controllability of a veldfire as derived from Teie (2003).

Mean flame length (m)	Fire hazard class	Controllability
0 -1.2	Low	Veldfires are easily managed with conventional equipment. Suitable for prescribed burning
1.3 - 2.0	Moderate	Veldfires are controllable. Prescribed burning should be carried out with care under these conditions.
2.1 - 5.0	High	Veldfires are difficult to control only with only indirect control measures being practical. Back-burning must be carefully considered. No prescribed burning should be done under these conditions.
> 5.0	Extreme	Veldfires are very difficult to control. Long range fire spotting occurs. Back-burning should be avoided.

FIRE SUPPRESSION

"All the work and activities connected with fire-extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished"

14. FIRE FIGHTING SAFETY RULES

Fire suppression is only one part of veldfire 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:

Photo courtesy of L. Vosloo

- Keep informed of fire weather conditions and forecasts
- Know what your veldfire is doing at all times
- Base all actions on the current and expected veldfire 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 veldfire aggressively but put the safety of your fire fighters first

15. COMMAND STRUCTURE

Regardless of the size of the veldfire, certain basic management actions are required to establish rapid and efficient control, and minimise 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. Examples of the basic fire command structure for small, medium and large veldfires are provided in Figures 7 to 9. The information discussed in this section will ensure that Activity 5 of Table 2 will be implemented by the Park.

