



UNITED REPUBLIC OF TANZANIA
MINISTRY OF NATURAL RESOURCES AND TOURISM
TANZANIA FOREST SERVICES (TFS) AGENCY



MANAGEMENT PLAN FOR MOUNT RUNGWE NATURE FOREST RESERVE
(2016/17 – 2020/21)
RUNGWE DISTRICT, MBEYA REGION, TANZANIA



Enhancing Nature Reserves
Network For Biodiversity
Conservation in Tanzania

MARCH 2017



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Citation: URT (United Republic of Tanzania) (2017). *Mount Rungwe Nature Forest Reserve Management Plan*. 133 pp.

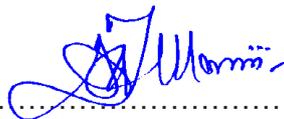


Cover Photo:
Mount Rungwe Nature Forest Reserve, Rungwe District, Mbeya Region.

APPROVAL

This Management plan for Mount Rungwe Nature Forest Reserve is approved for implementation, and will be reviewed from time to time as deemed appropriate.

Approved by:



.....
Prof. Dos Santos Silayo
Chief Executive -Tanzania Forest Services (TFS) Agency

Date: March 2017

FOREWORD

Protected areas continue to play a critical role as they are more than instruments for conserving nature, in fact they are also vital for responding to some of today's most pressing challenges, including food and water security, human health and well-being, disaster risk reduction and climate change. They are cornerstones of sustainable development strategies providing a wide range of social and environmental values, and generate significant economic resources.

The Mt. Rungwe Nature Forest Reserve (MRNFR) is a reservoir of the species heritage of Tanzania and the world at large. The area demands greater sensitivity in management interventions as well as abating threats as it is host to rare, endemic and endangered flora and fauna. The Reserve is host to two of the world's twenty-five rarest primates, the Kipunji and the Rungwe galago. It harbours important antelope including the very rare Abbott's duiker. The Reserve hosts a rich diversity of plants including those that are endemic to the Eastern Arc and the Southern Highlands of Tanzania.

Mt. Rungwe Nature Forest Reserve is also a key water tower in the region providing water to countless villages and towns for domestic, agriculture and industrial use in Mbeya, Rungwe and Kyela Districts. Providing this water through other means would be a costly endeavour and beyond the means of most of the communities currently benefiting from this service. MRNFR also has a long historic and cultural link with the people (Safwa, Nyakyusa and Kinga) around the Reserve.

By any standards and with reference to the importance of its unique biodiversity components and ecosystem services, MRNFR is small in size pointing to the need for buffer areas to augment habitats in the small reserve as well as corridors for connectivity with other reserves. This suggests a critical role and responsibility for surrounding communities and other neighbours to ensure conservation of the reserve through participation in reserve management as well as commitment to land use practices that are compatible with conservation in their areas.

Through its objectives, targets, actions and monitoring programmes this management plan pays particular attention to the proper management of the Exceptional Resource Values for Mt. Rungwe. I envisage and am confident that implementation of this management plan will go a long way to fulfil the mandate of the Reserve which is to sustain the desired state of the wilderness, water catchment qualities and the exceptional resource values for the benefit of present and future generations.

In keeping with the spirit that has been shown by all stakeholders who participated and contributed to the development of this management plan, I endorse that the care and management (2016 – 2021) of Mt. Rungwe Nature Forest Reserve will be guided by this management plan.



Prof. Dos Santos Silayo

Chief Executive – Tanzania Forest Services Agency

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EXECUTIVE SUMMARY

Mount Rungwe Nature Reserve has a long history that dates back to 1949 when it was first gazetted as a Catchment Forest. The reserve is currently 13,652.1 ha in size. MRNFR is a tropical montane forest with unique species composition, structure and biodiversity. It is an important conservation area in Tanzania, as well as having great value at regional and global levels. The reserve is also of considerable economic value to local communities and the nation as it serves as catchment area. In addition to its catchment value MRNFR is protected for its outstanding biodiversity including two flagship species, Abbot's duiker and the Kipunji monkey.

This General Management Plan for Mount Rungwe Nature Reserve is a five year plan (i.e 2016/17-2020/21) and a product of the review of the previous management plan (2008 – 2013). The Plan addresses the challenges and threats facing the reserve, issues and opportunities presented by existence of the Reserve. The plan aims to achieve this through application of forest management prescriptions and guidelines integrated into four interlinked management programmes.

MRNFR was established according to the Tanzania National Forest Policy 1998, Forest Act No. 14 of 2002. Supporting instruments included the National Forest Programme and Forest Regulations of 2004. The Reserve is under the jurisdiction of Tanzania Forest Services (TFS) Agency through G.N 386 of 2009. TFS is a semi-autonomous Government Executive Agency established through Government Notice (G.N) 269 of 30 July 2010. The reserve area's economic value includes its contribution as a water catchment, and its provision of forest resources and other ecosystem services beneficial to adjacent agricultural areas. MRNFR is also important for its potential for ecotourism. The reserve's ecosystem is also of great importance to the local communities in the area as a source of medicine, fuel wood, building materials and sacred forest area for worship and performing rituals.

MRNFR has unique resources and offers many opportunities for the development of Tanzania through its biological, hydrological, economic and cultural roles. Five exceptional values of the reserve are explained below.

Exceptional Value 1. The Montane Forest: The MRNFR is the remainder of the once extensive Eastern Arc and Southern Rift forest landscape. The reserve consists of montane and upper montane forests and high plateau grasslands, and acts as a refuge to threatened montane forest and grassland species, many of which are rare and of high conservation value.

Exceptional Value 2. Biological Diversity: The MRNFR is classified as a global centre of plant diversity in terms of species richness and endemism. It is also recognised as a site of considerable biodiversity significance due to the presence of rare, endemic and endangered species.

Exceptional Value 3. Endemic and threatened Flora and Fauna: MRNFR is home to two of Africa's rarest primates including the continent's rarest monkey, the kipunji (*Rungwecebus kipunji*). This species was discovered in recently and named after Mt. Rungwe where it was first found. The reserve is an Important Bird Area (IBA), a Primate Priority Area (PPA), and a Key Biodiversity Area (KBA) and has a high percentage of endemic species of both vertebrates and invertebrates.

Exceptional Value 4. Ecosystem, hydrology and ecological values: MRNFR is host to one of the most important water tower in Southern Tanzania. Kiwira and Mbaka Rivers emanating

from MRNFR provide domestic water to Tukuyu and Kyela Districts and Mbeya City as well as supplies to industries, estates and local communities. The southern part of MRNFR'S catchment drains into the Kyela Valley and hence Lake Nyasa and support a lot of agriculture in the region.

Exceptional Value 5. Ethno-botanical, historical values and community support: The MRNFR has plants of ethno botanical value to communities in Rungwe and Busokelo Districts. The reserve provides local communities with medicinal plants, many of which are not found elsewhere. MRNFR is host to ritual, traditional and historical sites which are of great importance to local and national heritage.

MRNFR is divided into zones for management purposes and protection of sensitive habitats. Each zone is accompanied by a set of guidelines to guide management and use. These zones were adopted from the previous plan with minor changes to align with TFS zone types and names. Zones in the new scheme include Biodiversity Zone which is divided into two sub-zones (BZI and BZII), Amenity Zone, Catchment Zone and Biodiversity Corridors. Biodiversity Zone I, is defined as areas that will be managed under minimum human interventions while Biodiversity Zone II, cover areas within the former Nature Restoration Zone that still require restoration due to the presence of invasive species and damage from wildfires. In effect MRNFR management will be allowed to carry out appropriate and only relevant restoration activities in some parts of the BZII. As soon as areas in BZ II are restored they will fall under BZ I and be managed under the same conditions.

Immediately outside the Reserve is a zone recognised as the Community Support Zone. Here MRNFR management has no jurisdiction but the area forms an important zone to influence communities to engage in conservation friendly land use practices. Thus targeted conservation initiatives will be promoted in this zone to minimize negative impacts on the reserve. The scheme recognises that the Catchment Zone is cross cutting, as the whole reserve is a catchment area however with some specific sensitive portions. Therefore, caution was taken in setting guidelines for all zones to ensure that permitted activities do not lead to degradation of water resources and catchment integrity. On implementation, attention will be paid to demarcating the zones on the ground and ensuring visitors, other users, patrol teams are well informed on zone boundaries and prescriptions.

Following the TFS guidelines for the preparation of management plans for natural forests, this plan is composed of five sections. Part I gives general descriptions of the reserve. Part II reviews the previous management plan. Part III describes management directives. Part IV presents the management prescriptions and the last part represents finances, budget, monitoring and revision of the management plan. The main activities to be carried out during the plan period include: boundary maintenance; enrichment planting; general protection; ecotourism development; extension services; office construction with full furniture; transport facilities; and office equipment. Overall this plan is designed to be a guide and a quick reference that can be easily accessed and understood by the owners, implementers and stakeholders. The implementation of this management plan is estimated to cost a total of TSH 4,366,845,000/- with TSH 1,082,427,000/- to be spent in year 1. The funding is expected to come from the government through Tanzania Forest Services Agency and other development partners.

ACKNOWLEDGEMENTS

The review process of the MRNFR management plan was a participatory process, involving a cross section of stakeholders for the Reserve. More important was the participation and involvement of the twenty-three villages surrounding the reserve represented by their local leaders and local organizations such as HIMARU.

Other neighbours to the Reserve also contributed immensely to the planning process, notably Kiwira Forest Plantation, Kitulo National Park, Rungwe Tea Growers and Rungwe Mission.

The process saw commendable contributions from the African Wildlife Foundation, Wildlife Conservation Society, Rungwe District Council, Regional Secretariat, District Natural Resource Officers, SPANEST, CORRECT, Tourism Operators, Ministry of Natural Resources and Tourism and other experts on different subjects relevant to the plan.

Special thanks go to UNDP focal persons, Director of Resource Management (TFS, Mr. Z. Mbwambo), Project Director (TFS, Mr. Mkeya), The National Project Coordinator (TFS, Mr. G.J. Kamwenda) and Prof. Neil Burgess who have all contributed immensely in the development of the management plans.

The planning process proceeds under the guidance of Tanzania Forest Services Agency Southern Highlands Zone and Mount Rungwe Nature Reserve management. The process was financially supported and facilitated by the Critical Ecosystem Partnership Fund through the African Wildlife Foundation and conducted under the coordination of a Core Planning Team comprising of representatives from the various organizations mentioned above.

We want to extend our sincere appreciation to all the contributors mentioned above for their active roles in the preparation of this plan and their continued interest and support for conservation and management of Mount Rungwe Nature Reserve

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ABBREVIATION AND ACRONYMS

AZ	Amenity Zone
AWF	African Wildlife Foundation
BZ	Biodiversity Zone
COP	Community Outreach Programme
CT	Conservation Target
CORRECT	Community Option Renewable Resources & Environment Conservation Trust
CSZ	Community Support Zone
DFO	District Forest Officer
DNRO	District Natural Resources Officer
EIA	Environmental Impact Assessment
ERV	Exceptional Resource Values
FBD	Forest Beekeeping Division
GMP	General Management Plan
HIMARU	Hifadhi Ya Mazingira Rungwe (Rungwe Environmental Conservation)
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature
JFM	Joint Forest Management
KEA	Key Ecological Attributes
KNP	Kitulo National Park
MNRT	Ministry of Natural Resources and Tourism
MoU	Memorandum of Understanding
MRNFR	Mount Rungwe Nature Reserve
PA	Protected Area
PPA	Primate Priority Area
Rungwe DC	Rungwe District Council
RNRA	Regional Natural Resources Advisor
SPANEST	Strengthening the Protected Area Network in Southern Tanzania Project
TANAPA	Tanzania National Parks
TFS	Tanzania Forest Service Agency
UNDP	United Nations Development Programme
VFMA	Village Forest Management Area
VGA	Village Government Authority
VEC	Village Environmental Committee
WEO	Ward Executive Officer

PART I

1.0 GENERAL DESCRIPTION

1.1 Legal status, ownership, governance and administration

Mount Rungwe Forest Reserve was gazetted and access by communities to the forest resources was restricted through the Declaration Order G.N 773 of 26/5/1949 with JB 92. Since its gazettelement then have been various other government orders notably G.N 54 and 55 of 20/2/1953. In 2009 the catchment forest was upgraded to a nature reserve through G.N 386 of 2009.

The reserve is now under the jurisdiction of Tanzania Forest Services (TFS) Agency. It is managed by the Conservator who reports to the Zonal Manager, Southern Highlands Zone. Administratively, the nature reserve is divided into 3 ranges namely Syukula, Unyamwanga and Bujingijila which are under forest rangers. TFS is a semi-autonomous Government Executive Agency established through Government Notice (G.N) 269 of 30th July 2010. TFS establishment was supported by the Executive Agency Act (Cap.245) as amended in 2009, the National Forest and Beekeeping Policies adopted in March 1998 and administered through the Forest Act (Cap 323 R.E of 2002) and Beekeeping Act Cap 223 R.E of 2002 which provide the legal framework for the management of forests and bee resources. The administrative structure is indicated in Fig. 1 below.

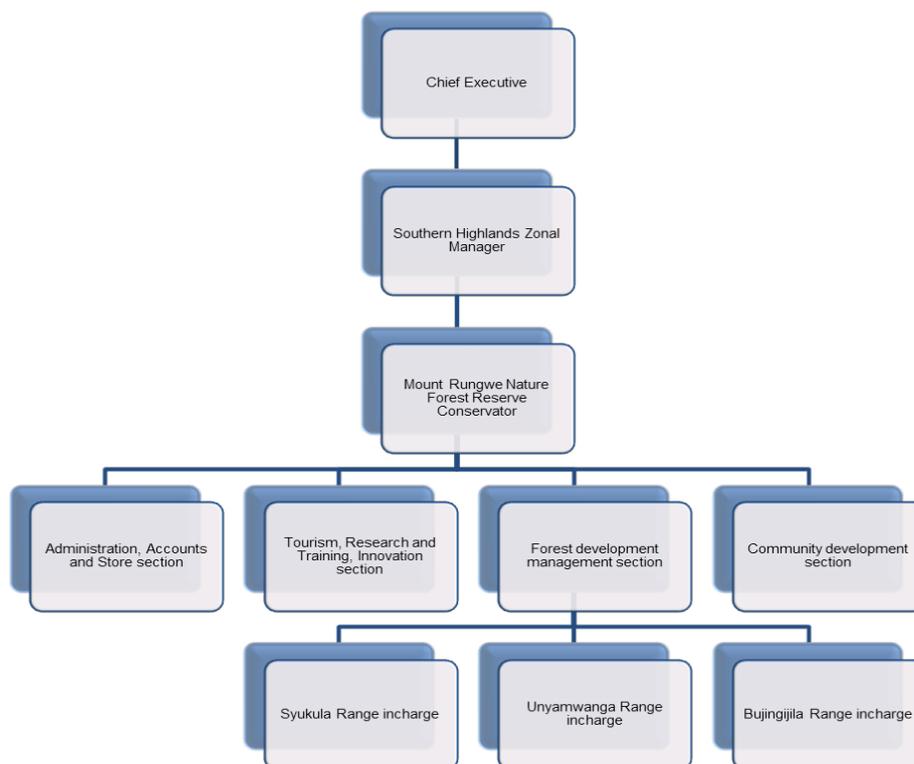


Figure 1. Administrative structure for MRNFR

1.2 Location

The MRNFR is in Rungwe district, Mbeya region, Southwest Tanzania covering most of Mount Rungwe located between 9° 03' - 9° 12'S and 33° 35' - 33° 45'E. Regionally Rungwe district borders Kyela district in the South, Ileje district in the West, Makete district in the East and Mbeya district in the North. Rungwe district consists of 4 divisions namely Ukukwe, Busokelo, Pakati and Tukuyu. The district occupies an area of 2,211km² of which 1,668 (75%) is suitable for agriculture. The remaining 45 km² (2%) is covered by forests and 498 km² (23%) comprises mountains and residential areas. The reserve is 25 km southeast of the regional centre, Mbeya town, and 7 km north of Tukuyu. The reserve can be accessed in the north and east via the Isongole-Ndala road which runs between the reserve boundary and KFP. In the West, the area is serviced by the Rungwe Mission road which runs along the reserve boundary in several places. In the South, access to the reserve is by the Katumba-Kandete road. Some 10 km to the northwest is the Poroto Ridge Forest Reserve with impressive Crater of Lake Ngosi

1.3 Size and Boundaries

The MRNFR covers an area of 13, 652.ha with a boundary length of 69.3 km. To the east, MRNFR is bordered by Livingstone Forest, which is part of Kitulo National Park. The reserve is bordered and surrounded by 16 villages. In the north the reserve is bordered by Kiwira Forest Plantation which is primarily pine plantation owned and managed by Tanzania Forest Services Agency. Bordering the reserve in the west is Rungwe Avocado Farm and the Moravian Mission that owns a small section of the Rungwe forest.

