Challenges for Fire Management in the Changing Socio-Environment of the Western Cape – South Africa

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Abstract: The Western Cape Mediterranean Region of South Africa is home to the fynbos Floral Kingdom. Fires are a regular and frequent disturbance in this vegetation type, particularly in the severely folded mountain ranges which intersect the Region.
The socio-economic scene in South Africa is consistently changing as the economic climate varies with global trends. Government conservation and forestry agencies, which have traditionally been responsible for fire management activities, now find that funding has been appreciably reduced as funds are assigned to essential social and welfare needs. At the same time, since the Western Cape is one of the richest of the nine provinces in South Africa, the local population in rural and metropolitan areas has grown. The frequency of uncontrolled wild fire has increased concurrently over the past two years. Whilst some of this increase may be attributed to environmental influences such as climatic change, there is an indication that many fires may be attributed to an increase in arson. An accelerated fire regime on the fynbos biome can impact significantly on the biodiversity of this exceptional vegetation type.
The Western Cape Nature Conservation Board is the principal agency responsible for the conservation and management of the Floral Kingdom, the only such agency in the world responsible for an entire floral kingdom. Innovative strategies have had to be planned to manage both the environmental and social challenges it faces in trying to meet its long term fire ecological goals. These strategies cover a spectrum of disciplines, and include the establishment and development of independent fire management contractors, education and training programmes, aerial fire-fighting options, as well as the deployment of volunteers.
These approaches are discussed, detailing in particular the findings following the 2002/2003 fire season.

Introduction:
The following paper will look at the Western Cape in South Africa in terms of its biophysical and social characteristics, in an attempt to characterise the challenges and opportunities faced by agencies responsible for fire management in the area.

Land of Contrasts:
The Province of the Western Cape, covers only 10,6% of the Republic of South Africa and as such is one of the smallest of the nine provinces in the country (Anon 1996). It lies in the south western corner of the African continent (Figure 1), with a coastline in excess of 1200 km. (Anon 1994).

The Western Cape is a land of contrasts and diverse landscapes, ranging from unique desert scenery in the north and north east through to spectacular folded mountain ranges in the south and southwestern regions. Several large rivers flow throughout the province to the coast where a variety of geographical features adds to the aesthetic quality of its scenery.

The Climate:
The Western Cape climate is typically Mediterranean, with cold wet winters and hot dry summers. Temperature variations between summer and winter are severe.

Rainfall extremes are also experienced over geographical regions. The winter rainfall region forms an integral climatic unit, which presents various implications for those managing the natural environment. On the west coast, the rainfall ranges from very low near desert conditions, to medium to high rainfall in the southwestern and southern Cape. Rainfall in the mountainous regions of the south western Cape is of the highest in the country and accounts for 76% of water yield for the province. Although snow sometimes occurs at high altitudes, the province has the mildest climate in the country, which is of considerable importance with respect to its potential as a tourist destination (Anon 1994).

Lightning strikes occur regularly on mountaintops during summer thunderstorms. Flash densities though may be lower than in other parts of the country (Edwards 1984).

Desiccating strong southeasterly winds can blow for several successive days during the summer months, particularly in the southwestern region of the province. Conversely hot Fohnlike "bergwinds" precede cyclonic weather systems, during winter in the southeastern parts of the province. These winds are both associated with extremely high temperatures, and low relative humidity readings of between 5 and 20% (Kruger and Bigalke 1984).

The vegetation:
Two major ecological regions are represented in the Western Cape, providing a unique character to the province.

The semi-arid **Karoo biome**, which includes the Namaqualand and the Nama-Karoo, is of specific interest because of its succulent plants of which over 500 are endangered (Anon 1994).

Of particular significance is the **fynbos biome**, also known as the Cape Floristic Kingdom (CFK). One of the worlds' six floral kingdoms, it is found almost exclusively within the boundaries of the province (Anon 2002 (a)). While it is the smallest of the Floral Kingdoms (90 000 km^2), it is also the most species rich with 9 600 species on record, more than 70% of which are found nowhere else on Earth (Anon 2000 (a)).

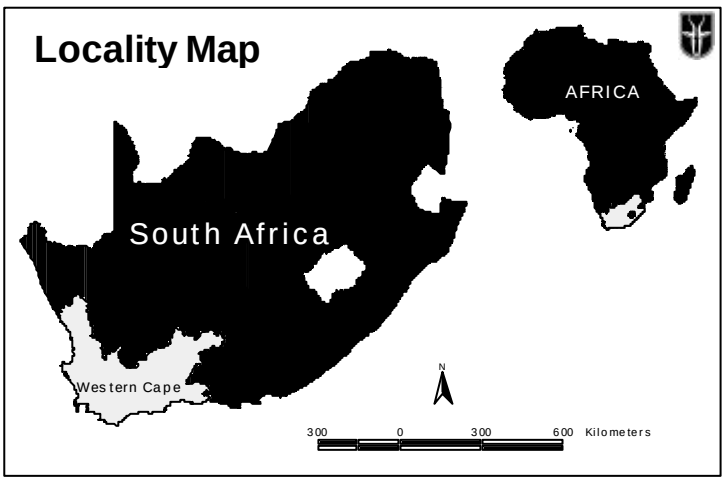

Figure 1 The Western Cape lies on the south western tip of the African continent.

Fynbos - which means fine leaved, consists of evergreen sclerophyllous shrubs. The presence of three families generally identify the vegetation type, namely – low shrub Ericaceae, leafless reed like Restionaceae and waxy broadleaved Proteaceae.

Fire is a natural phenomenon given the climatic and topographical features that prevail in the Western Cape. Fynbos has evolved complex avoidance and tolerance mechanisms to survive fire. Indeed, fynbos is both fire prone and fire dependant (van Wilgen et al. 2001). Without regular burning, fynbos can become senescent – and conversely with fire that is too frequent, species that have not adapted to recurrent fires can become extinct. Survival mechanisms are invariably adapted to the inherent fire regimes that may prevail in any particular fynbos type. There is consensus amongst botanists that fynbos is adapted to fire intervals ranging from between 10 to 30 years (van Wilgen 1987), dependant on localized factors such as climate and topography.

Ecological threats to Fynbos:
The fynbos biome is subject to numerous diverse threats. Factors that have affected, or led to a change in the natural fire regime, are briefly described here.

- Invasive trees and shrubs are thought to have exerted the greatest ecological effects on the fynbos biome. Such effects include the alteration of sediment patterns, river bank erosion, reduction in streamflow, alteration of natural plant and animal communities (Richardson et al. 1992), and most extensively changes to fire regime. Fuel loads are much greater in dense stands of invader plant species, than in fynbos communities. Fires burning in infested areas are invariably larger and far more difficult to control. Such fires are often intense, and excessive heat can lead to the destruction of shallow ground seed stores (Holmes et al. 2000). Several invader plant species, such as *Hakea sericea*, *Acacia cyclops* and *A. Saligna* also evolved in fire prone regions. Massive seed stores held in alien trees invariably spread and germinate following a fire vastly increasing the scale of invasion (van Wilgen et al. 2001).

- It has now generally been accepted by scientists that global climatic change as a result of an increase in carbon dioxide and other greenhouse gasses, will have an effect on all of the earth's ecosystems. Scientists of the National Botanical Institute of South Africa predict that the Western Cape will lose as much as 25% of its winter rainfall (Midgley et al. 1999). Seasonal rainfall patterns will change increasingly, and marked modification of the biotic component is expected. Most significantly, the frequency of fire increases as temperatures rise and fire seasons become longer (Anon (b)).

- Agricultural and urban development and forestry practices have resulted in the fragmentation of fynbos into small remnants particularly in the lowland areas. Conservationists know that survival of species is linked to the relative size or area of the threatened habitat (Bond et al. 1988). The smaller the area to be managed the larger the likelihood that important plant species will be lost. The boundaries of the areas to be managed are also proportionally increased, which simultaneously raises the risk and incidence of externally ignited fires.

Who are the Managers?
Since fire is a natural phenomenon, it can be assumed that all landowners are responsible for managing fire. Legislation in the form of the National Veld and Forest Fire Act (101) of 1998 (NVFFA), clearly spells out the accountability and responsibilities of landowners in this respect.

In terms of the Constitution of South Africa, nature conservation is a concurrent responsibility of all spheres of government. Since the management of the fynbos biome is predominantly a conservation activity, this responsibility in the Western Cape has fallen primarily to the Western Cape Nature Conservation Board (WCNCB) a Parastatal formed on the 1st April 2000 to manage all nature conservation concerns in the province.

Other Conservation Agencies and landowners are however actively involved in fire management and related conservation activities. Table 1 reflects the current conservation management status in the Western Cape.

Conservation Areas in the Western Cape and the Responsible Management Authorities

Nature Reserve Type	Number of Units	Management Authority	Area Protected (Ha)
Wilderness Areas	4	WCNCB	116 924
Provincial Nature Reserves	79	WCNCB	576 757
Contractual Provincial Nature Reserve	1	WCNCB	933
Island Reserves	12	WCNCB	295
Marine Protected Areas	6	WCNCB	41 930
Local Authority Nature Reserves	38	Municipalities in association with WCNCB	25 582
Mountain Catchment Areas	15	Private landowners in association with WCNCB	619 038
Private Nature Reserves	148	Private landowners in association with WCNCB	122 399
South African Natural Heritage Sites	36	Private landowners in association with WCNCB	33 198
Conservancies	43	Private landowners in association with WCNCB	563 121
National Parks	7	South African National Parks	90 283
		Total Area in Ha Protected	**2 190 460**

Table 1 Conservation Areas in the Western Cape showing respective Management Authorities. (Based on figures in le Roux et al 2002).

The WCNCB is directly responsible for managing 736,839 Ha, and indirectly for an additional 1,661,338 Ha. According to le Roux et al (2002), 10.7% of the Western Cape's surface area falls under statutory conservation areas, while an additional 7.7% falls under privately owned conservation land.

Social and economic background:

The Western Cape has a thriving viticultural sector, and has seen a recent growth in deciduous fruit exports. The spectacular natural environment and recent changes in global tourism trends, has also resulted in an escalation in the Tourism Industry. These factors have contributed to the fact that the Western Cape economy accounts for 14.3% of the national Gross Domestic Product (GDP). Economic growth rates have generally exceeded national growth rates since 1980 (Anon (a) 2001).

This prosperity has encouraged immigration from poorer neighbouring provinces as people seek employment. The total population for the province is 4,5 million, which is roughly 10% of the South African population. The population of Cape Town is 3,1 million (Anon (b) 2001), leaving a balance of 1.4 million people in the rural, and small town areas.

Unemployment rates are high at 18%, perhaps as a result of the influx of job seekers. Literacy and life expectancy figures however, are higher in the Western Cape than in any other province.

Changes in the Structures of the Conservation Management Authorities.
Funding by government for nature conservation agencies has historically always been inadequate. In 1993 for instance, the total allocation for nature conservation was less than 0.5% of the total Provincial Government budget (Anon 1994).

When South Africa finally achieved democracy in 1994, Government had to focus spending on portfolios that had been neglected by the previous Government. Most provincial government spending has thus over the past 10 years been spent on uplifting social services such as health, welfare, and education in an attempt to address the wrongs of the past.

Funding for nature conservation remained static while inflation persisted at levels of 15%. Ultimately the budget for the Western Cape Provincial Government conservation authority decreased to the extent that nearly 85% of funds allocated to nature conservation were devoted to salaries, leaving 15% for capital and operational expenses.

The solution to this problem was to form a statutory board. This is an organisation which is still funded by the Provincial Government to carry out its statutory conservation function, but which is legislated to raise its own funds, thereby allowing it to increase revenue to drive core function objectives.

Two years after the formation of the WCNCB, the organisation was restructured to restrict expenditure while increasing efficiency. The majority of the labour force was retrenched, and management levels were collapsed. Today the WCNCB consists of a staff component of less than 500, by far the smallest provincial conservation organisation in the country. Despite this, the WCNCB is considered by many to be one of the leading conservation authorities in the country.

Conflicts and challenges
The core business of the WCNCB is biodiversity conservation (Anon 2002 (b)). The primary objective of every strategic and management plan written for reserves in the WCNCB, is to enhance and maintain biodiversity management. To achieve this goal, conservation managers try to establish a mosaic of differently aged fynbos vegetation. It is an unfortunate reality however, that this is a conservation principle that has proven difficult to realize. Late in 2002 a survey was conducted in the major conservation areas of the province (Table 2). It was found that more than 57% of the veld was younger than 6 years of age. The figure in the Boland Mountains, considered by botanists to be the "epicentre" of the fynbos biome due to exceptionally high levels of endemism and diversity (Oliver et al. 1983), was recorded at 76%. Fynbos can, under extremely hot and dry conditions, burn when it is only 4 years old. Frequent fires at this age leads to the local extinction of slow maturing and reseeding fynbos plant species. In the Boland Mountains for instance, 23 species of Proteaceae alone, are currently threatened with extinction should an uncontrolled fire burn in the area (Johns pers.

comm. 2003). One species, *Erica sacciflora*, is already thought to have become extinct as a result of too frequent wildfires.

Extremely large uncontrolled fires raged over the province during the 1999/2000 fire season. A number of causes for the fires were identified in the review commissioned by the Minister of Water Affairs and Forestry. These included global change, the el nino' effect and the spread of woody invader plant species (Anon 2000 (b)). The most significant basis for the lack of control in the majority of WCNCB fire reports however, was sited as the shortage of suitably qualified and trained staff. What had happened in effect was that the endless series of budget cuts over earlier years, had restricted training programmes. Many experienced Managers had also accepted early retirement packages following a national drive by the government to reduce the number of state employees.

The already tenuous situation was further exacerbated at the start of the 2002/2003 fire season when 90% of the permanent workers that had traditionally made up the bulk of the WCNCB fire-fighting force, were retrenched in line with the comprehensive restructuring process mentioned earlier. Conservation managers now found themselves facing a critical fire season, without any permanent staff. A new concept of employing fire-fighters on a contractual basis had to be introduced. This in itself was a learning process, particularly as far as fire fighting was concerned. In many cases local workers did not have the necessary expertise or experience. Managers were faced with the dilemma of paying contract workers on an hourly or daily tariff to put out fires. Would workers desperate for funds resort to lighting fires for payment ?

Many other conflicts exist such as the fact that landowners manage fire to achieve different objectives. For instance, foresters will want to maintain low fuel loads in areas alongside plantations, while neighbouring conservationists will try to adhere to natural burning regimes which require longer burning intervals. In 2000 nature conservators accused foresters of lighting back burns to protect pine plantations. These back burns then subsequently created uncontrollable conflagrations that burnt out large areas of the Boland Mountains.

Most of the small towns of the Western Cape have seen rapid population growth over the past few years. Many migrant workers seeking employment have settled in small towns. No infrastructure had ever been provided for the increased populations, and informal settlements have sprung up on the outskirts of the urban areas. These urban areas all border the natural protected areas, in most cases managed by the WCNCB. Villiersdorp is a typical example of such a town, where in 1993 100 families lived on the eastern section of the town. By 2003 this small community had increased to 700 families (pers. comm. Cronje 2003). Four fires have started on the outskirts of the Villiersdorp settlement in the past year (pers. comm. Shone). The situation is even more clearly illustrated in the Cape Peninsula where more than 18 fire callouts in one year were received for the area surrounding the Red Hill Informal Settlement (pers. comm. Prins 2003). Frequent wild fires originating from these sources impact negatively on the natural burning regime. Mountain fynbos for instance, should in these areas burn at a cycle of between 10 to 30 years. Every protected area has a series of small bordering towns each with their own emergent populations. This factor alone has raised the occurrence of fire quite significantly. The causes of the fire are in most cases

impossible to determine. It should be borne in mind however, that families are dependant on candles, and paraffin for lighting and cooking. Many of the residents also originate from

Major Conservation Areas and Corresponding Fynbos Age.

Protected or Conservation Area	%
Cederberg	**70**
Riviersonderend	**60**
Langeberg	**40**
De Hoop	**27**
Waterval	**72**
Boland Mountains	**76**
Outeniqua	**57**

Table 2 Percentages reflect area of fynbos which are younger than 6 years of age.

grassland habitats that are traditionally burnt on a more frequent cycle.

Previous governments in South Africa pursued discriminatory policies which denied large groups of the population access to educational facilities. The result today is that management and scientific posts are filled mostly by professionals from the white populace. The government has introduced legislation to achieve equity in the workplace and this has been met with some success in certain quarters. However, a report in the Cape Times by Smith (2003) indicated that while whites made up only 20% of the total population in the Western Cape, unemployment levels amongst whites was only 10%. Blacks on the other hand, who made up the balance of the population, showed unemployment figures as high as 60%. This he attributed to the whites having higher skill levels as a result of apartheid policies of the past. That this situation is prevalent in Fire Management circles was evident at a meeting held on the 24th April 2003 at the Central Fire Station in Cape Town where all 20 of the various role players present were white males (pers. obs.).

Top Management of all structures and role players involved in Fire Management need to take cognisance of this fact. Most communities to be found in the urban fringes are black communities that are expected to change habits and adhere to Fire legislation. This legislation is invariably enforced by white fire officers. An equity plan that will see more black officers filling higher management posts in all spheres of Fire Management needs to be established.

The way forward.

Weather conditions during the 2002/2003 fire season have not been extreme and fire statistics reflect a reasonably low number of fires compared to previous years. Managers were able to deploy contract teams with reasonable efficacy although there is concern that

should conditions such as those experienced during the 1999/2000 year persist, then contract numbers would be far deficient of what one would require to manage fires safely and effectively. Some WCNCB conservation managers were able to set up medium term contracts, which proved to be the most cost effective. This is a system whereby teams are contracted for a period of 5 or 6 months and paid a monthly retainer, irrespective of the number of fires that they are deployed to extinguish. Efforts will be made in future to develop contracts on this basis that would be to the benefit of both parties.

An initiative to integrate fire management on a national basis was launched during 2002. This programme, called Working on Fire, is funded by the Department of Water Affairs and Forestry (DWAF). It has a number of objectives, most important of which is the creation of work and the upliftment of poor communities living in fire prone regions. Very little progress has been made to date with the programme in the Western Cape, as the DWAF need to negotiate the appointment of an implementing agent.

The Ukuvuka Firestop Campaign is a partnership jointly sponsored by private enterprise, the media, and the government. Broad aims of the Campaign are to control alien plant invaders, rehabilitate fire-damaged areas, as well as to create employment opportunities for disadvantaged communities. This four year programme has conducted prominent and effective communications and education programmes. Unfortunately all operations have been confined to the Cape Peninsula and Cape Town Metropolitan areas. There has been some suggestion that the campaign could be rolled out in to other areas. It is certainly hoped, by the author at least, that the lessons learned about effective biodiversity conservation in the Cape Peninsula could be linked to social delivery and passed on elsewhere in the province of the Cape, where similar campaigns could be efficiently run.

Regulations for Section 2 of the NVFFA were promulgated in May 2003. This Section of the legislation deals with the establishment and management of Fire Protection Associations (FPA's). The regulations effectively sanction landowners to form FPA's, and to jointly take ownership of Fire Management on their properties. They elect their own Fire Protection Officer who in terms of the act has certain legislative powers as well. The WCNCB conservation managers are actively pursuing the formation of FPA's within their areas of jurisdiction since it will lead to the resolution of many of their fire management dilemmas. A strategy to establish FPA's in conjunction with local municipalities is currently underway.

The NVFFA also deals with the introduction of a National Fire Danger Rating System. Trials are currently underway to test the distribution of daily forecasts to conservation managers. The system will be in place at the start of the 2003/2004 fire season.

Late in May 2003, conservation managers in the WCNCB learnt that the National Lotteries Development Trust Fund had awarded R1,000,000 to the WCNCB for the training and provisioning of 180 fire-fighters. Training is due to start in September and fire-fighters should be able to fulfil contractual obligations during the forthcoming 2003/2004 fire season.

All these developments should assist conservation managers in meeting the challenges of the future. The WCNCB has in its new structure established a matrix of specialists in various fields of conservation management. A portfolio for a Fire Management Programme has been established, and a Programme Manager is currently implementing a Strategic Plan with the following core objectives and activities.

Knowledge: Training, policy setting, fire reporting and history, legislation, research, fire danger rating indexes.
Partnerships: FPA's, volunteers, stewardships and incentive programmes.
Preparation and Suppression: Fire Management plans, and quality controls.

The fire management challenges facing conservation managers in the Western Cape are numerous and diverse, ranging from ecological threats to highly complex social issues. Decision makers need to ensure that the social needs of the communities in the province are met without compromising the biodiversity of natural areas. This requires changes in the way such issues have been addressed in the past and ongoing reassessment of situations and methods to ensure that the challenges of the changing conditions are continuously incorporated into management strategies. Fortunately managers are acutely aware of the conflicts they face and are constantly adapting to meet these challenges.

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