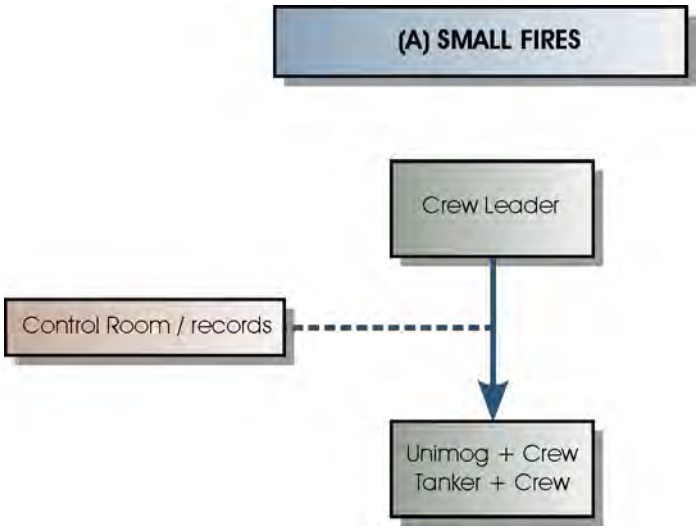


Figure 7: An example of the basic command structure for a small veldfire

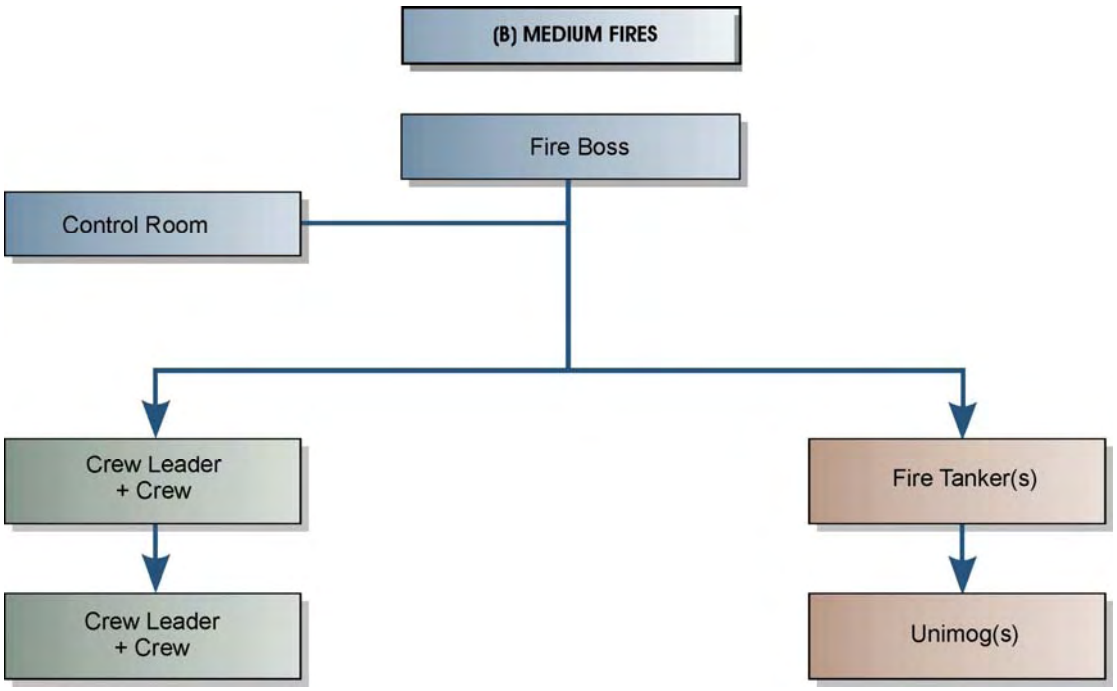


Figure 8: An example of the basic command structures for a medium veldfire

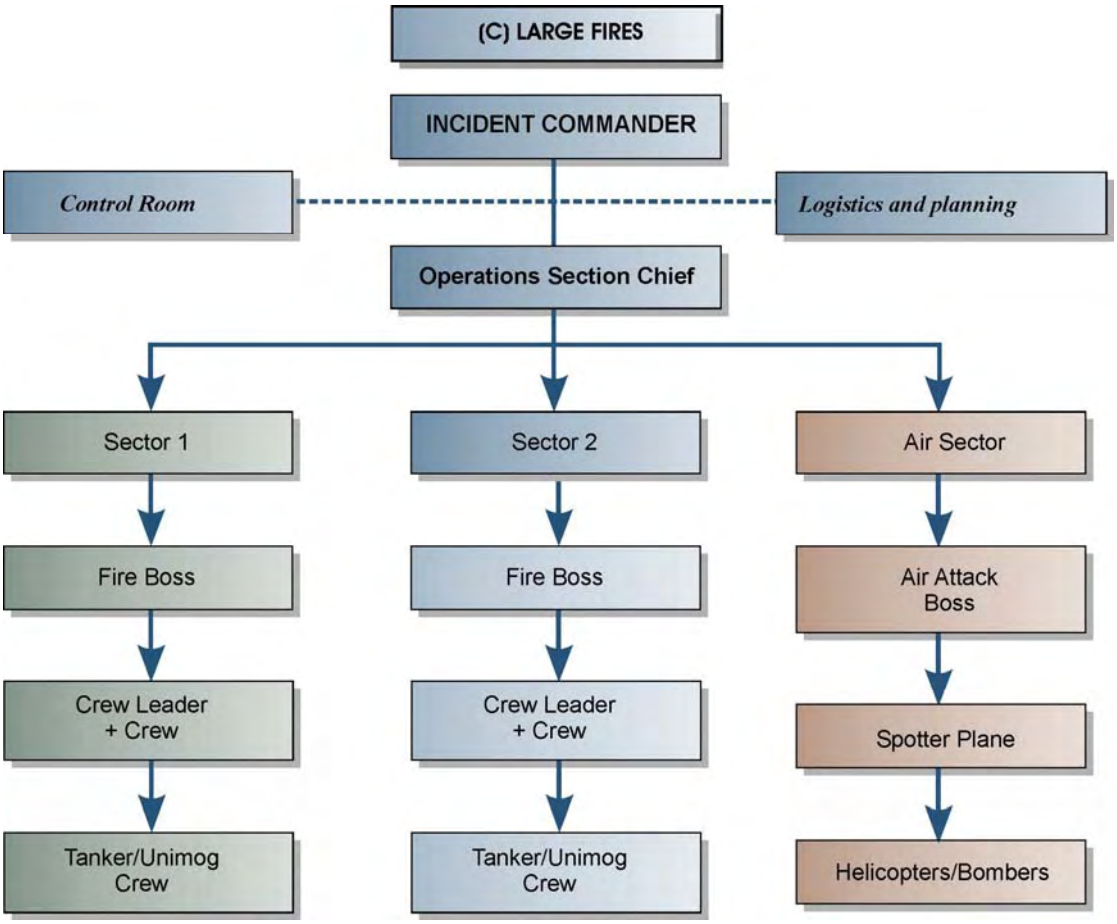


Figure 9: An example of the basic command structure for large veldfires

Roles and responsibilities of the various personnel in the command structure:

