



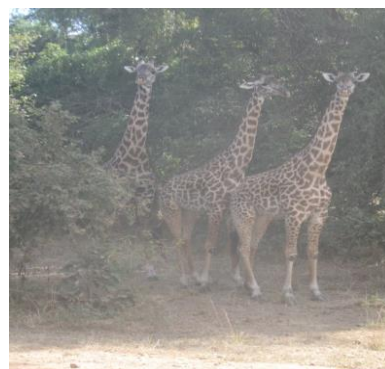
REPUBLIC OF ZAMBIA

MINISTRY OF TOURISM

FIRE MANAGEMENT PLAN

FOR

SOUTH LUANGWA NATIONAL PARK



2022 – 2026



DEPARTMENT OF NATIONAL PARKS AND WILDLIFE

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Left to right (Prescribed early season burning; Park entry gate at the South Luangwa National Park and iconic giraffe species in the South Luangwa National Park).

SUPPORTED BY



APPROVAL PAGE

The Fire Management Plan for the South Luangwa National Park has been approved for implementation by the Department of National Parks and Wildlife.

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LIST OF ABBREVIATIONS AND ACRONYMS

AW	Area Warden
BCP	Biocarbon Partners
CBU	Copperbelt University
CIUZ	Conservation Intermediate Use Zone
CLUZ	Conservation Limited Use Zone
CRB	Community Resources Board
CSL	Conservation South Luangwa
CWET	Chipembele Wildlife Educational Trust
DNPW	Department of National Parks and Wildlife
EO	Extension Officer
FMP	Fire Management Plan
FMU	Fire Management Unit
GMP	General Management Plan
GPS	Global Positioning System
IRPG	Incident Response Pocket Guide
IUZ	Intensive Use Zone
LSA	Luangwa Safari Association
LSGA	Luangwa Safari Guides Association
MODIS	Moderate Resolution and Imaging System
MOTA	Ministry of Tourism and Arts
PFMG	Park Fire Management Group
PRI	Park Ranger Infrastructure
PRLE	Park Ranger Law Enforcement
RT	Research Technician
SCO	Senior Conservation Officer
SER	Senior Ecologist Research
SLNP	South Luangwa National Park
SLAMU	South Luangwa Area Management Unit
SWPO	Senior Wildlife Police Officer
SWW	Senior Wildlife Warden
USFS	United States Forest Service
USAID	United States Agency for International Development
WZ	Wilderness Zone
ZAWA	Zambia Wildlife Authority
ZCP	Zambian Carnivore Programme
ZFC	Zambia Forestry College

FOREWORD

The South Luangwa 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 United Agency for International Development (USAID) and United States Forest Service (USFS), Government formulated this FMP to address the challenges of undesired wildfires. It builds on the overall General Management plan for 2014 – 2024. 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 tourism businesses.

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 South Luangwa National Park (LNP), which covers a five-year period (2022 to 2026) was prepared through a pre-field visit and stakeholders' consultation to provide guidance on management of fire in the SLNP 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 SLNP
- 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 SLNP 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 six fire management units (FMUs), which overlay the park management zones contained in the park's general management plan (GMP). For each FMU, details of the current and proposed fire management strategies, vegetation types, current condition and desired condition, firebreaks and facilities available that will play a role in fire management for the park are availed.

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, conservation organisations (CSL, CWET and ZCP) and communities to be represented by the Community Resources Boards (CRBs) as a way of involving various stakeholders in fire management. The PFMG will meet periodically in the year to support the implementation of the FMP. Overall, the implementation of the FMP will require K3, 250,610.15 (USD147, 755.00) 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. This communication plan has elucidated on aspects of internal VHF radio 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 SLNP 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 SLNP.

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 beginning or end of the year by stakeholders in order to assess the extent of its implementation. In all its implementation, the FMP will adopt an adaptive management strategy.

LIST OF 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	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	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

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1. INTRODUCTION

1.1 Background

Fire has an important role in the development and maintenance of productive and stable savanna vegetation communities. Fire is recognized as a valuable tool in the management of wildlife habitats in Zambia's Protected Areas. A fire management plan (FMP) for South Luangwa National Park (SLNP) fulfills the key requirement of the Department of National Parks and Wildlife (DNPW) fire policy for each protected area to have a specific FMP (ZAWA, 2005). It 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 SLNP and the greater Luangwa ecosystem are critical to insulating the country against impacts of climate change due to their vast and intact wilderness. The SLNP is particularly significant because it:

- Is an important sanctuary for large mammals;
- Has Cookson's wildebeest which is endemic to Luangwa Valley;
- Has the Luangwa River, which is the main water body in the Luangwa Valley;
- Has unique and remote wilderness areas offering excellent experience to visitors;

1.2 Problem Statement, Need and Purpose

Fire is a key driver of habitat change in miombo and mopane woodlands that dominate the Luangwa valley. Uncontrolled wild fires contribute to forest degradation in Zambia (Trapnell, 1959; Lawton, 1978; Chidumayo, 2013). Most wild fires that damage forests and woodlands in Zambia are caused by anthropogenic activities. Studies have shown that an average of 188,000 km² of Zambia's total land area was burnt annually between 2007 and 2012 and this accounted for approximately 25% of the total area and disproportionately affected protected areas (Sikaundi, 2013; Hollingsworth et al., 2015). The actual damage to biodiversity of these wild fires has not been adequately assessed.

However, frequent late fires prevent regeneration of fire-intolerant species and induce changes in species diversity. Fire frequently disturbs fire sensitive ecosystems and leads to land degradation with undesirable effects on water resources and soil productivity (Le et al, 2014). In Miombo ecosystems, the combination of extensive late burning in the dry season, continued population growth, wood extraction and agricultural expansion have contributed to a dramatic increase in the rate of deforestation and environmental degradation. However, in fire adapted ecosystems, managed fire plays a positive role in ecosystem health and vitality. Both forest resources and wildlife are impacted negatively by late forest fires.

That is why early dry season burning is recommended as the main strategy to reduce fuel loads for late season wildfires, therefore protecting the ecosystem. Fire management also needs to take into account local ecology and local uses of fire by surrounding stakeholders.

1.3 Description of the Park

1.3.1 Location and size

SLNP is approximately 700 km from Lusaka. The park is the second largest in Zambia, covering an area of 9,050 km² in extent and lies between latitude 12° 17' - 13° 45' South and longitude 31° 00' - 32° 08' East in the Luangwa Valley. It is bordered by the Muchinga Escarpment in the west and the Luangwa River in the east. The Luangwa valley is part of the Great Rift Valley (Carr, 1995). The park is surrounded by five Game Management Areas (GMAs) namely; Munyamadzi in the north, Lumimba and Lupande in the east, Sandwe in the southeast and Chisomo in the southwest (Figure 1).

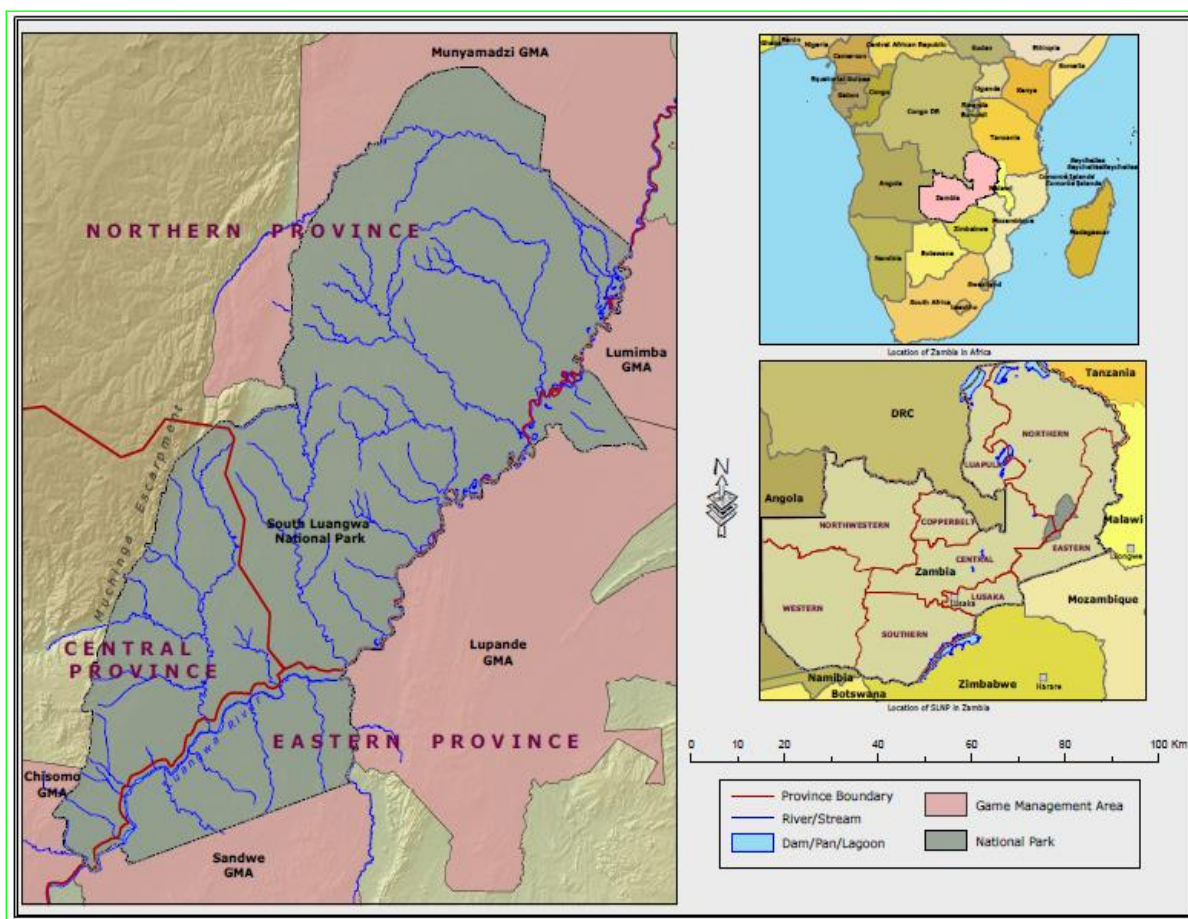


Figure 1: Location of South Luangwa National Park

1.3.2 Climate

Typically, SLNP has three seasons as follows; hot-rainy season (late November to April), cool-dry season (May to August) and hot-dry season (September to early November) (ZAWA, 2014). Most of the fires occur in the cool-dry season and hot-dry season, with occasional fires igniting in the first month of the hot-rainy season.

Generally, a hot climate with mean daily maximum temperatures of 32-36°C, while maximum and minimum temperatures of 36°C (October) and 15°C (June-July) are experienced in the SLNP. Temperature regulates the rate at which grass fuel cures with fuels on the valley floor drying much earlier and requiring earlier commencement of prescribed burning. With grass fuel completely dry, fires become difficult to control in months of the year when temperatures are high and humidity is low particularly during the hot-dry season (Trollope et al, 2004). Experience has shown that wildfires in the SLNP during the hot-dry season are better controlled during the night when temperatures are lower than in the daytime.

The mean annual rainfall is in the range of 400-800 mm, but can reach up to 1000 mm in the north of the valley (ZAWA, 2014). In years of above average rainfall, the grass grows to produce above average fuel load. During the cool-dry and hot-dry seasons, the above average grass fuel load increases the fire hazard (Trollope et al, 2004).

