

# Challenges of Managing Fires along an Urban-Wildland Interface - Lessons from the Cape Peninsula, South Africa

P Combrinck<sup>1</sup>, Y Dwarika<sup>1</sup>, S Fowkes<sup>1</sup>, P Prins<sup>2</sup> and P Smith<sup>3</sup>

<sup>1</sup> Santam/Argus Ukuvuka Campaign, Cape Town, Western Cape, South Africa

<sup>2</sup> Cape Peninsula National Park, Cape Town, Western Cape, South Africa

<sup>3</sup> City of Cape Town Fire Services, Cape Town, Western Cape, South Africa.

## Abstract

The Cape Peninsula (49 134 ha), situated in the Western Cape Province, South Africa, is home to one of the highest concentrations of plant species in any temperate ecosystem. The Peninsula has a rugged mountainous topography ranging from sea level to just over 1000m above sea level. Average annual rainfall is 760mm/year, falling predominately between May and September, a typical "Mediterranean" climate.

The dominant vegetation (fynbos) is both fire-prone and fire dependent. Fynbos fuels build up between fires, reaching 20 to 40 tonnes/ha 10 years after fire. Invasions by alien trees and shrubs increase the fuel load by 50 to 100%. It is therefore essential that any fire management plan should be carefully integrated with a plan to control invasive alien plants. If the natural fire regime in an area is well understood, then management actions that mimic this regime are likely to result in the maintenance of the biodiversity of plant communities.

The Peninsula has a mosaic of urban and natural areas, leading to challenges for fire management in the interface. With the Cape Peninsula's combination of hot dry summers and persistent strong winds, wildfires are inevitable causing damage to homes, infrastructure, farmland and forests. Management of the Cape Peninsula wildlands dramatically improved in 1998 with the formation of the Cape Peninsula National Park which streamlined the previous plethora of landowners and managers. A further significant event was the promulgation of the National Veld and Forest Fire Act in 1998 as it promotes co-operative governance and decentralisation of wildfire management. However, neither of these 2 developments could protect the Cape Peninsula from its most serious fires ever.

In January 2000, fires burned 8370 ha of the Peninsula. **Fourteen** structures, including 8 houses, were destroyed and over 50 other structures badly damaged. These were the largest and most expensive fires in recent history. The total cost of these fires was more than R30 million. The crisis provided the momentum for a small group of visionary individuals to forge a short-term partnership between government and business, the Santam Cape Argus Ukuvuka Operation Firestop Campaign, which was operational by mid 2000.

This different institutional form – a short-term partnership between government and business – is offering advantages to the bodies challenged with the complexity of fire management in the Cape Peninsula. Acting as an external facilitator and catalyst, Ukuvuka has assisted these bodies to:

- fast track the new Fire Protection Association, the long-term institution to manage wildfires,
- clear much of the fuel load of fire-hazard invading alien plants, and

- undertake these actions in a way that also delivers multiple social development benefits.

Fire management on the Peninsula is a complex issue, however, initiatives such as the new national legislation, the Cape Peninsula National Park's Fire Management plan, the City of Cape Town's Natural Interface Strategy that incorporates a fire risk management zone and its associated guidelines into the City's decision-making framework, and the short term Ukuvuka partnership are all contributing to significantly improved fire management on the Cape Peninsula.

## **1.0 Introduction**

### **1.1 Cape Peninsula – Background Information**

The Cape Peninsula (49 134ha), 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 Peninsula has a rugged mountainous topography ranging from sea level to just over 1000m above sea level. The dominant vegetation (fynbos) is both fire-prone and fire dependent. Natural landscapes (30 955ha) in the Cape Peninsula have been grouped into a land category known as the Cape Peninsula Protected Natural Environment (CPPNE). Public land forms the largest proportion (80%) of the CPPNE. The 20% of land in private ownership is divided among approximately 150 landowners. The City of Cape Town (CCT) is located within this area of world-class biodiversity and unique conservation value.

