# REPUBLIC OF ZAMBIA

## MINISTRY OF TOURISM

FIRE MANAGEMENT PLAN

FOR

LUKUSUZI NATIONAL PARK



**2022 – 2026**

DEPARTMENT OF NATIONAL PARKS AND WILDLIFE
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## CITATION

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## COMPILATION

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## COVER PHOTOS

Left to right (Prescribed early season burning; Fire management equipment (Bladder bag, fire beater and drip torch) available at Chikomeni, Lukusuzi National Park and burnt area by late wild fire in the Lukusuzi National Park).

## SUPPORTED BY

## APPROVAL PAGE

The Fire Management Plan for the Lukusuzi National Park has been approved for implementation by the Government of the Republic of Zambia through the Ministry of Tourism and Arts, Department of National Parks and Wildlife.

Signature……..

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Date :……

## ACKNOWLEDGEMENTS

The Department of National Parks and Wildlife (DNPW) is grateful for the financial support from the World Bank, Global Environmental Facility (GEF) and BioCarbon Fund through the Zambia Integrated Forests Landscape Project (ZIFLP), which enabled the preparation of the first Fire Management Plan (FMP) for the Lukusuzi National Park (LNP). The Department also appreciates various stakeholders who included the Community Resources Boards (CRBs) around the LNP, Government Officers from different departments and Traditional leaders for their participation and contribution towards the preparation of the FMP during the field visits and consultative stakeholders' workshop.

## ACRONYMS

| | |
|---|---|
| AAR | After Action Report |
| AW | Area Warden |
| CBU | Copperbelt University |
| CIUZ | Conservation Intermediate Use Zone |
| CLUZ | Conservation Limited Use Zone |
| CRB | Community Resources Board |
| COMACO | Community Markets for Conservation |
| DNPW | Department of National Parks and Wildlife |
| EO | Extension Officer |
| FMP | Fire Management Plan |
| FMU | Fire Management Unit |
| GEF | Global Environmental Facility |
| GMP | General Management Plan |
| GPS | Global Positioning System |
| IFAW | International Fund for Animal Welfare |
| IRPG | Incident Response Pocket Guide |
| MODIS | Moderate Resolution and Imaging System |
| MTA | Ministry of Tourism and Arts |
| PFMG | Park Fire Management Group |
| PR | Park Ranger |
| ER | Ecologist Research |
| LNP | Lukusuzi National Park |
| ELAMU | East Luangwa Area Management Unit |
| SWPO | Senior Wildlife Police Officer |
| WZ | Wilderness Zone |
| ZAWA | Zambia Wildlife Authority |
| ZCP | Zambian Carnivore Programme |
| ZFC | Zambia Forestry College |
| ZIFLP | Zambia Integrated Forests Landscape Project |

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## FOREWORD

The Lukusuzi National Park (LNP) Fire Management Plan (FMP) sets the direction and measures to be pursued to address the historical problem of wildfires for the benefit of both nature and people. The focus is to increase the spatial coverage of the area under early burning (i.e. prescribed fires) as this reduces the risk and impact of undesired wildfires which are more destructive. If left unchecked, late season wildfires will endanger the integrity of the Greater Luangwa Ecosystem and constrain its contribution to national economic development *inter alia* generation of ecosystem services and growth of tourism.

Working in partnership with the Zambia Integrated Forest Landscape Project (ZIFLP), Government formulated this FMP to address the challenges of undesired wildfires. It builds on the overall General Management plan for 2020 – 2030. The strategy was developed through a stakeholder consultative process. The stakeholders comprised diverse groups – conservation agencies, research organizations, land owners and managers (public, private and local communities), nature-based enterprise owners and tourism businesses and civil society organizations.

The strategy recognizes that managing wildfires is a complex task particularly due to the different land tenure systems and land uses around the park. Fire management can therefore no longer be considered an exclusive function of state agencies, whether on state or communal conservation lands. This challenge can best be addressed by adopting a stakeholder-based fire management program (SFMP), which is the philosophy adopted in this strategy. The SFMP is further supported by the continued low institutional management capacity among public agencies responsible for nature conservation. This approach creates the following benefits:

i. Enhance optimal resource mobilization and utilization and is in line with Government's resource mobilization strategy as outlined in the seventh national development plan (7-NDP), which recognizes the positive contribution of various stakeholders to national development;
ii. Mainstreaming of wildfire management into the country's strategic response to climate change as fire is considered one of the major drivers of climate change;
iii. Mainstreaming of SFMP into the country's National Adaptation Program of Action of 2007 and;
iv. Creating alignment between fire management and sustainable forestry management under the $REDD^{+}$ program as wildfires have been noted to contribute significantly to deforestation, degradation and atmospheric emissions of greenhouse gases and on public health and safety.

This approach and paradigm shift to a SFMP is deemed critical to sustainable wildfire management and subsequently in maintaining the ecosystem integrity and health; promote the country's sustainable forest management; reduce its carbon foot print; strengthen the carbon storage capacity of the landscape and reduce the risk of invasion of the ecosystem by invasive species.

## EXECUTIVE SUMMARY

The Fire Management Plan (FMP) for Lukusuzi National Park (LNP), which covers a five-year period (2022 to 2026) was prepared through a pre-field visit and stakeholders' workshop to provide guidance on management of fire in the LNP on a daily, seasonal and annual basis. This is critical as all parks are required to have FMPs as stipulated by the fire management guidelines for protected areas.

### Vision, Goal and Objectives

The FMP has the vision of ''A landscape without uncontrolled wild fires.'' To achieve this vision, the overall goal is ''to maintain the long term integrity of the wildlife habitats.'' Six objectives under the overall goal have been formulated as provided below;

i. To reduce wildfire incidences and extent (i.e spatial coverage of uncontrolled fires)
ii. To increase the number of persons with appropriate skills and knowledge on fire by 10% annually
iii. To build strong and functional partnerships for fire management in the LNP
iv. To increase financial capacity for fire management by 50%
v. To ensure the availability of minimum fire management equipment in all sectors by 2026
vi. To conduct fire research and monitoring programmes that feed into park fire management
vii. To increase awareness on and participation in fire management of surrounding communities by 2026

### Action Plan

In order to achieve the above objectives, an action plan has been prepared for the LNP FMP encompassing activities to be implemented, the period of implementation of activities, the means of verification and points out key responsibility persons for the activities.

### Fire Management Units

As part of ensuring effectiveness of fire management, the park has been divided into four fire management units (FMUs), which overlay the park management zones contained in the park's general management plan (GMP). For each FMU, details have been provided of the current and proposed fire management strategies, vegetation types, current condition and desired condition, firebreaks and facilities available which will play a role in fire management for the park.

### Fire Management Strategies and Procedures

The FMP will require implementation of prescribed burning, fire prevention and suppression strategies. Critical to all these strategies will be planning. Hence, the plan provides details on pre-season and burn planning procedures. Additionally, the plan has also laid out the procedures to be followed in case of decision making, implementing prescribed burning, fire management safety rules, response to unwanted fires and communication during wildfires. As alternatives to prescribed fire, the plan provides for mechanical treatment and fire prevention particularly public awareness.

## Fire Management Organisation and Budget

Organisation and budgeting were recognized as cardinal to the implementation of this FMP during its preparation. Therefore, the FMP has proposed the establishment of a Park Fire Management Group (PFMG), which will comprise of DNPW, Tour operators though currently there are none in the park, Conservation organisations (IFAW and COMACO) and Communities to be represented by the Community Resources Boards (CRBs) as a way of involving other stakeholders in the management of fire in the LNP. The PFMG will meet periodically in the year to support the implementation of the FMP. Overall, the implementation of the FMP will require USD56,632.62 as indicated in the five-year budget.

## Communication Plan

A part of the FMP has integrated a communications plan to guide the flow of information between the park and other stakeholders. Though LNP is just operationalizing its radio communication network, the plan has elucidated on aspects of internal VHF radio communication and internet communication. To ensure smooth flow of information, the communication plan has also detailed the key contact persons, medium of information transmission, type of information to be provided and the possible sources of wild fire information.

## Fire Research

The FMP considered the current status of research and the need for future research. No fire research has been conducted in the LNP since its establishment implying a general lack of localized information of the impacts of fire on the park biodiversity. Therefore, the FMP has recommended for the need for fire research to be initiated in the LNP.

## Monitoring and Evaluation

To keep in tandem with the management plans prepared for DNPW, the FMP provides a section on monitoring and evaluation. There are a number of activities proposed under this section which include activation of the use of the MODIS active products, aerial surveillance using both aircrafts and drones when finances become available, taking of photo-points and capture of the fire perimeter.

Finally, it is recommended that the FMP be subjected to annual review preferably at the end of the year by the PFMG in order to assess the extent of its implementation. In all its implementation, the FMP will adopt an adaptive management strategy so that changes can be made during its life span.

## DEFINITIONS

| Term | Definition |
|---|---|
| Early Burning | Prescribed burning early in the dry season before the leaves and undergrowth are completely dry or before the leaves are shed carried out as a precaution against more severe fire damage later in the fire season |
| Early Fire Season | Fires which occur from April to June |
| Fauna | All the animal life in a particular area |
| Firebreak | Any natural or constructed discontinuity in a fuel bed utilized to segregate, stop and control the spread of fire or to provide a control line from which to suppress a fire; characterized by complete lack of combustibles down to mineral soil |
| Fire Ecology | The study of the relationships and interactions between fire, living organisms and the environment |
| Fire Frequency | The average number of fires or regularly occurring fire events per unit time in a designated area |
| Fire Intensity | Amount of heat produced by a fire. Usually compared by reference to the length of the flames. |
| Flora | All plants and parts of the plants in a particular area |
| Fire Management Plan | (i) A systematic, technological and administrative management process of determining the organisation, facilities, resources and procedures required to protect people, property and forest areas from fire and to use fire to accomplish forest management and other land use objectives |
| Fire Management Units | Area where there are common fire management goals, objectives and fuels and where resource uses have been defined. FMU relates well to the strategies for managing wildland and prescribed fires that are defined in the FMP |
| Fire Prevention | All measures in fire management, fuel management, forest management, forest utilization and concerning the land users and the general public, including law enforcement, that may result in the prevention of outbreak of fires or the reduction of fire severity and spread |
| Fire Suppression | All activities concerned with controlling and extinguishing a fire following its detection (Syn. Fire control, firefighting) |
| Fuel | All combustible organic material in forests and other vegetation types including grass, branches and weeds |
| Late Burning | Prescribed burning activities towards the end of the dry season |
| Late Fire Season | Fires which occur from July to August |
| Mid Fire Season | Fires which occur from September to November |
| Prescribed Burning | Controlled application of fire to vegetation in either their natural or modified states, under specified environmental conditions which allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to attain planned resource management objectives (cf. prescribed fire) |

| Term | Definition |
|---|---|
| Wildfires | (i) Any unplanned and uncontrolled wildland fire which regardless of ignition source may require suppression response or other action according to agency policy |
| Wildlife Habitats | A Place where a species or ecological community naturally occurs |
| Wildlife | Wild animals or species of birds that are found in Zambia in a wild state and vegetation which is indigenous to Zambia and grows naturally without cultivation |

# 1. INTRODUCTION

## 1.1 Background

The fire management guidelines for protected areas in Zambia require that fire management plans (FMPs) for all protected areas subject to wildland fires are developed and implemented (ZAWA 2005). This arises from the recognition of fire as a useful management tool in wildlife habitats in Zambia's protected areas. Fire plays a role in the development and maintenance of productive and stable vegetation communities.

The FMP for Lukusuzi National Park (LNP) therefore fulfills the key requirement of the Department of National Parks and Wildlife (DNPW)'s fire policy for each protected area to have a specific FMP. This plan also provides an opportunity for managing fire in a manner that will enable DNPW to achieve best habitat management practices necessary to minimize damage to the wildlife habitat and the Luangwa ecosystem at large.

The LNP and the greater Luangwa ecosystem are critical to insulating the country against impacts of climate change due to their vast and intact wilderness. The LNP is particularly significant based on the depiction below;

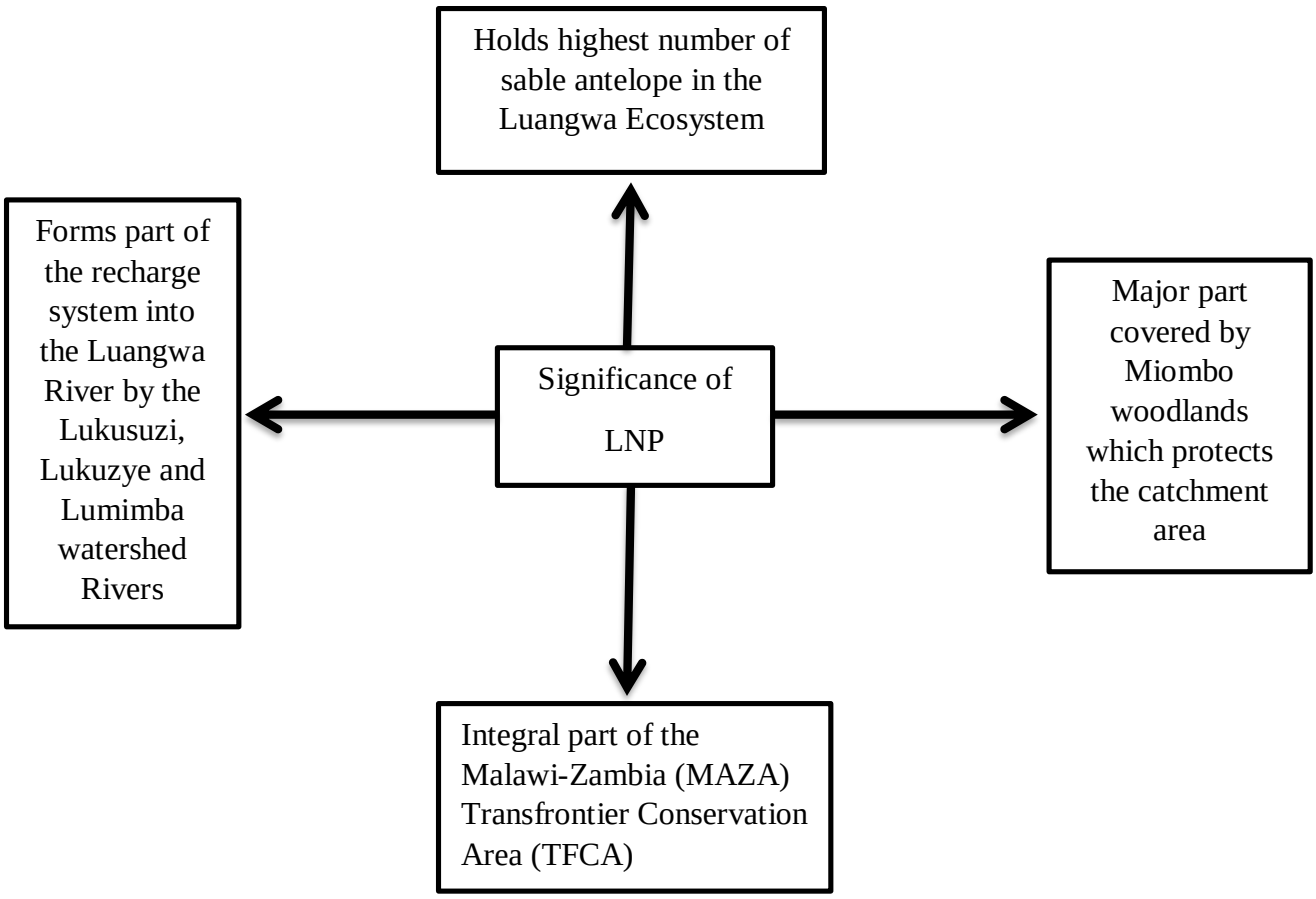


**Figure 1: Significance of the Lukusuzi National Park from a local, regional and international perspective**

## 1.2 Problem Statement, Need and Purpose

The LNP has never had a FMP since it was established as a protected area. This has resulted in uncoordinated management of fire in the park. Absence of a FMP has also implied lack of information pertaining to fire regimes, impact of fire on the flora, fauna, soils and hydrology. There is no document with details on the staff and financial capacity of the park to manage fire. Exigencies of the surrounding communities and their role on fire management in the park have not been understood and documented as well. Unmanaged wildfires have the potential to contribute to carbon emissions and affect the air quality in the surrounding area and beyond.

A FMP will therefore assist in the correction of current inadequacies particularly certain information gaps in terms of human and financial resources. The FMP will also put in place strategies to ameliorate the occurrence of unplanned wild fires.

The purpose of a FMP will therefore be the provision of guidance on management of fire in the LNP on a daily, seasonal and annual basis.

## 1.3 Description of the Park

### 1.3.1 Location and size

LNP is located in the Luangwa Ecosystem between latitude 12°27'17.1"- 13°5'24.2" South and longitude 032°33’38.5”- 032°30'12.9" East. Having a size of 2,720 km$^2$, it is the largest national park lying entirely within the Eastern Province. The park is bordered by Lumimba Game Management Area (GMA) on its north and west, while open areas are on its east and south boundaries (Fig.2).

### 1.3.2 Climate

LNP as is typical of Zambia undergoes three seasons as follows; hot-wet from November to March, cool-dry from April to August and hot-dry from September to October. The hot-wet season records average seasonal rainfall ranging between 750-1000 mm (DNPW 2016). Conditions favourable to occurrence of fire are in the cool-dry and hot-dry seasons. However, the fires that occur in the hot-dry seasons are more severe and difficult to control as the fire spread, combustion and consumption have higher rates with lower moisture content in the hot-dry season than in any other season of the year (Govender et al 2006). Additionally, the high temperatures during the hot-dry season also promote rapid curing of the grass fuel leading to higher fire spread.