1.4 Physical features

1.4.1 Topography and Hydrology

The Rungwe district is generally mountainous with Mt Rungwe forming the second highest peak in southern Tanzania at an altitude of 2 981 masl. Mt Rungwe stands at the junction of the eastern and western arms of the Great Rift Valley and forms the northern extent of the Southern Rift. The outstanding topographical features of Mt Rungwe are the mountain peaks and the dormant volcanic crater at the top of the mountain.

Mount Rungwe ecosystem is critically important for its water catchment value. High rainfall and extensive forest cover on the mountain continuously feed water into numerous streams providing water to villages and towns from Kiwira, Katumba, and Tukuyu to Kandete towns, and nourishes the rich agricultural lands of the Kyela valley. The mountain is the catchment for key rivers in the landscape including Kiwira, Suma, Mbaka, Kilasi, Marogala, Mrombo, Mulagala, Sinini and Mwatisi Rivers, which flow into Lake Nyasa shared by Tanzania, Malawi and Mozambique.

1.4.2 Geology and Soils

Mount Rungwe is a dormant volcano built up mainly of phonolitic-trachyte lavas and tuffs, olivine-basalts, phonolitic trachyte lavas, pumice and ash from a nest of conelets within the Rungwe caldera. The parent material for most soils in the area is volcanic ash and pumice (extrusive volcanic rock) typically well drained with low bulk density (weight of soil in a given volume). On steep slopes of Mt Rungwe, soils are predominantly dark greyish and dark brown as well as dark-yellowish-brown with sandy and clay loams. The topsoil is brownish-gray followed by a subsoil of alternating layers of pumice gravel and soil. In high grasslands, soils are thin and quite rocky. Soils in arable areas surrounding Mt Rungwe are of medium fertility, coarse or medium textured, ranging from sandy loams to alluvial.

1.5 Climate and Climate Change

The region's climate is significantly determined by the topographical landscape particularly in terms of annual and seasonal rainfall and temperature regimes. The general range of temperature in the reserve area is between -6^o C in the highlands and 29^o C in the lowlands. The area enjoys abundant and reliable convectional rainfall with continental/convectional temperatures which stimulate abundant agriculture on the rich volcanic soils. The rainy season typically starts from November to May while the dry season starts from June to October. Including the surrounding lowlands, rainfall in the area ranges from 900 mm in the lowlands to 2 700 mm in the highlands. Exceptionally, the south eastern slopes of the mountains receive up to 3 000 mm of rainfall a year, the highest rainfall in Tanzania.

1.6 Special sites and features

Mount Rungwe offers a diverse of unique scenery featuring Rungwe Peak, a barren mountain top from which one can view Poroto Ridge, Mbeya Peak, Loleza (Kaluwe) Peak and areas stretching down into Malawi. These attract an array of mountain hikers and climbers. Another feature of interest is a crater Lake Lusiba found at 2400 m a.s.l. below the bamboo belt. Lusiba-lukafu is an evergreen creek, which dries during the dry season and flows in the rainy season. The area is also host to special sites of traditional importance to the surrounding communities, one such is Masieto for Wanyakyusa to conduct traditional rituals or ceremonies.

1.7 Historical events

Mount Rungwe Nature Reserve was first gazetted as a Catchment Forest in 1949 and recently upgraded to the status of a Nature Reserve in 2009. In 1959 Kiwira Forest Plantation was established from two blocks of natural forest - one from Rungwe forest and the other from Mt Livingstone Forest. During the colonial era management of natural resources was based on customary laws thus MRNFR was managed as a Traditional Forest. After independence the Reserve was managed by Central Government (Forestry and Beekeeping Division). Currently the reserve is managed by Tanzania Forest Services Agency.

The long relationship between people and their environment has shaped the landscape of the Mount Rungwe area, creating a mosaic of woodlands, bushland, croplands, settlements, home gardens, plantations and forests. Wide ranging fires and logging in the past years, human population growth and resettlements had a significant impact on resource use. Some pockets of forest adjacent to MRNFR are owned by private owners, such as the Moravian mission on the western side of MRNFR.

1.8 Socio-cultural rights, privileges and safeguards of adjacent communities

The objectives of the reserve do not provide for any extractive exploitation of the forest resources within the reserve. However, surrounding communities have been given special rights and privileges on utilisation of the forest resources. These include extraction of non-timber forest products; medicinal products, fruits, mushroom and grasses for thatching also privileges for traditional rituals for worshipping. These activities are undertaken through licence and supervision of the nature reserve management. Land ownership in the villages around Mount Rungwe falls under two categories. First, land which is obtained through customary rights of occupancy and secondly land which is offered through village rights of occupancy, parliamentary act of 1975.

1.9 Biological aspects (Flora and Fauna)

1.4.1 Flora

Table 1. Some of the biological flora in the MRNFR

Floral Aspects	Description
Montane forest	Montane forest primarily defines the reserve’s lower elevations with the bulk of the forest cover located in the southeast quadrant of the reserve. The forest is mainly composed of <i>Aphloia theiformis</i> , <i>Ficalhoa laurifolia</i> , <i>Maesa lanceolata</i> , <i>Trichocladus ellipticus</i> , <i>Albizia gummifera</i> and <i>Bersama abyssinica</i> . There are more than 550 plant species out of which approximately 400 are used as traditional medicines by the residents of Rungwe, Mbeya and Kyela districts. The forest is critically important for faunal species - among them the Kipunji monkey - as well as the rivers that emanate from Mt. Rungwe.

Upper montane forest	Upper montane forest is found at higher elevations in the reserve with broken canopy 10-25 m high. Common trees here include <i>Albizia gummifera</i> , <i>Aphloia theiformis</i> , <i>Bersama abyssinica</i> , <i>Bridelia micrantha</i> , <i>Diospyros whyteana</i> , <i>Hagenia abyssinica</i> , <i>Macaranga kilimandscharica</i> , <i>Maesa lanceolata</i> , <i>Maytenus acuminata</i> , <i>Myrinthus holstii</i> , <i>Neoboutonia macrocalyx</i> , and <i>Schefflera goetzenii</i> . Other trees and shrubs include <i>Agauria salicifolia</i> , <i>Allophylus sp.</i> , <i>Albizia schimperana</i> , <i>Alsophila sp.</i> , <i>Cassipourea gummiflua</i> , <i>Catha edulis</i> , <i>Chrysophyllum gorungosanum</i> , <i>Cornus volkensii</i> , <i>Cussonia spicata</i> , <i>Dombeya sp.</i> , <i>Esente ventricosum</i> , <i>Ficalhoa laurifolia</i> , <i>Ficus sur</i> , <i>Garcinia buchananii</i> , <i>Ilex mitis</i> , <i>Myrica salicifolia</i> , <i>Nuxia congesta</i> .
Bushed grassland	The reserve has sizeable areas covered by bushed grassland. Some of the bushed grassland is found near the western boundary, but most is on the mountain top, where it covers approximately 3000 ha. Mountain top grasses are short and generally occur above 2500 m. Scattered shrubs are common with occasional invasive exotic <i>Pinus patula</i> trees. <i>Buchnera rungwensis</i> , and <i>Valeriana capensis</i> are herbs found at higher elevations. Bush and tree species found include <i>Agauuria salicifolia</i> , <i>Aloe spp</i> , bracken, <i>Catha edulis</i> , <i>Erica spp</i> , <i>Hagenia abyssinica</i> , <i>Hypericum revolutum</i> , <i>Maesa lanceolata</i> and <i>Protea spp</i> , Near the forest edge are found <i>Heteromorpha arborescens</i> , <i>Osyris compressa</i> , <i>Syzigium cordatum</i> and <i>Tecoaria spp</i> .
Bamboo belt	There are extensive stands of bamboo in parts of the forest. This belt is found at elevations above 2,600 m and covers an area of 866 ha.
Heath	There is a heath zone, which is a transition zone between the forest and the upper grasslands. The Ericaceous belt is most developed in the upper south and southeast elevations around 2600 - 2800m. It is dominated by <i>Erica spp</i> with a lesser number of <i>Protea spp</i> and low stature <i>Hagenia abyssinica</i>
Exotic tree species	<i>Pinus patula</i> is the most notable exotic species in the reserve. This pine species is a major concern threatening existence of natural habitats in the reserve. The species has spread to most parts of the reserve from the adjacent Kiwira Forest Plantation. Stands of these pines have already replaced grasslands in the northeast part of the reserve. To date, it is estimated that about 2,270 ha (16.6 %) of the reserve area has been invaded by pines.

1.9.1.1 Forest areas supporting production

According to the management objectives of MRNFR as outlined by TFS, there will be no extraction of wood for commercial purposes from the Reserve. However, there are invasive species (*Pinus patula*) that can be harvested as a management tool. Harvesting of these invasive species will only occur under a special license/directive to be issued by TFS management. A subsidiary plan regarding the management of *Pinus patula* in MRNFR has been prepared by TFS.

1.9.1.2 Forest areas supporting protection

MRNFR has important areas of conservation value including catchments, biodiversity and soil erosion conservation areas. There are areas in the Reserve that will be managed strictly for conservation and protection of sensitive populations of rare, endemic and endangered species. These areas include large portions of the montane forest which is habitat to Kipunji and Abbott's duiker. The same areas also form the headwaters for most of the rivers emanating from the Reserve.

1.9.1.3 Other vegetation types

The vegetation types described in part 1.9.1 above is exhaustive for MRNFR.

1.4.2 Fauna

The wildlife of Mount Rungwe (and the contiguous Livingstone Forest in Kitulo National Park) is unique. A unique biodiversity hotspot, this is the only landscape on earth where the suite of species present is drawn from the Eastern Arc, the Southern Rift and the montane Tanzania areas of endemism. MRNFR is home to almost 100 species of mammals, over 230 species of birds, 34 species of 45 species of amphibian and 10 species of fish. A number of these are endemic and rare, including the Kipunji and the Abbott's duiker which are classified in the IUCN Red Data list as 'Critically Endangered' and 'Vulnerable' respectively. A full list of rare, endangered and endemic species in the reserve is provided in Table 1.

1.4.3 Plant and animal species of special concern

MRNFR is home to several faunal species of particular conservation concern, most notable being the Kipunji *Rungwecebus kipunji*. The Kipunji was first discovered in December 2003, and was initially described as a Mangabey, the first new African monkey species discovered since 1984. Further molecular studies however, showed that the species is more closely related to a baboon and thus a new genus. Thus, in 2006 the species was finally described as *Rungwecebus kipunji*, named after Mount Rungwe where it was first found. Other rare species have since been discovered in the reserve primarily by Wildlife Conservation Society (WCS) including new species of bush baby, chameleon, lizard, frog, fish and invertebrates. Some examples of fauna of particular importance are listed in Appendix 4.

1.4.4 Species posing management challenges

The only floral species posing management challenges in MRNFR are the *Pinus patula* and to a certain extent eucalyptus trees, both exotic and invasive species. *Pinus patula* has spread from plantation areas and covers almost the whole grassland area at upper elevations of the reserve. Currently, bush pigs have become a threat to forest adjacent farms as they feed on them. This has caused a negative response regarding conservation of MRNFR from the surrounding community.

1.10 Buffer zones and corridors

MRNFR has no officially recognised buffer zones and due to the changes in land use around the Reserve it is slowly becoming an island isolated from other biodiversity areas such as Kitulo National Park and Poroto Ridge Forest Reserve. Due to increasing human activities these zones have been degraded, leading to some encroachment in the reserve. However, there still exist some sizeable forest patches within the land surrounding the reserve. The forest patches outside the reserve are owned by villages, clans, local government, institutions (Moravian Church) and individuals. Through collaborative management these forest patches provide opportunities for establishing buffer areas in certain areas of the reserve boundary. On the northern part of the Reserve is Kiwira Forest plantation acting as a buffer zone and on the eastern part is buffered by Kitulo National Park while on the Southwest side is buffered by the Rungwe Mission.

Since gazettelement of a buffer zone to the Reserve was not an option the previous plan proposed the establishment of a Community Support Zone to operate immediately outside the reserve. This zone was meant to encourage communities to be involved in better stewardship of their land and the natural resources therein. Conservation measures such as fire management, nursery development and tree planting, conservation clubs in schools, village environmental committees, community training in natural resource management and patrol by village forest guards, have been initiated in some of the villages surrounding the reserve, these efforts need to be stepped up to ensure this zone acts as an adequate buffer to the reserve as well as ensuring community benefits.

1.11 Socio-economic status of adjacent communities

1.4.1 Forest adjacent communities

There are 23 main villages surrounding MRNFR. Most of these are traditional settlements but a few, Ndaga, Unyamwanga and Ilundo were formed by the re-settlement scheme of the mid-1970. A mixture of tribes inhabits the area, of which Safwa, Nyakyusa and Kinga are the major ones. Others include Ndali, Malila and Bena. In 2002 the population of the area was at 52 594 inhabitants from 5, 772 households by 2012 the population had increased to 59 091 inhabitants indicating 11 % increase (Table 2).

Communities in the area have had a strong impact on forest cover over the years. Indeed, Mt Rungwe was still contiguous with Poroto Forest Reserve until comparatively recently. After independence the Reserve suffered serious depletion from population growth in surrounding villages, high demand for forest products, villagisation schemes, unplanned or illegal logging, charcoal making, market changes and division fuel resource extraction in the forest.

Villages surrounding the reserve have established Village Environmental Committees. These committees assist in management of the reserve through joint patrols with MRNFR staff.

Table 2: Estimated population sizes in villages surrounding Mt. Rungwe Nature Reserve.