- Basic Organisation (applies to any veldfire):
    - **Fire Boss:** In control of fire fighters equipment within a specific sector or flank of a veldfire. In the case of small veldfires it could be the Crew Leader at initial response, but who would be replaced if a veldfire increased in size or severity.
    - **Crew Leader:** In control of a fire control crew that could consist of a team of beaters, a tanker crew or a mopping-up crew. The Crew Leader serves as supervisor on the actual fire line, and is responsible for suppression of the veldfire on a particular line.

- Expanded organisation (as veldfire size or severity increases, functions are delegated by the Fire Boss):
    - **Incident Commander**: Assumes overall control of a large veldfire.
    - **Logistics Section Chief:** Generally positioned on larger veldfires, the Logistics Officer is responsible for ensuring that the supply of equipment and other resources (including rations) arrive on site, on time.
    - **Planning Section Chief:** Uses weather, terrain, veld age and other parameters to develop plans of attack; propose future control lines, and estimate potential veldfire size.
    - **Operations Section Chief**: Responsible for all suppression activities at a large fire and reports to the Incident Commander.
    - **Air Attack Boss:** Responsible for the tactical operations of all aircraft assigned to a veldfire including their logistical support.

16. VELDFIRE BEHAVIOUR

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

16.1 Fuels

Knowledge of fuels is fundamental to understanding veldfire behaviour. The important elements are:

- Fuel type (e.g. grasslands, fynbos, 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 veldfire suppression.
- Fuel arrangement – the arrangement of fuel will affect the probability of ignition and subsequent rate of spread.

16.2 Weather

Weather factors that have a major influence on veldfire behaviour include temperature, relative humidity, wind speed and wind direction.

Weather and veldfire behaviour in general:

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

16.3 Prediction

The ability to predict veldfire behaviour is vital in the planning of wildfire suppression, and the application of prescribed burning.

Fire intensity (see section 3.2.3) is a useful means of comparing veldfires 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 veldfire behaviours for the same fire intensity value. Flame height is an indicator of fire intensity and in general the longer the length of the flame (see section 13.4) the greater the fire intensity.

Fire danger and veldfire behaviour: Fire danger is the combination of all the factors that determine whether a veldfire starts, spreads and does damage, and whether and to what extent veldfires can be brought under control (see Table 12 and Chapter 2).

Veldfire behaviour in general:

- 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 veldfire increasing fourfold.
- Halving the fuel load will decrease the rate of spread fourfold.

VELDFIRE BEHAVIOUR "WATCH OUT" SITUATIONS FOR FIRE FIGHTERS

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

17. COMMUNICATION DURING A WILDFIRE

17.1 Issues to communicate to the public

During major veldfires, the key requirement for people is to know what is happening and how the veldfires might affect them. Much of this is about reassuring the public that the park 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 veldfire headed?
- Is the weather forecast good or bad for controlling the veldfire?
- Is the veldfire under control or dangerously out of control?
- How many people are fighting the veldfire, 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 Park has designated the Communications Manager as spokesperson to deal with the media during a veldfire. During a veldfire, the Incident Commander 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 veldfires, the Incident Commander will act as the designated alternative spokesperson and will deal with the media.

18. PROCEDURES FOR WILDFIRES

18.1 Pre-fire planning (as per Table Mountain National Park procedure code)

- Immediately before each fire season (during October) a meeting should be convened to set up contingency plans in the event of a wildfire.
- The veldfire hazard map presented at this meeting would need to have been modified to reflect any prescribed burns that have taken place in the late summer or early autumn.