The City of Cape Town has a population of more than 3 million people. Urban development has encroached into the fynbos fire zone on the slopes of the mountain ranges and hills bordering the City. Land uses found on the urban edges of the City range from high-density urban development and informal settlements to rural residential development, agriculture, institutional uses and conservation.

Average annual rainfall is 760mm/year, falling predominately between May and September. The Cape Peninsula enjoys a typical "Mediterranean" climate similar to parts of Australia, California and the south of France. With the Cape Peninsula's combination of hot dry summers and persistent strong winds, wildfires are inevitable, with the potential to cause damage to homes, infrastructure, farmland and forests.

The Peninsula has a mosaic of urban and natural areas, leading to problems of fire management in the interface between the two. In addition, the area is badly invaded by invasive alien shrubs and trees, which both threaten the remarkable biodiversity and increase biomass so fuelling fire intensity and frequency. The need for a systematic plan and appropriate institutional arrangements to deal with fire on the Peninsula is a clear priority.

Changes to the fire regime (resulting from fragmentation of the vegetation, the introduction of fire protection policies, artificial sources of ignition, and changes to the fuel loads brought about by invasive alien plants) are seen as a major threat to the conservation of biodiversity in the area. Fire is also a major logistical problem for managers, as they are expected to deal with the threats of Wildland fires to property owners on the boundaries of the recently declared Cape Peninsula National Park (CPNP) located in the heart of the CPPNE. Current fire management practice on the Cape Peninsula focuses on fire suppression, especially in the hot windy summer months

when fires are difficult to contain. However, the CPNP fire management plan makes provision for the use of prescribed burns at times when the fire danger rating is low. An active alien invasive eradication programme also serves to reduce high fuel loads on the Peninsula.

## 1.2 Vegetation of the Cape Peninsula

There are about 2 285 plant species in the Cape Peninsula including 88 species that are endemic to the area. About 30 955 ha (63%) of the original vegetation remains, with urbanisation and agriculture accounting for most of the losses. (Forsyth *et al.* 2000)

From a management perspective, the vegetation of the Cape Peninsula can be divided into four major types namely, forest and thicket, renosterveld, wetland and vlei vegetation, and fynbos.

Forest and thicket vegetation will not normally carry a fire although the margins are often scorched. Renosterveld will burn in a fire with most of the fuel provided by the dry, fine, grass and herb fuels. Fynbos vegetation is both fire-prone and fire-dependent, and is therefore very susceptible to changes in fire regime. It is also the most extensive vegetation on the Cape Peninsula.

The structure and development of the different fynbos communities has important implications for fire management because of the differing patterns of fuel accumulation, which in turn affects fire control planning.

According to van Wilgen & Scott (2001) fynbos fuels build up steadily between fires, reaching 20 to 40 tonnes/ha 10 years after fire. Table 1.1 depicts typical fuel loads in proteoid shrublands. Invasions by alien trees and shrubs increase the fuel load by 50 to 100%. According to van Wilgen & Richardson (1985), invasion of fynbos by *Hakea sericea* resulted in a 60% increase in fuel loads and invasion by *Acacia saligna* resulted in a 50% increase in fuel loads.

Fires through untreated stands of invasive alien plants result in prolific regeneration, spread and establishment of dense forests of invasive aliens, which suppress indigenous elements and alter ecosystem properties. Invasive alien plants, spread by repeated fires, are one of the most significant threats to the conservation of biodiversity on the Peninsula. Invasive alien plants also increase fire intensity, resulting in increased fire risk to houses and properties, damage to the soil, increased erosion and stress on stormwater infrastructure. It is therefore essential that any fire management plan should be carefully integrated with a plan to control invasive alien plants.

