

**THE EFFECTIVENESS OF BIOSPHERE RESERVE AS A TOOL FOR SUSTAINABLE
NATURAL RESOURCE MANAGEMENT IN VHEMBE DISTRICT MUNICIPALITY,
LIMPOPO PROVINCE, SOUTH AFRICA**

By

MOSIMA FLORINA MPHIDI

STUDENT NUMBER: 9607849

**A Thesis submitted to the Department of Geography, School of Environmental
Sciences, University of Venda in fulfilment of the Master of Environmental
Sciences.**

September 2019

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SUPERVISOR: PROF B.D.O. ODHIAMBO

CO-SUPERVISOR: MR. M.J. MOKGOEBO

September 2019

DECLARATION

I, **MOSIMA FLORINA MPHIDI** student number **9607849**, hereby declare that this dissertation for Master of Environmental Sciences in Geography has not been submitted previously for any degree at this or any other Universities. In addition, it is my own work in design and execution and all reference materials contained therein, have been duly acknowledged.

M.F Mphidi (student)

Signature.....

Date.....

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Firstly, I would like to thank the Almighty GOD for giving me the strength and a healthy body and mind to accomplish this project.

Throughout this study, there were also some guiding stars, and I would like to thank all of them who contributed to make this study a success in various ways:

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ABSTRACT

The purpose of this study was to contribute towards a better understanding of the effectiveness of Biosphere Reserve as a tool in managing natural resources in the Vhembe District Municipality (VDM), Limpopo Province of South Africa. There are limited documented materials for a better understanding of the effectiveness of Biosphere Reserve (BR) as a tool in managing natural resources in the Vhembe District Municipality (VDM). As a result, this study was undertaken to bridge this gap and to discover new insights to assist in understanding the effectiveness of BR as a tool in managing natural resources.

This study adopted a pragmatic research approach, which is a mixture of the qualitative and quantitative research approaches, wherein data were collected using primary and secondary sources. Both primary and secondary data were used, in order to obtain information concerning the effectiveness of biosphere reserve in the study area. Primary data were obtained using a combination of methods, including participatory rural appraisal (PRA) tools and techniques, and informal and formal surveys. The secondary data was collected from desk-based examination of relevant documentation relating to conservation of the Biosphere Reserves areas. The documents included previous reports from Greenest Municipality Competition (GMC) results for all local municipalities from 2012 to 2017, Management Effective Tracking Tool (METT-SA) from 2016 to 2018, and previous research data on conservation.

The results obtained revealed that Biosphere Reserve (BR) is an effective tool for the conservation of natural resources within Vhembe District, South Africa. This is because natural resources are taken into consideration when there are developments and projects being undertaken. Furthermore, the communities in Vhembe District Municipality benefit from the programmes and projects aimed at conserving natural resources within the VBR. The study also revealed that there are environmental challenges within the Vhembe Biosphere Reserve due to mining activities, climate change, developments in natural resources and deforestation, which require the enforcement of by-laws and programmes and projects aimed at conserving natural resources.

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ABBREVIATION AND ACRONYMS

BR: Biosphere Reserve

CTC: Cleanest Town Competition

DEA: Department of Environmental Affairs

DLM: Dzomo la Mupo

EES: Environmental Empowerment Services

GMC: Greenest Municipality Competition

LEDET: Limpopo Economic Development, Environment and Tourism

MAB: Man and Biosphere Reserve

METT-SA: Management Effective Tracking Tool of South Africa

MPRDA: Minerals and Petroleum Resource Development Act

NWMS: National Waste Management System

SDG: Sustainable Development Goals

UNIVEN: University of Venda

UNESCO: United Nations Educational, Scientific and Cultural Organization.

VDM: Vhembe District Municipality

VBR: Vhembe Biosphere Reserve

WNBR: World Network of Biosphere Reserve

Definition of Terms

The operational concepts in this study are presented and defined below:

Biosphere Reserves: Sites recognized by UNESCO's Man and the Biosphere (MAB) Programme to promote sustainable development based on local community efforts and sound science, which have three equally weighted aims namely; conservation of biological and cultural diversity; economic and social development; and logistic support for research and education (Jackson *et al*, 2011).

Conservation: The protection, care, management and maintenance of ecosystems, habitats, wildlife species and populations, within or outside of their natural environments, in order to safeguard the natural conditions for their long-term permanence (IUCN, 2017).

Development: The definition of development in the context of a Biosphere is to foster economic development, which is socio-culturally and ecologically sustainable. All Biospheres therefore accept and encourage development within their areas (VBR, 2017).

District Municipality: A municipality that has municipal executive and legislative authority in an area that includes more than one municipality, and which is described in section 155 (1) of the constitution as a category C municipality (RSA, 2000).

Man and the Biosphere (MAB) Programme: A UNESCO Intergovernmental Scientific Programme which emphasizes both conservation and sustainable use of biodiversity (Montini & Bogdanovic, 2011).

Natural Resource Management: The management of natural resources such as land, water, soil, plants and animals with a particular focus on how management affects the quality of life for both present and future generations (Ochola *et al.*, 2010).

Research: Are expanding knowledge about earth, living systems, future, and place in the universe by employing interdisciplinary thinking and collaborative efforts. It is also used to educate on earth systems planning and management for policymakers, students, and the public (UA, 2017).

Sustainability: The ability to meet the need of present and future generations through the responsible use of resources (DEA, 2007).

Sustainable Development: The integration of social, economic and environmental factors into planning, implementation and decision making so as to ensure that development serves present and future generations (RSA (b), 1998).

UNESCO: United Nations Educational, Scientific and Cultural Organization, UNESCO “is focused on the building of peace, the eradication of poverty, sustainable development and intercultural dialogue through education, science, culture, communication and information” (UNESCO, 2010).

CHAPTER 1

INTRODUCTION

1.1. Introduction

Through the establishment of Biosphere Reserves (BR), the Man and the Biosphere Programme (MAB) sets a basis for improving the relationships between people and their environment, a long-term approach that increases people's ability to manage natural resources sustainably into the future. Conceptually, the BR concept is attractive, yet the practical reality is likely to be challenging, particularly given the history of disappointments of traditional Integrated Conservation and Development (Coetzer *et al.*, 2013). Ishwaran *et al.* (2008) affirmed that the BR as a concept and a tool of United Nations Educational, Scientific and Cultural Organization (UNESCO), has an origin in the protected areas domain but has now evolved into an international designation that allows context-specific conservation and development relationships to be developed in land and seascapes. As such, each biosphere reserve could be a context-specific experiment in sustainable development at varying scales.

AfriMAB (2013) revealed that the concept of BR is one of the important standard bearers of what has been referred to, in the convention on biological diversity, as the ecosystem approach. BR are designed from the start, with the local people involved in conserving and managing biodiversity, while at the same time meeting their livelihood needs (Pool-Stanvliet & Clusener-Godt, 2013). According to Van Cuong *et al.* (2016) BR, which is established under the UNESCO's MAB program, are aimed at harmonizing biodiversity conservation and sustainable development. UNESCO's BR designation concept encourages regions, to take strides towards sustainability and specifically addresses the need to balance conservation of biological and cultural diversity with economic and social development. The world network of BR, fosters the harmonious integration of people and nature for sustainable development through participatory dialogue, knowledge sharing, poverty reduction and human well-being improvements, respect for cultural values and society's ability to cope with change thus contributing to the Sustainable Development Goals (SDG) (UNESCO, 2011).

Özyavuz (2017) affirms that BR embraces all areas of terrestrial and coastal ecosystems,

promoting solutions to reconcile the conservation of biodiversity with its sustainable use. When the UNESCO BR concept began in 1970, the objective was primarily about conservation alone. However, there has been an evolution of the concept to include sustainable development and a commitment to sharing experiences with other regions. Vhembe Biosphere Reserve (VBR) faces challenges of pollution, land degradation, and mining, among others, especially in the biosphere's transition zone and buffer zone. Therefore, there is a strong need to evaluate the effectiveness of the biosphere reserve concept as a tool for sustainable natural resource management in Vhembe District Municipality (VDM).

1.2. Statement of the Research Problem

VDM comprises of number of sensitive environments, which also include culturally-important sacred places, which need to be conserved for future generations. It also includes areas with high biodiversity, such as the Kruger National Park, the Mapungubwe National Park and World Heritage Site, and several Provincial Nature Reserves. However, the area also has a relatively large and rapidly growing human population, coupled with a high unemployment rate which results in severe negative impacts on natural resources, which are utilised for energy, food, medicine and other items (VBR, 2008). The total population is estimated at 1,393,949 and the density of 50.6 per km² (131/sg mi) (StatsSA, 2018) and population was 1,294,722 from the 2011 Census, and 1,240,035 from 2007 Community Survey. It reveals that from 2001 to 2007 the population of Vhembe has increased by 41,979 people, and 54,687 from 2007 Community Survey to 2011 Census. On the other hand, vast reserves of minerals, mainly coal, have been identified and the mineral rights have been issued. The challenge is whether the minerals will be exploited while ensuring the long-term sustainable conservation and simultaneous development of the VBR. According to the Minerals and Petroleum Resource Development Act (MPRDA) (2002) section 37(2), any prospecting or mining operation must be conducted in accordance with generally accepted principles of sustainable development by integrating social, economic and environmental factors into the planning and implementation of prospecting and mining projects in order to ensure that the exploitation of the mineral resources serves present and future generations.

The VBR is largely rural, with the majority of its stakeholders consisting of relatively poor local communities having few economic opportunities. Thus, poverty alleviation is a high

priority (VBR, 2017). Even when the municipalities are participating in the provincial greenest municipality competition VDM still experiences several environmental challenges that lead to the depletion of natural resources. Furthermore, some of the sector tools in the local municipalities within VDM that are aimed at ensuring the protection of the natural resources are either not available or are outdated, which leads to environmental challenges within the municipalities. The VBR was designated in 2009 and LEDET, under Environmental Empowerment Services (EES) directorate and the VBR committee, have the obligation to ensure that the biosphere remains intact. In the Vhembe District, is the BR effective tool for sustainable natural resource management?

1.3. Aim of the study

The main aim of this study was to contribute towards a better understanding of the effectiveness of BR as a tool in managing natural resources in the Vhembe District Municipality (VDM), Limpopo Province of South Africa.

1.4 Objectives

- To examine the usefulness of the biosphere reserve concept as a tool for conservation of natural resources.
- To assess the contribution of development project in natural resource management.
- To evaluate the contribution of research in sustainable natural resource management.

1.5 Research Questions

The study seeks to provide answers to these research questions:

- Is biosphere reserve concept a useful tool for conservation of natural resources?
- How does development projects contribute to natural resource management within the Vhembe biosphere reserve?
- How does research contribute to sustainable natural resource management within the VBR?

1.6 Significance and Justification of the Study

The choice of the VDM as a primary area of the investigation was made in order to contribute towards the limited amount of the information available about the effectiveness of biosphere reserve as a tool for sustainable natural resource management. Despite the explicit need for and extensive research within biosphere reserves, most of the work to date is highly disciplinary and focuses mainly on the natural sciences. While these are critical studies to broaden the understanding of biological diversity and ecological integrity of core areas, or the gradient of human impacts across buffer zones, or the best management practices for particular resources in transition areas, very little social science has been undertaken on the effectiveness of the biosphere reserve itself.

The VBR is expected to conserve the ecosystem, provide long-term in-situ conservation of genetic diversity, provide opportunities for education and training, provide appropriate sustainable management of the living resources, and promote international cooperation in VDM and surrounding areas (UNESCO, 2011). This study will disclose more information about the actual role of the biosphere designation in natural resource management within VDM.

Furthermore, the findings of this study may instigate the authorities to put efforts in enforcing the law and influence the decision that will be made when there are developments for sustainable natural resource management. This study, in the main, derived its relevance from the fact that there is hardly any study that provides empirical evidence on the effectiveness of VBR as a tool for natural resource management in VDM of SA. Furthermore, researchers have not given adequate attention to the BR as a tool for sustainable natural resource management. This study sought to change this situation, by seeking to empirically establish the nature, extent and degree of severity of the impacts that the concept of biosphere provides to the area as a conservation tool.

1.7 Research assumptions

The main assumption of the study was that biosphere reserve concept was able to assist the areas declared to conserve its natural resources, benefit the sharing and promotion of local economic development in the area. It was also assumed that the designation of areas

as a biosphere reserve would assist the local communities to raise funds to start projects aimed at nature conservation.

1.8 Limitations of the Study

The findings of this study seek to contribute to the discourse of the effectiveness of biosphere reserve as a tool for sustainable natural resource management in Vhembe District Municipality. The study focused on the use of key variables, which are Greenest Municipality Competition (GMC), Management Effective Tracking Tool (METT) report and Research data of the Vhembe District Municipality. The research was also limited in aspects like, lack of previous studies about the effectiveness of biosphere reserve as a tool for sustainable natural resource management in Vhembe District Municipality. Consequently, the literature review is more generic and less focused on the management of biosphere reserve per se. The study therefore shares the limitation of most pioneer studies of having very wide scopes, in order to capture the broad picture.

1.9 THE STUDY AREA

1.9.1 Geographical Location

VDM is located in the northern part of Limpopo Province and shares borders with the Capricorn and Mopani District Municipalities in the eastern and western directions respectively (Figure 1.1). The shared borders extend to Zimbabwe and Botswana in the North West and Mozambique in the South East through Kruger National Park. The district covers 21,407 km² of land with the total population of 1,393, 949 people (Stats SA, 2018). Makhado, Musina, Collins Chabane and Thulamela are four local municipalities that make up VDM. VBR is one of the six ecosystems in South Africa, and is the third to have been established in Limpopo Province (Van der Westhuizen, 2010).

According to DEA (b) (2017:1), VBR covers a total of 3,070, 000 hectares (ha) and the core area comprises 460,000 ha, buffer zone covers 357,400ha and transition area covers 2,252, 600 hectors. Various privately-owned properties make up the buffer zone, which, added to the core, comprises some 100,000 hectors.

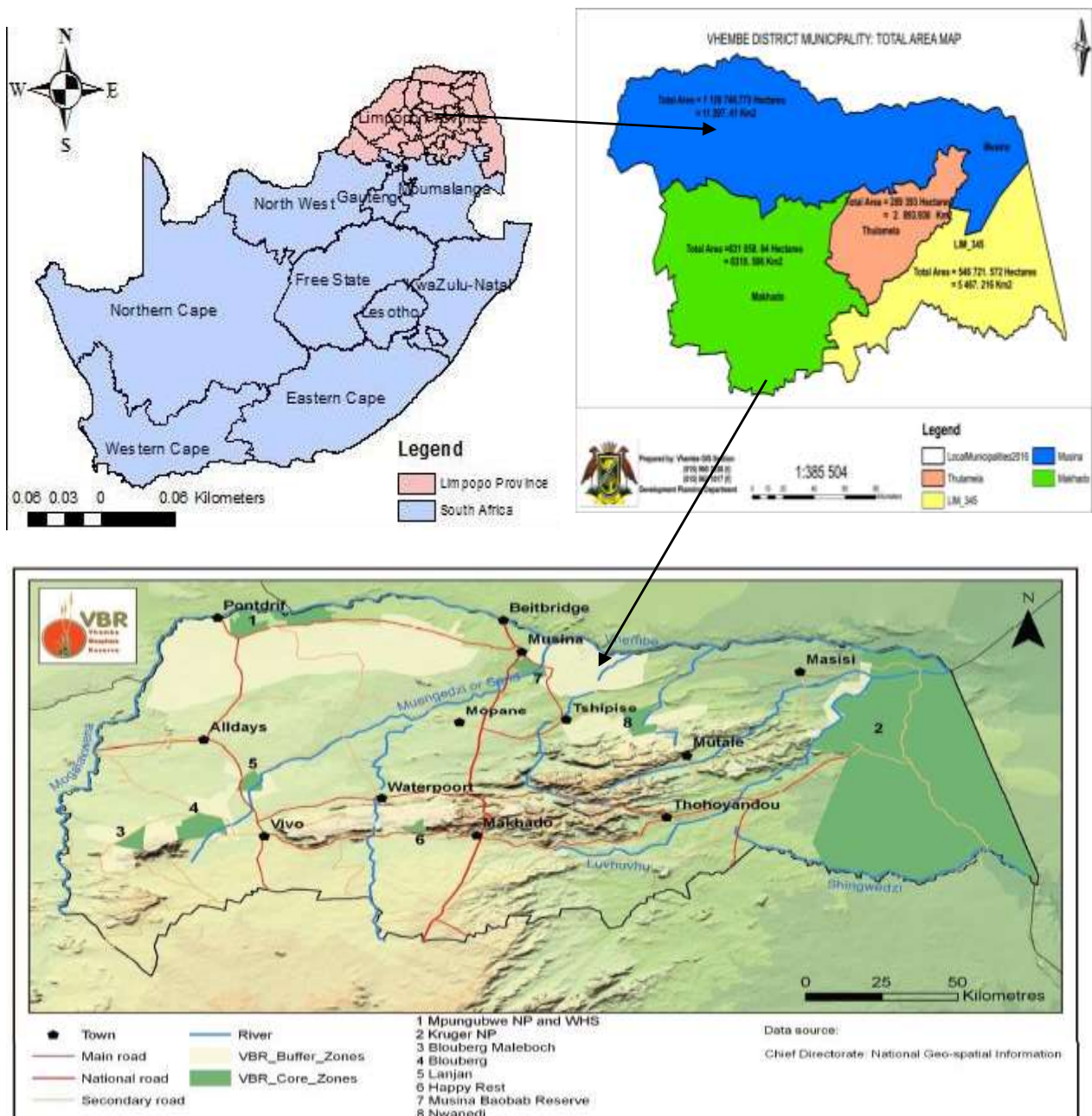


Figure 1.1 Location of the study area.

1.9.2 Climate

VBR is found in a semi-arid region, and it is characterized by climate variability, which makes it prone to floods and droughts incidences (Mulugisi, 2015). The area experiences annual rainfall of approximately 500 mm per annum out of which about 87.1% falls between October and March. The rainfall pattern is largely influenced by the orographic rainfall effect of the Drakensberg Mountains joining the Soutpansberg perpendicularly; hence the rain decreases from east to the west of the district. The rainfall peaks in January to February,

and this is when floods are also expected. Rainfall exceeds the potential evapotranspiration in the months of December to March. Temperature can drop sharply in the evenings. During winter periods, less than 20 mm of monthly rainfall is received in Vhembe District, with the average rainfall dropping to 8 mm during August. During the winter months, (from May to August), the climate is warm during the day, with dry air prevailing. The annual temperature ranges from a minimum of 10°C during winter to a maximum of up to 40°C, especially around the Musina Local Municipality (MLM) (Mpandeli, 2014). The area also experiences frequent drought, most particularly in the parts of the Thulamela Local Municipality (TLM) and MLM which are predominantly semi-arid (VDM, 2017).

1.9.3 Flora and Fauna

VDM has an amazing biological diversity of flora and fauna. This rich biodiversity is attributed its biogeography and diverse typology. The district falls within the greater-Savanna biome, commonly known as the Bushveld, with some small pockets of grass land and forest biome. These and other factors have produced a unique assortment of ecological niche which are in turn occupied by a wide variety of plants and animal species (VDM, 2017). Alien vegetation are also found in Vhembe District that include exotic species such as *Lantana camara*, *Acacia saligna*, *Acacia Cyclops*, *Sesbaniapunecia*, *Azollafiliculoids*, *Eichhorniacrassipes* and *Nicotianaglauca* that have invaded large area of arable land and displaced native species in wetlands (Mulugisi, 2015).

A sound knowledge of the vegetation ecology; wildlife; environmental management programmes and conservation policies, is essential as the optimal use of natural resources cannot be taken care of without adequate knowledge of the ecosystems (Mashau & Gotze, 2014). Nature reserves and national parks provide reserves of the District's fauna and flora. There are large extensive areas within Vhembe District Municipality that are conservancies among other including the Kruger National Park and the Mapungubwe National Park and the World Heritage Site. The Soutpansberg is recognized as a centre of endemism and a centre of biodiversity and forms part of one of the priority areas for conservation in South Africa (DEA, 2017).

1.9.4 Water Resources

There are few catchments areas which are stressed by high demand of water for development activities, such as agriculture, human consumption and mining. Water management in the district faces challenges that include imbalance between the supply and demand for water, alien invasive species and inappropriate land use practices in the river valleys, the impact of fertilizers and pesticides, inadequate monitoring, poorly managed sewage systems, high concentration of pit latrines, flood events and drought (VDM, 2017).

1.9.5 Air Quality

The quality of the air is a critical factor that affects not only human health, but also wildlife, and vegetation (LEDET, 2016). Poor air quality has a direct impact upon the health and life expectancy of people. Therefore, improving it is an ambition of all of us. The sources of air pollution are largely constituted of formal and informal industries (point and non-point), domestic fuel burning, vehicle emissions, dust entrainment, and biomass burning as well as waste disposal (VDM, 2017). Mining and its waste dumps are also responsible for air pollution in the district. In addition, poorly-managed coal mines discharge methane into the atmosphere, and coal waste dumps contain materials that can burn on their own (self-combustion) and produce poisonous particles and gases. Finally, fugitive emissions from brickworks/ klamp kilns process are other main contributors to air pollution, including dust fallout at mine and brick yards (VDM, 2017).

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The literature review was consulted using previous dissertations, journals, government gazettes and the internet, to obtain data that support the study. The diverse views of scholars on biosphere reserve, threats and opportunities are discussed. This assists the researcher to widen the scope in terms of biosphere reserve and assist in responding to the research questions.

2.2 Legislative Framework

There are several legislations that are designed to protect the natural environment, which include:

2.2.1 National Environmental Management Act 107 of 1998

The National Environmental Management Act creates the fundamental legal framework that gives effect to the environmental right guaranteed in section 24 of the Constitution of South Africa, 108 of 1996. It states that everyone has the right to an environment that is not harmful to their health or wellbeing; the environment protected for the benefit of present and future generation through reasonable legislative and other measures. It can be through prevention of pollution and ecological degradation; promotion of conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development (Van der Linde, 2010). The act ensures the right of citizens to live in a clean and healthy environment, and the core environmental principle is the promotion of ecologically sustainable development. The aim of the Act is to provide the principle for decision making on matters affecting the environment, institutions that will promote co-operative governance, and procedures for coordinating environmental functions exercised by organs of state. The National Environmental Management Act No. 107 of 1998 (NEMA) gave rise to other acts that have roles in the protection of natural environment thus, National Environmental Management: Biodiversity Act No. 10 of 2004 (NEMBA); Air Quality Act, No. 39 of 2004 (NEMAQ) and the Protected Areas Act No. 57 of 2003 (NEMPAA).

National Environmental Management: Biodiversity Act, 10 of 2004 provides for the management and conservation of South African biodiversity within the framework of the National environmental management Act. Also the act provides for the sustainable use of our resources, and the fair and equitable sharing of benefits arising from the use and application of genetic resources and material (Van der Linde, 2010). The National Environmental Management: Biodiversity Act (NEMBA) also regulates all invasive organisms in South Africa, including a wide range of fauna and flora. Regulations published in Government Notices R.506, R.507, R.508 and R.509 of 2013 under NEMBA categorizes and regulates the control of invasive and alien species as follows. According to the Act all organs of state in all spheres of government must prepare an invasive species monitoring, control and eradication plan for land under their control. This plan must form part of a municipality's environmental plans, and be part of a municipality's Integrated Development Plan.

National Environmental Management: Air Quality Act, aim to prevent air pollution and ecological degradation, by providing norms and standards for regulating air quality monitoring, management and control by all spheres of government. It also provides specific air quality measures securing ecologically sustainable development, while promoting justifiable economic and social development (Van der Linde, 2010). Finally, the Act provides for the introduction of standards limiting the emission of any pollution source and any harmful impact, including impacts affecting adversely the atmosphere itself.