Photo courtesy of L. Vosloo

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

18.2 Preparedness

- The level of preparedness should be based on the daily Fire Danger Rating. Senior Section Rangers must use Table 12 to understand veldfire behaviour and veldfire control actions required for each fire danger rating class.
- Basic preparedness that should be maintained throughout the fire season, irrespective of the Fire Danger Rating include:

1. Vehicles used for fire fighting (unimogs and tankers) 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.
2. Motorised, 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.
3. Any defects or damages to vehicles or equipment must be reported to the Manager Fire and Technical Services immediately.
4. 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.
5. In addition to the crews required for standby, an initial strike attack team will be accommodated at Newlands Forest during working hours, i.e. from

Mondays to Fridays. This team will operate exclusively with the helicopter based at Newlands Forest from where they will be immediately deployed, should the Newlands Control Room receive report of a wildfire.

18.3 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 veldfire.

REMEMBER: Fire Response must be based on the potential threat not the immediate size of the veldfire.

The daily Fire Danger Rating is a useful guide for predicting the potential behaviour of the veldfire 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 veldfire 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 veldfire should be treated as dangerous, and when the fire alarm is given, immediate and effective action is imperative**.

The following **PROCEDURE** is applicable during working hours, from Mondays to Fridays (the same procedure will be applicable after hours and over weekends and public holidays, but on these days the responsible persons will be the duty officer and the control officer).

PROCEDURE

1) When receiving a wildfire call, the Assistant Section Ranger, Section Ranger or Senior Section Ranger must immediately despatch a team to the wildfire taking with them the necessary equipment.

2) The Assistant Section Ranger, Section Ranger or Senior Section Ranger must immediately inform the Manager Fire and Technical Services of the wildfire, and if the Fire Danger Rating is ORANGE (High) or RED (High-Extreme), the Manager Fire and Technical Services will immediately request the helicopter to be airborne.

3) The initial strike attack team will be deployed with the helicopter.

4) The Assistant/ Section Ranger, or who ever arrives at the scene of the wildfire first, must make an assessment and inform the Manager Fire and Technical Services.

5) The Manager Fire and Technical Services will, depending on the potential threat, inform all other affected parties of the wildfire.

6) In cases of small wildfires, the Manager Fire and Technical Services, in liaison with the Assistant/Section Ranger (who will act as the Fire Boss) will determine an appropriate action plan to extinguish the wildfire.

7) The Assistant/Section Ranger must inform the Manager Fire and Technical Services once control has been established and when fire fighting resources are withdrawn from the wildfire.

8) In cases of larger wildfires, which require the attendance of the Manager Fire and Technical Services, there will be a change to the command structure as different staff members will be required to perform different functions (at a small wildfire, one person can deal with logistics, planning and control. This is not the case with larger wildfires).

9) The Manager Fire and Technical Services will on his arrival assume control of the wildfire. He will together with the Assistant/Section Rangers present decide on an appropriate action plan and he will act as the Incident Commander if deemed necessary.

10) Depending on the size or severity of the wildfire, the following functions could be delegated by the Incident Commander: ***Logistics Section Chief:*** generally positioned on larger wildfires, the Logistic Officer is responsible for ensuring the supply of equipment and other resources (including rations) arriving on site, on time. ***Operations Section Chief:*** Positioned on larger wildfires and reporting to the Fire Boss, the Operations Boss is responsible for all suppression activities. ***Air Attack Boss:*** Where aerial fire fighting is employed, the Air Attack Boss is responsible for directing this attack.

11) Where more than one party is involved in a wildfire and where there is a threat to neighbouring property, a Joint Operations Centre (JOC) will be established by all the role-players. The Incident Commander will meet with the other role players and the parties concerned must reach a decision on attacking the wildfire. The Fire Protection Officer (FPO) of the newly established Cape Peninsula Fire Protection Association will assumes overall control over such a wildfire, and from this stage on, all the parties concerned, will cooperate in operations and will instruct their Fire Bosses on movement and procedure as decided by the FPO. The Fire Bosses will be in regular contact with the FPO and keep him or her informed.

12) Once final control has been established, the mopping up of the area must be undertaken until the FPO is satisfied that the wildfire has been extinguished.

13) After every large wildfire, the Manager Fire and Technical Services will call for a debriefing session of all the concerned parties so as to discuss and examine the record of response and determine whether or not there were any areas requiring improvement.

The flow of response during a wildfire as the wildfire becomes more difficult to control is given in Figure 10.

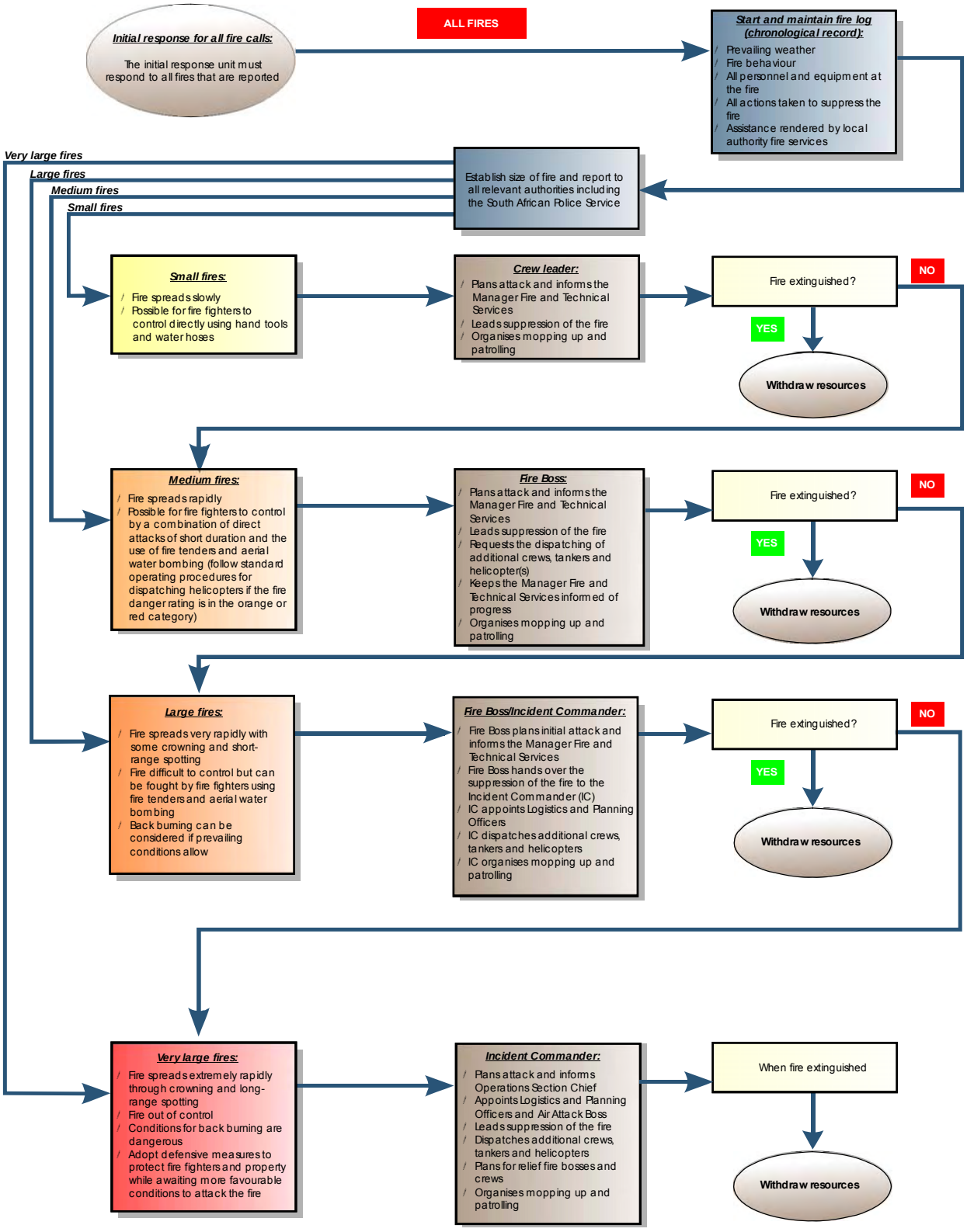


Figure 10: Flow of response, and escalation of activities as the wildfire becomes more difficult to control

18.4 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 (the helicopter will immediately respond to a wildfire reported on a orange or red day). See Table 12.