**Table 1.1: The effects of post-fire age on above-ground biomass and fuel mass in proteoid shrublands.** [Data from van Wilgen (1982)]

Post-fire age (yr)	Biomass (gm <sup>-2</sup> )
5	1000
10	2700
20	5000
30	6400

## 2.0 The Fire Problem

### 2.1 Fynbos Fire Regimes

Key components of a fire regime are the fire frequency, fire season, fire intensity and the size of the burnt patches. 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. The same logic suggests that by maintaining the diversity of the plant communities, the diversity of the faunal communities will also be maintained. The different components of the fire regime are described below.

Research over a number of years (van Wilgen *et al.* 1992) suggests that, under natural conditions, fires in fynbos in the Western Cape should occur somewhere between 8 and 20 years after the previous fire; the ideal interval between fires being between 12 and 18 years after the last fire. Table 2.1 depicts the probability of fire as a function of vegetation age.

**Table 2.1: The probability of fire on Table Mountain as a function of vegetation age.**

[Data from Richardson *et al.* (1994)]

Time since last fire (yr)	Probability of fire (%)
2	4
5	13
10	22
15	57
20	94
25	99

Studies of the natural occurrences of fires show that fires can occur at any time of the year in fynbos, but most fires happen in summer and early autumn (Table 2.2 ). Summer and early autumn have both the highest incidence of lightning, and would have the hottest and driest weather, which in turn would have supported by far the longest burns historically. As noted by Scott *et al.* (2000), there is an inevitability regarding intense fires in the Cape Peninsula because there have always been fires in the region, thus the unique fynbos vegetation has evolved in the presence of fire and conditions will occur on the Cape Peninsula where fire, in any vegetation, will burn uncontrollably. As fynbos has evolved with fire, fire is now vitally important in maintaining the ecological functioning of the fynbos system (Kruger and Bigalke 1984).

**Table 2.2: Frequency distribution of the month in which fires could burn in fynbos.**

(Data from Forsyth *et al.* 2000)

Month	Percentage of fires (%)
Jul/Aug	2
Sept/Oct	7
Nov/Dec	28
Jan/Feb	36
Mar/Apr	25
May/Jun	2

## 2.2 Cape Peninsula Fire History

In the past lightning was the main natural source of ignition in the Western Cape (van Wilgen 1981), although sparks from rolling quartzitic rocks may also cause veldfires [observations of rockfall-induced fires are extremely rare (Bond 1997)]. Human action has now become the main cause of contemporary wildfires in the Cape Peninsula.

During the past 25 years a total area of 34 851ha was burned in wildfires on the Cape Peninsula. Looking at an average of 1 394ha per year, it seems to be less than the amount of fynbos that would have burned in natural circumstances. (2063 ha on a 15 year rotation) The problem however is that many of these fires (as a result of human action) have occurred in the same area,

with a negative effect on biodiversity as well as the fact that invasive alien plants increase fuel loads and fire intensity, resulting in increased fire risk to houses and properties, damage to the soil and increased erosion. Wildfires on the Cape Peninsula are now more complex than ever before and need sound management.

The average area (705 ha/year) that was burned in wildfires on the Cape Peninsula during the past two fire seasons (Table 2.3), is 49% less than the average area (1394 ha/year) that was burned during the last 25 years, which suggest that the current fire management strategies on the Cape Peninsula maybe showing positive results.

**Table 2.3: Summary of wildfires on the Cape Peninsula (2001...2003)**  
(Data from Cape Peninsula National Park records)

	2001/2002	2002/2003
Total number of fires	57	64
Number of fires = 1ha	45	53
Number of fires between 1ha and 4ha	11	6
Number of fires = 4ha	1	5
Largest single incident area	800ha	400ha
Total area burned	831ha	578ha
Total helicopter flying hours	30	63
Total cost of fire fighting (excl. standby costs)	± R1.5 million	± R3.5 million

Swift and effective action by the fire fighting services is the likely reason why the majority of the wildfires in Table 2.3 are less than 1ha in size.

In January 2000, two major fires broke out burning 8370 ha of the Peninsula. At least 14 houses or other structures were destroyed and more than 50 other buildings badly damaged in the fire. These were the largest and most expensive fires in recent history with a total cost of more than R30 million, including insurance claims and structural damage.

### **3.0 Response to the Fire Problem**

#### **3.1 Management history**

According to van Wilgen (1996) effective management of the Cape Peninsula was bedeviled by the fact that the area was controlled by no less than 14 different public bodies, resulting in fragmentation of effort and the lack of a standardised approach to management. The now defunct Cape Peninsula Fire Protection Committee was formed and was charged with co-ordinating fire-fighting activities in the area. This committee represented the only real forum where land managers co-operated and pooled resources to a significant degree in the Peninsula. However, this committee had no brief to consider conservation matters, and has only functioned sporadically over the past few years. According to van Wilgen & Scott (2001), the need for prescribed burning of fynbos vegetation on the Peninsula was recognized by some landowners in the latter half of the 20<sup>th</sup> century, but only a subset of these had stated policies to conduct prescribed burns. The lack of a coherent, focused, and well-funded fire management plan for the entire Peninsula was identified as a serious deficiency (van Wilgen 1996).

Firebreaks have long been a feature of the Cape Peninsula landscape. The old firebreak network needed considerable modification as it was designed purely from a fire protection point of view and resulted in highly visible firebreaks with little consideration of the biological and aesthetic impacts. These were typically composite firebreaks consisted of two or three firebreaks burned on a rotational basis so that the vegetation in at least one of them was younger than three years old. Each individual firebreak consisted of two parallel hoed tracer strips (tracers) from which the intervening veld, typically 50 m wide, was burned at regular intervals. (Forsyth *et al.* 2000) These burns were the cause of many wildfires and flanking tracers were often a source of soil erosion because the firebreaks were aligned perpendicular to steep slopes, hence the decision to adopt a policy to only brushcut firebreaks.

### **3.1.1. Cape Peninsula National Park (CPNP)**

The combination of varying land ownerships, fire-prone vegetation, ecological sensitivity and human developments, create complex challenges for managing fire on the Cape Peninsula Mountain Chain. The recent creation of a National Park has brought the management of 77% of the Cape Peninsula Protected Natural Environment under a single authority. The 24000ha CPNP is situated within the boundaries of the City, with approximately 100km of its boundaries touching the City. The first portions of the CPNP were proclaimed on 29 May 1998. Negotiations are still underway to incorporate parcels of conservation-worthy land into the park. When the park is finally consolidated it will comprise an area covering some 29000 ha. Presently the area within the CPNP includes most of the Peninsula's remaining natural landscapes and incorporates the three former nature reserves on the Peninsula - Table Mountain Nature Reserve, Silvermine Nature Reserve and the Cape of Good Hope Nature Reserve.

The completion of a Fire Management Plan for the Park (Forsyth *et al.* 2000), represented a significant step towards the integrated management of the natural ecosystems of the Cape Peninsula. The production of the plan was commissioned just prior to the disastrous fires of January 2000.

Fire management of the Cape Peninsula improved with the formation of the Cape Peninsula National Park in 1998.

## **3.2 Legislation**

Fire management is being positively impacted by the legislative developments as well as the institutional changes described above. Legal measures add another tool to the toolkit of land managers. The long-awaited changes in South Africa, brought about by the arrival of democracy are encapsulated in the Constitution, which incorporates principles of co-operative governance by the de-centralisation to the local sphere whenever appropriate and possible. This is intended to place more responsibility on individual citizens whilst government plays more of a facilitation and regulatory function.

These constitutional principles have underpinned the reform of national legislation around wildfires, resulting in the National Veld and Forest Fire Act 101 of 1998. The promulgation of this Act has elevated the importance of fires countrywide and has taken the issue to a much wider target audience than only the forest industry. The purpose of the Act is to prevent and

combat veld, forest and mountain fires throughout the country. The Act provides for a variety of institutions, methods and practices for achieving the purpose.

The main principles emanating from the Act are those of decentralisation and integration, individual responsibility, co-operation and co-ordination. The positive effects are evident as individual landowners are taking more responsibility to manage their fire risk. The Act also imposes costs on landowners who refuse to comply. A very real example of this is the newly created institution, the Fire Protection Association.

The Act aims to limit and reduce the damage and losses caused by fires to life, fixed property, infrastructure improvements, moveable property, stock, crops, fauna and flora and veld. The burden to control fires is put squarely on the shoulders of the landowner, which means that regulation by government is limited to a minimum, but is still enough to encourage economic and social progress.

Fire when used as a management tool on the Peninsula, is also regulated by the Smoke Control by-law and the Nuisance Regulations of the City of Cape Town.

Streamlining the number of managers and management approaches as well as the introduction of legal requirements has made fire management more strategic, rational and coherent. However, the changes were not fast enough as the fires of January 2000 revealed.

### **3.3 The Ukuvuka Operation Firestop Campaign**

The January 2000 fires highlighted that the nature of the challenge posed in the interface between the urban and natural areas was complex and required a multi-organisational and multi-sectoral response if similar events were to be prevented in future. The events revealed clearly the inadequacies in the infrastructure and the consequences of the uncontrolled spread of invasive alien plants. A short-term public/private partnership (The Santam Cape Argus Ukuvuka Operation Firestop Campaign) was formed, acting as a facilitator and catalyst. “Ukuvuka” is a Xhosa word meaning “to wake up”, a name selected to highlight the need for both the individual and institutional citizens of the Cape Peninsula to wake up to their responsibilities to take proactive steps to lessen their vulnerability to fire.

Launched in 2000, this four year campaign’s aim is to change the conditions that have led to fires in the mountain chain (wildlands) as well as the informal settlements. The desired outcome is that the frequency and severity of fires is significantly decreased. This is done by facilitating, supporting and uniting existing efforts of authorities, landowners, volunteers and public. The Ukuvuka campaign focuses on the:

- Control of invasive alien plants;
- Rehabilitation of fire-damaged areas;
- Implementation of integrated fire management plans;
- Management of the urban edge;
- Protection of the most vulnerable communities from fire;
- Promotion of co-operation and social cohesion between communities and
- Creation of employment, training and poverty relief for disadvantaged people.

### **3.3.1 Changing behaviours and conditions**

To change the behaviours and conditions that led to the January 2000 fires, it is necessary to pursue a coherent, integrated strategy. The existence of a body with this as its major focus, located outside of the bureaucracy of large established agencies and resourced by multiple partners, gives flexibility and responsiveness. Ukuvuka is pursuing a mix of interest-based and rights-based approaches to deliver its objectives.

The “interest-based” approaches are undertaken through awareness raising and education initiatives. The Campaign has used its media partner, the Cape Argus newspaper, as well as its budget for communication and education to create awareness of responsible fire prevention and appropriate response particularly among those who live on the urban-wildland (natural) interface.

In the three years of its existence Ukuvuka has funded the circum-peninsula fire belt system with 83% of planned fire belts in place on private and public land as well as the clearing of 50% of the area identified as a fire hazard because of the proximity of dense vegetation (especially invasive alien woody plants) to urban structures. The Cape Peninsula National Park has cleared 75% of the fire hazard area that it manages. Less than 20% of the privately owned fire hazard areas have been cleared in spite of direct communication with land-owners. Clearly interest-based approaches on their own are not enough.

“Rights-based” approaches, that enforce the requirements of the law for landowners to clear their land of invasive alien plants or of fire hazards, are now being applied. South Africa does not have a plethora of case law around the courts’ enforcement of laws relating the spread of fire and removal of invasive alien plants, as the country does not currently have a particularly litigious culture. There do exist however, recent civil case precedents where landowners were awarded damages to be paid by negligent neighbours who allowed fire to spread onto the plaintiff’s property. In addition, regulations in terms of the Conservation of Agricultural Resources Act are being used to issue directives to clear invasive alien plants. The intention is to create a few highly publicised prosecutions to send the unequivocal message that landowners have to take the steps that will prevent the consequences of their lack of responsibility imposing costs on their neighbours, the local authority and society at large.

### **3.3.2 Advantages of a short-term partnership**

The two major wildland fire management institutions on the Cape Peninsula, the City of Cape Town and the Cape Peninsula National Park have multiple responsibilities other than fire and thus the creation, triggered by the crisis of the January 2000 fires, of a short term body with a mandate focussed on addressing fire issues, is assisting them to maintain the momentum to resolve fire-related problems in a sustainable manner.

The device of creating a short-term partnership, Ukuvuka, with the remit to significantly decrease the risk of damage and danger from fire, has “woken up” the responsible agencies to the possibility of using this different type of institutional form. The advantages of having such an “outside” body are that it can:

- More easily create the forums for both the inter- and intra-institutional collaboration necessary to deal with an issue as complex as improving approaches to fire management;



- Create the “safe space” in which to test out different approaches that would probably be difficult, if not even inappropriate, in a large, risk-averse public institution;
- Raise funding from diverse sources and apply them with greater flexibility and responsiveness;
- Garner the media and political support to raise wildfire awareness and enforce legal measures;
- Explicitly extract the lessons learned, manage the resulting knowledge gained and provide a role model.

### **3.4 The Cape Peninsula Fire Protection Association**

The City of Cape Town Fire Services has been driving the process of co-ordinating fire prevention and protection in the Cape Peninsula among all role players. The most obvious mechanism for achieving a coordinated response to fire management on the Cape Peninsula is through the formation of a single Fire Protection Association (FPA) under the National Veld and Forest Fire Act (101 of 1998). This Act provides for the development of an integrated fire management strategy for the Cape Peninsula, which should in turn feed into the local and provincial disaster management plans. Each FPA is empowered under the Act to set its own rules and policies, which bind its members and which would assist in the implementation of the integrated fire management strategy.

Any municipality within the fire protection area is obliged to become a member of the FPA, as is any owner of State land. Additionally, all private landowners within a fire protection area have a right to join the association, provided they abide by the constitution and rules.

The National Veld and Forest Fire Act contains a presumption of negligence clause. This states that if a person who brings a civil action, having proved loss suffered from a veldfire, which started on, or spread from land owned by the defendant, the defendant is presumed to have been negligent, until he or she proves the contrary. This presumption, however, is not applicable to landowners who are members of the FPA, creating an incentive for landowners to affiliate themselves with the association.

One of the key functions of the FPA is to develop and apply a fire management strategy for the Cape Peninsula, which in turn should feed into local and provincial Disaster Management Plans. This fire management strategy would be supported by rules and policies, to which the members agree and adhere. Based on issues arising from past experience, key elements that a fire management strategy for the Cape Peninsula would need to include are:

- Standardised incident command and control
- Centralised radio communications
- Standardised operating procedures
- Pooled resources with compatible state of the art equipment wherever possible
- Formal agreements on assistance and cost sharing.

The National Veld and Forest Fire Act (101 of 1998) also provides for the appointment of a Fire Protection Officer. The duties of a Fire Protection Officer include taking charge of a fire in the event of it threatening life or property, enforcing the rules of the association, monitoring and

reporting compliance with the National Veld and Forest Fire Act, training of members, and land inspection.

For many years the preparation of firebreaks was co-ordinated and often paid for by the now defunct Cape Peninsula Fire Protection Committee. More recently the Technical Committee of the new FPA co-ordinate, the fire protection activities of the authorities responsible for the Peninsula Mountain Chain.

The FPA has made extensive use of the fire management plan prepared for the Cape Peninsula National Park by the CSIR. According to Forsyth *et al.* (2000), fire management on the Cape Peninsula would need to meet two broad objectives:

- To ensure the conservation and continued survival of viable populations of all of the indigenous biota in the area; and
- To minimise the potential and actual damage done by fires.

Achieving these objectives will involve numerous activities, each of which will have its own set of goals. The activities are listed below (from Forsyth *et al.* 2000).

- Establish and maintain the necessary trained human resources to manage fires.
- Purchase and maintain the necessary equipment to manage fires.
- Design, establish, and maintain a network of firebreaks.
- Institute a programme for the control of invasive alien plants.
- Institute a programme of prescribed burning. This activity will be necessary to achieve the objective of ensuring the conservation and continued survival of viable populations of all of the indigenous biota in the area. Prescribed burning is also a necessary element in the control of invasive alien plants
- Develop and implement a co-ordinated capability to respond to and contain wildfires.
- Develop and implement communication procedures to ensure that residents and visitors on the Cape Peninsula remain informed with regard to fire-related issues. A supportive public that both understands the importance of fire in the conservation of the national park, and acts in a responsible and sympathetic manner with respect to fire, will make the difficult task of fire management a lot easier for the park managers.
- Develop and implement a system that ensures that the Park meets all of its legal obligations with respect to fire management.

Ukuvuka is actively supporting the City in the formation of the FPA. Whilst the legislation would have led to the new FPA structure in time, the focussed attention of a body such as Ukuvuka resourced and thus speeded up the process. Ukuvuka has also added additional value to the functions of an FPA as defined in the Act by linking social development opportunities for disadvantaged communities to the FPA tasks e.g. clearing firebreaks and clearing invasive alien plants. There is also an innovative project that has trained 22 members of disadvantaged communities in the mountaineering and alien clearing skills needed to remove from the mountain cliffs the sources of on-going seed pollution and thus of fuel for future fires. Finally Ukuvuka is creating a role model at a key time when the national legislation is, at last, promulgated so that other potential urban-based FPAs might shorten their learning curves to effective operation.

### **3.5 Volunteers**

One of the outcomes of the 2000 fires was the overwhelming desire by so many of the citizens to offer their services as volunteers. Even before these fires a Volunteer fire fighting unit had been established in 1999, in association with the National Park. Today the unit consists of 100 volunteers from all walks of life. The common denominator is their passion to make a positive difference to the natural assets of the CPNP.

Volunteer “hack” groups have also played an important role in the control of invasive alien plants. There are groups all over the Peninsula who meet on a regular basis to quietly and steadily transform large tracts of previously infested land back to their original pre-invaded state.

The CPNP managers are all too aware that the size of the invasive alien plant problem is such that it is highly unlikely that sufficient funding to clear it all can be raised from the public or private sector, locally, nationally or even internationally. The most likely way of bridging the deficit is through the “sweat equity” of volunteers.

The volunteer fire fighters are also making a significant contribution to minimizing the costs of fighting fires as they have taken over the 24-hour standby function that previously had to be paid out of the CPNP budget.

The Ukuvuka Campaign has contributed funds to fire fighting and alien clearing volunteers on the Peninsula in recognition of the important role that they currently play (and will continue to play) in the long-term effectiveness and sustainability of conservation efforts in the Peninsula.

### **3.6 Natural Interface Study**

Many of the problems of the fire management have been exacerbated by inappropriate planning in the past. Consequently, the City of Cape Town Directorate of Environmental Management, with the assistance of the Spatial Planning Branch is co-ordinating a natural interface study, which was initiated under the banner of the Ukuvuka campaign to develop policies and controls with regard to fire risk and stormwater management in developments along the urban/natural interface. The goal of the study is to ensure the long-term sustainability of developments on the slopes of the mountain chain by taking the fire risks associated with the location into account. The natural interface study focuses on the development of guidelines and criteria for new and existing developments in a special fire risk management zone that was identified using planning, environmental, engineering and disaster management criteria. The fire risk management zone and associated guidelines will be incorporated into the decision-making framework of Cape Town City. The guidelines and policies from the natural interface study will also be applicable in other areas where similar fire risk situations exist. In the near future the City will have guidelines that will set the City firmly on its way to reduce fire risks and increase sustainability in developments on the Peninsula mountain chain.