National Environmental Management: Protected Areas Act, 57 of 2003, provides for the protection and conservation of ecologically viable areas representative of the country's biological diversity, natural landscapes and seascapes. It further provides for the establishment of a national register of protected areas, management, cooperative governance, public participation and matters related to protected areas (Van der Linde, 2010). special nature reserves, nature reserves, national parks and protected environments are explained in the Act as protected areas. Although biosphere has not been identified in Protected Areas Act it can be conserved using available sector tools.

2.2.2 Spatial Land Use Planning

The Spatial Development Framework (SDF) is a legally binding spatial framework that

promotes sustainable environmental, economic and social development within a municipality. In terms of section 26 of the Municipal System Act (Act no. 32 of 2000), municipalities are obliged to develop a spatial development framework, as representation of their integrated development plan. Another vital spatial planning tool is the Environmental Management Framework (EMF), which is provided for by the National Environmental Management Act (Act 107 of 1998). Essentially the environmental management framework represents mechanism to guide sustainable development and ensure that the right types of development occur within the correct areas. These acts are intended to guide decision-making in respect of environmental impact regulations and provide support in respect of land use planning and decision making.

In Overberg District Municipality Spatial land use plan assisted the municipality prior to designation of the biosphere to explore options for the implementation of UNESCO's MAB (Man and the Biosphere) Programme as a mechanism for the promotion of sustainable Development. Also the municipality supports the establishment of conservancies as a mechanism or strategy to promote sustainable land use and holistic environmental planning through spatial development framework (Overberg District Municipality, 2004)

2.3 An Overview of the Existence of Biospheres Reserve Concept

The concept of biosphere reserve originated from within United Nations Educational, Scientific and Cultural Organization (UNESCO) Man and Biosphere programme (MAB). MAB is an international program of cooperation which has been underway since 1971. Biosphere reserves are areas of terrestrial or coastal/marine ecosystem or a combination of both. The biosphere reserve concept corresponds to the understanding of human's relation to nature, an appropriate understanding of the good human life and a comprehensive understating of values (Lechtape, 2012). The biosphere reserve approach is a good concept for meeting both conservation objectives and human needs (UNESCO, 1996). The UNESCO initiative had its beginnings in 1968, when scientists, governments and non-government representatives from around the world gathered in Paris to discuss ways of protecting the biosphere from the increasing anthropogenic impacts. At the request of conference participants, UNESCO subsequently set up the Man and the Biosphere (MAB) Program to test innovative solutions to human impact in a variety of ecosystems.

According to UNESCO (2016) there are seven hundred and one (701) biosphere reserves

in hundred and twenty (124) countries, including trans-boundary sites. It works to foster the harmonious integration of people and nature for sustainable development through participatory dialogue, knowledge sharing, poverty alleviation, human wellbeing improvements, and respect for cultural values and by improving society's ability to cope with climate change. In Africa there are seventy (79) biosphere reserves in 29 countries. In South Africa there are ten (10) biosphere reserves in six (7) Provinces, namely Kogelberg biosphere reserve which is found in Western Cape Province, Cape West Coast biosphere reserve situated in Western Cape Province, Waterberg Biosphere situated in Limpopo Province, Kruger to Canyons Biosphere Reserve situated in Mpumalanga and overlap in Limpopo Province, Cape Winelands Biosphere Reserve situated in Western Cape Province, Vhembe Biosphere Reserve situated in Limpopo Province, Gouritz Cluster Biosphere Reserve situated in Eastern and Western Cape Provinces and Magaliesberg Biosphere Reserve which is found in Gauteng and North West Province, Marico Biosphere Reserve situated in North West Province and The Garden Route Biosphere Reserve located within the Cape Floristic Region along the southern coast of the country . (UNESCO, 2019).

The designation of a site in recognition of particular biological, landscape or geological characteristics, the designation is also for other purposes, such as sustainable development results from a process of identifying the site and its specific characteristics and then establishing boundaries which increasingly involves consultation with local people and other stakeholders. Designation cannot be an end in itself; it leads into a second process of management to achieve the desired goals in the site itself and, to contribute to wider goals to safeguard the special characteristics of sites (Price *et al.*, 2010). According to Nguyen *et al.*, (2017) biosphere reserve management must take account of the multiple functions of conservation, sustainable development for local communities, and scientific research, education and training. It must also accommodate changes over time. Furthermore, biosphere reserves, with their interrelated objectives of conservation, development and logistic support, offer a practical and creative approach to the imperative of linking conservation and sustainable development. In addition, the biosphere reserve also calls for new forms of institutional co-operation and increased integration between levels of economic and political decision making (Nguyen *et al.*, 2017).

2.3.1 Kogelberg Biosphere Reserve

The Kogelberg Biosphere Reserve is the first biosphere in South Africa and it was designated by UNESCO in December 1998. The biosphere is located in the Western Cape Province of South Africa and its first South African Biosphere (UNESCO, 2016). The purpose of the Kogelberg Nature Reserve is to fulfil the Organization's mandate through conserving the unique biodiversity of the area through integrated catchment management and effective partnerships; to ensure sustained water yield; to allow the opportunity to access the reserve and to be proactive in fostering relationships with surrounding communities. The biosphere reserve comprises approximately 100 000 hectares, including terrestrial and marine components, covering terrain from below sea level to the highest peak of 1 270 meters and stretches along the coast from Gordon's Bay in the west to the Bot River Vlei in the east, and inland to the Groenlandberg. It also includes the marine zone up to two nautical miles along its 70 kilometer coastline. Included are vast tracts of natural vegetation, important marine habitats, major wetland systems, five towns and various settlements, agricultural lands, commercial plantations and recreational resorts (Kogelberg, 2016).

The Kogelberg Biosphere Reserve lies within the Cape Floristic Region (CFR), the smallest and most diverse of the six floral kingdoms of the World. The CFR is regarded as a hot-spot for biodiversity conservation worldwide. The Kogelberg Biosphere Reserve is implementing a small grants facility in collaboration with the Table Mountain Fund. This facility aims to establish and resource a number of small, locally based projects, coordinated by the Kogelberg Biosphere Reserve Company and in support of the Kogelberg Biosphere Reserve's Catchment to Coast initiative. The facility assists local organizations and entrepreneurs in building income generative activities providing ecosystem services within the Kogelberg Biosphere Reserve region. It also aims to identify and implement economically viable uses for alien vegetation, such as innovative craft products, packaging materials and raw materials for building components. The Nature Reserve forms part of the Cape Floral Region Protected Areas World Heritage Site. Cape Nature manages the protected area as an integral part of the core area of the Kogelberg Biosphere Reserve. This area has been successful in increasing the biodiversity of the entire biosphere reserve (Mizuno *et al*, 2016).

The management entity of the Kogelberg Biosphere Reserve is the Kogelberg Biosphere Reserve Company (KBRC), a registered non-profit company in terms of the South African Companies Act (No. 71 of 2008). The KBRC consists of an elected Board of Directors, which is supported by a Management Committee. All major stakeholders are represented on the Management Committee. Cape Nature, being the land manager of the primary core areas of the Kogelberg Biosphere Reserve, is a permanent member of the Management Committee. Other members include government departments, local authorities, non-profit organizations and community groupings (Kogelberg, 2016).

2.3.2 Kruger to Canyon Biosphere Reserve

The Kruger to Canyon (K2C) was registered with the United Nations Educational, Scientific and Cultural Organization's (UNESCO) Man and the Biosphere Programme in September 2001. It is the largest Biosphere Reserve in South Africa and the third largest in the world (Coetzer, 2014). The K2C biosphere reserve bridges the Limpopo and Mpumalanga provinces in the northern part of South Africa and its approximately 4,800,000 hectares. The biosphere is demarcated in three areas, which includes the core area which is assigned strictly for environmental protection, buffer zone which is only for activities relating to conservation objectives and transition zone which is where sustainable resource management is practiced by the local community members (Kamau & Winter, 2013).

Kruger to Canyon is currently implementing the Environmental monitor programme in partnership with provincial government, non-governmental organizations and research institutions. The main aim of this programme is to provide additional support to host institutions in the K2C Partner Network to attain their respective mandates supportive of biodiversity conservation, contributing to improved livelihoods and resilient economic development, this programme has resulted in creation of 272 jobs. Kruger to Canyons has submitted the Ten Year Periodic Review in accordance with MAB programme which was approved in June 2014 by the MAB ICC (UNESCO, 2015).

The network provides for an exchange of information and ideas among the biosphere reserves, which undertake projects that demonstrate practical approaches to conservation and sustainable development (Kreisberg, 2014). The main purpose of the UNESCO Man and the Biosphere (MAB) programme was to enhance the relationship between human

beings and the environment on a global basis (RSA, 2014). The Biosphere Reserve (BR) model of UNESCO's Man and the Biosphere Programme (MAB) represents a shift towards people centred conservation, explicitly acknowledging humans, and human-interests, in the conservation landscape. By interdisciplinary research and cooperation between stakeholders on different levels, the MAB should contribute to knowledge and sustainability (Ankre, 2009). At the end of the 1960s, the initial idea of the MAB programme was to get a balance between usage and conservation by practical solutions. However, the idea of the MAB was ahead of its time because it did not get worldwide attention until some decades later.

In 1992, at the United Nations' conference about the environment and development in Rio de Janeiro, the Agenda 21 was accepted by government representatives from around the world. The concept sustainable development was thereby established. The aim was to work against pollution and other environmental problems, in order to sustain the environment for the coming generations (Ankre, 2009). Conceptually the Biosphere reserve model is attractive, yet the practical reality is likely to be challenging, particularly given the history of disappointments of traditional Integrated Conservation and Development Projects. Additionally, given that each Biosphere reserve remains under the sovereignty and legislation of the country in which it is found, the BR designation does not guarantee the effective implementation of the concept (Coetzer *et al.*, 2013). These is as the results of increased rate of landscape change which poses challenges for landscape management, with future predictions of escalating transformation likely to undermine Biosphere reserves sustainability, as well as options for a regionally connected protected area network.

The UNESCO Biosphere Reserve designation concept encourages regions to take strides towards sustainability and specifically addresses the need to balance conservation of biological and cultural diversity with economic and social development. The Man and the Biosphere Programme (MAB) was launched in 1971, after the 1968 'Conference on the Rational Use and Conservation of the Resources of the Biosphere, as a progression from the International Biological Program (Coetzer *et al.*, 2013). It was created under the United Nations Man and the Biosphere (MAB) Programme that is now celebrating its 40th anniversary. The World Network of Biosphere Reserves fosters the harmonious integration of people and nature for sustainable development through participatory dialogue, knowledge sharing, poverty reduction and human well- being improvements, respect for

cultural values and society's ability to cope with change thus contributing to the Millennium Development Goals (UNESCO, 2011).

When the UNESCO Biosphere Reserve concept began in the early 1970s, the objectives were primarily about conservation. However, there has been an evolution of the concept to include sustainable development and a commitment to sharing experiences with other regions.

MAB is an interdisciplinary and international approach to resolve ecological and resource management problems, centred around three major themes:

(i) conservation of genetic resources and biological diversity; (ii) international research and monitoring; and (iii) ecologically sustainable development. These themes translated into conservation, logistic and development roles. Thus, Biosphere Reserves continue to be MAB's instrument to fulfil these roles.

2.4 Background Information of Vhembe Biosphere Reserve

The Vhembe Biosphere Reserve covers an area of 30,700 km² (3,070,000 ha). Approximately 18% of this is included in existing Provincial Nature Reserves and National Parks, which will become core conservation areas and part of buffer zones. Some of the core areas are relatively small but the functioning of these areas will be enhanced by buffer zones with limited environmental impact. The VBR covers five local municipal areas of the Limpopo Province; namely Blouberg, Musina, Makhado, Thulamela and Mutale. A portion of the Kruger National Park, north of the Shingwedzi River is also included plus the eastern border formed by the Mogalakwena River and the southern border which extends roughly from just south of the Blouberg - Makgabeng and Soutpansberg Mountain Ranges, across the Luvuvhu River catchment, to the east. The Northern and Eastern boundaries are formed by the international boundaries with Botswana, Zimbabwe and Mozambique (Van der Westhuizen, 2010). The Vhembe Biosphere Reserve (VBR) is one of eight ecosystems in South Africa and the third to have been established in the Limpopo Province.

The Biosphere reserve area extends up to the Limpopo River in the north and the Kruger National Park in the East. The essence of a Biosphere reserve is integrated management of the environment; where man conserves and utilizes the environment in a sustainable

manner benefiting local communities, farmers, government administrators and scientists (UNESCO, 2019).

2.5 Biosphere Reserves and Sustainable Development

Since the creation of the first biosphere reserve in 1976, the concept and land-use management tool have evolved considerably. Biosphere reserves were created in a context when conservation, often referred to using the term “protection,” was considered to be opposed to development, and the notion of sustainable development had not yet been formulated (Bouamrane *et al.*, 2016). The 17 Sustainable Development Goals (SDGs) are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity where they are living. MAB and its World Network of Biosphere Reserve (WNBR) are thus well-placed to support the implementation of the 2030 Agenda for Sustainable Development of different levels. In particular, Sustainable Development Goal (SDG) 15 related to life on land, as well as SDG 13 on climate, SDG 6 on water, SDG 14 on sea and oceans, SDG 11 on cities, SDG 2 on food and SDG 1 on poverty alleviation (UNESCO, 2019).

Managing natural resources has long been a challenge in developing countries where information is scarce, demands often high and the resources available to improve management often limited, and since the 1980's many African countries have implemented various decentralizing reforms that involve the country's natural resource management (Löwegren, 2013). The Convention on Biological Diversity emphasizes the conservation of biological diversity, the sustainable use of its components, and the equitable sharing of benefits. Particularly since the Rio Earth Summit in 1992, there has been a great interest in approaches which marry conservation and sustainable development, and thus provide working models of how these aims can be mutually supported. The biosphere reserve as a concept and a tool of UNESCO has an origin in the protected areas domain but has now evolved into an international designation that allows context specific conservation and development relationships to be developed in land and seascapes where more than 80% of the designated area lies outside of legally protected core zones (Nguyen *et al.*, 2017).

The Convention on biodiversity emphasizes the conservation of biological diversity, the sustainable use of its components, and the equitable sharing of benefits (Bridgewater and

Cresswell, 1996). Biosphere reserve as a concept and a tool of UNESCO has its origin in the protected areas domain but has now evolved into an international designation that allows context specific conservation and development relationships to be developed in land and seascapes, where more than 80% of the designated area lies outside of legally protected core zones (Ishwaran *et al.*, 2008). The biosphere reserve concept explicitly entails securing ecosystem services for human well-being. Therefore, the sites are promoted as “learning sites” to explore innovative ways of fostering sustainable development.

IUCN (2017) suggests that biosphere reserves, with their interrelated objectives of conservation, development and logistic support, offer a practical and creative approach to the imperative of linking conservation and sustainable development. In addition, the biosphere reserve calls for new forms of institutional co-operation and increased integration between levels of economic and political decision making (UNESCO, 2000). The concept builds on the idea that humans and nature are intrinsically linked and the only way to conserve and protect our remaining natural places is to work closely with the people living there. The biosphere reserve concept may provide opportunities to revive the local economy. Furthermore, it offers opportunities for developing tourism as an alternative source of income (West, 2001).

According to Emas (2015), the Brundtland Commission proposed that sustainable development is a concept of conserving resources for future generation. The overall goal of sustainable development (SD) is the long-term stability of the economy and environment; this is only achievable through the integration and acknowledgement of economic, environmental, and social concerns throughout the decision making process.

The area of land under legal protection increased exponentially, particularly in developing countries where biodiversity is greatest. These areas are charged with improving human wellbeing and providing economic benefits across multiple scales. At many sites, management and donor agencies have initiated participatory zoning projects to balance conservation and development around Protected Areas (Naughton, 2007). However, in spite of usually substantial political support for conservation, not all protected areas are able to meet their conservation goals due economic and social constraints on exploiting the existing natural resources. There are numerous instances (i.e., so-called “paper

parcs”) in which Protected Areas generate, rather than alleviate, social conflicts; this is usually associated with insufficient funding or lack of interest in conservation by local authorities and communities (Iloja *et al.*, 2010).

However, as a human population expands, wildlife resources are increasingly subjected to severe pressure, which threatens their existence and sustainability. Apart from consumptive utilization, other anthropogenic activities such as agriculture have indirectly influenced the survival of wildlife species through manipulation of their habitats (Wilfred, 2010). UNESCO Biosphere Reserves actively set out to balance conservation with economic and social development thus requiring cultural sensitivity, scientific expertise and consensus-driven policies and decision-making. To address this challenge, strategic methods in community engagement are needed to involve, educate and empower the diverse stakeholder groups that make up communities and regions in all corners of the world (Jackson *et al.*, 2011).

2.6 The Functions of the Biosphere Reserve

The main functions of the biosphere reserves are to promote social and economic development, to protect biodiversity and to be the focus for research and education (Ankre, 2009). MAN and biosphere’s objectives for 2015-2025 were derived directly from the function of the biosphere reserve identified in the statutory framework of the World network of biosphere reserve. The key global challenges of climate change, identified in the Madrid Action Plan for biosphere reserve is to conserve biodiversity, restore and enhance ecosystem services, and foster the sustainable use of natural resources, including contributing to sustainable, healthy and equitable societies, economies and thriving human settlements in harmony with the biosphere. It also facilitate biodiversity and sustainable science, education for sustainable development and capacity building, supporting mitigation and adaptation to climate change and other aspects of global environmental change (UNESCO, 2017).

The purpose of the biosphere reserves is to get new knowledge and to develop management together with local stakeholders, in particular the people who live and interact in the area. Professionals, politicians and volunteers should use the biosphere reserve as a tool for sustainable development. The concept is a linkage between research and the public, in order to understand how biodiversity may be conserved and how to create a sustainable development (Ankre, 2009). Bridgewater (2002) discusses conservation and

asserts that it has to be practical, acceptable to society and easy to understand. The broader values of society are not sovereign from the values that define conservation. The concept of sustainability represents an intellectual attempt to balance human use of resources with the protection of resources for future generations, a concept with rather poorly defined processes for a vaguely (and variously) defined goal (Bridgewater, 2002).

The zonation pattern specified in the Statutory Framework means that biosphere reserves are not protected areas which fit into the six-fold system of categories developed by International Union for the Conservation of Nature (IUCN) (The World Conservation Union, 1994). The biosphere reserve zoning is a zoning applied worldwide, but it should be adjusted after the area's limitations and geographical conditions. Biosphere reserves are organized into three interrelated zones namely the core, buffer zone and outer Transitional area. These interrelated zones are presented in the following section

2.6.1 The Core

The earlier biosphere reserves had only one core area. However, since the 1990s, most biosphere reserves are made of several core areas. Thereby, several areas of high value which are spread geographically can be included in one biosphere reserve (UNESCO, 2007). The function of the core areas is to ensure long-term protection of biodiversity. They are rendering services to society in large, for example, research, clean air and water, recreation environment, ecotourism, which means work opportunities, finances, new knowledge and sustainable development (UNESCO, 2013).

An area needs to be legally established and give long-term protection to the landscapes, ecosystems and species it contains. It should be sufficiently large to meet these conservation objectives. As nature is rarely uniform and as historical land-use constraints exist in many parts of the world, there may be several core areas in a single biosphere reserve to ensure a representative coverage of the mosaic of ecological systems. Normally, the core area is not subject to human activity, except research and monitoring and, as the case may be, to traditional extractive uses by local communities (LEDET, 2010). In Vhembe District there are currently mining activities occurring in the core areas, as well as that there are still new mining activities being approved by the government. However, there are protected areas such as Mapungubwe National Park and Soutpansberg which have been identified

as important and sensitive natural and cultural environment that need to be conserved. There are a number of mining projects proposed in the area and it is a challenge to ensure that the development will not be at the expense of the long-term sustainable conservation of the natural and cultural assets of the area.

2.6.2 The Buffer Zone (or zones)

A buffer zone refers to that which is clearly delineated and which surrounds or is contiguous to the core area. The buffer zones surrounds core protected areas and serve to shield the protected area from direct impact by human activities adjacent to the area (Lausche, 2011). Activities are organized here so that they do not hinder the conservation objectives of the core area but rather help to protect it; hence, the idea of "buffering". It can be an area for experimental research; for example, to discover ways to manage natural vegetation, croplands, forests, fisheries, to enhance high quality production while conserving natural processes and biodiversity, including soil resources, to the maximum extent possible. In a similar manner, experiments can be carried out in the buffer zone to explore how to rehabilitate degraded areas. It may accommodate education, training, tourism and recreation facilities (LEDET, 2010). However, the protection of the buffer zone will be the advantage to the future generation to know some of the indigenous species.

2.6.3 The Outer Transition Area (or area of co-operation)

Extending outwards, this may contain a variety of agricultural activities, human settlements and other uses. It is here that the local communities and other stakeholders must agree to work together to manage and sustainably develop the area's resources for the benefit of the people who live in the area. Given the roles that the biosphere reserve should play in promoting the sustainable management of the natural resources of the region in which they live, the transition area is of great economic and social significance for the regional development (LEDET, 2010). Although there can be activities in these regions the area is not sustainably utilized. The Vhembe Biosphere Reserve is largely rural with the majority of its stakeholders consisting of relatively poor local communities having few economic opportunities. There is a need for poverty alleviation initiatives which can be developed to reduce unemployment. In Vhembe District there are developments demarcated where it comprises critical areas such as wetlands. Most of the projects that are aimed at

conserving the environment are closed because there is no funding to sustain such projects.

2.7 Biosphere Reserve Designation Process

A key component of the MAB reserve programme is the designation of the biosphere reserves to promote sustainable development based on local community efforts and sound science. The reserves are important because they provide laboratories in which to fulfil the research component of the programme while preserving the portion of biosphere that will serve as a standard for monitoring environmental change. Over the years the concept of biosphere reserves has evolved, informing managers and landowners of ways that encouraged better land management (Francis, 2016). The land and forest being the state concerns, the respective state governments have to agree to designate the identified area as BR. MAB committees are responsible for preparing biosphere reserve nomination and involving the appropriate government agencies, institutions, and local interested parties in preparing the nomination. UNESCO biosphere reserve advisory committee then examines all the nominations and makes all the recommendation to the international coordinating council of the Man and biosphere programme. The council makes the final decision in designation of the area (Platt, 2006). The Central government provides financial assistance for management and research activities in these biosphere reserves. The VBR is assisted financially by the Limpopo Economic Development, Environment and Tourism which the funds are managed by the Vhembe Biosphere Reserve Board members.

The designation of an area as a biosphere reserve should be given appropriate publicity by the state and authorities concerned. The Man and Biosphere programme statutory framework does not incur binding legal obligation under public international law as participation by state in the programme is voluntary (Dux, 2016). A UNESCO designation of recognition does not, and cannot, interfere with legal mandates, private property rights, aboriginal rights, and management policies that are already in place. The designation signifies only that the arrangements in place appear sufficient for developing the functions of biosphere reserve.

In South Africa specifically, the management of a designated area involves a set of comprehensive measures essential for its protection, organization and function and aims

to encompass all its values, without neglecting the overall goals of protection and sustainable development. In other countries e.g. France and West Africa designated areas are governed by multi-stakeholder boards, on the basis of a management plan (Bouamrane *et al*, 2016). It implies a process of active participation of diverse stakeholders working together in concert to develop a unified proposal or common focus (in terms of visions, objectives, points of view, and concerted action). The plan is in line with the national and international legislations and it outlines the vision and the mission of the area which also includes the measures and actions necessary for its protection and effective management and operationalization of the management body.