1.3.3 Geology and Soils

Though the geology of the Luangwa Valley is similar in origin to the East African Valley System, its age is the same as that of the Zambezi Valley, as it contains Paleozoic and Mesozoic strata and not recent sediments of the rocks that form the dominant strata of the valley floor (ZAWA, 2014).

With soils in the SLNP, these are varied depending on the location. Soils near the confluences of broad levees carry dark-brown clay to loamy alluvial soils, which are moderately well drained and have vigorous growth of grass and herbaceous fuel. The meander belts are mostly flanked by interfluvial areas covered by slightly saline and basic soils that are either poorly drained or well drained on sandy soils with sparse grass and herbaceous fuel. Low hills and ridges have reddish-brown fine loams, while the escarpment has shallow loamy soils of variable texture supporting less vigorous fuel growth (ZAWA, 2014).

1.3.4 Flora

The park has a number of vegetation types namely grasslands, thickets, wetlands, miombo woodlands, mopane woodlands, combretum-faidhebia woodlands, acacia-combretum woodlands and riparian woodlands (ZAWA, 2014). Vegetation is important as it provides material for fire and therefore, it is essential to know the types of vegetation in a protected area for fire management purposes.

Table 1 provides details of the vegetation type in SLNP, the objective and appropriate time for fire application. Detailed description of the vegetation of the SLNP is found in the SLNP GMP (ZAWA, 2014).

Table 1: Types of vegetation in the South Luangwa National Park, purpose and season of fire application

No	Vegetation Type	Main species ²	Purpose of Fire Use	Recommended Time for Fire Application
1	Grasslands	<i>Andropogon</i> , <i>Aristida</i> , <i>Chloris</i> , <i>Dichanthium</i> , <i>Digitaria</i> , <i>Dinebra</i> , <i>Echinochloa</i> , <i>Elionurus</i> , <i>Enteropogon</i> , <i>Eragrostis</i> , <i>Hemarthria</i> , <i>Heteropogon</i> , <i>Hylebates</i> , <i>Hyparrhenia</i> , <i>Isachne</i> , <i>Leptochloa</i> , <i>Oryza</i> , <i>Oxytenanthera</i> (bamboo), <i>Panicum</i> , <i>Pennisetum</i> , <i>Phacelurus</i> , <i>Rhytachne</i> , <i>Sehima</i> , <i>Setaria</i> , <i>Sporobolus</i> , <i>Tragus</i> , <i>Tripogon</i> , <i>Tristachya</i> and <i>Urochloa</i>	Removal of old grass material and promotion of regrowth of grass ¹	Prescribed fires in areas with limited grazing in early, mid and late fire seasons*
2	Thickets	<i>Capparis tomentosa</i> , <i>Combretum elaeagnoides</i> , and <i>C.obovatum</i>	Reduction of fuel load and prevention of bush encroachment	Prescribed fires early and late seasons
3	Wetlands	<i>Azolla nilotica</i> , <i>A. pinnata</i> , <i>Ceratophyllum demersum</i> , <i>Ipomoea aquatica</i> , <i>Ludwigia stenorraphe</i> , <i>Marsilea minuta</i> , <i>Neptunia oleracea</i> , <i>Pistia stratoites</i> and <i>Trapa natans</i>	Prevent growth of unpalatable grasses ¹	Mid/early season fires every two years for wetlands on fertile clay soils and late season for dry wetlands*
4	Miombo	<i>Brachystegia</i> , <i>Isoberlinia</i> and <i>Julbernardia</i>	Maintenance of basic species composition and structure ¹	Early to mid-fire season*
5	Mopane	<i>Colophospermum mopane</i>	Reduction of dense bushes and encourage growth of grasses ¹	Early to mid-fire season
6	Combretum Faidherbia/Acacia Combretum	<i>Combretum imberbe</i> and <i>Faidherbia albida</i> /Acacia and <i>Combretum</i>	Provision of firebreaks ¹	Early to mid-fire season
7	Riparian	<i>Berchemia discolor</i> , <i>Breonadia salicina</i> , <i>Diospyros mespiliformis</i> , and <i>Trichilia emetica</i>	Maintenance of basic species composition and structure	Early and mid-fire season

¹Zieger and Cauldwell, 1998, ²ZAWA 2014

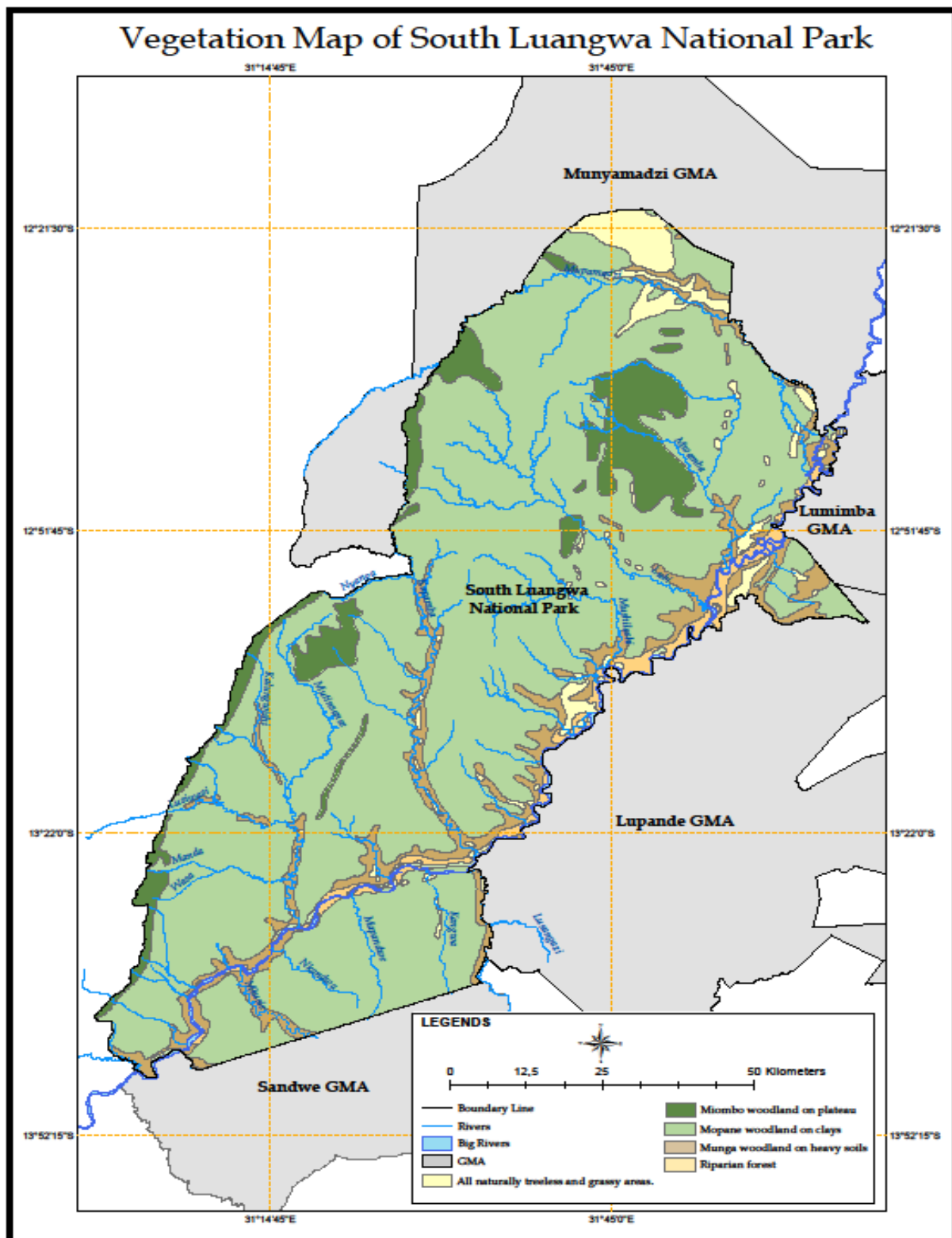


Figure 2: Vegetation types in the South Luangwa National Park

1.3.5 Fauna

The SLNP has an abundance and variety of fauna owing to the combination of diverse topography, mosaic of vegetation, availability of perennial rivers and ox-bow lakes (ZAWA, 2014).

Mammals include endangered, threatened and rare species which are found in other parts of Zambia. Mammals in SLNP include; elephant, giraffe, eland, hippos, buffalo, zebra, waterbuck, roan, sable, bushpig, bushbuck, warthog, kudu, cookson wildebeest, puku, reedbuck, impala, grysbok, oribi, common duiker. The carnivores include; lion, leopard, spotted hyaena, wild dog and the primates sighted are yellow backed baboon, vervet monkey, moloney's monkey and bush baby (ZAWA, 2014).

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 have not been studied to the same extent as mammals and hence limited information is available for these groups apart from snakes, crocodiles and monitor lizards. The limited information available also applies to fish and invertebrates (ZAWA., 2014). Information on response of reptiles and amphibians to fires is limited, but certain species like the tortoise use evasive strategies to cope, while other species get into crevices, rocks or move on bare patches of ground (Goldammer and Ronde, 2004).

Bird life is diverse as well and over 700 species have been recorded in the Luangwa Valley (Carr, 1997; Astle, 1987). 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), which 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;

The 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.

The 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

3.1 Temporal occurrence of fires

A review of fire records for five years (2013-2017) using the MODIS active products indicated a downward trend of active fires detected in the park. Active fires detected ranged between 539 and 1049 with the lowest active fires detected in 2017 (Figure 3). It was difficult to classify the source of fires as not all fires were ignited by DNPW. The majority of the fires are attributed to illegal activity particularly in the mid to late fire season.

Average monthly records for the past five years indicated that the number of active fires gradually increased from the first month of the early fire season and reached its peak in the first month of the late fire season. After September, the number of active fires decline until the last month of the year (Figure 4). The keeping of such fire records and their mapping will be essential in fire management planning as it will assist in identifying seasons of the year when and what type of resources should be made available for wild fire suppression.

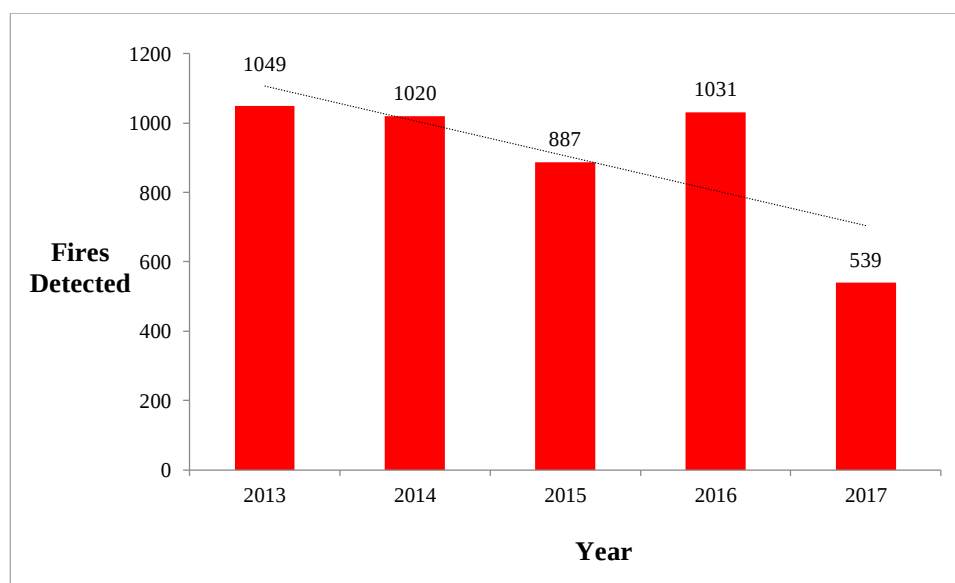


Figure 3: Active Fires detected from 2013 to 2017 using MODIS

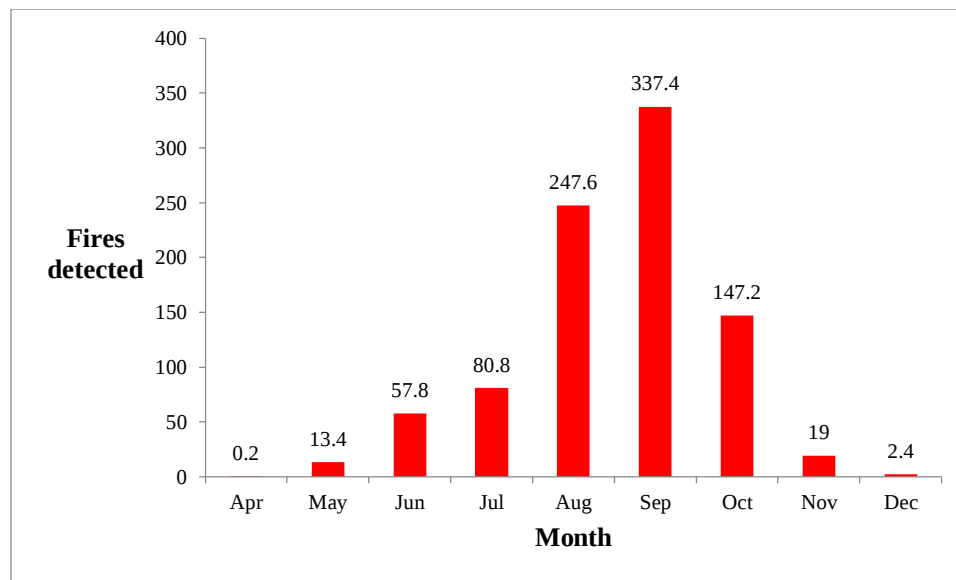


Figure 4: Average number of fires detected per month for five years (2013-2017)

3.2 Spatial distribution of Fires

The spatial distribution of active fires shows that ignition starts on the eastern side during the early fire season, which is due to this area lying in the valley and grass material drying faster than in any parts of the park on higher land. There might also be more fire ignitions on the east due to the prescribed early burning programme by DNPW and its partners (Figure 5). As the fire seasons progress, the active fires detected move from the central section towards the western boundary of the park (Figures 6 and 7). This spatial pattern in the mid to late fire seasons might be attributed to a multiplicity of factors, which include fuels curing much later in the year on the plateau and ignition by poachers in order to avoid detection after illegal incursions in the park.

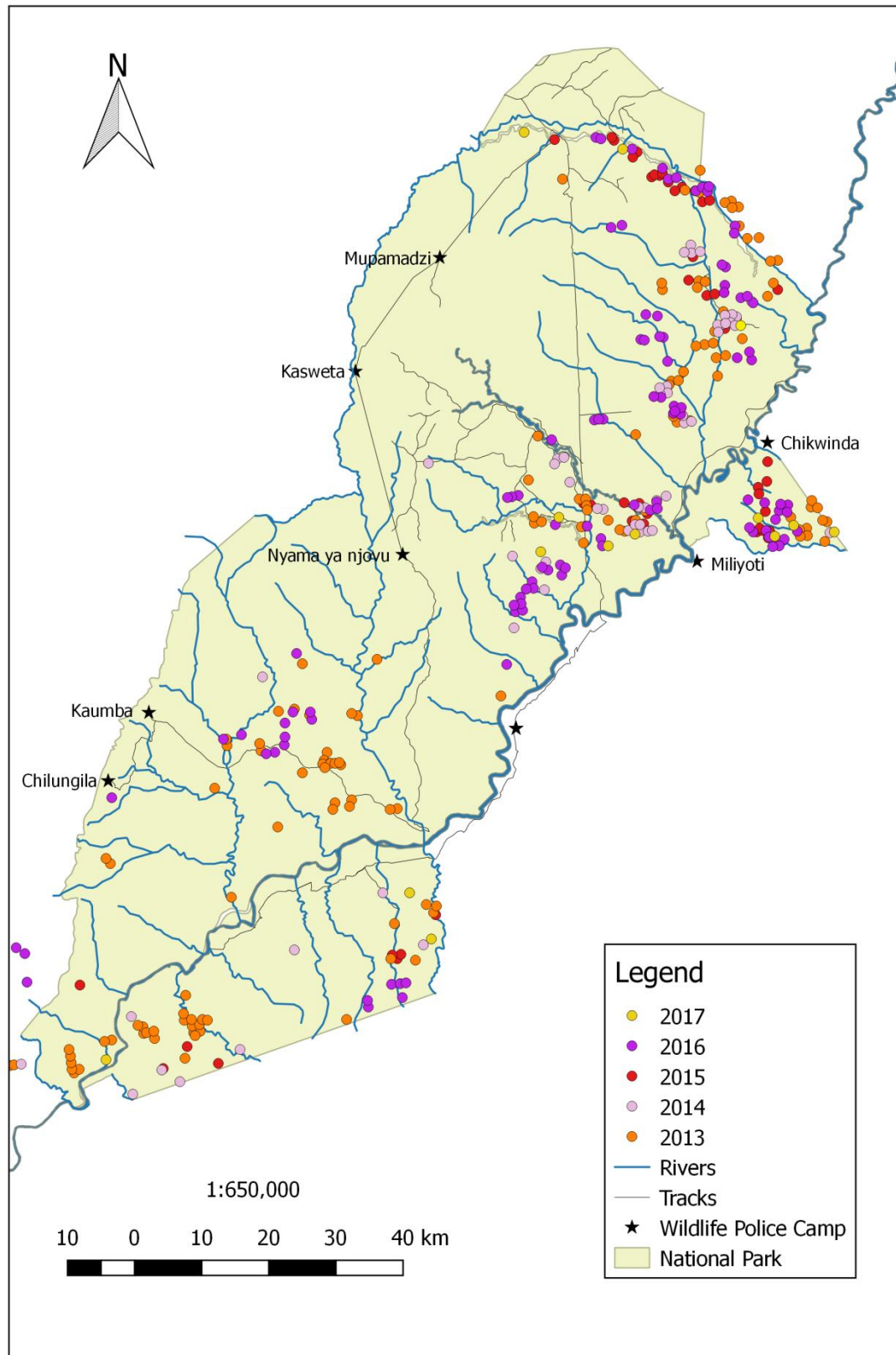


Figure 5: Spatiotemporal Fire Occurrence (early fire season) in the South Luangwa National Park using MODIS Active Fire products

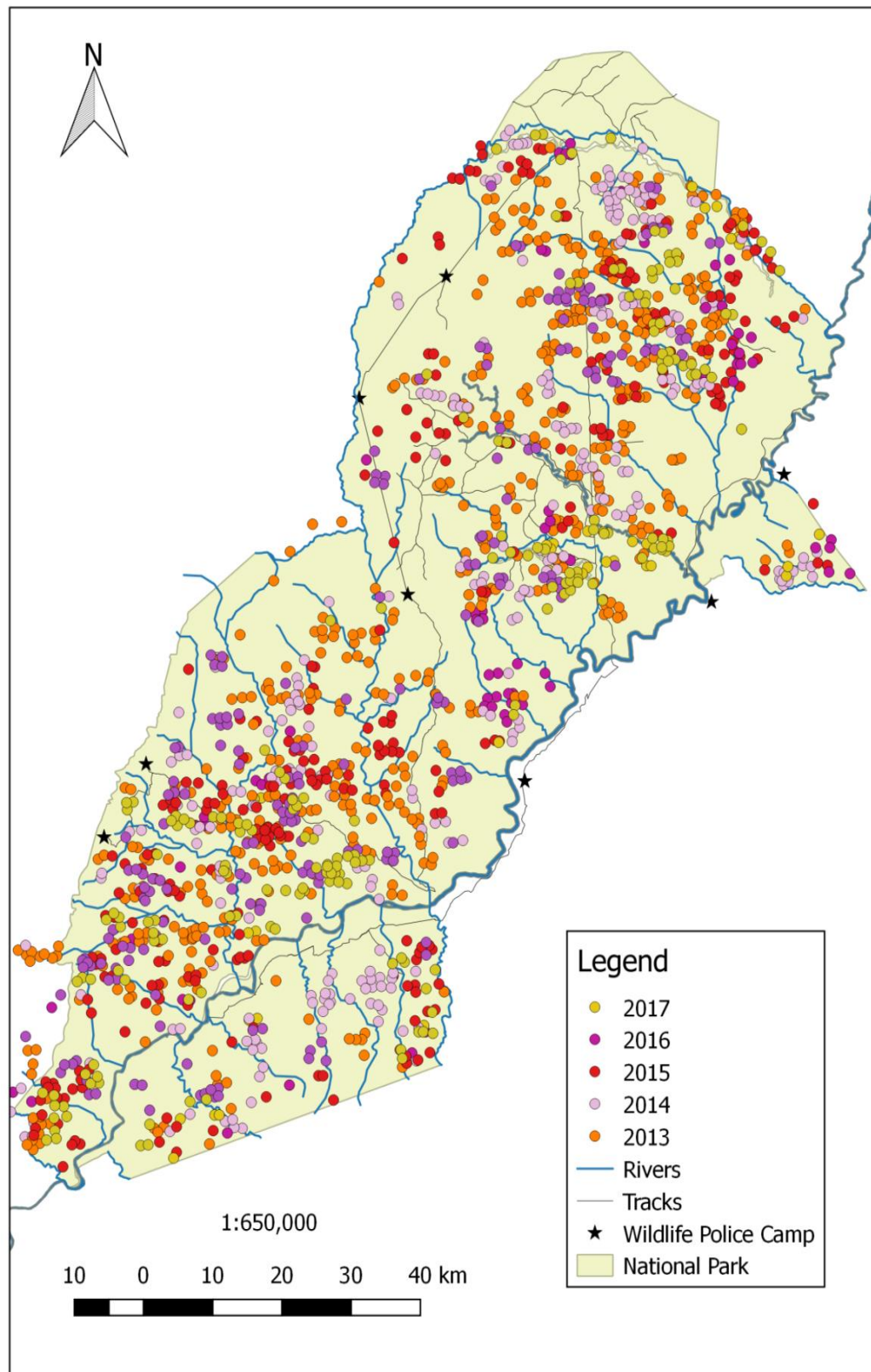


Figure 6: Spatiotemporal Fire Occurrence (mid fire season) in the South Luangwa National Park using MODIS Active Fire products

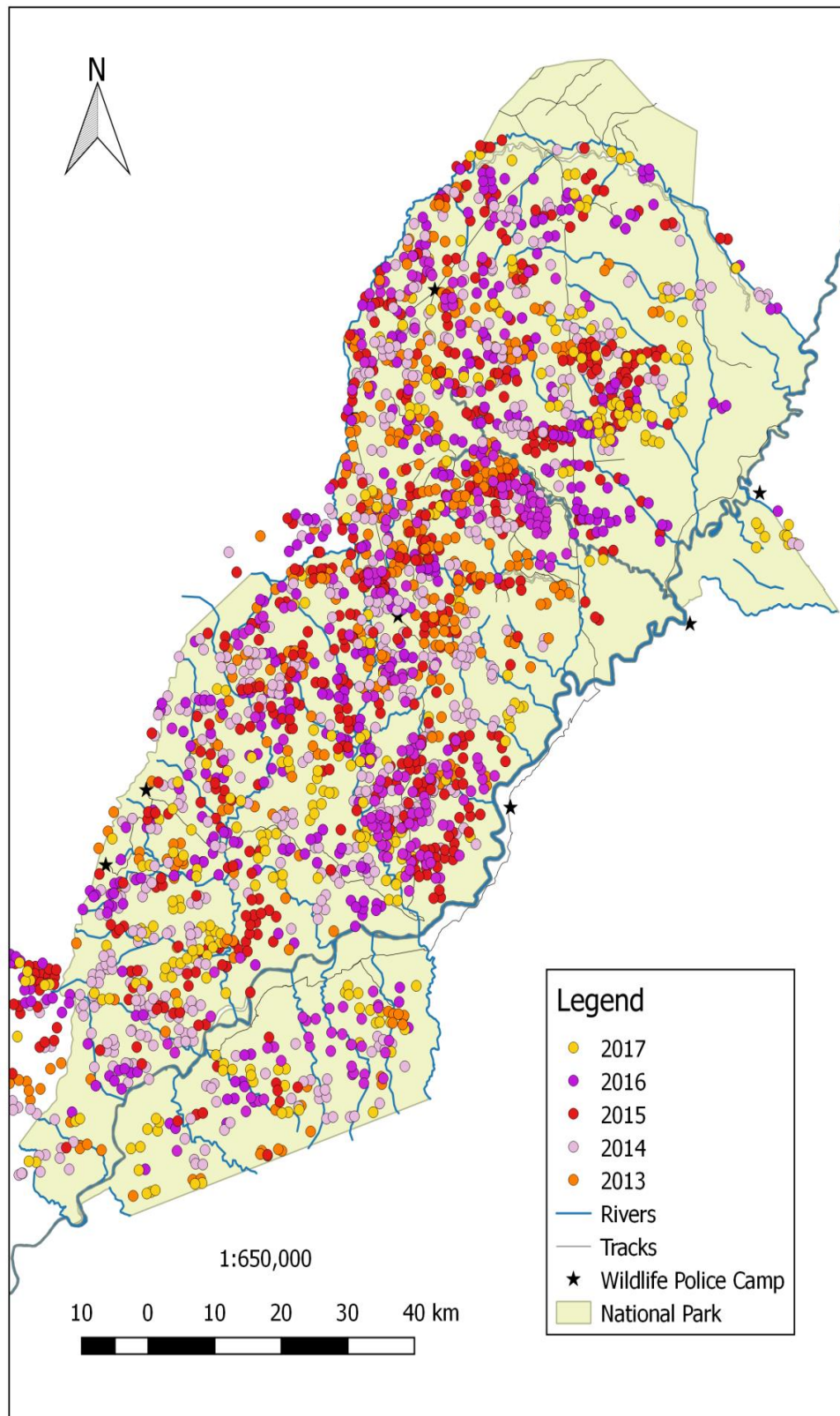


Figure 7: Spatiotemporal Fire Occurrence (late fire season) in the South Luangwa National Park using the MODIS Active Fire products

4. FIRE MANAGEMENT VISION, GOAL, OBJECTIVES AND OUTCOMES

4.1 Vision

“A landscape without uncontrolled wildfires.”

4.2 Goals and Objectives

The overall goal for implementation of the SLNP Fire Management Plan (FMP) as set out in the Fire Management Guidelines for National Parks and Game Management Areas is “*to maintain the long term integrity of the wildlife habitats.*” This will be achieved through a number of activities among them prescribed burns, suppression, mechanical removal of vegetation, setting up firebreaks and fire awareness programmes. In addition there is a need to build organizational capacity within DNPW in order to effectively meet the fire management objectives.

The strategic objectives of fire management in the SLNP are therefore as listed below:

- 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 SLNP
- 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

4.3 Outcomes

While prevention of unplanned fires is an important broader strategy, certain key outcomes must be achieved in order to deal with the socio-ecological aspects of fire as well as the organizational capacity within DNPW to deal with fire. This fire management plan therefore envisions four (4) key outcomes as follows:

Outcome 1: Improved landscape resiliency to impacts of late wildfires.

Outcome 2: Improved resource mobilization and utilization of resources for fire management.

Outcome 3: Information generated to feed into fire management decision making improved.

Outcome 4: Effective participation and awareness that contributes to reduced wildfire incidences.

To fulfill the above objectives will require financial and human resources, as well as partnerships with other stakeholders. The action plan has been prepared giving details for the implementation of the SLNP FMP.

Table 2: Action Plan for the South Luangwa 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 wildfire)	Incidences of unplanned wildfires reduces by 10% of previous year	a) Form Stakeholders Park Fire Management Group (PFMG)	First quarter of year 1	Minutes of inception meeting	- Qualified staff available - External partners willingness to be stakeholder members	Senior Warden and Senior Ecologist
				b) Prepare annual fire management operational plan	Meetings held every six months	Minutes of park fire management committee meeting	Availability of members for meetings	Senior Ecologist/Park Rangers/ Extension Officer
				c) Present proposed annual fire management operational plan to PFMG		Annual operational fire plan		Senior Warden and Senior Ecologist
				d) Implement annual operational plan for selected blocks	AOP implemented quarterly	- After action report - Fire maps	Resources available to conduct fire management activities	Senior Ecologist/ Park Ranger
				e) Suppress selected unplanned fire reports	Second to fourth quarter	Fire incident reports	Resources available to enable response	Senior 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 - Qualified trainers available	Senior 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 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	Senior Ecologist
		To build strong and functional partnerships for fire management in the SLNP	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 • Concept notes	• Cooperation from stakeholders • Resources secured through concept notes	Senior Warden and Senior Ecologist
		To increase financial capacity for fire management by 50%	Number of proposals prepared and submitted Amount of funds allocated to fire management from DNPW and other partners	a) Conduct needs assessment and budgeting b) Identify potential funding sources c) Prepare and submit proposals for funding	On-going	• Financial reports • Proposals	• Cooperation from stakeholders • Funds available internally	Senior Ecologist and Accountant
		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 • Financial resources available	Senior Ecologist and Park Ranger-Infrastructure

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	Research Technician and Senior Wildlife Police Officer
				c) Procure required equipment	Ongoing	Local purchase order	Resources available to procure equipment	Procurement Officer and Senior 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 Thresholds of potential concern determined	a) Prepare project proposal to establish long term fire biodiversity research in the park b) Conduct study on knowledge levels and perceptions of stakeholders on fire management	Second quarter of year 1	- Project proposal - Technical Report/peer reviewed articles	Financial and human resources available	Senior Ecologist
				a) Develop fire monitoring protocols b) Implement fire monitoring protocols	Fourth quarter of year 1 On-going from first quarter of year 2	- Fire monitoring protocols - Monitoring reports	- Financial resources available - Financial and human resources available	Senior 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	a) Identify stakeholders linked to fire ignitions in the SLNP	Ongoing annually from second quarter of year 1	- List of identified stakeholders - Fire sensitization materials prepared - Minutes of meetings conducted	- Stakeholders with role in fire management correctly identified - Funds available to prepare sensitization materials - Communities receptive to community meetings	Extension Officer, Ranger Infrastructure and Senior Ecologist
			Number of sensitization meetings conducted	b) Prepare fire sensitization materials (signage, posters)				
			Number of fire sensitization materials prepared	c) Hold sensitization meetings with stakeholders				
			Number of fire signs placed in the park	a) Broadcast fire management information on local radio station	Ongoing from second quarter of year 1	- Number of programmes featured on radio - Signage available and in place	Financial resources available to feature radio programmes and prepare signage	Senior Ecologist and Extension Officer
				b) Prepare and place fire materials in strategic areas of the park and GMA				

5. ZONING FOR FIRE MANAGEMENT

Currently, the park is zoned or sub-divided into management zones as contained in the SLNP GMP and as management units for the purpose of law enforcement. These two sub-divisions overlap each other.

Management zones in the GMP are set up based on the concept of limits of acceptable use. Taken into consideration when setting limits of acceptable use are the; fragility of the ecosystem, infrastructure and activities taking place in an area and future plans for that area. Based on this approach, SLNP has been zoned into four zones of Wilderness Zone (WZ), Conservation Low Use Zone (CLUZ), Conservation Intermediate Use Zone (CIUZ) and Intensive Use Zone (IUZ).

However, in terms of day-to-day administration, the park and surrounding Lupande Game Management Area were sub-divided into six (6) management zones (Figure 9). Since most of the patrols and other fire management activities are mostly undertaken by the camps within the park, the current five (5) management zones of the park will be adopted as FMUs to enable better coordination of fire management activities. A sixth FMU covering the Nsefu sector of SLNP will be annexed from the management zone that includes the northern part of the Lupande GMA. This implies that a FMU will have a number of park management zones and a number of wildlife camps.

5.1 FIRE MANAGEMENT UNITS

This section provides the description, fire management strategies both current and proposed, current condition and future desired condition of the six (6) FMUs within the SLNP.

5.1.1 Fire Management Unit 1

5.1.1.1 Description

The FMU 1 has an area of 2020 km² and comprises of management zones designated as CIUZ and CLUZ with a small WZ. Conservation and maintenance of the natural habitats with limited tourism activities is the primary objective of the zones within this management unit. There are a number of game viewing loops and tourism facilities in this unit especially on the Mupamadzi River and Luangwa River. The main vegetation in this zone is mopane woodlands with miombo woodlands in the central part, grasslands in the north, munga woodlands and riparian forests on the periphery of the rivers. This FMU has the largest area of grasslands than any other unit of the park (Figure 9).

5.1.1.2 Fire Management Strategies

A combination of prescribed fire, fire prevention and wild fire suppression strategies maybe appropriate in this unit for two reasons. Firstly, prescribed fire and fire prevention with resource objectives will be important for the conservation and maintenance of the natural habitats, which support the fauna within the unit as well as the protection of the tourism assets. Secondly, suppression of wild fires will be cardinal in case of a potential threat to the tourism facilities, human lives and habitats. Currently, the main fire management strategy has been prescribed burning by patrols and limited wild fire suppression.

5.1.1.3 Current Condition and Desired Future Condition

There has been a high frequency of late fires in this unit though the habitats are mostly still intact and have not been degraded. However, there is need to reduce the occurrence of wildfires particularly in the late fire season and ensure that prescribed burning programmes are undertaken during the right season of the year. In certain instances, there may be need to apply late season fires in the grasslands to prevent bush encroachment and hence maintain the grasslands.