18.5 Fire detection and initial reporting

The nature (topography) and extent of the Park means that there are very few if any ideal lookout sites. In the past the percentage of wildfires detected by sources other than lookouts (i.e. public, neighbours, police and aircraft) was very high and for this reason staffing of the fire lookouts has been discontinued.

The Park should ensure that:

- Procedures for reporting wildfires should be publicised in newspapers and on notice boards erected along all major public access routes within the Park, stating the contact telephone number for wildfire reporting.
- The "**107**" telephone number should be constantly advertised as a fire-emergency telephone number.
- The volunteer corps could be utilised for detecting wildfires. They could used to patrol areas identified as high fire hazard areas on days when the fire danger rating is HIGH, particularly during the time of the day when the danger is highest (between 14h00 and 20h00).

18.6 Fire logs

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

The **responsibility** to maintain this record during large wildfires, has been delegated to the **Newlands Control Room**. However, it is important that within each management area office, a staff member is designated to keep a detailed log of events that forms part of the Fire Report Form (see Appendix 6).

Table 12: Expected veldfire behaviour, 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	Veldfires 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.	Veldfires 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.	Veldfires 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.	Veldfires 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 fynbos, 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	Veldfires easily approached and suppressed using hand tools.	Veldfires can safely be approached on foot and suppression is readily achieved by direct manual attack methods.	Direct attack constrained as veldfires 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 authorised fireplaces. Prescribed burning should be conducted with care, and any prescribed veldfires should be extinguished should the forecast fire danger-rating become high.	All efforts should be made to bring any veldfires under control. Areas should be put on standby for evacuation in the event of a veldfire, should the fire danger conditions be forecast become worse.	Dangerous areas to be evacuated in the event of a veldfire. Equipment such as water tankers should concentrate efforts on the protection of houses and other structures.
PRESCRIBED ACTIONS	None	None	Any wildfires should be extinguished.	No outdoor fires permitted.	No outdoor fires permitted.

POST-FIRE RECOVERY

"The process of returning a disturbed ecosystem or area as a result of a veldfire to its original state"

19. IMMEDIATE RECOVERY ISSUES

19.1 Checklist for actions to be taken immediately after veldfires

There are a number of procedures that need to be adhered to after a prescribed or wildfire has been extinguished. The following procedures should take place as quickly as possible after the end of a veldfire:

CHECKLIST	
☑	After a veldfire has been brought under control, patrolling and inspections should continue until the Fire Boss is satisfied that the veldfire has been extinguished. Veldfires are only really considered to be "under control" once they are extinguished.
☑	The extent of the veldfire should be mapped on a 1:10 000 orthophoto and a Fire Report Form completed.
☑	During the patrolling phase, hazardous situations where a veldfire 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 veldfire has been extinguished, all equipment should be returned to the correct storage facilities and inspected.
☑	All infrastructure within the perimeter of the veldfire should be inspected for damage and repaired 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.

19.2 Checklist for actions three months after veldfires

CHECKLIST	
☑	The secondary effects of removal of vegetation by intense veldfires 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
☑	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. For example, silt curtains could be constructed as a short-term preventative measure.
☑	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 (section 3.3) should be recalculated after significant veldfires, to assess whether or not any significant thresholds have been reached.
☑	After all major veldfires, a formal debriefing should be held involving all relevant agencies. At this debriefing, the cause of the veldfire should be identified and the discussion should focus on the cooperation of all relevant agencies in the extinguishing of the veldfire.
☑	The Park is using the ISO14001 approach as a basis for their Environmental Management System. Therefore post-fire issues need to be addressed through checking and corrective action, and through a management review. This regular review will ensure that the management plan remains relevant and appropriate to changing conditions and experience.

Wildfires are often a source of opportunity, the fire managers need to be aware of the following:

- The occurrence of a wildfire often stimulates the flowering of geophytes and represents a significant opportunity to raise awareness amongst the public of the role and importance of fire in the ecology of the Park.
- Wildfires could result in the removal of large stands of dense alien plants, but equally this could stimulate mass germination of a large number of seedlings.
- Many plant species flower only within the first year or two after a veldfire. These post-fire blooms represent rare opportunities to expand knowledge on the occurrence and distribution of such plant species.
- The occurrence of veldfires also offers the opportunity for initiating research investigations to increase the understanding of the role of veldfires in the dynamics and conservation of the Park's ecosystem.

19.3 Veldfire reporting

It is essential that during any veldfire, an accurate chronological record of the veldfire, weather and actions be maintained. This will ensure that the Park 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 veldfire.

19.4 Cost sharing and litigation if necessary

Currently, the situation with regard to cost allocation is based on unwritten agreements between fire management agencies on the Cape Peninsula. In general, the agencies are prepared to assist one another in controlling and extinguishing wildfires, and undertake to bear their own costs, but, in certain circumstances agencies may invoice each other for costs related to wildfires.

The proposed Memorandum of Agreement between the Park and the City of Cape Town provides for each party to invoice each other for costs incurred (see section 7.1.2).

After a wildfire the following should take place:

- A formal debriefing should be held involving all relevant agencies.
- The cause of the wildfire should be identified and a decision made on whether there is sufficient evidence available to assign liability and cost for the wildfire.
- If evidence is available a decision should be made by the Manager Fire and Technical Services whether to pursue legal action.
- The chronological fire log maintained during the wildfire should be used as a basis for legal action and apportioning costs to the different fire authorities.

CONTINUOUS IMPROVEMENT

20. ALIGNMENT WITH ISO 14001 REQUIREMENTS

20.1 Policy

ISO 14001 is an international standard of environmental management that requires continual improvement in performance through systematic monitoring and review of environmental management performance.

To comply with ISO14001 the South African National Parks should define the organisation's environmental policy to ensure that it:

- Is appropriate to the nature, scale and environmental impacts of its activities, products or services;
- Includes a commitment to continual improvement;
- Includes a commitment to comply with relevant environmental legislation and regulations;
- Provides the framework for setting and reviewing environmental objectives and targets;
- Is documented, implemented and maintained and communicated to all employees; and
- Is available to the public.

The success of ISO 14001 Environmental Management System Standard (Figure 11) depends on the commitment from all levels and functions, especially from top management.

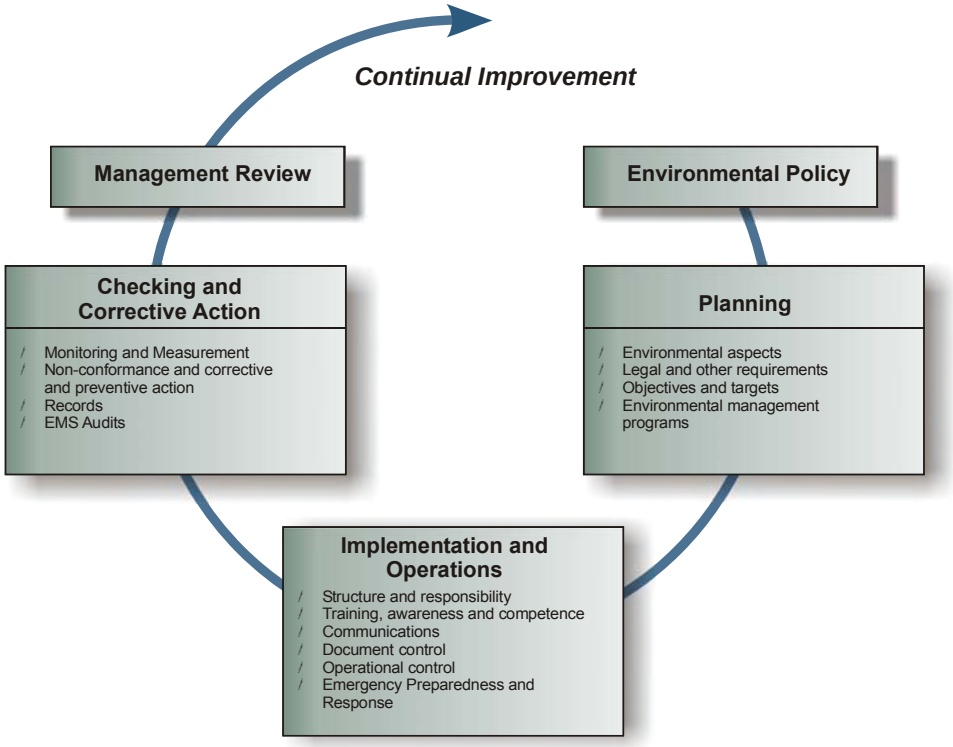


Figure11: Environmental management system model for the ISO 14001 International Standard.

A system of this kind enables an organisation to establish and assess the effectiveness of procedures to set an environmental policy and objectives, achieve conformance with them, and demonstrate conformance to others.

20.2 Plan

Environmental aspects: In order to comply with ISO14001, the Park would have to establish and maintain procedure(s) to identify the environmental aspects of its activities and services that it can control and over which it has influence.

Legal and other requirements: The Park should establish and maintain a procedure to identify and have access to legal and other requirements to which it subscribes, that are applicable to the environmental aspects of its activities, products or services.

Objectives and targets: The Park should establish and maintain documented environmental objectives and targets, at each relevant function and level within the organisation.

Environmental management programme(s): The Park should establish and maintain programme(s) for achieving its objectives and targets. It shall include:

- Designation of responsibility for achieving objectives and targets at each relevant function and level of the organisation; and
- The means and time frame by which they are to be achieved.

20.3 Implement the plan

Structure and responsibility: Roles, responsibility and authorities should be defined, documented and communicated in order to facilitate effective environmental management.

Training awareness and competence: The Park should identify training needs. It shall require that all personnel, whose work may create a significant impact upon the environment, should have received appropriate training.

It shall establish and maintain procedures to make its employees or members at each relevant function and level aware of:

- The importance of conformance with the environmental policy and procedures.
- The significant environmental impacts of their work activities.
- Their roles and responsibilities in achieving conformance with environmental policy and procedures.
- The potential consequences of departure from operating procedures.

Personnel performing the tasks that could cause significant environmental impacts should be competent on the basis of appropriate education, training and/or experience.

Communication: With regard to its environmental aspects and environmental management system, the Park should establish and maintain procedures for:

- Internal communication
- Receiving, documenting and responding to relevant communication.
- Considering processes for external communication on aspects of veldfire management.

Environmental management system documentation: The Park should establish and maintain information, in paper or electronic form, to:

- Describe the core elements of management system and their interaction.
- Provide direction to related documentation.

Document control: The Park should establish and maintain procedures for controlling all documents required by this International Standard to ensure:

- They can be located.
- They are periodically reviewed and revised if necessary.
- Current versions of relevant documents are available at all locations where relevant operations are performed.
- Obsolete documents are promptly removed.
- Suitably identify obsolete documents which are to be retained for legal and/or knowledge preservation purposes.

Emergency preparedness and response: The Park should establish and maintain procedures to identify potential for and respond to accidents and emergency situations and for preventing and mitigating the environmental impacts that may be associated with them. The Park should also review and revise, where necessary their emergency preparedness and response procedures.

20.4 Check (monitor and evaluate)

Monitoring and measurement: The Park should establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of its operations and activities that can have significant impact on the environment.

Monitoring equipment shall be calibrated and maintained and records of this process shall be retained according to company procedures.

Records: The Park should establish and maintain procedures for the identification, maintenance and disposition of environmental records. These records shall include training records and the results of audits and reviews.

Environmental records should be legible, identifiable and traceable to the activity, product or service involved. Records should be stored and maintained in such a way that they are readily retrievable and protected against damage, deterioration and loss.

Environmental management system audit: The Park should establish and maintain programme(s) and procedures for periodic environmental management system audits to be carried out in order to:

- Determine whether the system conforms
  - to planned arrangements for veldfire management, including the requirements of this International Standard; and
  - has been properly implemented and maintained.
- Provide information on the results of audits to management.

20.5 Take corrective action if required

The Park should establish and maintain procedures for defining responsibility and authority for handling and investigating non-conformance, taking action to mitigate any impacts caused and for initiating and completing corrective and preventative action.

20.6 Review the process

The Park's management should, at intervals that it determines, review the environmental management system, to ensure its continuing suitability, adequacy and effectiveness. The management review process shall ensure that necessary information is collected to allow management to carry out this evaluation. This review should be documented.

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