	Village	Ward	Division	Population (2002 census)	Population (2012 census)	
1	Bujingijila	Kandate		828	872	5
2	Ndala	Kandate		2 541	1 777	-43
3	Lugombo	Kandete		934	781	-20
4	Katumba	Katumba	Pakati	5 255	6 452	19
5	Ibumba	Suma	Pakati	1 165	1 136	-3
6	Masebe	Katumba	Pakati	1 255	1 375	9
7	Kabale	Suma	Pakati	998	909	-10
8	Ngumbulu	Isongole	Ukukwe	115	1 107	90
9	Ilundo	Kiwira	Ukukwe	4 051	4 694	14
10	Nditu	Suma	Ukukwe	2 391	2 415	1
11	Syukula	Kyimo	Ukukwe	4 653	4 461	-4
12	Ikama	Katumba	Ukukwe	1 682	1 415	-5
13	Ndwati	Isongole	Ukukwe	431	392	-10
14	Mpandapanda	Kiwira	Ukukwe	6 308	8 356	25
15	Isyonje	Isongole	Ukukwe	1 631	1 389	-17
16	Ndaga	Isongole	Ukukwe	4 044	5 056	20
17	Mbeye one	Isongole	Ukukwe	961	1 167	18
18	Kibisi	Kyimo	Ukukwe	1 728	1 678	-3
19	Ilolo	Kiwira	Ukukwe	3 891	3 239	-20
20	Unyamwanga	Isongole	Ukukwe	1 502	1 372	-9
21	Ntokela	Isongole	Ukukwe	3 390	6 438	47
22	Idweli	Isongole	Ukukwe	1 864	1 768	-5
23	Suma	Suma	Ukukwe	976	839	-16
Total				52 594	59 091	

1.4.2 Local economy

Communities around MRNFR mainly depend on small-scale farming, pit sawing and charcoal burning for their economy. The main farming techniques are shifting cultivation of food crops. Firewood is produced chiefly for the markets in the urban areas of Mbeya and Tukuyu and is one of the most reliable cash-generating activities. Irish potatoes are lucrative for the people surrounding the reserve. Money obtained from these activities is used for clothing, youth education, medical services and food. MRNFR is the main water source used for human

consumption in the adjacent villages. Agricultural activities around the reserve are throughout the year due to high humidity influenced by the reserve. Eco and cultural tourism are also contributing though to a less extent, the increase in the income for the surrounding communities.

1.4.3 Local land use

The reserve is surrounded by predominantly agriculture land uses and settlements from the surrounding villages. Main crops grown include tea, banana plantations and avocado plantations, beans, maize, potatoes, and small woodlots. In the north and east are the Kiwira Forest Plantation and Kitulo National Park. Only four of the 23 villages surrounding the Reserve have land use plans, supported by AWF. These integrated land use plans appropriately allocate land uses to meet needs of the people while enhancing biodiversity conservation. This is a step towards sustainable management of their land and natural resources and should be carried out in all 23 villages.

1.12 Other activities that could impact on the forest reserve management

There are several stakeholders working outside MRNFR that might affect its management. Some institutions include the Rungwe Avocado Company in the western part of the reserve, an avocado production company working with small out grower farmers, Rungwe Tea Company and Maji Rungwe producing tea and water and Kiwira Forest Plantation pine production for timber respectively.

Currently MRNFR is financed by UNDP under the project “Enhancing the Forest Nature Reserves Network for Biodiversity Conservation in Tanzania.” This is a five year (2015 – 2020) project that will support different conservation activities in the reserve. Activities that will be supported include boundary consolidation, office building, Reserve entrance gates and working facilities.

PART II

2.0 REVIEW OF EXISTING MANAGEMENT PLAN

2.1 Review of previous plan

An extensive review of the previous MRNFR management plan (2009 – 2014) was carried out with participation of stakeholders as well as field assessments. The review looked at key components of the plan including: zonation scheme and guidelines, management challenges, conservation targets, threats to conservation targets and management prescriptions and activities. The review also gave special attention to the implementation status of the proposed plan activities focusing on which activities were carried out by who, where and when. The following sections outline some of the activities that were implemented as well as the partners who were responsible or supported implementation of these activities.

The review indicated that the previous plan brought in the much needed management direction to MRNFR. A number of management prescriptions stipulated in the plan were implemented successfully. The review process and assessments indicated that implementation of the previous plan went a long way in addressing some of the key challenges to the reserve and threats to conservation targets. As indicated in the threat analysis presented in Appendix 5, many of the threats to conservation targets changed from very high magnitude to lower magnitude. This change can be attributed to the upgrading of the area to a nature reserve with strict protection and also implementation of the management plan. Despite the successes from the previous plan more remains to be done as some of the management prescriptions were partially implemented while some have not been implemented. Details of some of the activities implemented in the previous plan are provided in the following sections.

2.1 Assessment of existing forest resources

There have been no recent surveys on existing forest resources in the reserve. Information presented here is adopted from the previous plan. This has been identified as a key activity to be undertaken in the implementation of this management plan. The MRNFR comprises over 550 species of plants. The last survey in 2008 reported a mean total of 1,045 stems per hectare of different tree species in Mount Rungwe Nature Reserve. The mean total volume and basal area per hectare in the reserve were 69.53m³ per ha and 7.39m² per ha respectively. Efforts are currently underway to develop lists of invertebrate species in the reserve.

2.2 Forest Reserve management activities

2.2.1 Boundary consolidation

MRNFR boundaries have been demarcated and communicated to the surrounding villages.

In many places the boundary has been marked using beacons and trees planted to mark the reserve boundary, however there are concerns on the type of species that was used for this. The main concern was on the possibility of the eucalyptus species used spreading into the reserve. Many of the challenges that arose due to unclear boundary have been addressed. Notably, encroachment into the reserve area has been reduced although not to the extent expected (100 % reduction). There still remain a few villages (Kibisi and Kyimo) bordering the reserve where agricultural encroachment is still a problem.x

2.2.2 Forest protection

The nature reserve has a 66.3 km demarcated fire line constructed at the boundaries of the reserve. The nature reserve management relies on hired labour from communities to clear the fire line thus due to limited resources only a portion is maintained annually. The reserve is benefiting from community participation in patrols and fire-fighting. Patrols are done by VECs and Community Forest Guards (CFGs) in collaboration with MRNFR staff. This has contributed to a considerable decrease in illegal activities in the nature reserve.

2.2.3 Carbon stock enhancement through restocking and natural regeneration

Activities on carbon stock enhancement mainly focused on promotion of natural regeneration through effective protection of the forest reserve. Restocking activities were carried out in some parts of the community support zone. In 2012-2013, a total of 33,500 indigenous tree seedlings were planted in Bujingijila and 17,500 in Nditu catchment with a recorded survival rate of at least 60 %. Tree species planted were *Hagenia abyssinica* and *Podocarpus sp.*

2.2.4 Nurseries

In 2012 – 2013 two nurseries were established in Isongole (Idweli) and Ndala villages raising 140,000 tree seedlings from a targeted 300,000. Tree species raised were *Pinus patula*, *Acrocarpus fraxinifolius* and *Eucalyptus spp.* Some of the seedlings were distributed to the communities and some were planted to mark the reserve boundary. Through programmes run by WCS, HIMARU and TFS local communities in Ndala, Nditu and Iloilo villages were trained on nursery establishment, hygiene and management techniques.

2.3 Management of buffer zones and corridors

As pointed out that MRNFR has no buffer zone. The current boundary resurvey indicated that Bujingijila corridor which was previously thought to be wholly under the jurisdiction of the village is partially under MRNFR and Kitulo National Park. The survey revealed that MRNFR and KNP share a boundary length of 3.2 km that covers part of the corridor. However, a substantial and important part of the corridor is under the jurisdiction of Bujingijila village thus indicating the need to work with the villagers to secure this corridor for continued ecological connectivity between MRNFR and KNP.

2.4 Watershed areas management and soil conservation

MRNFR is a water tower in the southern highlands region with key rivers emanating from the area. Major threats to river headwaters in the reserve have been significantly reduced due to the protection of the nature reserve. One of the key threats was grazing in the nature reserve which has now been stopped. Poor agricultural practices remain the main threat to water sources in areas surrounding the reserve. There is need to focus on promoting agricultural activities that avoid siltation and pollution of soil and water sources. Programmes focusing on land use planning, agroforestry and conservation agriculture should be extended to all villages surrounding the reserve. There is need for more community awareness on water source management as directed by the Environmental Act.

2.5 Physical resources

Currently there is insufficient infrastructure in MRNFR for management or operations. The reserve has no offices, staff quarters or security outposts. Construction of main office buildings in Kiwira/Isongole, sub-office in Kandete, and Ranger outposts in Unyamwanga, Katumba, and Malambo was flagged as priorities in the previous plan. The reserve staff are located in different areas with the Conservator operating from Mbeya, Forest Officer in Tukuyu and Forest Assistants in Namba 1 and Kiwira. For efficient management and coordination of operations in the reserve it is critical that a central and permanent base of command be established. As part of implementation of this plan, the reserve infrastructure will now be constructed by UNDP through the project “Enhancing the Forest Nature Reserves Network for Biodiversity Conservation in Tanzania.” This will include a Main office in Tukuyu, Ranger posts in Isongole, Kandete and Syukula, and renovation of sub-offices at Namba 1 and Mwakaleli. Access roads to the reserve and inside the reserve are not up to standard. Some areas surrounding the reserve are not accessible particularly in the rainy season making it difficult for patrol operations and carrying out management activities in these areas. Key roads in the area that need attention and regular maintenance include road from Bujingijila to Ngumbulu, Ngumbulu to Unyamwanga and Syukula to Kibisi.

Currently the reserve transport section has 3 functional motor cycles (one donated by UNDP and 2 relatively new from TFS) and 1 hard top Toyota Land cruiser (from UNDP). For efficient management and operations MRNFR needs more transport equipment including vehicles and lorry primarily for road and fire line maintenance, motorbikes and bicycles for security and patrols. The reserve has basic fire fighting equipment and protective gear which needs to be upgraded.

2.6 Human resources

2.6.1 Staff

There are currently six management staff and one volunteer in MRNFR (Table 3). All staff are

employed and directed by TFS. Forest Officers bear the primary responsibility of maintaining security in the reserve; however, the three officers are few and cannot adequately cover the whole reserve. This challenge has been addressed by collaborating with CFGs and VECs to conduct patrols in the reserve and immediate areas; however, the reserve relies too much on community patrols. Going forward, the reserve should have a small security unit and involvement of communities should be supported and further promoted. The efforts of CFGs and VEGs not only compliment work of MRNFR staff but also provide employment for community members. More efforts should be put into training community scouts and equipping them for patrols.

Table 3: Current staff in MRNFR

S/N	Designation	Current Location	Duties & Responsibilities
1	Conservator	Mbeya	<ul style="list-style-type: none"> Responsible for overall management of the Reserve Responsibilities include supervising staff Best utilization of allocated resources Supervise implementation of approved plans/ activities among other responsibilities assigned by TFS
2	Forest Officer	Tukuyu	<ul style="list-style-type: none"> Responsible for providing technical support and enforce forest policies and legislations Supervise forest management activities Conduct research, enforce legislation, and build capacity of staff Conduct planning in forest and coordinate collection and analysis of forest products statistics and other stakeholders and any other duties as allocated by Reserve Conservator
3	Forest Assistant	Namba 1	<ul style="list-style-type: none"> Is the Ranger in charge Responsible for providing technical support and enforce forest policies and legislations Collect and good keeping of seeds Tend to tree seedlings and management of tree nurseries
4	Forest Assistant	Kiwira	
5	Forest Assistant	Mwakaleli	<ul style="list-style-type: none"> Manage trees and forests Undertake patrols within the forests, Inspect and grade forest products Carry out menstruation in forest Carry out forest extension services Carry out any other duties as assigned from time to time by Supervisor

6	Driver	Mbeya	<ul style="list-style-type: none"> • Drive the reserve's vehicles • Maintain vehicle logbook and movement records • Maintain smooth running of vehicles • Make simple repair of the vehicles • Maintain vehicle cleanliness and service schedule and carry out duties as assigned by Reserve Conservator
7	Tourism officer	Tukuyu	<ul style="list-style-type: none"> • Volunteer – supports tourism activities in the reserve and carry out duties as assigned by Supervisor

2.6.3 Training

MRNFR staff should be well versed in new approaches to forest reserve management and new technologies that can improve reserve management and operations as well as guidelines and management approaches adopted by TFS. There is need to ensure there is an adequately trained and professional staff for the reserve. In 2014, a few of the reserve staff went through training in Forestry and Customer Care by way of short courses. As part of planning process for this plan some MRNFR staff received training on mapping and GIS however there is lack of equipment for such purposes in the Reserve. Introduction of new technologies such as CYBERTRACKER and SMART (Appendix 7) for effective patrol deployment and natural resource monitoring will require that staff and VEGs receive training.

There have been several training events for communities surrounding the reserve, mostly on fire control, nurseries and tree planting, bee keeping and most recently on land use planning and conservation agriculture. In 2010, VEGs and Village Governments were trained on use and application of by-laws. However most of the training covered only a few villages there is need to ensure the training is carried out in all 23 villages surrounding the reserve. There is also need to ensure that VECs are trained in Natural Resources Management and that CFGs receive adequate training before they are deployed for patrols.

2.6.4 Forest adjacent communities

2.6.4.1 Community organizations

Communities surrounding the reserve are slowly participating in management of the nature reserve and conservation in their areas mainly through VECs. Communities are mostly involved in fire management activities including fire control, fire line maintenance and tree planting. Community Forest guards play a critical role in the reserve's security, involved in daily and regular patrols and general enforcement against illegal activities in the forest and their respective villages. There is need to continue supporting and strengthening the capacity of VECs. Collaboration among VECs will also be essential thus an umbrella body representing all VECs should be established to provide a focal point for any collaboration with the reserve. Sixteen villages in the area have developed by-laws which have been approved at District level. These by-laws will go a long way in governing management of natural resource in the villages

as well as consolidating the responsibilities and roles of VECs. The remaining six villages should also be encouraged to develop by-laws for approval by the District. VECs should be empowered to implement and monitor adherence to by-laws, in this regard collaboration with Village Government Authorities will be the key.

2.6.4.2 Instruments to facilitate community participation

Community participation in conservation and management is gradually improving, however up to now it has been indirect and largely been driven by isolated projects implemented in areas surrounding the reserve. As stated in the previous plan there still no clear rights or ownership aspects of property with regards to the forest nature reserve to facilitate full participation of communities in the reserve's conservation and management. Joint Forest Management Agreements will be formulated by TFS, MRNFR management and VECs in the near future. These agreements will also take care of the aspects of benefit sharing between the government and the surrounding communities.

2.7 Extension services and social studies

Extension services to villages have been carried out mainly focusing on tree nursey establishment and tree planting but they now also include village land use planning and conservation agriculture. Public awareness has been carried out around MRNFR through extension services targeting schools and VECs and other local organizations. Awareness campaigns on different environmental subjects have been ongoing since 2003, covering 17 villages, 21 primary schools and 17 VECs.

A survey was carried out by WCS in 2012 – 2013 to determine fuel wood consumption in seven villages. Information gathered from this survey informed promotion and installation of fuel efficient stoves in the villages. These studies should help to shed light on how communities are utilizing natural resources in the area and highlight opportunities for conservation and nature based enterprises

Under the AWF programme four villages, Unyamwanga, Isongole, Ndaga and Ngumbulu, neighboring the reserve underwent land use planning processes which are expected to improve land and natural resources management in these villages. Land use planning as well as initiatives to improve land management should be scaled up to the other 19 villages neighboring the Reserve.

2.8 Marketing and initiatives for revenue generation

Communities surrounding the reserve are just starting to engage in revenue generation enterprises that are compatible with conservation and management principles of the reserve. To date the only revenue generating initiative in the area is beekeeping. The project started in 2011 and seven beekeeping groups have been established and supported with training and

equipment. Ecotourism was identified as a potential revenue generator for communities in the area. To date nothing has been done towards establishing an ecotourism program in the area. There is potential for developing such a program in the area. MRNFR is part of the Southern Highlands tourism circuit, however it has not fully realized its potential as a destination within the circuit.

2.9 Potential values of the forest

The MRNFR has several exceptional values important to the ecosystem of the region as well as globally. The reserve is a key water tower in the region providing water for different uses. The catchment importance is high, as the reserve feeds numerous villages and towns from Kiwira to Katumba, Tukuyu and Kandete and all points in between. All streams from the northwest and southwest flow into the Kiwira River. The streams include the Marogala, Sinini, Kipoke, Kilasi Ndala and Mulagala. In the southeast the Mbaka River begins, with the Suma River feeding into it. In the east the Mrambo and the Mwatisi flow out of the Reserve. All of the above rivers flow into Lake Nyasa. Some of the inherent values of the forest include; soil erosion control, and recreational values. The forest comprises a variety of food resources, such as plant leaves, fruits and roots, honey, mushrooms and edible insects which can support the local community. Furthermore, the reserve is used for a variety of medicinal purposes. The MRNFR has high timber and biodiversity value. The MRNFR plays an important part globally as a sink for carbon produced from human activities.

2.10 Inter-sectoral linkages and co-operation

Forest management is impacted by a number of functions and services in other related sectors such as agricultural production, livestock development, wildlife management, mining, energy and the overall land development. This necessitates the need for formal cross-sector coordination and emphasizes on the importance of harmonization of respective policies and instruments to ensure sustainable management with sound ecological systems in relation to ensuring sustainable land productivity including enhancing soil fertility, hydrological balance and conservation of biological diversity. This highlights the importance of co-operation with the agricultural sector and the inclusion of land-use planners in the management process to reduce impact of over utilization of forest resources.

Implementation of the MRNFR previous plan saw collaborative linkages between players from different sectors in addressing issues in and around the reserve. The collaboration between TFS, MRNFR management and WCS was critical in addressing the operations, research and monitoring needs in the reserve. In the wider area there has been interaction of different stakeholders driving different initiatives aimed at engaging communities in conservation, better management of land and farming practices, protections of the reserve and water management. Some of the key organisations playing a role towards effective management of the reserve and the surrounding areas include, SPANEST, WCS, AWF, TANAPA, Mpanga-Kipengere

the surrounding areas include, SPANEST, WCS, AWF, TANAPA, Mpanga-Kipengere Game Reserve, FEMA-WOMEN CBO, Lake Nyasa Water Basin Board, Rungwe District Council, TFS, Busokelo District council, Matamba Chimala Water Resource Management (MACHIREMA), regional secretariat, HIMARU. Such collaborations will continue to be important as MRNFR goes to the next phase.

2.11 Financial resources

Adequate financial resources and planning is required to ensure that MRNFR is conserved sustainably. Conservation demands financial investments however today's competing claims such as food and water security, human health, shelter and security have seen less allocation of financial resources towards conservation. MRNFR is no exception to the lack of adequate finance that plague the conservation sector. The reserve has several components that require financial input for efficient administration, operations and conservation. Long term financial resources for the reserve have not been secured; MRNFR still relies on budget allocation from TFS which currently covers only 14.5 % of the estimated TZS 850,000,000 annual budget for MRNFR. The Reserve's financial administration has improved over the years notably the development of a proper system for revenue collection from ecotourism activities as well as distribution. However, there is still need to monitor the effectiveness of this system. Tourism to the reserve is currently the only revenue source however generating very low revenues through entry fees and camping. Between February 2014 and June 2015 tourism generated TZS 6,007,655 which is only 0.7 % of the estimated operational budget for the Reserve.

These figures can improve and raise revenues by developing and implementing a comprehensive tourism plan as well as emphasis on marketing of MRNFR as part of the Southern Highlands tourism circuit with well-trained tour guides, visitor office and well designed and serviced camp sites.

2.12 Management challenges

A number of issues were identified as challenges in managing MRNFR in the previous plan. Assessments were carried out in development of the current plan to determine the current status of challenges in MRNFR. Some challenges still exist in the area and some have significantly reduced that they are no longer a concern. Stakeholders attribute the reduction in some of the challenges to upgrading of the natural forest to the Reserve status. This meant most of the activities that were previously carried out in the forest by local communities were not allowed and to a greater extent communities have complied with the reserve regulations. Presented below are some of the current challenges facing MRNFR (Table 4).

Table 4: Management challenges facing MRNFR

Challenges	Description
Boundary marking	There are some areas where the boundary between community areas and the Reserve is known but it has not been marked for everyone to see. There is need to install beacons and signboards and plant boundary marking trees.
Securing boundary	The boundary of the reserve was surveyed and demarcated as part of implementation of the previous plan however now the challenge is to secure the reserve boundary from encroachment. This challenge is compounded by the lack of enough reserve staff to patrol the reserve area.
Species used in boundary marking	MRNFR staff have been planting trees as part of marking the reserve boundary however some of tree species planted, such eucalyptus, pose a danger of invasion into the natural forest. Therefore there is need to use of non-invasive species in boundary marking
No buffer zone	One of the underlying issue to MRNFR challenges is issue of hard edges in some areas between the reserve and community areas. This is creating direct pressures from the surrounding farmlands and fuels issues such as crop raiding by animals from the reserve, invasive species and fires from the farms. There is need to scale up ongoing efforts on land use planning to other villages as this will ensure land uses in areas immediately surrounding the Reserve are conservation compatible.
Staffing and Financial resources	There are a few staff in MRNFR and this has made it difficult to manage the reserve. There is no adequate staff to patrol the reserve, current patrols are carried out in collaboration with village members. Added to the challenge of human resources is the issue of limited financial resources. The reserve budget remitted from TFS is very small and added to this the reserve is not generating much from tourism

PART III

3.0 MANAGEMENT DIRECTIVES

3.1 Global initiatives, Policy statements and directives

Tanzania is among signatories of various international conventions related to forest conservation and management commitments/obligations. Global initiatives as far as MRNFR are concerned means translating international conventions and agreements into actions through National Policies and Programmes. Implementation of this management plan for MRNFR responds to wider global and societal trends which advocate for Sustainable Forest Management practices. Globally, Tanzania is party to commitments of the Convention on Biological Diversity (CBD), the UN Convention on Combating Desertification on climate Change (UNFCCC) and the 2015 Sustainable Development Goals (SDGs), mostly aligning to Goal 1, 6, 15 and 16. Other conventions include Convention on International Trade in Endangered Species of wild Fauna and flora (CITES, 2003) and Ramsar convention.

3.2 Management objectives and their management tools

3.2.1 Statement of objectives

The operational National Forest Policy, which was approved in 1998 places the responsibility of managing the forest resources sustainably under the forest sector, in collaboration with key stakeholders. The policy places emphasis on participatory gender-balanced management and decentralisation. These are radical changes from the earlier forest policy and legislation that focused on preservation and control under centralized forest management. The overall goal of the national forest policy is to enhance the contribution of the forest sector to the sustainable development of Tanzania and the conservation and management of her natural resources for the benefit of present and future generations. The National Forest Policy and other related institutional policies are to be considered for better promotion and development of MRNFR both nationally and internationally. The management plan is among the tools for implementation of forest policy statements. Selected statements of these policies are as follows, Table 5.

Environmental Policy

The overall objectives of the National Environmental Policy are as follows, to: -

- i. Ensure sustainable use of resources for meeting the basic needs without degrading the environment or risk health.
- ii. Prevent and control degradation of the land, water, vegetation and air which constitute our life support system.
- iii. Conserve and enhance our natural and man-made heritage, including the biological diversity of the unique ecosystem of Tanzania.
- iv. Improve the condition and productivity of degraded areas including rural and urban

settlements in order that all Tanzanians may live in safe, healthy, productive and aesthetically pleasing surroundings.

- v. Raise public awareness and understanding of the essential linkages between environment and development and to promote individual and community participation in environmental actions.
- vi. Promote international co-operation on the environmental agenda, and expand our participation and contribution to relevant bilateral sub-regional, regional and global organisations and Programmes, including implementation of conventions.

Table 5: National policies applicable in MRNFR governance and management

Policy	
No. 3:	To enable participation of all stakeholders in forest management and conservation, joint management agreements with appropriate user rights and benefits will be established. The agreement will be between the central government, specialized executive agencies, private sectors or local governments, as appropriate in each case, and organized local communities or other organization of people living adjacent to the forest.
No. 5:	To enable sustainable management of forests on public lands, clear ownership for all forests and trees on those lands will be defined. The allocation of forests and their management responsibility to villages, private individuals or to the government will be promoted. Central, local and village governments may demarcate and establish new forest reserves.
No. 6:	Village forest reserve will be managed by the village governments or other entities designated by village government for this purpose. They will be managed for production and/or protection based on sustainable management objectives defined for each forest reserve. The management will be based on forest management plans.
No. 16:	Biodiversity conservation and management will be included in the management plans for all protection forest. Involvement of local communities and other stakeholders in conservation and management will be encouraged through Joint Forest Management Agreements.
No. 17:	Biodiversity research and information dissemination will be strengthened in order to improve biodiversity conservation and management.
No. 20:	Watershed management and soil conservation will be included in the management plans for all protection and production forests. Involvement of local communities and other stakeholders in watershed management and soil conservation will be encouraged through joint management agreements.
No. 21:	Research and information dissemination will be strengthened in order to improve watershed management and soil conservation.
No. 22:	Management of forest reserve will incorporate wildlife conservation. Wildlife resources assessment will be intensified.
No. 30:	The capacity of local government to administer and manage forest resources will be strengthened and a co-ordination mechanism between the local and central governments will be established. The recruitment of qualified and competent forestry staff for local governments will be emphasized and in-service training promoted. Sustainable direct and indirect uses of forests by local governments will be encouraged.
No. 31:	Cross sectoral co-ordination between the forest administration and other government institutions will be promoted at all levels.

No. 33:	To ensure adequate professional, technical and specialist staff in the sector, forestry training institutions will be promoted.
No. 35:	To ensure increased awareness and skills among the people on sustainable management of forest resources, the forestry extension service will be strengthened.
No. 36:	Forestry related extension messages delivered by different natural resources management sectors and other related sectors will be harmonized through integrated planning research and training.
No. 39:	Local communities will be encouraged to participate in forestry activities. Clearly defined forest land and tree tenure rights will be instituted for local communities, including both men and women.

3.2.1.1 Forest management zones

A zonation plan allows management to pursue its objectives more effectively in particular through defining the specific activities and developments that are permitted and not permitted in the different zones. A zone plan also serves to allow for protection (or strict protection) of sensitive habitats or species in a protected area. A protected area can be zoned for management and/or utilisation purposes and these zones need to be agreed on by all stakeholders.

a) Ecological Zones

The previous plan recognized four ecological zones primarily based on vegetation types (Figure 5). Since the previous plan there have been no significant changes in size of each zone. The four zones are presented in Table 6.

Table 6: MRNFR ecological zones, their sizes and composition

Zone	Area (ha)	Description
Bamboo	866	Composed of native bamboo species. There was concern on how some bamboo were drying up. This was thought to be a disease but it was never substituted through research. Currently the major threat to this vegetation unit is fire. The area covered by Bamboo in the reserve is expanding largely at the expense of other species, mostly <i>Hagenia abyssinica</i> .
Montane Forest	13,000	Montane and upper montane forest includes bamboo
Grassland	1,843	Includes heath and upper Ericaceous Some areas have been heavily invaded by <i>P. patula</i> with fires also promoting further extension of the areas covered by the invasive species.
Wooded grassland	544	Mainly <i>Ocotea usambarensis</i> .

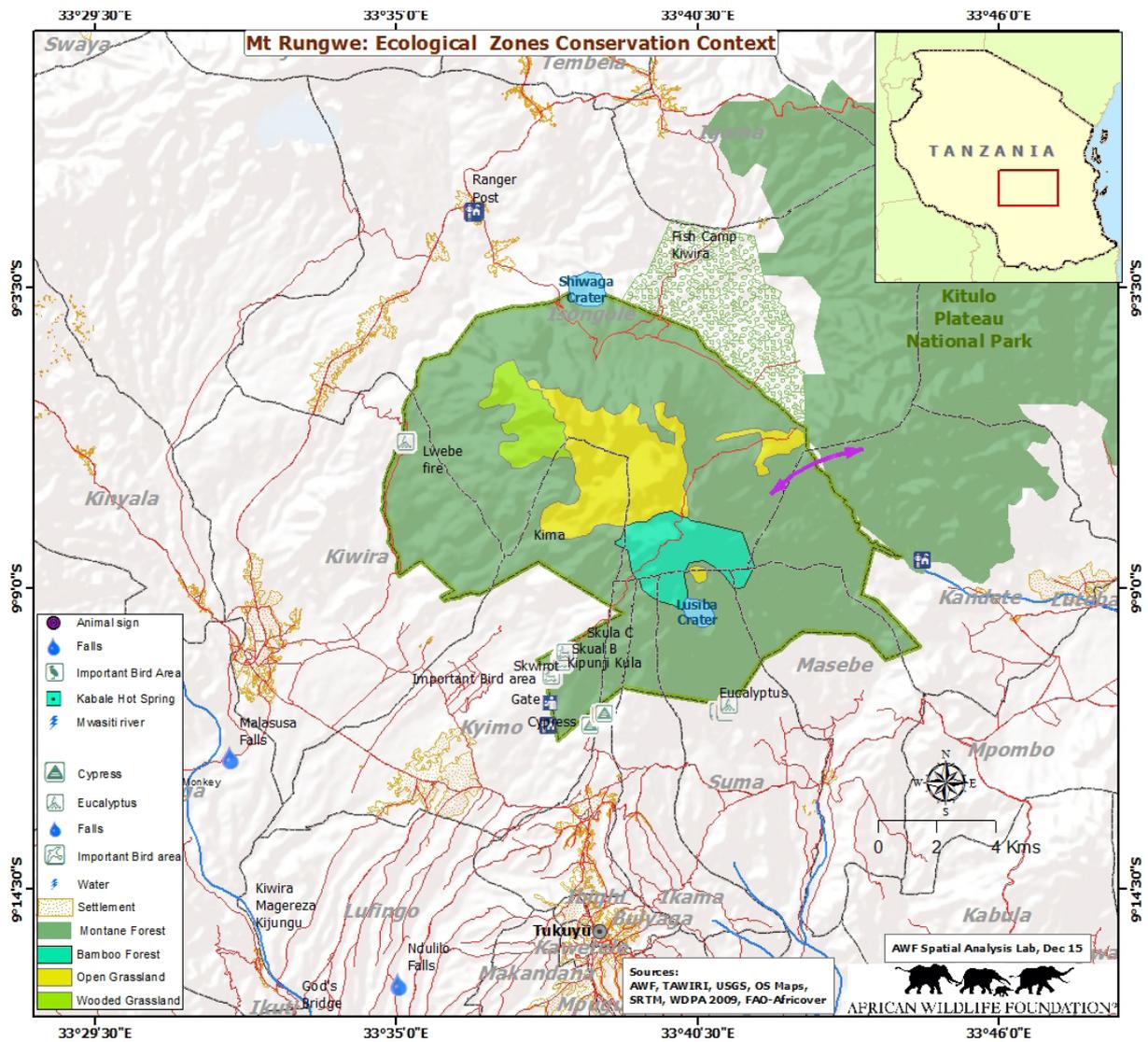


Figure 2: Map showing MRNFR main ecological zones

b) Management Zones

The basic zone plan for MRNFR considered the ecology of the reserve. The zonation scheme in the previous plan was essentially premised on regulations, management objectives and local needs. The scheme ensured separation of conservation and utilization. They were some challenges on implementation of management zones due to unclear zone boundaries and conflicting zone prescriptions. Firstly, most of the zone boundaries did not follow physical features that are easily identifiable and no form of demarcation was carried out to mark zone boundaries. This seriously affected implementation of zone prescriptions that were part of the plan. Secondly, some of the activities prescribed for some zones no longer align with reality on the ground.

Apart from these, they were no other challenges with the zonation plan. Therefore, during this planning process the broad zonation was deemed to be effective and only minor changes were made (Table 7). The main change effected on the zonation was carried out in order to align with TFS zone types and names. This resulted in shift of the Nature Restoration Zone which is now under the Biodiversity Zone. It was noted that some areas within the former NRZ

are still in need of restoration due to invasive species and fire damage. Thus, the Biodiversity Zone now has two sub-zones (BZI and BZII), with the only difference between the two is that MRNFR management will be allowed to carry out restoration activities in some part of the BZII (Figure 3). It was recognised that the Catchment Zone is cross cutting, thus caution was taken in setting guidelines for zones to ensure that permitted activities do not lead to degradation of water resources/catchments in the reserve. On implementation attention will be paid to demarcating the zones on the ground and ensuring visitors, other users, patrol teams are well informed on zone prescriptions.

Table 7: Management zones in MRNFR

Zone	Description	Activities
	Areas	
Amenity Zone	Grassland, craters, forest, calderas	Recreation, research, tourism, education, NTFP, fuelwood collection under license, <u>invasive species and fire control.</u>
Biodiversity zone	Water catchments, breeding areas of key species (e.g. Kipunji and Abbott's duicker)	Research, tourism, education, invasive species control.
Biodiversity Corridors	Bujingijila corridor linking MRNFR to Livingstone forest in Kitulo National Park, part of the area belong to Bujingijila village	Research, invasive species control, rehabilitation
Community Support Zone	Areas surrounding MRNFR, belong to the surrounding villages	Community conservation initiatives and other developmental support

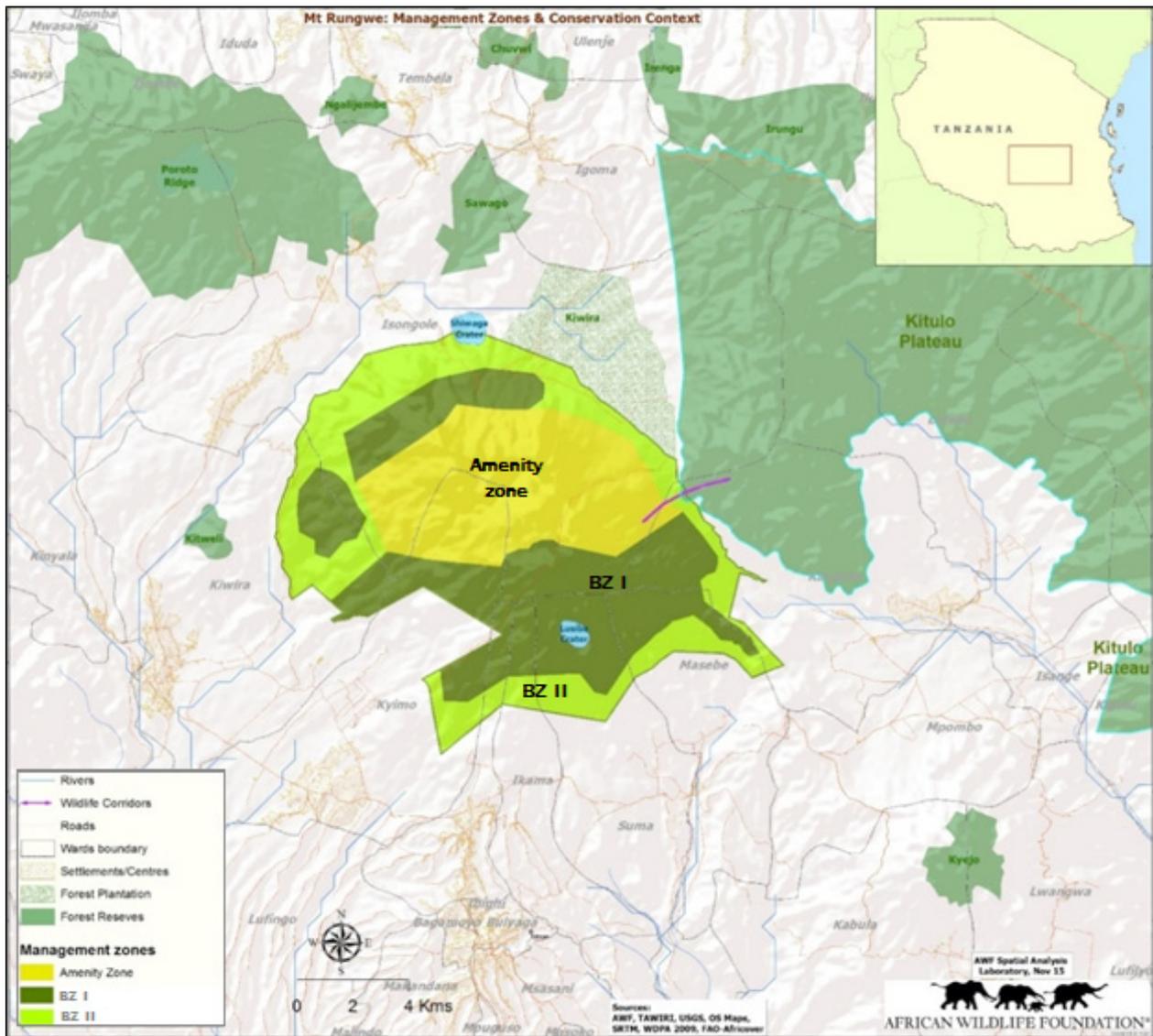


Figure 3: Map showing management zones in MRNFR

i. Biodiversity Zone

The zone includes areas of MRNFR with highest diversity and concentrations of endangered and endemic species. Under the previous plan this zone was under strict protection with permitted activities restricted to research and monitoring activities. The rationale was mainly for protection and to allow recovery of Kipunji population and habitat in the reserve. There have been significant improvements in the population of Kipunji population as well as the habitat thus under the revised guidelines some activities will now be allowed in this zone as outlined below (Table 8 and 9). The zone is divided into two areas, BZ I and BZ II. Much of BZ I is still intact with the least disturbed habitat in the reserve. BZ II which is an area surrounding much of BZ I still faces disturbances such as fire, logging and invasive species thus will continue to require management interventions for restoration. The two zones will be managed under the same prescriptions with only defined restoration activities allowed in BZ II. This part of biodiversity zone will exist to restore the natural vegetation in the disturbed areas through natural succession or management interventions. Once an area in BZ II has been deemed

restored it will immediately be added back to the appropriate zone.

The specific objective of the biodiversity zone is to:

Maintain high biodiversity, genetic resources and natural processes in as undisturbed state as possible and provide opportunities for research and monitoring of undisturbed forest ecosystems as well as carefully chosen ecotourism activities.

Table 8: Management infrastructure and tourism facilities in the Biodiversity Zone

Facilities	No. of facilities	Description/Limitations/Prescriptions
Tourist Campsites	1 (existing)	Carrying capacity to be determined by tourism assessment Basic infrastructure only, water tank, covered cooking area, benches, toilets Water borne sewage and showers in ablutions Wood available on site for purchase Allocated attendant for protection and maintenance Where appropriate site can have a gazebo shelter No permanent structures
Research campsites	1 (existing)	Carrying capacity to be determined by tourism assessment Basic infrastructure only, water tank, covered cooking area and wooden benches, toilets Water borne sewage and showers in ablutions Wood available on site for purchase Where appropriate site can have a gazebo shelter No permanent structures
Picnic sites	1	Maximum 10 people per site. To be selected with expert advice during tourism assessment Table and benches
Reserve main entrance gate	1 in Syukula	One entrance gate to be developed at Syukula Ensure limited disturbance of vegetation in constructing Eco-friendly structure in sync with the reserve's core values
Access roads and paths	existing	Access roads and paths in this zone will be limited to the existing Roads and paths to be maintained for easy access No new roads/paths to be opened

Table 9: Visitor activities in MRNFR biodiversity zone and amenity zone

Activity	Description/Limitation
Hiking	Will be allowed along designated routes to Mt Rungwe Peak
Guided walks and viewing	Will be allowed, with trained guides as necessary
Interpretive walks	Short unguided walks around identified key attractions
Picnics	At designated sites
Overnight camping	Camping will be permitted at the designated campsites only
Specialist excursions	To help gather and document information on the Reserve's resources, specialist excursions will be encouraged.
Research	Ecological research in accordance with MRNFR management requirements and limitations, and with permission from TFS

ii. Amenity Zone

This zone occupies mostly the centre of MRNFR and captures small portions of critical habitat for endangered and endemic species. The specific objective of this area remains to: *provide areas for managed visitor and tourism use, NTFP and medicinal plant collection under license, offering opportunities for recreation and environmental education without disturbance to more sensitive areas.*

iii. Biodiversity Corridors

MRNFR is quite isolated from other key biodiversity areas in the region. The only existing linkage is between MRNFR and Livingstone Forest which part of Kitulo National Park. The two protected areas are linked by Bujingijila corridor (Figure 2). It was previously thought that MRNFR and KNP did not share a boundary however a recent survey of the area showed that the two protected areas share a boundary for a length of 3.2 km. Thus part of Bujingijila corridor is effectively under the two protected areas. However, a significant portion, on both sides of the corridor is under jurisdiction of the Bujingijila Village. Areas under the village are increasingly shrinking from agricultural expansion. The specific objective of the corridor will be to: *Maintain connectivity between MRNFR and Livingstone forest for continued animal movement and gene flow.*

iv. Community support zone

The community support zone is an area outside and surrounding MRNFR. It comprises the villages and other privately owned land units adjacent to reserve (23 villages presented in Part I: Table 1). This zone was necessitated by lack of a buffer zone for MRNFR which has resulted in hard edges between the reserve and adjacent plantations and farming areas. However, this does not mean MRNFR assumes control or has jurisdiction over this zone. Instead the zone was highlighted to provide guidance on land uses and other initiative/activities that could be promoted in the area in order to ensure compatibility with conservation of the reserve. Presented below are some of the key natural resource that communities used to extract from the reserve which they are no-longer allowed to, also provided are possible resource interventions that are

being and should continue to be promoted in this zone in order to address some of the natural resource needs of the communities (Table 10). These interventions will be promoted primarily through Village by Laws with VECs as the vehicle to ensure adoption.

Table 10: Possible resource management interventions in the community support zone

Resource	Remarks/Priority Areas for Intervention
Firewood	Improve agroforestry activities Improve tree planting and woodlot management Use of efficient stoves and alternative energy sources
Medicinal plants	Domestication of medicinal plants Formation of herbalist groups/associations
Vegetable	Improve horticulture
Mushroom	Scale up mushroom farming projects
Fruits	Planting fruit trees through agroforestry Improve horticulture, Include fruit trees in nurseries
Poles and withies	Increase tree planting Promote use of ceramic and clay blocks and bricks
Timber	Regulations to be adhered to Increase tree planting and retention Efficient use of timber
Beekeeping	Training and capacitating beekeeping groups Regulations to be adhered to Improve beekeeping and marketing
Animal grazing	Land use planning with grazing zones Use of modern animal husbandry practices Improved breeds, Cultivation of fodder
Grass collection for fodder	Cultivation of fodder Use of food supplements
Commercial firewood (exotic trees)	Regulations to be adhered to Increase tree planting
Planting and harvesting bamboo	Regulations to be adhered to Increase planting of alternatives
Collection of <i>Hagenia abyssinica</i> seeds and wildlings	Raise seeds in nurseries Increase planting of <i>H. abyssinica</i> in farmland
Cultivation in watershed areas	Not allowed
Mining	Not allowed
Gravel and sand	Subject to special permit At designated sites, Not in water sources and rivers
Planting exotic trees	Professional advice should be sought Not to be planted in watershed areas

v. Zone Regulations

Clear management and utilisation regulations in each zone will guide use and management of the reserve (Table 11). This will also allow provision of specialized protection for critical or representative habitats, wildlife, ecosystems and ecological processes, and avoid conflicting

human interests including levels of tourism. This will also help protect the natural or cultural values and allow damaged sensitive areas time to recover or be restored. Efforts will be put into providing information on regulations to management, all users, communities and patrols units.

Table 11: A summary of regulations within zones to guide use and management of MRNFR

Activity	Biodiversity Zone	Amenity Zone	Biodiversity Corridor
Research and monitoring	Permitted	Permitted	Permitted
Forest protection	Permitted	Permitted	Permitted
Control of exotic species	Permitted	Permitted	Permitted
Restoration activities	Not permitted (only in BZII)	Permitted	Permitted
Fuel wood collection	Not permitted	Permitted (under license)	Not permitted
Collecting medicinal plants	Not permitted	Permitted (under license)	Permitted
Use of agreed traditional paths	Permitted	Permitted	Permitted
Access to designated worshiping sites	Permitted	Permitted	Permitted
Ecotourism	Permitted	Permitted	Permitted
Management & Tourism Trails	Permitted (only existing)	Permitted (only existing)	Permitted (only existing)
Designated campsites and picnic sites	Permitted	Permitted	Not permitted
Viewing points	Not permitted	Permitted	Not permitted
Water abstraction	Not permitted	Permitted (under license)	Not permitted
Grass cutting	Not permitted	Not permitted	Not permitted
Tree cutting	Not permitted	Not permitted	Not permitted
Grazing	Not permitted	Not permitted	Not permitted

3.2.1.2 Forest Management Units

MRNFR is divided into three main management units namely Syukula, Unyamwanga and Bujingijila. There are no administrative units therefore any Village Forest Management Area (VFMA) will be guided by Joint Management Agreements.

3.2.1.3 Management maps

An updated map showing the different management zones of the Nature Reserve exists (Figure 2). Apart from the zones, the map indicates major communication lines, rivers and boundary.

PART IV

4.0 MANAGEMENT PRESCRIPTIONS

4.1 Forest management operations

4.1.1 Forest resource assessment and monitoring

For informed management and sustainable utilisation of MRNFR there is need for continued monitoring of ecological management targets that act as proxy's to the general natural resource base in the reserve. This plan will seek to introduce the use of technologies such as Cyber tracker and SMART (Appendix 7) in management of the reserve. These technologies are not only useful for efficient patrolling but allow for collection of data during patrols which is essential for monitoring and evaluation purposes. Monitoring and evaluation will be based on the identified indicators for each key ecological attributes for each targets. Inventories will be conducted in the second year of implementation by using NAFORMA methodology. Participatory Forest Resource Assessment (PFRA) will also be conducted during the implementation of this plan. Management Effectiveness Tracking Tool (METT) will be filled annually to assess changes in the management of the reserve.

4.1.2 Harvesting plan

According to the set objectives of MRNFR, no harvesting is allowed. The reserve is protective and will be used for nature conservation, scientific studies, ecotourism and other stipulated environmentally friendly activities.

4.1.3 Silvicultural systems (prescriptions)

Under natural regeneration it is expected that the forest stock will increase in volume from 50m³/ha to 62.5m³/ha over a period of 3 yrs. The following are silvicultural systems which are applicable to MRNFR.

- i. Natural regeneration.* The forest will be left to regenerate by coppice, natural seedling and or suckers.
- ii. Weeding and cleaning.* The activities will be carried out along the boundary line (fire line) only. This will be done once in the dry season and twice in the rainy season. The forest attendants, VECs and casual labours around will perform these activities.
- iii. Boundary planting.* Evergreen tree species will be planted along the boundary to act as fire breaks such as *Khaya anthotheca*, *Cedrella mexicana* and *Senna* sp. Exotic species (*Eucalyptus* sp.) that were used for boundary marking will be replaced by indigenous species.

A subsidiary plan for invasive species control in the reserve has been prepared (PART VI). As stated before, there are 3 invasive species in MRNFR (*Pinus patula*, *Eucalyptus sp* and *Cupressus lusitanica*). The plan prepared is for *Pinus patula* that has seriously become a threat to the sustainable development of the reserve.

4.1.4 Boundary Consolidation

Marking the boundary is important in preventing people from entering the forest illegally as well as agricultural encroachment. Considerable efforts have already been put into marking the reserve boundary and this has reduced conflict between the MRNFR and the surrounding community. Beacons have been installed as permanent markers to the boundary however there is need to ensure this is done for the whole perimeter. As visible markers, trees have also been planted to mark the boundary and this will continue by use of appropriate species. Replacement of beacons and signboards and installation of new ones will be done as appropriate.

4.1.5 Forest Protection

Protection of the forest has improved considerably over the lifespan of the previous plan. Security in the reserve has been strengthened by involvement of community forest guards in patrols to compliment MRNFR staff. Collaboration with communities will continue to be critical in ensuring continued protection of the forest. The following approaches will be used to ensure continued protection:

- ❖ Establishing ranger outposts
- ❖ Increased patrols by MRNFR staff in collaboration with community forest guards
- ❖ Good relationships between MRNFR management, patrol units and communities
- ❖ Public awareness through extension services by meetings, workshops and school programmes
- ❖ Local community adherence to village by-laws
- ❖ Fire line maintenance

4.1.6 Enhancement of Carbon stocks through restocking and natural regeneration

Natural regeneration of the Reserve will be promoted through effective protection mechanisms. Since the main function of the Nature Reserve is to keep the nature in the natural state with minimum disturbance and where such disturbance had occurred to reduce it if possible to natural state. The gaps within MRNFR are mainly caused by human disturbances. These gaps will be closed both through replanting and by enhancing natural regeneration.

4.1.7 Nurseries

One temporary flying nursery will be established at Namba1 Village for the purpose of supplying indigenous tree seedlings for boundary marking in the reserve and other management zones. Nurseries currently being established in schools will be supported and seedlings will be

distributed for planting in the community. Schools that have not yet established nurseries will be encouraged to do so and supported with training and materials. MRNFR management will solicit the involvement of other stakeholders in the area to support nursery establishment and planting of trees. Management will also monitor the type of species used and provide technical support.

4.2 Management of buffer zones and corridors

Initiatives focused on promoting conservation in the CSZ are already underway in some villages. To date activities that have been carried out include, tree planting, agroforestry, land use planning, fire control, woodlot establishment and beekeeping. Such initiatives will be scaled up and extended to other villages. Now that VEGs in collaboration with village governments have the mandate to control utilization of resources in the CSZ they will be capacitated to promote conservation initiatives in their areas and more importantly to monitor social and conservation impact of these initiatives. Each VEGs will be mandated to carry out resource base assessments in their respective areas.

4.3 Watershed areas management and soil conservation

A large part of the work here will focus on working with VEGs, village governments and communities in the CSZ to improve their water and land management. The following approaches are recommended:

- ❖ Identify sensitive river headwater areas and prohibit grazing and water abstraction
- ❖ Promote land use planning in all villages
- ❖ Promote agriculture in appropriate areas, and practices that avoid erosion, siltation and pollution
- ❖ Promote environmental monitoring
- ❖ Provide technical support on appropriate tree species to be planted in each area in order to maintain ecological niches for other species

4.4 Physical resources

Currently, MRNFR has very limited physical resources. In the planning period, the reserve headquarters will be established at Tukuyu town. A basic office complex will be constructed that will comprise 2 offices, 1 meeting room, toilets and kitchen. Three ranger outposts will be constructed at Bujingijila, Syukula and Unyamwanga villages. Fixtures and fittings to the constructed houses will be supplied according to the specifications for the government houses. Regular maintenance of these infrastructures will be done throughout the planning period. In terms of working gears, 1 off-road vehicle (Toyota Land Cruiser H/Top), 4 motor bikes and a 7 tonnes lorry will be procured. A total of 16 bicycles will be procured for the Village Environmental Committees (VECs). Key roads leading into MRNFR will be improved whereby a total of 40 km road length will be improved and maintained throughout the planning period,

50 km of footpaths will be maintained and signposted. The procurement of these facilities and road maintenance will be under funding from GEF/UNDP through project “Enhancing Forest Nature Reserves Network for Biodiversity Conservation in Tanzania.”

4.5 Human Resources

4.5.1 Staff

Currently MRNFR has five permanent employees of different academic levels: one Conservator (MSc level), one Forest Officer (BSc level) and three Diploma holders. Two personnel are employed on temporal basis, the driver and ecotourism personnel. This number is too small to manage the reserve in a sustainable way. To achieve its management effectively, the reserve needs additional personnel as indicated in table 11 below.

Table 12: Staff requirements for MRNFR

S/N	Education	Number	Responsibilities
1	BSc (Forestry)	1	To head development and research section
2	BSc (Tourism)	1	To head tourism section
3	Diploma in Forestry	3	Ranger in charge in each of the three Blocks
4	Certificate in Forestry	5	To assist Block Ranger in charge
5	Driver	1	To drive vehicles
6	Accountant	1	Funds management
	Total	12	

4.5.2 Training

MRNFR staff should be well versed in new approaches to forest reserve management and new technologies that can improve reserve management and operations as well as guidelines and management approaches adopted by TFS. There is need to ensure there is an adequately trained and professional staff for the reserve. Within the planning period of 5 years MRNFR management will carry out long term and short term training for her staff and local communities as a strategy for capacity building. Trainings help to improve the working skills and knowledge of the staff. Long term training will be in the following category; 1 BSc holder to MSc, 2 Diploma holders for BSc. Throughout the planning period various on-job training will be offered. Short courses training which will cover areas such as: alien species control; fire management control; Remote Sensing and Geographic Information System (GIS); Global Positioning System (GPS); Computer courses and tour guides from the adjacent villages. Training on beekeeping techniques, agroforestry, nursery establishment for timber, fruit and fodder trees, animal keeping and zero grazing training and sustainable fish farming and fishing methods. VECs will also be trained in Natural Resources Management but also CFGs will be trained before they are deployed for patrols.

4.5.3 Enhancement of community participation (JFM)

MRNFR has formed an Advisory Board. This board was formed by having two representatives from 16 villages directly bordering the reserve. This is an important instrument that will enhance effective communication between the reserve and local communities. There are also VECs in the adjacent villages that will work closely with the MRNFR management. VECs from 23 villages will be trained on their roles and responsibilities so as to act as a link between the local adjacent communities and the MRNFR management. Memorandum of Understandings (MoUs) will be formulated and that communities will continue to be the key players in implementing agreements contained in the MoUs. Furthermore, Joint Management Agreements will be formulated to ensure effective community participation and benefit sharing.

4.5.3.1 Community organizations and institutions

Village Environmental Committees are the key players that will link the implementation of VNRMP and the MRNFR Management Plan. Schools, Women groups and individuals involved in farm forestry will also contribute to the management of MRNFR. These groups will be trained so as to strengthen their involvement in the management of the reserve e.g. involvement in Reserve tourism, fire control and management, invasive species control and boundary maintenance. A transparent MoUs between the community organizations and MRNFR management will be developed.

4.5.3.2 Instruments to facilitate community participation

A participatory approach was used in the development of this plan. This ensured involvement of communities in the planning process through their representatives and consideration of their views, concerns and aspirations. To ensure continued community participation in the management of the Reserve instruments like forest policy, village by- laws, Village Resources Management Plan (VRMP), Village Action Plan, Village forest Management Agreements VFMA, MoUs between MRNFR and villagers bordering the reserve will be used.

4.6 Extension services and socio-economic studies

4.6.1 Extension services

These services include various conservation and development initiatives that will be carried out in collaboration with communities either by TFS and MRNFR management or by various partners supporting conservation and development in the area.

Development of village land use plans will be encouraged in order to reduce problems of land shortage, land degradation and soil infertility. Methods to enhance soil fertility include use of organic manure, i.e. animal manure, green manure and compost, promotion of soil conservation practices such as cut-off-drains, grass strips, mulching, rehabilitation of gullies to prevent soil erosion and various other agro forestry practices. To enhance the participation of various stakeholders' conservation extensions methods that include fields visits, meeting, workshops, seminars will be used. Materials such leaflets, brochures, calendars will be

prepared and distributed to the forest adjacent communities. Training on commercial tree seedlings raising will be supported to individuals and groups in all 23 surrounding villages. The use of fuel-effective stoves and beekeeping will be promoted in order to decrease the need of fuel and increasing income respectively. A Participatory Forest Resource Assessment will be conducted in order to identify various Income Generating Activities (IGAs) that could be supported by MRNFR management.

4.6.2 Socio-economic studies

Social economic studies will be conducted in collaboration with local communities in all 23 villages surrounding MRNFR. The information from these studies will assist in developing community projects that are demand driven. To achieve sustainable and harmonious conservation land use plans will be carried out in the villages surrounding MRNFR.

4.7 Initiatives for revenue generation and sharing

4.7.1 Ecotourism

Ecotourism is one means to contribute to revenue generation in MRNFR. This activity requires proper planning, due diligence, market knowledge, well-organised visitor facilities and tourism services, including marketing and on site development. Careful planning is necessary to combine the conservation objectives and tourism activities into environmentally sound practices. A total of 578 tourists visited the reserve between July 2014 and June 2015. The entrance fee into the Reserve per person per day is USD 10 (Tshs 22, 834 at current exchange rate) for non-Tanzanians and TSH 3,000/- for Tanzanians. Permit for camping per person per day is USD 10 for each owned tent and USD 15 for each hired tent (non-Tanzanians). For East African Citizens the fees are Tsh 3,000/- per person per day for owned tent and Tsh 10,000/- for hired tent.

To attract more tourists in MRNFR effective marketing and networking activities is required. Nature trails will be maintained annually to ensure a good tourism product and labelling of plant species along the nature trails. A plant check list will be prepared for visitors. An emblem will be designed for MRNFR that will be used in all materials produced by the reserve such as letters, envelopes, interpretation materials and signs. The web page will be developed that will contribute in publicizing MRNFR.

4.7.2 Research fees

MRNFR uniqueness is in terms of ecosystem and species diversity that attracts various researchers to the reserve and hence form potential for revenues generation through charging research fees. Currently entry into the Reserve for research purposes costs USD 10 per head per day.

4.7.3 Fines

Fines will be collected from violators of Reserve regulations. However, this will contribute little as there are frequent patrols which up to now have resulted in a decrease in illegal activities in the Reserve.

4.7.4 Ecosystem services

MRNFR hosts significant watershed and biodiversity value. The concept of payment for ecosystem services is gaining traction globally and may provide an opportunity for MRNFR to generate revenue to support its conservation. To catalyse this, an ecosystem service valuation would be required by an expert. Thereafter, a market mechanism would be developed and would need to be presented to potential buyers.

4.7.5 Other types of tourism

In the efforts of increasing MRNFR revenue, other types of tourism like cultural, historical, religious and pleasure tourism will be promoted and advertised.

4.8 Inter-sectoral linkages and co-operation

There are several stakeholders working in the buffer zone of MRNFR that might affect the management of MRNFR in different ways. The following institutions and their activities are of great concern to MRNFR. Among these are Rungwe Avocado Company, Tukuyu Water Supply Authority, Maji Rungwe, Tanzania Forest Research Institute, Tanzania Electric Supply Company, AWF, WCS and SPANEST. There exist opportunities to collaborate with some of these entities to improve management of MRNFR as well as generating resources to fund conservation in and around the Reserve.

PART V

5.0 FINANCES, BUDGET, MONITORING AND REVISION

5.1 Financial Implications

Mount Rungwe Nature Reserve management plan will cover a five-year horizon from 2016 to 2021. The total budget for the plan period is Tshs 4,366,845,000/=. Detailed budget is provided in Appendix 1. Budget estimates for various activities followed standard coding. For effective management, the reserve requires financial inputs for construction (office buildings, roads and ranger out posts), procurement of equipment and services (transport facilities and house fittings). These investments are required to be effected in the first two years so as to quickly make a step forward. Funds for the implementation of various activities stipulated in this management plan will be sourced by TFS and other development partners.

5.2 Annual Plan of Operation (APO)

The MRNFR Annual Plan of Operation (APO) is based on the five years management plan. In this plan activities are scheduled to start their implementation in the third quarter of the financial year 2015/2016. Activities which are expected to be done include, awareness raising on PFM at district level for Mount Rungwe NR, conduct awareness meetings on PFM at village level, conduct social economic study, training to VNRCs (Village Natural Resources Committee), staff training (short courses), Local communities (study visit), CBOs (short term training), staff (Seminars, Meetings), local communities (Seminars) and Local NGOs and CBOs (seminars). Survey and identify eco-tourism potential sites, preparation of thematic maps for various ecotourism sites, preparation & distribution of leaflets (2 types), preparation & distribution of posters (1 type), preparation & distribution of brochures (2 types) and, to maintain nature trails. Other activities to be implemented are; establishment and maintenance of camping sites, awareness creation on forest protection, fire prevention, fire line maintenance (fire prone areas), establishment of PSP and monitoring of the threatened and endemic species, gap and enrichment planting (10 ha), boundary tree planting, beacon preparation and installation/replacement, boundary weeding, preparation and installation of sign boards and, supporting the communities on soil conservation measures in 23 villages. All these activities are expected to cost a total of Tshs 1,082,427,000/=.

5.3 Monitoring and evaluation

5.3.1 Monitoring

MRNFR will establish monitoring and evaluation mechanism that will be used as a management tool. Monitoring will be carried out through specific implementation reports (monthly, quarter, semi-annual and annual reports). Monitoring of activities will be based on indicators developed and attached to this management plan (Appendix 5). A participatory monitoring and evaluation approach which involves adjacent villages will be adopted. This is a very important tool in forest management where communities are involved in monitoring.

A framework for monitoring some of the key biological components of MRNFR is provided in Appendix 5. This can further be developed to cover other biological components of the Reserve. Available information on forest inventory, plant and animal lists will provide a baseline upon which data and other information generated through monitoring can be used to evaluate changes of these components in and around the Reserve.

5.3.2 Evaluation

Internal evaluation will be done after two years of implementation so as to give feedback to the management. External evaluation will be done in the fourth year of its implementation. The findings of the exercise will feed back into the review process of the MRNFR management plan in the fifth year of implementation. Nevertheless, the successful implementation of this management plan will depend on the availability of both financial and human resources.

5.4 Constraints

Existing constraints to the management of MRNFR need to be addressed for successful implementation of the plan. Key among these are the issues of financial resources and the number of staff in the Reserve. There is need to secure funding in order to implement the planned activities through soliciting support from the donor community or implementation of some activities by partner organisations. Participation of local communities in some aspects of the Reserve management have proven to be valuable in the face of limited staff numbers. This should be encouraged during implementation of this plan. The authority of this plan is within the boundaries of the Reserve thus its prescriptions cannot be forced on the surrounding communities or other neighbours to the Reserve. In order to ensure a healthy influence in these areas MRNFR will seek to use Joint Management Agreements with well-established MoUs with surrounding communities and other land holders as tools to drive collaborations that enhance biodiversity conservation in their areas.

5.5 Plan lifespan, amendments and revision

This is a five-year management plan, 2016 – 2021. During this period, there will be annual reviews that will be carried out internally by TFS and MRNFR management. Mid-term review will also be carried out after two years of implementation. This will be followed by an end term review which will culminate in the update and development of another five-year plan.

PART VI

6.0 SUBSIDIARY PLANS

6.1 MOUNT RUNGWE FIRE MANAGEMENT PLAN

6.1.1 INTRODUCTION

Wildfires have increasingly become a concern globally due to the severe socioeconomic and environmental impacts. Wildfires have the potential to burn through acres of land within minutes destroying lives and properties and causing ecological degradation. The major causes of fire are human activities. A wildfire can be defined as any unplanned and uncontrolled wild land fire which regardless of ignition source may require suppression response or other action according to agency policy.

The long term impact of frequent fires may result in negative changes in productivity and population structure of a species. Fires modify growth and reproductive rates, change the availability and use of resources and alter competitive and other relationships between organisms. Frequent fires reduce woody plant densities, and can influence changes of floristic and structural composition by killing or suppressing individuals especially in the smaller diameter size classes.

Projections suggest that climate change will make areas that are already vulnerable to wildfires even more fire-prone, and that the increasing intensity of fires can dramatically change forest composition. Forests are storehouses of carbon dioxide, a greenhouse gas that is largely responsible for global warming, and forest fires release the stored gas into the atmosphere. The additional carbon dioxide can lead to further global warming that will exacerbate the forest-fire problem even more.

6.1.2 Wildfire in Tanzania

Wild fire is among major ecological challenges in Tanzania. In Tanzania wild fires are reported to be increasing at an alarming rate due to insufficient plans and programs to control fire, inadequate human and financial resources; insufficient extension programmes for local communities and lack of or weak integration of informal (Indigenous) knowledge and policy implementation relating to forest fires management.

Forest fire is a very prevalent disturbance in Tanzania's landscape with several hundred million hectares of vegetation burning every year. Between 2001 and 2007 fire affected a yearly average of 12 % of area in Tanzania, ranking fourth within the SADC region. FAO (2011) reported that between 1990 and 2010 Tanzania lost an average of 403,350 hectares of forest or 0.97% per year due to fire.

In Tanzania analogous to those found elsewhere most fires are caused by human activities. The main human activities that have been identified as major causes for wildfire in the country include farm preparation, game hunting, honey hunting, burning to simultaneously improve pasture quality and to eliminate parasites, charcoal burning, mining, pit sawing, grazing, controlled burning, arson and wildfire attributed to pedestrians. Used as a management tool under controlled and managed conditions, fire is proven to have positive impacts in some ecosystems in Tanzania. Fire is useful to regenerate and stimulate growth of grass and maintaining habitat structures of important wildlife species and domestic animals. However uncontrolled fire has resulted in many negative impacts. Wildfires contributed to human deaths, loss of crops and livestock, reduction in plant biomass and litter, impacts on soil, water and atmosphere, killing animals, loss of habitats, plant density and alteration of floristic and structural composition of plant communities.

6.1.3 Legislative Framework

Currently each natural resource management sector e.g. forestry, agriculture and livestock, beekeeping, wildlife, land and environment, has a separate sectoral management policy and separate management act and most often, these policies and acts conflict widely on the wildfire issues. Almost all the sectoral policies and acts don't treat wildfire with the attention it deserves; only the Forest Act No. 14 of 2002 dedicated sections on it.

The Forest Act No. 14 of 2002 and forest regulations, 2004 on bush/forest fires cover issues of fire including offences and penalties. Of specific interest are Sections 70 (1-5) which articulate restrictions on burning vegetation, Section 71 (1-5, 73, 75) talks about the authority which requires persons to assist in extinguishing fire, Section 91 (1 and 5) covers actions/offences deemed as unlawful in handling fire, and Section (49 (1-13) of the forest regulations 2004 about restriction on use and inflammable objects.

In summary sections of the Forest Act and the regulations specify restrictions on burning of any vegetation on any land outside the cartilage of one's compound. Exemption is only by an order made by the Minister and published in the Gazette or permission from the person having control of the said land or from a forestry or other officered with the authority to grant such permission. The law also requires citizens in the vicinity of a fire to either notify occupier of the land upon which such fire is burning, attempt or assist in extinguishing such fire with due consideration to their safety. The law considers that one shall be guilty of an offence and upon conviction, shall be liable to a fine of not less than fifty thousand shillings for lighting, rekindling or adding fuel, and/or leaving unattended fire lighted without authority. Any person who will fully and unlawfully sets fire to any forest reserve, forest plantation, standing trees, sapling or shrubs, whether indigenous or not, commits an offence and upon conviction shall be liable in accordance with the provisions of section 321 of the Penal Code.

6.1.4 WILDFIRE IN MRNFR

In Mount Rungwe Nature Reserve and surrounding village areas wildfire continue to be a concern with fire incidences having a social and economic impacts. Over the years wildfire incidences have seen destruction of habitats in and outside the reserve, loss of food and cash crops in the surrounding villages, economic losses for tree farms and plantations of eucalyptus and pines that are all around the Reserve.

Due to the absence of a buffer zone the Reserve is susceptible to fires spreading from the surrounding farms and plantations. Surrounding plantations are dominated by fire prone *Pinus patula* which landscape is at risk of fire outbreaks. Clearing of fields for planting, honey collection and hunting have been identified as some of the chief causes of fire in this area.

Generally, fire instances are in increase in Tanzania and this holds true for the MRNFR and the surrounding areas. A fire management plan (FMP) is an essential component for the prevention, suppression, and management of fire within forests and adjacent lands.

6.1.5 Fire History in MRNFR

Fire regime and fire history information is an essential component in describing the role that fire plays in ecosystems. This information contributes to an understanding of disturbance patterns and processes. A fire regime is defined as “the kind of fire activity or pattern of fires that generally characterize a given area”. It is derived from the fire history including: fire frequency, fire type, fire size, fire season, fire severity and fire intensity, of fires that occur in a given area. Evaluating these given characteristics provides necessary information to support various aspects of forest protection and fire management strategies.

6.1.6 Fire frequency

Fire frequency is the number of fires that occur over a period of time. They are scant records on the frequency of fire in MRNFR. The available records indicate that on average there are three to four fire incidences in and around the Reserve. Satellite active fire observations from the last decade reinforce these records and show some of the highest activity in the Bujingijila Corridor area (Figure 1). According to MRNFR staff, large fires of high intensity often occur during the peak of the dry season, August – September.

6.1.7 Fire intensity

Fire intensity is a measurement of the rate and amount of heat released per length of flame front (kW/m). There is no recording of fire intensity for MRNFR. The intensity of fire in the area is largely determined by the type of fuel and wind direction.

6.1.8 Fire size

MRNFR has experienced fire incidences that have profoundly impacted its biodiversity and the survival of montane grassland and the natural forest cover. In 1984 and 1989, severe fires broke out in MRNFR destroying 400 ha and 1500 ha, respectively, of natural forest cover. Sketchy information also indicates to the occurrence of severe fire in 2000 and 2009. The fire in 2009 is said to have lasted 18 days (12 - 30th September) reaching the peak of Mt Rungwe burning the high altitude grasslands and destroying 2150 ha of forest.

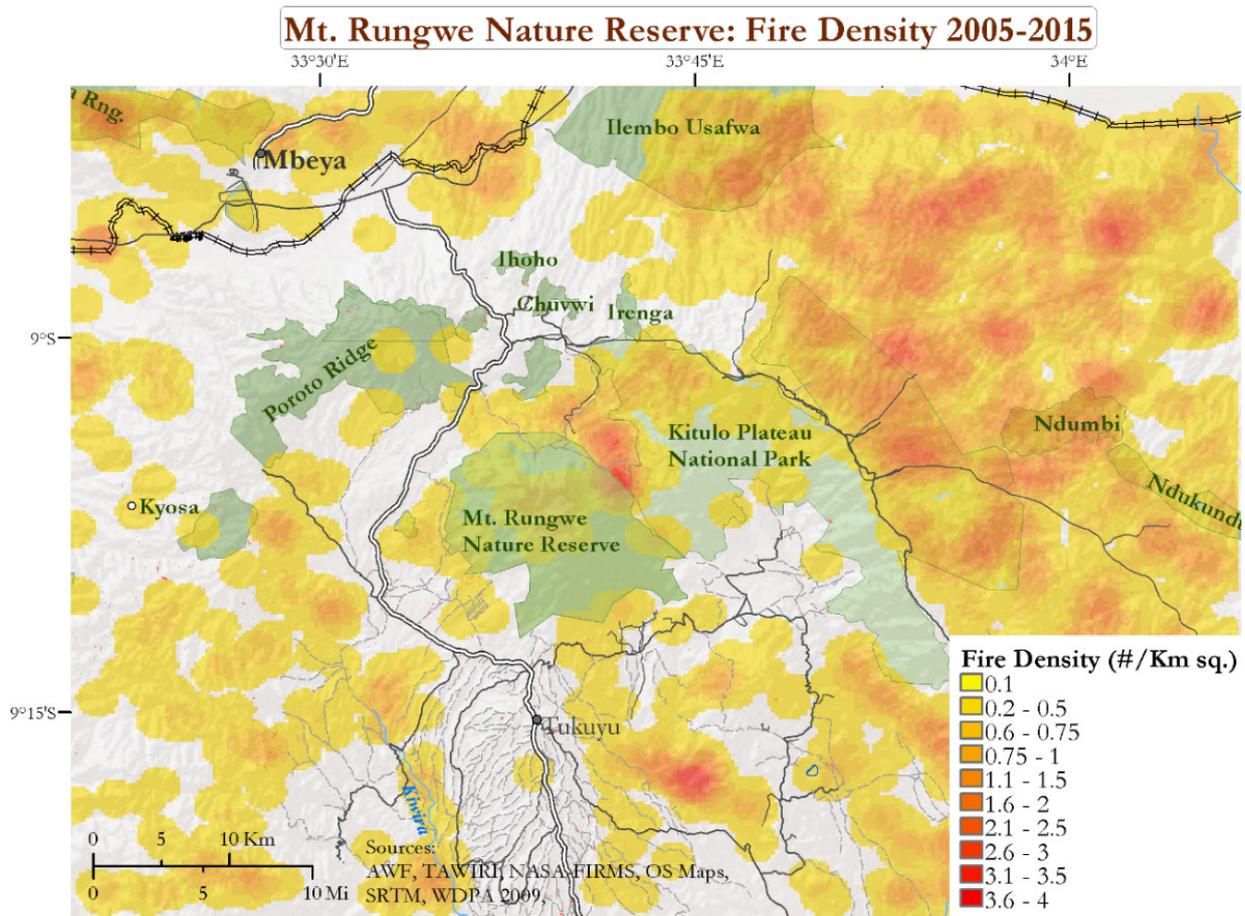


Figure 1. Fire density in MRNFR region as derived from MODIS active fire observations

6.1.9 Fire type

Fire type refers to the cause of the fire, either human-caused (anthropogenic) or ignited by lightning. Records show the leading cause for fire occurrences in MRNFR was human activities. Leading among the human causes are fires started through illegal hunting, field clearance and honey collection. Other activities causing fires in the area include firewood collectors and pit-sawyers.

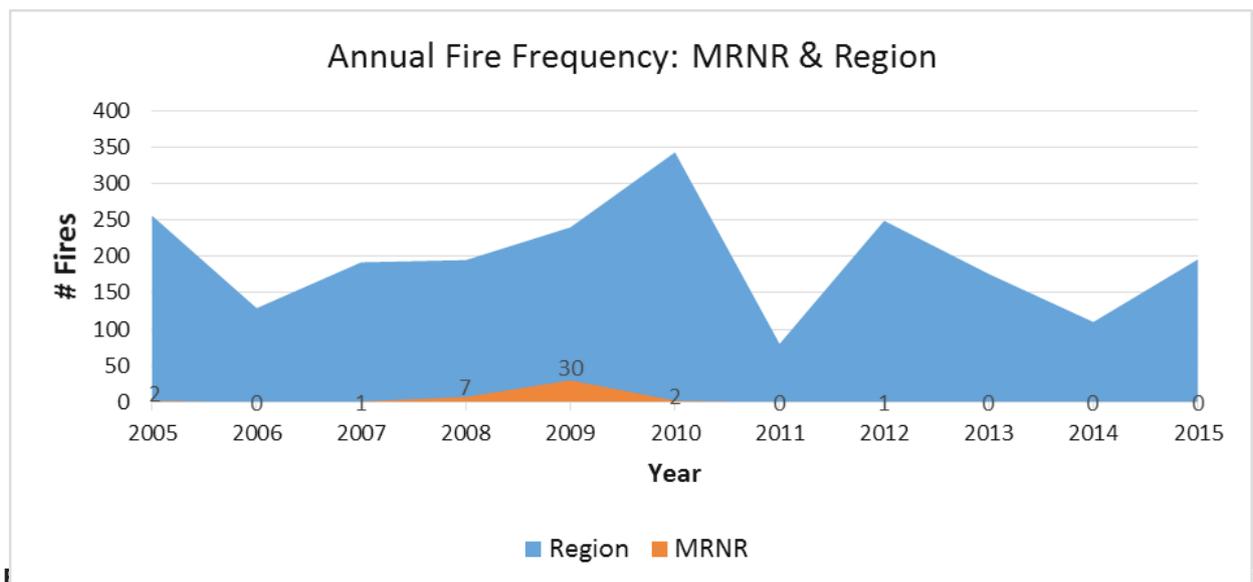
6.1.10 Fire season

Fire season is the period of the year during which fires are most likely. In MRNFR and surrounding areas uncontrolled fire incidences often occur during the dry season, June to October. August and September have been recorded as the high risk month in terms of possible fire outbreaks.

6.1.11 Fire suppression history

The Forest Act No.14 of 2002 requires local people to extinguish fires burning in any forest in their proximity. In MRNFR suppression of fire has been a challenge due to a number of reasons key among these is financial resources and manpower for adequate response efforts. Communities thus play an important role in helping to suppress fires in and around the Reserve. Before 2009, community involvement and cooperation was very limited mainly due to their concerns about forest management and benefits from the forest. Respondents surveyed in 2010 displayed a low awareness that forest fires were devastating events leading to a decrease in forest cover in the Mt Rungwe ecosystem, with only 14% raising it as a serious concern.

In MRNFR before the 2009 fire incident there were no organised efforts to forestall or suppress fires in the forest reserve⁹. Since 2009, measures have been instituted by the government in collaboration with the Wildlife Conservation Society in order to reduce fire occurrences. Local communities are now involved in monitoring illegal activities including illegal logging, hunting and honey collection in the forest reserve. In each of the surrounding villages two people have been selected by the village for patrolling the Reserve. The WCS provided garments, equipment and compensation: gumboots, rain jackets and machetes, and pays a subsistence allowance. These measures have helped to combat some of the key causes of wildfires including illegal hunting and lumbering activities in the forest reserve over recent years. Satellite fire observations reveal a significant decline in MRNFR annual fire frequency (the # of fires per year inside the Reserve) since 2009 and no fires recorded from 2012-2015 (Figure 2).



frequency is labelled in graph.

6.1.12 Recommendation for Fire Regime Records

Wildfire regime analysis contributes to the understanding of fire as an important ecological process in the forest ecosystems. The regime analysis defines the activity and patterns of fire in a particular area by analyzing the historical data for: fire frequency, cycle, intensity, size, severity, type and season. A fire regime analysis attempts to capture common fire effects, temporal and spatial patterns to gain a sense of the variability within natural fire regimes. It provides useful information to improve fire and fuels management, strategies for control and define levels for fire hazard across the landscape.

Fire history in MRNFR currently is limited and scarce with some of the important aspects such as intensity, cycle and severity barely recorded. This highlights the need to develop a wildfire regime database for future analysis and fire management. Fire regime information provide very important baselines from which to determine trends and devise appropriate preventive and response strategies. Adequate records will also assist in measuring the results of implementing the fire management plan.

6.1.13 Reserve Assessment

It is critical to use of wildfire threat assessment and fire regime analysis to evaluate the negative ecological, social, and economic impacts of wildfire. A wild fire threat analysis can provide some preliminary context useful in developing a fire management planning. Some of the components that can be considered for the assessment matrix incorporates four components i) Fire behaviour potential, ii) Fire occurrence risk, ii) Values at risk, and iv) Suppression capability. Assessing each of these components is key in determining the component that is driving the wildfire threat. Wildfire threat can be used to identify areas on the landscape most at risk to wildfire. Wildfire threat analysis information can be incorporated into fire management planning and risk mitigation.

Due to lack of information a detailed wildfire threat analysis was not carried out for MRNFR. Provided here is a qualitative information derived from observations in the landscape. It is highly recommended that a wildfire threat analysis model be developed in order to provide a full picture on dynamics of fire in the Reserve and surrounding areas. There are opportunities to use active fire data as part of gathering the necessary information on fire in the area.

6.1.14 Fire behaviour potential

Fire behaviour is the driver of fire. It is the manner in which fuel ignites, flame develops, and the fire spreads to exhibit other fire phenomenon due to the interaction between fuels, weather and topography. Fuel, topography and weather are the three primary variables that influence wildfire behaviour. In MRNFR the potential of high or extreme fire behaviour is due to fire prone

P. patula plantations neighbouring the reserve, and extensive grasslands and steep slopes on Mt Rungwe.

6.1.15 Fire occurrence risk

Fire occurrence risk is determined by the presence of causative agents, such as human and lightning. Natural causes of fire such as fire are not well documented in MRNFR. Known ignitions of fire in the area are human activities such as hunting, field clearing, honey collection, camping and pit-sawing. Therefore, great fire occurrence risk for the Reserve is found in areas adjacent to villages where there is high human activity as well as pine plantations. Monitoring efforts should be focused on identifying and mapping high risk.

6.1.16 Values at risk

Values at risk are human or natural resource values that may be destroyed or altered by fire. An area will have a higher rating if it includes, or is in close proximity to, priority values at risk or several values at risk. Within Rungwe landscape priorities for fire suppression to protect values at risk are: human life, property and crops, plantations, infrastructure, watershed and soils and natural resources.

By virtue of its size, MRNFR is a priority area in terms of fire suppression. Within the Reserve there exist areas of high priority in particular sensitive habitats such as the montane forest which is host to rare, endemic and endangered species, and also important for the catchment values of the Reserve. All around the Reserve, life, farms, infrastructure and commercial timber resources are the main values at risk. Kitulo National Park and Poroto Ridge are significant components of the conservation context with similar prevalence of ecological value at risk.

6.1.17 Suppression capability

Suppression capability includes factors and limitations that are related to the ability to contain a wildfire upon detection. Currently suppression capability in MRNFR is poor therefore raising the risk of wildfire. The Reserve does not have adequate resources to contain any fire outbreaks. The reserve does not have detection towers thus the ability to detect fires is limited. Inadequate fire-fighting equipment, protective gear as well as limited staff numbers are confounding factors. Lack of awareness within surrounding communities and their unwillingness to cooperate raise the risk.

6.1.18 Fire management strategies

In the Mt Rungwe landscape wildfire management strategies are focused on suppression of all wildfires given the high risk to spread and impact on important values. MRNFR is intricately tied to its surroundings thus largely affected by what happens in adjacent areas. For this reason, this fire management plan gives special attention to developing strategies that go beyond the

Reserve boundaries. It is critical to highlight the important role that surrounding communities and other neighbours play in management of fire in and around the Reserve. Soliciting their involvement, raising their awareness and capacity will be one of the key strategies for success of this plan.

This FMP was developed to provide direction and outline for actions that will be taken in meeting the fire management goals for the area. The plan was prepared based on the comments, suggestions and recommendations made during meetings with village governments, village environmental committees, Tanzania Forest Services (TFS) Agency, Kitulo National Park and Districts governments of Rungwe and Makete. The plan highlights basic forest fire information, existing practices adopted by local community in suppressing forest fire, and fire prevention and control strategies to be adopted into community living adjacent to MRNFR.

The goal of this fire management plan is to,

- ◆ protect biological resources, infrastructure, and human life by reducing uncontrolled fires through preventive collaborative efforts and mobilization of local community, government and other stakeholders.

The FMP aims to:

- ◆ ensure protection all fauna, flora and infrastructure within and around the Reserve from uncontrolled fires
- ◆ increase fire awareness and preparedness within and outside the Reserve
- ◆ ensure adequate law enforcement and adherence to set by laws
- ◆ ensure timely co-ordination of manpower and adequate fire fighting equipment for putting out fires, and
- ◆ adequate fire monitoring, record keeping and reporting

6.1.1 Objectives and Actions

The goal of this plan will be achieved through a set of objectives and actions. The following objectives were formulated in order to address the key issues concerning uncontrolled fires in and around the MRNFR. Each objective is accompanied by a set of actions that need to be carried out to achieve the set goals. It should be noted that this fire management plan is subsidiary to the MRNFR general management plan and thus largely depends on implementation of some of its activities.

Table 13 . Objectives and Actions for Fire management

Goal 1 – Prevention – Reduce the number of fire incidences in and around MRNFR	
Objectives	Actions
1. Reduce fire incidences by 50 % over five year period	a. Agree upon fire responsibilities - appoint fire dedicate officer among MRNFR staff
	b. Training to MRNFR staff and forest guards on fire management
	c. Increase communication and coordination with partners on fire management
	d. Explain laws and regulations on fire management, and offences and penalties to communities and penalties
	e. Incorporate and emphasize fire related issues in village by laws
	f. Patrols to assess adherence to by laws and fire management procedures
2. By 2018 community awareness on and participation in fire management raised significantly	a. Conduct awareness meetings in the 23 villages
	b. Design fire prevention materials
	c. Train VECs, VGs and other community members on fire management
	d. Organize fire awareness and prevention campaigns (roadside signs, posters, T-shirts)
	e. Agree on prescribe burning procedures for farmers field clearing and provide training on best techniques
	f. Training on preventive measures and alternative methods in farmer’s field clearing
	g. Explain and seek adoption of fire management plan by communities, other neighbours and partners
Goal 2 – Firefighting - Increase capacity to suppress fires in and around MRNFR	
3. By 2021 the amount of hectares burned reduced by 20 %	a. Firebreaks and fire lines constructed and well maintained
	b. Establish fire outlook locations during periods of high fire danger
	c. Acquire firefighting equipment for the reserve
	d. Make available firefighting equipment and protective gear for villages
	e. Improve mobilization of firefighting partners (MRNFR, communities and other stakeholders)
Goal 3 – Recording & Monitoring – Fire monitoring plan developed and recording ongoing	
4. Fire monitoring plan and recording methods in place by 2016	a. Establish baseline information on fire in and around the reserve (fire frequency, cycle, intensity, size, severity, type and season)
	b. Incorporate indigenous fire management techniques
	c. Improve fire history collection and data management, methods
	d. Use monitoring data to continuously carry out wildfire threat analysis for MRNFR and surrounding areas
	e. Develop data sheets for fire incidences reports
	f. Explore use of satellite real time data and imagery in fire detection and regime records

6.1.19.1 Prevention

Fire prevention forms the first line of defence. It is important that fires are prevented due to the difficulty involved in suppressing them as well as the damage they can cause. The primary strategies focused on reducing fire occurrence in and around the reserve include public

awareness, low enforcement, training for staff and community and allocation of responsibilities in fire management.

6.1.19.2 Community outreach

6.1.19.2.1 Awareness

There are ongoing efforts towards community education and awareness on various environmental issues including fire management. It will be critical that these efforts are stepped up and aligned to proposed activities in this plan. Awareness in MRNFR communities and other neighbours to the reserve will be carried out through a number of ways some of which include, awareness meetings, social marketing on fire impacts, risks and prevention messages, production of posters and distribution of various written materials for learning and training. Existing structures such as VECs, VGs and District conservation committees, conservation and development partners working the area will assist in delivering messages and information on fire management. Awareness campaigns will also engage the youth in and out of schools. Campaigns will be carried out in all schools in the area.

6.1.19.2.2 Capacity Building

Training on fire management issues will be provided for Reserve staff, communities and other neighbours to the reserve. These will focus on fire management procedures and techniques, prevention measures such as firebreaks construction, field burning, fire risk assessment and firefighting. In schools, teachers will also be targeted for training as they are well placed to teach and instruct a wide audience of pupils on fire prevention and other fire management aspects. Us should be made of training manuals that have been developed by TFS on fire management.

6.1.19.2.3 Prescribed burning

An important aspect that needs to be highlighted is use of fire in clearing of fields in preparation for planting. Communities in this area have use this practice for a long time. It will be difficult and unsustainable to ban the use of fire in these communities. Thus it is practical to work with the communities to develop and agree on the prescribed burning procedures and safe techniques. Safe burning demands sound methods, burning conditions, correct time of the day, skilled personnel, and favourable weather forecast. Training offered to communities on fire management should cover these aspects as well as the procedures and techniques. Some of the aspects farmers should be well informed and trained on to consider include, to

1. consider alternatives to burning, e.g. livestock grazing
2. plan for burns well in advance
3. consider time of the year
4. consider use of firebreaks
5. inform village environmental committee of planned farm clearing burns

6. advise neighbouring land owners/farmers of any clearing burns being undertaken
Farmers should also be able and mandated to assess the following before burns,

- ◆ wind direction
- ◆ adjoining land, assets at risk
- ◆ fuel type and fire size
- ◆ firebreaks to contain fire within set boundaries
- ◆ lighting up pattern
- ◆ time of the day
- ◆ personal requirements for their safety

6.1.19.3 Fire fighting

It will not be possible to completely prevent fire occurrences in the area thus it is important that the capacity to respond and suppress fires for the reserve staff and the communities is raised. The Reserve will see adequate maintenance firebreaks and fire lines. Where there is need for new firebreaks they will be constructed. Resource allowing firebreaks and fire lines are also recommended in some community areas. Fire detection locations will also be established in the Reserve to allow for early response. These locations will need to be manned for constant monitoring during high risk times of the year.

Critical to fire fighting is the presence of adequately trained personal for effectiveness in extinguishing fires in time as well as safety of the fire fighters. Both MRNFR staff and surrounding communities should be trained in fire fighting procedures and suppression techniques.

Both the Reserve and some communities received some basic fire fighting equipment. It is important that this equipment is upgraded. Fire fighting equipment should be acquired for the reserve and for distribution to the surrounding villages. Training on use on use of equipment should be availed were necessary.

6.1.19.4 Reporting and monitoring

Current information on fire regimes and history for the Reserve is very limited. It is important that a monitoring system be put in place designed for maximum collection of data on various aspects of fires affecting the Reserve and the surrounding areas. Standardized recording method should be developed and staff trained on their use. Information collected will useful in understanding the fire regime in MRNFR and also be useful in carrying out wildlife threat analysis for the area which help to formulate better fire management strategies.

Many protected areas are also benefiting from using satellite real time data and imagery. The added advantage is coverage of large areas and requires few personal. There exist platforms which provide such information on fire. One of the most reliable and suitable for MRNFR is the 'Fire Information for Resource Management System' (FIRMS). Through this platform MRNFR

management can subscribe to receive daily, monthly or yearly information on hotspots and fire locations in the landscape. For adequate collection and monitoring of fire in the area, MRNFR management should make use of such platforms. This will require training of staff in order to process the information.

Village environmental committees and village authorities will form an integral part of reporting, recording and monitoring fire management in their respective villages. Each village office will keep records on fire incidences, causes and locations in their area. Reports should be submitted monthly to MRNFR management.

6.1.19.5 Law enforcement

The existing national regulations on fire management give a strong impetus for this management plan as they provide a legal basis which is needed. The laws and regulations provide for penalties to offenders thus citizens are already mandated to employ sound fire management practices. Added to these laws and regulations, each village in areas surrounding the MRNFR has developed by laws to guide management of natural resources in their areas. These by laws also cover fire management. It will be important to work with the villages to ensure laws, regulations and by laws governing fire management are upheld. Patrols by forest guards will form one way of ensuring people are upholding the laws.

6.1.19.6 Stakeholder and Roles

Together with MRNFR management who are owners of this plan, successful adoption of this plan and its implementation is dependent on a number of key stakeholders in the area. Collaboration among these stakeholders and execution of their assigned roles will ensure fire occurrences are reduced as well as improved response to any fire outbreaks. Below are brief description of key stakeholders and their roles in fire management in the area.

6.1.19.6.1 Village Environmental Committees

Village Environmental Committees are responsible in managing all environmental issues at the village level including forest fire control, forest protection, awareness creation and supervision of conservation activities such as tree planting. It is at this level that the community-based fire management is best carried out. The functions of village environmental committees are:

- ◆ Planning and supervise execution of all fire management activities in the village
- ◆ Discuss and agree upon the request/ intention for and participate into prescribed fires around agricultural fields before setting fire to clear land for cultivation.
- ◆ Mobilize and supervise public participation into sustainable fire management initiatives in the village.
- ◆ Propose to the village government the necessary amendments to be made on the existing fire management plan and by-laws.

- ◆ Ensure effective communication for successful and sustainable fire management in the village.

6.1.19.6.2 Village Government

The village government will be required to:

- ◆ Approve the fire management by-laws
- ◆ Organize meetings with VEC and village assembly to discuss issues related to sustainable fire management in the area.
- ◆ Ensure that the VEC is fully undertaking its responsibilities as per the management plan.
- ◆ Issue permission for prescribed fires in the village.
- ◆ Supervise enforcement of fire by-laws and effectiveness of the associated penalties/ fines and compensation.
- ◆ Ensure that communities are fully involved into sustainable fire management activities in the village.
- ◆ Contribute (in kind and cash) into successful implementation of the fire management plan.
- ◆ Keep in custody all materials and tools that would be available for fire fighting in the village.

6.1.19.6.3 The Communities/villagers

The local communities would be responsible for:

- ◆ Participate in meetings, trainings etc. regarding sustainable fire management issues in the area including approval of the fire management plan and by-laws.
- ◆ To voluntarily participate fully into all uncontrolled fire suppression work in the area.
- ◆ To voluntarily participate into firebreaks construction work around their farms adjacent to protected areas.
- ◆ Implementing the fire management plan
- ◆ To elect members for the VEC
- ◆ Report in good time to the village government, VECs or MRNFR management any uncontrolled fires in the area.

6.1.19.6.4 Other Neighbors

There are other land holders neighboring the Reserve who are equally affected by any wildfire occurring in the area. Thus their role and participation in fire management in the area is important. Among these neighbours is Kiwira Forest Plantation, Rungwe Avocado Farm, Rungwe Mission, and Kitulo National Park. These neighbours to the Reserve should,

- ◆ Participate in meetings, trainings etc. regarding sustainable fire management issues in the area.
- ◆ To voluntarily participate fully into all uncontrolled fire suppression work in the area.

- ