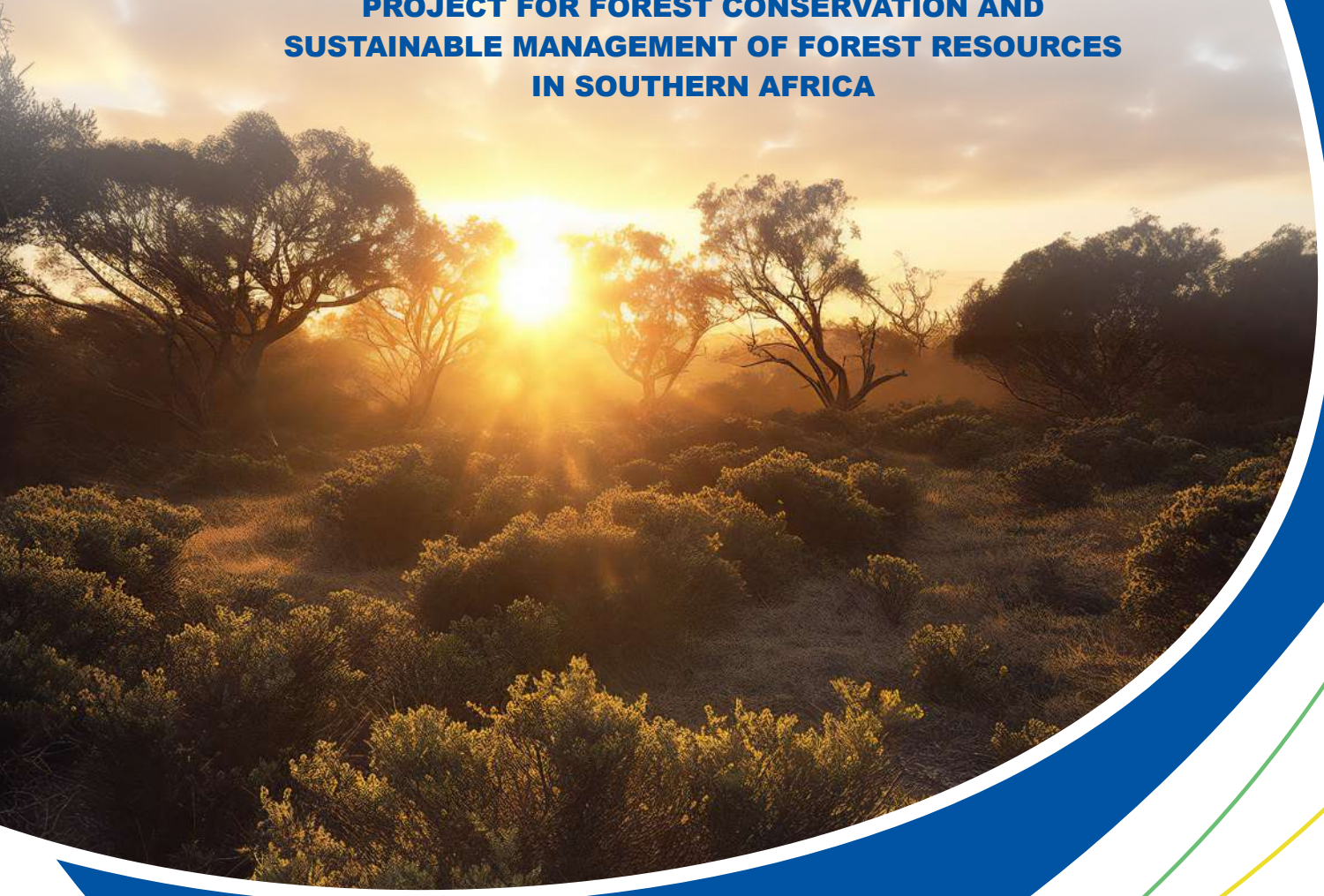
SADC REGIONAL GUIDELINE FOR FOREST FIRE MANAGEMENT (FFM)

PROJECT FOR FOREST CONSERVATION AND SUSTAINABLE MANAGEMENT OF FOREST RESOURCES IN SOUTHERN AFRICA



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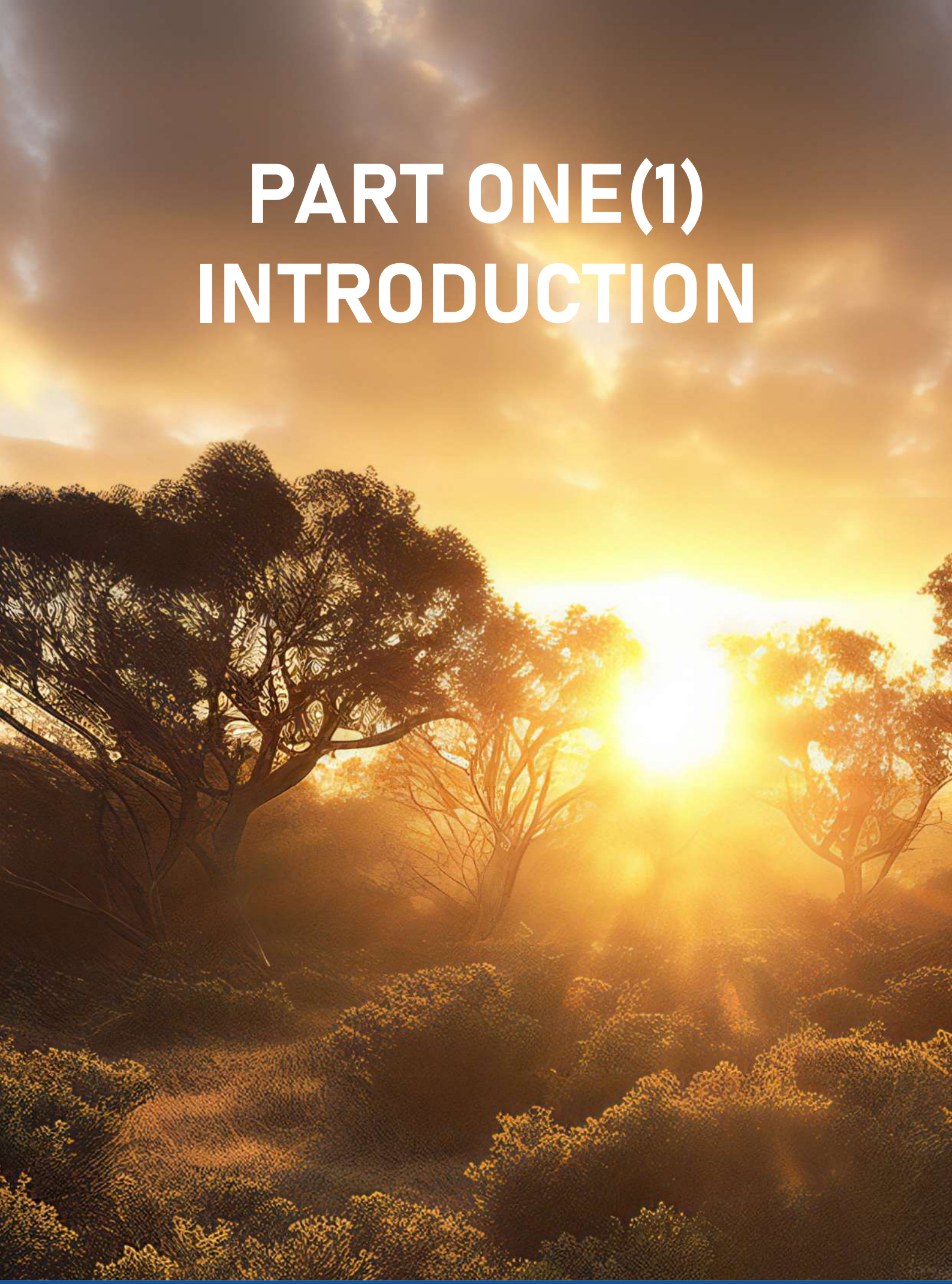
ABBREVIATIONS

AFIS	Advance fire information system
CSIR	Council for Scientific and Industrial Research
DRC	Democratic Republic of the Congo
ESKOM	Electricity Supply Commission in South Africa
FAO	Food and Agriculture Organisation
FDI	Fire danger index
FFM	Forest fire management
FM	Fire management
FPA	Fire protection association
Ha	Hectare
ICS	Incident Command System
IFM	Integrated fire management
JAFTA	Japan Forest Technology Association
JICA	Japan International Cooperation Agency
LEFPA	Lowveld Escarpment FPA
MAI	Mean annual increment
MESA	Monitoring of the Environment for Security in Africa
MNRT	Ministry of Natural Resources and Tourism
MODIS	Moderate Resolution Imaging Spectrometer
NAFORMA	National Forest Monitoring and Assessment
RISDP	Regional Indicative Strategic Development Plan
SADC	Southern African Development Community
WOF	Working on Fire

PART ONE(1)
INTRODUCTION



PART ONE: INTRODUCTION

1. BACKGROUND

Forests and woodlands, which cover about 40% of the Southern African Development Community (SADC) total land area, support national economies and rural livelihoods. Therefore, the SADC launched the project of Conservation and Sustainable Management of Forest Resources in Southern Africa which aims to improve the capacity of members about forest information systems, forest management and wildfire management. The Government of Japan has supported this project through Japan International Cooperation Agency (JICA) and Japan Forest Technology Association (JAFTA).

Fire has shaped African landscapes for about 10 million years. The prolonged dry season has allowed fires to occur across vast grassland and woodland areas where, over time, it has profoundly changed the structure and function of ecosystems. Every year, between half and two thirds of burned area worldwide is in Africa. Unlike in tropical rainforest, regular fires form a critical component of sound rangeland and ecosystem management in these areas.

Nevertheless, these wildfires can have economic, social, and environmental consequences in the SADC. This has prompted JAFTA to commission Kishugu to develop practical FM guidelines for the region.

This report is aimed at policy makers and practitioners that focus on improving natural resource management and livelihoods in SADC.

2. OBJECTIVES

This report is intended to serve the following objectives:

- To analyse the nature of FM in SADC
- To develop common understanding of the role of fire in SADC landscapes
- To align globally accepted IFM principles to the land-uses, environment and people of SADC
- To explore guidelines that will improve IFM within SADC

3. APPROACH

This report is compiled relying on the Kishugu experience in SADC as well as literature on fire management in contemporary Africa such as Goldhammer 2004, Teie 2009, Forsyth 2010, Trollope 2015, Fynbosfire 2016 and TerrAfrica 2016.

The study commences with a brief situation analysis presented in a format that may also be useful for local assessments.

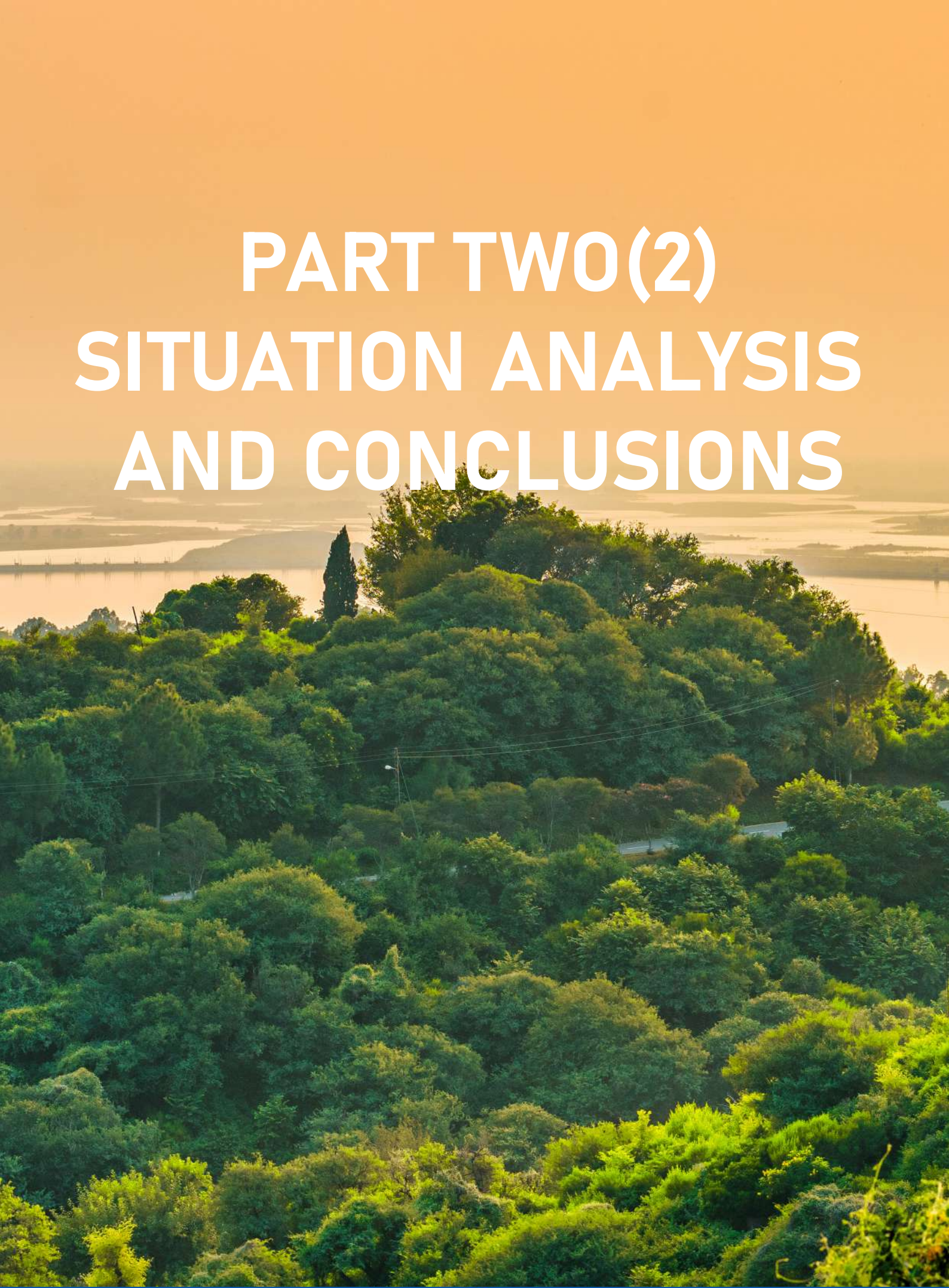
The above situation analysis, as well as FAO 2006 and TerrAfrica 2016, enabled the formulation of IFM principles to direct guidelines for SADC. In compiling these guidelines consideration has been given to the simple IFM format described by Myers (2006) which is IFM format described by Myers (2006) which is accepted worldwide by forest sectors and funding agencies, namely: fire prevention, protection and suppression.Each land-use type in SADC has its own fire management needs, ranging from low-key to highly sophisticated interventions.Therefore, it is expected from the IFM implementer to understand the role of fire in SADC region, and then use these guidelines to consider on a suite of IFM interventions appropriate for the land-use (risk and scale) and available resources. In general, it is easier, more effective and cheaper to implement fire prevention. Then follows protection and lastly suppression. Implementers of IFM need to keep in mind that most fires are started by people, and most fires are also successfully suppressed by people. Wildfires do not respect borders. Therefore, the relevant SADC protocols , as well as the priority intervention areas identified by the Regional Indicative Strategic Development Plan (RISDP), have been carefully considered in the approach to this report.

FM details and case studies are presented as annexures in the report.
E.g.

- Forestry Protocol which includes the prevention and suppression of uncontrolled fires as well as transboundary assistance.

- Including poverty eradication; gender equality and development; science and technology; information and communications technology; environment and sustainable development; and sustainable food security.

PART TWO(2)
SITUATION ANALYSIS AND CONCLUSIONS



PART TWO:SITUATION ANALYSIS AND CONCLUSIONS

4. SITUATION ANALYSIS

4.1 Location

SADC comprises a whole suite of landscapes in 12 sub-Saharan countries reaching South Africa in the south to DR Congo in the north, as well as the 4 Indian Ocean island countries of Madagascar, Mauritius, Seychelles and Comoros.

Figure 1- SADC countries

The Angola/ Benguela currents to the west and Mozambique/ Agulhas currents to the east straddle the SADC region.

SADC is endowed with diverse topographical features with altitude variation from sea level to over 2000m.

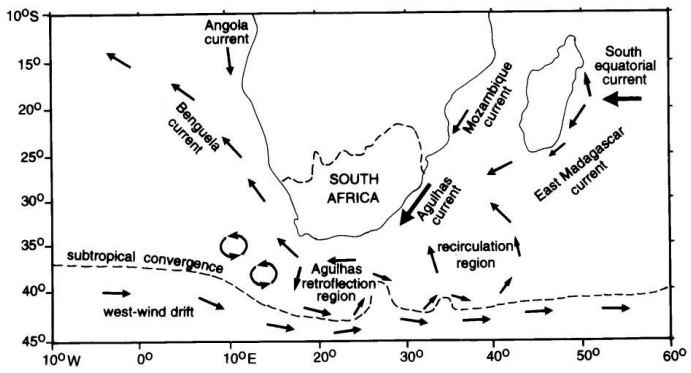


Figure 2- SADC ocean currents (www-das.uwyo.edu)

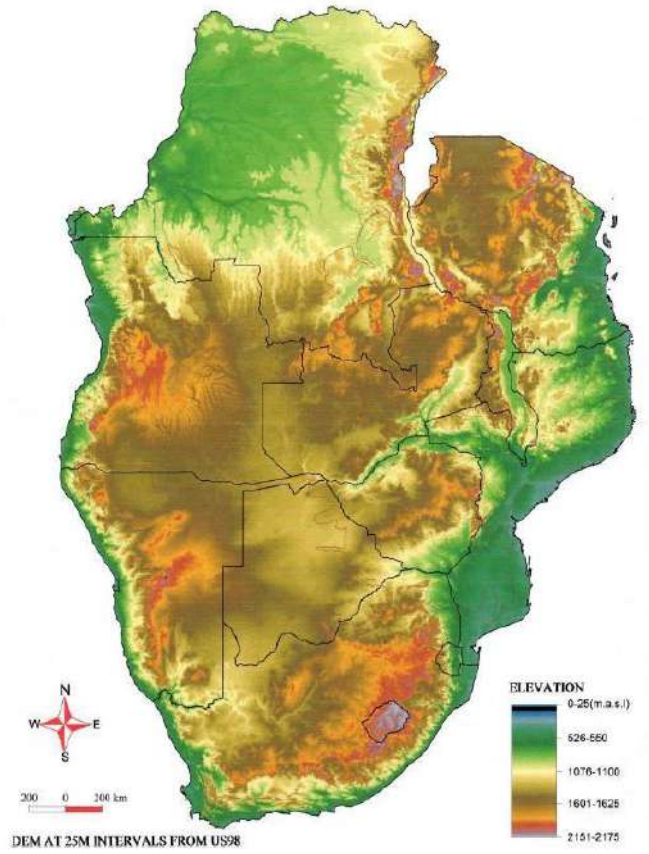


Figure 3- SADC altitude (Timberlake 2001)

4.2 Climate

SADC incorporates several distinct climate zones:

- Equatorial
- Humid Tropical
- Tropical
- Sahelian
- Desert
- Mediterranean.

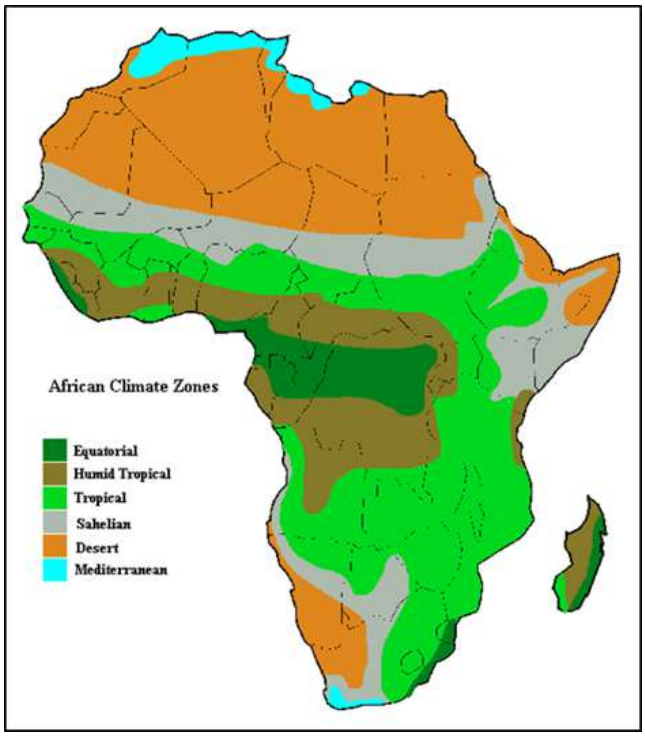


Figure 4- Africa climate zones (learn.mindset.co.za)

The tropical zone represents the largest area within SADC. It is prone to frequent droughts and uneven rainfall distribution. This zone has two distinct seasons – a wet season roughly from November to April, and a dry season roughly from May to October. Certain areas experience bimodal summer rainfall (e.g. short and long rains in northern Tanzania). Two major systems affect the climate of the tropical zone. The first is the inter-tropical convergence zone (ITCZ), which brings moisture from the north. The ITCZ moves southward early in the summer and back north in autumn and therefore almost all rain fall in summer. Wet summers occur when the ITCZ has pushed far south. Most moisture in the ITCZ feeds into equatorial Africa from the south-easterly Indian Ocean trade winds, but moist air also blows into the ITCZ from the Atlantic Ocean from across the Congo Basin towards the SHR. A second system counteracts the flow of moisture from the ITCZ. This is the zone of high-pressure anticyclone cells that lie to the south. This zone also moves north and south, bringing cool and dry air to southern Africa. Interactions between the anti-cyclonic cells and the ITCZ amount to something of a contest, the high-pressure cells feeding in dry air, which pushes away the warm and moist ITCZ air. The high-pressure zone shifts north in winter where the anticlockwise movement of its northern tip results in easterly winds, which are cold and dry, from the lifting action caused by the African plateau. The effects of the above systems are accentuated by the cyclic nature of the seawater temperature referred to as El Nino or La Nina. During an El Nino cycle the higher temperature results in weaker trade winds and lower rainfall in Southern Africa. During a La Nina cycle the effect is the opposite.

The east coast is influenced by the southward-flowing Mozambique current, which brings warm water and humid air from the Equator and creates a humid, warm climate. In contrast the west coast is influenced by the cold Benguela current from the Atlantic Ocean, which produces a drier climate.

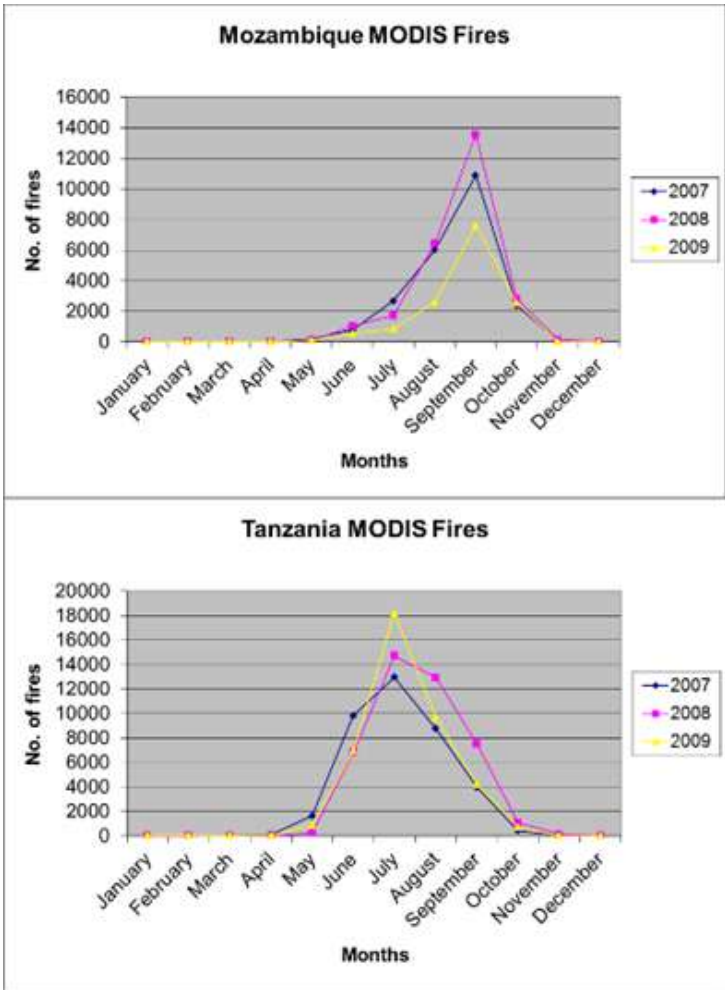
The Equatorial and Humid Tropical zones (mainly DRC Congo and the islands) receive rainfall throughout the year.

Maritime conditions influence the climate of the Mediterranean zone (southern and Western Cape regions of South Africa). Summers are dry and cold fronts cause rainfall during the winter.

Average annual rainfall in SADC varies between less than 100mm and 3000mm in a pattern that mirrors the climate zones (image above).

Local fire weather is determined by climate zones and influenced by topography, vegetation cover, rainfall and prevailing winds (e.g. during dry season in South Africa from the west, and from the east on the African plateau). The effect of the climate on fire weather can be illustrated by an analysis of the Moderate Resolution Imaging Spectrometer (MODIS) fire point data. For Mozambique, 2007 to 2009 resulted in a higher for occurrence of MODIS fire points in the months of August through to October with the maximum number occurring in September (the higher number of points in these months is an indication of an increase in the fire activity).

In Tanzania the peak seems to be one month earlier. These analyses are handy tools to determine local fire prohibition periods as addressed in the guideline section of this report.



4.3 Vegetation

The terrestrial biomes of SADC mirror the climate zones (image above) and include:

- tropical rainforest
- moist savanna
- dry savanna
- temperate grassland
- montane
- semi-desert
- desert
- Mediterranean (fynbos).

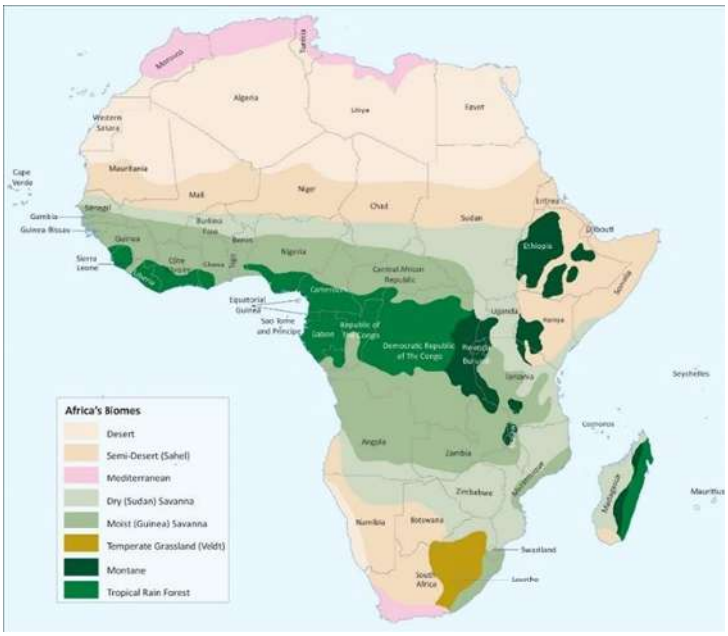
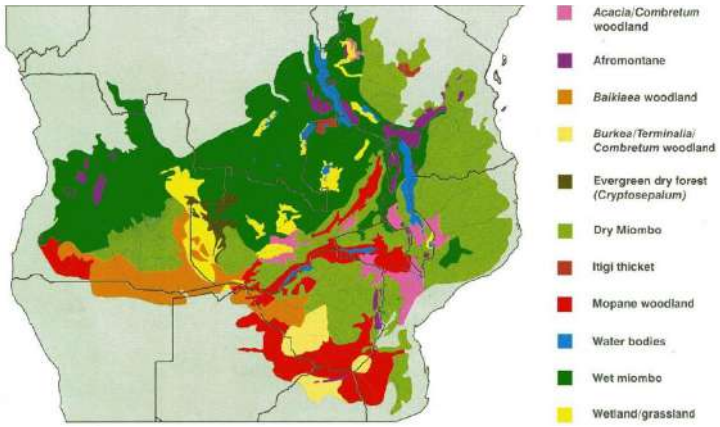


Figure 6- Africa biomes

Zambezian Woodland (also called dry forest or sub-humid woodland) is the most extensive vegetation formation in SADC and located within the Moist Savanna and Dry Savanna terrestrial biomes. Zambezian Woodland, comprising Miombo, Undifferentiated and Mopane (White 1983), is fire-adapted. It is light-demanding, subjected to the ecological process of disturbance-recovery, and regenerates mostly through sprouting of roots and stems (Geldenhuys 2005).

Miombo woodland is characterized by the dominance of Brachystegia species, either alone or in association with Julbernardia and Isoberlinia species with two distinct Miombo vegetation groups to be found - dry and wet - separated by the 1 000 mm isohyet covering southern Malawi, Mozambique and Zimbabwe and northern Zambia, Eastern Angola, southwest Tanzania and northern Malawi respectively.



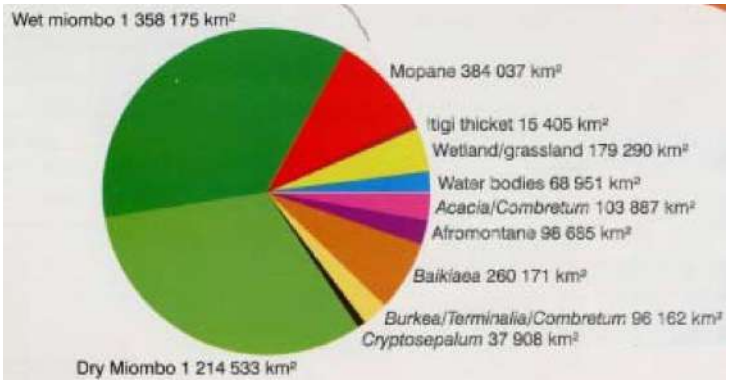


Figure 7- Miombo ecoregion (Timberlake 2011)

Ecoregion classification is a good starting point for planning fire management at landscape scale, e.g. as per image of Miombo ecoregion above.

The dry forests in SADC have not been managed for multiple-use forest products, which complicates fire management. The reasons are:

- The perceived low value of logs. Less than 10 % of the annual allowable cut is suitable for commercial markets and felled trees are not fully utilised
- The perceived low growth rate (MAI), resulting from yield regulation, regeneration and silvicultural strategies not suitable for light demanding species
- Limited understanding of the ecology and market potential of the woodlands.

However, the dry forests are extensively utilised for cooking energy, e.g. 95% of Tanzania's energy supply is in the form of firewood and charcoal, which translates to about 47 million m3 annually (MEM 2013). The figures for Mozambique are 85% and about 30 million m3. Most of this is cut in a clandestine way.

4.4 Land-use

Man has introduced various farming systems into SADC as illustrated in the image below (FAO 2001).

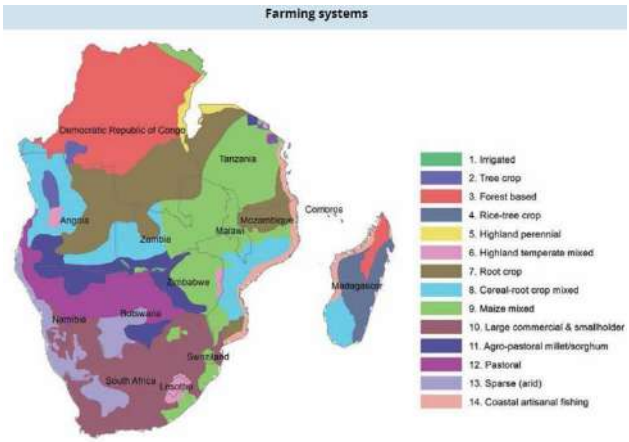
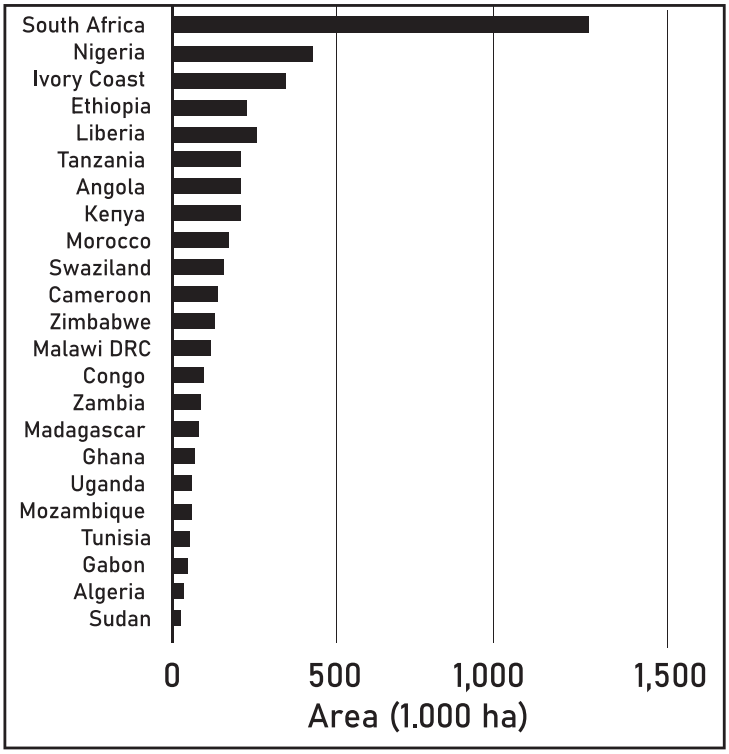
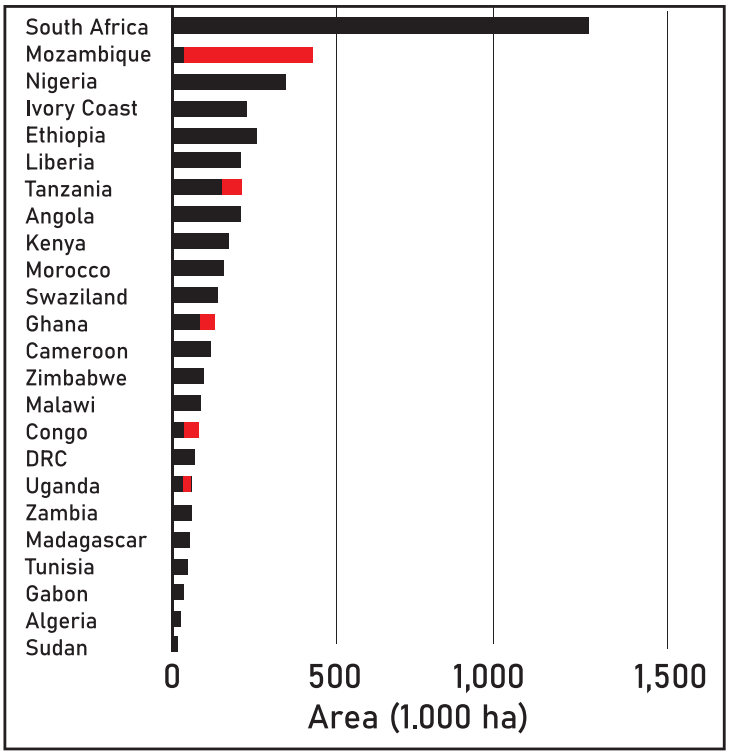


Figure 8- SADC farming systems

There are only about 2.3 million ha plantation forests in SADC. South Africa does not have much natural forests but makes up for it with the largest planted forests, followed by Tanzania. Significant expansion is expected in Mozambique and Tanzania.

There are about 2.5m ha of industrial forest plantations in Sub-Saharan Africa, SA excluded, but included poorly managed government plantations, etc Angola, Tanzania & Malawi. These plantations are in various countries and are not concentrated.





Industrial forest plantations in Africa, possible greenfields in red (Pöyry 2011)

The modification of SADC landscapes has led to changes in the natural fire regime and with disastrous wildfire consequence when not properly planned and managed. It is easier and cheaper to introduce FM planning during the initial stage of land-use change, e.g. commercial agriculture & afforestation, industrial & town development and tourism. Two concepts require understanding:

Land tenure and Forest ownership. Most ownership of land in SADC vests with the state, however land may be granted to users based on a contract for commercial purposes and on customary rules for purposes of subsistence to local communities. Most of the food is produced by small-scale farmers by means of slash-andburn traditional farming.

This does not pose a challenge to FM where traditional knowledge is recognised, and community-based collaboration supported. Clarity on forest ownership is essential for implementing IFM. In some countries, landowners are not automatically entitled to exploit forest resources, e.g. Mozambique. In other countries such as Zimbabwe land tenure also includes forest ownership.

4.5 Fire ecology

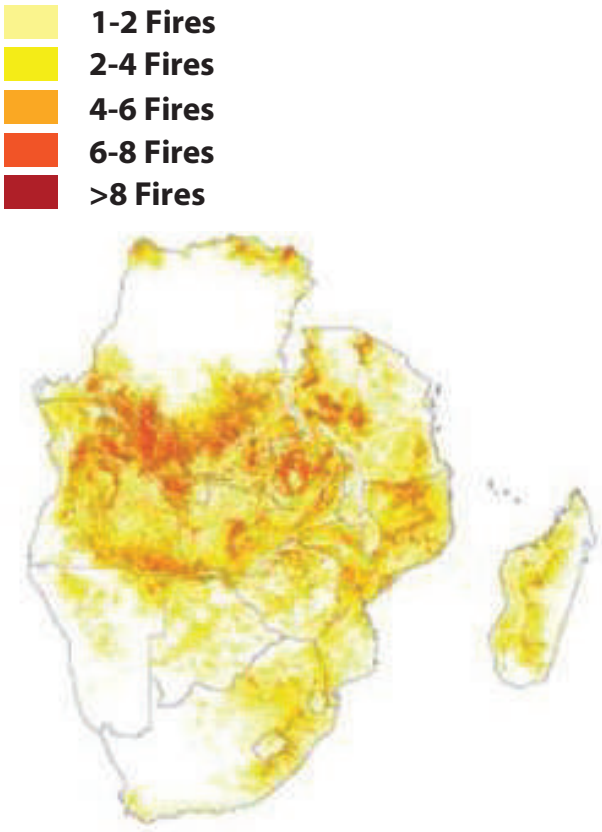
Originally most fires were caused by lightning, but more than a million years ago our ancestors learned to light and manage fires, exploiting and augmenting the natural causes of fires to manage the vegetation for their own purposes. Today, more than 90% of fires are lit by people, either deliberately or accidentally.

Fire is a complex ecological disturbance and has different effects on the vegetation, depending on the type of fire, intensity, season and frequency of burning.

Fire regime is the history of fire in a vegetation type or area including the frequency, intensity and season of burning.

Fire regime alteration can be defined as the extent to which the prevailing patterns of fire diverge from the ecologically acceptable ranges of variation in key fire regime elements for that ecosystem type. This creates an ecological hazard that can result in megafire episodes.

Fire frequency



Fire frequency refers to the number of times an individual MODIS pixel was classified as burned from April 2000 to March 2012.

A fire ecology type is a class of vegetation types that is relatively uniform in terms of the fire regimes (e.g. frequency, season, intensity and size) within the constituent vegetation types. This classification begins by dividing vegetation types into one of three broad fire-ecology types:

- Fire-dependent describes ecosystems where fire is necessary for the regeneration of most plant species but where inappropriate fire regimes can alter the species composition, vegetation structure or ecosystem function or a combination of these. E.g. moist grasslands, Zambezian woodlands and fynbos (Mediterranean)

- Fire-sensitive ecosystems are those that do not require fire for regeneration, but which occur among fire-prone ecosystems and can be adversely affected by the inevitable fires, especially if they are too frequent or severe.
  E.g. tropical forests, montane forests, forest plantations and agricultural crops

- Fire-independent ecosystems also do not require fires for regeneration and occur in environments where fires are very rare or absent, usually because there is little or no fuel for fires. E.g. desert and semi-desert. (Forsyth 2010). The popular view in South Africa is that the country burns too much. The ecologically accepted area required to burn annually (based on fire return periods) is estimated at over 23 million ha. However, the actual burned area estimated by remote sensing (AFIS) between 2003 and 2014 averaged just under 5 million ha annually (Marais 2015), resulting in high fuel loads.

It is therefore no surprise that the country is experiencing megafire episodes from time to time. The country should burn 4-5 times more in terms of area.

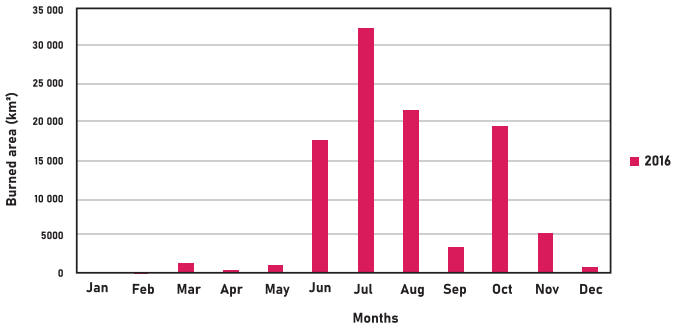
Great concern has been expressed in Tanzania about the average area of about 11 million ha burned annually in all land-use types (TAFORI 2016). Most landscapes in the country are firedependent with fire return periods of 2-5 years, therefore up to 25 million ha (90m ha/3.5yrs) could burn annually and be ecologically acceptable – about double the area. The reason why Tanzania is burning more than South Africa can most probably be attributed to fire suppression capacity. Therefore, Tanzania has fewer mega fire events than South Africa.

There is no benefit in suppressing fire for climate change mitigation in many SADC landscapes, excluding amongst others, tropical forests and peatlands. These areas will inevitably burn and release carbon. It is therefore part of the natural carbon cycle (TerrAfrica 2016).

4.6 Fire history

Fire history can be determined for the whole SADC by means of remote sensing technology, e.g. MODIS, AFIS and others. It can be quantified in area burned or number of fires. However, care should be taken in the interpretation as the heat-detection sensors on the satellites are very sensitive and can over-estimated burned areas 2-3 times (TerrAfrica 2016).

The figure below illustrates 11 years of fire history for the whole of Tanzania (TAFORI 2016). Refer to Annexure 1 for more on fire history in FIREWISE (TFS 2013)



It is important to understand the causes of wildfires so that both the incidence and impact can be reduced. Most land-use areas experience surface fires and the main cause is typically anthropogenic (human ignited). Wildfires threatening e.g. fire-sensitive plantation forests are generally from outside, caused by farmland preparation, cattle grazing, charcoal burning, hunting, honey harvesting, smoking, cooking, and sometimes arson following land tenure dispute.

4.7 Fire risk

Wildfire risk viewed as the combination of the likelihood and consequences of fires in each fire-ecology type. The likelihood of fire is related to the average fire return period for that vegetation type, determined from the literature. Likelihood ratings are almost certain (fires 1 in 2 years), likely (fires 1 in 5 years), possible (fires 1 in 10 years), unlikely (fires 1 in 20 years) and rare (fires 1 in 100 years). The consequences of fires are grouped into the following categories: catastrophic (regular loss of life and significant economic consequences of fires occur); major (extensive injuries and serious economic consequences of fires occur); moderate (localised damage and economic losses occur); minor (minor financial losses and damage occur); and insignificant (damage from fires is inconsequential).

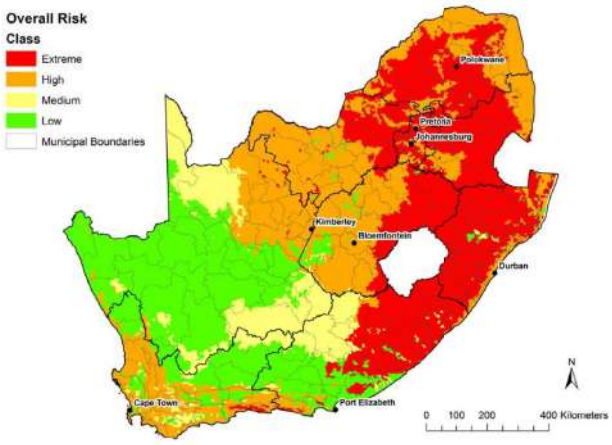
Risk categories are defined as low, medium, high or extreme, depending on the combinations of likelihood and consequences. For example, if fires are almost certain, but of minor consequence, the risk is moderate, if they are almost certain and catastrophic, risk is extreme; and if they are rare, but have moderate consequences, the risk is low. (Forsyth 2010).

Likelihood Rating	Consequence Rating				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Medium	Medium	High	Extreme	Extreme
Likely	Low	Medium	High	Extreme	Extreme
Possible	Low	Medium	High	High	Extreme
Unlikely	Low	Low	Medium	High	Extreme
Rare	Low	Low	Low	Medium	High

Fire hazard classification very useful for resource allocation at national, fire protection association (FPA) and plantation forest levels. This is currently only done in South Africa.

The development of national comparative fire risk classification in terms of likelihood of ignition (fire ecology-type and fuel load) and consequence (economic, social and environment) will assist regional, FPA and plantation forest planners.

Below is the high-level fire risk map developed for South African IFM planners.



The risk classification process followed in South Africa is summarised in Annexure 2.

The establishment of the Working on Fire Programme and the progressive deployment of Fire Protection Associations are contributing to the successful mitigation of risk factors In South Africa (Forsyth 2010, Marais 2015).

4.8 Traditional knowledge

Traditional knowledge of FM is evident and very useful in SADC. Unfortunately, Eurocentric fire policies and legislation introduced during the last century has suppressed this knowledge in many areas.

4.9 Policy and legislation

Uncontrolled fires are largely prohibited in the SADC countries because of the fire-adverse policies adopted (TerrAfrica 2016). Most countries have a maze of fire management policies, acts and bylaws within various disciplines/departments. E.g. at the 2011 IFM workshop for Tanzania in Morogoro, the general view was that the absence of an overarching FM policy has compromised institutional efforts to address wildfires appropriately. However, it is the informed view of Kishugu that SADC countries should first focus existing resources on piloting basic FM on landscape scale, then simplify/harmonise policies only after successful implementation and adaptation (learning by doing).

The National Veld and Forest Fires Act (1998) guides all fire management in South Africa. It requires that landowners take measures for fire protection and that communities should establish Fire Protection Associations (FPAs) to address the need for collaboration and coordination. A national support structure (Working on Fire) provides rapid response and additional resource capacity to rural communities as well as commercial sectors for supressing large fires.

Member of States are obligated by the SADC Treaty 1992 (consolidated 2015) which forms the legal basis for, amongst others, cooperation in fire management. FM within SADC is supported by the following protocols, programmes and projects:

- SADC Protocol on Wildlife Conservation and Law Enforcement 1999. The primary objective is to establish within the Region and within the framework of the respective national laws of each Member State, common approaches to the conservation and sustainable use of wildlife resources and to assist with the effective enforcement of laws governing those resources. It is linked to natural resource management programmes, since it supports the principles of sustainable use of natural resources such as wildlife, and the rights of Member States to decide on such use. It also calls for cooperation and information sharing on management and control of natural resources. Because of this Protocol 18 TFCAs has been established in SADC. Hence the TFCAs provide a meaningful and convenient legal basis in which SADC member states can effectively practice cooperation on the management and protection of shared natural resources, and contribute to the implementation of various SADC programmes, including trans-boundary fire management support.

- SADC Protocol on Forestry 2002 provides a policy framework for forest management in the SADC region. Objectives addressed in this protocol include increasing public awareness of forestry and capacity building. More specifically, the framework addresses research gaps, laws, education and training, the harmonisation of regional sustainable management practises, increasing efficiencies of utilisation and facilitation of trade, equitable use of local forests and a respect for traditional knowledge and uses.

- SADC Protocol on Shared Water Resources 2002

- SADC Regional Biodiversity Strategy 2006

- Regional Indicative Strategic Development Plan (RISDP). Priority intervention areas include poverty eradication; gender equality and development; science and technology; information and communications technology; environment and sustainable development; as well as sustainable food security

- The Dar es Salaam Declaration on Agriculture and Food Security 2005. A Plan of Action in which forest resources have an important role to play

- SADC Forestry Strategy 2010-2020 aims to facilitate cooperation amongst Member States to promote the active protection and sustainable use of forest resources.

- The Regional Cross-Border Fire Management and Cross-Border Cooperation Programme (Maputo 2010) focuses on reducing the incidence of uncontrolled forest fires in the region through collaboration by relevant stakeholders. By reducing uncontrolled fires, biodiversity might be protected as are the local people who depend on forest products for their livelihoods.

- The SADC Support Programme on Reducing Emissions from Deforestation and Forest Degradation (REDD+) 2012-2015 provides background information on climate change and REDD, a framework to improve the capacities of Member States to design national REDD programmes and to cooperate on common strategic REDD issues that are of regional interest.

- The SADC Regional Forest Law Enforcement, Governance and Trade (FLEGT) Programme has been developed as a first attempt to adopt a comprehensive programme to promote forest law enforcement and governance as well as legal harvesting and trade in forest products in the region.

- Development of Integrated Monitoring Systems for REDD+ in the SADC Region.

- Transboundary Use and Protection of Natural Resources 2012-2015. SADC Project to implement amongst others capacity building of FM.

- SADC Programme for TFCAs 2013.

- SOP for Cross-Border Fire Management in TFCAs, draft 2014. Supports cross-border FM in the following TFCAs:

    - Nyika TFCA. Zambia and Malawi,
    - Greater Limpopo Transfrontier Park (GLTP). South Africa and Mozambique,
    - Lubombo TFCA. South Africa and Swaziland
    - Kavango-Zambezi (KAZA) TFCA. Angola and Namibia.

Experience over the last 100 years of colonial-era fire policies demonstrates that attempting to suppress fire over long periods of time, other that plantation forests, is usually unsuccessful.

Without fire the open grasslands and savanna, which support an abundance of game and cattle, would become landscapes of thorn trees and unhealthy woodlands.

4.10 IFM knowledge gaps

The natural landscapes and land-uses in this report are not unique to SADC. Therefore, the gaps in IFM knowledge are relatively few:

- Uniform fire ecology-type and land-use maps are not readily available to facilitate interpretation of fire history from remote sensing applications.

- Fire risk classification of SADC in terms of likelihood of ignition (fire ecology-type and fuel load) and consequence (economic, social and environment) will provide valuable guidance to policy makers and planners at regional, country, landscape and land-use levels.

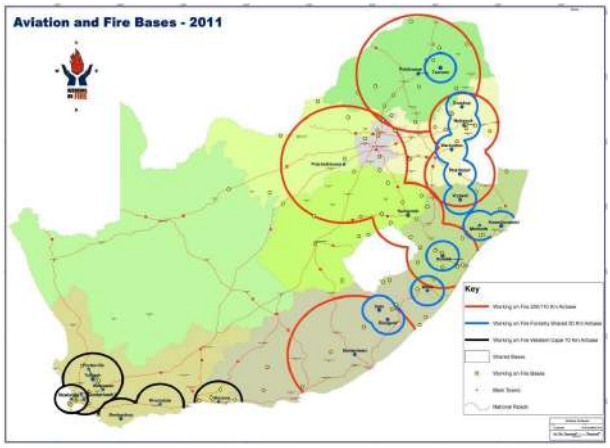
- Dry forests (Zambezian Woodlands) is the most extensive vegetation formation in SADC. However,

to align fire management appropriately, the market demand/potential for forest products requires better understanding

- The fire-dependant dry forests are not managed in SADC. The technical management thereof and the role of fire within requires better understanding, e.g. silvicultural application.

4.11 Readiness

South Africa has two fire seasons according to rainfall patterns, the dry summer months in the Western Cape, and the dry winter months in the rest of the country.



Working on Fire (WoF) is a government-funded, job-creation programme focusing on IFM in South Africa. WoF employs more than 5000 young men and women who are fully trained as wildfire firefighters and are stationed in more than 200 bases across South Africa. WoF's firefighters are recruited from marginalised communities and trained in prevention and fire suppression skills. WoF supplies firefighting services to the forestry sector in South Africa, the KZN Provincial Department of Agriculture and Environment, South African National Parks, KZN Wildlife, CapeNature, Mpumalanga Parks Board, Fire Protection Associations, municipalities and various other organizations, and is available as a national firefighting resource in the event of a disaster.

The implementing agency for the programme (Kishugu/WoF), makes use of FPAs (which were born out of the necessity for a single IFM structure) to distribute resources effectively.

In SADC, outside South Africa, ongoing IFM is unfortunately only to be found in high value plantation forest investments.

4.12 Conclusions

- Readiness. Large areas of SADC landscapes are being transformed into a mosaic of diverse land-use types, including the fast-expanding wildland-urban interface. Each land-use type has its own fire management needs, however readiness for IFM is not evident outside South Africa and commercial plantation forests.
- The fire risk to high value fire-sensitive land-use is mostly from outside. However, there is little evidence of collaboration with adjacent role-players.
- Much attention has been given to FM policies and laws; however they are very much Eurocentric in nature and there is little evidence of effective implementation.
- Traditional fire management knowledge is evident in rural areas and very useful.
- The lack of basic fire management training and tools is evident.
- Understanding of fire-ecology is not evident at management level
- Dead grass resulting from the annual dry season is highly flammable fuel that supports frequent and extensive, but low-intensity fires. There is no benefit in suppressing fire in many African landscapes (excluding tropical forests and peatlands) for climate change mitigation as these areas will inevitably burn and release carbon. It is therefore part of the natural carbon cycle.
- The lack of forest management in the dry forests could be a barrier to effective implementation implementing of IFM.
- Change in natural fire regimes may lead to mega fire events (Chapter 4.6).
- Gaps in IFM knowledge that require urgent research are relatively few (addressed in Chapter 4.10).

PART THREE(3) INTEGRATED FIRE MANAGEMENT

PART THREE: INTEGRATED FIRE MANAGEMENT

5. IFM DEFINITIONS

Africa is a fire continent (Komarek 1971). Every year, between half and two thirds of burned area worldwide is in Africa. Familiarity with fire and its deliberate use as a landscape management tool is deeply embedded traditional knowledge (TFS 2003, Goldammer 2004, TerrAfrica 2016).

Fires are regarded as a natural ecological factor of the environment and have been occurring since time immemorial in the grassland, savanna, woodland and fynbos areas of SADC. The use of fire in the management of vegetation for both livestock and wildlife systems is widely recognised and fire is best summed up as being a bad master but a good servant (Philips 1965). IFM has been described in various ways, including the following:

5.1 Myers

Focussed applied research over the past few decades have led to the development of the concept of integrated fire management (IFM). It can be described in many ways, but it is basically series of integrated fire management (FM) actions, e.g. a) the three technical components of fire management (prevention, fire use and suppression) and b) key ecological attributes of fire (fire regime) and c) the socio and cultural necessities of using fire along with the negative impacts that fire can have on society (Myers 2006).

Many parts of the world have sophisticated prevention and suppression programs, yet their fire problems continue to mount. The side of the triangle that is frequently missing or poorly developed is all the technical approaches to fire use (also called fire protection), i.e. prescribed fire, controlled agricultural and silvicultural burns, and wildland fire use decisions.

Integrated fire management assumes that fire problems cannot be addressed effectively solely by utilising and modernising the technical aspects of fire management, but rather fire management decisions must be made with an understanding of the fire ecology of the affected ecosystems and the culture and necessities of the people living in those ecosystems.

5.2 FAO

The integrated approach to fire management is set out comprehensively in the Fire Management Voluntary Guidelines (FAO 2006), and involves:
Integrating all activities related to FM, such as prevention, protection, suppression and restoration, into one coordinated process of fire management policy, planning and implementation.

- Integrating the use of fire as a land-management tool and management of devastating wildfires into one process, which involves the acceptance of fire use in certain situations.
- Integrating all actors and sectors involved into the same process
- Integrating all actors involved in fire suppression, using the Incident Command System (ICS), in the case of wildfires.

5.3 De Ronde

De Ronde (2011) highlights the main actions of IFM as a) to assess fire hazard at regional scale and at plantation level, b) to determine fire protection requirements in the landscape, and c) to move away from ineffective, rigid, firebreaks (particularly on property boundaries) and replace these with more effective firebreak systems and so-called “buffer zones”. Recent wildfire history in forestry has confirmed that extreme wildfires will cross, jump or spot even the widest firebreaks existing according to the old fire protection regime applied in plantations. This reality forced forest managers to take a fresh look at fire protection requirements, as well as realistic, effective fire protection options. As the new approach to fire management/protection requires a system of strategic protection lines, placed in the landscape regardless where property boundaries were situated (thus within multiple properties), and because it incorporated conservation requirements, riparian zones, wetlands, montane grasslands and plantations with selected prescribed burning applied, it was referred to as “integrated fire management”.

5.4 Fynbosfire

Fynbosfire (2016) describes IFM as a series of actions that includes fire awareness activities, fire prevention activities, prescribed burning, resource sharing and co-ordination, fire detection, fire suppression, fire damage rehabilitation and research at local, provincial and national levels to create a sustainable and well-balanced environment, reduce unwanted wildfire damage, and promote the beneficial use of fire.

5.5 Kishugu

FAO (2011) clarifies the disaster management alignment to IFM: integrated approach to fire management place greater emphasis on addressing underlying causes and seek long-term, sustainable solutions that incorporate the same five essential elements (5 Rs) that have been adopted globally in dealing with disaster management. The Kishugu Group, a global implementer of IFM with a long history of focussing on fire suppression follows a cyclical disaster management approach: a series of actions implemented through reduction, readiness, response and recovery planning and management (Kishugu 2018).

5.6 This report

For the SADC guidelines it has been decided to use the simple format accepted by forest sectors and funding agencies for allocating resources as well as reporting globally: fire prevention, fire protection and fire suppression.

6. IFM PRINCIPLES

The brief situation analysis compiled on SADC, as well as FM Voluntary Guidelines (FAO 2006) and Africa The Fire Continent (TerrAfrica 2016), enabled Kishugu to formulate IFM principles for strategic direction.

The analysis of the current SADC situation enabled the team to formulate clear integrated fire management (IFM) principles for SADC , aligned to the international thinking reported in FAO 2006.

The following principles will form the foundation for IFM guidelines:

6.1 Economic

Understand both the likelihood and consequence of wildfire in different land-uses. The active use of fire as a cost-effective management tool to protect assets and lives should be integrated at landscape scale.

6.2 Environment

Respect the ecology of the natural environment. Recent changes in land-use will affect natural fire regimes resulting in severe fires with negative consequence for ecosystem services and local communities.

6.3 Social

Engage with all stakeholder communities. Use fire responsibly to maintain traditional agricultural practices and livelihoods. Invest fire prevention education for communities, local recruitment and training.

6.4 FM safety

Always implement FM interventions with the safety of firefighters and communities in mind.

6.5 Legal

International Law and binding SADC protocols provide good basis for Member States to simplify, harmonise and overarch national FM policy. It should sensitise the needs of different land-use types and implementation FDI, fire risk classification and FPAs.

6.6 Institutional

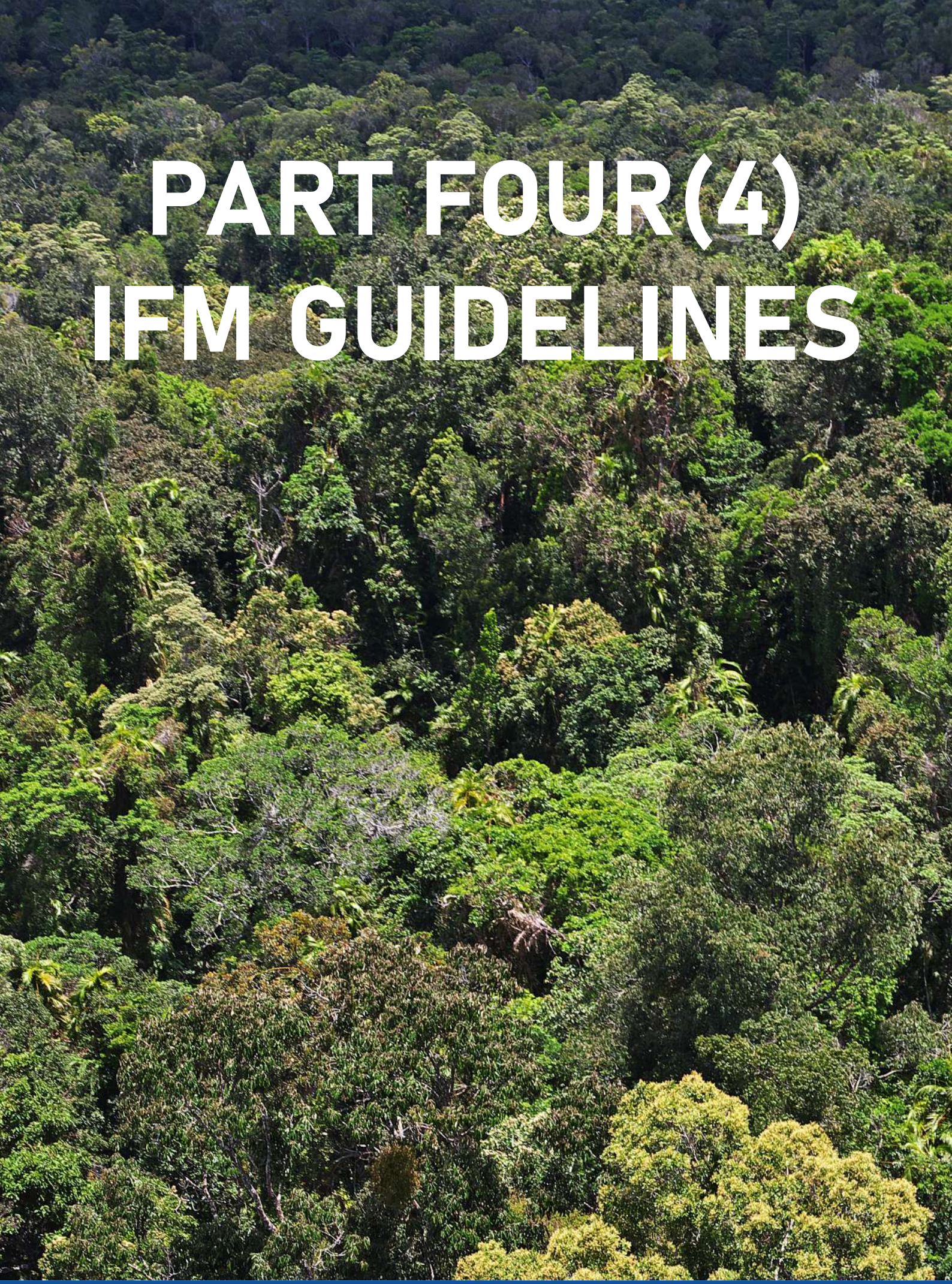
Establish FPA-like capacity to address institutional, collaboration and coordination barriers to effective implementation of IFM.

6.7 Enhanced capacity

Fires respect no boundaries. Collaboration and pooling of resources are of the outmost importance to achieve early warning, instant detection, and fast reaction. The proximity of different land-use types within emerging landscapes requires a shift from isolated FM interventions to a coordinated approach at scale. Invest in community-based FM support which includes and empowers women. People start almost all wildfires, and people are also the most effective resource to put out fire.

6.8 Stay informed

Keep abreast of new innovations and development in IFM and landscape programmes. Assess the condition of vegetation and other parameters before fuel reduction burns. Implement FM programmes timeously but monitor vegetation condition and adapt intervention where necessary. Support the use of fire danger index (FDI). Explore and utilise traditional FM knowledge.



PART FOUR(4)
IFM GUIDELINES

PART FOUR: IFM GUIDELINES

Use these guidelines below to consider a suite of IFM interventions appropriate for the landuse (risk and scale) and available resources (Chapter 3 Approach). The simple IFM format of fire prevention, -protection and -suppression used in this report and described by Myers (2006) is accepted worldwide by forest sectors and funding agencies.

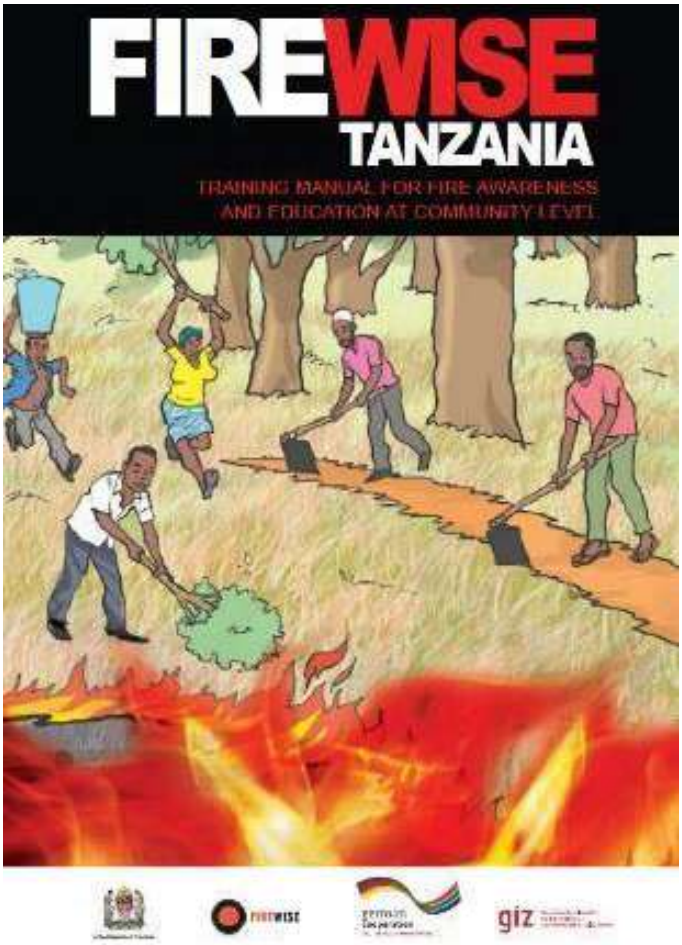
Each land-use type in SADC has its own fire management needs ranging from low-key to highly sophisticated interventions. Therefore, it is expected from the IFM implementer to understand the role of fire in SADC region, and then use these guidelines to decide on a suite of IFM interventions appropriate for the land-use (risk and scale) and available resources

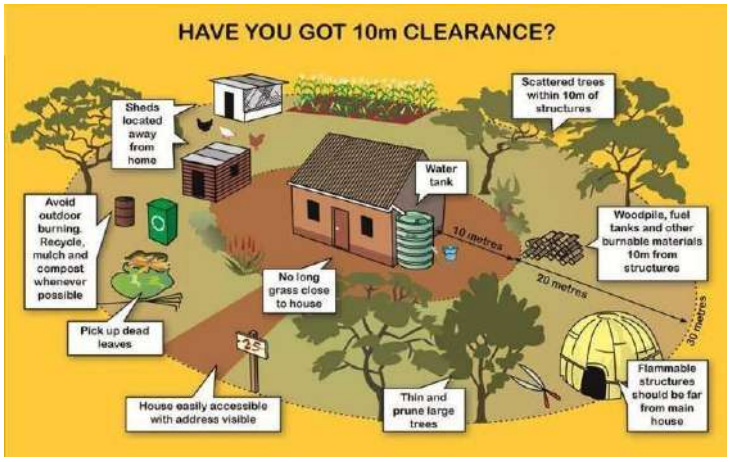
7. PREVENTION

Fire prevention is described as activities directed at reducing unwanted wildfire events. It is the most sensible, cost-effective and least risky component of IFM. In the SADC context, it includes:

7.1 Fire awareness

Establish awareness of good and bad fires by means of public education at village and household levels. A well-known approach is the FireWise one below (Hoffmann 2013, TFS 2013).





Align FM education to good traditional practices such as slash-and-burn agriculture and burning for grazing (also known as indigenous knowledge).

Fire is necessary for the functioning of many ecosystems within SADC. Exclusion of fire in firedependent vegetation will lead to the build-up of fire fuels which are detrimental to ecosystem health and will increase risk to lives and property (Fynbosfire 2016).

7.2 Causes of fires

Land-users and communities need to explore the causes of wildfires so that both the incidence and impact can be reduced. Most land-use areas experience surface fires and the main cause is typically anthropogenic (human ignited). Wildfires threatening land-use change of high value, e.g. fire-sensitive plantation forests, are generally from outside, caused by farmland preparation, cattle grazing, charcoal burning, hunting, honey harvesting, smoking, cooking, and sometimes arson following land tenure dispute.

7.3 FM collaboration

Increased collaboration at all levels is the key to effective IFM. E.g. the equipment of local fire brigades in SADC is in general not suitable for wildfire application. However, there are always good opportunities in collaborating, e.g. typical water tanker units below are very suitable for bulk water supply at accessible points.

7.4 Fire Protection Associations (FPAs)

The proximity of different land-uses requires a shift from isolated fire management interventions to a collaboration approach at scale. This can be achieved in short time and cost effectively by means of FPAs, which are groups of land-users that voluntarily collaborate on all matters pertaining to IFM, with the common objective of mitigating fire risk. This includes preventing, managing and suppressing wildfires by means of pooling resources.

The FPA concept works well in various countries, including New Zealand and South Africa. Kishugu/ WoF has introduced the FPA concept to, amongst others Eswatini, Namibia, Botswana, Tanzania and Indonesia. Unfortunately, it has not yet been rolled out in SADC countries, but good progress is being made in Indonesia (called clusters, Wilson 2018).Strong community structures, existing CBFM programmes, and the current renewal of traditional knowledge promise to compliment implementation of the FPA approach within SADC. It is recommended that members keep to the same basic name for FPAs.

FPAs are resourced in different ways. A review of FPAs globally and across South Africa provides a spectrum of options for resourcing FPAs ranging from a lean small management team with the activities of the FPA largely driven by the membership to a large well-resourced institution driven by staff capacity. Given the global and local financial situation, pressures on government resources and the challenges of sustaining the human capital required to drive IFM, leaner FPA structures should be encouraged (Fynbosfire 2016). Two different but effective approaches are illustrated in South African case studies (Annexure 3).

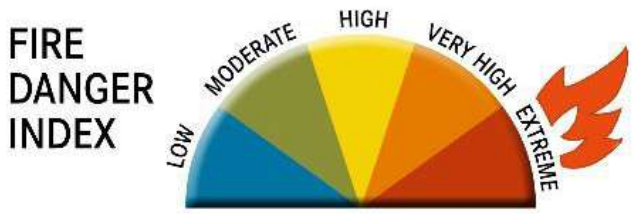
Members in a SADC FPA would typically include a champion (e.g. commercial plantation forest or national park), adjacent land-users, village and district authorities and town fire brigades. FPAs should be of manageable size but must include adjacent land-uses. Utilise existing structures (e.g. government and timber grower associations) and keep current administrative boundaries. For a suite of FPA administrative tools, refer to Annexures 4 (Fynbosfire 2016, LEFPA 2018):

- Proforma constitution for FPA
- FPA rules
- Example of FPA budget
- Example of FPA fees
- IFM tasks for a plantation forest-type FPA

7.5 Early warning system

Fire danger index (FDI) is the globally accepted weather talk of foresters and natural resource managers. It is a fire danger rating calculated from temperature, relative humidity, wind speed and rainfall measurements or forecasts. FDI therefore measures fire weather to predict the chances of a fire occurring and the fire behaviour once it has occurred.

FDI provides FPAs, land-use managers and foresters with an excellent base for observing trends and developing personalised fire control guides and action plans for each alert stage.



Place FDI display boards at strategic locations, e.g. forest plantations, villages, community centres, schools etc. Communicate FDI daily to indicate current alert stage status on the boards.

Below are examples of fire alert stages (Jacovelli 2009, LEFPA 2018):

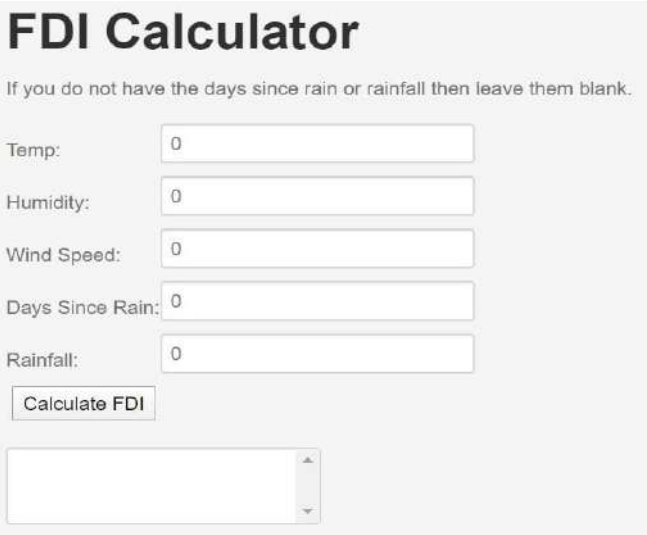
FDI Description	Colour	Category	Lowveld FDI Precaution
SAFE	BLUE	0 - 20	Low fire hazard. Controlled burn operations can normally be executed with a reasonable degree of safety.
MODERATE	GREEN	21 - 45	Although controlled burning operations can be executed without creating a fire hazard, care must be taken when burning on exposed, dry slopes. Keep constant watch for unexpected wind speed and direction changes.
DANGEROUS	YELLOW	46 - 60	Controlled burning not recommended when fire danger index exceeds 45. Aircraft should be called in at early stages of a fire.
VERY DANGEROUS	ORANGE	61 - 75	No controlled burning of any nature should take place. Careful note should be taken of any sign of smoke anywhere, especially on the upwind side of any plantation. Any fire should be attacked with maximum force at hand, including all aircraft at the time.
EXTREMELY DANGEROUS	RED	75+	All personnel and equipment should be removed from the field. Fire teams, labour and equipment placed on full standby. At first sign of smoke, every possible measure should be taken to bring the fire under control in the shortest possible time. All available aircraft should be called for without delay.

Fire Alert Stages	BLUE	GREEN	YELLOW	ORANGE	RED
Fire Danger Index	0-20	21-45	46-60	61-75	76-100
Fire Behaviour	SAFE	MODERATE	DANGEROUS	VERY DANGEROUS	EXTREMELY DANGEROUS
Flame Length (m)	0-1	1-1.2	1.2-1.8	1.8-2.4	2.4+
Fire Control Guide	Low fire hazard. Fires unlikely to start: control and mopping up easy. Controlled burning operations can normally be executed with a reasonable degree of safety.	Only light surface fires likely. Although controlled burning operations can be done without creating a fire hazard, care must be taken when burning on exposed, dry slopes. Keep a watch for unexpected wind speed and direction changes.	Direct attack needed if fires start: moderate mopping up needed. Extreme caution should be taken when controlled burning is carried out.	Spread of fires can be fast: control and mopping up difficult. No controlled burning of any nature should occur. Careful note should be taken of any sign of smoke – especially on the up-wind side of any plantation. Any fire that occurs should be attacked with the maximum force at hand.	Fires will be very hot and spread very fast. All personnel and equipment should be removed from field. Fire teams, labour and equipment are to be placed on full stand-by. At the first sign of smoke, every possible measure should be taken in order to bring the fire under control in the shortest possible time.

Using a handheld Kestrel weather instrument, a combination of the temperature, wind direction and speed, and rainfall and humidity are required to determine the fire danger rating. This can be done by means of manual calculation (LEFPA 2018, Annexure 5). However, convenient technology is available, e.g. AFIS below.

CSIR Meraka provided their early warning wildfire system and satellite-based detection to certain SADC countries through the MESA project (which has come to an end). Some countries continue using the free viewer.

In addition, some FPA websites have easy FDI calculators as demonstrated below (www.lefpa.co.za/online-fdi-calculator):



Also refer to application in Google Play store, android and apple compatible(https://play.google.com/store/search?q=fdr%20calculator&hl=en):

7.6 Fire prohibition period

Establish an annual fire prohibition period as indicated by MODIS fire history results indicated in chapter 4.2. This is a simple solution for bad fires during high fire danger period. The annual period can be determined by dates or weather conditions (FDI). In South Africa, the start of the prohibition period is determined by individual FPAs and the end by 50 mm of summer rainfall (alternatively one week of continuous blue FDI. In SADC, the indication is to start with prohibition about one month later than the peak fire activity indicated by remote sensing analysis (reason being to exclude the necessary controlled burning period reported by the technology). This should be compatible with the reasonable requirements of most land-users. Fire prohibition, applicable to all land-users, within the FPA administrative area will enhance fire detection. Burning during the prohibition period is only allowed by permit with conditions (including FDI and resource requirements). In some countries these permits are issued by village authorities without collaboration with other villages and upper level authorities. FPAs should take responsibility for the burning permit system and advise on the enforcement of it. Examples of burning prohibition announcement and permit protocol are per Annexure 6 (LEFPA 2018).

7.7 Safe time of burning

Practice safe burning by changing the time of burning. For most land-users (excluding commercial-scale plantation forests) after 16.00 in the afternoon. Should a fire get out of control, it would present a shorter period of suppression and reaching of dewpoint (the temperature at which the air is 100% saturated with water vapour, and either begins to form dew or condense into clouds or fog).

8. PROTECTION

Fire protection is described as actions taken in advance of the dry season to protect assets and lives against wildfires.

It is always more effective to initiate FM planning from the onset of land-use change. Proper planning, in terms of compartment and block sizes, access roads, fire belts (external and internal), natural firebreaks and open areas before and during plantation establishment will make plantation forests safer.

This is also true for developments such as commercial agriculture, industrial & town, and tourism.

Figure 25- Well-planned plantation forest

Figure 26- Compiling fire hazard map (Fynbosfire 2016)

Assess the fire risk of the management unit and adjacent areas by means of likelihood of ignition and consequences (economic, social and environment), and compile a simple fire hazard map (classifying low, medium, high and extreme areas). This map will guide protection measures required, which may include:

8.1 Buffer zones

Buffer zones is a system of strategic protection lines with a low fuel hazard, placed in the landscape regardless where property boundaries were situated. Identify and maintain buffer zones in relation to the most dangerous wind direction. Open-ended fire break (utilising safe burning window between late afternoon and dewpoint) are specialised but a quick and costeffective way to maintain buffer zones in natural landscapes.

Figure 27- Open-ended fire break

8.2 Firebreaks

Make full use of natural firebreaks and infrastructure, e.g. rivers, valley bottom forests, rocky ridges and roads. A very effective fire protection approach within the fire-dependent dry forests is to maintain the natural fire regime and traditional mosaic pattern.

8.3 Fire belts

A fire belt is an artificial barrier from which most flammable material has been removed for the purpose to stop light surface fires and serve as a line of defence to work from. Prepare a 2m tracer in advance on the perimeter before burning a fire belt. Tracer and fire belts can be prepared in various ways, including: chemically, grazing, burning, hoeing, slashing, disking and grading. Fire belts can be burned annually or bi-annually in rotation. Place and maintain external and internal fire belts appropriately: wide and long enough to have a reasonable change to stop a fire without causing soil erosion. The width depends on the risks, but 20m free of vegetation for external belts adjacent to plantation forest or grassland, and 10m for cropland are good guidelines. Roads, 5m clear of vegetation, and indigenous buffer zones are recommended for internal belts. See LEFPA 2018 recommendation (Annexure 7). The planting of (green) fire belts with tree species is not recommended for SADC. More important is the local pattern of natural forests and the position of fire belts (Geldenhuys 2011).

8.4 Power lines

Wildfires pose a threat to powerlines, a national asset. Powerlines can also cause fires.

Annexure 8 shows common servitude widths in South Africa. It is probably applicable to most of SADC. It also provides guidelines for vegetation management under power lines.

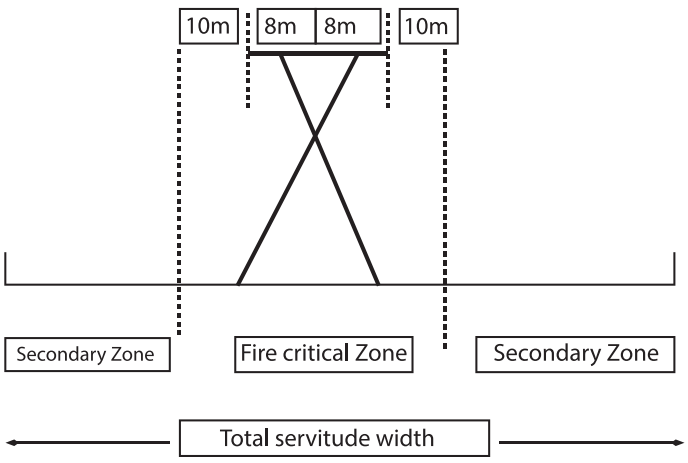


Figure 28- Typical cross section of powerline

8.5 Fuel load reduction

Fire needs oxygen, fuel and heat to burn. In the process of growing fire-sensitive trees (e.g. plantation forests), we add fuel to the forest floor which adds to the intensity of any fires which may occur. The more intense the fire is, the more difficult it is to contain and the greater the damage to the growing crop. The critical success factor is to create low fuel load zones inside the plantation from which wildfires can be contained. Fuel loads can be managed as follows:

- Remove, mulch, rotary slash or burn plantation residue resulting from silviculture, harvesting and sawmilling operations. Burn residue only after 75mm of rain and FDI not exceeding mid-yellow

- Keep compartments weed free until canopy closure

Figure 29- Weed free plantation forest compartment

- Maintain ecological fire regime in natural areas by means of appropriate season, frequency, and intensity of burn. The next chapter 8.6 Role of fire in ecosystems, as well as Annexure 9 provides general guidelines.

- Small-scale growers to weed and clean all planted areas before start of dry season.

- Under-canopy burning is a useful investment to manage fuel loads in hazardous areas. Unfortunately, days with ideal burn conditions for most commercial species are very limited in plantation forest areas within SADC. Regeneration with thicker bark species, e.g. Pinus caribaea hybrids could be considered for these areas.

Figure 30- Under-canopy burning

- Plan burning for traditional farming practices outside of fire prohibition period and later than 2 hours before sunset

- Mobile sawmills and charcoal burning. Within plantation forests or natural vegetation, the following minimum requirements are applicable:

  - Fire belt 10-15m wide around operation if not in burned area
  - Basic fire suppression tools including minimum of 200l water available on site for fire suppression
  - FDI reaches orange, stop charcoal burning.

Figure 31- Traditional charcoal manufacturing

8.6 Role of fire in ecosystems

Many ecosystems within SADC are dependent on fire for regeneration. Refer to, Chapter 4.5 Fire ecology.

The role of fire in grasslands/ savannas and fynbos (Mediterranian) has been extensively researched in SADC and management guidelines implimented. However research into effective forest management of dry forests that includes fire as a silvicultural tool, is still work in progress.

Below are guidelines for rangelands within grasslands and savannas in SADC:

The current view amongst range scientists and progressive livestock and wildlife farmers on the permissible reasons for burning are to:

- remove moribund and/or unacceptable grass material
- control and/or prevent the encroachment of undesirable plants.

Ecological Criteria for Prescribed Burning. The necessity for burning rangeland depends upon its ecological status and physical condition.

Quantitative techniques have been developed to assess the condition of the grass sward in relation to prescribed burning. The first technique involves determining the condition of the grass sward in terms of its botanical composition, ecological status and basal cover and involves classifying the different grass species into different ecological categories according to their reaction to a grazing gradient i.e. from high to low grazing intensities as follows:

- **DECREASER SPECIES** Grass and herbaceous species which decrease when rangeland is under or over grazed
- **INCREASER I SPECIES** Grass and herbaceous species which increase when rangeland is under grazed
- **INCREASER II SPECIES** Grass and herbaceous species which increase when rangeland is over grazed.

The second technique involves estimating the grass fuel load using an acceptable method, e.g. the Disc Pasture Meter below.

Figure 32- Disk pasture meter

The criteria that can be used to objectively decide whether rangeland needs to be burned or not are that prescribed burning should not be applied if the grass sward is in a pioneer condition dominated by Increaser II grass species caused by overgrazing. Burning is generally not recommended when rangeland is in this condition to enable it to develop to a more productive stage dominated by Decreaser grass species. Conversely, when the grass sward is in an under grazed condition, dominated by Increaser I species, it needs to be burned to increase the better fire adapted and more productive Decreaser grass species and increase the overall palatability of the grass sward. Finally, controlled burning is necessary when the grass sward has become overgrown and moribund because of excessive self-shading. These conditions develop when the standing crop of grass is generally >4000 kg ha-1 and can be estimated with a Disc Pasture Meter (Trollope 2015).

Figure 33- Controlled burn in Serengeti NP

Annexure 9 describes the fire regime for burning rangeland (Trollope 2015).

9. SUPPRESSION

Readiness according to early warning (FDI, Chapter 7.5), instant detection, and fast reaction are the key to effective fire suppression. Salient measures include:

9.1 Detection

Spotting a fire early enables you to put measures in place to suppress it or if outside, to prevent it from entering your property.The smaller the fire is when you start suppressing it, the easier to control. Once a fire gets to a certain size you cannot even fight it but must wait until it burns itself out. Fire lookouts can be permanent or temporary (placing someone at high ground during dangerous FDI periods). Most commercial plantation forests in SADC make use of fire lookout towers and medium-scale growers of patrol persons. Digital camera fire detection systems are used in South Africa.

The AFIS early warning package available from CSIR Meraka includes active fire detection by the Geostationary MSG satellite every 15 minutes.

Figure 34- Fire lookout

9.2 Communication

The ability to communicate with all role players in the fire suppression process is critical e.g. radio, cell phone or fire alarm.

Each member must have a cell phone available for firefighting operations; this will enable the member to receive the daily fire danger index (FDI) forecasts through an SMS system on his cell phone. The cell phone will enable the member to communicate directly with the ops room. All members, where applicable, require radio communications between the various fire fighting vehicles and ground teams. These radios should be coordinated where possible on common frequencies (LEFPA 2018).

9.3 Dispatch and coordination

It is essential to manage large firefighting resources by means of dispatch and coordination capacity coupled with incident command system (ICS) at FPAs or large plantation forests. South Africa has adapted best Western practices to suit southern African conditions, however the nature of wildfire event and resources dictate the scale of dispatch and coordination function requires.

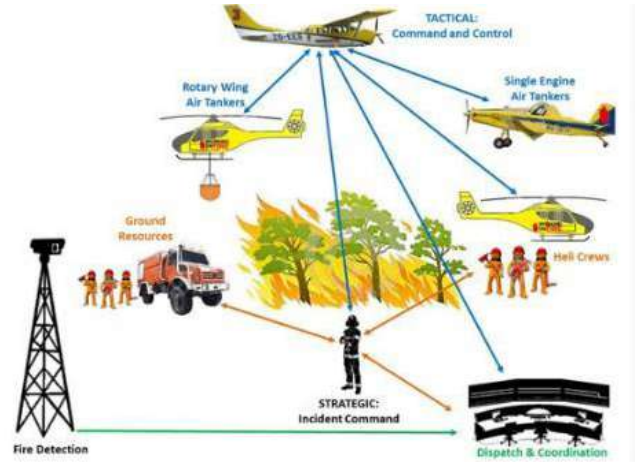


Figure 35- Typical dispatch and coordination function in South Africa

9.4 Fire response teams

Essential for forest plantations and village authorities. Can ideally be pooled and coordinated by the FPA system. Ideally the firefighters need to be employed. First-world countries make good use of volunteers (with other full-time employment). Unfortunately, the experience in developing countries has not been positive. Volunteers often do not have other employment and are hesitant to fight fires at night (which is the best time to suppress fires safely), or without compensation. Piecemeal compensation often leads to more fires. FPAs in the Mediterranean region of South Africa are having success with career-person volunteers. Ghana, on the other hand, has many thousands of volunteers, but disappointing success with wildfire suppression despite good fire management structures. The cost of a small village team in SADC (including PPC and tools but excluding transport), is estimated below:

ITEMS	NUMBER	COST USD	TOTAL USD
PPC (boots, trousers, jacket, t-shirt)	6	200	1 200
Fire Beaters	3	10	30
Rake hoes	2	30	60
Water backpack	2	100	200
Drip torch	1	120	120
FM training (basic)	5	100	500
FM training (crew leader)	1	290	290
Employment per year	6	600	3 600
Total			6 000

Firefighting personnel need to be properly trained and in an appropriate state of readiness guided by FDI and management unit.

9.5 Personal protective clothing (PPC)

The following basic clothes will be suitable at wildfire events:

- ONLY 100 % cotton, including underwear and socks. Overalls with a high synthetic content should be avoided as these will melt in the event of close contact with a fire and result in serious injuries to the fire fighter
- A cotton T-shirt worn as an under garment will assist in keeping the direct heat off the skin
- Leather boots. Plastic boots are not recommended as these will melt when in close contact with fire for prolonged periods. Steel tipped safety boots to be avoided as they can get so hot that toes get burned.

Refer to Annexure 10 for more detail.

9.6 Equipment and tools

Depending on individual risk, a general guideline for higher value land-use in SADC is as follows:

Equipment	<10 ha	11-25 ha	26-100 ha	101-500 ha	501-1000 ha
Slip-on unit				1	2
Knapsack	1	2	3	4	8
Fire beater	1	4	8	10	15
Rake hoe		1	2	4	6
Drip torch				1	2
Firefighters	1	2	4	6	10

Annexure 11 recommends detailed minimum requirements for various type and size of landuse (LEFPA 2018).

The most basic equipment and tools required for fire suppression are noted below. Firefighters in SADC need to understand and practice how to use them (in terms of the fire triangle in Chapter 9.7):

Slip-on unit suitablef or single or double cabL DV

Fire beater with woodenh andle

Knapsack water pump rigid

or collapsible

Rake hoe

Drip torch

- Bakkie-sakkie (slip-on unit). A water tank manufactured from fibre glass or plastic containing 200 to 700 litres. The tank will have a water pump driven by a petrol engine. The pump will be an impeller or piston type pump. The unit will have a hose reel with a minimum length of 30 m of rubber hose. The pump will have self-filling [suction] capability. This is a quick reaction unit and highly recommended for all forester and natural resource vehicles during fire season.

- Fire beaters. Constructed of conveyor belt 400 mm wide x 400 mm long and 7-12 mm thick. The tool is attached to a wooden handle.

- Knapsack Pump. Rigid or flexible. A plastic container carried on a fire fighter's back, which holds approximately 15 – 20 litres of water. The water is delivered through a double action hand operated pump.

- Rake Hoes. Hoe manufactured of steel 27 cm wide x 23 cm high. The tool will have teeth a minimum of 8 cm long. The tool must be attached to a wooden or steel handle of approximately 2 m. Drip torch fire lighter. A cylindrical steel, aluminium or plastic container with a 5-litre capacity. The burning fluid is delivered through a pipe onto a wick.

9.7 Fire triangle

Fire is a chemical reaction and can only burn when fuel, oxygen and heat are present at the same time. If one of these elements is removed or missing, then fire will not burn or will be extinguished. This is the key to fire suppression (Teie 2009).

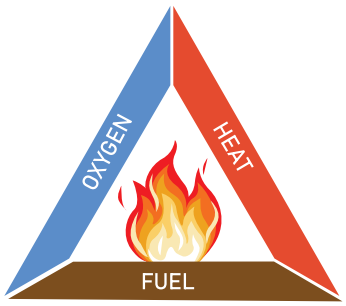


Figure 37- Fire triangle

9.8 Critical fire factors

Key factors effecting fires to consider in suppression are:

- Weather. Temperature, relative humidity and wind. Wind and lack of rainfall are the most important
- Fuel type. Light/heavy, ground, surface and aerial (canopy). High fuel-loads pose high fire risk
- Topography. The shape of the land. Fire burns uphill very quickly and slower downhill.

9.9 Types of fire

Wildfires are categorised by where they burn:

- Surface fires. Just above the surface and the most common fire in SH. They can burn either as head fires with the wind or back fires against the wind. Head fires are faster moving and release their heat above ground level causing least damage to the grass layer but significant damage to trees and shrubs. Backfires on the other hand, burn against the wind and are cooler and have slower moving flames that release their heat at ground level (Trollope 2015)

- Crown fires. In the canopy of trees under extreme weather conditions

- Ground fires. In the ground, e.g. roots, peatlands.

9.10 Fire suppression strategies

Initial attack. Plan a direct, indirect or parallel attack as per Teie 2009, and communicate it to firefighters. To suppress a fire, one needs to break the fire triangle (Chapter 9.7), e.g.:

- Cut a control line to remove fuel (rake hoe in plantation forests)
- Use water to cool the fire (knapsack or slip-on unit)
- Remove oxygen by smothering the fire (beater)
- Use fire to remove fuel (drip torch for burning-out or back burning).

Figure 38- Aerial suppression is only effective with well -trained firefighters in the ground

Extended attack. Necessary if fire is not put out in the first hour. Once you have people busy with suppression, assess the progress and any changes, adapt your plan and call in time for more resources and establish incident command system (ICS).

9.11 Mopping up

Always have a small team available right from the beginning to guard the rear (completed section of the burn) and start mopping up as soon as a section has been burned and continue following up as the burn progresses.

Figure 39- Mopping up plantation forest fire

Work from the fire line toward the centre of the fire. On larger burns, such as large open areas or slash compartments in plantation forests, mop-up a minimum of 20m, or to such a distance that nothing will blow, roll or spot across the line. Widen and clean the fire line next to problem areas. Burn out islands (unburned sections). Dig out dead or burning roots that cross under the fire line. Feel for hot material along the fire line. Ensure that this line is properly anchored on both ends. Constantly check for spot fires, especially downwind from the fire line. Check heavier fuels (logs, snags, slash, etc.) for smouldering material.

Figure 40- Mopping up after Air Tanker in wildland-urban interface

Follow-up with guarding and/or patrolling. Ensure that food, water and suitable tools to extinguish flare-ups are available.

9.12 Firefighting safety rules

Adhere to firefighting safety rules:

- Provide for safety first: be sure that your firefighting teams have the correct skills, protective clothing and tools.
- Analyse fire behaviour and watch for changes – use what you have learned about fire
- Check the weather forecast and note all changes such as wind speed and direction. Be sure you know what the fire is doing always.
- All instructions and plans must be clear to everybody fighting the fire.
- Communication with everyone at the fire is critical.
- A lookout person is a good idea as this person can report any overall changes in the fire behaviour.
- React quickly and decisively.

- When you are stressed, hungry, thirsty and breathing in smoke you can make irrational decisions, so focus on staying alert and keeping calm.

- Make sure you know where the safety zones are and the escape routes. Safety zones are predetermined open areas where you can escape the fire, smoke and heat (previously burned areas, bodies of water etc.). You need at least two potential escape routes.

- Never try to outrun a fire uphill, fire moves fast. Rather escape sideways or try to get into the burned area.

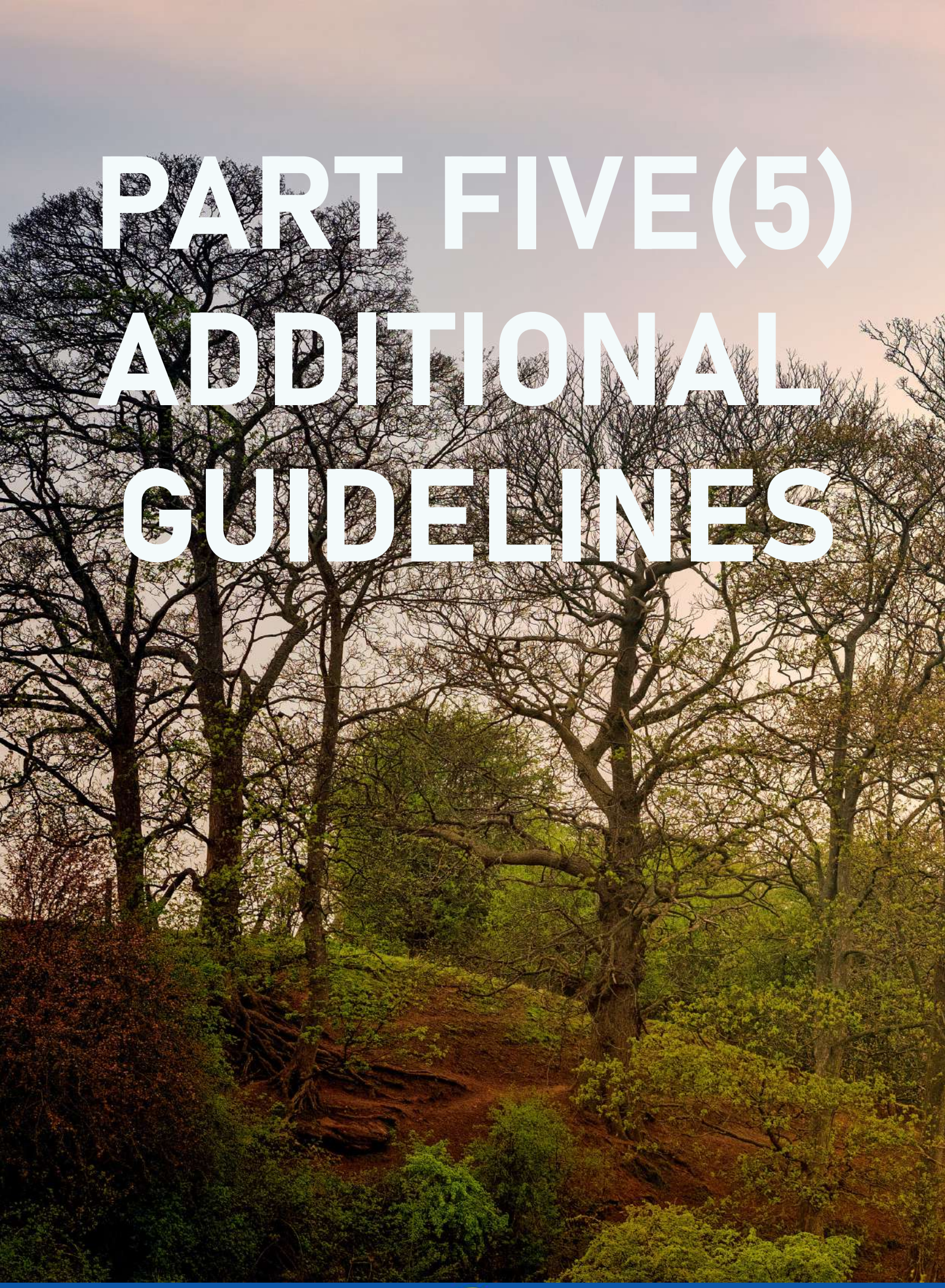
For more on FM safety see LACES as well as the ten firefighting orders in Annexure 12.

9.13 Water

Water is an important part of suppressing fires. Ensure easy access to natural water features and consider manmade water filling points where necessary, e.g:

- Dams
- River crossings with an available suction point
- Overhead pipes (hydrants)
- Overhead tanks
- Pump facilities (borehole/dam).

Figure 41- UH1 helicopters filling Bambi buckets in sea for fire suppression



PART FIVE(5) ADDITIONAL GUIDELINES

PART FIVE: ADDITIONAL GUIDELINES

10. TRAINING

Training requirements and course details are summarised below (Kishugu Training and LEFPA websites).

- **Basic Firefighter**
  - All personnel involved in fighting fires are to have completed a Basic Firefighters course.
- **Initial attack teams (or fire response teams)**
  - All members must have completed a Basic Firefighters course
  - All members are to have passed a minimum physical fitness test
  - All supervisors are to have completed a Crew Leaders course.

Basic Firefighter	Crew Leader
Modules: a. Wildfire legislation b. Fire Danger Rating c. Understanding Fire d. Types of Fire e. Duties and Organization at Fires f. Safety at Fires g. Survival at Fires h. The use of hand tools for Fire Fighting i. Mopping up j. Aerial Firefighting Operations	**1.** The candidate must have completed the Basic Firefighters Course. 2.The Crew Leader's course must consist of the following modules: a. Fire Terminology b. Wildfire legislation c. Fire Behaviour d. Fire Danger Rating e. Organization at Fires f. Initial Attack Strategies and Tactics g. Fire extinguishing methods h. Aerial Firefighting Methods

Figure 42- FM training

MINIMUM REQUIREMENTS FOR TRAINED PERSONNEL PER CATEGORY

	Basic fire fighting	Crew leader / Landowner	Proto teams	Fire Boss/ Landowner	Incident Commander
Landowners	yes	yes		****	
Commercial farmers	yes	yes		yes	****
Nature conservation areas	yes	yes		yes	****
Cane growers	yes	yes		****	
Timber processors, sawmillers and charcoal plants	yes	yes	yes	yes	
Fire contractors	yes	yes	yes	yes	****
Forestry	yes	yes	yes	yes	yes
ESKOM contractors	yes	yes	yes	yes	ESKOM – ORHVS 1/2/3

**** Recommended

Kishugu Training and approved FIREWISE institutions are well equipped to facilitate fire awareness (Chapter 7.1) education for communities.

Fire investigation. Conduct a post-mortem after a fire event to establish cause, ensure that lessons are learned, and fire report is completed (Chapter 12). Forensic fire investigation involves specialised training in technical and legal aspects, however outside the scope of these guidelines.

Kishugu Training conducts incident command system (ICS, Chapter 9.3 and 9.10) training. It is important for land-user(s) to implement ICS, aligned to existing disaster management structures, and preferably by means of FPA (Chapter 7.4).

Annexure 11 recommends, amongst others, minimum number of first aid kits. Land-users must ensure that designated staff are properly trained in first aid.

Land-users must ensure that institutions training their firefighters include short practicals to make basic FM tools from locally available resources, e.g. fire beaters using tree coppice for handles, conveyor belting or rags; fire igniter utilising drip torch fuel, 5l paint tin, and wire with maize cob or monkey's tail (Xerophyta retinervis).

11. REHABILITATION

Assess burned areas for possible ecological damage soon after fire events.

Regenerate burned areas as soon as possible and erect wind/ water barriers where necessary to avoid erosion.

Ongoing management of silviculture and sawmilling plantation residue will lower risk. Sawmill and other residue sites will have the effect, once combusted, to smoulder for days and even months and when conditions are right, will flare up and have the potential to instigate catastrophic fires. It is therefore important to manage these sites responsibly and dispose of them in a way so as not to be an environmental hazard. When this plant residue leaches into rivers, it may cause over enrichment of nutrients, depletion of oxygen and all life in the water course.

Restore the natural fire regime in fire-dependent vegetation, e.g. fynbos.

Rehabilitate fire belts on steep slopes and relocate where possible.

12. MONITORING AND RECORDKEEPING

The person in control (e.g. fire boss or dispatch and control) of the fire needs to keep notes of everything that happened at the fire, e.g.:

- When reported
- When people got there
- Changes in weather or fire
- When extra people arrived
- When brought under control
- When mopping up started
- When sending people back
- When posted guards
- Things that went wrong
- Things that worked well.

Figure 43- Dispatcher keeping record

Conduct post-mortem immediately after fire event to ensure lessons are learned.

Report wildfires and controlled burns as per required format, including fire damage and causes to relevant authority. FPAs will coordinate data for rapid analysis to identify gaps in IFM implementation. Adapt IFM guidelines to address gaps.

FDI record is also simple longer-term monitoring tool to observe changes in local fire weather and climate.

13. NOTES ON PRESCRIBED BURNING

Prescribed burning is a fire protection action (Chapter 8), mostly taken in advance of the dry season to reduce fuel loads for the protection of assets and lives against wildfires and in the same time maintaining ecosystem integrity (Chapters 4.5 and 8.6).

Remote sensing technology, e.g. MODIS, AFIS and others can determine fire history (also referred to as hot spots) for SADC (Chapters 4.2 and 4.6). The fire history of a landscape, together with the spatial distribution of the fire ecology vegetation types, will assist natural resource managers with clear reasons for burning (Chapter 8.6).

Below are burning procedures applicable to fire-dependent vegetation types in SADC (Fynbosfire 2016).

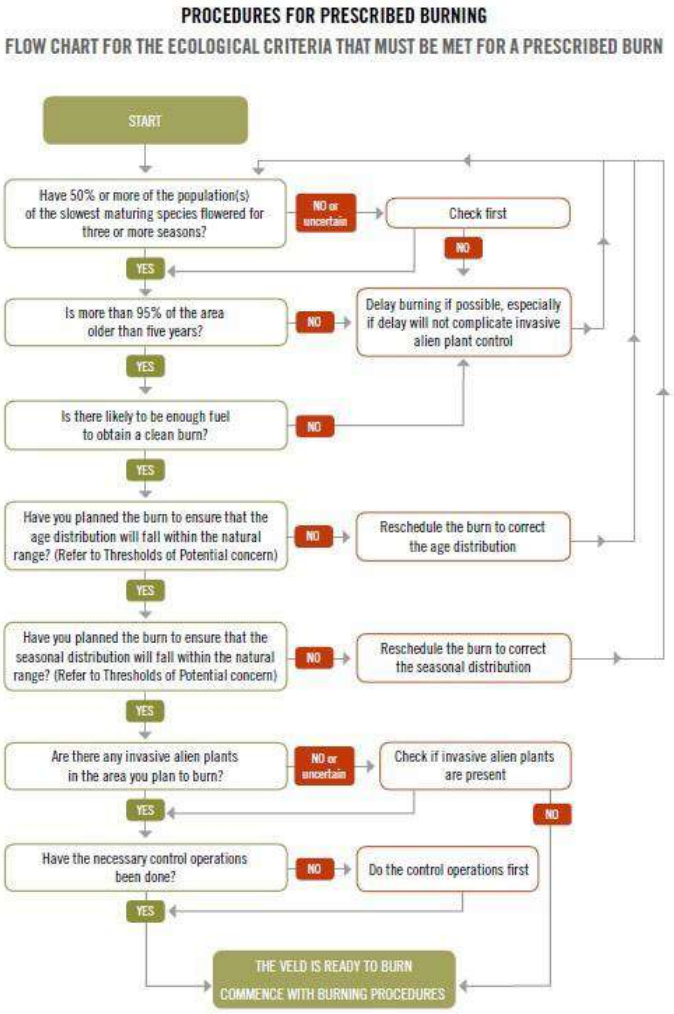


Figure 44- Procedures for prescribed burning

14. CROSS-BORDER FIRE MANAGEMENT

- **Background**

Wildfires do not respect borders. The SADC Treaty, applicable Protocols and documents agreed by Member States, as described in Chapter 4.9 and illustrated below, present the legal base for collaboration on FM.

Figure 45- Legal framework (Bocchino 2017)

- **SOP for Cross**
  - Border Fire Management in TFCAs (draft 2014). Supports cross-border FM in the following TFCAs:
  - Nyika TFCA. Zambia and Malawi
  - Greater Limpopo Transfrontier Park (GLTP). South Africa and Mozambique
  - Lubombo TFCA. South Africa and Swaziland
  - Kavango-Zambezi (KAZA) TFCA. Angola and Namibia.

- **Lesotho/South Africa**
  - Cross-border collaboration between governments is on-going
  - A joint FM plan exists between Ukhahlamba Drakensberg Park and Sehlabathebe National Park.

Figure 46- Controlled burning UDP (Holmes 2001)

- **eSwatini/South Africa/Mozambique**
  - MoU between eSw/SA governments on cross-border fires, 2011. Unfortunately, not implemented yet
  - General TFC and resource area protocol between Mozambique, South Africa and eSwatini forms overarching legal framework for 5 distinct TFCAs:
    - Songimvelo- Malolotja TFCA between South Africa and Swaziland
    - Nsubane- Pongola TFCA between South Africa and Swaziland.
    - Lubombo Conservancy- Goba TFCA between Mozambique and Swaziland
    - Usuthu-Tembe-Futhi TFCA between Mozambique, South Africa and Swaziland.
    - Ponta do Ouro- Kosi Bay TFCA between Mozambique and South Africa.
  - S-M Transfrontier CA: Draft integrated cross-border FM plan and SOP, 2018. This SOP describes the relevant Acts in the two countries, collaboration with stakeholders, procedures for fire suppression and prescribed burning, as well as the governance of the TFCCA.

- **S-M Transfrontier CA**

The figure below illustrates the practical implementation of governance in S- MTFCA as per SOP for Cross-border FM (draft 2014). It clarifies the use of Working Group, Task Group and Joint Management Committee.

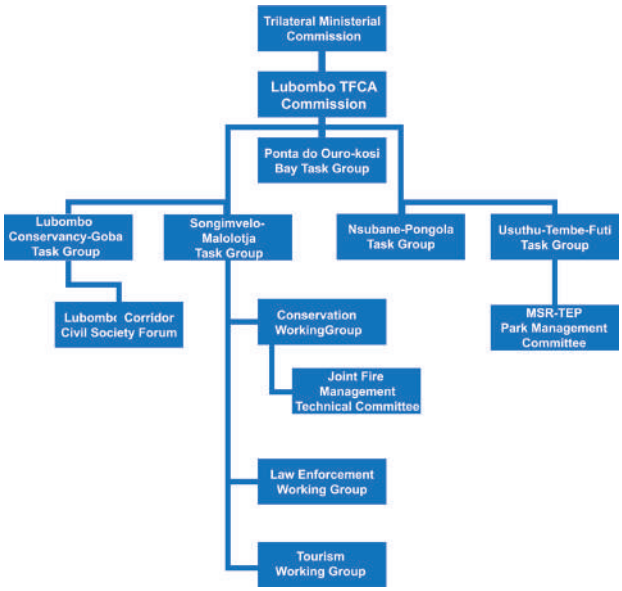


Figure 47-S -M Transfrontier CA

The above committee comprises:

- Reserve Managers
- Fire Chiefs/Official responsible for fire management
- Conservation Managers or Ecologists
- Community Outreach/Liaison Officers

- **Way forward**

The way forward for cross-border FM is to start implementation within the TFCAs. The legal base is sorted out and objectives are easy to integrate (below, Bocchino 2017).

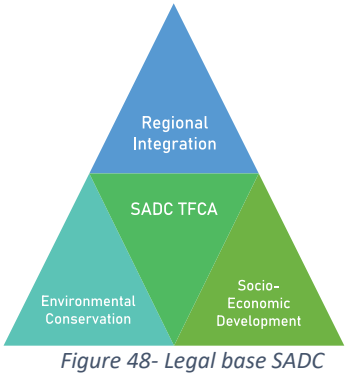


Figure 48- Legal base SADC

Establish FPAs by following the procedures described in the Chapter 7.4. Within SADC only South Africa has legislation supporting FPAs, however it is more practical to agree to implement, adapt and legalise later.

Decide on a suite of basic IFM guidelines suitable for the specific land-use(s), implement as soon as possible and adapt when necessary.

Member states should take care not to negatively alter natural fire regimes with crossborder FM activities.

15. RESEARCH

The natural landscapes and land-uses are not unique to SADC, but some IFM knowledge gaps require research (Chapter 4.10 of the situation analysis).

- Uniform fire ecology-type and land-use maps are not readily available to facilitate interpretation of fire history from remote sensing applications.

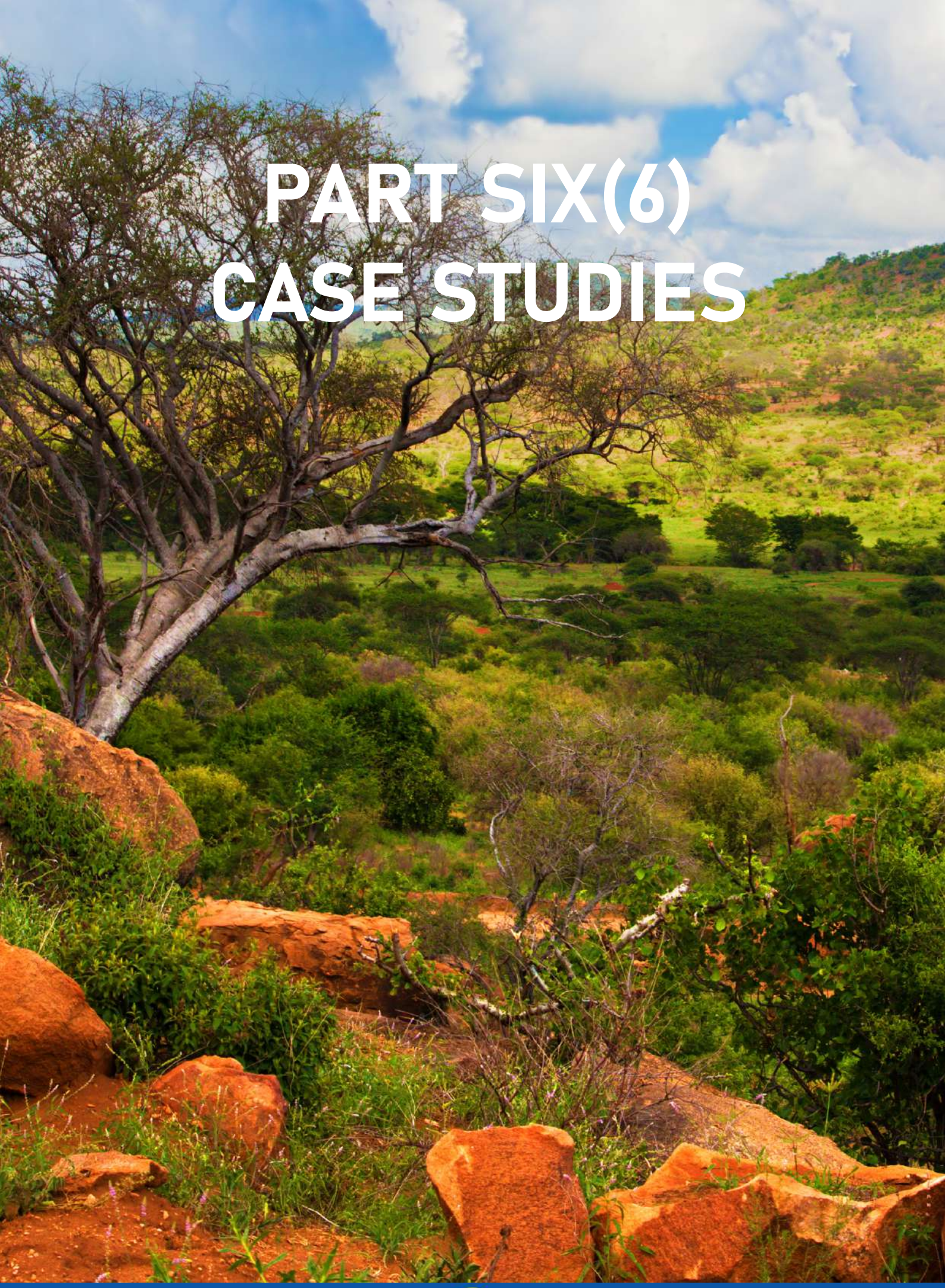
- Fire risk classification of SADC in terms of likelihood of ignition (fire ecology-type and fuel load) and consequence (economic, social and environment) will provide valuable guidance to policy makers and planners at regional, country, landscape and land-use levels.

- Researchers should utilise wildfire statistics and the national fire danger index system to identify real weather and climate change trends. This will be useful for updating fire risk maps and adapting IFM guidelines.

- Dry forests (Zambezian Woodlands) is the most extensive vegetation formation in SADC. However, to align fire management appropriately, the market demand/potential for these forest products requires better understanding.

- The fire-dependant dry forests are not properly managed in SADC. The technical management thereof and the role of fire within requires better understanding, e.g. silvicultural application.

- SADC leadership to collaborate with CSIR Meraka Institute to implement and maintain standard system of early warning and active satellite-based fire detection. Meraka is also well positioned to provide relevant information for researching the relationship between mega fire events (as in South Africa) and natural fire regime change/ fire suppression.



PART SIX(6)
CASE STUDIES

PART SIX: CASE STUDIES

16. CASE STUDIES OF FFM IN SADC

Representatives from SADC member states provided FFM case studies on the following:

Countries	Prevention	Protection	Suppression	Rehabilitation	Cross-border
1. ANGOLA		•			
2. DRC	•	•			
3. ESWATINI	•		•		•
4. LESOTHO	•	•			
5. MADAGASCAR	•				
6. MALAWI	•			•	
7. MAURITIUS		•		•	
8. MOZAMBIQUE	•				
9. SOUTH AFRICA		•			
10. TANZANIA	•		•		
11. ZIMBABWE			•		

Figure 49- SADC case studies

The published case studies are attached as Annexure 13 in separate volume.

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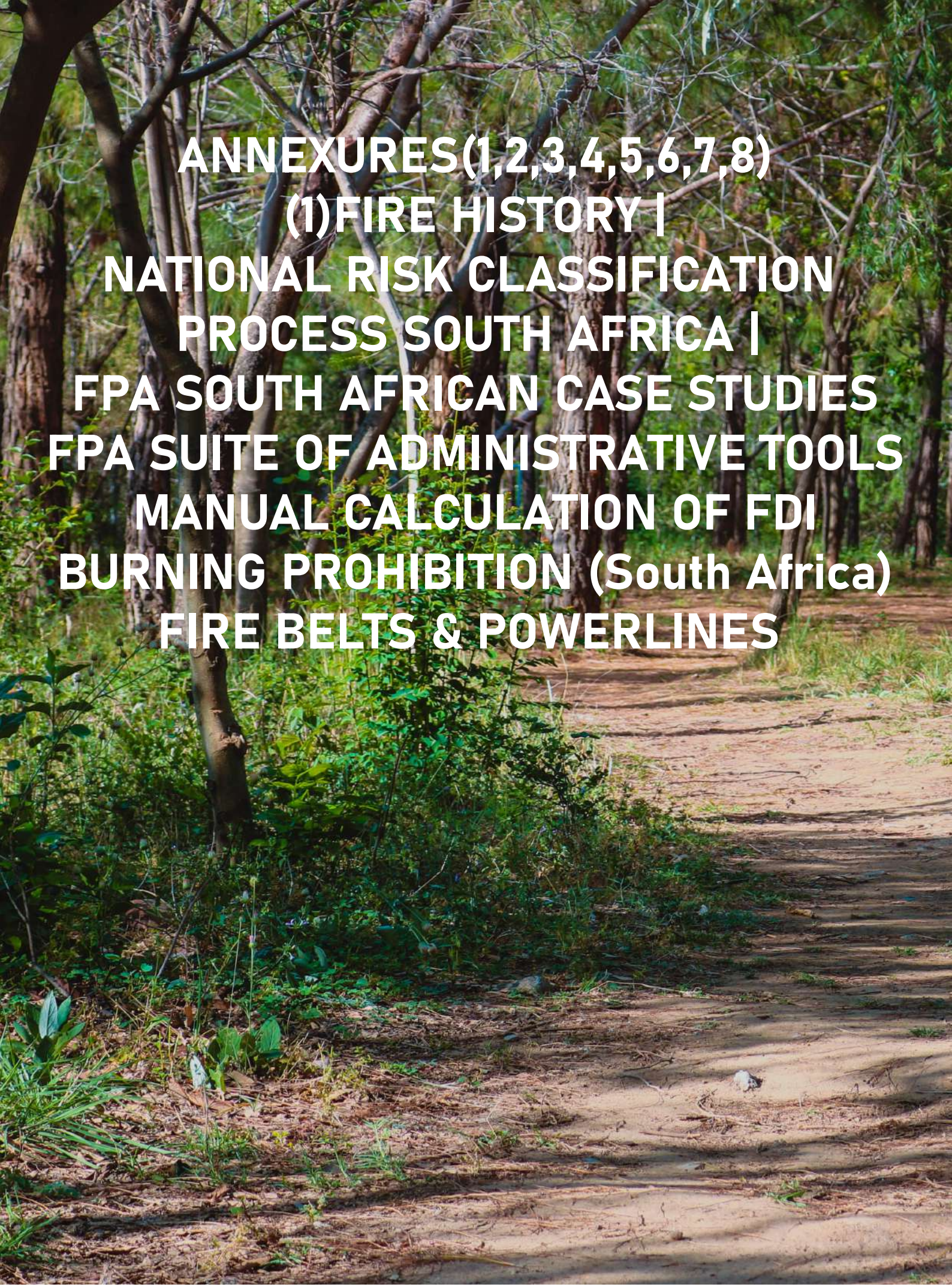


ANNEXURES(1,2,3,4,5,6,7,8)
(1)FIRE HISTORY |
NATIONAL RISK CLASSIFICATION PROCESS SOUTH AFRICA |
FPA SOUTH AFRICAN CASE STUDIES
FPA SUITE OF ADMINISTRATIVE TOOLS
MANUAL CALCULATION OF FDI
BURNING PROHIBITION (South Africa)
FIRE BELTS & POWERLINES

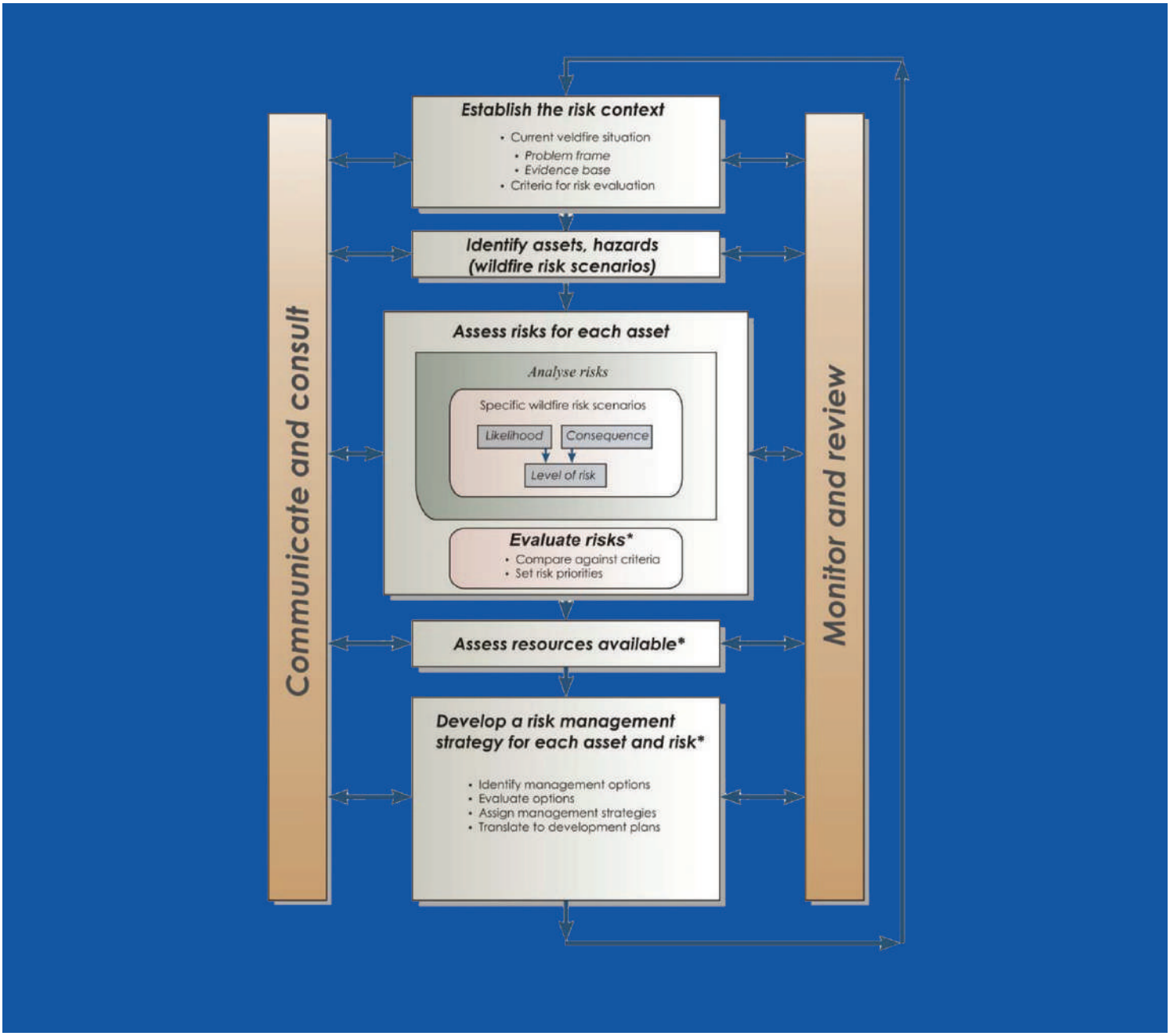
ANNEXURE 1. FIRE HISTORY

Introduction to FIREWISE Tanzania (TFS 2013)

Fire has been used in Tanzania for hundreds of years for preparing land for agricultural and pasture management purposes as well as for hunting, pest control and for various other land management reasons. Fires set by local people have contributed to the creating and maintaining of ecosystems and biodiversity across the African savanna and miombo forest ecosystem. Fire is a tool to achieve wildlife and conservation management targets. For rural people fire is a viable economical tool for the attainment of various land management objectives.

Local communities often have traditional knowledge on how to manage and prevent fire. However, the intricate balance between people, fire and the natural environment has been difficult to attain due to the changing demographics, land management practices and a breakdown in relay channels of indigenous knowledge used in natural resource management. There is growing concern over the fate of the perceived rise in the number of fires and associated negative impacts on forests and woodlands resources, and human livelihoods under the ongoing climate change.

Recent studies based on satellite image data reveal that an average of 11 million ha burn annually in Tanzania. Most of the burning occurs in the west and southern highland regions particularly Rukwa, Tabora Kigoma and Mbeya, while in the south-eastern part Lindi region is mostly affected by fire. The land cover types most affected are woodland and shrub land comprising of about 70 % of Tanzania's average annual burned area or 6.8 million ha. Most burning occurs in protected areas, with an annual average of 3.7 million ha in forest reserves, 3.3 million ha in Game Reserves and 1.46 million ha in National Parks, totalling close to 8.5 million ha or 77 % of the annual average burned area of Tanzania.



Likelihood rating	Indicative frequency	Description
Almost certain	once in 2 years	Is expected to occur
Likely	once in 5 years	Will probably occur
Possible	once in 10 years	Might occur at some time; as likely as not
Unlikely	once in 20 years	Could occur at some time
Rare	once in 100 years	May only occur in exceptional circumstances

Level of consequence		Consequence end points		
		Social consequence criteria	Economic consequence criteria	Environmental and ecological consequence criteria
1	Catastrophic	Death of one or more persons in the scenario	Depressed economy of the Municipality. Extensive and widespread loss of assets. Major impact across a large part of the community. Long-term external assistance required to recover.	Permanent loss of species or habitats within the area or of water catchment values and other ecosystem services (and not assessed as an economic consequence).
2	Major	Extensive injuries to people in the scenario, requiring emergency hospitalisation and affecting work capacity; or, 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 and other ecosystem services (and not assessed as an economic consequence), requiring many years to recover.
3	Moderate	Medical treatment required but full recovery possible.	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

Social assets

We used life and health as measures of social assets, i.e. we simply took the exposure of people to the hazard of veldfires as the endpoint measure. However, we assumed social vulnerability to be a function of the proportion of people living below the mean living level. This measure correlates strongly with the distribution of dispersed rural settlements.

There is general concern about the vulnerability of communities at the urban-rural interface.

Economic assets

We identified economic assets that are vulnerable to veldfires from the available reports for damaging wildfires. We used information from fire reports on losses in fires as well as the map of agro-forestry gross value added to guide the assessment of economic consequences of specific-risk scenarios.

These assets included infrastructure (such as power lines), industrial facilities (e.g. sawmills), fodder, livestock, homesteads, resorts, and plantation forests. We excluded dryland crops, such as maize, since these seldom suffer loss. In addition, certain harvestable natural resources, such as thatch-grass stocks, are lost in fire, to the detriment of local communities. These resources now are largely confined to protected areas and commercial farms; we provide for this in the specific risk scenarios where appropriate.

Environmental assets

Most, if not all, ecosystems in areas of fire risk are resilient to veldfire, being fire-dependent or fire-independent. Thus, in most cases, we did not rate ecosystems as vulnerable to veldfires. This applies even where the conservation status of ecosystems has been rated in biodiversity assessments as being vulnerable to factors other than fire.

Environmental values are vulnerable where fires occur in forest plantations. This is the case where intense blowup fires occur in plantations with high ground fuel loadings, or where there are heavy ground fuels of slash after clear-felling. In such circumstances, the fire will often destroy the structure of the surface soil horizon, causing accelerated erosion, and consequent loss of soil and catchment values. We take account of this in the fire risk scenarios and the risk assessments attached to these.

ANNEXURE 3. FPA SOUTH AFRICAN CASE STUDIES

- The Lowveld and Escarpment FPA (LEFPA), registered in 2004 in terms of the National Veld and Forest Fire Act, is one of the more established FPAs in South Africa. LEFPA has about 600 members, with combined land holdings of about 980 000 hectares in a total area of 1.8 million ha. All the large corporate growers as well as commercial farmers, municipalities, and the Mpumalanga Tourism and Parks Board are members.

  The forestry companies play a leading role in LEFPA, contributing the bulk of the funding and strategic management input. They also represent 46% of the landholdings under LEFPA. To protect the interests and investment of larger landowners, the FPA has categorised membership into four categories namely forestry industry, agriculture, conservation, and municipal/residential. Each group is afforded votes on the Governance Body. In this way, the FPA has been able to ensure the larger landowners, representing the bulk of hectares under the FPA, are not outvoted by smaller members' interests. As forestry represents the largest landholdings, it has two votes and each of the other categories has one vote.

- The Greater Overberg FPA (GOFPA), established in 2014 has a few hundred members. Most of the members are farmers. It has organised these members into geographically defined Fire Management Units. These are largely aligned with municipal areas. Each FMU has a representative and vote on the FPA Governing Body to ensure each unit has equal say in all decisions.

ANNEXURE 4. FPA SUITE OF ADMINISTRATIVE TOOLS

4a. FPA proforma constitution

[NAME] FIRE PROTECTION ASSOCIATION CONSTITUTION [DATE]

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1. Name of the Association

- The name of the Association is: [NAME] FIRE PROTECTION ASSOCIATION herein referred to as "the Association".
- The Association will henceforth trade under the following name: [NAME] FIRE PROTECTION ASSOCIATION
- Upon approval by the department responsible for the administration of the National Veld and Forest Fire Act, the name of the Association will change to [NAME] Fire Protection Association;
- The shortened name will be "[FPA]".

2. Body Corporate

- The Association shall exist in its own right, separately from its members, and will continue to exist even if membership or office bearers are amended.
- The Association will be able to own property, capital or other assets, and will be able to sue and be sued in its own name.

3. Area of the Association

- The domain of the Association falls principally within the [NAME] District Municipal boundaries.
- The general boundaries of the Association are described in Annexure A.
- The land use in the domain includes rural commercialised agricultural properties (commercialised and non-commercialised), rural communally owned properties, large mountainous conservation areas managed by conservation authorities and by private land owners, urban areas managed by local authorities, and other state land managed by various government departments.
- The Association is divided into Management Units, according to geographical areas.

4. The Address of the Association

- The postal address of the Association is: [NAME] Fire Protection Association [POSTAL ADDRESS]
- The physical address of the Association is: [PHYSICAL ADDRESS]
- The electronic correspondence address of the Association is: [EMAIL ADDRESS]

5. Application of the Act to this Constitution

- This constitution must adhere to Chapter 2 of the National Veld and Forest Fire Act (No.101 of 1998) (the Act) and the regulations promulgated thereto.

6. The Objectives of the Association

- The primary objective of the Association is to provide a community driven Integrated Fire Management service to members of the Association; and
- The secondary objectives of the Association are to: i.Predict, prevent and assist with wildfires, where possible; ii.Assist members to comply with the Act, the regulations made in terms of the Act, this constitution and rules, iii.Improve the knowledge base for the implementation of Integrated Fire Management strategies; iv. Improve awareness on Integrated Fire Management and prevention; and v. Reduce fire risk associated with the occurrence of wildfires by devising Integrated Fire Management plans.

7. Duties and Functions of the Association

- The duties and functions of the Association are to:

  Develop and implement a veldfire management strategy for the area; Make rules that will bind members; Regularly communicate the fire danger rating referred to in sections 9 and 10 of the Act to its members; Organise and train its members in firefighting, management and prevention; The boundary of the FPA should correspond with local or district municipal boundaries Inform its members of equipment and technology available for preventing and fighting veldfires; Annually provide the Minister with statistics about veldfires within the Association; Provide any information requested by the Minister in order to prepare or maintain the fire danger rating system; Assist members to prepare applications for exemption from the duty to prepare and maintain firebreaks in terms of Section 15 of the Act; Carry out the powers and duties passed on to it by the Minister; Appoint personnel to ensure compliance to the Act and to improve management capacity within the Association; Provide firefighting resources to members at a fee, when available; When possible, provide technical support and information to members. This would include instances where insurance claims are being investigated; and Where appropriate, conclude agreements with adjoining Fire Protection Associations relating to matters of common interest and collaboration.

8. Membership

- All landowners as defined by the Act and within the domain of the Association can become members.

- All landowners, lessees, state entities, municipalities, or communities, are members provided that: they have applied for membership and completed and submitted membership application forms; and they have paid their membership fees. The membership of any existing member will automatically lapse if they are in arrears with the payment of their membership fees.

- If any member of the Board (EC) objects to any applicant's admission as a member or any member's continued membership, the Board must, within fourteen (14) days: i.give the applicant or member written reasons for the objection; ii. consider application at the next Board meeting; and iii. notify the applicant or member of the date, time and place of the meeting.

- The applicant or member has the right: i.to speak at the meeting and argue for admission or continued membership; and ii. to make a complaint to the Minister if not satisfied with the Board's decision.

9. Membership Database and Communication

- Every new member must provide the FPA General Manager and the Manager of the Fire Management Unit within which their property is located with a fully completed and signed application form in order to ensure that the correct information is available for the database.

- Every member must inform the FPA General Manager and the Manager of the Fire Management Unit within which their property is located of any change of address, telephone number, e-mail address or transfer of property, within two weeks.

- The FPA General Manager or any other designated employee must keep all the details referred to in sub-paragraphs (1) and (2), and other relevant information, in a Register of Members.

10. Responsibilities of Members

- embers of the Association are responsible to:
  follow this constitution, the rules of the Association and the rules of the Fire Management Unit in which their property is located; dhere to guidelines and management practices that may be determined by the Association; commit themselves to the implementation of a fire management plan where such plans exist; pay any fees and charges as set by the Association from time to time; actively involve and participate in activities and capacity building programmes offered by the Association; and comply with the requirements of the National Veld and Forest Fire Act, particularly in relation to the establishment of firebreaks, the reduction of fuel loads, the retention of firefighting equipment and staff, and preventing the starting of fires on their land or the spread to adjoining land.

11. Termination of Membership

- A member may terminate his or her membership by written notice to the FPA General Manager, or when selling the property.
- If a member terminates membership, he or she gives up all fees and charges already paid, and remains liable for any outstanding monies to the Association.
- Membership is automatically terminated if a member does not pay his/her membership fees within three months after the start of the financial year of the FPA and receipt of invoice.
- A person whose membership has automatically terminated due to non-payment of membership fees, who subsequently seeks to reinstate their membership, will be required to again pay the once-off joining fee.
- The property of a member who dies will still be protected under this Constitution if: i.on his or her death, the fees, charges and interest are fully paid; or ii. his or her successor-in-title applies for registration.
- The association may terminate membership of any member who fails to comply with the rules after receiving a notice of failure to comply with an agreed rectification plan from the Fire Protection Officer.

12. Income and Assets

- The Association will keep a record of all assets and procurements and will not give or donate any funds or property to its members or office bearers, except if such person or office bearer has been in service of the Association and is paid in accordance with such duties. A member may only be reimbursed for any expenses if he/she has paid for such expenses in line with his/her duties.
- Members or office bearers will have no vested rights over any assets belonging to the Association.

13. Fees, Charges and Interest

- The Board will annually determine and, at the Annual General Meeting, approve a budget for the forthcoming year.
- The Board will from time to time:
  i.determine fees and charges for membership and services that are necessary for the proper management of the Association; and ii.charge interest on unpaid fees that will be calculated according to rates of financial institutions applicable at that time.
- The fees of the Association are:
  i.a once off joining fee, in an amount determined at an Annual General Meeting, regardless of the size of the land; =annual fees based on a rate determined at the last Annual General Meeting; any other fee that may be charged for any other services and resources provided by the Association; and any annual or once-off levy imposed by the Fire Management Unit.
- Annual membership fees must be paid within 90 days of the start of the financial year.
- If membership fees are not paid timeously, membership will automatically lapse, and a lapsed member will be required to again pay the joining fee in order to restore membership.
- If a member should die, their successor-in-title shall not be liable for the payment of the onceoff joining fees, provided that the membership of the deceased has not lapsed.
- Any increase in registration and membership fees must: be approved at an Annual General Meeting by the majority of voting members present; or if not done at an Annual General Meeting, be approved by the majority of voting members present at a special general meeting called for that purpose.
- Notwithstanding the above, provided that they meet the total membership fee contribution budgeted by the Board for the members of a Fire Management Unit, members of that Fire Management Unit may determine an alternative fee structure for their members.
- Any annual or once-off levy relating to a Fire Management Unit must: be decided by the majority of members of that Fire Management Unit present at a meeting called for that purpose and approved at the Annual General Meeting, or at a special general meeting called for that purpose; and The basis of fee calculation must be included in the proposal that is put forward at an Annual General Meeting.
- All levies must be paid directly to the Association unless otherwise agreed between the Association and the majority of the members of a Fire Management Unit.

14. Liability of Members

- Members are not individually liable for any debts or duties owed by the Association.
- Members are liable for unpaid fees and charges and interest thereon.

15. The Structure of the Association

- The Association will consist of the following bodies:
  - The Board
  - The Advisory Forum
  - The Management Oversight Committee
  - The Management Team v. Fire Management Units

- The Board of the Association

i.The Board of the Association will -

- Be responsible for the governance of the Association.
- In consultation with the Advisory Forum of the Association:
  - set policy for the Association; and b)determines the strategic direction of the Association and make decisions relating to it.
- Appoint any staff of the Association.
- Guide, oversee and assist the FPA General Manager in performing their day to day management functions. This includes, but is not restricted to, communication with key role players and members.
- Compile special reports, documents and policies.
- Procure the items needed for effective management of the Association.
- Represent the Association on other committees or meetings as needed from time to time.
- Prepare and sign off annual financial documents after membership approval.
- From time to time assign responsibilities and specific tasks to a member, employee, a person or an institution. This will include a committee that determines staff remuneration packages. ii. The Board of the Association will consist of the following:

- **As full members:**
  - **By virtue of their office:**

i)The Chief Fire Officer of the District Municipality; ii) The Fire Advisor employed by the Department of Agriculture responsible for the district;

- **By virtue of their land ownership:**

i) One representative from a nature conservancy; ii) One person collectively representing the Government Department, Local Authority and other Organ of State that manages land within the boundaries of the Association; iii) One private landowner from each Fire Management Unit:

1) such private land owner to be nominated by the members of that Fire Management Unit at the AGM;
2) in the event of such private landowner not being nominated or subsequently vacating office, a landowner from that fire management unit may be co-opted by the Board.

- **As associate members:**
  - any other member that has been co-opted for a specific input or task; and b)any service provider engaged within the Working on Fire programme.
  - An associate member does not have voting rights on the Board, but can provide input to the issue in hand; and
  - A person in the employment of the Association may not be elected to the Board.
    iii. The Board will be convened as follows:
    1)At the AGM, the members will elect a person who is a member of the Board by virtue of their landownership to serve as the Chairperson,
  - The members of the Board, including the Chairperson, are elected for a period of two (2) years, but may stand for re-election at the end of that period. The membership of the Board will be staggered so to ensure continuity with 50% being appointed each year; and
  - If any Board member resigns, dies, becomes incapacitated or disqualified, or is removed from office, the Board will appoint a suitable candidate to serve on the Board for the remaining period until the next Annual General Meeting.
  - A member of the Board becomes disqualified if he or she: a)is declared to be of unsound mind by a court of law; b)is convicted of a crime involving fraud or corruption. Any member serving a suspended sentence may not serve on the Board; and c)has been absent without a valid reason from two consecutive Board meetings. iv.Between Annual General Meetings the Board will seek to discharge its business at meetings convened to take place immediately after the meeting of the District Fire Working Group, or every four months, whichever occurs sooner; and v.A minimum of five (5) Board members, which includes the Chief Fire Officer, present at a meeting will constitute a quorum.

- **The Advisory Forum of the Association**

The [NAME] District Fire Working Group convened by the Chief Fire Officer of the District will serve as the Advisory Forum of the Association. The Advisory Forum of the Association will: 1)give strategic guidance to the Association; and 2)help integrate the fire management efforts of the Association into other fire management initiatives within the district.

- **The Management Oversight Committee:**

The function of the Management Oversight Committee is to oversee the day to day function of the affairs of the Association between Board meetings; The Chairperson of the Board and the Fire Protection Officer will form the management oversight committee; and iii.The Management Oversight Committee will meet monthly with the FPA Manager.

- **The Management Team:**

  The Board may employ any person it considers necessary to help the Association to carry out its function, including an FPA manager; and ii. All employees remain in employment notwithstanding any change in the Board.

- **Fire Management Units:**

  A Fire Management Unit of the Association:
  consists of a localised area, in which integrated fire management efforts between individual landowners can be most effectively coordinated, existing FPA's becoming part of the Association will generally become a single Fire Management Unit; may in turn be divided into small fire management areas based on logistical fire management requirements; gives guidance to the Association on Integrated Fire Management in the area covered by the FMU; is to hold bi-annual meetings for the purpose of pre-fire season planning and post-fire season feedback; and may require that the Association ring-fences assets provided and funds raised by the fire management unit as being for the benefit of that Fire Management Unit.

  The area of the individual Fire Management Units will be determined annually by the majority of the members at the Annual General Meeting.

16. Finances

- The financial year of the Association starts on 1 April and ends on 31 March of the following year.
- The Association will appoint a suitably qualified person and/or institution to be responsible for the financial administration of the Association.
- The person and/or institution must present a financial statement of the Association's accounts for the previous financial year, including full details of income, expenditure and assets.
- The financial statement must be available within reason for inspection by any member for a period of three (3) weeks (21 days) from the date of the annual general meeting.
- All financial year-end documents must be signed off by the Board.
- The Association will operate as a voluntary association in terms of the common law, unless the National Veld and Forest Fire Act is amended to provide for a non-profit Company and the members then decide to change the nature of the entity.
- The Association will further operate as a non-profit organisation.
- A bank account and, if necessary, petrol and debit/credit cards will be opened at an accredited financial institution as decided by the Board.
- The year-end financial statements must be signed off by the board.

17. Annual General Meeting

- An annual general meeting must be called by the Board within sixty (60) days of the end of the financial year, and ii. with fourteen (14) days of written or emailed notice to all members.
- In addition to any other business, the annual general meeting must include: the annual report presented by the FPA General Manager or the Chairperson of the Association; presentation of the financial statements of the Association by the accounting officer; the Fire Protection Officer's report; the introduction and approval of any increase of fees, charges or interest; changes to the constitution, business plan and rules; and additional agenda points that have been submitted to the FPA General Manager at least seven

(7) days prior to the meeting.

- Each Fire Management Unit will be entitled to delegate one voting member to attend and vote at the Annual General Meeting. Such voting member will be determined by simple majority of the paid-up members of that Fire Management Unit.
- One (1) voting member from each of fifty percent (50%) of the Fire Management Units is needed to form a quorum.
- If a quorum is not reached, the meeting is adjourned and after ten (10) minutes may be reconvened where the voting members present will constitute a quorum.
- Discussion at the meeting will be limited to the circulated and notified agenda.
- Only those voting members whose registration and membership fees are fully paid up have a right to vote, subject to the number of votes described in Section 19

18. Special General Meeting

- The Board may convene a special general meeting at any time giving fourteen (14) days' notice stating the reason for the meeting and providing an agenda.
- A special general meeting must be convened by the Board if thirty (30) or five percent (5%), whichever be the lesser, of the paid-up members request this meeting in writing and name the issues to be dealt with.

- Each Fire Management Unit will be entitled to delegate one voting member to attend and vote at the Special General Meeting.
- The voting members present will constitute a quorum.
- Discussion at the meeting will be limited to the circulated and notified agenda.

19. Voting

- Only members qualifying for membership in terms of section 17 (f) may vote on the delegate to represent the relevant Fire Management Unit at an Annual or Special General Meeting.
- A member, voting member or Board member may vote for other members by means of a written and signed proxy.

20. Dissolution

- The Association may be dissolved
  i.by a resolution passed at an Annual General Meeting or a Special General Meeting called for that purpose; and /or ii.by its deregistration by the Minister under section 8 of the National Veld and Forest Fire Act (No. 101 of 1998).
- After confirmation of the dissolution and at that meeting, the members must pass a resolution for the appointment of a liquidator to dispose of the Association's assets, pay its debts and settle its liabilities.
- Any net proceeds from the assets of the Association will be paid over by the liquidator to a nonprofit organisation with basically the same objectives as the Association.

21. Dispute resolution

- In the event of a dispute between members regarding operational matters, members must negotiate to resolve the dispute.
- If such negotiations fail, any member may approach the Management Oversight Committee, who shall appoint an independent arbitrator of good standing to resolve the dispute and whose decision shall be final. Any costs incurred shall be borne by the parties to the dispute.
- In the event of a dispute between members of the Association and Board and/or Management Oversight Committee, then the process in preceding sub-paragraph should be followed with the exception that the appointment of the arbitrator shall be by the Chairperson of the Association and the member's party to the dispute by consensus.

22. Declaration

This constitution was adopted as the constitution of the [NAME] FPA at the general meeting held on the

……

(List of members that attended are attached as annexure A)

Signatures

Chairman…… Date ……

Secretary …… Date ……

4b. FPA rules

FIRE PROTECTION ASSOCIATION

RULES
(INCLUDING CODE OF CONDUCT)

FIRE PROTECTION ASSOCIATION RULES

Contents

FIRE PROTECTION ASSOCIATION RULES

(Where rules concern the FPO, he/she is responsible for overseeing the implementation thereof and/or he/she can delegate these duties to a capable person in each management unit)

1.Membership

- All members must undertake to abide by the Rules and Code of Conduct (Annexure A) of the FPA as stipulated in Chapter 2 section 4(6) of the National Veld & Forest Fire Act (No. 101 of 1998).
- All members must be conversant with and abide by the Constitution of the FPA as drafted in terms of the regulations under the National Veld and Forest Fire Act (No. 101 of 1998), which sets out the functions of the Association.
- Any landowner applying for membership must complete the "Proforma Membership Application" form, otherwise the application will not be accepted.
- It is the responsibility of members to notify the Secretary of the Association in writing of any change of membership details according to Section 8 of the Constitution, including change of ownership.
- Members must pay the membership fee as set by the FPA every year before 31 July.
- Membership is automatically terminated if a member does not pay the membership fees, charges or interest within 90 days.
- In order to terminate membership, members are required to give written notice of termination of membership.
- New membership annual fees will be charged pro rata

2. General

- All members must comply with the National Veld and Forest Fire Act (No. 101 of 1998) and strive to comply with the Conservation of Agricultural Resources Act (No. 43 of 1983) in terms of alien vegetation clearing.
- All members must be conversant with the overall Business Plan, including the Veldfire Management Strategy for the FPA and other Acts and by-laws as mentioned in the Business Plan.
- Members must attend the Annual General Meeting (AGM) to elect office bearers and decide on any amendments to the Business Plan and fee structure.

3. Specific fire hazard area protection

- Members are responsible to isolate any fire hazardous area that is present or likely to develop on their property to eliminate any danger it may create to themselves or adjoining properties.
- Where members are in doubt regarding the danger of a specific area they must contact the FPO for advice.

4. Housekeeping

- It is the responsibility of every member to ensure that the buildings on their property are protected and made safe against the danger of fires. (Examples of remedies are to create firebreaks and clean areas around properties and orchards, clean gutters, sprinklers on thatched roofs, etc.)

5. Fire Management Plan/Hazard assessment

- An Integrated Veldfire Management Plan (for a 5-year timeframe) must be submitted for each management unit, to the Executive Committee and FPO for approval, within a year after the registration of the FPA. Also see Section 9. This 5year plan will include an annual plan of operation.
- Members must carry out an annual Fire Hazard Audit in conjunction with the relevant representative member of the Executive Committee during February or March and prepare an action plan where this affects their property.

6. Compliance with Fire Danger Rating (FDR) System

- Forecasts of the fire danger rating will be communicated to members on a daily basis
- Members must be conversant with the daily fire danger rating system and comply with the instruction (pertaining to the danger ratings, e.g. fires in the open air, standby levels, etc.),

enforce and apply prescribed actions and restrictions strictly. See Standard Fire Rating requirements.

7. Designated fireplaces

Must be at a site or permanent constructed fireplace surrounded by ground that is clear of all combustible matter for a distance of at least 2 meters. Fires may not be left unattended until entirely extinguished.

8. Firebreaks

- All members are responsible for the creation of firebreaks and must comply with the prescriptions for firebreaks in the approved Integrated Veldfire Management Plan for each management unit.
- Firebreaks must be prepared and maintained on an annual basis as from January and must be completed by no later than the end of March.
- Members must comply with the National Policy applicable to exemptions.
- Firebreaks may be prepared by any method but must avoid negative environmental impacts as far as possible.

9. Prescribed burning

- Members must comply with the prescribed burning program where it applies to their property and the program must be updated annually during November.
- Members intending to conduct a prescribed block burn must obtain a burning permit from the relevant authorities delegated by the Fire Protection Association to conduct the burn.
- Members must observe all conditions of their burning permit.

10.Minimum firefighting requirements

- All members must comply with Chapter 5 of the National Veld and Forest Fire Act (No. 101 of 1998) by having equipment, protective clothing and trained personnel as is reasonable for the extent of the member's property. Adhere to minimum requirements for firefighting.
- Before approval of the Integrated Veldfire Management Plan as stipulated in Section 5.1, the representative Executive Committee member and the FPO must evaluate all the properties within the management unit and will check compliance with the minimum firefighting requirements as per Section 10.1.
- Current members of the FPA with firefighting capabilities may assist other members as the Mutual Aid Agreement.
- All members must ensure that, in their absence, there is a responsible person present on or near the property that will assist in extinguishing fires and take reasonable steps to alert the FPO and neighbouring landowners when the Fire Danger Rating is high.

11. Training

- Members and/or their staff performing firefighting must be trained in basic firefighting by a FIETA/SETA accredited training institution.
- All persons fighting fires must have the minimum safety equipment and protective clothing that is required for firefighting.
- The FPA will have the following responsibilities with regards to training: Schedule courses for members and persons in charge of fires or firefighters; Schedule refresher training on a regular basis for trained members and staff; Schedule training for new members and their staff; Ensure that training is conducted on an acceptable level; and Organise field days for members, staff and firefighters for additional training.
- Member has the following responsibilities regarding training: Make persons available for scheduled courses; Carry the cost of refresher training if funding could not be secured; Keep a register of all trained persons in their service, which include name, ID, type of course, training institution, and copy of certificates.

12. Reporting Fires

- Members must report all fires immediately after being sighted to their neighbours and the FPA / FPO.
- The landowner on whose property the fire started must fight the fire. Members must help wherever practically possible. This assistance may be charged at a prescribed tariff determined annually by FPA.
- Members must be aware of the weather conditions and other circumstances regarding the spread of the fire and to take adequate precautions and actions during a fire situation.
- The FPA / FPO will follow the fire reporting structure as described by the fire management plan for different management unit.

13. Operational response and management / incident command

- Members must adhere to the firefighting command structure as per the Business Plan and be conversant with the chain of command and communication procedures for the management unit.
- Members must be aware that the FPO may assume command upon arrival.
- Members must verbally hand over the incident to the FPO and inform him/her of any specific danger areas.

14. Fire access

- Members must ensure that access routes for firefighting are reasonably maintained.
- Members must understand that in the absence of any access, fences will be damaged to gain access to the fire. Repairs to the fences will be for the account of the landowner on whose property the fire is burning.

15. Post fire actions

- The following Mopping-up Rules to apply:
  The scene of the fire may not be left unattended. The perimeter must be patrolled and any smouldering material within 5m of the perimeter of the fire extinguished.Patrolling is especially necessary where underground fires may have occurred e.g. in dense litter or marshy ground. The fire line should be patrolled for at least two days or until a qualified Fire Boss declare the area safe.

- All fires must be reported to the Fire Protection Officer on the standard Fire Report form with an accurate to-scale map. The FPO must send this to DAFF and the FPO who must keep statistics of all fires in the FPA.

- Areas exposed by fire, which have the potential for erosion, must be identified for future action.

- All firefighting equipment must be checked and serviced after each fire.

- The FPO must conduct a debriefing session to evaluate the firefighting action in all major fires. Members should make every effort to attend post mortems of fires that they were involved in or were threatened by.

16. Statistics

- Each management unit must supply fire statistics to the FPO including a fire report or where assistance was rendered at a fire, to ensure adequate record.

- The FPO must update the statistics and forward it to the Secretary for annual submission to the Minister.

- Members must hand in the prescribed fire reports within 5 days after a fire has been brought under control.

17. Fire Debrief

- The FPO will conduct a fire debrief when necessary to discuss the actions during the fire especially where the fire spread across properties.

18. Mutual aid agreement

- Where appropriate, each management unit members shall draw up formal agreements with neighbours within the unit regarding mutual assistance and procedures.

19. Communications

Radio and telecommunication standards:

- Members must ensure that some form of communication is achieved with their staff and other members
  .
- Member contact details must be given to all members and the FPO in order to communicate with each other.
- Spare radios may be handed to members at the fire scene for the FPO to communicate with them during a fire situation.

20. Invasive Alien Plant Clearing

- The coordinated removal of invasive alien plants is of importance to reduce combustible fuel and to improve biodiversity.

- Fire Management Units must compile a map of the status of invaded areas.

- Landowners must endeavour to secure funds to clear areas according to a priority plan.

- The use of biological control should also be considered for the eradication of invading aliens

21. Enforcement

- The following will be the enforcement officers regarding provisions under the National Veld and Forest Fire Act (No. 101 of 1998), by-laws affecting fires, and the rules of the FPA as applied within the area of the FPA: The Fire Protection Officer; The Chief Fire Officer and members of the Fire Service; Forest Officers of the Department of Agriculture, Forestry and Fisheries; and Members of the South African Police Service.

Item	Quantity	Monthly Cost	Annual Total	Budget Total (ideal)	Budget total (min)
Staff				R 888 000	R 252 000
Manager	12	15 000	180 000		180 000
Area manager	12	10 000	120 000		
Area manager	12	10 000	120 000		
Area manager	12	10 000	120 000		
Administrator/GIS	12	6 000	72 000		72 000
Administrator	12	8 000	96 000		
Operational and Communication support	12	15 000	180 000		
Administration				77 000	22 000
Postage	1	1 000	1 000		
Telecommunications (manager)	12	1 500	18 000		18 000
Telecommunications (3 x area managers)	12	3 000	36 000		
Office	12	500	6 000		
Catering budget	6	1 000	6 000		
Stationary	12	500	6 000		500
Audit fee	1	3 000	3 000		3 000
Banking Charges	1	1 000	1 000		500
Marketing				16 000	6 000
Advertising	1	10 000	10 000		
Website	12	500	6 000		6 000
Transport & Logistics				108 000	36 000
Fuel, and S&T	12	3 000	36 000		36 000
Fuel, and S&T	24	3 000	72 000		

Vehicle	0	10 000	0		
Training				80 000	20 000
Training of members	1	80 000	80 000		20 000
Fire Management Plan					20 000
Development of Fire Management Plan	1	100 000	100 000		20 000
Other Commitments				11 000	10 000
UFPA	1	10 000	10 000		10 000
Insurance	1	1 000	1 000		
Total Expenditure				R 1 180 000	R 366 000

LEFPA has tiers of fees according to the type of protection required - most members are basic members.

Membership Tier	Benefits	Fee
Basic Members	Access to the Working on Fire Teams. No access to any Aerial Resources. Discounted rates on training.	Per hectare rate with basic minimum fee.
Aircrafts	First-call status on Spotters and Helicopters (Will also have second-call on fixed wings).	A higher per hectare rate and minimum fee.
Fixed Wing - Second call	Second call on fixed wing bombers (available to Hellicopter members).	An even higher per hectare rate.
Fixed Wing	First-call status on Bombers as well as Helicopters	A per hectare rate with a minimum fee.

SCFPA has a flat rate for different categories of landholdings under a certain amount of hec- tares, and then a per hectare rate for private landowners, scaled flat rates for commercial and gated estates, and a flat rate for government as detailed below.

PRIVATE LANDOWNERS		GATED ESTATES	COMMERCIAL LANDOWNERS- FORESTRY/ TOURISM/ INDUSTRY	GOVERNMENT/ CONSERVATION
<25 ha	Min flat fee	size, which is a lot higher than private or commercial.	Scaled flat rate between private and gated based on size of land holdings.	Flat rate regardless of size.
25-50 ha	Min flat fee			
50-100 ha	Min flat fee			
100-300 ha	Higher flat fee			
300-500 ha	Per hectare rate			
500-1000 ha	Per hectare rate			
1000-2000 ha	per hectare rate			
>2025 ha	Per hectare rate			
SOE land	Per hectare rate			
SOE servitude	Per hectare rate			

Fire Prevention
Ensure a Fire Protection Officer (**FPO)** is appointed and in office.
To ensure landowners are **educated about forest and rural fire prevention**.
Communicate to landowners & the public regarding veldfire management – educate landowners about forest and rural fire prevention i.e. fuel load reduction and necessity of fire breaks.
Liaise & Coordinate action/s with the District Municipality and or Provincial Disaster Management Centre
Exercise the **powers and perform the duties** delegated to it by the Minister.
Communicate the Fire Danger Index to its members
Ensure minimum firefighting **equipment and personnel standards** are met or exceeded while not compromising operational efficiency or effectiveness

Assist its members where court cases arise, by providing **expert witness, and statistical and weather information**
Provide **equipment, personnel and training standards,** where the fires services have not provided these
Fire Protection
Strategic policy & planning: develop a veldfire management strategy, including contributions to local disaster management plans
Coordination functions: co-ordination of equipment and other resources between individual FPAs
To ensure **planning and resources** are in place to proactively ensure communities within the area of operation are appropriately protected in the context of rural fuel load reduction, readiness, fire prevention, response and recovery;
Identify the **ecological conditions** that affect the fire danger, ecosystems, alien plant control;
Weather data collection for National Fire Damage Rating System (NFDRS) improvements;
Provide weather stations **for the FDI** data inputs;
Implement a **radio network to effectively handle emergencies**
Provide **management services, training, capacity building and support for communities** in their efforts to manage and control veldfires;
Training, where training is not provided by an industry;
Furnish any **information requested by the Minister**;
Management and maintenance of **fire detection** and **aerial support services.**
Fire Suppression

ANNEXURE 5. MANUAL CALCULATION OF FDI

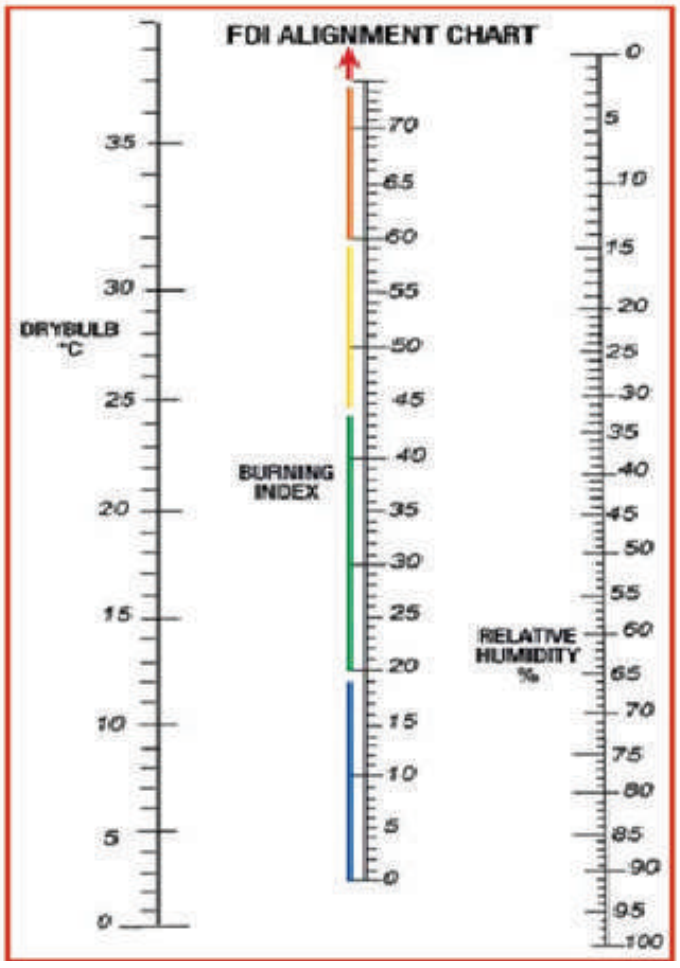
- Check the temperature outside at 10h00 and 14h00 daily
- Measure the rainfall daily at 10h00
- Calculate the relative humidity
- Measure the wind speed in km/hr

FDI RAINFALL CORRECTION FACTOR

RAINFALL	NUMBER OF DAYS SINCE LAST RAINFALL										
mm	1	2	3	4	5	6	7-8	9-10	11-12	13-15	16-20
0.1-2.6	0.7	0.9									
2.7-5.2	0.6	0.8	0.9								
5.3-7.6	0.5	0.7	0.9	0.9							
7.7-10.2	0.4	0.6	0.8	0.9	0.9						
10.312.8	0.4	0.6	0.7	0.8	0.9	0.9					
12.9-15.3	0.3	0.5	0.7	0.8	0.8	0.9	1.0				
15.4-20.5	0.2	0.5	0.6	0.7	0.8	0.8	0.9				
20.6-25.5	0.2	0.4	0.5	0.7	0.7	0.8	0.9	1.0			
25.6-38.4	0.1	0.3	0.4	0.6	0.6	0.7	0.8	0.9	1.9		
38.5-51.1	0.1	0.2	0.4	0.5	0.5	0.6	0.7	0.8	0.9		
51.2-63.8	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.8	0.9	
63.9-76.5	0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.9
76.6+	0.1	0.1	0.1	0.2	0.4	0.5	0.6	0.6	0.7	0.8	0.9

WIND FACTOR Add the correction factor to the BI to calculate the FDI

Wind Speed	Correction Factor	Wind Speed	Correction Factor	Wind Speed	Correction Factor	Wind Speed	Correction Factor
0	0	12	10	24	15	36	26
1	0	13	10	25	16	37	29
2	4	14	10	26	19	38	30
3	5	15	10	27	20	39	30
4	5	16	11	28	20	40	30
5	6	17	14	29	20	41	31
6	9	18	15	30	20	42	34
7	10	19	15	31	20	43	35
8	10	20	15	32	21	44	35
9	10	21	15	33	24	45	36
10	10	22	15	34	25	46	40
11	10	23	15	35	25	47	40



Using the FDI Alignment Chart, place a ruler between the temperature and the humidity readings.

This will give you the burning index.

Add a wind correction factor using the Wind Factor wind correction table

This gives you the Fire Danger Index (FDI) if there is no rain.

If there is rain, then you need to correct this with the FDI Rainfall correction table. This adjusts the index based on the number of days since the last rainfall - the longer the number of days, the higher the danger.

ANNEXURE 6. BURNING PROHIBITION (South Africa)

6a. Notice

BURNING PROHIBITIONS IN TERMS OF CHAPTER 2 OF THE NATIONAL VELD AND FOREST FIRE ACT 101 OF 1998 LOWVELD AND ESCARPMENT FIRE PROTECTION ASSOCIATION AS PER REGISTRATION WITH DAFF (NR 871/01/01)

The Lowveld & Escarpment Fire Protection Association (LEFPA) hereby declares a period of extraordinary fire hazard and therefore directs:

- That, within the boundaries of the LEFPA and the Ehlanzeni District, no person shall from 1 June up to and including 31 October make a fire in the open air, or, if such a fire has been made, allow it to continue to burn or add fuel thereto, otherwise than – a.fires made within a demarcated picnic or camping area or caravan park, or holiday resorts, but only at places within such an area which have been specifically prepared and maintained for that purpose; provided that such fires are properly extinguished with water and/or sand;c.fires made on residential and industrial stands in proclaimed townships; d.fires made for initiation school purposes, but only at places, which have been specially prepared and maintained for that purpose to prevent fires from spreading;

- That, within the boundaries of LEFPA and the Ehlanzeni District, no person shall from 1 June up to and including 31 October destroy by burning slash originating from any timber plantation or self-sown exotic trees and or Alien invasive plants

- That, within the boundaries of LEFPA and the Ehlanzeni District, no person shall from 1 June up and including 31 October destroy by burning residue, cultivated crop fields and veld, clear or maintain a fire belt by burning, or execute block burns;

  - provided that such fires may be made only on days when the Average Fire Danger Index at 14:00 for the fire region, as determined by LEFPA, is less than 55, except on Saturdays, Sundays and Public Holidays and the day before a Public Holiday i.subject to the directions in terms of regulation 12 of the Regulations promulgated in terms of the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983),

in consultation with the local interested parties and the implementation of reasonable precautions to ensure that fires do not spread in the area and where applicable, ii.A burning permit must be obtained from LEFPA.

- Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983) Burning of Grassveld can be done under the following recommendations, after a burning permit is obtained from LEFPA: 'Dry Tall Grassveld' – Burn from 15th August to 31st October - Comply to the High Intensity Burn Protocol It is further recommended that grazing veld only be burnt on rotation every 3 years Lowveld & Escarpment Fire Protection Association rules include:
  - Landowners intending to conduct a harvest residue burn or to burn a firebreak must inform their neighbours.
  - Permission must be obtained, by means of a burning permit, from the LEFPA office. Fire breaks and firefighting resources must also be in place.
  - Neighbours to co-operate when burning mutual fire breaks.
  - No burning if an FDI of 55 or higher is predicted for that day.
  - No burning on public holidays or weekends. In extreme cases, the LEFPA office may grant permission to burn on these days with a permit
  - Firebreaks of a minimum width of 10m are to be made around all dwellings and properties.
  - Where dwellings are in a cluster or close proximity to each other, a firebreak can be made around the perimeter of such an area.
  - Any runaway fires to be reported to neighbours immediately.
  - Any planned controlled burns under Eskom power lines to be reported to Sonja Liebenberg on 082 857 6607 before such burn.
  - Every attempt must be made to complete burning of firebreaks by end July.
  - It is a criminal offence to leave controlled burns unattended before the fire is totally extinguished

BURNING PERMIT PROTOCOL

Criterion	Types of Burn or Fuel					
Category of Burn	Land Management		Firebreaks	Harvest Debris No burning from 1st Jun - 31st Oct	Cane	Waste
	Conservation / CARA	High Intensity				
Locality	For local forecast (Currently, for LEFPA, default is Regional forecast)	For local forecast (Currently, for LEFPA, default is Regional forecast)	For local forecast (Currently, for LEFPA, default is Regional forecast)	For local forecast (Currently, for LEFPA, default is Regional forecast)	For local forecast (Currently, for LEFPA, default is Regional forecast)	For local forecast (Currently, for LEFPA, default is Regional forecast)
FDI 14:00 Forecast	55	70	55	55	55	45
Wind Speed 14:00 - km/hr - Average	15	20	15	15	20	15
Fuels	Knee, waist height or more?	> 4 tonnes/ha	N/A	Light, medium or heavy?	N/A	What type?
Age of fuel	1, 2 or more years?	N/A	1, 2 or more years?	N/A	N/A	N/A
Resources	As per FPA rules	Specialised, as per FPA rules	As per FPA rules	As per FPA rules	As per FPA rules	As per FPA rules
Defensible space	N/A	> 50 metres	N/A	N/A	2 metres	2 metres

Neighbours	Phone (Unless otherwise legislated by Local Municipality By-laws)	Written and phone (Unless otherwise legislated by Local Municipality By-laws)	Written and phone (Unless otherwise legislated by Local Municipality By-laws)	Phone (Unless otherwise legislated by Local Municipality By-laws)	Phone (Unless otherwise legislated by Local Municipality By-laws)	Phone (Unless otherwise legislated by Local Municipality By-laws)
Monday	Permit can be issued	SPR	Permit can be issued	Permit can be issued	Permit can be issued	Permit can be issued
Tuesday	Permit can be issued	SPR	Permit can be issued	Permit can be issued	Permit can be issued	Permit can be issued
Wednesday	Permit can be issued	SPR	Permit can be issued	Permit can be issued	Permit can be issued	Permit can be issued
Thursday	Permit can be issued	SPR	Permit can be issued	Permit can be issued	Permit can be issued	Permit can be issued
Friday	Permit can be issued	SPR	Permit can be issued	Permit can be issued	Permit can be issued	Permit can be issued
Saturday	SPR	SPR	SPR	SPR	Permit can be issued	Permit can be issued
Sunday	SPR	SPR	SPR	SPR	Permit can be issued	Permit can be issued
Public Holiday	SPR	SPR	SPR	SPR	Permit can be issued	Permit can be issued
	SPR = Special permission and permit required in advance from local FPA					

MINIMUM REQUIREMENTS FOR FIREBREAKS

	10 m Fire breaks	Internal Fire breaks	20 m firebreaks	Strategic breaks
Less than 10ha	Refer to page 1			
Landowners	yes	****		
Commercial farmers	yes	yes	****	
Nature conservation areas	yes	****	****	****
Cane growers	yes	****		
Timber processors, sawmillers and charcoal plant)			yes	****
Fire contractors				
Forestry	yes	yes	yes	yes
ESKOM power lines	Refer to page 5			

**** Recommended

Voltage Lines	Servitude total width	Ground clearance from centre poles on both sides	Safe distance to trees outside servitude width
132kV	31/36m	6.3m	3.8m
220kV	47m	6.7m	4.2m
275kV	50m	7.2m	6 m
400kV	55 – 65m	8.1m	10 m
533kV DC	30m	8.6m	6.1m
765kV	80m	10.4m	8.5m

The interaction of vegetation and power lines is complex. The main reasons for managing the vegetation under power lines are:

- Ensuring safe clearances under and around power lines
- Ensuring adequate access for inspection, maintenance and repair activities
- Reduction of fuels for fires under power lines that causes flashovers

Also take into consideration the requirements of the land owner. Prior to carrying out vegetation management, first determine the following:

- Is the plant breaching safe clearance?
- Does the plant prevent access to the line?
- Will the plant provide sufficient fuel during a fire to cause a flashover?

Fire critical zones in savannah

Fire critical zone for flashovers resulting from fires in densifiers, happens within 5 m from the vertical below the conductor, predominantly in the mid span area. These values are highly influenced by the atmospheric conditions at the time of the fire.

Based on the results of the measurements taken at a flash site after a fire, the area of the servitude within 5m from the outside conductors should be considered as criticall for clearing any densifiers or any other plants that pose a fire risk. As atmospheric conditions have a highly variable effect on fires 10 m is regarded as a practical rule of thumb

Atmospheric conditions, during which flashowers become very likely, have been determined as follows:

- Ambient air temperature greater than 20'C
- Relative humidity less than 20%
- Wind speed greater than 20 km/h

Fuel management in the servitude

Not all plants in the servitude pose a fire risk. The excessive removal of plants not only leads to a risk of erosion in certain soils and generates large quantities of unwanted plant material, but will also have an impact on the species of grass that will grow in the servitude in this newly modified habitat

Disposing of cut material

The disposing of large quantities of cut material generates its own problem. As a result of the fire risk that the cut materials generate, selective cutting procedure is proposed. This should adequately reduce fire risk without generating an unnecessarily large quantity of cut material that has to be disposed of.

The FDI must be obtained and burns must be carried out by people with the correct training and equipment appropriate for the task. Cognisance should be taken of the possibility of soil sterilisation and consequential plant succession during these burns. As a rule, landowners must report all burns to Eskom so that the necessary arrangements can be made to safeguard the lines.

ANNEXURE 9. FIRE REGIME FOR BURNING RANGELAND

The fire regime to be used in prescribed burning refers to the type and intensity of fire and the season and frequency of burning:

- **Type of Fire:**

  It is recommended that fires burning with the wind either as surface head fires in grassland or a combination of surface head fires and crown fires in tree and shrub vegetation be used in prescribed burning, because they cause least damage to the grass sward, but can cause maximum damage to woody vegetation if necessary (Trollope, 1999).

- **Fire intensity:**

  When burning to remove moribund and/or unacceptable grass material, a cool fire of <1000 kJ s-1m-1 is recommended. This can be achieved by burning when the air temperature is <20°C and the relative humidity >50%. When burning to control undesirable plants like encroaching bush, an intense fire of >2000 kJ s-1m-1 is necessary. This can be achieved when the grass fuel load is >4000 kg ha-1, the air temperature is >25°C and the relative humidity <30%. This will cause a significant topkill of stems and branches of bush species up to a height of 3 m. In all cases the wind speed should not exceed 20 km h-1 (Trollope, 1999).

- **Season of Burning:**

  Research in southern Africa has clearly indicated that least damage is caused to the grass sward if prescribed burning is applied when the grass is dormant. Therefore, it is recommended that when burning to remove moribund and/or unacceptable grass material burning should preferably be applied when the grass is dormant but under mild weather conditions in terms of temperature, relative humidity and wind during the dry season. Burning to control encroaching plants should be applied before the first rains, initiating the commencement of the growing season (i.e. when the grass is very dry and dormant) to ensure a high intensity fire (Trollope, 1999). "Early burning" at the beginning of the dry season, is practiced in places where low-intensity fires are desired to minimize damage to individual trees or forest patches and to ensure that the fire is controllable.

- **Frequency of Burning:**

  When burning to remove moribund and/or unacceptable grass material the frequency of burning will depend upon the accumulation rate of excess grass litter (Trollope, 1999). Field experience indicates that this should not exceed 4000 kg ha-1 and therefore the frequency of burning should be based on the rate at which this phytomass of grass material accumulates. Generally, in high rainfall areas (>700 mm p.a.) this will result in the frequency of burning being every 2-4 years. In lower rainfall areas the frequency will be much lower and in fact the threshold of a grass fuel load >4000 kg ha-1 will generally exclude fire in these regions particularly where

the condition of the rangeland is degraded, and excessive grass fuel loads never accumulate (Trollope, 1999). When burning to control undesirable encroaching plants the frequency of burning will depend upon the growth characteristics of the individual encroaching plan species.

- **Post -Fire Range Management:**

  It is recommended that when burning to remove moribund and/or unacceptable grass material, grazing should be applied as soon as possible after the burn, to take advantage of the highly nutritious regrowth of the grass plants (Zacharias, 1994; Kirkman, 2001). However, this practice must be combined with a rotational resting system involving withdrawing a portion of the rangeland from grazing for an extended period of at least a growing season or longer (6-12 months) to maintain the vigour of the grass sward and enable seed production to occur, for plant recruitment. The "resting period" application should be allowed during the season prior to the intended prescribed burn.

The following fire regime is recommended when applying prescribed burns using the range condition burning system:

- **Type of Fire:**

  It is recommended that fires burning with the wind either as surface head fires in grassland or a combination of surface head fires and crown fires in tree and shrub vegetation be used in prescribed burning because they cause least damage to the grass sward but can cause maximum damage to woody vegetation if necessary (Trollope, 1999).

- **Fire Intensity:**

  Fire intensity is an important component of the fire regime that needs to be varied according to the reason for burning, using the same guidelines as recommended for managing rangelands for domestic livestock. In savannas where browsers are an important component of wildlife populations, high intensity fires are often necessary to cause a significant top kill of stems and branches of trees and shrubs up to a height of 3 m to make the vegetation more available for shorter browsing animal species. In all cases the wind speed should not exceed 20 km/h for safety reasons (Trollope, 1999). As can be expected these detailed prescriptions, prescribed burning is better suited for the use of fire in smaller and more intensively managed conservation areas and game ranches. In these situations, prescribed burns are applied and completed in a matter of hours and it is therefore possible to burn under specific atmospheric conditions. Conversely, in large conservation areas, it is more difficult to vary the intensity of fires relative to the reason for burning as well as the duration of the fires, as the latter can extend over significant periods of time. At best this can be achieved by varying the time of burning to different periods during the dormant season, relative to the moisture content of the grass fuel and selected suitable periods predicted by weather forecasts.

- **Season of Burning:**

  In wildlife areas it is also recommended that prescribed burns be applied when the grass sward is dormant, to avoid any detrimental effects on the regrowth and basal cover of the sward. The burning window can extend over the entire dry season and the actual timing of fires can be varied according to the reasons for burning. When burning to remove moribund grass material, prescribed burns can be applied at any time during the dormant season. When burning to reduce the density and size of trees and shrubs it is recommended that fires be applied when the grass fuel is at its lowest moisture content to ensure a high intensity fire.

- **Frequency of Burning:**

  As is the case with managing grassland and savanna vegetation for domestic livestock, the frequency of burning required to remove moribund and/ or unacceptable grass material will depend upon the accumulation rate of excess grass litter (Trollope, 1989), i.e. grass fuel load >4000 kg ha-1. Therefore, the frequency of burning will be variable and a function of the stocking rate of grazing animals and the amount of rainfall an area receives. When burning to reduce the density and size of trees and shrubs in savanna areas, the frequency of burning cannot be prescribed precisely, because this will depend on the stocking rate of browsing animals and/or the rate of regrowth of the trees and shrubs. In moist savannas (rainfall >700 mm p.a.) generally the rainfall is adequate for the accumulation of adequate grass fuel loads to enable frequent and intense fires to occur every three to four years that will maintain encroaching woody species in the "fire trap" and prevent them from growing taller than approximately three meters. Conversely in arid savannas (rainfall <500 mm p.a.) the rainfall is generally too low and variable for the production and accumulation of adequate grass fuel loads to support regular fires to maintain encroaching woody species in the "fire trap ".In these arid savannas the role of fire in controlling woody species is to reduce and/or maintain the encroaching trees and shrubs at an available height and in a palatable condition for browsing ungulate species. Because the intense fires necessary to maintain the woody vegetation at an available height and condition for browsing animals only occur after above average rainfall seasons the frequency of burning is very low. Research results from the experimental burn plot trial in the Kruger National Park suggest a burning frequency more than burning every 10 years (Trollope et al., 2009).

- **Post-Fire Grazing Management:**

  Grazing after burning in wildlife areas is difficult to control. To prevent overgrazing, it is important to ensure that the burned area exceeds the short-term forage requirements of the grazing animals, that are attracted to the highly palatable and nutritious regrowth that develops after a burn i.e. burn relatively large areas at any one time (Trollope, 1992). Another strategy that has been successfully used in southern Africa is to apply a series of patch burns at regular intervals throughout the duration of the burning window during the dormant season. This has the effect of attracting the grazing animals to the newly burned areas after the different fires thereby spreading the impact of grazing over the entire burned area and avoiding the detrimental effects of heavy continuous grazing after the burns (Brockett et al., 2001).

ANNEXURE 10.PERSONALPROTECTIVE CLOTHING (PPC)

MINIMUM REQUIREMENTS FOR PROTECTIVE CLOTHING

	Leather Boots (no steel tips)	Leather gloves	Balaclavas	Fire fighter helmet	T-shirts	100% cotton overall
Landowners	yes	yes	****	****	****	yes
Commercial farmers	yes	yes	****	****	yes	yes
Nature conservation areas	yes	yes	****	****	yes	yes
Cane growers	yes	yes	****	****	yes	yes
Timber processors / sawmillers & charcoal plants	yes	yes	yes	yes	yes	yes
Fire contractors	yes	yes	yes	yes	yes	yes
Forestry	yes	yes	yes	yes	yes	yes
ESKOM contractors	yes	yes	yes	yes	yes	Yes

**** Recommended

MINIMUM REQUIREMENTS FOR FORESTRY FIRE FIGHTING AND STAFFING

Property Size ha	Bakkie Sakkie Min 200 litres	Water Tanker Min 2000 litres	Water Tanker Min 4000 litres	Rake Hoes	Beaters	Knapsacks Min 15 litres	Drip Torch	Cell phone	Handheld radio	Mobile radio	First aid kit	Fire Fighters	Crew Leaders, landowners or Fire Boss	Access to Aerial Resources
0 - 500	1	1	0	10	10	10	2	2	2	1	1	10/20*	1	Recommended aerial support
501 - 1000	2	2	1	20	20	15	2	2	3	1	2	15/30*	2	Aerial support
1001 – 5000	2	2	1	30	40	20	3	2	4	2	2	25/50*	3	Aerial support
5001 +	3	2	2	60	80	40	4	4	6	4	4	40/100*	3/3*	Aerial support

*ACCESS TO RESOURCES WITHIN 30 MINUTES

MINIMUM REQUIREMENTS FOR LANDOWNERS, NATURE CONSERVATION AREAS, COMMERCIAL FARMERS AND CANE GROWERS

Property Size ha	Bakkie Sakkie Min 200 litres or Tractor/trailer	Water tanker Min 1000 litres	Water tanker Min 2000 litres	Rake Hoes	Beaters	Knapsacks Min 15 litres	Drip Torch	Cell phone	Hand held radio	Mobile Radio	First Aid Kit	Fire Fighters	Crew Leaders Owner/Fire Boss
Less than 10ha	***				1	1						1	
11 - 25	1 *	0	0	1	4	2	0	1	0	0	1	2	1
26 - 100	1	0	0	2	5	3	0	1	0	1	1	4	1
101 - 500	1	1	0	5	10	4	1	1	1	1	1	9****	1
501 - 1000	1	1	0	10	15	10	1	1	2	1	2	10/20*	1
1001 - 4000	2	0	2	15	20	10	2	1	4	2	2	15/30*	3
4001 – 10 000	2	2	1	20	40	20	3	1	4	2	5	25/40*	3/4*
10 000 +	3	3	2	20	40	20	3	1	5	2	5	30/50*	4/5*
Timber processors/ sawmiller, charcoal plants	1	1	0	4	4	2	0	1	0	0	1	4/10*	1/2*
Contractors	1 **	1	0	5	5	5	2	1	2	1	1	10	1
Cane growers 1 – 25ha	1	0	0	1	4	2	0	1	0	0	1	2	1
Cane growers 26 – 100ha	1	0	0	2	5	2	0	1	0	1	1	4	1

***ACCESS TO RESOURCES WITHIN 30 MINUTES**

Refer to Contractors Protocol * Minimum 30m hose pipe **** it is recommended that you have a written agreement with the neighbour if you do not have enough equipment or people according to the minimum rules, that collectively meet the minimum requirements.

12a. LACES

The acronym LACES was developed by Paul Gleason, a highly experienced and respected fire specialist employed by the USDA Forest Service. The purpose was to provide a simple way to help firefighters remember some key elements to survival (LEFPA 2018).

- **L = Lookout**

  The Lookout is the eyes of the firefighter, especially of the Crew Boss, Fire Controller or Section Fire Boss. Lookouts should be in a position from where they can see the fire line, the fire staff and the crews working the fire. The lookout should be able to recognise and anticipate situations and must report changes immediately.

- **A = Awareness**

  All firefighters, including the lookouts, should be aware of the action plan. Everyone involved should also be aware of the fire weather, fire behaviour, the activities around them, the terrain, etc.

- **C = Communications**

  The fire officer, crew leaders and lookouts should at all times be able to communicate. This may be by direct radio contact, or through a lookout or other relay point. Ensure good communications at all times.

- **E = Escape routes**
  Have at least two planned routes of escape. If your primary route is cut off, know what you are going to do. Every person on the fire line must know the plan.

- **S = Safety zones**
  Safety zones are places (known to every person on the fire line) of refuge, places you can be assured of your safety. Their size is dictated by the fuel, terrain, weather conditions and worst-case fire behaviour.

12b. Ten standard firefighting orders

- Keep informed on fire weather conditions and forecasts
- Know what your fire is doing at all times
- Base all actions on current and expected behaviour of the fire
- Identify escape routes and safety zones, and make them known
- Post lookouts when there is possible danger
- Be alert. Keep calm. Think clearly. Act decisively
- Maintain prompt communications with all your forces, your supervisor and adjoining forces
- Give clear instructions and insure they are understood
- Maintain control of your forces at all times
- Fight fire aggressively, having provided for safety first (LEFPA 2018).

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