5.1.2 Fire Management Unit 2

5.1.2.1 Description

This FMU has all the four zones of the park, but comprises largely of the CLUZ with other areas covered by the WZ, CIUZ and IUZ. It has an area of 2220 km². The objectives of the zones are to conserve, maintain the natural habitats and preserve the pristine wilderness, while stopping further degradation of habitats. Most of the tourism facilities in the park are within the IUZ in this FMU. There are a number of game viewing loops that also form part of the deterrent in crossing of wild fires from one part of the zone to the other. Mopane woodlands cover the largest portion, while miombo woodlands have the second largest area in the unit (Figure 9).

5.1.2.2 Fire Management Strategies

A combination of prescribed fire, fire prevention and wild fire suppression strategies have been implemented in the CIUZ and CLUZ. In the WZ, the strategy has been mainly to use the prescribed fire strategy. Fire prevention has been undertaken through law enforcement when patrols are deployed in the area. The IUZ has mostly been an area of no burn with suppression strategy being dominant due to the tourism facilities and tourist game viewing loops.

In this FMU, it is recommended that a suite of prescribed fire, fire prevention and wildfire suppression strategies should still continue to be implemented. The prescribed fire will play a role in maintenance of the habitats and reduce the associated negative effects of the late fires, which can spoil the visitor experience. An additional advantage of the prescribed fire strategy is that it will also protect tourism facilities from late fires by setting of early season fires that burn at low temperatures leaving burnt and unburnt patches of vegetation. Suppression strategies will also be necessary to reduce loss of the flora and fauna as well as prevent the destruction of tourism facilities in case of late season fires. Fire prevention strategies will also play a critical role as law enforcement continues to act as a deterrent to illegal entrants into the park.

5.1.2.3 Current Condition and Desired Future Condition

The FMU has been experiencing late season fires over the years, which is not recommended for maintenance of woodlands. For this FMU, the high frequency of wildfires should be reduced in order to maintain the species composition and structure of woodlands.

5.1.3 Fire Management Unit 3

5.1.3.1 Description

All the four zones (CLUZ, CIUZ, IUZ and WZ) of the park are found within FMU 3. The total area of the zone is 1320 km². CIUZ covers the largest area of the FMU. The objectives of the zones are to conserve, maintain the natural habitats and preserve the pristine wilderness, while stopping further degradation of habitats. Tourism facilities are predominantly domiciled in the CIUZ, with a few in the IUZ. This FMU also has a number of game viewing loops as part of the road network in the park. The major vegetation is mopane woodlands and other vegetation types include; miombo woodlands, munga woodlands, riparian forests and grasslands (Figure 9).

5.1.3.2 Fire Management Strategies

In this FMU, the prescribed fire, fire prevention and suppression strategies have been applicable to all the four zones. However, the prescribed fire has been applied far from the tourism facilities and limited prescribed fires have been applied in the IUZ.

The recommended strategy is a continued combination of prescribed fire, fire prevention and wild fire suppression in this unit. Implementation of the prescribed fire, fire prevention and suppression strategies will be especially important in the IUZ and CIUZ in order to protect the tourism facilities and maintain visitor satisfaction.

5.1.3.3 Current Condition and Desired Future Condition

This FMU has recorded a high number of late fires, which are detrimental to the maintenance of the flora and fauna. To maintain the woodlands, the fire management programme should ensure that there are less late fires and more prescribed fires during the right fire season.

5.1.4 Fire Management Unit 4

5.1.4.1 Description

The total size of this FMU is 2170 km² with only two zones of WZ and CIUZ. The largest size of WZ is found in this FMU for the entire park. No tourism facilities are found in FMU 4, but there are two management facilities close to the edge of the western park boundary. Access in this FMU is through a management road, which forms part of the firebreak system in the park. The objectives of the zones in FMU 4 are to maintain and preserve the habitats, while allowing for low volume tourism activities (Figure 9).

5.1.4.2 Fire Management Strategies

Prescribed fire and fire prevention have been the major strategies implemented in this FMU. The management facilities have been protected by carrying out prescribed burning during the mid-fire season as vegetation in this area gets dry later in the year as it receives high rainfall being close to the Muchinga escarpment and is not on the valley floor. Law enforcement by means of patrols has been the major form of the fire prevention strategy.

Use of the prescribed fire strategy should still continue in this patrol zone as a way of maintaining suitable habitats for the fauna. The prescribed fire strategy will also prevent late fires that are prone in this area due to illegally ignited fires. Fire prevention strategies should also continue to be implemented in this FMU, with limited public awareness on the western boundary of the park as there is less possibility of wild fires coming from across the Muchinga escarpment.

5.1.4.3 Current Condition and Desired Future Condition

Wild fires have been occurring regularly in this FMU and might be compromising the integrity of the woodlands and river systems. The number of late season fires should be reduced unless when required and substituted by prescribed early and mid-season fires with suppression activities when deemed necessary.

5.1.5 Fire Management Unit 5

5.1.5.1 Description

FMU 5 has an area of 970 km². It has two zones of the CIUZ and CLUZ. No facilities have been developed in the CLUZ though sites are available, while the CIUZ currently has a single tourism facility operating. There are a number of game viewing loops, which are also used for management purposes. The objectives of the zones in this FMU are to conserve and maintain the natural habitats, while allowing for low volume tourism (Figure 9).

5.1.5.2 Fire Management Strategies

This area has been managed mostly using the prescribed burning and fire prevention strategies with limited suppression due to its distance from the park headquarters and limited man power levels. Prescribed burning has mostly been conducted to create patches of burnt and unburnt areas and hence reduce the impact of late season fires later in the year.

For this FMU, there is need for more focus in the implementation of the prescribed burning strategy. Hence, areas should also be identified where there might be need for application of suppression strategies as there has been less attention given in this FMU. Furthermore, there is need to incorporate the communities in the Sandwe Game Management Area in the public awareness programmes as the FMU is not protected by a natural barrier and hence wildfires set unintentionally in the communal area have the potential to stray into the park.

5.1.5.3 Current Condition and Desired Future Condition

The unit has been subjected to occurrence of late season fires that are not recommended for the woodlands and fauna at that critical time of the year. The desire is to maintain the flora and fauna by ensuring that late season fires occurrences are reduced in this zone.

5.1.6 Fire Management Unit 6

5.1.6.1 Description

This FMU comprises of the Nsefu sector of the SLNP and is the smallest FMU with an area of 166 km². It only has the CLUZ and has a number of tourism facilities located on the banks of the Luangwa River. Three management camps are dotted on the periphery of the FMU. The objectives of the zones within the unit are to conserve the natural habitats, while permitting low use tourism and management infrastructure. Mopane woodland only slightly covers a larger area of this zone than the munga woodlands. Grasslands are also found within this zone with riparian forests on the banks of the Luangwa River.

5.1.6.2 Fire Management Strategies

FMU 6 has mainly been managed through use of prescribed burning and fire prevention strategies with limited suppression. Prescribed early burning has been carried out to prevent late season fires and also to promote early season fires through this area in order to prevent unplanned fires, which are set by communities transiting from Mwanya to Mfuwe. There is a good network of game viewing loops in this zone and these have been useful in stopping fires crossing from one area to the other.

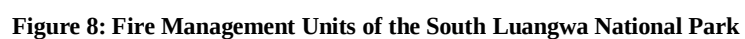
Prescribed burning should still continue to be applied though more detailed planning should be encouraged for the FMU. Suppression in case of tourism facilities being at risk from wild fires should also be taken as a fire management strategy particularly in the late months of the year. Thirdly, there is need for fire prevention strategies to be pursued as this is a major transit route used by the communities between Mfuwe and Mwanya, who at times light wild fires for the purpose of improved visibility or to scare away animals.

5.1.6.3 Current Condition and Desired Future Condition

Like the other FMUs of the park, this FMU has not been an exception as it has also experienced wild fires in the late fire season. There have been modifications to the vegetation in this zone with shrubs encroaching into the woodlands alluded to high elephant populations in the seventies and probably due to flooding which resulted in the mortalities of mopane trees. Reduction in the number of late wild fires will be a priority in this zone.

Table 3: Vegetation types and proposed fire management strategies for Fire Management Units of the South Luangwa National Park

Fire Management Unit	Vegetation Types	Current Fire Management Strategies	Proposed Fire Management Strategies
1	• Grasslands • Mopane • Miombo • Munga • Riparian	• Prescribed fire • Wildfire suppression • Fire prevention	• Prescribed fire • Wildfire suppression • Fire prevention
2	• Mopane • Miombo	• Prescribed fire • Wildfire suppression • Fire prevention	• Prescribed fire • Wildfire suppression • Fire prevention
3	• Mopane • Munga • Riparian	• Prescribed fire • Wildfire suppression • Fire prevention	• Prescribed fire • Wildfire suppression • Fire prevention
4	• Miombo • Mopane • Munga	• Prescribed fire • Fire prevention	• Prescribed fire • Wildfire suppression • Fire prevention
5	• Miombo • Mopane • Munga	• Prescribed fire • Fire prevention	• Prescribed fire • Wildfire suppression • Fire prevention
6	• Grasslands • Mopane • Munga • Riparian	• Prescribed fire • Wildfire suppression • Fire prevention	• Prescribed fire • Wildfire suppression • Fire prevention



6. FIRE MANAGEMENT PLANNING AND PROCEDURES

6.1 Fire Management Planning

6.1.1 Pre-season Planning

The best time for pre-season planning will be the months of February to March, which coincides with reduced activities in the park due to inaccessibility experienced during the rainy season. Pre-season planning will involve a meeting of the research unit, law enforcement unit and infrastructure unit. All the officers in charge of the camps or sectors in charge where possible will be required to attend the pre-season planning meeting. Furthermore, DNPW shall also request for an input into the pre-season planning from the lodges operating in the park. Ideally, the pre-season planning should be finalized by end of March as in most years there is a marked reduction in the amount of rainfall activities by April.

The following are some of the issues that can be considered during the pre-season planning process;

- a) Review 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 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 and communicate to 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 and other interested stakeholders
- 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.

A key output of the pre-season planning will be the annual burn plan for the park. During the first meeting of the Stakeholders Park Fire Management Group, the annual burn plan shall need to be presented in order to provide information to other stakeholders.

6.1.2 Burn Plan Writing Process

Individual burn plans will be prepared by the Research Unit with input from Law Enforcement and Infrastructure Units for identified blocks before undertaking prescribed burning in a particular year. 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 - Weather conditions
e) Estimated Number of days for prescribed burning	Season of the year to burn
f) Time of Day	- Standard work day - Knowledge of local weather - Reliability of weather forecast
g) Firing Plan	- Narrative section - Detailed map
h) Escaped-Fire Plan	- Potential fire escape and actions to take (LCES) - Contingency resources
i) Safety/Emergency Plan	- Safety guidelines (IRPG) - 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

A detailed burn plan has been attached in appendix I.

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.

- 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
- Range condition especially in years of low rainfall

6.2.2 Implementing Prescribed Fire

The commencement of the prescribed burning programme will be determined by the extent of fuel curing after the cessation of the rainy season based on field assessments by field officers. Once, it has been confirmed that prescribed burning can start; the following procedure will need to be followed;

- a) All necessary equipment should be in a working order and organized a day before the prescribed burning programme
- b) Weather forecast conditions should be obtained from the nearest Zambian Meteorological Department (ZMD) in this case, Mfuwe International Airport
- c) The team should periodically record and monitor weather conditions using the kestrel at 2 to 3 hour intervals throughout the burning period
- d) The team implementing the prescribed burning process should be given the procedure on prescribed burning of the area
- e) Test burning should be carried out before firing
- f) Operators and other stakeholders should be informed about the prescribed burning programme before its commencement if facilities are within the block
- g) Communication should readily be available to enable information dissemination in case of the prescribed fire escaping and getting out of control
- h) The location of all prescribed fires ignited should be recorded using a GPS

6.2.3 Fire Management Safety Rules

Implementation of the fire management plan will need consideration of rules that ensure that risks to officers, property, tourists and individuals from photographic tourism facilities are reduced or kept to a minimum. In any fire situation, human life will be placed as a top priority above property and equipment. The implementation of safety rules will require that notification of prescribed burning be provided to the local communities particularly the Mwanya community, who use the Nsefu sector of the park as a transitory route to Mfuwe and also the photographic tour operators. Other users of the park will be informed on a case by case basis.

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 be in use in Zambia as well 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

Unwanted fires (wildfires) will continue to occur in a protected area with the size of the SLNP despite all efforts by management as it is a vast park and therefore prone to other anthropogenic factors. The wildfires are potentially attributed to illegal incursions and carelessness by travelers or users of the park. Due to competing demands pertaining to 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. It is proposed that a combined team of officers from the research and law enforcement sections should always be on stand-by especially from the last month (August) of the mid-fire season to the last month (October) of the late fire season as a response team to suppress wildfires. A minimum of seven officers including the driver is recommended for this particular scenario. In case, it will not be possible to use officers due to other competitive demands and finances permitting, the option of hiring casual workers from the nearby community can be considered during the mid and late fire seasons. These casual workers will need to be trained and be available annually for the required period.

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

- 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 an unwanted fire 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 (wildfire) and decide on how best to fight the fire
- i) A mop-up operation should be conducted once the fire has been put off (controlled)
- j) The team leader should inform the Area Warden once the fire has been put off in the park

6.2.5 Communication during Wildfires

Flow of information during wild fires will be important as it can save lives and property. The communication 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. The following will need to be communicated during wild fires;

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

The team battling the wild fire will be able to communicate with the park headquarters using the radio handsets and cellphones, while exchange of information between DNPW and other stakeholders might have to be through the internet and mobile phones.

6.2.6 Best Management Practices for Fire Management

The implementation of the fire management plan will ensure the application of the best management practices in order to reduce potential negative impacts from fire management. A number of management practices, which have been applied in other protected areas will also be considered for application in the SLNP. Table 5 below outlines a number of best management practices for fire management (Daigneault 2014).

Table 5: Best Management Practices for Fire Management in the South Luangwa National Park

Activity	Best Management Practice
1. Prescribed burning	• Carry out the prescribed burn with trained team • Avoid prescribed burning on steep slopes with high erosion potential or high erodible soils • Avoid intense burning which might expose mineral soil • In wetlands, organic matter should not be completely consumed • 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 • Firebreaks/firelines should not be placed in sensitive habitats like wetlands, dambos, lagoons unless it is absolutely necessary • Construct firelines/firebreaks in a way that reduces erosion and sedimentation and prevents runoff directly entering watercourses • Firebreaks should not be constructed straight up and down hill but on the contour • Hand tools should be used when linking firebreaks into stream channels

6.2.7 After Action Review Process

Fire management activities will be subjected to review immediately after they are undertaken in order to improve future decision making for fire management. The review will focus on activities such as prescribed early burning and wildfire 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 their Senior Officers (Ecologist and Park Ranger).

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 year

As part of the review process, the following questions should be considered (try to limit to 30 minutes):

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

7. ALTERNATIVES TO PRESCRIBED FIRE

7.1 Mechanical Treatment

Slashing or mowing of grass particularly around tourism and park management facilities is an option that has been and will continue to be of use in the park. The advantage of slashing and mowing is that it reduces the amount of fuel and hence reduces the danger of large conflagrations of wild fires during the mid or late fire seasons. This activity should be undertaken in the early fire season before the commencement of the early burning programme and continue during the mid-fire season.

7.2 Fire Prevention

The prevention of fire in the SLNP will require a combination of activities. Some of the activities that have proven successful in other areas include law enforcement, public awareness and reduction of fire risks. With the exception of law enforcement, the other two activities have been implemented on a minor scale. The challenge however with law enforcement has been the limited number of law enforcement staff available to carry out patrols in the park. The following approaches will therefore be taken into consideration when implementing the two activities that have not been part of fire prevention in the SLNP;

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 SLNP especially in the Mfuwe area. These programmes have mostly focused on wildlife conservation awareness in schools and local communities 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 wildfires 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.

7.2.1.2 Target audience

The target audience may be identified by their potential to be a source of wild fires in the park. Wildfires ignited by communities on the east of the SLNP in the Lupande Game Management Area (GMA), are unlikely to enter into the park as the Luangwa River forms an almost impenetrable natural firebreak. However, the wildfires ignited by communities residing in the south, west and north buffer areas of the SLNP have the potential to spread into the park as major sections of the park boundary do not have natural firebreaks. The communities in the south are in the Sandwe GMA, while the communities in the north are in the Munyamadzi GMA. On the west of the park however, most of the communities are in an open area and have had limited interaction with wildlife conservation issues. Not to be forgotten is the Mwanya community, which frequently transits the Nsefu sector of the park. Apart from the surrounding communities in the buffer areas of the park, it is important to include the lodge workers who spend almost six months in the park and can also be a source of wild fires.

7.2.1.3 Dissemination of Public Awareness Information

The information on fire management will have to be communicated through community meetings, programmes on community radio stations, leaflets, posters, notice boards and signposts. In developing these materials, DNPW should consider working closely with other conservation organisations like Chipembele Wildlife Educational Trust (CWET) that have experience in conducting environmental education and preparing materials for dissemination.

7.3 Reduction of fire risk

The unplanned occurrence of fires should also be reduced by managing the fire risk. There are a number of options available to reduce fire risk and these include;

- 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 SLNP 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

The facilities available within the park to assist with fire management include the workshop, which has a number of qualified mechanics and water tanks. Water is available at the junior guest house, senior guest house and the park headquarters. The park headquarters located only about 3.0 km from the main park entry gate has a control room with radio communication linked up with the park, internet facilities to enable download of active fires detected and their mapping. Worth noting are the water facilities available at tourism facilities within the park, which the department can make use of during critical periods of fire suppression.

8.2 Equipment and Supply Needs List

In order for the implementation of the fire management plan to be successful, the Department will need to procure equipment that is affordable, easy to use and maintain by its staff. Currently, the park has in stock fire beaters, backpack pumps, vehicles, tractor, tow grader, motorized grader and water bowser. Though basic and simple, match sticks have been very useful in starting prescribed fires within the park. Appendix II lists the current and required basic equipment for park fire management.

8.3 Firebreaks

Firebreaks in the old SLNP firebreak plan were located in different areas of the park. Figure 3 shows a total of nine (9) firebreaks as contained in the SLNP firebreak plan of 1996. Some of these firebreaks were mechanically put in place being part of the road network in the park, while others were placed through controlled burning during the early fire season and still others were used for igniting prescribed fires. Firebreak A, B, D, E, F, G, H and J are both on roads that can be graded and prescribed fires were set from these areas using perimeter ignition. Firebreaks C, I, K are not located along any roads, but prescribed fires were set from these lines through point ignition (Figure 12). Most of these firebreaks will continue to be maintained in the implementation of fire management in the park being part of the road network.

In the old firebreak plan, few natural features formed part of the firebreak system though the still worked in stopping fires. Due to the vast size of the park, there is need to include the streams and rivers apart from the roads and game viewing loops as part of the firebreak system of the park. On the east side of the park, the Luangwa River forms an effective firebreak and no wild fires cross into the park. The concern is on the north, west and south portions of the protected area, which are vulnerable to wildfires from outside.

However, when setting up the unnatural firebreak system in the park, the following features will need to be considered;

- i) The research, workshop, 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
- 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

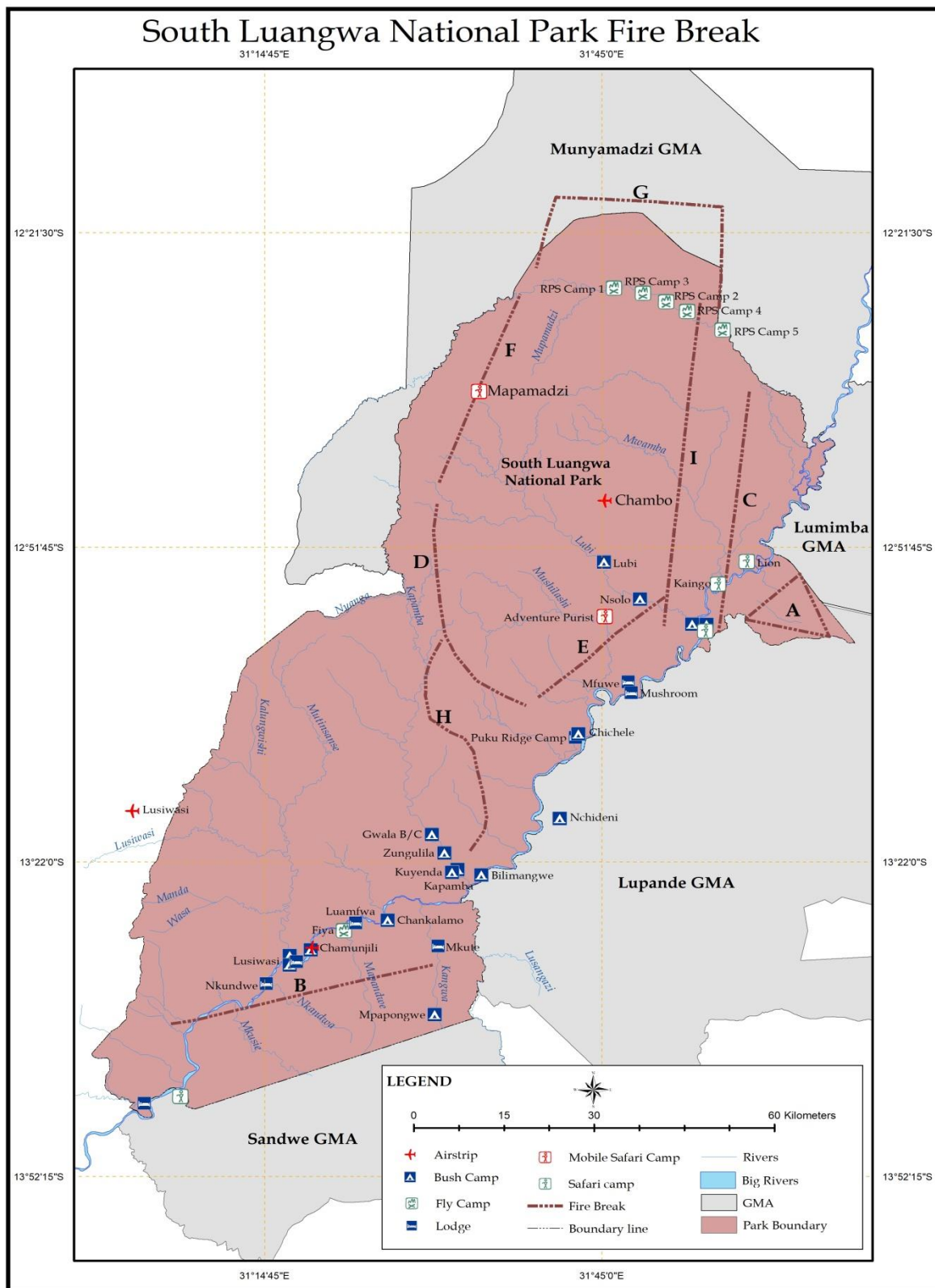


Figure 9: Current firebreak system in the South Luangwa National Park

9. FIRE MANAGEMENT ORGANIZATION AND BUDGET

9.1 Fire Management Organisation

9.1.1 Formation of Fire Park Management Group

To enhance fire management for the park, there is need to form a stakeholder Park Fire Management Group (PFMG) that will be kept informed of the fire management programme for the park. This group should comprise of the DNPW, representatives of the tour operators, conservation organisations and communities contiguous to the national park (Figure 13). The Senior Warden will chair the group and coordinate communication with all members of the group. The Ecologist will assume lead responsibility for implementation of the fire management programme for the park under the office of the Senior Warden and will collaborate with the Park Ranger-Law enforcement, who supervises the Senior Wildlife Police Officers that lead patrol groups, the Park Ranger infrastructure responsible for infrastructure and the Conservation Officer. Support will also be provided by the other units of the Department like Accounts, Infrastructure and Workshop on a need by need basis.

The group should meet and at least hold two meetings in a year with the first being in March for the presentation of the annual fire management programme for the park and the second one in November/December to review its implementation.

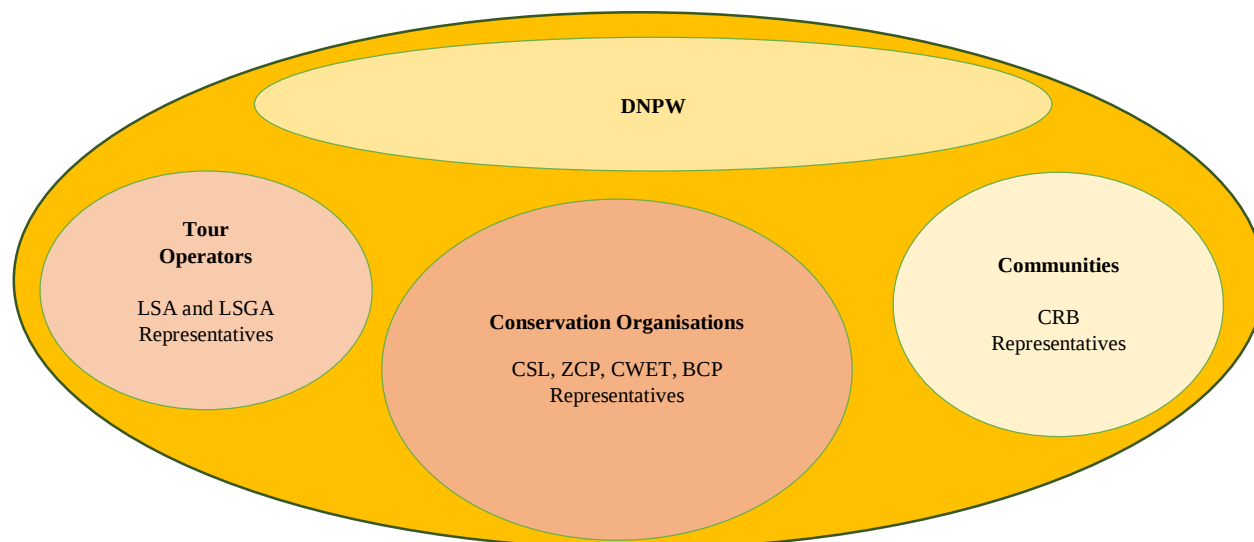


Figure 10: Composition of the Fire Management Group for the South Luangwa National Park

9.1.2 Training

Ideally, there is need for training in fire management of all field staff so that they have a better understanding of fire management. In the short term, priority should be given to officers that spend most of their time in the field or officers who are most likely to be involved in fire management.

From 2015 to 2017, the United States Agency for International Development (USAID)/United States Forestry Service (USFS) conducted a series of workshops on fire management in Eastern Province. A total of fifteen (15) officers were trained from 2015 to 2017 from SLAMU. There is need to build capacity in the remaining field officers that have not been exposed to any fire management training. One option might be for the officers who attended the training to conduct training to remaining untrained fellow officers. Internal refresher courses should also be conducted annually before the commencement of the fire season to remind officers of critical aspects of fire management.

DNPW should continue to incorporate a fire management course as part of the training for Wildlife Police Officers at both Nyamaluma and Chunga Training Schools. Other institutions like the Copperbelt University (CBU) and Zambia Forestry College (ZFC) hold short training courses in fire management and it would be worthwhile for staff to attend these courses in order to keep them up to date with current developments in fire management. Where possible, DNPW should continue to take advantage of international training opportunities in fire management as has been the case with the United States of America and Republic of South Africa.

Apart from fire management, 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 also during other field operations in the park.

9.1.3 Collaborative Partners

A number of partners are operating in the park with interests in the photographic, conservation education and research areas. Currently, certain tourism operators particularly in the central section of the park are involved in active fire management with DNPW. The partners also assist in relaying information on the occurrence of unplanned fires in the park especially in the dry season when there is a potential threat to their property and when it burns in their game viewing area. However, there is still potential for enhanced collaboration with the various partners of the park by incorporating them on the PFMG. The current partners operating in and around the park that might be of assistance in the implementation of the fire management plan are listed in table 8.

Table 8: Collaborative partners operating inside and outside the South Luangwa National Park that can or play a role in Fire Management

Consumptive Tourism Operators	Non-Consumptive Tourism Operators	Conservation and Research Operators	Government Departments
Hunting outfitters (Munyamadzi, Lupande, Sandwe, Lumimba and Chisomo)	- Robin Pope Safaris - Norman Carr Safaris - Bushcamp Company - Remote Africa Safaris - Chikunto Safaris - Kafunta Safaris - Lion Camp - Shenton Safaris - Mapazi Safaris - Safari Explora	- Conservation South Luangwa - Zambian Carnivore Programme - Chipembele Wildlife Educational Trust - Biocarbon Partners	Zambia Meteorological Department

9.2 Budget

Annual funding for the fire management programme in SLNP is provided by the Zambian Government through the Ministry of Tourism. Funds for the implementation of the fire management programme do not fall under a single budget line as various activities contribute to fire management in the park. Wildlife Research, road maintenance and law enforcement operations budget lines provide funds towards prescribed burning and suppression, grading of firebreaks and fire prevention respectively. However, it will be necessary to source for more funds to enable full implementation of the FMP as it is beyond the current limited annual operational budget for fire management. The total estimated cost for five years of implementation of this FMP amounts to K3, 250, 610.15 (USD147, 755.00)

Details of the budget to support full operationalization of this plan is in appendix III.

10. COMMUNICATIONS PLAN

Communication will continue to be maintained through the existing and established system within DNPW and with its external partners. Regular communication will mainly be through cell phones, internet and VHF radio network. The current channels of communication are highlighted in the annual operational plan for the SLNP and below;

- a) Internal VHF radio communication: DNPW has an established radio communication system in place, which links Park headquarters (HQs) to the outposts. However, there are limited radios for the patrol teams, which have been part of the fire management programme in the park. In any case, the field teams will continue to make use of the available radios to communicate with the park HQs when implementing prescribed burning and putting off wildfires in the park. An additional source of information on wildfires will be through radio communication from the CSL/ZCP aircraft to the control room.
- b) External VHF radio communication: DNPW has an established radio network with CSL for resource protection activities. This option enables a channel for communicating with the lodges to relay information on wildfires within the park from the lodges to DNPW.
- c) Internet communication: Almost all the lodges have wireless internet facilities for communication purposes and therefore maintain regular direct contact with DNPW. When working, this means of communication will provide a quick approach to report and get back ground information on wildfires in the park.

Table 6: Communication Protocol for Fire Management in the South Luangwa National Park

Source of wildfire information	Organisation recipient of wildfire information	Contact person	Media of information transmission	Contact information	Type of information
CSL/ZCP Aircraft	DNPW	Ecologist	Phone	TBA	- Wildfire location (Descriptive) - Property at risk (Descriptive) - Direction of wildfire (Descriptive)
			Email	TBA	
		Park Ranger-GMA	Phone	TBA	
			Email	TBA	
		Park Ranger-SLNP	Phone	TBA	
			Email	TBA	
Lodge operators	DNPW	Park Ranger-IT	Phone	TBA	- Wildfire location (Descriptive) - Property at risk (Descriptive) - Direction of wild fire (Descriptive)
			Email	TBA	
		Ecologist	Phone	TBA	
			Email	TBA	
		Park Ranger-SLNP	Phone	TBA	
			Email	TBA	
		Park Ranger-GMA	Phone	TBA	
			Email	TBA	
DNPW field officers	DNPW	DNPW radio operator	Radio	DNPW base radio	- Wildfire location (Coordinates) - Fire behaviour (ground, surface, crown, rate of spread, direction) - Weather conditions (Temperature,
			Phone	TBA	
Tourists	DNPW entry/exit gates	Duty Officers	Direct contact	Main gate	Wildfire location (Descriptive)
				Chivungwe gate	
				Lusangazi gate	
				Chikwinda gate	
				Miliyoti gate	

11. FIRE RESEARCH

11.1 Current Status of Fire Research

At the moment, there is no on-going long or short term research on fire and its impact on biodiversity within the SLNP. Most of the information that guides fire management in the SLNP is based on information that has been generated on fire ecology either in other parts of Zambia or other countries. Though eight permanent vegetation monitoring plots within the park have been set up for the purpose of tracking changes in the vegetation, they are limited in coverage. Data on the species diversity, species importance and biomass as key indicators has been collected from these plots whose establishment commenced in 2008. Despite the plots not being linked to fire research the occurrence of fire is recorded when vegetation monitoring is conducted on the plots after two to three years.

11.2 Need for Fire Research

Better decisions on fire management will require generation of information through research on fire and biodiversity within the SLNP. The establishment of a long-term fire ecology or fire research programme will be important especially with evolving climate change issues being faced globally. The department will need to prepare a detailed proposal and source for funding for the initiation of research on fire and its impacts on biodiversity in order to generate information. As manpower levels are currently low in the Research Unit and a project of this size will require extra manpower, the option that can be explored is for the department to request for either undergraduate students or postgraduate students to collect data during their industrial attachment. Alternatively, the DNPW can utilize individuals who were once attached to DNPW as students to work as interns to undertake the research work under the supervision of its fulltime Research Ecologists. Such a detailed research project will provide an opportunity for all DNPW ecologists to participate on a single project, which will build up their experience and enable them to publish peer reviewed work that will aid management decisions.

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 SLNP;

12.1 Fire Data Collection

12.1.1 MODIS web fire mapper

The University of Maryland provides data on active fires detected using the terra and aqua satellites in protected areas every 24 hours to subscribers. To make use of this data source, an officer should be assigned to download and store the data from MODIS on a daily basis. Wild fires that will be detected from the MODIS platform will be checked and depending on the location be suppressed by park management. The MODIS data will be used to prepare fire maps monthly, quarterly and

annually as a way of monitoring the spatial and temporal occurrence of fires in the park. Furthermore, the fire maps will provide an input into the pre-season planning activity.

12.1.2 Aerial Surveillance

As the park is vast and causes of certain fires are unknown at the time of detection by either MODIS web fire mapper or by other sources, it will be necessary to check these fires using an aircraft. This will particularly be important when the detected fires have not been started by park management or when the source of ignition is unknown. Currently, the Kakumbi airstrip in the SLNP hosts two aircrafts, one belonging to the Conservation South Luangwa (CSL) and another owned by Biocarbon Partners (BCP). When on law enforcement surveillance or tracking flights, the aircraft shall integrate verification of reported detected fires by MODIS in its flight plan. This will call for continued liaison between DNPW and its two partners to enable operationalization of this monitoring aspect. In future, when resources are available, the park can consider the procurement and use of unmanned aerial vehicles (UAVs) in monitoring of both wild and prescribed fires.

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 where 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 where 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 SLNP will therefore be captured using the MODIS burnt area product that is available from the University of Maryland and allows mapping of the extent of fires in large protected areas.

12.2 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.

12.3 Annual Fire Management Plan Review

The review 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 Research, Law Enforcement, Infrastructure and Conservations in November. The results of the review will be presented to the park management and later to the park stakeholders in November as tourism activities would have declined and most tour operators as well as other stakeholders will be available.

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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 (°C)			
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

No	Equipment	Current	Required	Additional number required
1	Fire beaters	18	40	12
2	Kestrel	3	4	1
3	Vehicle	1	2	1
4	Drip torches	3	5	2
5	Goggles	9	20	11
6	Gloves	50	50	0
7	Weather Station*	0	4	4
8	Tractor*	2	5	3
9	Water bowser*	2	2	2
10	Radio communication	1	3	2
11	Tow grader*	2	2	0
12	Motorised grader*	2	4	2
13	Front end loader*	1	2	1
14	Bladder bags	6	15	9

*South Luangwa National Park General Management Plan

Appendix III: Projected costs for implementation of the South Luangwa National Park Fire Management Plan for five years

Outcome 1: Improved landscape resiliency to impacts of late wildfires						Year				
No	Activity	Category	Item	Units	Unit Cost	1	2	3	4	5
1a	Form Park Fire Management Group	Stationery	Paper	1	140.00	140.00				
			Sub-total			140.00				
		Fuel	Local movements	50	15.59	779.50				
			Sub-total			779.50				
		Total				919.50				
1b	Prepare annual fire operational plan (including burn plan)	Fuel	Local movements	60	15.59	935.40	935.40	935.40	935.40	935.40
			Outpost within the park	300	15.59	4,677.00	4,677.00	4,677.00	4,677.00	4,677.00
			Sub-total			5,612.40	5,612.40	5,612.40	5,612.40	5,612.40
		Food	Driver	2	60.00	120.00	120.00	120.00	120.00	120.00
			Ecologist	6	60.00	360.00	360.00	360.00	360.00	360.00
			Park Ranger	4	60.00	240.00	240.00	240.00	240.00	240.00
			Camp in charge	16	60.00	960.00	960.00	960.00	960.00	960.00
			Sub-total			1,680.00	1,680.00	1,680.00	1,680.00	1,680.00
		Stationery	Paper	2	140.00	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
			Toner	1	1,500.00	1,500.00	1,500.00	1,500.00	1,500.00	1,500.00
			Sub-total			1,920.00	1,920.00	1,920.00	1,920.00	1,920.00
		Total				9,212.40	9,212.40	9,212.40	9,212.40	9,212.40
1c	Present proposed annual fire management operational plan to PFMG (Include annual review of implementation of fire management for previous year)	Fuel	Local movements	100	15.59	1,559.00	1,559.00	1,559.00	1,559.00	1,559.00
					15.59	0.00	0.00	0.00	0.00	0.00
					15.59	0.00	0.00	0.00	0.00	0.00
			Sub-total			1,559.00	1,559.00	1,559.00	1,559.00	1,559.00
		Refreshments	Food	20	40.00	800.00	800.00	800.00	800.00	800.00
			Sub-total			800.00	800.00	800.00	800.00	800.00
		Total				2,359.00	2,359.00	2,359.00	2,359.00	2,359.00
1d	Implement annual operational plan for	Lunch	Food	5	12,000.00	60,000.00	60,000.00	60,000.00	60,000.00	60,000.00

	selected blocks		Sub-total			60,000.00	60,000.00	60,000.00	60,000.00	60,000.00
		Fuel	Local vehicle	300	15.59	4,677.00	4,677.00	4,677.00	4,677.00	4,677.00
			Sub-total			4,677.00	4,677.00	4,677.00	4,677.00	4,677.00
		Support staff	Casual workers	500	150.00	75,000.00	75,000.00	75,000.00	75,000.00	75,000.00
			Sub-total			75,000.00	75,000.00	75,000.00	75,000.00	75,000.00
		Stationery	Paper	1	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
			Talk time	1	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00
			Satellite phone service	1	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00
			Vehicle service kit	1	11,000.00	11,000.00	11,000.00	11,000.00	11,000.00	11,000.00
			GPS batteries	140	30.00	4,200.00	4,200.00	4,200.00	4,200.00	4,200.00
			Sub-total			21,080.00	21,080.00	21,080.00	21,080.00	21,080.00
		Total				160,757.00	160,757.00	160,757.00	160,757.00	160,757.00
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
			Sub-total			12,000.00	12,000.00	12,000.00	12,000.00	12,000.00
		Fuel	Local vehicle	600	15.59	9,354.00	9,354.00	9,354.00	9,354.00	9,354.00
			Sub-total			9,354.00	9,354.00	9,354.00	9,354.00	9,354.00
		Support staff	Casual workers	150	150.00	22,500.00	22,500.00	22,500.00	22,500.00	22,500.00
			Sub-total			22,500.00	22,500.00	22,500.00	22,500.00	22,500.00
		Total				43,854.00	43,854.00	43,854.00	43,854.00	43,854.00
		Overall total for 1					217,101.90	216,182.40	216,182.40	216,182.40
Outcome 2: Improved mobilization and utilization of resources for fire management.										
No	Activity	Category	Item	Units	Unit Cost					
2a	Carry out manpower and training needs assessment for fire management		None	0	0	0.00	0.00	0.00	0.00	0.00
			None	0	0	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	200.00	9,000.00	9,000.00	9,000.00	9,000.00	9,000.00
		Lunch	Trainers	12	200.00	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00
		Allowances	Drivers	8	200.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00
			Sub-total			13,000.00	13,000.00	13,000.00	13,000.00	13,000.00

		Fuel	Local movements	150	15.59	2,338.50	2,338.50	2,338.50		
			From outposts	295	15.59	4,599.05	4,599.05	4,599.05		
			Sub-total			6,937.55	6,937.55	6,937.55		
		Stationery	Paper	2	140.00	280.00	280.00	280.00		
			Flip charts	2	140.00	280.00	280.00	280.00		
			Note books	15	30.00	450.00	450.00	450.00		
			Pens	15	10.00	150.00	150.00	150.00		
			Markers	10	20.00	200.00	200.00	200.00		
			Sub-total			1,360.00	1,360.00	1,360.00		
		Total			21,297.55	21,297.55	21,297.55			
2c	Identify and approach stakeholders who can contribute to fire management by the end of year 1	Fuel	Mfuwe	100	15.59	1,559.00	0.00	0.00	0.00	0.00
						0.00	0.00	0.00	0.00	0.00
		Sub-total			1,559.00	0.00	0.00	0.00	0.00	
		Total			1,559.00	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	Fuel	100	15.59	1,559.00	1,559.00	1,559.00	1,559.00	1,559.00
		Maintenance	Resupply/Accessories	50	30	1,500.00	1,500.00	1,500.00	1,500.00	1,500.00
		Sub-total			3,059.00	3,059.00	3,059.00	3,059.00	3,059.00	
		Total			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							
			Vehicle	1	1,500,000.00	1,500,000.00							
			Drip torches	1	4,400.00	4,400.00							
			Bladder bags	5	6,600.00	33,000.00							
			Googles	7	200.00	1,400.00							
			Gloves	30	200.00	6,000.00							
			Weather Station	1	5,500.00	5,500.00							
			Handheld radios	3	6,600.00	19,800.00							
			Talkabout two way radios	6	3,300.00	19,800.00							
			Cooking equipment	3	3,000.00	9,000.00							
			Water bottle	10	200.00	2,000.00							
			Rain gauges	6	8,000.00	48,000.00							
			Laptop computer	1	22,000.00	22,000.00							
			Projector	1	4,000.00	4,000.00							
			Printer	1	6,000.00	6,000.00							
			Sleeping bag	10	1,000.00	10,000.00							
			Tent	10	1,000.00	10,000.00							
			Machete	10	75.00	750.00							
			Axe	10	100.00	1,000.00							
			Rake	10	150.00	1,500.00							
			Shovel	10	200.00	2,000.00							
			First sid kit	6	600.00	3,600.00							
			Vehicle first aid kit	3	600.00	1,800.00							
			Vehicle radio	1	10,000.00	10,000.00							
			Satellite Phone	1	30,000.00	30,000.00							
			GPS	2	10,000.00	20,000.00							
			Sub-total						1,785,550.00				
			Total						1,785,550.00				
			Overall total for 2						1,811,465.55	24,356.55	24,356.55	3,059.00	3,059.00

Outcome 3: 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			
			Fuel	200	15.59	3,118.00	3,118.00			
			Sub-total			3,398.00	3,398.00			
		Total			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	0.00	0.00	0.00
Outcome 4: 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			
			Fuel	100	15.59	1,559.00	1,559.00			
			Sub-total			1,699.00	1,699.00			
		Total			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	
			Signposts	3	10,000.00	30,000.00	0.00	0.00	0.00	
			Sub-total			36,000.00	6,000.00	6,000.00	6,000.00	0.00
		Fuel	Local movements	300	15.59	4,677.00	4,677.00	4,677.00	4,677.00	
			Sub-total			4,677.00	4,677.00	4,677.00	4,677.00	0.00
			Total			40,677.00	10,677.00	10,677.00	10,677.00	0.00
4c	Hold sensitization meetings with stakeholders (ie communities)	Fuel	Local movements	400	15.59	6,236.00	6,236.00	6,236.00	6,236.00	6,236.00
			Sub-total			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
		Allowances	Extension officer	8	810.00	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		
			Driver	8	530.00	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		
			Sub-total					23,680.00	23,680.00	23,680.00	23,680.00	23,680.00
			Total					29,916.00	29,916.00	29,916.00	29,916.00	29,916.00
4a	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		
		circulation	Sub-total					14,000.00	14,000.00	14,000.00	14,000.00	14,000.00
		Total					14,000.00	14,000.00	14,000.00	14,000.00	14,000.00	
Overall total for 4						86,292.00	56,292.00	54,593.00	54,593.00	43,916.00		
Grant-total (ZMW)						2,118,257.45	300,228.95	295,131.95	273,834.40	263,157.40		