### **4.0 Conclusions**

Fire management in the Cape Peninsula is a complex issue, however, initiatives such as the new national legislation, the Cape Peninsula National Park’s Fire Management plan, the City of Cape Town’s Natural Interface Strategy that incorporates a fire risk management zone and its associated guidelines into the City’s decision-making framework, and the short term Ukuvuka partnership, are all contributing to significantly improved fire management on the Cape Peninsula.

Such initiatives bring a more coherent, integrated and strategic approach to fire management. The success of the changed approaches can only be fully evaluated in years to come. However, there are encouraging indications that the multi-sectoral, multi-institutional approach under the new legislation, catalysed by a short-term partnership, is minimising the costs to individuals, authorities and society of wildland fire in the Cape Peninsula.

### ***LIST OF TABLES***

- Table 1.1: The effects of post-fire age on above-ground biomass and fuel mass in proteoid shrublands.
- Table 2.1: The probability of fire on Table Mountain as a function of vegetation age.
- Table 2.2: Frequency distribution of the month in which fires could burn in fynbos.
- Table 2.3: Summary of wildfires on the Cape Peninsula (2001...2003)

### ***REFERENCES***

- Bond, WJ, Le Roux, D, Erntzen, R 1990. Fire intensity and regeneration of myrmecochorous Proteaceae. *South African Journal of Botany*, 56: 326-331
- Bond, WJ 1997. Fire. In: *Vegetation of Southern Africa*. Cowling, RM., Richardson, DM and Pierce, SM. (Eds). Cambridge University Press, United Kingdom, pp. 421-446
- Forsyth, GG., Van Wilgen, BW, Ruddock, G, Nel, JL, Le Maitre, DC, Smith, N, Cullinan, C and Chapman, RA 2000. A fire management plan for the Cape Peninsula National Park. CSIR Report ENV-S-C 2000-111. South Africa.
- Kruger, FJ and Bigalke, RC 1984. Fire in Fynbos. In: Booyesen PdeV, Tainton, N.M. (Eds) *Ecological effects of fire in South African ecosystems*. Ecological Studies 48. Springer, Berlin Heidelberg New York, pp 219-244.
- Richardson, DM, Van Wilgen, BW, Le Maitre, DC, Higgins, KB, and Forsyth, GG 1994. A computer-based system for fire management in the mountains of the Cape Province, South Africa. *Int. J. Wildland Fire* 4(1): 17-32
- Scott, DF, Prinsloo, FW and Le Maitre, DC 2000. The role of invasive vegetation in the Cape Peninsula Fires. Prepared for the Working for Water Programme, Department of Water Affairs and Forestry. South Africa

- Van Wilgen, BW 1981. Some effects of fire frequency on plant community composition and structure at Jonkershoek, Stellenbosch. *South African Forestry Journal*, 118: 42-55.
- Van Wilgen, BW 1982. Some effects of post-fire age on the above-ground plant biomass of fynbos (macchia) vegetation in South Africa. *Journal of Ecology*, 70: 217-225.
- Van Wilgen, BW and Richardson, DM 1985. The effect of alien shrub invasion on vegetation structure and fire behaviour in South African fynbos shrublands: A simulation study. *J. of Applied Ecology* 22: 955-966
- Van Wilgen, BW, Bond, WJ and Richardson, DM 1992. Ecosystem management. *The Ecology of Fynbos: Nutrients, Fire and Diversity* (ed. R.M. Cowling), pp. 345-371. Oxford University Press, Cape Town.
- Van Wilgen, BW 1996. Management of the natural ecosystems of the Cape Peninsula: current status and future prospects. *Biodiversity and Conservation* 5: 671-684
- Van Wilgen, BW and Scott, DF 2001. Managing fires on the Cape Peninsula, South Africa: dealing with the inevitable. *J. of Mediterranean Ecology* 2: 197-208