Every ten years after the first designation by UNESCO, each biosphere reserve has to undertake an evaluation, (i.e. the periodic review), and submit a report to MAB International Coordinating Council (ICC) to assess if it is still meeting the criteria (Armitage *et al.*, 2017). The report will be considered by the Advisory Committee for Biosphere Reserves for recommendation to ICC. If the ICC concludes that a site no longer satisfies the biosphere reserve criteria, it may recommend that the state take measures to ensure conformity with the provision. It may recommend to restore the site, but if the ICC finds that the biosphere reserve still does not satisfy the criteria, it can remove a site from the network (Telesetsky *et al.*, 2017). VBR ten-year review is due in 2019 and has to be submitted to MAB ICC.

It evaluates compliance with the specific criteria that relate to size, zonation, ecological characteristics, biodiversity importance, and regional sustainable development prospects; that allow individual Biosphere Reserves to meet the basic conservation, development and logistic roles expected of a site of excellence. Failure to fulfil these criteria may eventually lead to a site's UNESCO Biosphere Reserve status being revoked (Coetzer *et al.*, 2013). after the 10-year review, seven countries with twelve (12) biosphere reserve voluntary withdraw from participating from World Network of Biosphere Reserve. To date, UNESCO has never forced the withdrawal of a site, but rather recommends specific revisions to meet the criteria of the Statutory Framework. The delisting procedure foreseen should be considered as an exception to this basically positive approach, and should be applied only after careful examination, paying due respect to the cultural and socio-economic situation of the country, and after consulting the government concerned (UNESCO, 1996).

The Seville strategy was developed and adopted during the International Conference on Biosphere Reserves, organized by UNESCO in Seville (Spain) from 20-25 March 1995.

The conference adopted a two-pronged approach which is to examine past experience in implementing the innovative concept of the biosphere reserve; and to identify what emphases should be given to their three functions of conservation, development and logistical support within the Biospheres reserves.

The Seville strategy provides recommendations for developing effective biosphere reserves and for setting out the conditions for the appropriate functioning of the World Network of Biosphere Reserves. It does not repeat the general principles of the Convention on Biological Diversity nor Agenda 21, but instead identifies the specific role of biosphere reserves in developing a new vision of the relationship between conservation and development (UNESCO, 1996). It also serves as an opportunity for the authority concerned to work with local populations in reviewing designated zones and revising or redefining zones as needed (Lausche, 2011).

UNESCO has developed several international programmes to better evaluate and manage the Earth's resources. UNESCO's primary objective besides working together with its Member States to develop and promote education, science, culture, communication and information in all countries of the world is to achieve mutual understanding among nations and peoples (UNESCO, 2017). Biosphere reserves, each of which remains under the sole sovereignty of the State where it is situated and thereby submitted to State legislation only, form a World Network in which participation by the States is voluntary (Tanaka, 2016). This Statutory Framework is intended to contribute to the widespread recognition of biosphere reserves and to encourage and promote good working examples. Global mandates, protected areas (PAs) now are supposed to do far more than conserve biological diversity. These areas are charged with improving human wellbeing and providing economic benefits across multiple scales. The Man and biosphere reserve programme network of biosphere reserves have no treaty or legally binding obligation, participating in the network is voluntary (Maxted *et al.*, 2013).

Some countries have enacted legislation specifically to establish biosphere reserves. In many others, the core areas and buffer zones are designated as protected areas under national law. Policy and regulatory frameworks are created for land use, to determine the environmental and social costs of new developments and ensure the conservation and restoration of protected areas. A number of biosphere reserves simultaneously encompass

areas protected under other systems such as national parks or nature reserves and other internationally recognized sites such as World Heritage or Ramsar sites (UNESCO, 1996). Global concern is now well to the fore and result in appreciation of the need to conserve biodiversity, using range of methods from designation of the reserve areas to efforts such as genetic conservation of species taxa and linking these activities to sustainable development. The Biosphere Reserve model to be successful in the long-term, it requires political buy-in at the level of state/provincial or national government, and if popular political benefit is seen to be absent, it is unlikely that these governments will continue to support the ideals of the Biosphere Reserve concept (Coetzer *et al.*, 2013).

2.8 Challenges Faced by the Biospheres Reserves

BR is facing various challenges in order to make it strive to be effective as a tool of managing natural resources.

2.8.1 Pollution

Pollution refers to any adverse change in the physiochemical characteristics of anthropogenic or natural ecosystem causing short term or long term harm to society, ecosystems, material and cultural heritage, or to natural resources (UNESCO, 2013). The process affects natural resources such as rivers, oceans, wetlands, air and etc. The most important step in regulating the state of the environment is to detect pollution sources and control them by limiting pollutant emissions and introduction of rigid standards for such activities. The battle against pollution is essential in order to prevent damage to human health and also to protect the natural environment (Izrael, 1992). There are several legislations that regulates this natural resources such as:

2.8.2 Mining

Limpopo mines a wide variety of minerals, which include the largest diamond and copper mine in South Africa, the biggest open-pit platinum mine in the country and the biggest vermiculite mine in the world. Currently, 78 mines operate in Limpopo, with an additional 91 mines being planned for the future. Additionally, approximately 400 prospecting and mining licences have been granted (LEDET, 2016). Despite the potential for the growth of mining

in Limpopo, future expansion will largely depend on the state of the national and world economies, the international outlook for mineral commodities, and internal sector challenges of rising mining costs, available and committed investment levels, labour issues, ensuring a greener economy, and rising hopes and expectations of some communities for a better life related to mineral resource extraction.

The environmental management principles stated in section 37 of the act set out in section 2 of the National Environmental Management Act, 1998 (Act 107 of 1998), states that any prospecting or mining operations must be conducted in accordance with generally acceptable principles of sustainable development by integrating social, economic and environmental factors in planning and implementation of prospecting and mining projects. This means that the holder of the mining rights is responsible for any environmental damage, pollution or ecological degradation that has occurred as a result of operations in the area (RSA (C), 2002). The mining sector, by the very nature of its activity, has impacts on the biophysical, social and economic environment. Particular areas where the impacts of mining are on a large enough scale to drive environmental change include pollution and waste generation. For example, current mining activities and new mining applications threaten the existence of the Mapungubwe, Soutpansberg and Blouberg IBAs, whereby the impacts include soil erosion, soil contamination and change in land characteristics (LEDET, 2016).

Such impacts are due to the fact that a vast range of minerals are mined, requiring very different extraction and processing operations, and produce large quantities of waste rocks and tailings which are disposed to the land. During mining operations, the vegetation is often stripped, soil and rocks removed due to extraction of mineral resources, and as a result leading to degraded areas.

2.8.3 Invasive Alien Species

Invasive alien plants (IAPs) are plant species that have been introduced, either intentionally or unintentionally, to South Africa. They can reproduce rapidly in their new environments and tend to out-compete indigenous plants. The result usually includes a variety of negative ecological, social, and economic impacts (eThekweni Municipality, 2017). Plant species are only considered invasive when they occur outside of their natural distribution range, and

pose a threat to ecosystems, other species, the economy or human health. Many human activities, such as agriculture, horticulture, forestry and transportation promotes international or incidental spread of species, resulting in devastating economic impacts often threatening native biodiversity and ecosystem function (Pimentel, 2011). Some 10 million species of plants, animals, and microbes are believed to inhabit the earth, but so far only about 1.5 million of these have been identified. Invasive alien plants are a significant environmental problem in South Africa's terrestrial and freshwater ecosystems, whereby it increases above- ground biomass and evapotranspiration and thereby decrease both surface water runoff and groundwater recharge (Chamier *et al.*, 2012). South Africa suffers from a large number of nonindigenous species due to plants introduced into the country.

According to Pimentel (2011) more than 9000 plant species have invaded the vast South African ecosystem, and about 1000 of these are self-sustaining, and of this number 161 species are ranked as serious pest weeds. In comparison to other continental regions, and expressed in relation to total land surface areas, South Africa has several times more invasive alien species of trees per square kilometre than anywhere in the world (Moran *et al.*, 2013). Alien species have harmful effects and these are referred to as invasive species. Virtually all ecosystems are at risk from the harmful effects of introduced species, because they can change habitats and alter ecosystem function and ecosystem services, crowd out or replace native species, and damage human activities, costing the economy millions to replace.

Invasive species threaten biodiversity by causing disease, acting as predators or parasitic, acting as competitors, altering habitat, or hybridizing with local species (McGinley, 2017). Furthermore, IAPs can significantly alter the composition, structure and functionality of ecosystems. As a result, they degrade the productive potential of the land, intensify the damage caused by veld fires and flooding, increase soil erosion, and impact on the health of rivers and estuaries. Indigenous species may be reduced in numbers/coverage, or may be lost as a result of IAP infestations, posing a threat to South Africa's natural heritage in sensitive locations (eThekweni Municipality, 2017).

Alien and invasive plant species can be grouped into three categories (Peña, 2013):

- ❖ Category 1 plants are weeds that serve no useful economic purpose and possess

characteristics that are harmful to humans, animals or the environment. These plants need to be eradicated using the control methods stipulated in Regulation 15.D of the CARA.

- ❖ Category 2 plants are plants that are useful for commercial plant production purposes but are proven plant invaders under uncontrolled conditions outside demarcated areas.
- ❖ Category 3 plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas.

The planting of Category 2 and 3 plants should be confined to demarcated areas under controlled conditions of cultivation (Henning *et al.*, 2014). In Vhembe District municipality environmental change such as the spread of alien invasive plants, a process that can be accelerated by fire causes the overall potential for disastrous veld fires to grow (DCoGHSTA, 2017).

In terms of the amendments to the regulations under the Conservation of Agricultural Resources Act (Act No. 43 of 1983), all declared aliens must be effectively controlled. The Department of Environmental Affairs Strategic Plan for 2012–2017 outlines programmes and projects that collectively aim to contribute to sustainable development, livelihoods, green and inclusive economic growth through facilitating skills development, employment creation and infrastructure development and restore and maintain vegetation structure and function in order to contribute to ecosystem services through working for water programme (van Wilgen *et al.*, 2012). Working for Water has the dual mandate of protecting ecosystem services and providing employment. The Managing Authority should describe the parts of the relevant land area that are infested with the various Listed Invasive Species in a manner which aids the prioritization of their monitoring and control. This may relate to areas of high biodiversity importance, water security, risk of wild fires, erosion, siltation and flooding, and other similar indicators for prioritization. It is vital that clear objectives are set for Control Plans, and that this is done from the outset should ideally begin with a goal or goals that are SMART. The National Environmental Management: Biodiversity Act (NEMBA) regulates all invasive organisms in South Africa, including a wide range of fauna and flora. Regulations have been published in Government Notices R.506, R.507, R.508 and R.509 of 2013 under NEMBA. According to this Act and the regulations, any species designated under section 70 cannot be propagated, grown, bought or sold without a permit. It is

important to note that alien species that are regulated in terms of the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) as weeds and invader plants are exempted from NEMBA. This implies that the provisions of the CARA in respect of listed weed and invader plants supersede those of NEMBA. There are several methods that can be used to control the alien plants, these include:

❖ **Mechanical Control**

Mechanical control involves the physical destruction or total removal of plants. Mechanical techniques vary, and include hand-pulling, felling, uprooting, ring barking, cutting/slashing, strip-barking or mowing (eThekwini, 2017). The equipment used in mechanical control ranges from hand-held instruments such as saws, slashers and axes to power-driven tools such as chainsaws and brush cutters, and even to bulldozers in some cases. Mechanical control is labour-intensive and thus expensive to use in extensive and dense infestations, or in remote or rugged areas. Hand cutting and pulling may be used successfully to control some pestiferous plants, but this option is very time-consuming and often limited to relatively small areas. Furthermore, they can be successfully employed only against plants that will not re-sprout from cut stumps or that are small enough to be entirely removed from the soil (Wolansk, 2009). Mechanical control arouses less public resistance and can often be effective, especially for large woody plants, but it is difficult or impossible for wide spread species (Levin, 2009). Mechanical method is effective method in areas with low infestation as no contamination of water with herbicides will occur and not an effective method for dense infestations, as the cost of clearing is extremely high, with little or no impact (Hoare, 2014).

❖ **Chemical Control**

Chemical control refers to the use of registered herbicides to control alien plants. The method is effective against species that are extremely difficult to control or in situations where mechanical control would cause greater environmental damage (Kaufman and Kaufman, 2012). Chemical control is both effective and economic compared with other methods, but there are potential environmental risks including ill-effects on human health (Bhatt *et al.*, 2012). The use of this type of method should be cautious and should only be used as a last resort, since it is hazardous for natural vegetation. It should not be necessary

if regular monitoring is undertaken, which should be effective for controlling invasive alien plants. Chemical control complements mechanical control methods, increasing the effectiveness of control activities but may kill non-target plants or species and poses risks for remaining natural areas on site (Hoare, 2014).

❖ **Biological Control**

Biological control of weeds is a practice in which host specific plant feeding insects, mites and pathogens are transferred from their country of origin and released into a new country where plants have become a problematic. Prior to the implementing the process, rigorous safety tests are conducted under strict quarantine conditions which may take several years (Zimmermann *et al.*, 2004). Candidate agents in these categories, particularly those that have been tested, released and proven safe elsewhere in the world, require relatively short periods of confirmatory testing. Many prospective agents require much more elaborated and protracted testing. Some cactus-feeding species, may also be suitable for release because they are associated with host plant species that have no close relatives in the region where their releases are planned (Moran *et al.*, 2013).

According to Martens *et al.*, (2003) biological control agents take 10 or 20 years, or more, to build up in numbers and to effect satisfactory control of the target weed. Scientists and managers have sometimes labelled biological control as "unsuccessful" because a particular weed problem is not alleviated within a few months or years. Also, too often, impatient landowners have discounted biological control because they do not see results in the short term, and opt to the expensive and unnecessary use of mechanical controls or the use of herbicides. In South Africa the introduction of herbivores and pathogens of alien trees has had some success since it reduced stem densities by up to 98%. But there is concern with the potential impacts of biological control on non-targeted species (Levin, 2009). The biological control is the most environmentally friendly and most sustainable of all control methods.

2.9 Chapter Summary

The UNESCO Biosphere Reserve designation concept encourages regions to take strides towards sustainability and specifically addresses the need to balance conservation of biological and cultural diversity with economic and social development. The chapter

discussed the evolution of the biosphere concept in details, including the international processes to be followed for the area to be considered as the biosphere reserve. Examples of the international, national and regional biosphere reserves were analysed to assess their performance since their establishments. Sector tools that are used in South Africa for conservation of natural resources were analysed. Although the MAN and Biosphere reserve programme network of biosphere reserves have no treaty or legally binding obligation, rather participating in the network is voluntary but, designation of an area as a Biosphere reserve can provide conservation, network for an exchange of information and ideas among the biosphere reserves, which undertake projects that demonstrate practical approaches to conservation and sustainable development. Ten years' review plan has to be submitted to the World network of Biosphere Reserve if the country still intends to continue to participate in the programme. The countries that require to stop participating in the programme can also volunteering do so.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology used, in order to obtain the data in relation to the specific objectives of the research. It starts by outlining the research design, methods of data collection for data required to achieve the study objectives and answer the research questions. The chapter also details the procedure for analysing the collected data and the tools used.

3.2. Research Design

In order to assess the effectiveness of the Biosphere Reserve as a tool for conservation of natural resources, the data were collected with the purpose of achieving the aim of the study as guided by the objectives and research questions. Both primary and secondary data were used to obtain information concerning the effectiveness of the Vhembe Biosphere Reserve. Moreover, the study combines qualitative and exploratory research using four main methods: (1) structured interviews, (2) unstructured interviews, (3) document review, and (4) survey research. The mixed methods and data collection tools were selected in a manner that allowed for a collection of the appropriate degree of relevant qualitative and quantitative data to address the research objective as summarized in Table 3.1.

The secondary data was collected from desk-top examination of relevant documents relating to conservation of the Biosphere Reserves areas. These documents included reports from previous Greenest Municipality Competition (GMC) results of all local municipalities within Vhembe district municipality from 2012 to 2017, Management Effective Tracking Tool of South Africa (METT-SA), and national, provincial and district Biosphere reserve spatial planning tools.

3.3 Data Requirements and Methods of Data Collection

In order to adequately address the set objectives, data types and methods were addressed as per set objectives. Data collection methods were selected and used in a consecutive manner leading to the final resolution of the overarching research objective, and

completion of the research.

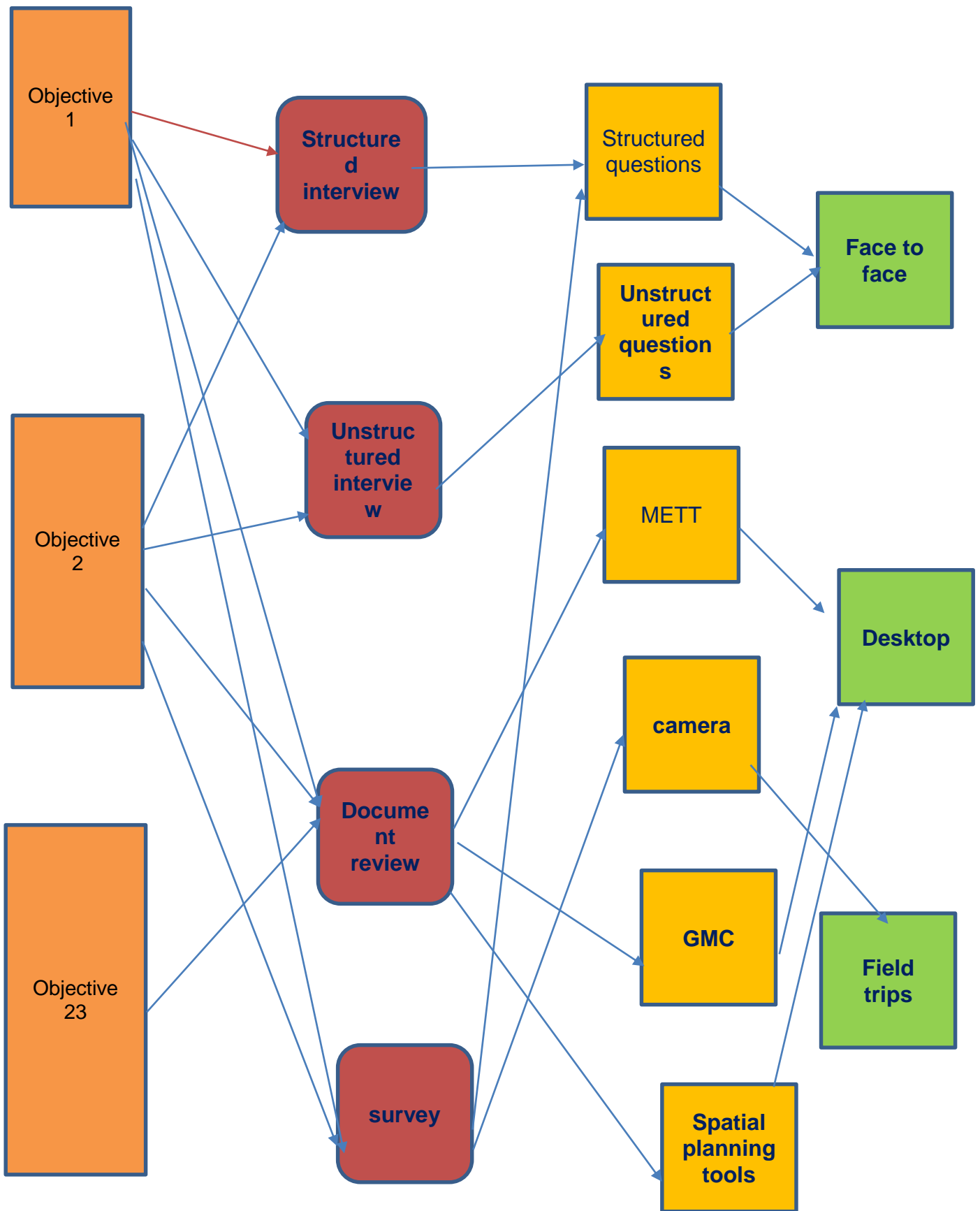


Figure 3.1: Flow Chart of the methodological steps followed in the study

The data collected included both qualitative and quantitative data obtained using face to face, desktop assessment, structured and unstructured interviews. The overall research “population” entailed bio- physical and human elements in Vhembe biosphere reserve. This refers to the sum of those individuals within a specific territory, or a small portion of a population, a smaller representation of a larger whole, intended to reflect and represent the character, style or content of a population from which it is drawn (Brink, 1996).

3.3.1 The usefulness of BR Concept

The data collected included both qualitative and quantitative data obtained using face to face, desktop assessment, and field trips. The research methods used were structured and unstructured interviews, document review and survey. The methods were chosen to examine the usefulness of the BR concept as a tool for conservation of natural resources.

3.3.1.1 Unstructured interviews

Informal discussions with unstructured questions were conducted telephonically and email requesting the utilization of METT report from LEDET and payment was made to the department (see Appendix C) as part of the data needed for the research. The department then granted permission for the utilization of the report and the document was forwarded via email (see Appendix D). Through the unstructured interview more information was collected about the utilization of the METT and how the data was compiled than the utilization of the structured interview.

The primary aim of the tracking tool is to supply consistent data about the progress of protected area management over time. The World Bank has been using the METT in monitoring its projects since 2001. The Global Environmental Facility (GEF) has also made the METT mandatory for use in all projects in protected areas funded by GEF- 3 grant (DEA, 2010). It has been widely tested and has been applied around the world. In the main METT assessment form, there are questions that are asked each with a four-point scale (0, 1, 2, and 3). The intention is that the scale respondents to choose whether the situation is acceptable or not. Generally, a 0 is equivalent to no or negligible progress; 1 indicates some progress; 2 means progress is quite good but has room for improvement; while 3 indicates that the protected area is approaching an optimum situation (Leverington *et al.*,

2008).

The methodology consists of a rapid assessment based on a scorecard questionnaire that includes the six elements of management. It provides a mechanism for monitoring progress towards more effective management over time. It is used to enable stakeholders to identify needs and obstacles, and prioritize actions to improve the effectiveness of PA management. The METT instrument is administered in two parts: datasheets and an assessment form.

- ❖ Datasheets: There are two datasheets, on which the first datasheet records basic information about the site, and assessment details. The second datasheet asks assessors to identify threats, and rank their impact on the PAs.
- ❖ Assessment form: briefly, the assessment is based on questions presented in a table with columns that should be completed for recording details of the assessment.

The data that were captured to evaluate the effectiveness of protected areas management situated in VBR and data collection was conducted by LEDET under State-Owned Nature Reserve Directorate. There are eight (8) provincial nature reserve, two national parks and several privately owned nature reserves within VBR. The data collected was from 2016 to 2018 on state owned nature reserves only, with regards to protection of natural resources in protected areas. The data was compared and chart was developed to plot the performance of the protected areas.