### 1.3.3 Geology and Soils

#### 1.3.3.1 Geology

Ancient rocks which have been subjected to repeated folding and metamorphism resulting in total reconstitution of the rocks as the original sedimentary and igneous characteristics that have been destroyed underlay the park. The west side of the park has recent segments of Karoo, which is only found in this part of the Luangwa Valley (DNPW 2016).

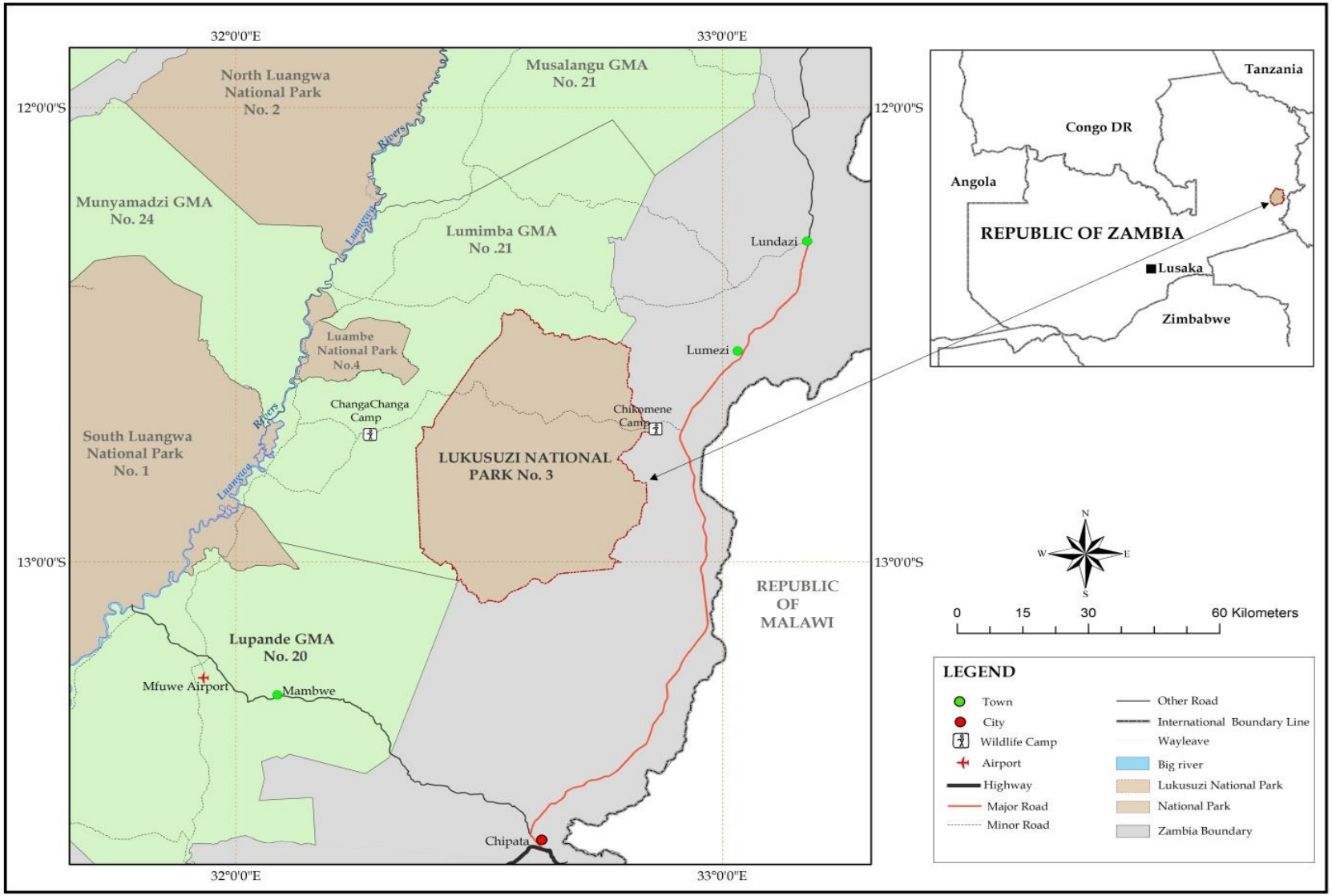


**Figure 2: Location of the Lukusuzi National Park from a national and international perspective**

The park is underlain by a variety of rocks including gneissic and granitic, which are coarse grained and essentially comprise of quartz, feldspar, and a certain amount of mica and amphibole. The hills in the park consist of original sedimentary sandstone and different schists (DNPW 2016).

Along the Msidza River and also near Lukusuzi River, west of the Mburuzi River, minor amounts of recrystalised dolomite and limestone have been recorded. Dykes of basic igneous rocks also occur in association with any of the above mentioned rocks. Weathering of basic rocks results in localised improvement of the nutritional status of the soil, which translates in improved quality of the vegetation cover (DNPW 2016).

### 1.3.3.2 Soils

Five soil types have been identified in the LNP. The soils are; leptosols, acrisols, luvisols, vertisols and gleysols. Table 1 provides a brief outline of these soils.

**Table 1: Properties and Response to Fire of the Five Soil Types in the Lukusuzi National Park**

| Variable | Leptosols | Acrisols | Luvisols and Vertisols | Gleysols |
|---|---|---|---|---|
| Properties | • Excessively drained to well drained<br>• Colour of dark brown to yellowish brown<br>• Friable, stony, gravelly, coarse to fine loamy<br>• Shallow soil depth<br>• Suseptible to erosion, desiccation and waterlogging | • Well drained to imperfectly drained, acidic, low base saturation and strongly leached<br>• Yellowish red to strong brown in colour<br>• Friable, fine loamy to clay soil<br>• Deep to moderately to shallow<br>• Quick chemical and organic degradation if utilized | • Yellowish red to strong brown<br>• Friable to slightly firm<br>• Slightly weathered and moderately leached<br>• Increased clay content with depth<br>• Cracking occurs in certain places | • Poorly drained to imperfectly drained<br>• Very deep<br>• Brown colour<br>• Slightly firm clayey soils |

### 1.3.4 Flora

Four types of vegetation occur in the LNP with miombo being the major type, while mopane, dambo grasslands and riparian cover less portions of the park (Figure 3).

Details of the species composition in the four vegetation types (DNPW 2016) as well as response to fire are provided below:

**a) Miombo Vegetation**

- **Composition:** comprising of *Brachystegia spp, Julbernardia spp* and *Terminalia spp* and occurs on the escarpment and plateau.

- **Response to fire:** Annual early to mid-season fires ensure the species composition and structure are maintained for miombo woodland, but repeated late season fires converts the woodland into an open savanna where the grass component dominates the trees (Zieger and Cauldwell 1998).

**b) Riparian Vegetation**

- **Composition:** Evergreen and belong to genus of *Acacia, Diospyros, Khaya, Kigelia, Tamarindus* and *Trichilia spp*.

- **Response to fire:** Tree growth is promoted with application of early season fires, while mid-season fires damage the smaller woody plants. Woody plants are prone to damage by late season fires (Zieger and Cauldwell 1998).

**c) Dambo grasslands**

- **Composition:** *Syzigium guineense* is commonly sighted. Main grass species consist of *Acrophalus* spp, *Sphaeranthus* spp, *Echinochloa spp*, *Eragrostis* spp, *Hyparrhenia* spp, *Loudetia* spp, *Sacciolepis* spp and *Cyperaceae* spp. *Loudetia* spp and *Echinochloa colonum* grow in the drier peripheral areas.

- **Response to fire:** Early season fires hinder growth of grass as grasses are not protected at the time of seeding, while mid-season fires impede the growth of other grasses when in a non-dormant state. The late season fires remove moribund grass material and promote growth of grass (Zieger and Cauldwell 1998)

**d) Mopane vegetation**

- **Composition:** mainly *Colophosphermum mopane* with associated species belonging to *Kirkia, Terminalia, Adansonia* and *Acacia* genuses.

- **Response to fire:** Trees are favoured by early season fires, but application of late season fires promotes grass growth at the expense of trees


**Figure 3: Vegetation types in the Lukusuzi National Park**

### 1.3.5 Fauna

The park is known to have a number of species belonging to mammals, birds, reptiles and amphibians. Noticeable carnivores include lion (*Panthera leo*), leopard (*Panthera pardalis*), hyaena (*Crocuta crocuta*) and wild dog (*Lycacon pictus*). Herbivores sighted in the park are; eland, sable, roan, kudu, duiker and hartebeest. The sable antelope requires sufficient post-fire regrowth, while roan antelope utilize both immediate post fire regrowth and sufficient post-fire regrowth. Other species like the kudu and eland following the application of dry season fires may avoid burnt areas (Goldammer and Ronde 2004).

Reptiles and amphibians data is limited. Nonetheless, records do exist for crocodile, rock or white throated monitor lizard. Other reptiles include black mamba, puff adder, black-necked Spitting cobra and African rock python.

Birds known in the park are globally threatened species, biome-restricted species and species of regional conservation concern with two, twenty-one and four species recorded respectively. Birds respond to immediate occurrence of fires due to provision of food by insects escaping from the fire or their feeding on dead insects after the fire. Certain species can also utilize the burnt areas for breeding purposes. However, the occurrence of fires can impact negatively on ground nesting species as fires can remove their habitat cover and destroy their nesting grounds (Goldammer and Ronde 2004).

## 2. POLICY LEGISLATION ON FIRE MANAGEMENT

Major policy development with regard to fire is the development of the National Fire Policy (Currently at draft Stage). It establishes firefighting as primarily a local government function. The Local Government Act of 2010 and its subsidiary legislation provides for the establishment of fire authorities and mandates Government to make financial grants to relevant local councils for fire services. The act deals mostly with fire as a destructive force in urban settings. The emphasis is on fire and rescue services rather than fire as a management tool for ecosystem management. Nevertheless, the fire policy acknowledges the role of fire in rural and wilderness areas and the need to reduce the incidence of late fires.

### 2.1 Legislation for Fire Management in Protected Areas

From a natural resource perspective, the following legislation deals with fire and fire management:

Zambia Wildlife Act (2015) and Forest Act (2015): promote the participation of local communities in fire management in their respective areas. In addition, both acts prohibit the lighting of fires in a forest without requisite permission. The Forest Act also makes it mandatory for persons over the age of 18 years to assist with firefighting and rescue, and makes the failure to do so an offence.

Environmental Management Act of 2011: provides for integrated environmental management and the protection and conservation of the environment as well as the sustainable management and use of natural resources. It further mandates the Minister responsible for natural resources, in consultation with the Zambia Environmental Management Agency (ZEMA), to prepare guidelines for the management of fire.

## 3. FIRE HISTORY

A spatio-temporal occurrence of fire in the LNP was reviewed for a decade covering the period from 2010 to 2019. Information on the history of fire occurrence is important as it can improve fire and habitat management in protected areas. Additionally, the availability of fire data can assist in the identification of fire hotspots and modelling of probability of fire occurrence (Chihiro et.al 2009). Due to the large size of the protected area, field staff are unable to detect every occurrence of fire whenever and wherever it is ignited without use of fire products or earth observation techniques (Gregoire and Simonetti 2010). Hence, to provide a fire history of LNP, MODIS active fire products were used as they have the advantage of providing data both spatially and temporally unlike other fire products (Pricope and Binford 2012).

### 3.1 Temporal Fire Occurrence

Generally, the pattern of fire occurrence in the LNP is indicative of an increasing trend for the review period. The number of active fires detected ranged from 598 in 2012 to 765 in 2016 with the average number of active fires detected per year being 664, implying that six years had active fires detected above the ten-year average (Figure 4). As anthropogenic activities are a major source of fire, the highest number of active fires detected in LNP in 2016 may be attributed to the presence of encroachment and other illegal activities.

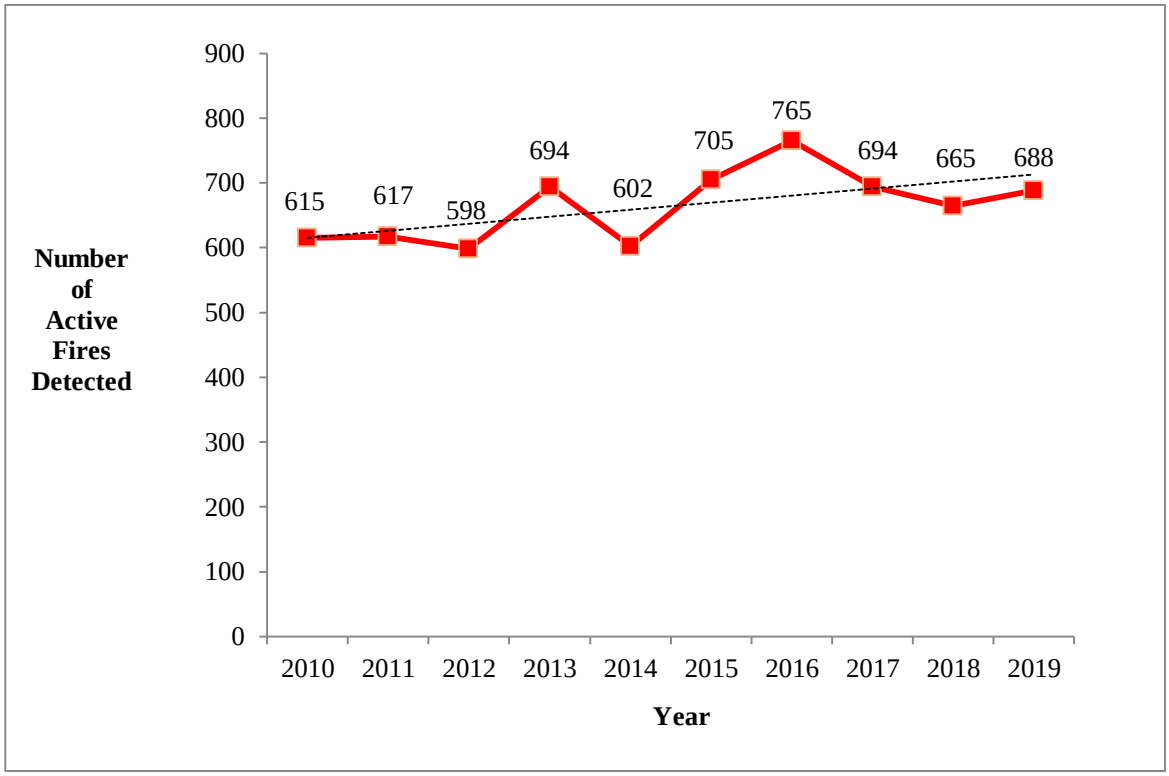


**Figure 4: Number of active fires detected using the MODIS fire product in the Lukusuzi National Park from 2010 to 2019. Total active fires per year were added up from the first month to the last month in which fires were detected.**

Seasonally, the highest average active fires were detected during the mid-fire season (July to August), followed by the late fire season (September to December) and the lowest number of active fires were detected in the early fire season (April to June) (Figure 5). The mid fire season concedes with prescribed early burning by protected area management staff which is conducted when the grass still has moisture and when weather conditions are not cool. However, illegal entrants into the park also probably ignite wildfires during the same period to lure animals on the green flash which sprouts after burning.

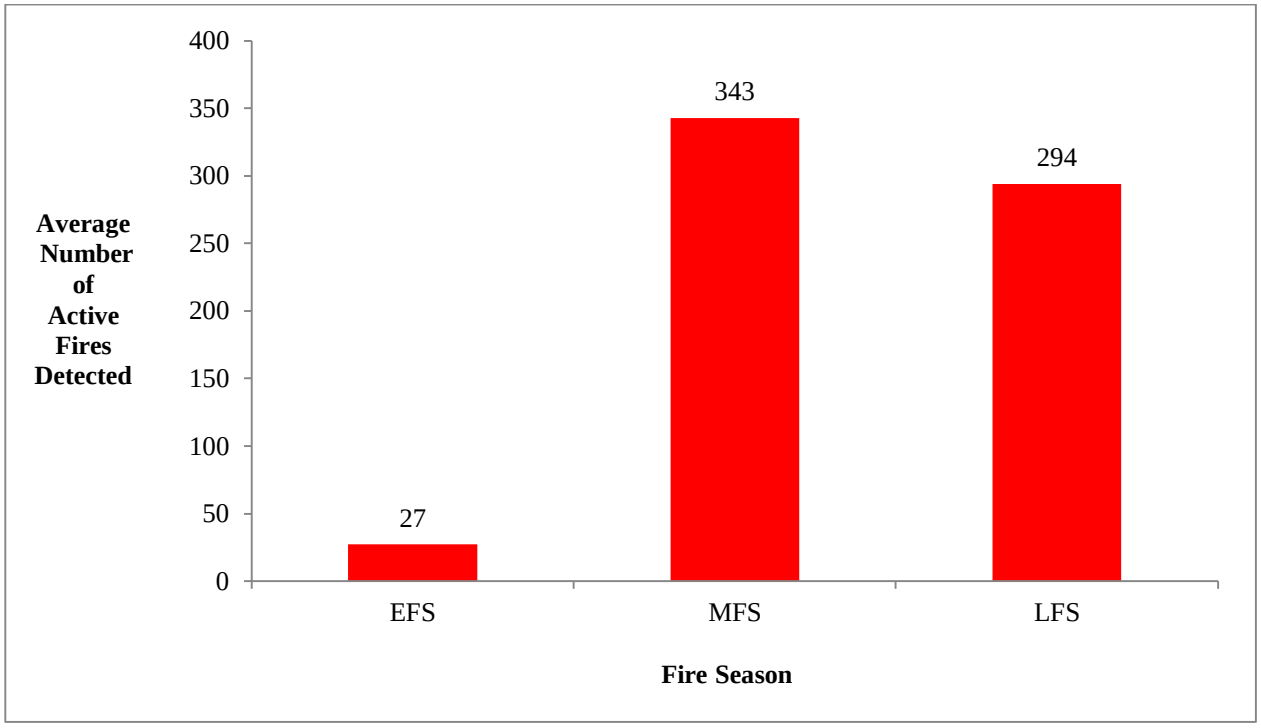


**Figure 5: Average number of active fires detected using MODIS fire products in the Lukusuzi National Park. Three fire seasons are categorized as early fire season (EFS) from April to June, mid fire season (MFS) from July to August and late fire season (LFS) from September to December.**

From a management perspective, frequent late season fires should be avoided as they have potential to destroy the canopy and reduce the woodland to coppice. To maintain woodlands, early season fires should be applied as trees won't critically get damaged and re-generation is also promoted for trees (Trapnell 1959). Going forward, there will be need to identify management interventions that will reduce the occurrence of late season fires taking into consideration the fire management objectives.

On a monthly basis, the review of average number of active fires detected indicated that August was the month with the highest occurrence of active fires. There was a gradual increase before the peak in August with the first active fires detected in May and gradually decreasing after August reaching the lowest number of active fires in November. No active fires were recorded in April. Of concern are the average number of active fires that were detected in September and October, which were the second and fourth highest respectively, as these all occurred in the late fire season when weather conditions are extreme and vegetation has low moisture content (Figure 6). Most of the late season active fires detected are associated with illegal activities as protected area management staff ideally put in early and mid-season fires.

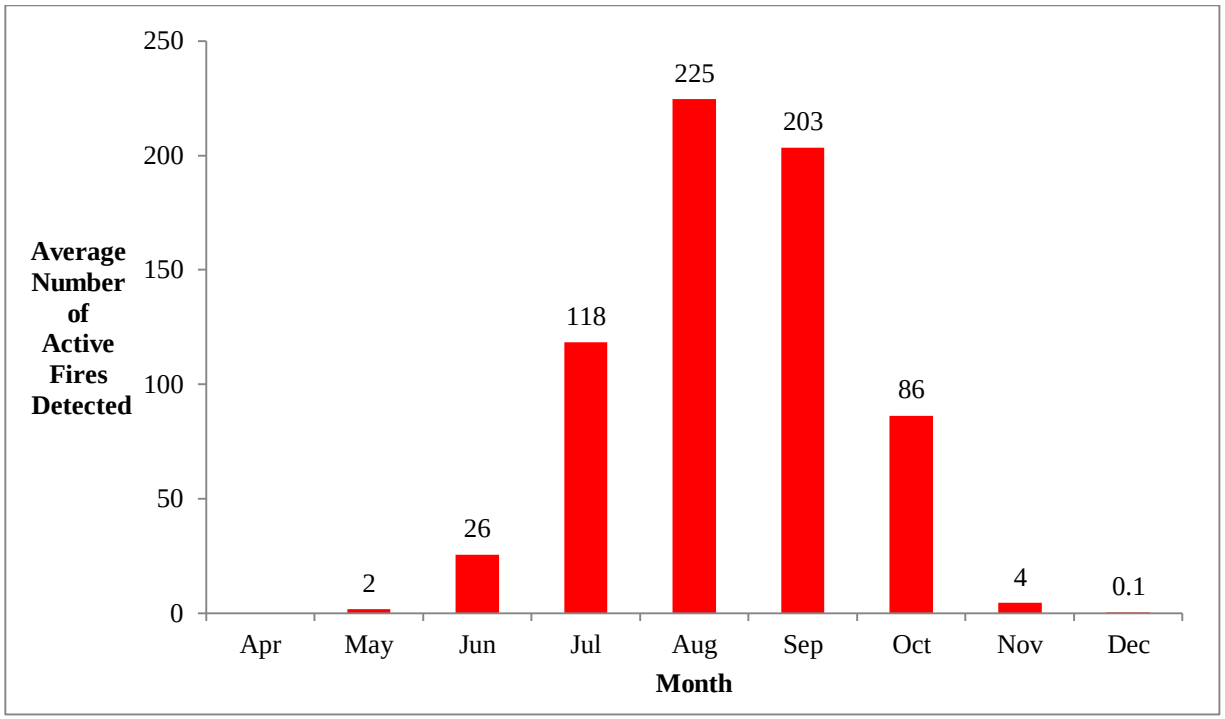


**Figure 6: Average number of fires detected per month from 2010 to 2019 in the Lukusuzi National Park using MODIS fire products**

## 3.2 Spatial Fire Occurrence

With the exception of two years (2018 and 2019), the majority of the fires were ignited on the western side of the LNP in 2015, 2016 and 2017 during the early fire season (Appendix III to V). These early fires are mainly attributed to patrol groups, which ignite early season fires in order to prevent the potential of late season wild fires which are more destructive to fauna and flora. The spatial occurrence of mid-season fires does not seem to have a definite pattern for the period of 2015 to 2019 (VI to VIII). However, there seems to be a concentration of ignited fires in the central section of the park possibly owing to the main road that acts as a source of ignition for passersby's in the park and at the same time provides access for park management staff involved in patrols and other activities like fire management. A similar spatial pattern was also observed for the late fire season with no general pattern of fire occurrence. The fires in the late fire season seem to be spread in different sections of the park for all the four years (2017 to 2018) of the five years (2019) (Appendix IX to XI).

The spatial pattern of fires in the LNP will assist management to make decisions pertaining to fire prevention, fire suppression and prescribed burning programmes during fire management planning.

# 4. FIRE MANAGEMENT VISION, GOALS AND OBJECTIVES

## 4.1 Vision

"A landscape without uncontrolled wildfires."

## 4.2 Goals and Objectives

The overall goal for implementation of the fire management programme for the LNP as provided for in the Fire Management Guidelines for Protected Areas in Zambia is ***"to maintain the long term integrity of the wildlife habitats."*** The achievement of this overall goal will require reduction of the fuel load through a prescribed burning program, reduction of the frequency and intensity of wildfires in the late dry season by application of a suppression strategy.

The overall goal has a number of sub-objectives that need to be achieved particularly pertaining to socio-ecological aspects of fire and organizational capabilities of DNPW in dealing with fire.

Below are the objectives of fire management in the LNP;

a) To reduce wildfire incidences and extent (i.e spatial coverage of uncontrolled fires)
b) To increase the number of persons with appropriate skills and knowledge on fire by 10% annually
c)To build strong and functional partnerships for fire management in the LNP
d)To increase financial capacity for fire management by 50%
e) To ensure the availability of minimum fire management equipment in all sectors by 2026
f) To conduct fire research and monitoring programmes that feed into park fire management
c) To increase awareness on and participation in fire management of surrounding communities by 2026

All the above objectives have been integrated as part of the action plan, which also includes details of indicators, activities, period of activity implementation, means of verification, assumptions and responsibilities (Table 2).

**Table 2: Action Plan for the Lukusuzi National Park Fire Management Plan**

| No | Outcome | Mgt Objective | Indicator | Activities | Period (Year) | Means of verification | Important assumptions | Responsibility |
|---|---|---|---|---|---|---|---|---|
| 1. | Improved landscape resiliency to impacts of late wildfires. | To reduce wildfire incidences and extent (i.e spatial coverage of uncontrolled fires) | Incidences of unplanned wildfires reduces by 10% of previous year | a) Form Park Fire Management Group (PFMG) | First quarter of year 1 | • Minutes of inception meeting | • Qualified staff available<br>• External partners willingness to be group members | Area Warden and Ecologist |
| | | | | b) Prepare annual fire management operational plan<br>c) Present proposed annual fire management operational plan to PFMG | Meetings held quarterly | • Minutes of park fire management group meeting<br>• Annual operational fire plan | • Availability of members for meetings | Area Warden and Ecologist |
| | | | | d) Implement annual operational plan for selected blocks | AOP implemented quarterly | • After action report<br>• Fire maps | • Resources available to conduct fire management activities | Ecologist and Park Ranger |
| | | | | e) Suppress selected unplanned fire incidences | Second to fourth quarter | • Fire incident reports | • Resources available to enable response | Ecologist and Park Ranger |
| 2. | Improved mobilization and utilization of resources for fire management. | To increase the number of persons with appropriate skills and knowledge on fire by 10% annually | Number of officers trained annually | a) Carry out manpower and training needs assessment for fire management | Annually | • Manpower and needs assessment report | • Manpower availability<br>• Qualified trainers available | Ecologist, Human Resources and Management Officer and Park Ranger |

| No | Outcome | Mgt Objective | Indicator | Activities | Period (Year) | Means of verification | Important assumptions | Responsibility |
|---|---|---|---|---|---|---|---|---|
| 2. | Improved mobilization and utilization of resources for fire management | To increase the number of persons with appropriate skills and knowledge on fire management by 10% annually | Number of officers trained annually | b) Conduct annual training of DNPW officers and other stakeholders | Annually in the second quarter | Training reports | • Financial and human resources available | Ecologist |
| | | To build strong and functional partnerships for fire management in the LNP | Number of partnerships for fire management created | a) Identify and approach stakeholders who can contribute to fire management by the end of year 1 | First quarter of year 1 | • Reports<br>• Concept notes | • Cooperation from stakeholders<br>• Resources secured through concept notes | Area Warden and Ecologist |
| | | To increase financial capacity for fire management by 50% | Number of proposals prepared and submitted<br><br>Amount of funds allocated to fire management from DNPW and other partners | a) Conduct needs assessment and budgeting<br>b) Identify potential funding sources<br>c) Prepare and submit proposals for funding | On-going | • Financial reports<br>• Proposals | • Cooperation from stakeholders<br>• Funds available internally | Area Warden and Ecologist |
| | | To ensure the availability of minimum fire management equipment in all sectors by 2026 | Minimum equipment needs met for two sectors annually (6 beaters, 2 bladder bags and 1 drip torch) | a) Conduct annual equipment inventory and needs assessment | First quarter of every year | • Inventory lists | • Equipment gaps correctly identified | Ecologist and Park Ranger |

| No | Outcome | Mgt Objective | Indicator | Activities | Period (Year) | Means of verification | Important assumptions | Responsibility |
|---|---|---|---|---|---|---|---|---|
| 2. | Improved mobilization and utilization of resources for fire management | To ensure the availability of minimum fire management equipment in all sectors by 2026 | Minimum equipment needs met for two sectors annually (6 beaters, 2 bladder bags and 1 drip torch) | b) Carry out periodic maintenance of equipment | Quarterly | • Maintenance reports | • Maintenance kit and skills available | Ecologist |
| | | | | c)Procure required equipment | Ongoing | • Local purchase order | • Resources available to procure equipment | Procurement Officer and Ecologist |
| 3. | Information generated to feed into fire management decision making improved | To conduct fire research and monitoring programmes that feed into park fire management | Number of fire datasets created and up to date<br><br>Thresholds of potential concern determined | a)Prepare project proposal to establish long term fire biodiversity research in the park<br>b) Conduct study on knowledge levels and perceptions of stakeholders on fire management | Second quarter of year 1 | • Project proposal<br>• Technical Report/peer reviewed article | • Financial and human resources available | Ecologist |
| | | | | a)Develop fire monitoring protocols<br>b)Implement fire monitoring protocols | Fourth quarter of year 1<br><br>On-going from first quarter of year 1 | • Fire monitoring protocols<br>• Monitoring reports | • Financial resources available<br>• Financial and human resources available | Ecologist |

| No | Outcome | Mgt Objective | Indicator | Activities | Period (Year) | Means of verification | Important assumptions | Responsibility |
|---|---|---|---|---|---|---|---|---|
| 4. | Effective participation and awareness that contributes to reduced wildfire incidences | To increase awareness on and participation in fire management of surrounding communities by 2026 | • Number of stakeholders sensitized<br>• Number of sensitization meetings conducted<br>• Number of fire sensitization materials prepared | a)Identify stakeholders linked to fire ignitions in the LNP<br>b) Prepare fire sensitization materials (signage, posters)<br>c)Hold sensitization meetings with stakeholders | Ongoing annually from first quarter of year 1 | • List of identified stakeholders<br>• Fire sensitization materials prepared<br>• Minutes of meetings conducted | • Stakeholders with role in fire management correctly identified<br>• Funds available to prepare sensitization materials<br>• Communities receptive to community meetings | Extension Officer and Ecologist |
| | | | • Number of fire signs placed in the park | d) Broadcast fire management information on local radio station<br>e) Prepare and place fire materials in strategic areas of the park and GMA | Ongoing annually from first quarter of year 1 | • Signage available and in place | • Skilled manpower to prepare signage available | Extension Officer and Ecologist |

## 5. ZONING FOR FIRE MANAGEMENT

Zones in the General Management Plans (GMPs) for protected areas are based on the concept of limits of acceptable use. The factors taken into consideration when setting limits of acceptable use are; fragility of the ecosystem, infrastructure and activities taking place in an area and future plans for the area.

As fire management programmes to be developed in the LNP will hinge on resource management objectives for the different park zones, the FMP will therefore adopt the zones in the GMP as fire management units (FMUs). Hence, the FMUs in the LNP will therefore be four in total as follows; Fire Management Unit 1a, Fire Management Unit 1b, Fire Management Unit 2 and Fire Management Unit 3 (Figure 7).

Details of the description, vegetation types, current and proposed fire management strategies, infrastructure available of the three FMUs are provided in table 3 below.

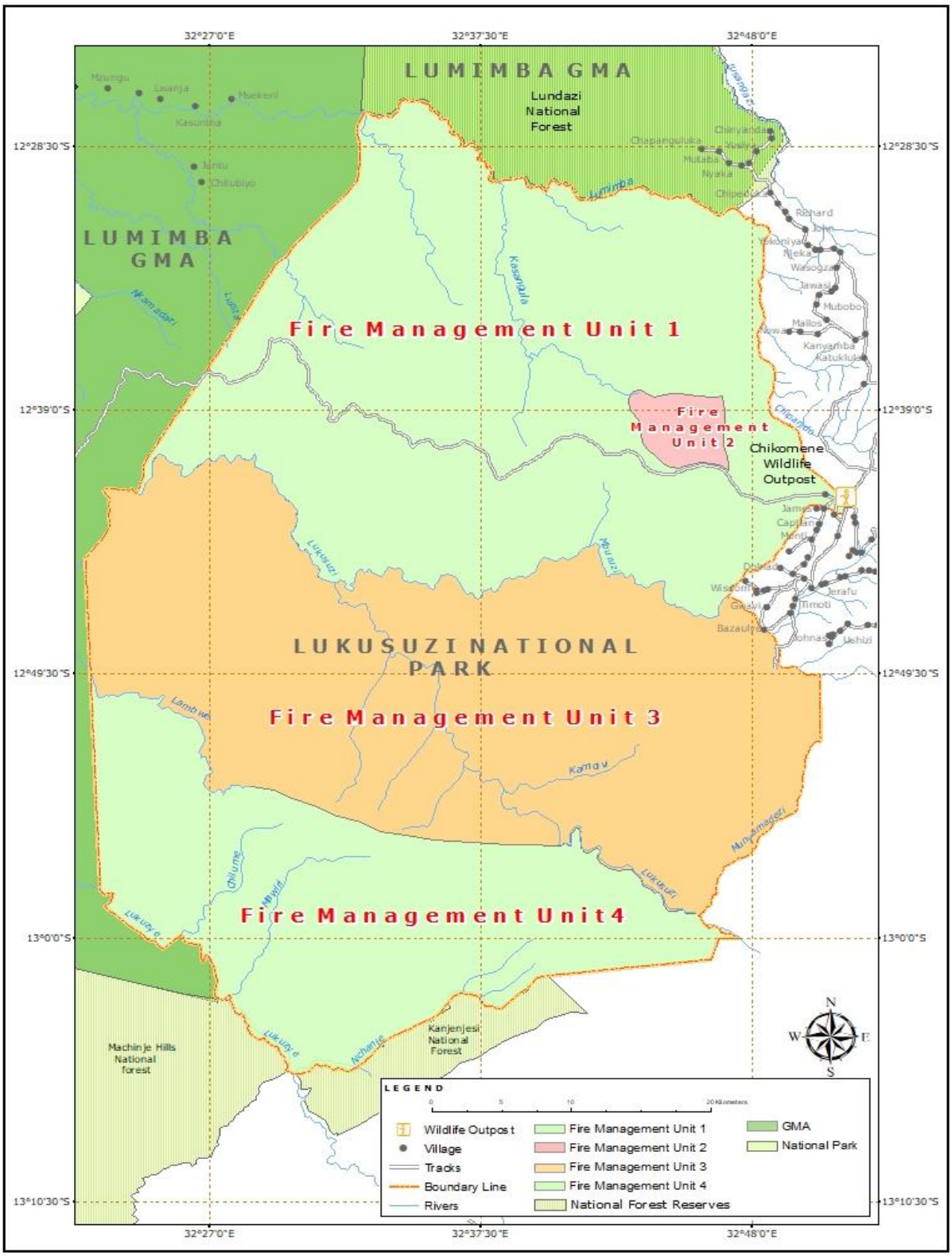


**Figure 7: Fire Management Units in Lukusuzi National Park**

**Table 3: Details of Fire Management Units for the Lukusuzi National Park**

| Fire Management Unit | Description | Vegetation Types | Fire Management Strategies | Condition | Infrastructure |
|---|---|---|---|---|---|
| 1 | This FMU is in the north of the LNP and bordered by the Lumimba River in the north and by the Lukusuzi and Mburuzi Rivers in the south. The FMU overlays the Natural Preservation Zone and has a size of 1321 $km^2$. Topographically, the area is hilly with an average elevation of 1085 m asl. | • Predominantly Miombo Woodland<br>• Patches of Dambo grassland close to the east side of the park boundary<br>• Riparian woodland<br>• Mopane woodlands in the north west | **Current**<br>• None<br><br>**Proposed**<br>• Prescribed fire<br>• Wild fire suppression<br>• Fire prevention | **Current**<br>• High occurrence of mid and late season fires<br><br>**Desired**<br>• Increase occurrence of early and mid-season prescribed fires, and reduce late season fires | **Roads/loops**<br>• Mwanya Chikomeni road<br>• Kapilinkesa road<br>• Chamvuwu road<br>• Kamsiza road<br>• Chivumbeni road<br>• Siame road<br>• Chief road<br><br>**Firebreaks**<br>• None<br><br>**Tourism Facilities**<br>• None<br><br>**Wildlife Outposts**<br>• Kasangula fly camp<br>• Lukusuzi DNPW Office |
| 2 | FMU 2 is the smallest in the LNP and overlays the cultural preservation zone. It has a size of 31 $km^2$. The area hosts historical rock paintings and caves. | • Miombo Woodland<br>• Dambo Grasslands | **Current**<br>• None<br><br>**Proposed**<br>• Prescribed fire<br>• Wild fire suppression<br>• Fire prevention | **Current**<br>• High occurrence of mid and late season fires<br><br>**Desired**<br>• Increase occurrence of early and mid-season prescribed fires, and reduced late season fires | **Roads/loops**<br>• Kasangula road<br>• Cave road<br><br>**Firebreaks**<br>• None<br><br>**Tourism Facilities**<br>• None<br><br>**Wildlife Outposts**<br>• None |

| Fire Management Unit | Description | Vegetation Types | Fire Management Strategies | Condition | Infrastructure |
|---|---|---|---|---|---|
| 3 | This FMU intertwines with the Tourism Development Zone. The size is 978 km$^2$. There are a number of rivers in this FMU which include Lukusuzi, Mburuzi, Kamoivi, Lambwe and Munyamadzi. | • Mainly Miombo Woodland<br>• Largest portion of grassland found in this FMU mostly close to the east side of park boundary | **Current**<br>• None<br><br>**Proposed**<br>• Prescribed fire<br>• Wild fire suppression<br>• Fire prevention | **Current**<br>• High occurrence of mid and late season fires<br><br>**Desired**<br>• Increase occurrence of early and mid-season prescribed fires, and reduced late season fires | **Roads/loops**<br>• Malidonga road<br><br>**Firebreaks**<br>• None<br><br>**Tourism Facilities**<br>• None<br><br>**Wildlife Outposts**<br>• Malidonga Fly Camp |
| 4 | The FMU is in the south of the park and overlays the Natural Preservation Zone. It has a size of 443 km$^2$ with the Lukuzye, Nchanje, Lukusuzi and Lambwe rivers forming parts of its boundary. | • Dominated by Miombo Woodlands<br>• Grassland patches extend from the north of this zone towards the east park boundary | **Current**<br>• None<br><br>**Proposed**<br>• Prescribed fire<br>• Wild fire suppression<br>• Fire prevention | **Current**<br>• High occurrence of mid and late season fires<br><br>**Desired**<br>• Increase occurrence of early and mid-season prescribed fires, and reduced late season fires | **Roads/loops**<br>• Bonbridge road<br><br>**Firebreaks**<br>• None<br><br>**Tourism Facilities**<br>• None<br><br>**Wildlife Outposts**<br>• None |

# 6. FIRE MANAGEMENT PLANNING AND PROCEDURES

## 6.1 Fire Management Planning

### 6.1.1 Pre-season Planning

The planning for annual fire management activities will be done from February to March of the same year. These months are associated with limited accessibility within the park and offer an opportunity for coordinated joint units planning at park level. It is proposed that the Research, Law Enforcement, Community Based Natural Resources Management (CBNRM) and Conservation Units be part of the planning process for fire management through a meeting to be attended by patrol leaders. To ensure effective fire management for the year, it is recommended that the pre-season fire management planning be concluded by mid-April before the cessation of the rains and commencement of unplanned wild fires. The annual burn plan, which will be a product of the pre-season planning, will need to be presented to the Park Fire Management Group (PFMG) at the first annual meeting within the month of April.

The following should be considered during the pre-season planning process;

a) Review of the past season prescribed burning program using reports and fire maps (seasonal)
b) Consider the resources required and available for the coming fire season
c) Identify and map the areas/blocks and vegetation types to be affected by prescribed burning in the coming season
d) Consider firebreaks and/or fire blocks that will be vital or be in place in the implementation of the prescribed burning program
e) Identify partners/collaborators that might be affected by the prescribed burning program
f) Identify facilities in the areas proposed for prescribed burning
g) Determine points and types of ignition for the prescribed burning programme
h) Schedule fire refresher training for park staff
i) Develop list of action items addressing the following topics: Specify tasks to be undertaken, responsible officer, start date, extent of completion of task, completion date and comments. Action items might include budget for fire management, preparation of prescribed burn plans and maintenance of equipment. This activity should be undertaken during the pre-season planning process

### 6.1.2 Burn Plan Writing Process

Preparation of the prescribed burn plan will be part of the pre-season planning process. The burn plans will be prepared for identified blocks were prescribed burning will take place in a particular year by the Research Unit with input from Law Enforcement and Conservation units. In the case of areas with tourism facilities, DNPW shall seek either the participation or input of the tour operators in the preparation of the prescribed burn plans. After review, the prescribed burn plans will be edited and finalized in preparation for implementation at the required time. The process of writing the burn plan will need to consider the following aspects:

**Table 4: Inputs of the Prescribed Burn Plan Writing Process**

| Prescribed Burn Plan Summary (Ronde., et.al 2004) | Detail of content |
|---|---|
| a) Purpose and objectives | • Reason for fire prescription |
| b) Burn Plan Map | • Map of the block or unit |
| c) Equipment and Personnel | • List of equipment and manpower |
| d) Fire Prescription | • Species composition<br>• Weather conditions |
| e) Estimated Number of days for prescribed burning | • Season of the year to burn |
| f) Time of Day | • Standard work day<br>• Knowledge of local weather<br>• Reliability of weather forecast |
| g) Firing Plan | • Narrative section<br>• Detailed map |
| h) Escaped-Fire Plan | • Potential fire escape and actions to take (LCES)<br>• Contingency resources |
| i) Safety/Emergency Plan | • Safety guidelines (IRPG)<br>• After action review (Formal) |
| j) Control and Mop-up | • Safeguards to contain fire depending on area |
| k) Evaluation | • Records of actual weather conditions, fire behavior, effects of fire on the environment |

## 6.2 Fire Management Procedures

### 6.2.1 Decision Making for Fire Management

Percentage of area to be burned annually will be determined by the amount of seasonal rainfall and biomass availability. Criterion for burning will also include risk assessments of people and property interacting with that part of the system. Particular focus will be paid to the following;

- Risk assessment which includes biomass assessment and risk to human life
- Whether the vegetation is dry at that time (extent of curing)
- Fire return interval for each vegetation type

### 6.2.2 Implementing Prescribed Fire

As part of fire management activities, prescribed burning will be carried out with identified goals or objectives (FWS 2003). Ideally, prescribed burning will commence after the cessation of the rainy season and when the extent of fuel curing as assessed by field officers permits ignition of prescribed fires. The DNPW will need to adapt the incident command system when carrying out prescribed burning in LNP as it will heighten the level of safety and at the same time ensure the effectiveness of the prescribed burning. Furthermore, the use of ICS will also allow for the field staff to get valuable training (NPWS 1999).

The procedure to be followed when implementing prescribed burning has been provided below;

a) The team should review and be briefed on safety guidelines

b) Record and monitor weather conditions using the kestrel at 2 to 3 hour intervals throughout the burning period
c) The team implementing the prescribed burning process should be given the procedure on prescribed burning of the area
d) Test burning should be carried out before firing
e) Operators and other stakeholders should be informed about the prescribed burning programme before its commencement if facilities are within the block
f) Communication should readily be available to enable information dissemination in case of the prescribed fire becoming a wild fire
g) The location of all prescribed fires ignited should be recorded using a GPS

### 6.2.3 Fire Management Safety Rules

Rules that minimize the risks to officers, property, tourists and workers of tourism facilities will be applied during the implementation of the fire management plan. Every effort will be made to ensure that the safety of the public is not endangered by the location of any prescribed fire within the park. This will therefore require notifying the surrounding communities around the LNP of the prescribed burning programme particularly the ones located on the periphery of the park and the users of the transitory route between Mwanya and Lumezi Boma. Other users of the park will be informed on a case by case basis at the park entry gates.

The Ten Standard Fire Orders, Eighteen Watch Out Situations and LCES (Lookouts, Communications, Escape Routes, and Safety Zones) provide the safety rules for the fire management program. The ten fire orders and eighteen Watch Out Situations that have been in use in other countries and will also be applicable in Zambia are as follows;

a) Keep informed on fire weather all the time
b) Know what your fire is doing at all times
c) Base all actions on current and expected behavior of the fire
d) Identify escape routes and safety zones, and make them known
e) Post lookouts when there is possible danger
f) Be alert, Keep calm and Think clearly, Act decisively
g) Maintain prompt communications with your forces, your supervisor and adjoining forces,
h) Give clear instructions and insure that they are understood
i) Maintain control of your forces at all times
j) Fight fire aggressively, having provided for safety first

### 6.2.4 Responding to Unwanted Fires

Despite all the best efforts to be put in by park management, it is anticipated that unwanted fires/wild fires will continue to occur in the LNP. These wild fires are potentially attributed to illegal incursions and carelessness by travelers or users of the park. Due to competing demands as a result of limited manpower levels and financial resources, it has and will not be possible to respond to all wild fires.

Moving forward, there is need to put in place guidelines that will assist in determining which fires park management should respond to as well as the procedures to be followed in responding to wild fires. Unwanted fires can affect the species composition of flora and deplete the food available for fauna and hence unwanted fires should be managed to benefit the resources of the park. Currently, the manpower levels are low in the park and it is proposed that a team of officers should always be on stand-by especially from the last month (August) of the mid fire season to the last month (November) of the late fire season. Funds permitting, there may be need to hire and train casual labourers from the surrounding communities for the prescribed burning and suppression activities of the fire season.

The following should be considered when responding to a wildfire in the LNP;

a) Any unwanted fire incidence should be properly documented and information should be transmitted to the research and law enforcement units;
b) The park team should try as much as possible to determine the exact location of the fire and assess the resources at risk from the unwanted fire and determine if it is one that should be responded to;
c) The team should always suppress fires that occur in critical habitats of the park;
d) The team should consider the weather conditions of the day and determine if it is the right time of the day after considering the resources at risk (fires in the daylight during the hot dry season in the valley are very difficult to control and there is potential for someone to be scorched);
e) The stand-by team should be informed as soon as a decision has been made that there is need to respond to the unwanted fire;
f) The stand-by team should be dispatched with all necessary equipment and food resources;
g) Safety of the officers involved in fighting the wild fire should not be compromised and should be top priority;
h) The team should assess the situation once at the site of the unwanted fire (wild fire) and decide on how best to fight the fire;
i) In situations where there is a combined team of DNPW and tourism operators, the DNPW will lead the operation of fighting the wild fire;
j) A mop-up operation should be conducted once the fire has been put off (controlled);
k) The team leader should inform the Area Warden once the fire has been put off in the park;
l) Debriefing of the team involved in the putting off of the wild fire should be conducted in order to obtain lessons on how the response and possibilities for future improvement;

### 6.2.5 Communication during Wildfires

To ensure the safety of lives and property, it will be important to maintain continuous flow of information during wild fires. The communication were possible will mainly revolve around the park management office, field officers fighting the wild fire and any stakeholders in the park that might be affected by the fire. Radio handsets, cell phones and internet will therefore be the main equipment for communication between the various points already outlined.

The following aspects will need to be communicated during wild fires;

a) Area of the park where the wild fire is burning
b) Property which might be at risk due to the wild fire
c) Manpower available to fight the wild fire
d) Equipment available to fight the wild fire
e) Appropriate time to fight the wild fire
f) Weather conditions
g) Firebreaks that might assist to fight the wild fire
h) Direction in which the wild fire is likely to go

### 6.2.6 Best Management Practices for Fire Management

Potential negative impacts from the implementation of the fire management plan will require the application of best management practices. Hence, DNPW will consider for adoption a number of management practices in the LNP that have been applied in other protected areas locally, regionally and globally. Table 6 below outlines a number of best management practices for fire management for application in the LNP (Daigneault 2014).

**Table 5: Best Management Practices for Fire Management in the Lukusuzi National Park**

| Activity | Best Management Practice |
|---|---|
| 1. Prescribed burning | • Carry out the prescribed burn with trained team<br>• Avoid prescribed burning on steep slopes with high erosion potential or high erodible soils<br>• Avoid intense burning which might expose mineral soil<br>• In wetlands, organic matter should not be completely consumed<br>• Consider the weather, time of year and fuel conditions |
| 2. Firebreak/Fireline construction | • Natural barriers should be used as firelines/firebreaks in areas where artificial construction would result in excessive erosion and sedimentation<br>• Firebreaks/firelines should not be placed in sensitive habitats like wetlands, dambos, lagoons unless it is absolutely necessary<br>• Construct firelines/firebreaks in a way that reduces erosion and sedimentation and prevents runoff directly entering watercourses<br>• Firebreaks should not be constructed straight up and down hill but on the contour<br>• Hand tools should be used when linking firebreaks into stream channels |

### 6.2.7 After Action Review Process

In order to improve future decision making for fire management, all fire management activities will be subjected to an after action review (AAR) process immediately after they are undertaken. This will be similar to the debriefing conducted after patrols. The review will focus on activities such as prescribed early burning and wild fire suppression. Part of the review process will require documentation of recommendations from the field staff involved in implementation of the fire management programs when they report back to the Ecologist.

The following aspects should be considered during the review process;

a) The effectiveness of ignition and extent of burning
b) Any challenges encountered during prescribed burning or wild fire suppression
c) State of equipment after each event
d) Areas for improvement in the next event/next year

All AAR should be limited to 30 minutes with the questions listed below being considered:

- What was planned?
- What actually happened?
- Why did it happen?
- What can we do better next time?

## 7. ALTERNATIVES TO PRESCRIBED FIRE

In addition to carrying out prescribed burning, there are a number of alternatives that can be implemented, which fall within the categories provided below.

### 7.1 Mechanical Treatment

The option of mechanical treatment will consider slashing or mowing of grass particularly around tourism and park management facilities. This option will be useful especially around facilities where burning might pose a high risk of damaging the property or where burning might not be possible. As a treatment, slashing and mowing reduces the amount of fuel at a particular site and therefore reduces the danger of large conflagrations of wild fires later in the mid and late fire season when the fire hazard is higher. It is recommended that mechanical treatment be undertaken in the early fire season before the start of the prescribed burning programme and repeated during the mid and late fire season depending on the amount of fuel available.

### 7.2 Fire Prevention

Apart from prescribed and fire suppression strategies, the implementation of the fire management plan will require the application of the fire prevention strategy. A number of activities will be undertaken as a prevention strategy in the LNP including law enforcement, public awareness and reduction of fire risks. Currently, the main activity being implemented as part of fire prevention is law enforcement though there are challenges of limited manpower and accessibility to most portions of LNP, which overall reduces the patrol coverage. The other two activities of public awareness and reduction of fire risks have been implemented on a minor scale in and around the park by partners like Community Markets for Conservation (COMACO). Going forward, the following activities will be implemented as part of the fire prevention strategy:

#### 7.2.1 Public awareness

##### 7.2.1.1 Current Status of Public Awareness

There a number of public awareness programmes being implemented close to the LNP especially in the open areas of Chikomeni, Mwasephangwe and Lumimba communities. These programmes have mostly focused on wildlife conservation awareness with limited emphasis on fire

management. A public awareness programme that explicitly deals with fire will therefore need to be developed and taken to the right audience.

The development of the public awareness programme will need to cover a number of topics that can assist in reducing the potential of wild fires entering the park from the communities and also discourage other park users from intentionally or accidentally lighting fires in the park. Topics that can be covered in the public awareness programme include; prescribed burning, causes of wild fires, reporting of fires, fire use by communities, protection of facilities and human life etc.

### 7.2.2 Target audience

A number of communities surrounding the LNP have the potential to be sources of wildfires. On the east there is Chikomeni and Mwasephangwe, while the west wild fires may originate from Mwanya, Chitungulu and Kazembe communities. While certain sections of the LNP are surrounded by rivers which also act as natural firebreaks, the seasonal nature of the rivers and streams makes crossing of wild fires into the park a possibility. The communities to be targeted for fire awareness will therefore be identified by their potential to be a source of wild fire that can spread into the LNP from the periphery of the park.

### 7.2.3 Dissemination of Public Awareness Information

All avenues available for dissemination will need to be explored by DNPW and its partners in order to ensure information on fire management reaches a wider audience. Through the Community Based Natural Resources Management (CBNRM) Unit, DNPW will take a leading role when it comes to dissemination of fire management information. Furthermore, the DNPW shall review all existing information available on fire management with its partners like COMACO and build on the already established public awareness programme. The information will be circulated through the following options; community meetings, programmes on community radio stations, leaflets, cellphones, sign posters and notice boards.

## 7.3 Reduction of Fire Risk

Management of the fire risk is critical if the unplanned occurrence of wildfires is to reduce. There is need to consider the options as prescribed below as a way of managing the fire risk;

a) Operations with potential to result in wild fires should include firefighting equipment on their list i.e. fire beaters
b) Designated camping sites in the LNP should provide a secure place for cooking
c) Any burning should be conducted during the appropriate time of the day

# 8. FIRE MANAGEMENT FACILITIES AND EQUIPMENT

## 8.1 Facilities

Currently, the LNP has limited infrastructure to support the implementation of the fire management programme. Largely, the LNP has remained underdeveloped as compared to the three other NPs within the Luangwa Valley. The park has gates along the Lumezi-Mwanya road at

Chikomeni and Mwanya with water and houses available at both park gates including houses. There is a single vehicle at each gate, a tractor and tow grading equipment at park level. However, there is no workshop at any of the gates and maintenance of vehicles is therefore done at the Chipata offices. This implies the absence of mechanics at the park level, which might be due to the few vehicles and other plant equipment available. A control room is also lacking at the park headquarters for LNP at Chikomeni.

### 8.2 Equipment and Supply Needs List

With support from Cooperating Partners (CPs), the DNPW has started stocking up fire management equipment at LNP. Thus far, eleven (11) firebeaters, two (2) drip torches, two (2) bladder bags, twenty (20) googles and one (1) GPS have been procured with support from GIZ. There will be need to increase on the levels of equipment, which are easy to maintain, use and affordable as the implementation of the fire management plan takes off in the LNP. Concurrently, DNPW should explore old traditional alternatives to the above equipment were possible like in the case of match sticks as an option for igniting prescribed fires in the absence of drip torches. Of major concern firstly, is the absence of handheld radios and radios in the vehicles, which will make communication difficult when on the fire management programme particularly in scenarios of fighting a wild fire in the park. Secondly, the local number of GPS handsets at park level is also of concern as it limits the capture of spatial and temporal data on fire locations in the park.

Appendix III lists the current and required basic equipment for park fire management.

### 8.3 Firebreaks

The LNP has no designated firebreaks. The Lumezi to Mwanya road which traverses the park is the only documented road which can be utilized as a firebreak. However, owing to lack of maintenance, there is a probability of it not being effective in confining wild fires to a particular compartment of the park. Over time, the DNPW officers have been gradually putting in place access loops for management purposes particularly deployment of patrols. As is the case with the main road in the park, the access loops are not subjected to annual maintenance. For effective fire management, there will be need to maintain the access loops annually in order for them to reduce the extent of burnt area, carry out prescribed burning and for fighting unplanned fires. The park management staff involved in fire management should also identify areas where to put in game viewing loops and other access loops, which can act as firebreaks in addition to the natural firebreaks like rivers and streams.

It is recommended that the following procedure be taken when setting up the firebreak system for LNP;

i) The research, planning, conservation and law enforcement units should work together to identify the firebreaks to be maintained based on funding availability
ii) Ideally, firebreaks should be 15 m in width, but were not possible burning on the side maybe the option
iii) DNPW should identify as to which loops the lodges will assist in grading (When lodges become operational in LNP)

iv) Funding and weather conditions permitting, all physical firebreaks should be in place before the commencement of the prescribed early burning season
v) Lodges should continue to put in place firebreaks around their facilities to avoid potential damage to their property (When lodges become available in LNP).

# 9. FIRE MANAGEMENT ORGANIZATION AND BUDGET

## 9.1 Fire Management Organisation

### 9.1.1 Formation of Fire Park Management Group

The implementation of the fire management plan for the LNP will require the formation of a Park Fire Management Group (PFMG). This group will enhance fire management in the park through the participation of different stakeholders. The PFMG will comprise of DNPW, representatives of the tour operators though there is no photographic operator in the park at the moment, conservation organisations and communities on the periphery of the park. The Area Warden will chair the PFMG.

The group should at the most hold three meetings in a year with the first meeting in March/April focusing on the annual fire management programme for the year, the second meeting in June/July to review the progress made in the implementation of the approved fire management programme and the last meeting in November/December to review the annual fire management programme. Apart from these specified tasks, the PFMG will also annually review the implementation of the fire management plan, challenges encountered and proposed actions for improvement.

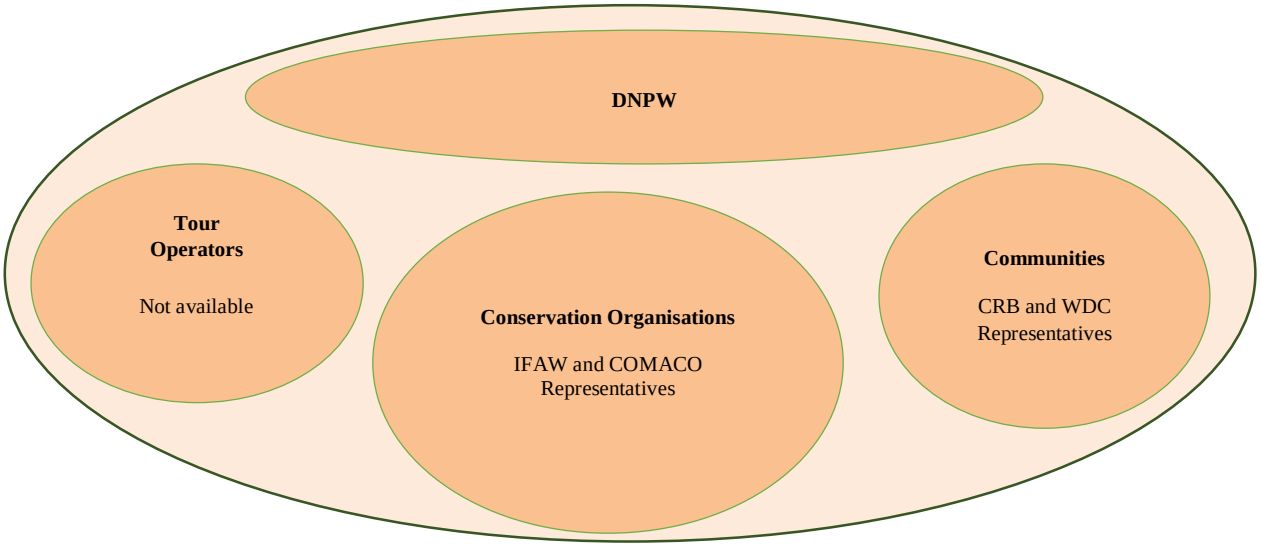


**Figure 8: Composition of the Proposed Fire Management Group for the Lukusuzi National Park**

### 9.1.2 Training

To improve the understanding of fire management in the LNP, it will be necessary to train field staff in fire management. A certain number of officers have been trained already with funding from GIZ. As there is staff movement and not all officers were trained at LNP, the recommendation is to build capacity by conducting annual fire management training as part of the annual fire management programme. One option would be to train the patrol leaders for a start before the training trickles down to the other officers. The key aspects of the training will be the reminders on safety and application of prescribed burning.

The DNPW should ensure that fire management is integrated or continues to be a part of field officers training at both Nyamaluma and Chunga Training Schools for new officers. At the same time, DNPW should take advantage of fire management training courses at the Copperbelt University (CBU), Zambia Forestry College (ZFC) and other international training institutions to expose their staff to the latest approaches in fire management.

Apart from fire management training, there is need for the officers to receive training in first aid as well. Being recipients of first aid training will not only assist them during fire management but during other field operations in the park.

### 9.1.3 Collaborative Partners

Notwithstanding that there are currently no photographic tour operators operating in the park, there are still a number of partners that DNPW can collaborate with in terms of fire management. Partners operating in the park mainly have interests linked to conservation and law enforcement, while others with interest in consumptive tourism and livelihoods are operating in the communities surrounding the park (Table 8).

Going forward, the DNPW will have to enhance collaboration with these partners in order to improve the management of fire in the LNP by including certain partners on the PFMG (Figure 11).

**Table 6: Collaborative partners operating inside and outside the Lukusuzi National Park that can or play a role in Fire Management**

| Consumptive Tourism Operators | Non-Consumptive Tourism Operators | Conservation and Research Operators | Government Departments |
|---|---|---|---|
| • Mwanya outfitter<br>• Chanjuzi outfitter<br>• Nyaminga outfitter | • No photographic operators at the moment in LNP | • COMACO<br>• IFAW | • Zambia Meteorological Department<br>• Forestry Department<br>• Ministry of Agriculture |

## 9.2 Budget

The annual funding for fire management activities is provided by the Government of the Republic of Zambia (GRZ) to DNPW. As fire management is not restricted to a single budget line due to various strategies involved, other sections like law enforcement, infrastructure and CBNRM can all contribute towards its implementation. To fully implement the fire management plan particularly with regard to fire research and monitoring and public awareness programmes will

require extra sources of funding which shall be sourced through project proposals and concept notes.

Details of the budget to support full operationalization of this plan are provided in appendix XII.

## 10. COMMUNICATIONS PLAN

DNPW recently installed a radio system in the LNP with support from GIZ. This will assist in communication during the implementation of the fire management programme in the park. Apart from the radio system, the staff will take advantage of cell phones and internet to obtain information on fire management. The current channels of communication are highlighted in the annual operational plan for the LNP and below;

a) Internal VHF radio communication: Three camps strategically located around the LNP currently have been installed with base radios. Additionally, there are three vehicles with radios which will enable communication between the three camps and the vehicles. There are also plans to procure handset radios for patrol teams to maintain communication between them and the base camps. Alternatively, the handset radios for patrol teams will be deployed during the annual fire management programmes.
b) External VHF radio communication: Due to the absence of photographic operators, there is no external VHF radio communication within the LNP. This will be developed when and as tour operators become available in the park.
c) Internet communication: This form of communication will be utilized between the Regional Office and the park offices at LNP in between meetings. In future, this option will be useful for communication of wild fire occurrences between the lodges and the park offices at Chikomeni as well as in responding to wild fires.

**Table 7: Communication Protocol for Fire Management in the Lukusuzi National Park**

| Source of wildfire information | Organisation recipient of wildfire information | Contact person | Media of information transmission | Contact information | Type of information |
|---|---|---|---|---|---|
| Lodge Operators (TBA) | DNPW | Ranger | Phone | TBA | • Wildfire location (Descriptive)<br>• Property at risk (Descriptive)<br>• Direction of wild fire (Descriptive) |
| | | | Email | TBA | |
| | | Ecologist | Phone | TBA | |
| | | | Email | TBA | |
| Transit Passengers | DNPW | Duty Officers | Radio | Changachanga gate<br><br>Chikomeni gate | • Wildfire location (Descriptive)<br>• Direction of wild fire (Descriptive) |
| DNPW field officers | DNPW | DNPW radio operator | Radio | Radio frequencies (TBA) | • Wildfire location (Coordinates)<br>• Fire behaviour (Type of fire: ground, surface, crown; rate of spread; direction)<br>• Weather conditions (Temperature, |
| | | | Phone | TBA | |
| Tourists | DNPW entry/exit gates | Duty Officers | Direct contact | Changachanga gate<br><br>Chikomeni gate | • Wildfire location (Descriptive) |

# 11. FIRE RESEARCH

## 11.1 Current Status of Fire Research

There has been no research conducted on fire and biodiversity in the LNP in the short, medium and long term. This is largely due to limited resources in terms of funds and human personnel. Information from other protected areas in southern Africa and other parts of Zambia has and will therefore be used to guide decisions on the fire regimes to be applied in the LNP.

## 11.2 Need for Fire Research

Moving forward, there is need to establish a fire and biodiversity research programme for the purpose of informing localized management decisions on fire management. This is important as the LNP is the only park in the Luangwa Valley with more than 80% covered by miombo woodlands and having species like sable antelope in the Eastern Region. Moreover, this kind of research will provide information on the biodiversity of the park which is line with the National Biodiversity Strategy for Zambia. Not to be left out will be the integration of climate change aspects in the fire and biodiversity research.

The fire research for LNP will need building synergies on the already established relationships with both local and foreign Universities, so as to draw on the experts and tap their student resources at both undergraduate and postgraduate levels in view of the low manpower levels in the DNPW. This research programme will also provide opportunities for ecologists and other officers within DNPW interested in fire and biodiversity work to enhance their research skills and knowledge on fire management.

To achieve such a research programme, the DNPW will need to prepare a detailed research proposal providing the financial and personnel resources required for the undertaking.

# 12. MONITORING AND EVALUATION

Monitoring and evaluation will be a cardinal aspect as it will enable park management to determine whether the fire management strategies are contributing towards the achievement of the fire management objectives. A number of monitoring approaches will be put in place.

The following are proposed as part of the monitoring program for fire management in the LNP;

## 12.1 Fire Data Collection

### 12.1.1 MODIS web fire mapper

To have an overview of fire occurrence in the LNP, there will be need to have daily data. Hence, the park will need to have access to the MODIS active fire products, which is downloadable from the emails sent to recipients every twenty-four (24) hours. There will be need to assign an officer at Chikomeni to receive, download and store for monitoring purposes. Additionally, the system should make it possible for the LNP to ground truth locational fire data made available by MODIS active fire products.

A number of key products will be prepared from the MODIS data which will include; monthly, quarterly and annual fire maps as a way of monitoring the spatial and temporal occurrence of fires in the park. All these maps will be useful when it comes to the pre-season planning and annual review meetings.

### 12.1.2 Aerial Surveillance

Owing to the current lack of road infrastructure, the proposed ground truthing of received MODIS data may be difficult in certain areas of LNP. Therefore, where funds are available and permit, the park management should utilize the option of aerial surveillance to confirm the fire points using either an aircraft or unmanned aerial vehicle. This option will also assist to confirm the source of ignition especially if it was caused by illegal entrants into the park.

### 12.1.3 Photo-points

Photo-points are a useful approach to monitor the impacts of wild fires and prescribed fires in a protected area. There will therefore be need to establish points in selected sections of the park were photos can be taken periodically and then stored for future reference. The photo-points will be integrated in the fire-biodiversity research programme of the park where experimental plots will be photographed in order to assess their response to different fire regimes that will be applied on them.

### 12.1.4 Capture Fire Perimeter

The methodology to capture the perimeter of a fire will vary depending on the extent of the burnt area. Small fires can easily be captured using a hand held GPS unlike large fires, which require satellite imagery or an aircraft to fly over the area affected by the fire. Considering the prescribed burning approach were fires are ignited and allowed to burn, it might be difficult for officers to follow the perimeter of a previous fire. Large fires in the LNP will therefore be captured using the MODIS burnt area product which is available from the University of Maryland and allows mapping of the extent of fires in large protected areas.

## 12.2 Annual Review of the Fire Management Plan

The review of implementation of the FMP will be conducted annually to ensure that activities are being carried out as planned. Review of the FMP will be conducted by the PFMG in November towards the end of the year after the cessation of fire season.

## 12.3 Adaptive Management Strategy

The implementation of the fire management plan will make use of the adaptive management strategy. This will involve management intervention as a tool to strategically probe functioning of an ecosystem, both to change the system and to learn about the system (Wilgen., 2011). In this particular case, fire will be the management intervention. A cardinal aspect of the adaptive management strategy will be the monitoring of the effects of fire on the biodiversity of the park over time. As time passes with the implementation of the fire management plan, adjustments will be made accordingly in response to observations in the park.

## REFERENCES


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3. DNPW. 2016. Lukusuzi National Park General Management Plan. Department of National Parks and Wildlife, Chilanga. Zambia.
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## Appendix I: Template for Prescribed Burn Plan

| | |
|---|---|
| Province: | |
| District: | |
| NP/GMA: | |
| Fire Management Unit: | |
| Fire Block: | |
| Chiefdom: | |
| Closest Village: | |
| GPS Coordinates Location | Eastings: (1) (2) |
| | Northings: (1) (2) |

**PRESCRIBED BURN OBJECTIVE**: range management, brush reduction, training, research etc.…

_____
_____
_____
_____
_____

**SITE DESCRIPTION (i.e vegetation, topography, elevation)**

_____
_____
_____
_____
_____

**REQUIRED NOTIFICATIONS:**

| Title | Name | Contact Information | Date Contacted |
|---|---|---|---|
| Lodge | | | |
| Lodge | | | |
| Lodge | | | |
| Lodge | | | |
| Wildlife outpost | | | |
| Chief: | | | |
| Nearest Community: | | | |
| Area Councilor: | | | |
| Other: | | | |
| Other: | | | |

**FUEL AND WEATHER PRESCRIPTION:**

| Weather Parameters | Minimum | Desired | Maximum |
|---|---|---|---|
| Air Temperature (ºC) | | | |
| Relative Humidity (%) | | | |
| Wind Speed (kph) | | | |

**EQUIPMENT & PERSONNEL:**

| Item | Quantity | Source |
|---|---|---|
| Weather kit | | |
| First Aid Kit | | |
| Water | | |
| Food | | |
| Axe | | |
| Slasher | | |
| Hoe | | |
| Machete | | |
| Beaters | | |
| Flappers | | |
| Protective Clothing | | |
| Personnel | | |
| | | |
| | | |

**FIRE IMPLEMENTATION PLAN:**

Burn boss: _____

Firebreak preparations: _____

_____

Safety zones and escape routes identified: _____

_____

Map attachments: estimated area to be burned, directions, location of control lines.

_____

**CONTINGENCY PLAN:**

_____

_____

**POST FIRE MANAGEMENT PLAN:**

| How long will the site be rested: | |
|---|---|
| | |
| | |
| Dates and times to be visited: | |
| | |
| | |

**Notes:**_____

_____

_____

_____

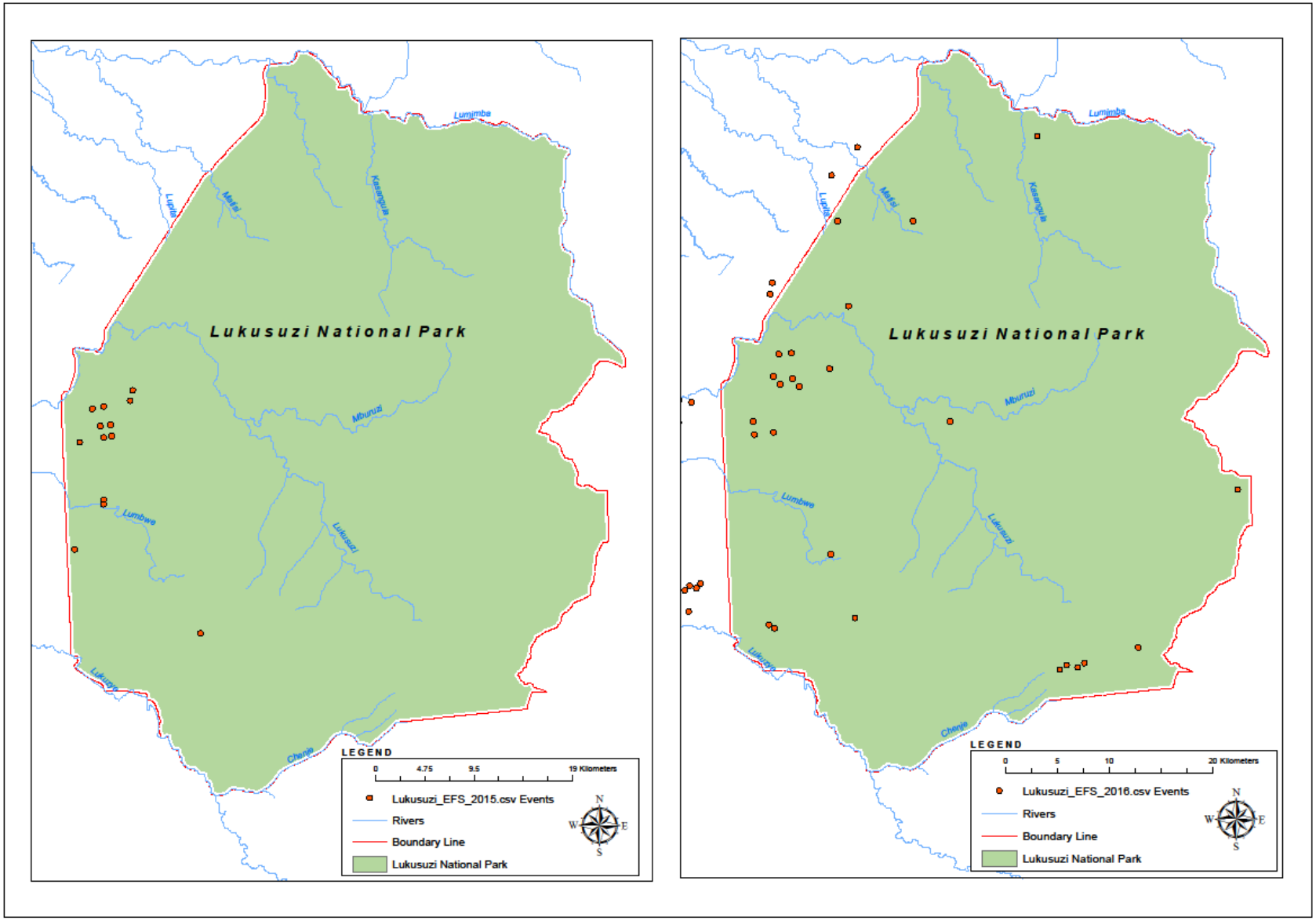
_____

**Appendix II: Current and proposed numbers of various equipment for Lukusuzi National Park***

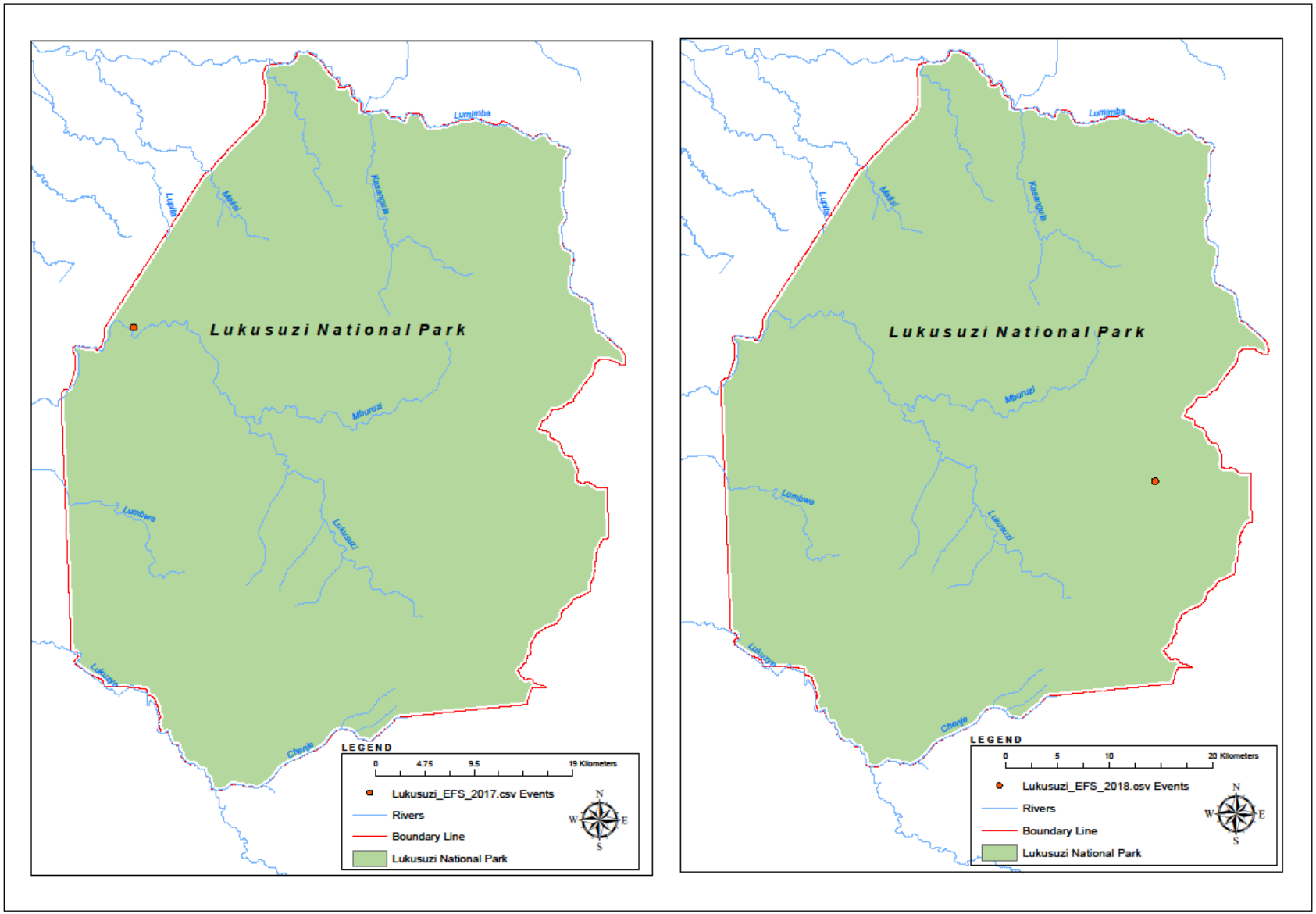
| No | Equipment | Current | Required | Additional number required |
|---|---|---|---|---|
| 1 | Fire beaters | 11 | 80 | 69 |
| 2 | Kestrel | - | 4 | 4 |
| 3 | Vehicle | - | 1 | 1 |
| 4 | Drip torches | 2 | 4 | 2 |
| 5 | Googles | 20 | 27 | 7 |
| 6 | Gloves | - | 27 | 27 |
| 7 | Weather Station* | - | 1 | 1 |
| 8 | Tractor* | 1 | 1 | 0 |
| 9 | Water bowser* | - | 1 | 1 |
| 10 | Radio communication (Handsets) | - | 6 | 6 |
| 11 | Tow grader* | 1 | 1 | 0 |
| 12 | Motorised grader* | - | 1 | 1 |
| 13 | Bladder bags | 2 | 13 | 11 |
| 14 | GPS | 1 | 4 | 3 |

*Lukusuzi National Park General Management Plan

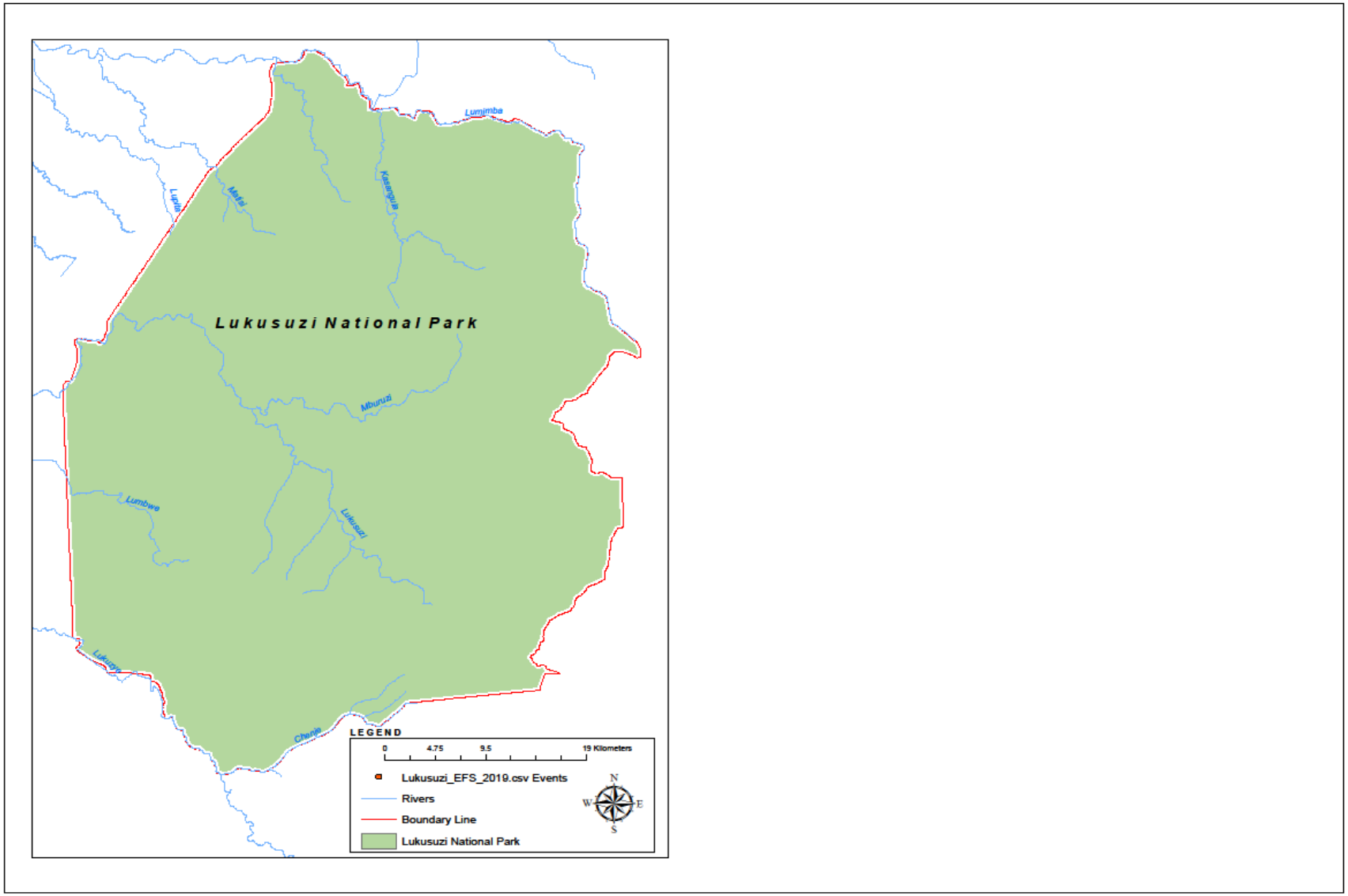
## Appendix III: Spatial Occurrence of Early Season Fires (2015 to 2016) in the Lukusuzi National Park



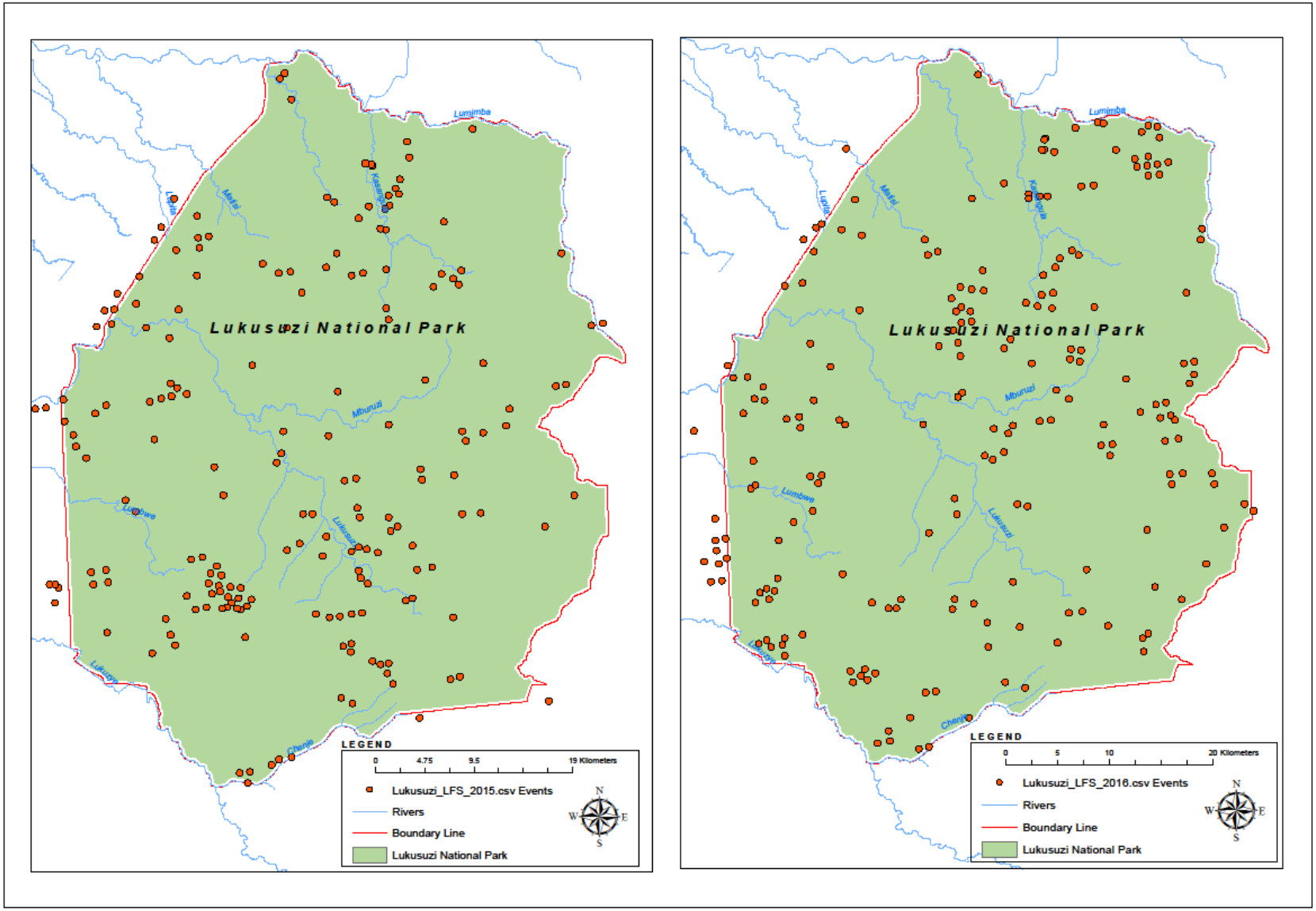
## Appendix IV: Spatial Occurrence of Early Season Fires (2017 to 2018) in the Lukusuzi National Park



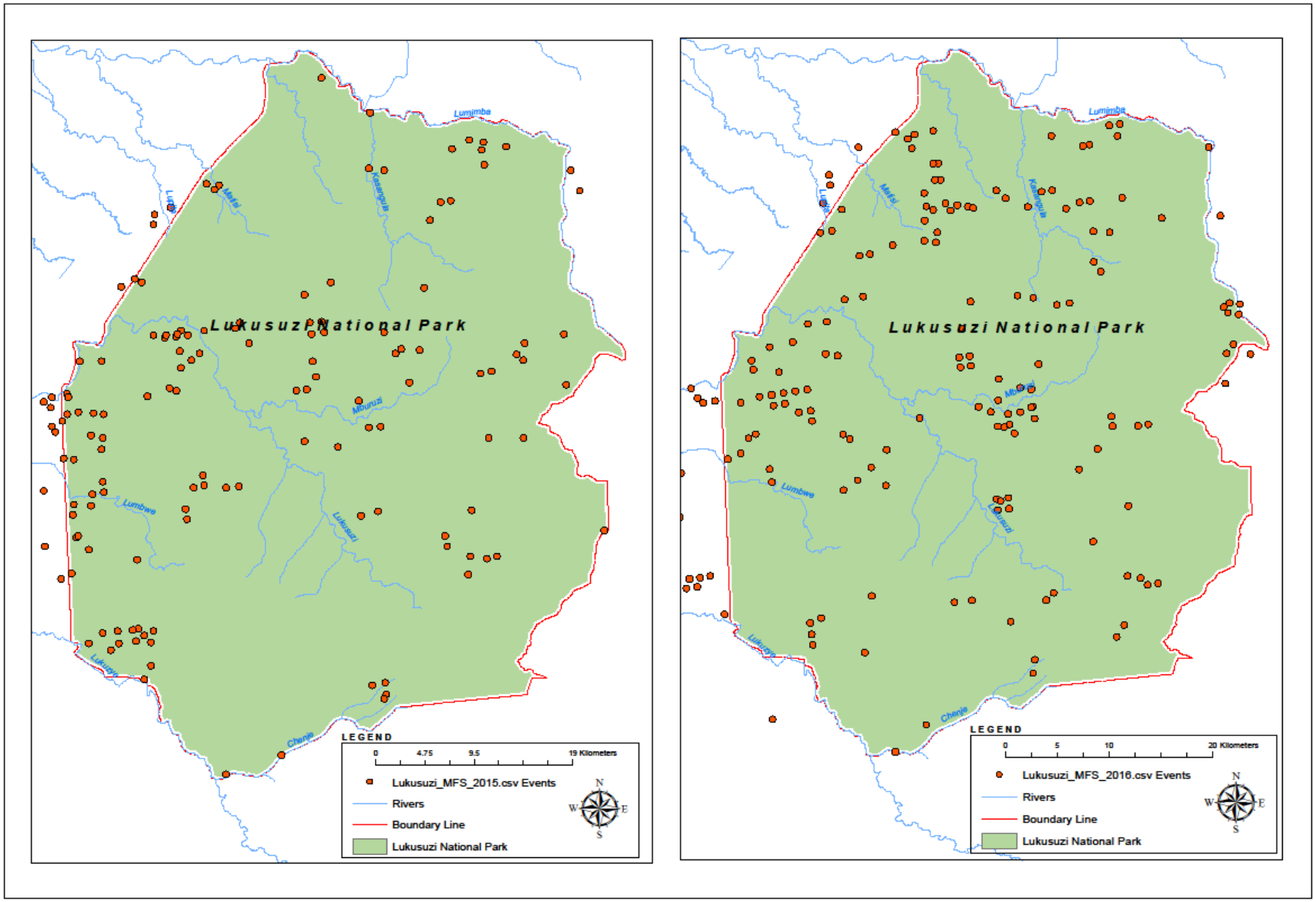
## Appendix V: Spatial Occurrence of Early Season Fires (2019) in the Lukusuzi National Park



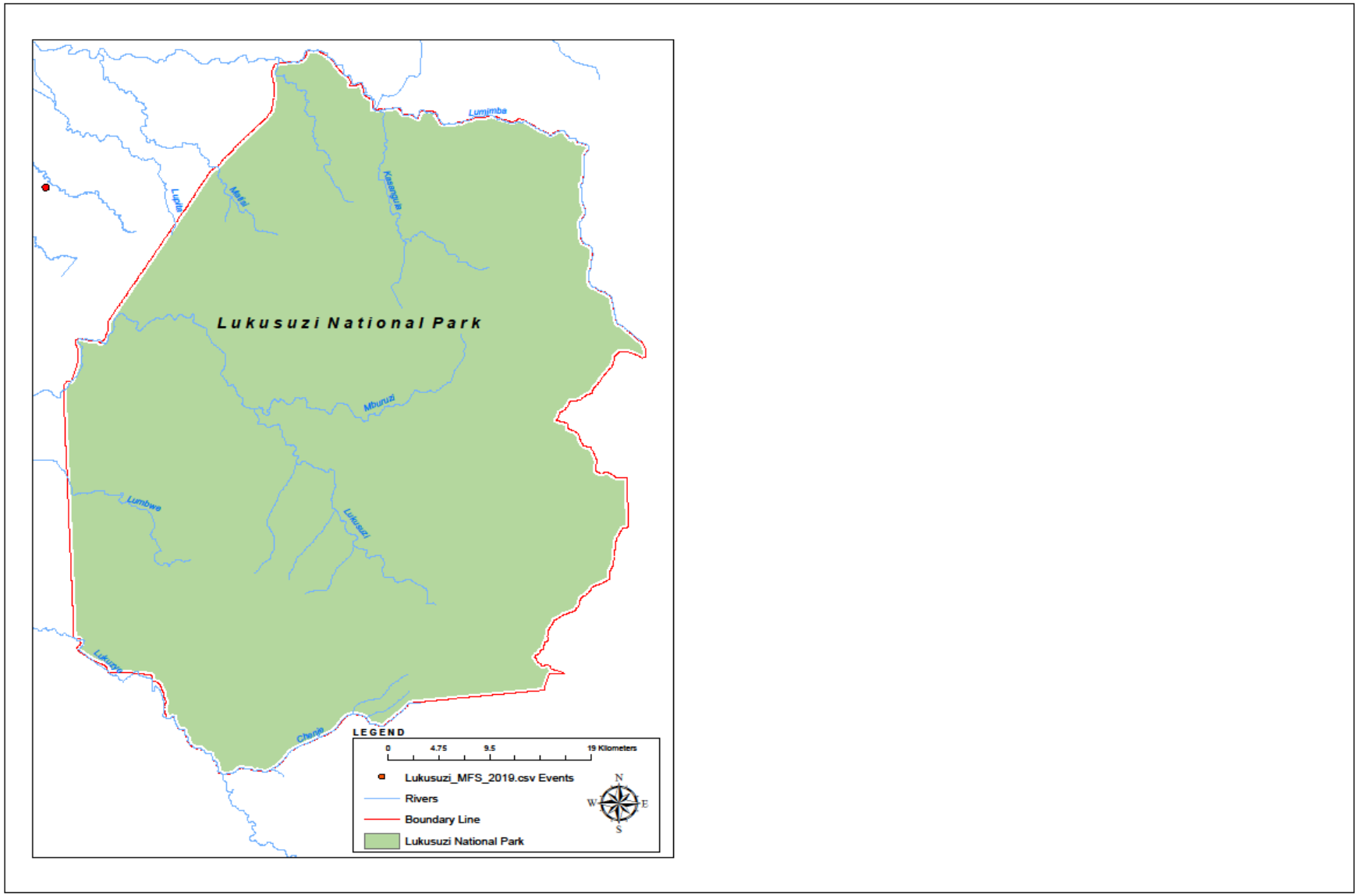
## Appendix VI: Spatial Occurrence of Mid-Season Fires (2015 to 2016) in the Lukusuzi National Park



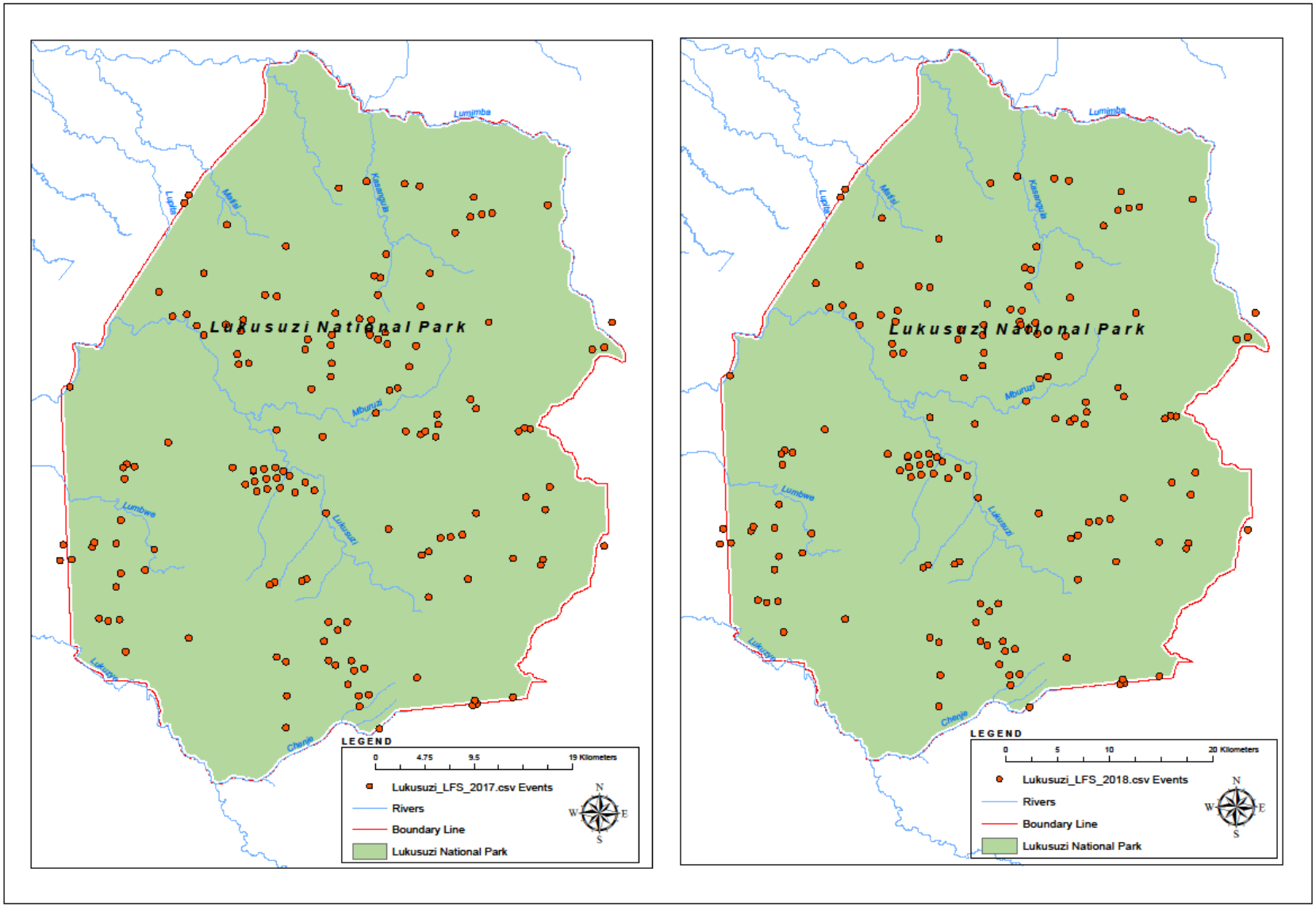
## Appendix VII: Spatial Occurrence of Mid-Season Fires (2017 to 2018) in the Lukusuzi National Park



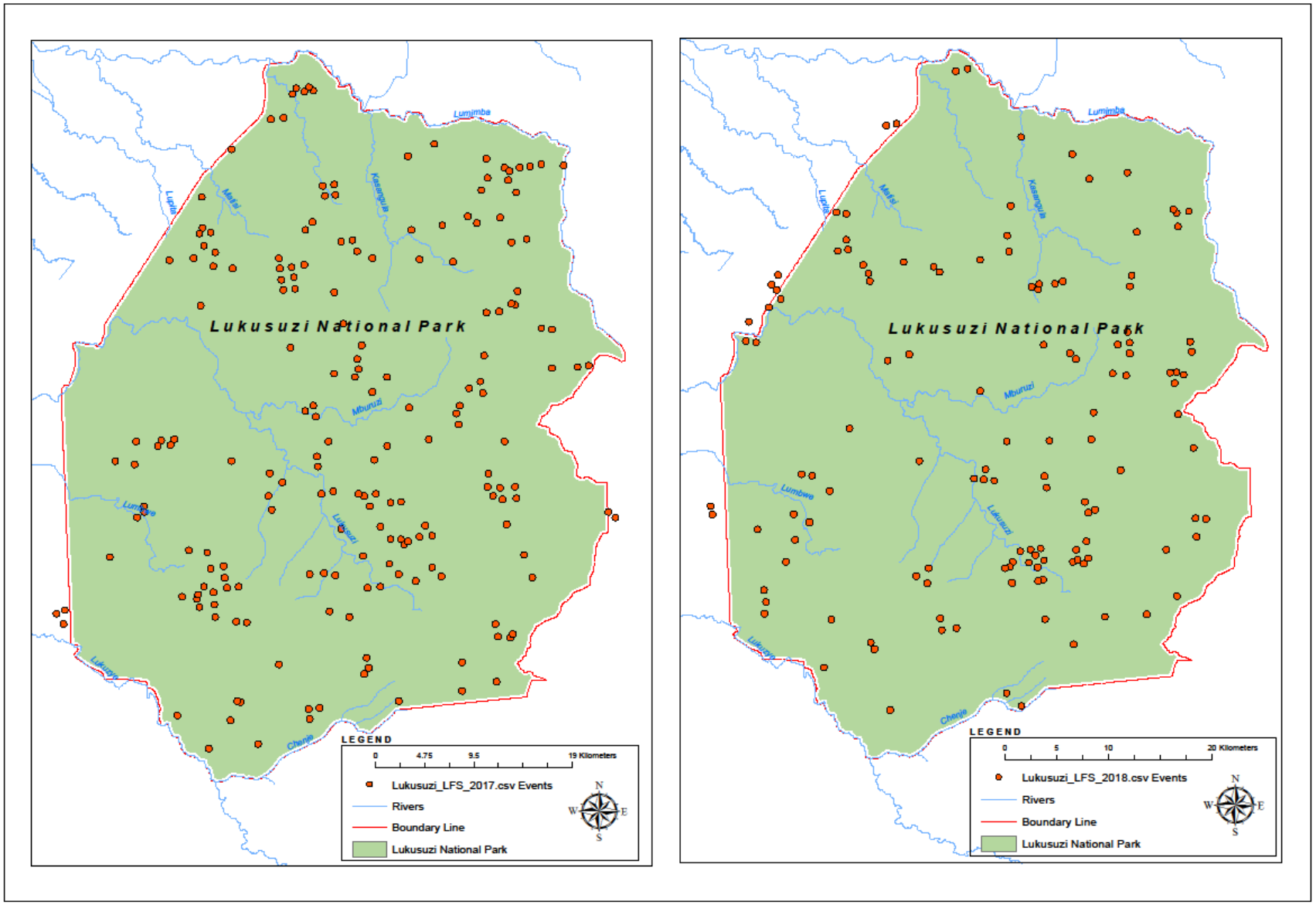
## Appendix VIII: Spatial Occurrence of Mid-Season Fires (2019) in the Lukusuzi National Park



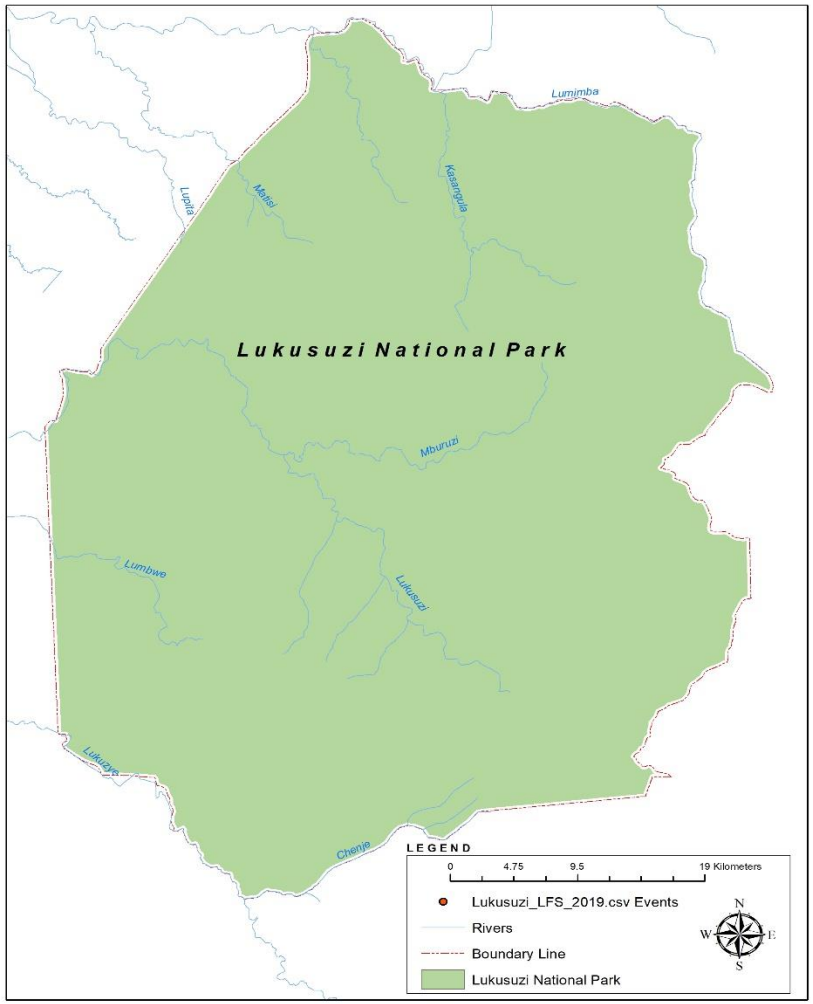
## Appendix IX: Spatial Occurrence of Late Season Fires (2015 to 2016) in the Lukusuzi National Park



## Appendix X: Spatial Occurrence of Late Season Fires (2017 to 2018) in the Lukusuzi National Park



## Appendix XI: Spatial Occurrence of Late Season Fires (2019) in the Lukusuzi National Park



# Appendix XII: Budget for Implementation of the Lukusuzi National Park Fire Management Plan (2022-2026)

| **Outcome: Improved landscape resiliency to impacts of late wildfires.** | | | | | | | **Year** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **No** | **Activity** | **Category** | **Item** | **Units** | **Unit Cost** | **Total Cost (ZMW)** | **1** | **2** | **3** | **4** | **5** |
| 1a | Form Park Fire Management Group | Stationery | Paper | 1 | 140.00 | 140.00 | 140.00 | | | | |
| | | | **Sub-total** | | | **140.00** | **140.00** | | | | |
| | | Fuel | Local movements | 50 | 15.59 | 779.50 | 779.50 | | | | |
| | | | **Sub-total** | | | **779.50** | **779.50** | | | | |
| | | | **Total** | | | **919.50** | **919.50** | | | | |
| 1b | Prepare annual fire operational plan (including burn plan) | Fuel | Chipata vehicle | 163 | 15.59 | 2,541.17 | 2,541.17 | 2,541.17 | 2,541.17 | 2,541.17 | 2,541.17 |
| | | | Outpost within the park | 100 | 15.59 | 1,559.00 | 1,559.00 | 1,559.00 | 1,559.00 | 1,559.00 | 1,559.00 |
| | | | **Sub-total** | | | **20,500.85** | **4,100.17** | **4,100.17** | **4,100.17** | **4,100.17** | **4,100.17** |
| | | Allowances | Driver | 2 | 530.00 | **1,060.00** | 1,060.00 | 1,060.00 | 1,060.00 | 1,060.00 | 1,060.00 |
| | | | Ecologist | 2 | 810.00 | **1,620.00** | 1,620.00 | 1,620.00 | 1,620.00 | 1,620.00 | 1,620.00 |
| | | | Park Ranger | 2 | 810.00 | **1,620.00** | 1,620.00 | 1,620.00 | 1,620.00 | 1,620.00 | 1,620.00 |
| | | | Camp in charge | 6 | 530.00 | **3,180.00** | 3,180.00 | 3,180.00 | 3,180.00 | 3,180.00 | 3,180.00 |
| | | | **Sub-total** | | | **37,400.00** | **7,480.00** | **7,480.00** | **7,480.00** | **7,480.00** | **7,480.00** |
| | | Stationery | Paper | 2 | 140.00 | **280.00** | 280.00 | 280.00 | 280.00 | 280.00 | 280.00 |
| | | | Flip chart | 1 | 140.00 | **140.00** | 140.00 | 140.00 | 140.00 | 140.00 | 140.00 |
| | | | Toner | 1 | 1,500.00 | **1,500.00** | 1,500.00 | 1,500.00 | 1,500.00 | 1,500.00 | 1,500.00 |
| | | | **Sub-total** | | | **9,600.00** | **1,920.00** | **1,920.00** | **1,920.00** | **1,920.00** | **1,920.00** |
| | | | **Total** | | | **67,500.85** | **13,500.17** | **13,500.17** | **13,500.17** | **13,500.17** | **13,500.17** |
| 1c | Present proposed annual fire management operational plan to PFMG (Include annual review of implementation of fire management for previous year) | Fuel | Chipata | 49 | 15.59 | 763.91 | 763.91 | 763.91 | 763.91 | 763.91 | 763.91 |
| | | | Mfuwe | 106 | 15.59 | 1,652.54 | 1,652.54 | 1,652.54 | 1,652.54 | 1,652.54 | 1,652.54 |
| | | | CRB and WDC | 100 | 15.59 | 1,559.00 | 1,559.00 | 1,559.00 | 1,559.00 | 1,559.00 | 1,559.00 |
| | | | **Sub-total** | | | **19,877.25** | **3,975.45** | **3,975.45** | **3,975.45** | **3,975.45** | **3,975.45** |
| | | Allowances | Drivers | 2 | 530.00 | 1,060.00 | 1,060.00 | 1,060.00 | 1,060.00 | 1,060.00 | 1,060.00 |
| | | | Area Warden | 1 | 810.00 | 810.00 | 810.00 | 810.00 | 810.00 | 810.00 | 810.00 |
| | | | Ecologist | 1 | 810.00 | 810.00 | 810.00 | 810.00 | 810.00 | 810.00 | 810.00 |
| | | | Extension Officer | 1 | 810.00 | 810.00 | 810.00 | 810.00 | 810.00 | 810.00 | 810.00 |
| | | | **Sub-total** | | | **17,450.00** | **3,490.00** | **3,490.00** | **3,490.00** | **3,490.00** | **3,490.00** |
| | | Lunch | Food | 10 | 100.00 | 1,000.00 | 1,000.00 | 1,000.00 | 1,000.00 | 1,000.00 | 1,000.00 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sub-total** | | | **5,000.00** | **1,000.00** | **1,000.00** | **1,000.00** | **1,000.00** | **1,000.00** |
| | | | **Total** | | | **42,327.25** | **8,465.45** | **8,465.45** | **8,465.45** | **8,465.45** | **8,465.45** |
| 1d | Implement annual operational plan for selected blocks | Lunch | Food | 5 | 6,000.00 | 30,000.00 | 30,000.00 | 30,000.00 | 30,000.00 | 30,000.00 | 30,000.00 |
| | | | **Sub-total** | | | **150,000.00** | **30,000.00** | **30,000.00** | **30,000.00** | **30,000.00** | **30,000.00** |
| | | Fuel | Local vehicle | 1000 | 15.59 | 15,590.00 | 15,590.00 | 15,590.00 | 15,590.00 | 15,590.00 | 15,590.00 |
| | | | **Sub-total** | | | **77,950.00** | **15,590.00** | **15,590.00** | **15,590.00** | **15,590.00** | **15,590.00** |
| | | Support staff | Casual workers | 250 | 150.00 | 37,500.00 | 37,500.00 | 37,500.00 | 37,500.00 | 37,500.00 | 37,500.00 |
| | | | **Sub-total** | | | **187,500.00** | **37,500.00** | **37,500.00** | **37,500.00** | **37,500.00** | **37,500.00** |
| | | Stationery | Paper | 1 | 140.00 | **140.00** | 140.00 | 140.00 | 140.00 | 140.00 | 140.00 |
| | | | Flip charts | 1 | 140.00 | **140.00** | 140.00 | 140.00 | 140.00 | 140.00 | 140.00 |
| | | | GPS Batteries | 140 | 30.00 | **4,200.00** | 4,200.00 | 4,200.00 | 4,200.00 | 4,200.00 | 4,200.00 |
| | | | **Sub-total** | | | **22,400.00** | **4,480.00** | **4,480.00** | **4,480.00** | **4,480.00** | **4,480.00** |
| | | | **Total** | | | **437,850.00** | **87,570.00** | **87,570.00** | **87,570.00** | **87,570.00** | **87,570.00** |
| 1e | Suppress selected unplanned fire reports | Lunch | Food | 3 | 4,000.00 | 12,000.00 | 12,000.00 | 12,000.00 | 12,000.00 | 12,000.00 | 12,000.00 |
| | | | **Sub-total** | | | **60,000.00** | **12,000.00** | **12,000.00** | **12,000.00** | **12,000.00** | **12,000.00** |
| | | Fuel | Local vehicle | 300 | 15.59 | 4,677.00 | 4,677.00 | 4,677.00 | 4,677.00 | 4,677.00 | 4,677.00 |
| | | | **Sub-total** | | | **23,385.00** | **4,677.00** | **4,677.00** | **4,677.00** | **4,677.00** | **4,677.00** |
| | | Support staff | Casual workers | 40 | 150.00 | 6,000.00 | 6,000.00 | 6,000.00 | 6,000.00 | 6,000.00 | 6,000.00 |
| | | | **Sub-total** | | | **30,000.00** | **6,000.00** | **6,000.00** | **6,000.00** | **6,000.00** | **6,000.00** |
| | | | **Total** | | | **113,385.00** | **22,677.00** | **22,677.00** | **22,677.00** | **22,677.00** | **22,677.00** |
| | **Overall total for 1** | | | | | **661,982.60** | **133,132.12** | **132,212.62** | **132,212.62** | **132,212.62** | **132,212.62** |
| **Outcome: Improved mobilization and utilization of resources for fire management.** | | | | | | | | | | | |
| **No** | **Activity** | **Category** | **Item** | **Units** | **Unit Cost** | **Total Cost (ZMW)** | | | | | |
| 2a | Carry out manpower and training needs assessment for fire management | | None | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | None | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | **Total** | | | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| 2b | Conduct annual training of DNPW officers and other stakeholders | Lunch/Allowances | Fire refresher | 45 | 530.00 | 23,850.00 | 23,850.00 | 23,850.00 | 23,850.00 | | |
| | | Allowances | Trainers | 12 | 810.00 | 9,720.00 | 9,720.00 | 9,720.00 | 9,720.00 | | |
| | | Allowances | Drivers | 8 | 530.00 | 4,240.00 | 4,240.00 | 4,240.00 | 4,240.00 | | |
| | | | **Sub-total** | | | **113,430.00** | **37,810.00** | **37,810.00** | **37,810.00** | | |
| | | Fuel | Chipata | 300 | 15.59 | 4,677.00 | 4,677.00 | 4,677.00 | 4,677.00 | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Chilanga | 295 | 15.59 | 4,599.05 | 4,599.05 | 4,599.05 | 4,599.05 | | |
| | | | **Sub-total** | | | **27,828.15** | **9,276.05** | **9,276.05** | **9,276.05** | | |
| | | Stationery | Paper | 2 | 140.00 | 280.00 | 280.00 | 280.00 | 280.00 | | |
| | | | Flip charts | 2 | 140.00 | 280.00 | 280.00 | 280.00 | 280.00 | | |
| | | | Note books | 15 | 30.00 | 450.00 | 450.00 | 450.00 | 450.00 | | |
| | | | Pens | 15 | 10.00 | 150.00 | 150.00 | 150.00 | 150.00 | | |
| | | | Markers | 10 | 20.00 | 200.00 | 200.00 | 200.00 | 200.00 | | |
| | | | **Sub-total** | | | **4,080.00** | **1,360.00** | **1,360.00** | **1,360.00** | | |
| | | | **Total** | | | **145,338.15** | **48,446.05** | **48,446.05** | **48,446.05** | | |
| 2c | Identify and approach stakeholders who can contribute to fire management by the end of year 1 | Fuel | Chipata | 200 | 15.59 | 3,118.00 | 3,118.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | **Sub-total** | | | **3,118.00** | **3,118.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| | | | **Total** | | | **3,118.00** | **3,118.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| 2a | Conduct needs assessment and budgeting | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | **Sub-total** | | | | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| | | | **Total** | | | | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| 2b | Identify potential funding sources | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | **Sub-total** | | | | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| | | | **Total** | | | | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| 2c | Submit and prepare proposals for funding | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | **Sub-total** | | | | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| | | | **Total** | | | | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| 2a | Conduct annual equipment inventory and needs assessment | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | **Sub-total** | | | | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| | | | **Total** | | | | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| 2b | Carry out periodic maintenance of equipment | Fuel | **Chipata** | 100 | 15.59 | 1,559.00 | 1,559.00 | 1,559.00 | 1,559.00 | 1,559.00 | 1,559.00 |
| | | Maintenance | **Accessories** | 50 | 30 | 1,500.00 | 1,500.00 | 1,500.00 | 1,500.00 | 1,500.00 | 1,500.00 |
| | | | **Sub-total** | | | **15,295.00** | **3,059.00** | **3,059.00** | **3,059.00** | **3,059.00** | **3,059.00** |
| | | | **Total** | | | **15,295.00** | **3,059.00** | **3,059.00** | **3,059.00** | **3,059.00** | **3,059.00** |
| 2c | Procure required equipment | Equipment | Fire beaters | 20 | 700.00 | 14,000.00 | 14,000.00 | | | | |
| | | | Kestrel | 2 | 5,500.00 | 11,000.00 | 11,000.00 | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Drip torches | 1 | 4,400.00 | 4,400.00 | 4,400.00 | | | | |
| | | | Bladder bags | 4 | 6,600.00 | 26,400.00 | 26,400.00 | | | | |
| | | | Googles | 7 | 200.00 | 1,400.00 | 1,400.00 | | | | |
| | | | Gloves | 27 | 200.00 | 5,400.00 | 5,400.00 | | | | |
| | | | Weather Station | 1 | 5,500.00 | 5,500.00 | 5,500.00 | | | | |
| | | | Handheld radios | 2 | 6,600.00 | 13,200.00 | 13,200.00 | | | | |
| | | | Talkabout two way radios | 6 | 3,300.00 | 19,800.00 | 19,800.00 | | | | |
| | | | GPS | 2 | 10,000.00 | 20,000.00 | 20,000.00 | | | | |
| | | | **Sub-total** | | | **121,100.00** | **121,100.00** | | | | |
| | | | **Total** | | | **121,100.00** | **121,100.00** | | | | |
| **Overall total for 2** | | | | | | **284,851.15** | **175,723.05** | **51,505.05** | **51,505.05** | **3,059.00** | **3,059.00** |
| **Information generated to feed into fire management decision making improved** | | | | | | | | | | | |
| 3a | Prepare project proposal to establish long term fire biodiversity research in the park | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | **Sub-total** | | | | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| | | | **Total** | | | | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| 3b | Conduct study on knowledge levels and perceptions of stakeholders on fire management | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | **Sub-total** | | | | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| | | | **Total** | | | | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |
| 3a | Develop fire monitoring protocols | Stationery | Paper | 2 | 140 | 280.00 | 280.00 | 280.00 | | | |
| | | | Fuel | 200 | 15.59 | 3,118.00 | 3,118.00 | 3,118.00 | | | |
| | | | **Sub-total** | | | **3,398.00** | **3,398.00** | **3,398.00** | | | |
| | | | **Total** | | | **3,398.00** | **3,398.00** | **3,398.00** | | | |
| 3b | Implement fire monitoring protocols | | | | | | 0.00 | 0.00 | | | |
| | | | **Sub-total** | | | | **0.00** | **0.00** | | | |
| | | | **Total** | | | | **0.00** | **0.00** | | | |
| **Overall total for 3** | | | | | | **3,398.00** | **3,398.00** | **3,398.00** | **0.00** | **0.00** | **0.00** |
| **Effective participation and awareness that contributes to reduced wildfire incidences** | | | | | | | | | | | |
| 4a | Identify stakeholders linked to fire management in the LNP | Stationery | Paper | 1 | 140 | 140.00 | 140.00 | 140.00 | | | |
| | | | Fuel | 100 | 15.59 | 1,559.00 | 1,559.00 | 1,559.00 | | | |
| | | | **Sub-total** | | | **3,398.00** | **1,699.00** | **1,699.00** | | | |
| | | | **Total** | | | **3,398.00** | **1,699.00** | **1,699.00** | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4b | Prepare and place fire sensitization materials (posters, signposts) in strategic areas of the park and GMA | Stationery | Posters | 6 | 1,000.00 | 6,000.00 | 6,000.00 | 6,000.00 | 6,000.00 | 6,000.00 | |
| | | | Signposts | 3 | 10,000.00 | 30,000.00 | 30,000.00 | 0.00 | 0.00 | 0.00 | |
| | | | **Sub-total** | | | **54,000.00** | **36,000.00** | **6,000.00** | **6,000.00** | **6,000.00** | **0.00** |
| | | Fuel | Chipata vehicle | 300 | 15.59 | 4,677.00 | 4,677.00 | 4,677.00 | 4,677.00 | 4,677.00 | |
| | | | **Sub-total** | | | **18,708.00** | **4,677.00** | **4,677.00** | **4,677.00** | **4,677.00** | **0.00** |
| | | | **Total** | | | **72,708.00** | **40,677.00** | **10,677.00** | **10,677.00** | **10,677.00** | **0.00** |
| 4c | Hold sensitization meetings with stakeholders (ie communities) | Fuel | Chipata vehicle | 400 | 15.59 | 6,236.00 | 6,236.00 | 6,236.00 | 6,236.00 | 6,236.00 | 6,236.00 |
| | | | **Sub-total** | | | **31,180.00** | **6,236.00** | **6,236.00** | **6,236.00** | **6,236.00** | **6,236.00** |
| | | Lunch | Food | 100 | 50.00 | 5,000.00 | 5,000.00 | 5,000.00 | 5,000.00 | 5,000.00 | 5,000.00 |
| | | Allowances | Extension officer | 8 | 810.00 | 6,480.00 | 6,480.00 | 6,480.00 | 6,480.00 | 6,480.00 | 6,480.00 |
| | | | Ecologist | 8 | 810.00 | 6,480.00 | 6,480.00 | 6,480.00 | 6,480.00 | 6,480.00 | 6,480.00 |
| | | | Driver | 8 | 530.00 | 4,240.00 | 4,240.00 | 4,240.00 | 4,240.00 | 4,240.00 | 4,240.00 |
| | | | Area Warden | 8 | 810.00 | 6,480.00 | 6,480.00 | 6,480.00 | 6,480.00 | 6,480.00 | 6,480.00 |
| | | | **Sub-total** | | | **118,400.00** | **23,680.00** | **23,680.00** | **23,680.00** | **23,680.00** | **23,680.00** |
| | | | **Total** | | | **149,580.00** | **29,916.00** | **29,916.00** | **29,916.00** | **29,916.00** | **29,916.00** |
| 4d | Broadcast fire management information on local radio station | Information | Broadcast message | 28 | 500.00 | 14,000.00 | 14,000.00 | 14,000.00 | 14,000.00 | 14,000.00 | 14,000.00 |
| | | circulation | **Sub-total** | | | **70,000.00** | **14,000.00** | **14,000.00** | **14,000.00** | **14,000.00** | **14,000.00** |
| | | | **Total** | | | **70,000.00** | **14,000.00** | **14,000.00** | **14,000.00** | **14,000.00** | **14,000.00** |
| **Overall total for 4** | | | | | | **295,686.00** | **86,292.00** | **56,292.00** | **54,593.00** | **54,593.00** | **43,916.00** |
| | | | | | | | | | | | |
| **Grant-total (ZMW)** | | | | | | **1,245,917.75** | **398,545.17** | **243,407.67** | **238,310.67** | **189,864.62** | **179,187.62** |