3.3.1.2 Structured Interviews

The questionnaire as another type of data collection, was used for structured interview, in order for the respondent to complete. A set of open-ended and close-ended questions in respect of a research objectives were developed and were clear, unambiguous, carefully-worded and arranged with the intention of taking each respondent through the same sequence and asking each respondent the same questions with essentially the same words. They were categorized into two for VBR management committee and LEDET officials and the second for community members (see Appendix A and B). The community members targeted are only those who are involved in the biosphere demonstration projects. Questionnaire was used basically to get views of respondents towards the

understanding of the BR as the tool for conservation of natural resources. The questionnaire comprised of twenty-one (21) questions for community members and seventeen (17) questions for VBR management committee and the respondents had to choose from a collection of alternatives or assign a numerical score and gender (see Appendix A and B). The questionnaires were written in English and there were individuals who were interviewed on a one on one basis and the questionnaires were filled for them, especially those who could not read and understand English well. During the interviews Tshivenda language was used, as it is the local language and it also made and enhanced conversation to be smooth. The questionnaires were distributed as follows:

Table 3.1: Questionnaires Distributed

Stakeholder's Identified	Questionnaires	Questionnaires
	Distributed	Returned
VBR management committee	04	03
Makhado municipality	04	04
Collins Chabane	08	08
Musina Municipality	02	02
Thulamela Municipality	33	33

The instrument was designed to be conducted to protect the anonymity and voluntary participation of respondents. The design, delivery and analysis of the question were conducted in accordance with University of Venda research ethics board (see Appendix F). Key informant sampling method was used with people who understand the concept of biosphere reserve. The purpose of key informant interviews is to collect information from a wide range of people which included community members representing biosphere reserve demonstration projects, professionals (LEDET officials and VBR management committee) who have first-hand knowledge about the community. These community experts, with their particular knowledge and understanding, provided insight on the nature of problems relating to the study and provided chance to be able to ask in-depth and probing questions. Snowball sampling assisted in approaching few individuals from the relevant population

and then act as informants to identify other members for inclusion in the sample.

3.3.1.3 Field Survey

The data on the biophysical data sets were obtained through field survey. Data sets on the general biophysical features for the area included but not limited to topography, land use, land cover and vegetation were obtained during direct observation within the study area. A camera Sony Cyber-shot 12.1 was used to capture photographs indicating vegetation of the area, land use and some of the features in the area, to investigate the operationalization of biosphere reserve concept in VBR. Based on the fact that the study was conducted in the National Park, State owned nature reserve, and villages around the VBR, consultation with the management and traditional leaders was done before the survey for the request of the permission to obtain data and to survey the area of study. Permission was requested in order to avoid problematic issue that may arise during the survey problem such as being chased away from the area by the security personnel, community members or the project members. Purposive sampling was used for selection of the areas, and the technique involves selecting certain units based on specific purpose rather than randomly (Teddlie and Yu, 2007). Through a survey and observation of the study area, it assists in giving the picture of the location when doing situation analysis, also observing the activities that cause the deterioration of the natural environment, which lead to ineffective management or conservation of the area.

3.3.2 Assess the contribution of development projects in natural resource management

Development projects are useful in the area as they create jobs and assist in food security. In order to assess objective 2 that relates to the contribution of development project in natural resource management the following research method were involved, field survey, unstructured and structured interviews and document review. The data is qualitative and quantitative in nature.

3.3.2.1 Field Survey

Field survey was used to collect data on the general features for the area that include

topography, land use, land cover and vegetation. During direct field observations in the study area, a camera was used to capture photographs showing vegetation of the area, land use and some of the features in the area, to investigate the effectiveness of biosphere reserve as a tool for conservation of natural resources in Vhembe District.

Several trips were conducted within Vhembe District Municipality's local municipalities in areas such as Mapungubwe National Park; Matshena village; Folovhodwe village, Ka-Madonsi, Mufulwi village and in all provincial state owned nature reserves and in several biosphere reserve demonstration projects. During field observations, notes were taken compiled and stored immediately after every trip and observation session. Field trips which involved observation of the study areas occurred over a period of five (5) months to ensure that the data collected was appropriate for the purpose of the research, and also to gather information and ensuring that the information is as rich and as accurate as possible. During sampling random selection method was used to select projects and representative subsets of other target subject matter such as vegetation and wildlife. Random selection was employed to ensure, unbiased selection and to equalize characteristics across observation sites for bio- physical components; and across projects for socio-economic parameters by obtaining data from respondents. Gender sensitivity was observed during the selection of the respondents in the questionnaire survey. Both male and females were given equal opportunities to participate in the study for all respondents identified.

Primary data obtained using a combination of methods, including Participatory Rural Appraisal (PRA) tools and techniques, and informal and formal surveys. Formal survey where on areas that were identified by the community members and informal survey where areas that were identified whilst travelling to the study areas.

3.3.2.2 Structured and Unstructured Interviews

Structured interviews using face to face method was conducted with key respondents mainly LEDET officials, and biosphere demonstration project members, in the study area in order to obtain information regarding conservation of natural resources within the VBR. The interviews enabled gathering information that could not be revealed using other methods. The interviews provided an opportunity for learning and self-reflection on the work processes with an established Biosphere reserve, and allowed increased

understanding of how the Biosphere programmes could be developed in the future.

LEDET officials were interviewed in order to obtain information relating to funding, legality of the biosphere, and plans to ensure environmental managements within the area. The interviews were conducted in the respondent's offices of the Department of Economic Development, Environment and Tourism in Vhembe district, using the questionnaire that was developed (see Appendix B). During the interviews, the questions were written in English but Tshivenda, Xitsonga and Sepedi languages were used, as they are the local languages. The local languages made the interviews more interactive and information was captured early from the respondents. Furthermore, the officers felt comfortable using the local languages.

The interviewees within the VBR demonstration projects were all above 18 years of age, because the under 18 years can only participate in research if their parents have provided informed consent. In order to identify the participants, simple random sampling was used. A camera and an audio tape recorder were used in capturing information from those selected. The tapes were replayed and photos scrutinised when analysing and transcribing the information obtained. The unstructured interview was also used to obtain information that relates to VBR demonstration projects.

3.3.2.3 Document Review

Informal discussions with unstructured questions was conducted face to face and telephonically with LEDET officials requesting the utilization of Greenest Municipality Competition (GMC) report from LEDET (see Appendix E) as part of the data needed for the research. Permission was granted permission for the utilization of the by the Director of Environmental Empowerment Services (EES). Through the unstructured interviews, more information was collected about the utilization of the GMC.

The Department of Environmental Affairs has introduced a wide range of programmes which ensure compliance, and enables a paradigm shift from traditional to a sustainable Green Economy. To achieve this, the National Department of Environmental Affairs has introduced and runs the Greenest Municipality Competition (GMC) which encourages municipalities as the coalface of service delivery to adopt green practices which ensure a

seamless transition to Green Economy. It addresses environmental protection, social and economic growth of the municipality (DEA, 2018). LEDET as provincial department has a mandate to ensure that provincially the programme is implemented at provincial level.

The GMC previously known as the Cleanest Town Competition (CTC), primarily focuses on the implementation of the National Waste Management Strategy (NWMS) and the Climate Change Response Policy (DEA, 2018). This are principles of reducing, reusing and recycling waste materials and introduction of renewable energy initiatives. The Cleanest Town Competition (CTC) was initiated in 2009, to implement the national waste management strategy. Although the CTC was fairly successful in achieving its primary objectives, developments within the greening movements require the modifications of the concept to include other elements which are outside the waste management category. The GMC enhances CTC by in-cooperating new elements and providing a broader focus (DEA, 2010). The results are qualitative and quantitative in nature and are explained in the next chapter and they are in a form of values and can be analysed.

LEDET forms a panel that includes members from other sector departments to assess the municipalities using the GMC assessment sheet (see Appendix E). There are forty-one (41) questions which are divided as follows: waste management (12), energy efficiency and conservation (4), water management (9), landscaping, tree planting and beautification (6), public participation and community empowerment (5), whilst leadership and institutional arrangements (5). The municipalities are assessed on physical environment and they have to submit proof of evidence with regard to everything they present. The panel then scores each municipality on the scale of 0 to 5; where 0 is poor and 5 is excellent. The winning municipality within the district proceed to the provincial competition where the municipality competes with other municipalities within Limpopo Province. The document was used to assess the role of the municipalities in conservation of natural resources within VBR. The data obtained on municipal performance was dated from 2012 to 2017 which is a five-year circle.

3.3.3 Objective 3: To evaluate the Contribution of Research in Sustainable Natural Resource Management.

The contribution of research in sustainable natural resource management is vital as the

result assists in ensuring conservation of natural resources. The data collection method involved in evaluating the contribution of research in sustainable natural resource management are qualitative research, consisting of reviewing existing documents or records. The data collected were from published and unpublished documents collected via internet, email, government publications and VBR website.

3.3.3.1 Document Review

To examine the effectiveness of Biosphere reserve concept as a tool for conservation of natural resources, publications that were reviewed included biosphere websites and government publications such as policies, VBR nomination form, spatial planning and land use management documents, and other relevant documents. Limpopo Economic Development, Environment and Tourism (LEDET) officials were consulted in order to get the scientific documents regarding the Vhembe Biosphere Reserve. The method seeks objective insight into the subject being studied by identifying the problem that defines the goal of the quest, gather data, posing tentative hypotheses both as a logistical means of locating the data and as an aid to resolving the problem. The hypotheses is then empirically tested by processing and interpreting the data to see if the interpretations of such data resolves the primary question which initiated the research in the first place (Leedy & Ormrod, 2005). The documents collected included hard and soft copies of agenda, minutes of previous meetings, reports and resolutions of annual general meetings (AGM). Other literatures were also consulted, which included previous written dissertations, journals, government gazettes and online-data bases in order to obtain data that support the study. Finally, the salient national policies were reviewed in order to understand best practices in natural resource management as is provided for in the constitution.

3.4 Data Analysis

In order to analyse the data, raw field notes were processed and converted into write-ups, which should be intelligible products that can be read, edited for accuracy, commented on and analysed (Welman et al., 2010). Data from the questionnaire were coded, captured, edited, tested for reliability, discussed and interpreted. During data analysis the data was organised categorically and chronologically reviewed repeatedly and continuously coded. All data were entered directly from hardcopy into Microsoft excel spreadsheet. The numeric data were imported into SPSS (PASW statistics 18.0.0) for statistical analysis tools that

includes utilities to access and manage data, as well as its editing and subsequent preparation to show the results. Text data from open-ended questions were imported into Microsoft Word, for content analysis. If respondents, however, answered less than half the questions in the questionnaires, these questionnaires would have then been discarded. Although at the end no questionnaire was discarded, the sample number was maintained; and (c) checking for logical records was done, for example male and female had values 1 or 2, and always made sure that 2 represented males and 1 represented female. During data analysis, quantitative approach was used to get logic of primary data. In addition, data verification was done by getting 100% of the total data and checking against the questionnaire to establish whether had been done correctly. The findings are discussed in Chapter 4, where the data are presented in the form of frequency tables and bar graphs.

3.5 Summary

The chapter discussed the methods and materials used to obtain the data required for the study that included structured and unstructured interviews, field survey and document review. Also, surveys of landscape features and vegetation, questionnaire survey, structured and unstructured interviews with selected individuals within the communities in the study area, rapid rural appraisal in the form of direct observation, participant observation, and document review of the spatial planning tools used nationally, provincially and within VBR. The data sets obtained were similarly a combination of quantitative and qualitative. The SPSS (PASW statistics 18.0.0) for statistical analysis tools was used to analyse quantitative data that includes utilities to access and manage data, as well as its editing and subsequent preparation to show the results. Text data from open-ended questions were imported into Microsoft Word for content analysis. The next chapter analyses and interprets the results of the study on the effectiveness of biosphere reserve concept as a tool for sustainable natural resource management.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents, interprets and discusses the results of the study obtained from the analysis of data sets outlined in the previous chapter. The interpretations focused on identifying dominant features and patterns in the data, while the discussion places the findings in the appropriate context using the researcher's own experiences, and by making references to results obtained in other studies. Tables and figures are used to present some of the information. The objectives of the Biosphere reserve are to conserve, develop and research in an area designated as a biosphere reserve. The general objective of the study is to assess the effectiveness of biosphere reserve concept as a tool for natural resource management in Vhembe District.

4.2. Usefulness of BR Concept as a Tool in Conservation of Natural Resources

Biodiversity captures concepts of the variety of life, if importance, the crisis presented by its loss and the need for conservation action (UNESCO, 2011). Therefore, conservation of biodiversity requires knowledge of the variety of species and their distribution, abundance, sensitivity and conservation status. It was indicated during interview with LEDET officials that LEDET has assisted the Vhembe District Municipality (VDM) in the development of the first Vhembe Bioregional Plan in 2017. The plan provides the primary biodiversity information to a range of planning and land- use authorization processes within the district. There are also district and national tools used for the conservation of natural resources, such as the National Environmental Management Biodiversity Act 10 (of 2004) and the Limpopo Environmental Management Act 07 (of 2003).

4.2.1 METT-SA

The Management Effective Tracking Tool of -SA (METT-SA) revealed that initially there were eight (8) state-owned nature reserves and two South African National Parks (SANparks) within the VBR. The two SANparks includes the; Mapungubwe National Park

and World Heritage site and the Kruger National Park. However, from these State's owned nature reserves, Thohoyandou Botanical gardens have been changed into a South African National Biodiversity Institute (SANBI).

The METT-SA assessment is conducted by LEDET officials who work under the Directorate of Environmental Compliance and Enforcement. These officials assess state-owned nature reserve only. The state-owned nature reserves in VBR that were assessed are: Makuya Nature Reserve; Mphaphuli Nature Reserve; Musina Nature Reserve; Brackenridge Nature Reserve; Langjan Nature Reserve; Nwanedi Nature Reserve; and Nzhelele Nature Reserve. The METT-SA assessment was conducted on the state-owned nature reserves only as the other institutions are regarded as private parks. The results are as presented in Table 4.1.

Table 4.1: METT-SA performance of State-owned nature reserves.

Name	2016	2017	2018
1. Makuya Nature Reserve.	36%	42%	42%
2. Mphaphuli Nature Reserve.	24%	No results	45%
3. Musina Nature Reserve.	39%	49%	56%
4. Brackenridge Nature Reserve.	24%	28%	28%
5. Langjan Nature Reserve.	33%	57%	36%
6. Nwanedi Nature Reserve.	35%	43%	58%
7. Nzhelele Nature Reserve.	36%	48%	50%

As per the result of METT-SA assessment the results in table 4.1 indicates that there has been great improvement in the management of the protected areas from 2016 to 2018. Nwanedi Nature Reserve shows a steady improvement as compared to the other nature reserves. The Nwanedi Nature Reserve received funding for the development of the reserve from the National Department of Environmental Affairs (DEA). Field observations undertaken during data collection revealed that there are several facilities which were

constructed in Nwanedi Nature Reserve. These indicate the marked improvement, and it has tourist facilities, access into the reserve and water installations.

Similarly, Musina Nature Reserve also showed some improvement, as METT-SA assessment showed 56% of its performance in 2018, followed by Nzhelele Nature Reserve, Mphaphuli Nature Reserve, Makuya Nature Reserve and Langjan Nature Reserve, with the least performing all year round was the Brackenridge Nature Reserve. There were no assessments conducted in Mphaphuli Nature Reserve in 2017 because there were no officials to conduct the assessment.

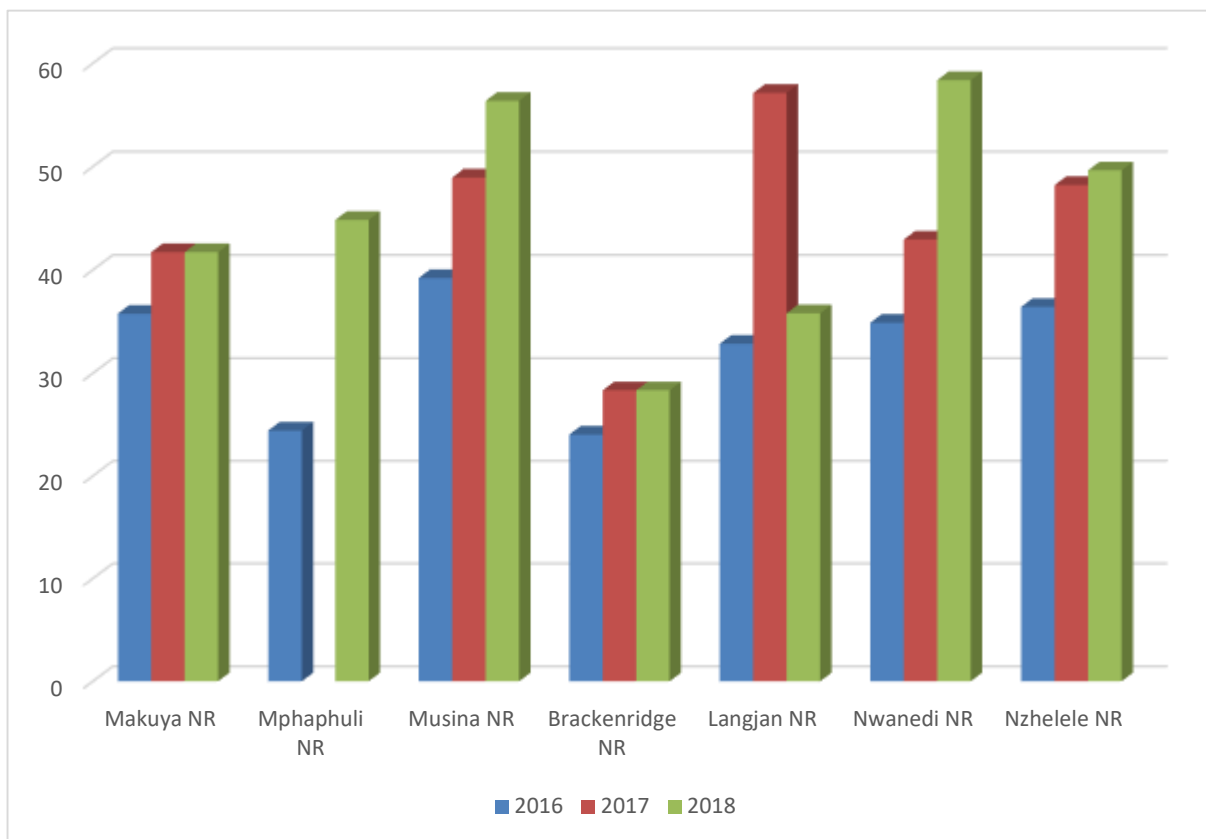


Figure 4.1: METT-SA Performance of State owned Nature Reserve from 2016 to 2018.

During the visit to the nature reserves there were challenges that were identified although there is an indication of improvements in such reserve according to the METT-SA assessment, which included challenges such as dilapidated offices, store rooms, fence and staff accommodation, were identified see Figure 4.2.



Figure 4.2: Dilapidated building in Nwanedi Nature Reserve (Survey: 2018)

The findings concur with those of Geldmann *et al.*, (2015). Geldmann *et al.*, (2015) specifically addressed the criticism that METT scores are not an accurate reflection of reality on the ground, that in general, most repeated METT assessments produce scores that suggest improvement in management over time as would be expected if increased METT scores were indicative of real improvements, but some 30% experienced no change, or even declines, in overall scores. Furthermore, Geldmann *et al.*, (2015) indicated that global assessments of protected areas management effectiveness have revealed major deficiencies across many criteria, including funding, human capital, and capacity to assess management effectiveness itself.

The results from this study showed that Mapungubwe and Kruger National Parks are conserved in partnership of three (3) countries (namely, Botswana, Mozambique and Zimbabwe) which share the Limpopo River System, and are part of a signed agreement between the three countries to establish the Greater-Limpopo Tran-Frontier Park and Limpopo/Shashe Trans-Frontier Conservation Area. The Mapungubwe National Park is conserved together with Botswana and Zimbabwe. The Mapungubwe National and World Heritage Site is located at the Shashe and Limpopo Rivers, bordering South Africa, Zimbabwe and Botswana.

The park's development was partly motivated by the ecological objective of re-establishing traditional migratory wildlife routes once fences between the three countries are dismantled (Spenceley, 2006). The wildlife within the parks move between the countries which also provide more space for the movement of wildlife within the conservation areas (Figure 4.4).



Figure 4.3: Trans-frontier conservation area at Zimbabwean site



Figure 4.4: Wildlife moving within Trans Frontier Park

South African National Parks (SANParks) in Mapungubwe National and World Heritage Site has embarked on tourism to generate income in support of the conservation of cultural and biodiversity assets, while enabling tourists the opportunity to enjoy the nature-based products and activities. SANParks boosts local economic development, by providing jobs, contracting certain services, thus stimulating the establishment of small and medium enterprises (SMME's) and public private partnership.

The Cape West Coast Biosphere Reserve (CWCBR) was allocated an alien species clearing project by the Department of Environmental Affairs through Working for Water programme. This project lasted three years ended in 2019, having employed 96 people from previously disadvantaged backgrounds. Approximately 2300 hectares of alien vegetation was removed from critically ecosystems. Since its inception, the programme has created jobs and cleared large areas previously densely-covered by alien vegetation (Cape West Coast Biosphere, 2019). Furthermore, from Kruger to Canyon biosphere, the environmental monitor programme in partnership with provincial government, non-

governmental organizations and research institutions, was implemented with the aim of supporting biodiversity conservation, contributing to improved livelihoods and resilient economic development and creation of 272 jobs.

4.2.2 The Biophysical Environment Challenges in VBR

In order to assess the effectiveness of biosphere reserve concept as a tool for conservation of natural resources, a survey of the landscape within Vhembe Biosphere Reserve was conducted. The survey included an assessment of the projects that are registered in the biosphere reserve data base; interviews with LEDET officials; assessment of GMC results

4.2.2.1 Project Impacts on Landscape

Results obtained from the landscape survey, during field work indicate that the processes being used by the Folovhodwe Magnesite mine to extract mineral resources negatively impact on the landscape. Open pit mining leaves “open wounds” in the landscape that are a safety risk particularly during the rainy season when they often get filled up with water. Mine tailing dumps are artificial monotonous bare hills features that have scarred the landscape even further. The mining activities have resulted in loss of agricultural and grazing land, which used to be the mainstay of the livelihoods of rural communities in the province. Such a loss of source of livelihoods has made the population in the area increasingly vulnerable to environmental challenges within the area as illustrated in Figures 4.5 and 4.6. Furthermore, the community members complained that the mining company left the areas without rehabilitating it, which poses a danger to their livestock and themselves. The mine has the responsibility to rehabilitate the damaged landscape to bring it back closer to the pre-mining conditions, but this seems not to be happening at Folovhodwe under Musina Local Municipality, surrounding villages and around Ka-Madonsi village within Collins Chabane Local Municipality.



Figure 4.5: Land made derelict due to dumping of mine waste (Survey: 2017)



Figure 4.6: Houses situated very close to unfilled quarries and excavations (Survey: 2017)

The environmental impacts caused by the Folovhodwe Magnesite and Madonsi gold mines were rated according to the community views expressed during the interview and the questionnaires completed (Figure 4.7). Illegal waste disposal, deforestation and climate change were rated high in terms of the environmental impacts caused by the mine.

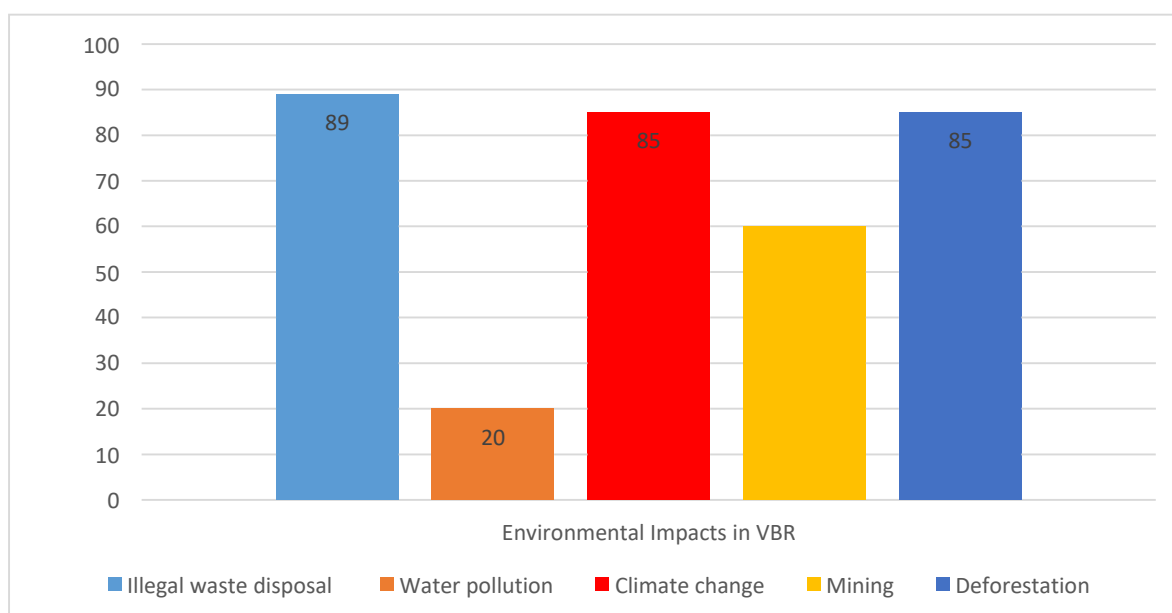


Figure 4.7: Environmental impacts caused by the mine

little vegetation grows on the tailing dumps, which makes them to be very vulnerable to soil erosion by water and wind. On all sites that the mine has operated in, vegetation has been

stripped. In addition, the coal ashes that the mine stock pile on the ground impacts aquatic life forms and can change the chemical composition of the soil in the area. Accordingly, the evidence of erosion on this tailing dump is less spectacular compared to the moderate erosion on steep slopes. On the other hand, there is clear evidence that creeping forms of vegetation as well as some species of grass are getting established on some sections of the tailing dump. The soil residues washed into water bodies, result in loss of habitat for aquatic species, changes the water quality due to pollutants, causes eutrophication which kills fish, elevates pH, depletes dissolved oxygen, and decreases species diversity (UNEP, 2006).

4.2.2.2 Development Project Impact on Vegetation and Wildlife

The results obtained from the interviews reveal that intensification of magnesite and gold mining activities in the area has negatively impacted on the forest ecology. There is a gradual decrease from dense to open forests during the previous years. During the early stages of the mining operations, a considerable portion of the dense forest was converted into settlements, roads and mining sites. Mining and activities thereof result in an irreparable damage to the forest ecosystem and that it has had far reaching negative impacts on the biotic components of the forest.

In the north-eastern part of the VBR, the fire wood business is highest as most households, street corners and vehicles were sported with fire wood being sold. The observation within the area were similar to the assertion of Cadman (2007) who indicated that fire wood businesses conducted by community members also make the matter worse as trees are cut to meet the demand.

The results from interviews and questionnaire surveys indicate that villagers complained about the conditions in their area as their domestic animals have less area to graze. The residents indicated that the mine has stripped off most of the vegetation cover in their area, resulting in, dumping of mine tailings and mine pits that have replaced range and crop lands (Figure 4.5). This situation has forced the villagers to take their domestic animals to other areas where they may get grazing land a typical transhumance arrangement. As with all transhumance arrangements, this one also involve loss of economic time of herders

moving their livestock from one location to another.

4.3 Impact of Development in Sustainable Natural Resource Management

The field survey undertaken for the purpose of this study revealed that natural features such as trees have been conserved to benefit future generations. This was observed in Matshena village in Musina Municipality, where baobab trees have been conserved and during the construction these trees are preserved, making the road to wend through the trees rather than cutting the trees to make way for the road. As such, the Municipality has saved trees that are thousands of thousands years old.



Figure 4.8: Big tree in Matshena village (Survey: 2017).



Figure 4.9: Trees Protected during Road Construction (Survey: 2017).

Figures 4.8 and 4.9 show the baobab trees that are preserved in Matshena village as evidence of the practical of conservation of Baobab trees in the area. During harvesting of the Baobab fruits, the community are not allowed to cut the trees. The community also work together during harvesting of the fruits.

During field survey several projects were identified that are aimed at the conservation of natural resources. Amongst those are waste management, adopt a river and community-based natural resource management. Under this MAB projects, there are 47 known and

registered projects that were formed with the aim of conserving natural resources (LEDET, 2018). Some of the projects are funded by LEDET under MAB programme, while others are funded by sector departments, which include the Department of Social Development, National Department of Environmental Affairs and the Small Grand Fund (SGF).

To encourage those who conserve the baobab trees, a group of community members are given certificate by Dr Sarah Venter of Eco-product as recognition for conservation effort of the Baobab trees (Figure 4.10); the Baobab guardians in Zwigodini village have planted trees that reached the height of 3.5 meters tall. The trees are planted in their home steads and they also have trees seedlings that they provide to those who need them.

During field survey, several areas were identified where development is taking place in natural resources areas, such as rivers and wetlands areas. Some of these areas are regarded as sacred places by the community members and any development is not supposed to take place in them.



Figure 4.10: Baobab Guardians Receiving the Certificates

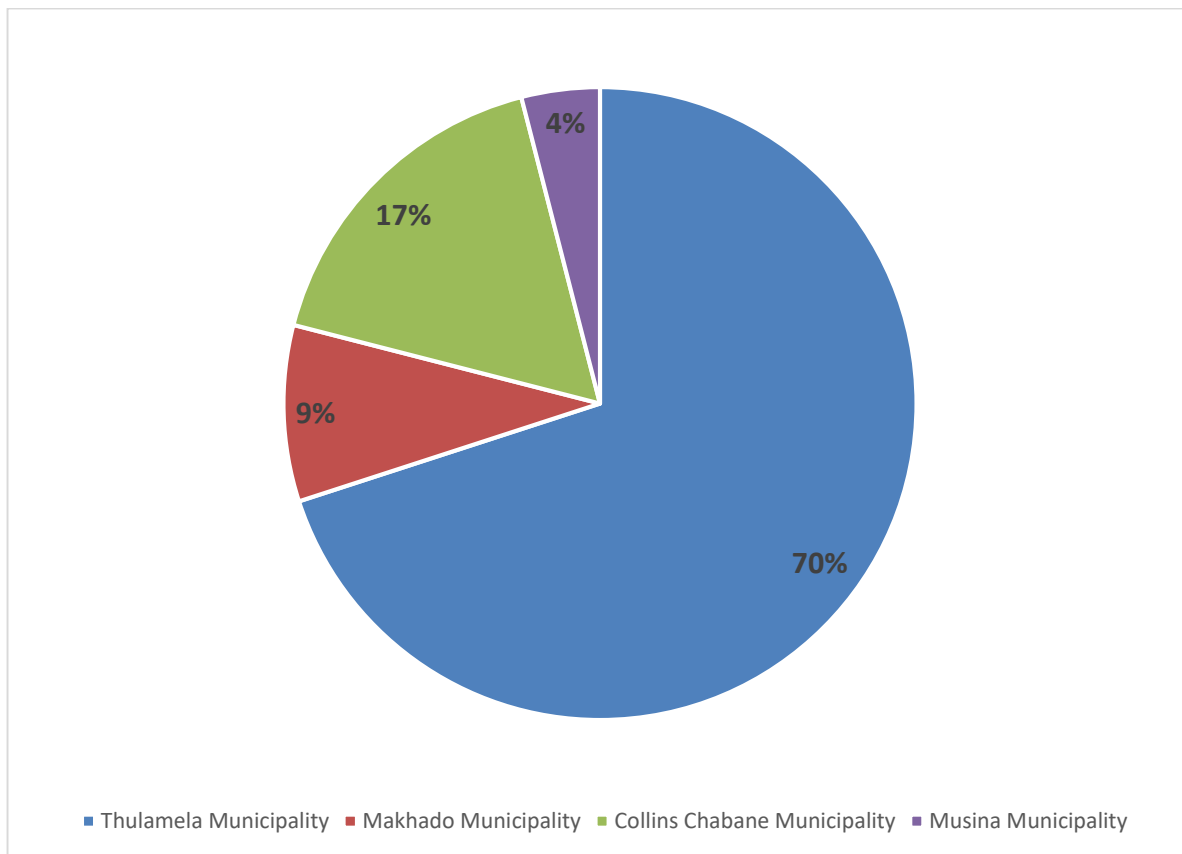


Figure 4.11: Number of Projects registered under VBR

The results from the interviews showed that there are thirty-three (33) projects under the Thulamela Municipality, four (4) projects under Makhado Municipality, two projects under Musina Municipality and eight (8) projects under Collins Chabane Local Municipality under MAB projects (Figure 4.11). These projects focus on conserving natural resources and undertake waste collection, tree planting, indigenous knowledge protection, water conservation and tourism. The following section describe in detail some of the projects that were selected.

4.3.1 Matavhela Greenery and Nursery Primary Cooperative Limited.

Matavhela Greenery and Nursery Primary Cooperative was started in 2013 by a group of women who were unemployed in the Mufulwi village (Figure 4.12). The project applied for funding under the Global Environmental Facility (GEF) that was meant for projects within the biosphere reserves. The project received an amount of USD 40, 000.00 which was for the development of the project that was struggling. The project also received an amount of R25, 000.00 from the Department of Social Development in Vhembe District for the

development of the project. The group was able to construct a nursery, clear the land which was not in use and practice agro- ecology, install water tanks and construct their office.



Figure 4.12: Matavhela Greenery and Nursery Primary Co-operative Limited

The funding received under GEF was able to ensure that the project employed more people into the project and jobs were created. Currently the project sells the products they produce to the community and surrounding villages, crèche, and schools. The project is capacitated by the project funding since they are able to manage the project and report on finances. The trees planted within their nursery are replanted in nearby schools as part of Abor Day Commemorations. Furthermore, the communities are no longer travelling to other areas for seedlings, as they are readily available within their nursery. The project also produces dried vegetables which are sold to the community (Figure 4.13).



Figure 4.13: Dried vegetables from Matavhela greenery and nursery cooperative

4.3.2 Eco Products

The Eco Product company is based in Louis Trichardt in Makhado Municipality. Its main objective is to make a meaningful contribution to the livelihoods of the rural people by conserving the baobab trees (Figure 4.14). Eco Products work with rural communities, to collect fallen fruits from baobab trees to produce the company products. The company has an implementation, monitoring and evaluation process to assess the state of the baobab tree populations in the areas where the fruits are collected. There are also trees that are distributed to the Baobab tree guardians and there is a nursery that was established to plant the baobab trees to boost the natural populations and sustainability through Baobab Foundation. The company also awards the baobab tree guardians with certificates after the trees planted grow to 3m high. As a result, unemployed women in the villages, where fruits are collected, are able to get an income, employment and conserve the trees in their areas for current and future generations. The products produced from baobab fruits are mainly organic baobab powder and baobab oil, which are sold in the manufacturing and retail sectors.



Figure 4.14: The logo for the Eco Products Company.

Figure 4.14 shows the Eco Product logo. The company has several forums that are formed to assist in the conservation, development and management of the biosphere reserves. The forums are established by the district and local municipalities, sector departments, NGO's, CBO's and biosphere management committee members. There are forums responsible for invasive species, land development forum, waste management forums, environmental management forum and VBR management forum. All the forums have their meetings on a quarterly basis and members report on the expertise with regard to the mandates as per the forum requirements.

4.4 Challenges facing development of BR projects

The interviews revealed that there are several challenges that faced the biosphere that hinder the development of the projects. Some of those challenges includes; climate change, water shortages, lack or minimal funding, conserving the cultural heritage and sacred places.

4.4.1 Climate change

The projects that are involved with sustainable agriculture are face challenges caused by climate change and associated water shortages. Their crops are collapsing due to extreme

heat and lack of rainfall faced within the district and the province as a whole (figure 4.15). Extreme temperatures and lack of rainfall makes the area dry and plants do not survive. The projects are unable to supply the markets due to lack of funds.



Figure 4.15: Crops at Matavhela Greenery Cooperative

4.4.2 Lack of inadequate funding

The funding that is received on an annual basis from VBR management is minimal, as compared to the projects that are available within the district. The funding model from VBR management committee provides minimal support as each project is funded with R30, 000.00 for 3 projects on annual basis. LEDET also assist the project to apply funding from other external funders such as National Department of Environmental Affairs, GIZ and GEF Small Grant Programme. Every two years, GEF Small Grand support three (3) projects financially within VBR to develop its self. The first groups funded in 2017 were Matavhela Greenery Cooperative, Mubvumoni Cooperative for the Disabled and Nombhela Gardens and Cultural Heritage Cooperative. In 2018, three more projects were funded; namely Dzomo la Mupo, Pfariso yashu and Tshikofokofo adopt a river project. The funds received are used to develop the projects by offering capacity-building, Climate-Adaptive Agro ecological Innovations and project management skills within VBR.

4.4.3 Conserving Cultural Biodiversity and Sacred Sites

The cultural heritage and sacred places in the district are facing challenges of destruction through deforestation, pollution and mining activities. The sacred sites where community members used to preserve their culture have been destroyed by fire-wood collectors. LEDET and Dzomo la Mupo (*the voice of mother earth*) non- profit company (NPC) has a programme wherein the community through which members are capacitated on the conservation of the natural resources and learn how the community can benefit from such sites. Dzomo la Mupo (DLM) which is a volunteering team with the aim of preserving and reviving cultural diversity by protection and restoration of critical ecosystem through indigenous living. DLM operates within the district and works together with women, elders, school children, youth and the custodians of the sacred natural sites. The project has been funded by GEF small grant programme for the protection and conservation of natural environment by planting trees (Figure 4.16).



Figure 4.16: Indigenous Trees Planting by Dzomo la Mupo

4.5 Greenest Municipality Competition

The performance of the municipalities in terms of environmental management and conservation of natural resources within the Vhembe Biosphere Reserve were analysed

using the Greenest Municipality Competition (GMC) reports from 2013- 2017. In 2016, GMC was not implemented to give the municipalities a chance to implement the GMC panel recommendations which outlined what the municipality should do to improve in terms of conservation and environmental management. In 2017, the Collins Chabane Local Municipality newly promulgated and immediately entered the competition. Previously, there was Mutale Municipality, which was also situated in the north eastern part of VDM. The municipality is divided into two; one part forms Musina Municipality while the other part forms part of Thulamela Municipality. Makhado Municipality did not formally participate in the competition and therefore it was assessed by LEDET, and did not make any formal presentation.

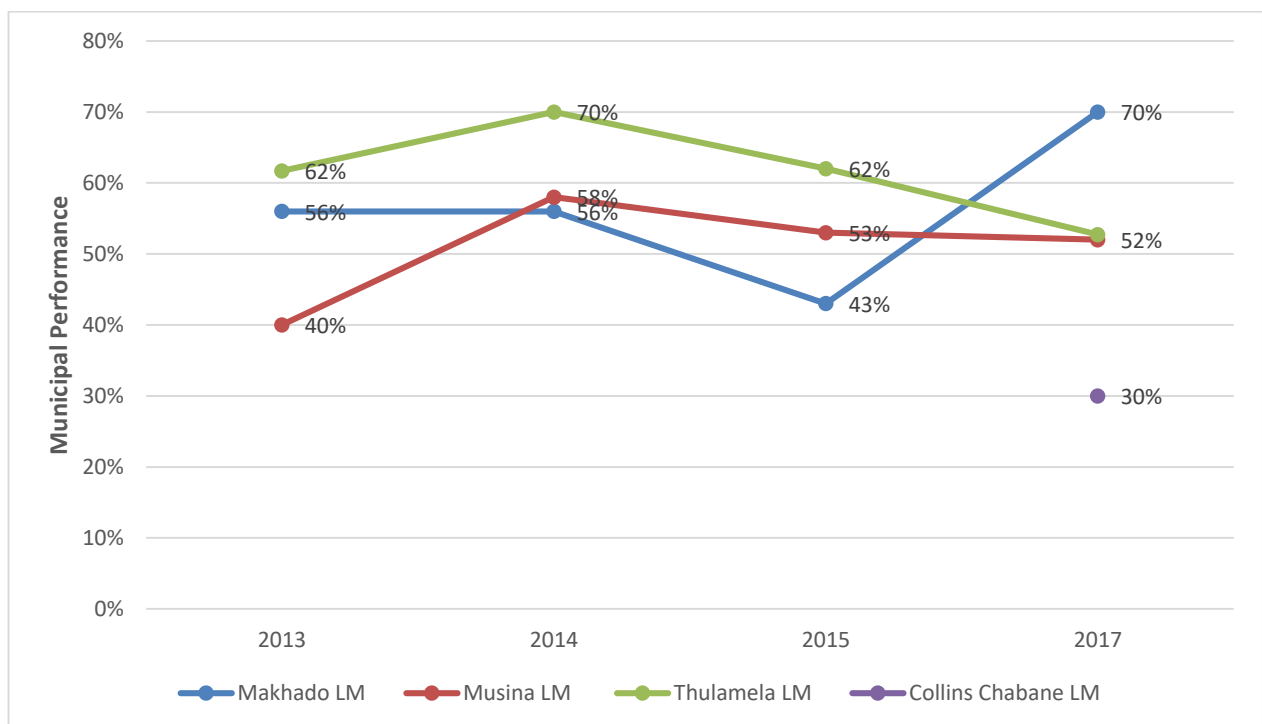


Figure 4.17: Waste Management

The municipality performance with regard to waste management Figure 4.17 indicates that there has been a great improvement with regard to waste management in Makhado Municipality; compared with other municipalities, they performed above 50%. The municipality has registered with SAWIS and reporting on waste generation within the municipality and they are developing their integrated waste management plan (IWMP). The municipalities are doing their best to ensure that community members receive proper services with regard to waste management. The Collins Chabane Local Municipality did not

have a formalized structure for waste management and because it is a new municipality, sector tools with regards to waste management are not available. The Thulamela Municipality waste management system has dropped from being the top performer to being average because their waste management sector tools are outdated, the landfill site operating license has expired and the major towns (Sibasa and Thohoyandou) waste is not managed properly.

Figure 4.18 shows the performance of municipalities with regards to energy efficiency and conservation. The Thulamela Municipality has improved from 2013 and is maintaining its status. Energy audits are also conducted for energy used within the municipality and there are sector tools and projects available for energy efficiency and conservation. Musina Municipality is not performing well with regards to the energy efficiency. The municipality has no sector tools for energy efficiency and conservation, and there are also no new projects. Makhado Municipality has improved with regard to energy efficiency and conservation. There municipality conducts energy audits and has developed energy strategy to assists the municipality with energy conservation. Collins Chabane Municipality did not have a functional unit to deal with energy efficiency and conservation and there was no information provided hence their score is 5%.

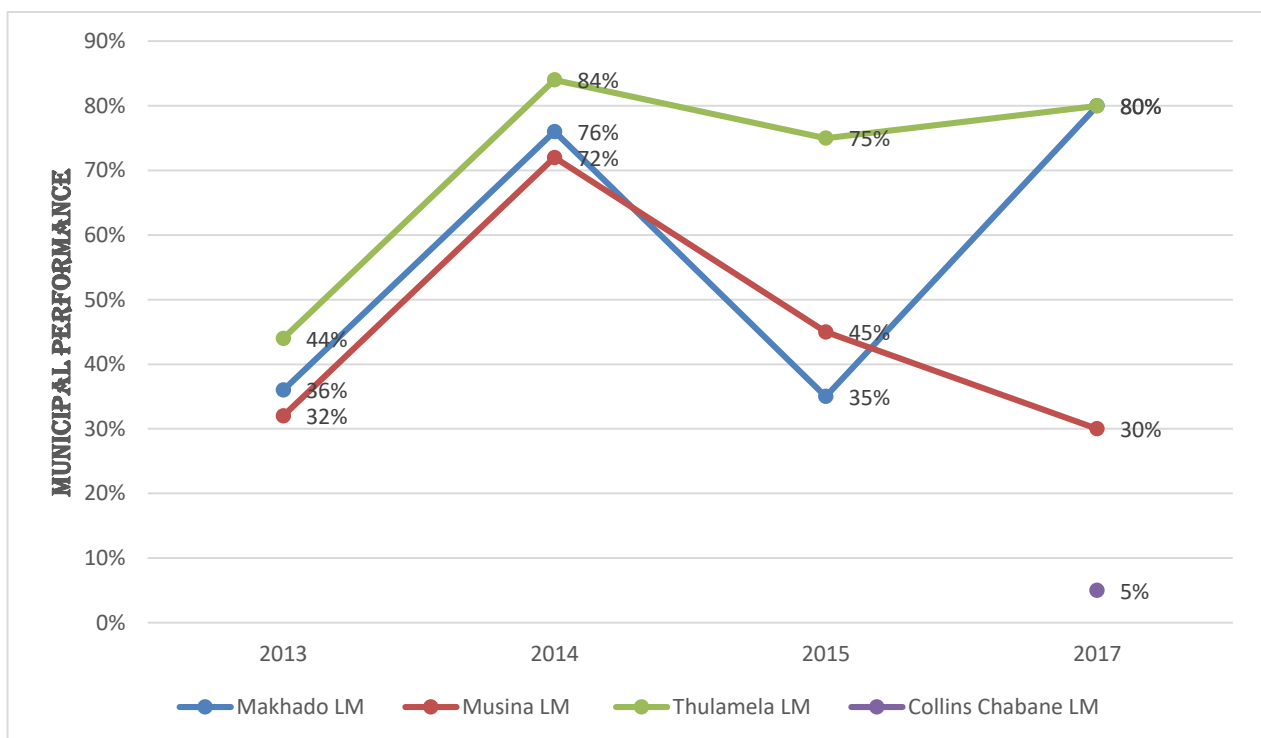


Figure 4.18 Energy Efficiency and Conservation

Figure 4.19 shows that Collins Chabane and Musina Municipality did not perform well on water management and conservation component. Musina Municipality does not have water harvesting or water conservation projects. Collins Chabane Municipality has no unit in place to deal with water management and conservation hence poor performance of 13%. The officers that presented were seconded from Makhado municipality and did not have relevant information for the new promulgated municipality. Thulamela Municipality performed above 50 percent, while Makhado Municipality improved from its previous performance. The municipality constructed dry parks to assist in conservation of water as they will not be watered.

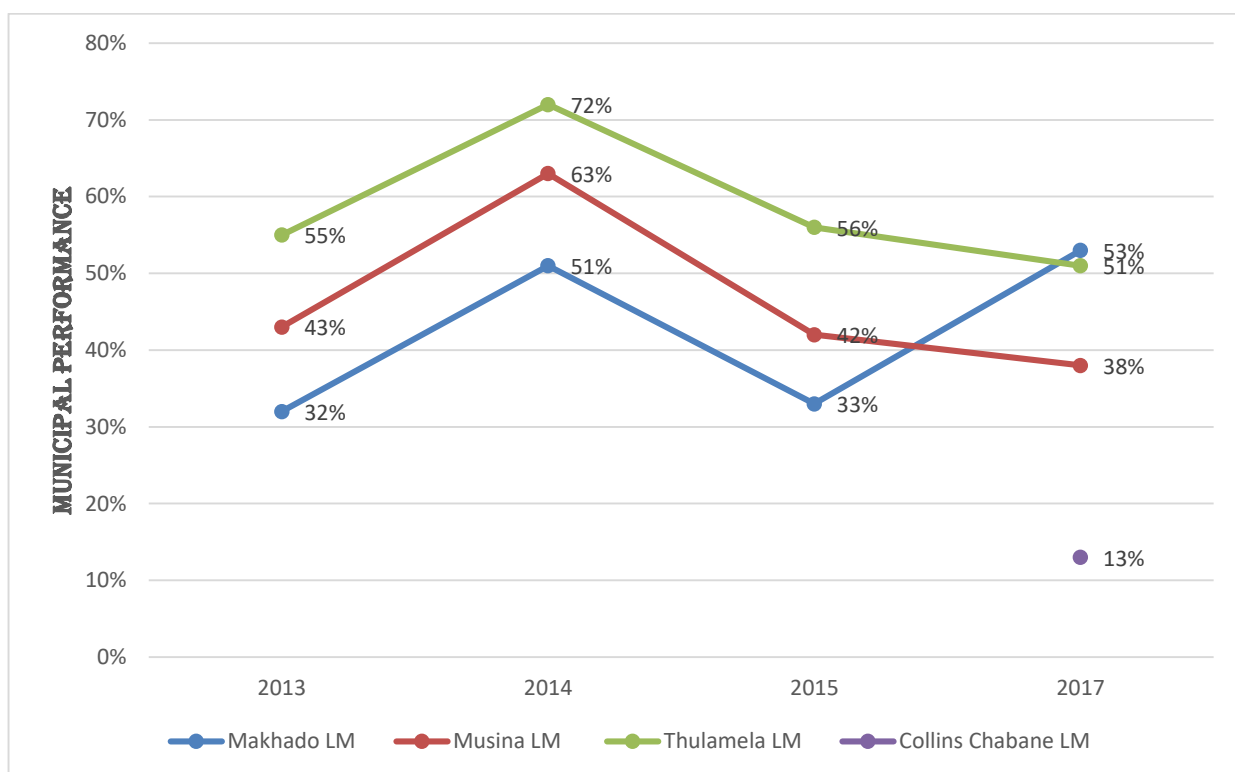


Figure 4.19: Water Management and Conservation.

The municipalities performed above average with regards to landscaping, tree planting and beautification (Figure 4.20). Thulamela Municipality's performance decreased because some of their parks were vandalised and resources stolen. Furthermore, the municipality does not have the Greening Action Policy. The Musina Municipality maintained the above average status.

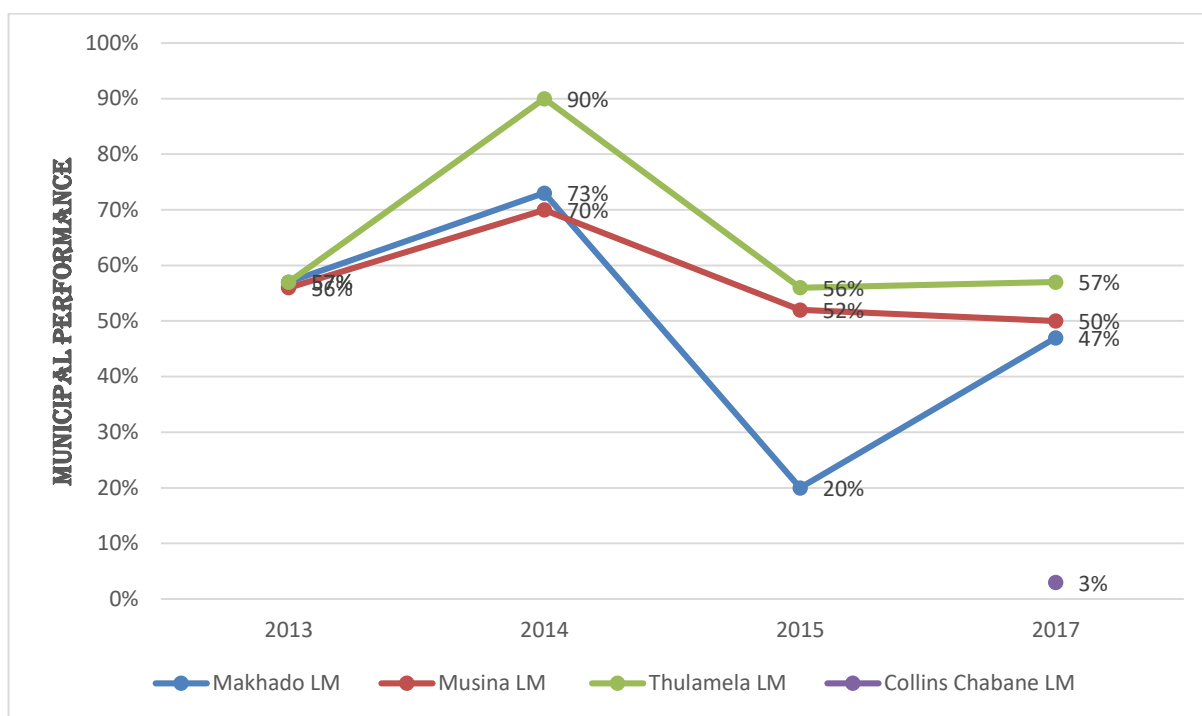


Figure 4.20: Landscaping, Tree Planting and Beautification (LSTPB)

The Collins Chabane Municipality does not have a functional unit for managing parks and tourist attractions. The municipality is involved in tree-planting initiatives, where there are targets set for the planting of trees especially during the September month that is dedicated for Abor Week. LEDET assist the municipalities with tree planting as they also have their programme within the district.

The Thulamela governance system remains higher than other municipalities as illustrated in Figure 4.21. This is due to the fact that the municipality has a fully functional environmental awareness team, community participation in municipal programmes and also availability of budget for GMC programmes. Makhado Municipality had shown a sign of improvement in the period 2015 to 2017 after dropping in the period 2014 to 2015; they also support LEDET programmes. In Musina Municipality there is less involvement of community members in the environmental programmes. The municipality also has no environmental management forum which assist in ensuring proper environmental management.

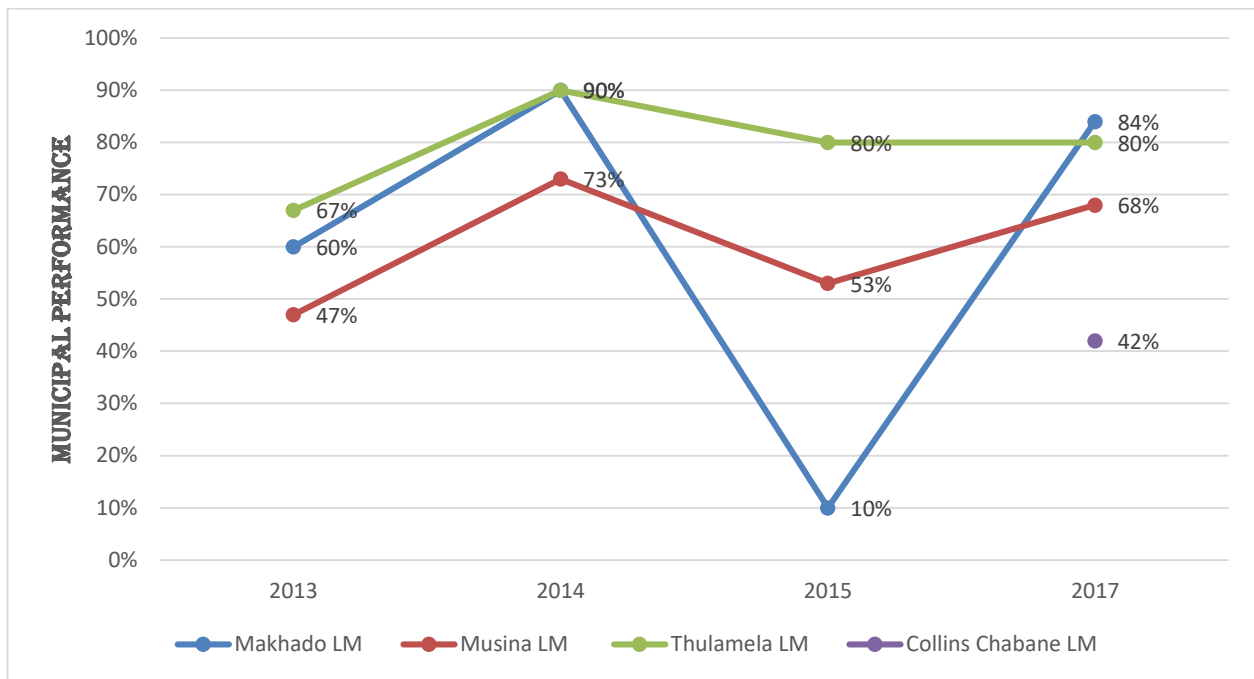


Figure 4.21: Governance

4.6 Contribution of Research in Sustainable Natural Resource Management

VBR has been a focal point for research in various disciplines for many years and a good knowledge-base is available in literature due to its unique biological and cultural features. Most of the basic research has been undertaken by South African universities, one of which is the University of Venda which is situated within the biosphere reserve.

Other Government or non-Government organizations have made and continued to make significant contributions to the knowledge base. These include the Agricultural Research Council, Department of Water Affairs and Forestry, National Parks Board, Council for Scientific and Industrial Research, National Research Foundation, Council for Geoscience, various museums, National Botanical Institute, National Bio-diversity Institute, Provincial Department of Economic Development, Environment and Tourism and the Mara Research Station. NGO's, societies and private individuals, have also contributed significantly to scientific research in the area.

Completed research within the School of Environmental Sciences in the University of Venda were selected according to their purpose. The researches that were conducted with the aim of conservation of natural resources within Vhembe District were selected. Figure

4.22, shows that 2015 had the highest number of researches conducted for conservation of natural resources, whilst 2016 had the lowest number of researches in Vhembe district. The research topics conducted by students were not related to conservation of natural resources in the Vhembe biosphere rather were focusing on other topics in other district and including international researches. There was no single document or research that was conducted within the past five (5) years that was meant for evaluating VBR. This research fills the gap for information about conservation of natural resources in the Vhembe biosphere reserve.

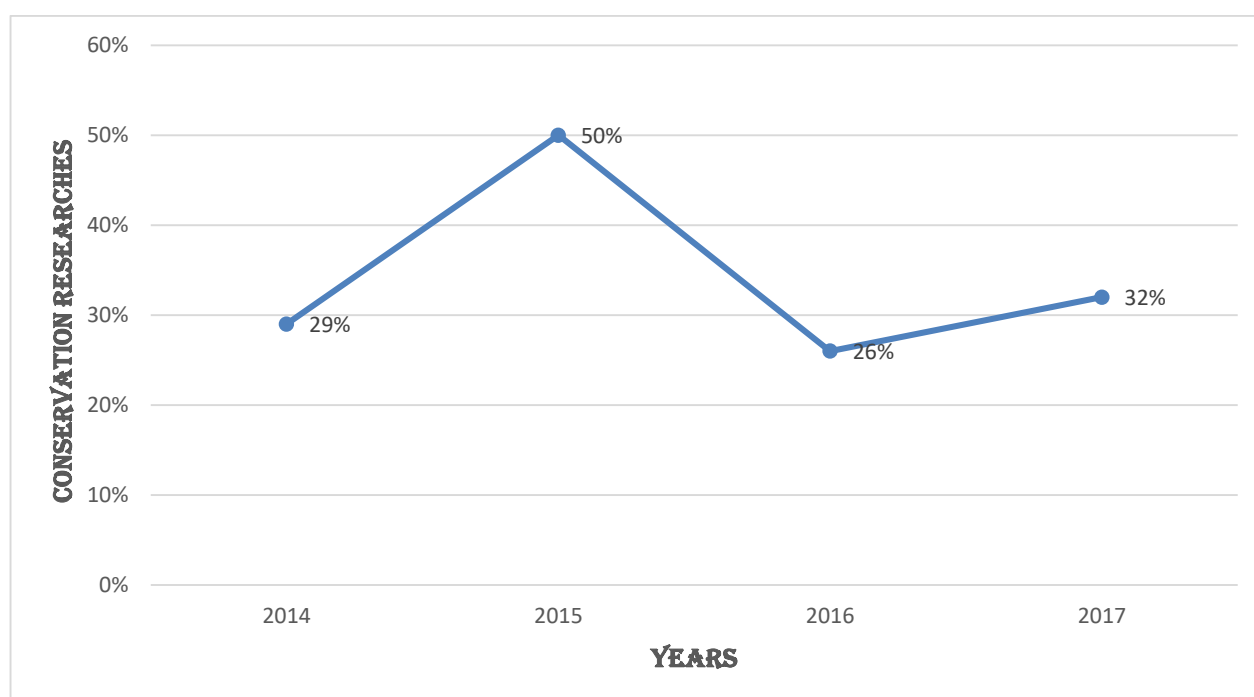


Figure 4.22: Researches in UNIVEN School of Environmental Sciences

LEDET also has an environmental education programme that is aimed at capacitating learners from different schools in research within VBR. Schools are taken on excursions to either state owned nature reserves or SANPAKs, where learners are given an opportunity to undertake research guided by the environmental officers. Dzomo la Mupo (DLM) also engages schools to revive cultural biodiversity through gatherings, celebrations and the facilitation of intergenerational knowledge transfer between elders and children. Learners are able to gain and appreciate how human existence interacts with natural environment and culture through indigenous knowledge system. The objective of DLM is for the protection of sacred sites which plays a vital role in indigenous knowledge system.

4.7 Chapter Summary

The findings of the study show that the Biosphere reserve has had significant positive impacts on the conservation of natural resources in the study area. Research has been done that contributes to the management of natural resources and recommendations on what has to be done to preserve the environment have also been suggested. There are systems in place that are meant for conservation of natural resources that are conducted by the government using METT-SA. The annual assessment assists the government to plan for the future needs of the areas. However, although the assessment is done within the protected areas and improvement is indicated by the tool, on the ground there are challenges faced by the employees of such areas.

The municipalities also have their roles that address conservation of the natural resources as is observed using the GMC assessment. GMC assessment encourages municipalities to conserve their natural resources through relevant programmes and projects. The Biosphere also promotes projects that focus on the conservation of natural resources through funding by government and external donors. Biosphere reserve has contributed positively in VDM through conservation of natural resources, in the development of the district, which contribute to sustainable natural resource management within the biosphere. Although there is minimal research which has been conducted with regard to assessment of Vhembe Biosphere Reserves, there are several researches that address conservation of natural resources within the district. Indigenous knowledge also assists in the conservation of natural resources through capacity-building conducted by some government structures and external stakeholders such as Dzomo la Mupo. The questionnaire assisted in identifying the environmental challenges faced by communities residing in the VBR which are due to climate change, mining activities and destruction of protected areas.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the conclusions drawn from the study. The conclusions revolve around the research objectives and questions presented in Chapter 1, as these provided the framework for the study. This chapter synthesises the relevance of the findings for future land-use decision making and further research in the Vhembe Biosphere Reserve (VBR), as well as the longer-term sustainability of the Biosphere Reserve model for this socio-economic system. Furthermore, as it happens in most cases, one single study like the one reported in this dissertation, could not uncover all facts about, and entangle the complexities of effectiveness of the BR concept as a tool for sustainable natural resource management in the area of study. This chapter also makes recommendations for further studies.

5.2 Conclusions in Relation to Research Objectives

The Biosphere Reserve model of UNESCO's Man and the Biosphere Programme reflects a shift towards more socially accountable conservation, setting a basis for improving the relationships between people and their environment. The Biosphere Reserve approach of dual conservation and sustainable development objectives is a long-term perspective that increases people's ability to sustainably manage environmental resources into the future.

The objective for assessing the effectiveness of BR in conservation of natural resources has been achieved. METT-SA was used to assess and to bring change in the protected areas within the VBR while the report and the physical assessment are not the same. The reports showed great improvement in some nature reserves whilst the physical condition is depleting. Also, in some areas the assessment was not done annually due to challenges at LEDET. Although there are challenges, METT-SA assessment provides a base for improvement in protected areas with regards to challenges identified and also provide room for improvement to ensure that natural resources are conserved.

There are opportunities that are brought by the biosphere, where there is conservation of

natural resources conducted by government, private institutions and communities and through trans-frontier programmes. Conservation of natural resources is done in collaboration with Botswana and Zimbabwe. Furthermore, communities, are benefiting through programmes that are aimed for supporting biodiversity conservation, contribution to improved livelihoods through job creation and resilient economic development through conservation of natural resources within the VBR.

The findings revealed that there are environmental challenges that have been identified within VBR. Those environmental challenges are due to mining activities, illegal waste disposal, deforestation and climate change. There is no rehabilitation process taking place in the area where mining activities occurred, as the mined areas are abandoned without implementing the mine closure strategies required by mine environmental policy in the country. The community members have adapted to such conditions as they are surviving regardless of the state of the environment they are in.

With respect to the objective of determining the effectiveness of the BR in development of VBR, it was discovered that, funding through biosphere programme from private and governmental entities has assisted many unemployed community members to create jobs that assisted them to develop their areas, conservation of natural resources and improve quality of livelihood. During developments, natural resources are considered and protected for the benefit of future generations.

Although there were some identified challenges within the biosphere, such as climate change, water shortages, lack or minimal funding, developments in natural resources such as wetlands and rivers, conserving the cultural heritage and sacred places for development of VBR, there are programme in place to assist in the development of the site. The government also involves the municipalities in the conservation of natural resources through programmes such as Greenest Municipality Competition (GMC).

The objective of assessing the contribution of research in sustainable natural resource management has been fulfilled. The study found that the contribution of research with regards to conservation of natural resources has been conducted at a high rate but research with regards to assessing the VBR has been minimal. Research has been

undertaken by government institutions, academia, private institutions that made and continue to make significant contributions to the knowledge base. In 2015 there was large number of studies conducted on conservation of natural resources, whilst 2016 had the lowest number of research for Vhembe Biosphere Reserve. The research conducted was mostly on other topics, but not for evaluating the VBR. There has been no document or research in the past five (5) years that was on evaluating VBR.

5.3 Conclusions in Relation to Research Questions

The question of whether VBR is effective in the conservation of natural resources has been answered. It was found that natural resources are conserved and protected by the community members, government and private entities including international bodies. METT-SA has been used to assess the protected areas to ensure conservation of natural resources for the benefit of future generation. Although there are challenges within the area, there is a need to involve more structures to protect the natural resources for the benefit of future generations.

The question on whether VBR is effective in the development of VDM has also been answered. It was found that conservation of natural resources is considered during development and there are programmes and projects that are aimed at the development of VBR as a whole through funding from different donors.

The question on whether VBR research, contributes to sustainable natural resource management has also been answered. Research has been conducted by different entities in relation to sustainable natural resource management. However, there has been no research that relates to assessing the effectiveness of VBR

5.4 Recommendations

Biosphere reserves, with their interrelated objectives of conservation, development and logistic support, offer a practical and creative approach to the imperative of linking conservation and sustainable development. From the findings of the present study it is clear that the Biosphere Reserve concept is poorly-known, compared to other conservation designations, and that the biosphere reserve concept provides opportunities to revive the

local economy, research, job creation and conservation of natural resources.

There should be verification process as part of the assessment in the implementation plan for the METT-SA conducted in all protected areas. These should include a detailed discussion and presentation process to develop, elaborate, clarify and/or present the METT-SA assessment findings, using interviews and discussions groups to discuss the results in all areas assessed. The discussion will provide the opportunity for the protected area managers, staff and community leaders and visit offices and staff outpost, which provided useful insights and context into the management of the site. The meetings will be able to assist in ensuring that the results are as per the reality of the situation on the ground. Furthermore, METT-SA should be conducted annually in all protected areas. There should also be funds available to deal with challenges identified during assessment to improve protected areas in VBR.

Intense environmental awareness is required to ensure the communities are aware of the concept and environmental management. Government, together with private entities, should join hands to ensure that there is improvement with regards to conservation of natural resources within VBR. The environmental management programme will describe specific measures that must be taken to minimize negative impacts and should include measures to reduce all environmental impacts identified in the study. The monitoring and implementation of environmental management plan and programmes should continue to be undertaken by the department and municipalities in order to verify, and to take precautionary measures to reduce the impact within VBR.

As the mine has been operating in this area most areas were left without vegetation. There is a need to develop a customised strategy for the rehabilitation of the area that will take into consideration the landscape attributes and provide the best appropriate rehabilitation approach. The mine should put rehabilitation in place, to transform the area into its original state or to the area acceptable by the authorities responsible for mine environment policy. Trees and grasses should be replanted in the area considering the weather conditions of the area to prevent soil erosion. The characteristics of this vegetation should resemble that of the natural environment except for the early growth, which may be a protective cover crop of non-seeding annuals. Only suitable vegetation should be selected as the area is very dry and cannot support plants that need lots of water. During re-vegetation some of

the mine tailings should be reduced so that even if there could be high rainfall or wind the vegetation should not be damaged and or washed away. The Department of Mineral Resources should strictly enforce mine closure requirement including the rehabilitation of areas in which mining no longer takes place, since the Department administers the funds for rehabilitation of former mining sites.

There is a need for additional funding and development of programmes and projects aimed at sustainable conservation of natural resources within the VBR. Government and private entities should continue to assist the community initiatives aimed at the development of the VBR. Consequently, the municipality together with government departments should ensure that prior developments environmental impact assessment is followed to ensure compliance when there are developments. Also more officials should be employed to ensure that there is conservation of natural resources in VBR.

There is a need for more research projects on the effectiveness of biosphere programme in VBR, to assist the government in making decisions when there are developments. This would help to minimise the impact of wrong decisions during development. This research should serve as the eye opener for further studies in these areas.

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Appendix A

Questionnaire for Community Members

Section I: DEMOGRAPHIC DATA

INSTRUCTION: Kindly, mark with a tick (✓) or an X in the box against the options that correctly represent you below.

1. Sex

1.	Female	
2.	Male	

2. Age

1.	20 – 30	
2.	31 – 40	
3.	41 and above	

3. Qualification

1.	No formal schooling	
2.	Primary	
3.	Secondary	
4.	Post-secondary	

4. Employment status

1.	Employed (other)	
2.	Employed by the government	
3.	Self employed	
4.	Un-employed	

5. Number of years residing in the area.

1.	<10 Years	
2.	10-19 Years	
3.	20-29 Years	
4.	30 +	

6. Position/status within the village

1.	Traditional Leader	
2.	Political Leader	
3.	Community member	

Other:.....
.....

7. What is your main source of income?

.....
.....

8. On average what is your monthly income?

1.	< R3 000.00	
2.	R3 000.00 – R 5 999.00	
3.	R 6 000.00 – R 8 999.00	
4.	R 9 000.00 – R 11 999.00	
5.	> R 12 000.00	

SECTION II: ENVIRONMENTAL IMPACTS OF DEVELOPMENTS

INSTRUCTION: Kindly mark with a tick or an X within the box or parentheses against the option that correctly represent your perception of the impacts caused by developments.

9. Which key environmental impacts are/is visible in you're the area? Tick

1.	Water pollution	
2.	Waste	
3.	Air pollution	
4.	Deforestation	
5.	Land slide	
6.	Pouching	

Specify others:.....
.....

10. Are there any projects/programmes to manage such impact?

1.	No	
2.	Yes	

If yes specify:.....
.....
.....

11. Are there any mining activities in your area?

1.	No	
2.	Yes	

12. Are there any disturbed/impacted areas caused by the mine operation?

1.	No	
2.	Yes	

If yes, indicate the area and extend at which the area has been impacted:
.....
.....
.....

13. Do you have mine waste dumps in your area?

1.	No	
2.	Yes	

If yes, what are the impacts of these mine waste dumps?
.....
.....
.....

14. Are there people living next to the mine waste dumps?

1.	No	
2.	Yes	

If yes specify:.....

15. Does the mine conduct/undertake rehabilitation of the despoiled land?

1.	No	
2.	Yes	

16. Are you involved in decision making that occurs in your area?

1.	No	
2.	Yes	

17. What do you use the available land for?

Specify.....

18. What is the impact of the developments on land use?

1.	No	
2.	Yes	

If yes specify:.....

19. What are health the risks caused by any developments to the community?

Specify:.....

20. What is your opinion regarding developments in your area?

Specify.....
.....
.....

21. Has there been any controversy over developments and conservation in your area?

1.	No	
2.	Yes	

If yes specify:
.....
.....

APPENDIX B

QUESTIONNAIRE FOR THE VHEMBE BIOSPHERE RESERVE MANAGEMENT COMMITTEE AND LEDET OFFICIALS

1. What are the functions of the proclaimed Vhembe Biosphere Reserve?

Specify:.....
.....
.....
.....

2. What significant environmental risk(s) are/is involved due to developmental activities?

Specify:.....
.....
.....

3. What procedures are in place to manage these risks?

Specify:.....
.....
.....

4. Who is responsible for ensuring that the procedures are followed?

Specify:.....
.....
.....
.....
.....

5. What sort of polluting emissions to the air are a result of the development? Tick

1.	Dust	
2.	Smoke	
3.	Exhaust fumes	

6. Does the mine conduct/undertake a process of rehabilitation of the ravaged land?

1.	No	
2.	Yes	

Specify:.....
.....
.....
.....

7. To what extent is the adherence to the by-laws and acts within the area?

Specify:.....
.....
.....

8. Does the municipality take into account the environmentally relevant national laws concerning the utilization of natural resources?

1.	No	
2.	Yes	

If yes, specify:
.....
.....
.....

9. What is the department doing to address negative impacts caused by developments?

Specify:.....
.....
.....

10. Did VBR designation influence employment rate in the area?

Specify:.....
.....
.....

11. Which activity/activities is/are VBR involved in for the development of the community?

Specify:.....
.....
.....

12. How is the biosphere benefiting the communities?

Specify:.....
.....
.....

13. Are there any programmes/projects aimed at job creation within the biosphere?

1.	No	
2.	Yes	

If yes, specify area/s and type of projects/programmes:.....
.....
.....

14. Are there any funding opportunities for biosphere programmes/projects?

1.	No	
2.	Yes	

If yes, specify:
.....
.....

15. How is biosphere benefiting the government?

Specify:.....

.....
.....

16. Has there been any controversy over development and conservation? Tick the applicable one.

1.	Yes	
2.	No	

Why?:.....
.....
.....

17. Do you have any suggestion of steps to make the biosphere function properly?

.....
.....
.....

18. Do the Biosphere Reserve criteria and existing conservation designations make provision for a structure for management/ governance/ monitoring? If yes, how does it compare to this structure?

.....
.....
.....
.....

Appendix C

Limpopo METT-SA Report

**THE METT (MANAGEMENT
EFFECTIVENESS TRACKING TOOL)
REPORT FOR 2016-2017 FINANCIAL YEAR
LIMPOPO**

1. INTRODUCTION

According to the agreement between DEA and the Department of Economic Development Environment and Tourism Limpopo and all provinces a yearly METT assessment must be conducted on management effectiveness on reserves managed by the relevant departments. The results from this yearly assessment must be handed to DEA at the end of each financial year. From 2010 to the end of financial year 2014-2015 the METT version one was used as the assessment tool. For the assessment year 2015-2016 and 2016-2017 the newly develop tool METT version 3 was used, as agreed. A total of 28 areas (2015-2016) were assessed and 34 areas (2016-2017) by the Sub Directorate Protected Areas Regulations. The methodology used will be discussed in detail later in the report.

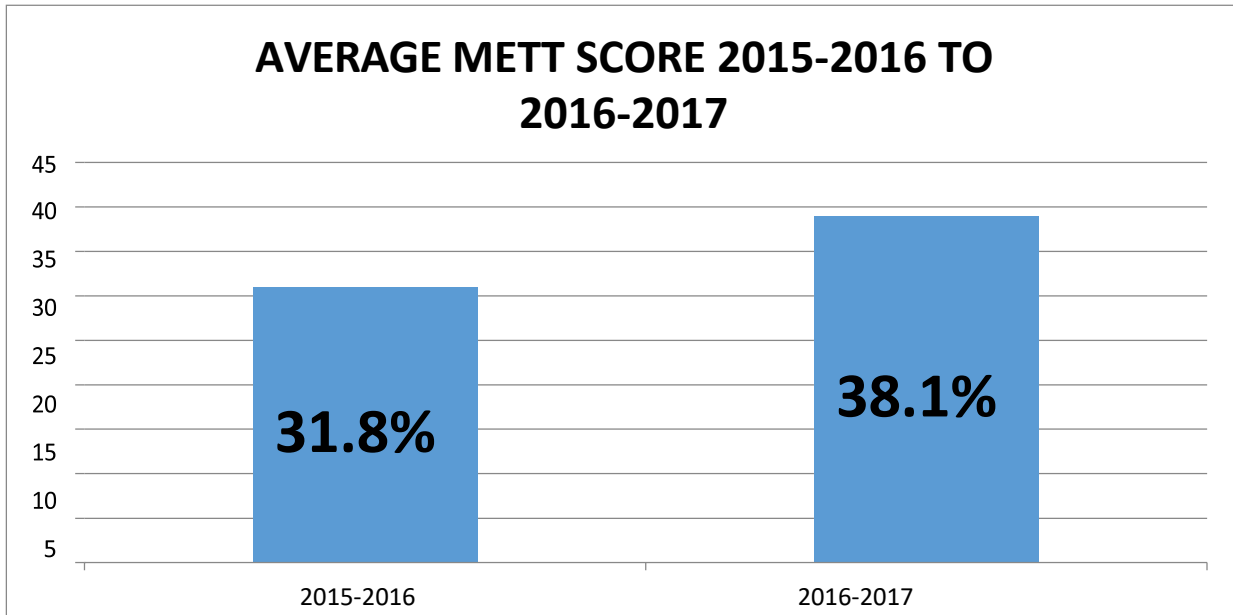
2. METT 3 BASELINE

As the METT assessment is based on sound scientific methodology and the fact that METT 3 was introduced in 2015 it is decided to use 2015-2016 assessment data as baseline figures in terms of the METT. Pre 2015-2016 METT assessment cannot be used as comparison under the new METT 3.

3. METT SCORE ANALYSES

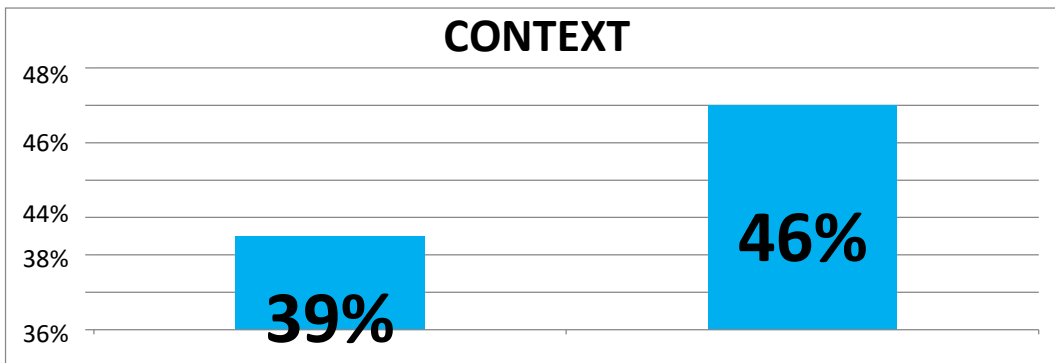
3.1 LIMPOPO AVERAGE METT SCORE

In 2015-2016 financial year the average METT score for LIMPOPO was 31.8% and in 2016-2017 financial year it was 38.1%. This is an increase of 6.3%.



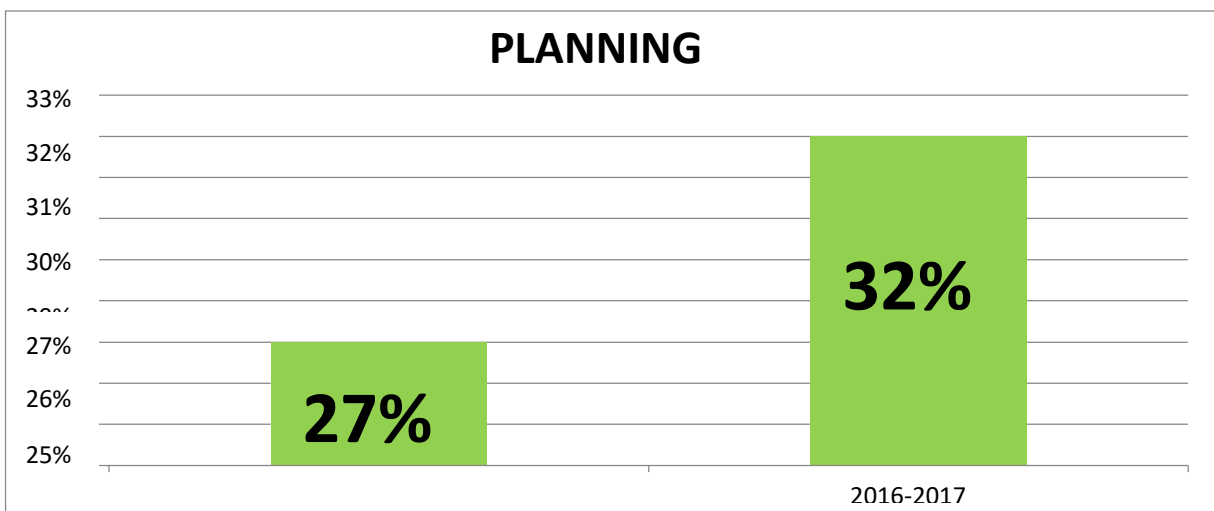
3.2 LIMPOPO ASPECT METT SCORE

3.2.1 CONTEXT



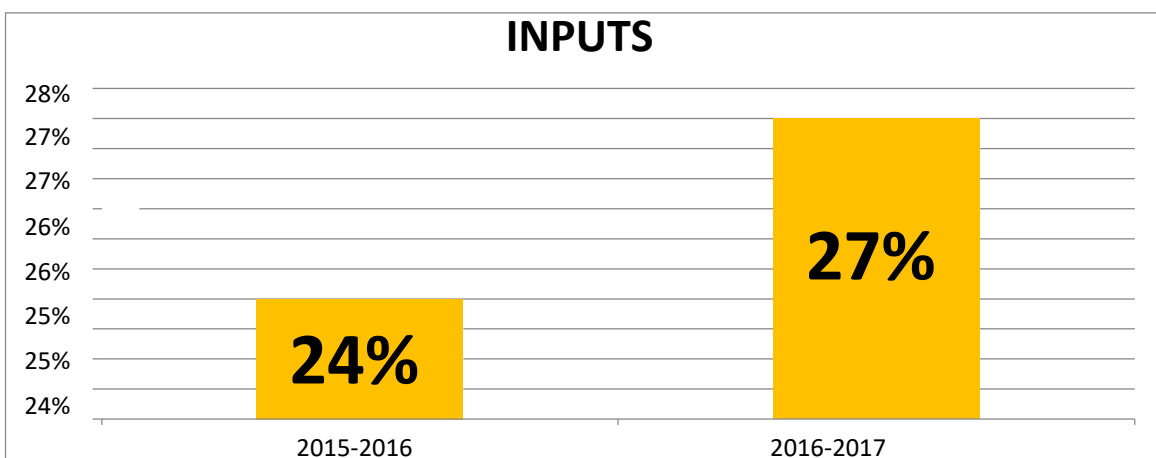
The average scores for the context aspect has increased by 7% for all areas assessed in Limpopo mostly due to the fact that areas are declared as Nature Reserves.

3.2.2 PLANNING



The average score for the planning aspect has increased from with 5% from 2015-2016 assessment to the assessment in 2016-2017.

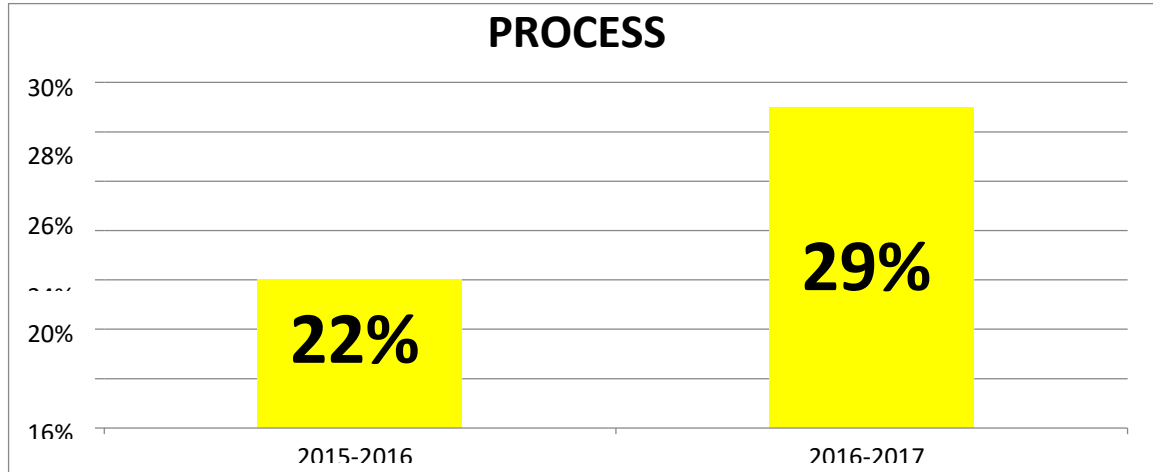
3.2.3 INPUTS



The average score for the input aspect has increase with 3% in the last two assessment years.

3.2.4

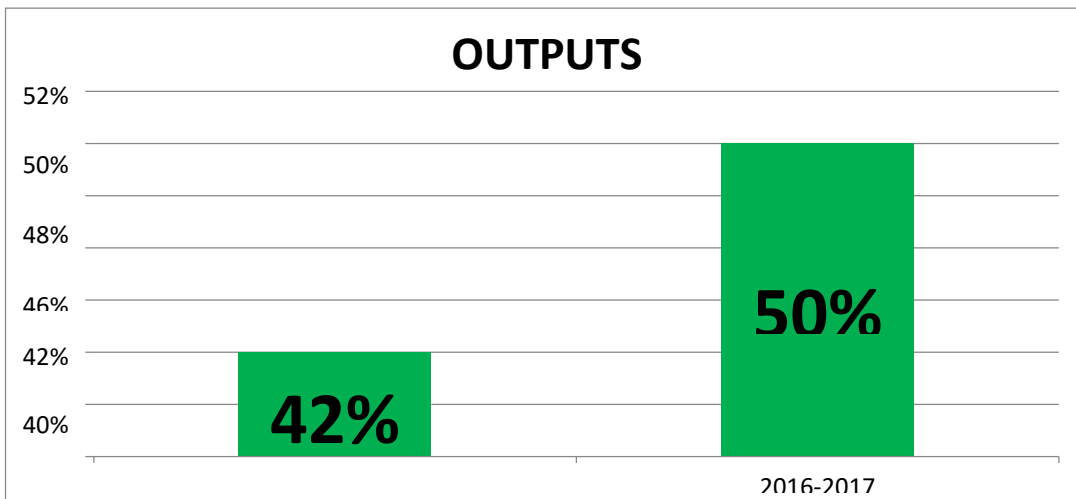
PROCESS



The average score for the process aspect for Limpopo areas assessed has increased by 7% in the last two assessments.

3.2.5

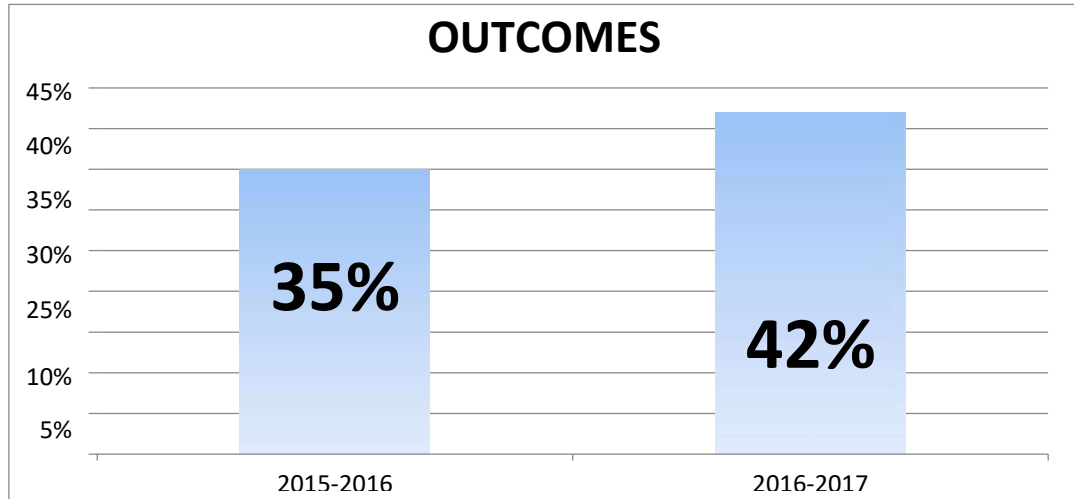
OUTPUTS



The average score for the output aspect has increased by 42% to 50% in the last two assessments, this is an increase of 8%.

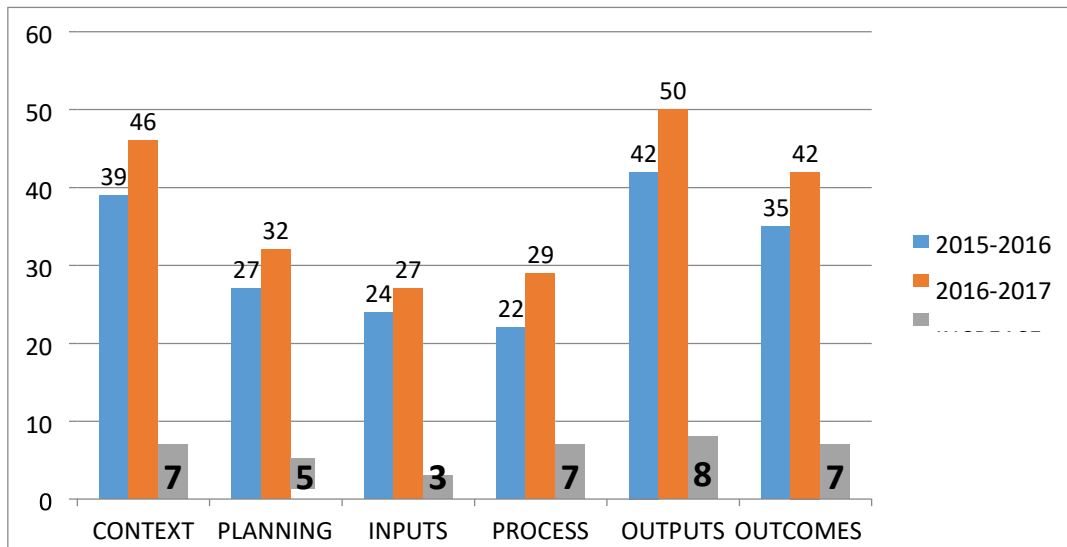
3.2.6

OUTCOMES



The average score for the outcome aspect has increased by 7%.

3.3 LIMPOPO AVERAGE METT SCORE PER ASPECT



It is clear from the chart above that the input aspect has shown the lowest increase from all aspects. This aspect only increased by 3%. It is clear that this aspect needs to be addressed.

The planning aspect has also shown the second lowest increase in score of 5%.

All other aspects have shown an increase score of between 7 and 8%. It is thus clear that, in general, with stagnant planning and low increase inputs, these areas are increased in terms of context, process, outputs and outcomes. This is commendable.

3.4 LIMPOPO AVERAGE INCREASE METT BASELINE SCORES PER RESERVE

3.4.1 STAGNANT METT BASELINE INCREASE SCORES RESERVES

Stagnant reserves are areas where the increase in average METT scores is between 0 and 1%. The following reserves are classified as stagnant reserves:

• Lekgalameetsi	• Tzaneen Dam
• Manombe	• Mogol Dam
• Happy Rest	• Witvinger
• Rust de Winter	• Modjadji
• Bewaarkloof	• Bothasvley

3.4.2 LOW METT BASELINE INCREASE SCORES RESERVES

Low METT score baseline reserves are areas where the increase in average METT scores is between 2% and 9%. The following reserves are low reserves:

• Percy Fyfe	• Schuinsdraai
• Makuya	• Brackenridge
• Atherstone	• Doorndraai
• Wonderkop	• Mantrombi
• Letaba Ranch	• Lillie
• Hans Merensky	• Dnyala
• Nwanedi	• Leswena

3.4.3 MEDIUM METT BASELINE INCREASE SCORES RESERVES

Medium METT score baseline reserves are areas where the increase in average METT scores is between 10% and 15%. The following reserves are low reserves:

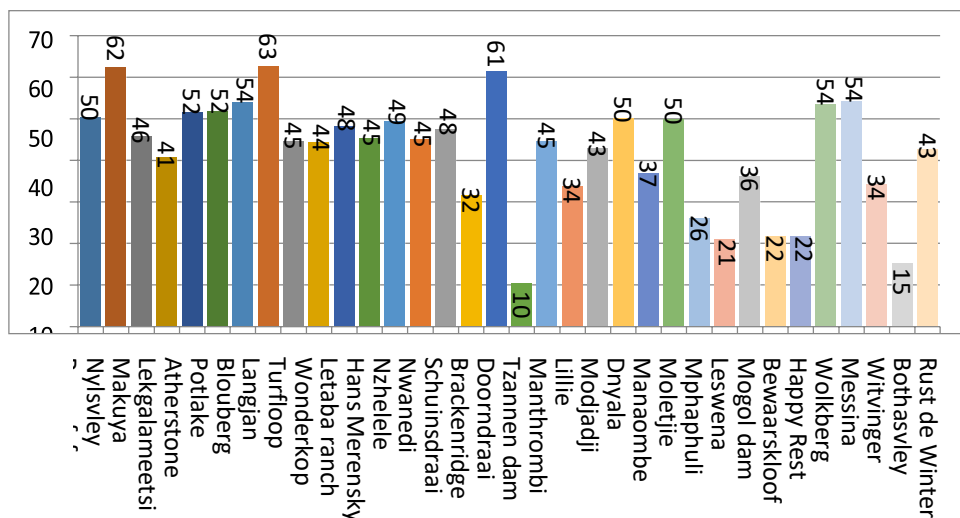
- Potlake; Blouberg; Nzhelele and Messina

3.4.4 HIGH METT BASELINE INCREASE SCORES RESERVES

High METT score baseline reserves are areas where the increase in average METT scores is between 16% and higher. The following reserves are low reserves:

- Langjan; Turfloop; Moletjie and Wolkberg

3.5 LIMPOPO AVERAGE METT SCORES PER RESERVE 2016-2017

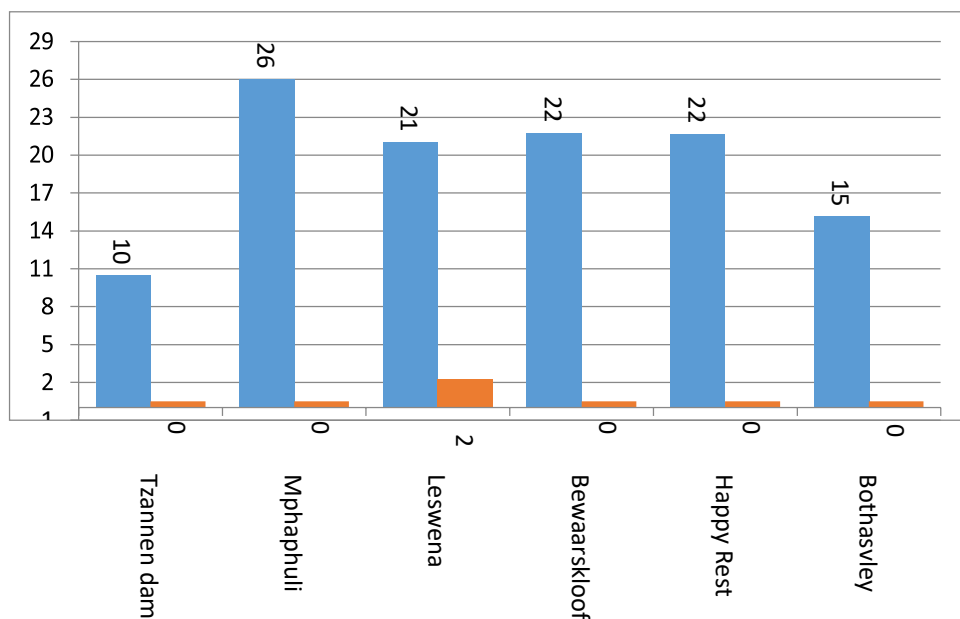


3.6 LIMPOPO AVERAGE METT SCORES PER RESERVE 2016-2017 vs INCREASE BASELINE SCORE

3.6.1 LOW AVERAGE METT SCORE AND STAGNANT METT INCREASE

This is areas that have a METT average score of less than 27% and have shown a METT baseline increase below 3%.

- Tzanneen Dam; Mphaphuli; Leswena; Bewaarskloof; Happy Rest and Bothasvley



4. METHODOLOGY

Methodology used in provinces is approached differently and are dictated according the capacity of each province. Limpopo is the provinces with the highest number of areas to be assessed in South Africa. Currently in the Sub Directorate Protected Areas Regulation three officers and two students are used to conduct assessments. Their team consists of a Deputy Director, Assistant Director, Environmental Officer and two students.

Due to the staff constraints and the high amount of areas to be assessed, as well as the cost implication it was decided to have a clustered approach to the assessments. Clusters were identified with reserves which are geographical close together. Clusters were consisting of two to five reserves respectively and in some cases single reserve were assessed.

At each assessment one officer was directing the assessment and each reserve was scored according to the discussion. Each reserve assessed was assisted by an officer who captured the score and comments as discussed. The schedule for the cluster visits was however revised a few times due to travelling and resource constraints and cancellations by Reserve Managers.

5. GENERAL ANALYSES

6. GENERIC ISSUES FROM 2015-2016 ASSESSMENT

During the 2015-2016 assessment numerous issues were identified where all reserves assessed scored 0 or 1 in the METT 3 results. These issues will be discussed in length below.

6.1 *Boundary deviations (Question 1.3.1 of METT)*

In all reserves where boundary deviations were present no maps or agreements exist for these deviations. Deviations are identified where fences are not on cadastral boundaries.

Steps to be taken:

- a) Reserve managers to request investigation on deviations with Protected Areas Directorate.
- b) Reserve managers to set up meetings with stakeholders to discuss these issues.
- c) Legal services to assist in drawing up agreements as required.
- d) Reserve Manager to ensure that agreements are kept safe at reserves.
- e) State Owned Director to ensure copies of all agreements is filed at Head Office.

6.2 *Servitude register (Question 1.3.2 of METT)*

In all reserves where there are servitudes, there were no servitude maps and paperwork or proclamations of these servitudes. Also no register exists for all servitudes on the reserve. Steps to be taken:

- a) Reserve manager to request investigation into servitudes on the reserve.
- b) Protected Areas Proclamation to investigate servitudes according to deeds of the properties.
- c) Legal services to assist in legalizing servitudes not documented.
- d) Reserve Manager to develop a register of servitudes and keep document safe on reserve.
- e) Director of State Owned to keep copies of all servitudes at Head Office.

6.3 *Cultural Heritage Knowledge (Question 1.5 of METT) Management plan for Cultural Heritage assets (Question 2.5 of METT) Biodiversity Management Plan for Heritage Sites (Question 2.6 of METT) Collection Management of Heritage Artifacts (Question 2.7 of METT) Cultural Heritage condition assessment (Question 6.7 of*

METT)

All aspects of heritage management need to be addressed on all reserves. Steps to be taken:

- a) Directorate State Owned to appoint accredit Heritage Assessor to conduct and develop the following:
 - Survey all reserve in terms of heritage and cultural assets and sites
 - Develop management plan and biodiversity heritage plans for identified sites
 - Develop collection and management plan for heritage artifacts where applicable on each reserve
 - Develop heritage condition assessment tool for monitoring.
- b) Director State Owned to appoint accredited Heritage Assessors to do condition assessment as per monitoring tool.

6.4 Format of Data (Question 1.5.1 of METT)

All cultural/heritage and biodiversity data to be stored in a specific format and ensure safety of data.

Steps to be taken:

- a) Biodiversity Unit to assist State Owned Directorate to develop a Database for all data and information with assistance of IT section of Department.
- b) IT section of department to develop back up system for safety of data.
- c) Reserve Manager to ensure that all data and info collected is stored in the database as per plan.

6.5 Risk Assessment (Question 1.6 of METT)

All reserves need to conduct a fully-fledged risk assessment per reserve with recommendation and implementation plan.

Steps to be taken:

- a) Reserve manager to request a full risk assessment per reserve from Risk Management Section.
- b) Risk Assessment to facilitate the appointment of accredited risk assessment for reserve risk assessment.
- c) Conduct periodical risk assessments per reserve.

6.6 Protected area expansion plan (Question 2.1.1 of METT)

In all reserves where expansion is possible it is needed to develop an expansion plan. Steps to be taken:

- a) Reserve manager to request an expansion plan from Protected Areas Development for each reserve.
- b) Protected Areas Development to develop expansion plan with reserve manager for each reserve.

6.7 Delineation of zone of influence (Question 2.1.2 of METT)

All reserves need to develop a map and description of the zone of influence of the reserve. This is the spatial area where the reserve needs to influence its surrounding. Example communities next to reserve.

Steps to be taken:

- a) Reserve manager to identify the reserves zone of influence and describe it.

- b) Reserve manager to request development of map for the area.
- c) Reserve manager to compile a report and map describing the zone of influence.

6.8 Education, Awareness and interpretation program (Question 2.3 of METT) Implementation of education, awareness and interpretation programs (Question 4.9 of METT)

On all our reserves no education, awareness or interpretation programs exist. Each reserve needs a program where applicable.

Steps to be taken:

- a) Reserve Managers to request Environmental Empowerment Services to develop plans for each reserve.
- b) Environmental Empowerment Services to develop plans.
- c) Implementation of plans as indicated.

6.9 Restoration of degraded areas (Question 2.6 of METT)

In most of our reserves ad hoc restoration programs takes place which includes erosion work, alien plant control and bush encroachment eradication as examples. This activity however happens without any plans. Thus plans needs to be developed to include activities plans.

Steps to be taken:

- a) Reserve Managers to ask assistance from Biodiversity Directorate to develop plans for these activities.
- b) Reserve Managers with Biodiversity to collect information and data for the plan.
- c) Reserve Manager with assistance of Biodiversity to develop all plans.
- d) Reserve Manager and staff to implement plans as developed.

6.10 Management research programs (Question 3.1 of METT)

In all of the areas that are managed by LEDET, no reserve management related research have been identified or conducted. There is a need to identify research needs and to look for possible solutions to address these research needs.

Steps to be taken:

- a) Reserve Managers to request Directorate Research and Planning to assist in identification of research needs on each reserve.
- b) Directorate Research and Planning to conduct research needs analysis.
- c) Directorate Research and Planning facilitate linking researchers with Reserve needs.
- d) Reserve Managers to manage researchers on their reserves.

6.11 Relationship with researchers (Question 3.1.2 of METT)

When research will be conducted on our reserves, there are no protocols on how to manage the activities. There is a need for protocol in terms of conduct, monitoring and reporting on research that are taking place on our reserves. It

must also include what happens with research reports and proposals for management.

Step to be taken:

- a) The Director of State-Owned must request Directorate of Research and Planning with collaboration with reserve managers to come up with a protocol.
- b) Reserve Managers to implement this protocol on their reserves.

6.12 Human Resource Capacity (Question 3.2 of METT)

This aspect is of major concern to our reserves. The following aspects are relevant to our reserves.

The following reserve has no human resource capacity, as there are no organogram for the reserve and no staff is deployed on these areas permanently:

- Bothasvley
- Happy Rest

On the rest of the areas there is limited capacity due to the following:

- The organogram of the Department is not aligned to the organogram in the management plans of the reserves.
- Vacancies exist and some posts in the organogram as vacant but unfunded.
- In most reserves the majority of staff is over 55 years old and cannot perform optimally.
- There is lack of job specific training of general staff.
- In some cases, staff are deployed to position for which they were not recruited or trained, especially for gate guards.
- Skills training of general staff does not take place. Steps need to be taken:
 - a) In selected reserves organograms and structures must be developed and approved by LEDET. The post in this new organogram must be filled.
 - b) HR and Director State-Owned must jointly ensure alignment of organograms in HR and in Management plans.
 - c) Ensure that staff is correctly deployed in reserves.
 - d) Director of State-Owned Reserves needs to contact Human Resource Development to implement training.

6.13 Adequacy of operational budget (Question 3.3 of METT) Security of operational budget (Question 3.4 of METT) Capital budget (Question 3.4.1 of METT) Budget management (Question 3.4.2 of METT) Delegation of management of budgets (Question 3.1.3 of METT)

All of the reserves do not have a dedicated budget for each reserve. The budget is centralized at head office. There is also not a capital budget for each reserve. Budget is managed at Head office level and reserves managers are not delegated to manage a budget.

Steps to be taken:

- a) Budgets must be de centralized as to give each reserve a dedicated budget by Director State Owned Reserves.
- b) Capital budget for each reserve must be developed.
- c) Budget management and delegation to manage these budgets must be delegated to each Reserve Manager.

6.14 Fund Raising (Question 3.5.1 of METT) Reserves have got no fund raising capacity. Steps to be taken:

- a) The Department to investigate the establishment of a unit to handle fund raising issues on Nature Reserves.

6.15 Health and Safety (Question 3.10 of METT)

No health and Safety assessment are being done on reserves. No recommendation exists to conform to Health and Safety issues on the reserve.

Steps to be taken:

- a) Reserve manager request a health and safety assessment for each reserve.
- b) The Director State-Owned Reserves to appoint accredited assessors to do assessment.
- c) Reserve Managers to implement recommendations of assessment.

6.16 Staff Housing (Question 3.11 of METT)

There is no staff housing policy ion the reserve to determine standards. Steps to be taken:

- a) Director of State-Owned Nature Reserve request Support Services to develop a policy on staff housing.
- b) LEDET to ensure staff are housed according to policy.

6.17 Annual plan of operations (Question 4.1 of METT)

Currently no Annual plan of operation exists for the reserves. The plans need to be developed yearly and must be signed.

Steps to be taken:

- a) Reserve Managers to develop annual plans yearly for each reserve.
- b) Director State-Owned Reserves to sign off plans as aligned to the budget.
- c) LEDET to ensure budget I made available to implement annual plan.

6.18 HR Management System (Question 4.3 of METT)

Most of the reserves agreed that HR Management and staff development are poor and constraints effectiveness.

This is due to the fact that training of general staff is non-existent in the last few years.

Steps to be taken:

- a) HR to do a skills audit of all staff on Nature Reserves.

- b) HR to develop a development plan for reserves staff training.
- c) LEDET to ensure budget is made available for training purposes.
- d) HR implement development plan for reserve staff.

6.19 Administrative support system (Question 4.4 of METT)

The reserves indicated that the Administrative system is poor and contains effectiveness. The procurement system is slow and the quality of good is not up to standard.

Steps to be taken:

- a) Director State-Owned Reserve to set up meeting with Procurement unit to solve problems.

6.20 Information Technology System (Question 4.5 of METT)

On some reserves there is no information technology infrastructure and on other reserves with some infrastructure there are connectivity problems.

Steps to be taken:

- a) IT section to do a full IT assessment on reserves.
- b) IT section to look at options for each reserve and develop a plan.
- c) IT section to implement plans as agreed.

6.21 Maintenance of operational equipment (Question 4.6 of METT)

From the reports of the Reserve Manager it is clear that maintenance of equipment is done on an ad hoc basis and no schedules exist. Equipment is repaired when broken and not when scheduled.

Steps to be taken:

- a) Reserve Managers to compile list of all equipment on the reserve.
- b) Reserve Manager to develop schedules for each piece or group of equipment.
- c) LEDET to ensure budget is made available for maintenance.
- d) Reserve Manager to ensure maintenance schedules are adhered to.

6.22 Maintenance of operational infrastructure (Question 4.6.1 of METT)

Infrastructure on all reserves is being done on an ad-hoc basis and when budget is available. No plans or schedules exist for the maintenance of operational infrastructure.

Steps to be taken:

- a) Reserve Manager to develop schedules and maintenance plans for all operational infrastructures.
- b) LEDET to ensure budget is made available for maintenance.
- c) Reserve Managers to implement plans and schedules.

6.23 Maintenance of transport fleet (Question 4.6.2 of METT)

The reserve fleet consist of GG vehicles as well as other vehicles not GG vehicles like boats, tractors, trailers, graders

and TLB, s. Government Garage vehicles are serviced according to manufacturer specification, however other vehicles are serviced on an ad hoc basis or when the vehicle brakes down. Maintenance schedules needs to be developed for non GG vehicles and a guideline must be developed to look at the standard of maintenance on non GG vehicles.

Step to be taken:

- a) Transport section of the department to assist in development of maintenance schedules for non GG vehicles.
- b) Transport section of LEDET to develop guidelines to evaluate standard of maintenance of non GG vehicles.
- c) Transport section to ensure non GG vehicles are maintained according to schedules and standards.
- d) LEDET ensure that budget is made available for maintenance of transport fleet.

6.24 Maintenance of tourism infrastructure (Question 4.7 of METT)

Tourism infrastructure is currently managed by two different units, LTA in some reserves and State Owned Directorate in other reserves. The function of maintenance of all infrastructure needs to given to one unit. A full tourism infrastructure development plan must be developed which includes a comprehensive maintenance plan for each reserve. This must for part of the management plan of the reserve.

Steps to be taken:

- a) LEDET to identify unit to develop and maintenance tourism infrastructure.
- b) The identified unit to develop tourism development plans which includes maintenance plans for each reserves tourism infrastructure.
- c) Identified unit to implement all tourism plans.

6.25 Public relation and communication programs (Question 4.10 of METT)

Reserves do not have any reserve specific public relations and communication programs to inform the public about the reserve.

Steps to be taken:

- a) EES with Communication unit of LEDET to develop a program for each reserve.

6.26 Management of hazardous substances (Question 4.13 of METT)

The staff on the reserve does not have training in handling hazardous material. There is no clear policy or procedure on how to handle these materials. Some reserves do not have any infrastructure to handle hazardous material and those that have infrastructure are not up to standard.

Steps to be taken:

- a) State-Owned Nature Reserve must request training for its entire staff to handle hazardous material through Human Resource Development unit.

- b) State-Owned Nature Reserves must request the development of infrastructure for hazardous material for all reserves in line with legislation.
- c) State-Owned Nature Reserve must develop a policy and operational guideline for the handling of hazardous material.

6.27 Environmentally responsible practices (Question 4.16 of METT)

No reserve has an environmentally responsible policy and programs. Steps to be taken:

- a) State-Owned Nature Reserves to develop a policy on environmentally responsible programs.
- b) State-Owned Nature Reserves to develop programs for each reserve in terms of environmentally responsible programs.

6.28 Integrated Compliance program (Question 5.2.1 of METT)

All reserves are in need of a fully comprehensive compliance plan (Security plan). Steps to be taken:

- a) State-Owned Nature Reserves with Security Services of the Department to appoint service provider to develop plans for each reserves.

6.29 Economic and Social Benefit Assessment (Question 6.1 of METT)

No economic or social benefit assessment has been done of our reserves. Steps to be taken:

- a) State-Owned Nature Reserves with Protected Areas Development appoint service provider to do assessment for all the reserves.
- b) Service provider to develop plans to improve benefits.

6.30 Achieving of Biodiversity Targets (Question 6.2 of METT)

Currently no systems exist to evaluate achievement of biodiversity targets on nature Reserves. Steps to be taken:

- a) Biodiversity Directorate to develop a system to evaluate achievement of targets

6.31 Ecological processes (Question 6.3 of METT)

Currently no systems exist to evaluate ecological processes on nature Reserves. Steps to be taken:

- a) Biodiversity Directorate to develop a system to evaluate ecological processes.

6.32 Ecosystem services (Question 6.4 of METT)

Currently no systems exist to evaluate Ecosystem services on nature Reserves. Steps to be taken:

- a) Biodiversity Directorate to develop a system to evaluate ecosystem services processes.

7. SUMMARY

Limpopo areas that was assessed in the 2016-2017 financial year has shown improvement in their average METT scores. This is a sign that continual improvement is achieved as per METT objectives. Been a There has been a 6.3% increase achieved.

It however is concerning that areas are still challenged in terms of inputs. Funding of these areas is a source of major concern as small improvement has been made in this regard. It must also be noted that the negative spinoff in term poor funding of these areas are influencing all other aspects of the METT.

For Limpopo areas to improve in the future it is necessary to address the lack of funding of these areas and more specific the funding of the approved management plans.

A second concerning issue is relating to staffing of the areas. Some areas are without reserve managers or in some cases limited supervision and staff training is lacking.

Appendix D







GMC Assessment Criteria

SELECTION CRITERIA AND SCORE SHEET: GREENEST MUNICIPALITY COMPETITION 2017

NAME OF DISTRICT MUNICIPALITY:

LOCAL MUNICIPALITY:

Criteria

-  Waste Management
-  Energy Efficiency and Conservation;
-  Water Management;
-  Landscaping, tree planting and beautification;
-  Public Participation and Community Empowerment;
-  Leadership and Institutional Arrangements

1. WASTE MANAGEMENT

/60

1.1 IWMP in place?

- Is IWMP approved by council?
- Implemented?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

1.2 Waste information system

- Does the municipality conduct waste management activities listed in annexure 1 of the national waste information regulations, 2012? If yes, are such activities registered and reporting waste data to the South African waste information system (SAWIS) established in terms of section 60 of the waste act.
- **Evidence: SAWIS registration certificate, reported waste data extracted from the SAWIS.**

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

1.3 What does the municipality do to prevent and minimize waste generation?

- What does the municipality do to re-use & recycle waste? (BBC's)

Strengths:

Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

1.4 Waste Disposal Facilities

Is there a land fill site? Yes

Is it licensed? Yes

Is it fenced? Yes

Is there compaction and daily covering? Yes....

Is the landfill Internal and external audit conducted and audit report? Internal audit conducted quarterly

What is the remaining life span?

Leachate management?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

1.5 Transfer Station

Is there a transfer station?

Is the transfer station registered?

Is it fenced?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

1.6 Drop-off areas

Is there a drop off area or site?

What waste can be dropped off at these stations? General waste/ garden waste

General cleanliness around drop-off

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

1.7 General Cleanliness in town

Waste receptacles placed in town centre and along streets?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

1.8 General cleanliness of urban residential and Townships areas

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

1.9 General cleanliness of rural areas

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

1.10 General cleanliness of industrial areas

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

1.11 Hazardous Waste Management

- Management of oil in the municipal areas.
- Health care risk waste management
- E waste and Chemical waste

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

1.12 Does the municipality waste sector contribute to the green economy through job creation, SMME's and cooperatives?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

2. ENERGY EFFICIENCY AND CONSERVATION

/20

2.1 "Green" Buildings

- Does the Municipality promote "green buildings and developments" such as solar heating, environmental friendly materials, water use, insulation, retrofitting?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

2.2 What is the Municipality doing to reduce their carbon footprint?

Does the municipality know their carbon footprint?

Mercury and Methane management.

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

2.3 Energy Audits

- GMC participants should demonstrate that they conduct some kind of energy audits every year to ensure that they understand their energy's environmental footprints.
- The first energy audit would be to establish baseline against which targets will be set.
- Is there evidence of the audits?
- Machinery (boilers, air-conditioning systems, computers, printers, faxes, light bulbs, elevators, incinerators, etc.);
- Systems (mechanisms that the municipality are using to ensure that they can reduce the carbon footprints, including but not limited to switching off lights and machineries when not in use);

Strengths:
Challenges:

Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

2.4 STRATEGY

- An energy efficiency strategy could add a lot of value in getting the participants to move towards a desired position.
- Does the participating municipality have a strategy to address energy challenges?
- Once the strategy has been developed, the next logical step is to ensure implementation, review and improvements.
- Is there a strategy in place? Proof?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

3. WATER MANAGEMENT AND CONSERVATION

/45

3.1 Does the municipality have blue drop water status? *(Per Facility)*

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

3.2 Does the municipality have green drop water status? *(Per facility)*

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

3.3 Does the municipality have projects on water harvesting?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

3.4 Water management in municipal buildings;

- Toilets?
- Kitchens?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

3.5 Water management in parks and gardens

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

3.6 Does the Municipality do water audits and water balancing in order to address water use efficiency? *Evidence is needed.*

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

3.7 Sewer management?

- Is the sewer plant operated correctly?
- Are there any contingency plans when equipment breaks?
- When blocked sewers are reported, what is the response time for unblocking the problem?
- Sewage volume and infrastructure.

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

3.8 Reuse of water – use of Black Water

Strengths:					
Challenges:					

Overall observations/recommendation:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

3.9 Does the municipality have a system where customers report water breakdowns?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

4. LANDSCAPING, TREE PLANTING AND BEAUTIFICATION

/30

4.1 How does the municipality manage parks?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

4.2 How does the municipality manage open spaces and leisure/tourist attractions?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

4.3 Tree planting initiatives

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

4.4 Invader plant control;

- How does the municipality address plant invaders?

Strengths:					
Challenges:					

Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

4.5 Does the municipality have or support local nursery?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

4.6 Do the municipality have a policy on greening actions?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

5.1 Governance:

/50

5.1.1 PUBLIC PARTICIPATION AND COMMUNITY EMPOWERMENT

- How does the municipality empower communities?
- Conservancies?
- Environmental Forums?
- Eco-schools?
- Any other?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

5.1.2 Schools:

- Municipalities to mention outstanding school programs!
- Evaluators to choose random any other school!
- General waste management at schools, recycling, re-use, reducing of waste and food gardens.

Strengths:					
Challenges:					
Overall observations/recommendations:					

0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

5.1.3 Environmental Management at Schools

- Curriculum link: Energy Efficiency, Water Management and Conservation, Waste Management.

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

5.1.4 Sanitary management

- How is the toilet managed?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

5.1.5 Environmental calendar days and week activities?

- Schools need to elaborate!

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

5.2 LEADERSHIP AND INSTITUTIONAL ARRANGEMENTS

5.2.1 Policy Statements (Vision & Mission), Env. Strategies, Env. Plans, Env.by laws.

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

5.2.2 Allocation of budget for Environment Management activities

- Alignment of budget to Environment Management activities

Strength:

Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

5.2.3 Municipal Organogram and Personnel.

- Is there designated WMO?

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

5.2.4 Mechanisms to raise environmental awareness:

- Community radio talks focusing on development and environment;
- Brochures and pamphlets focusing on environmental awareness;
- Industrial and community theatres performed at municipal offices, taxi ranks, community centres, schools, etc.;
- Schools environmental campaigns and programs;
- Formal environmental awareness training sessions; etc.
- Climate change awareness.
- Water awareness
- Energy Efficiency & Conservation

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

5.2.5 PRESENTATIONS

- Inclusiveness of all elements.
- Preparedness: Time and projector.
- Relevancy of the presentation.
- Co-operative governance.

Strengths:					
Challenges:					
Overall observations/recommendations:					
0	1	2	3	4	5
NO PERFORMANCE	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT

General observations of the Municipality

SCORE:

General observations of the Municipality

1. Areas of Strength:

2. Areas of Challenge:

3. Recommended Action: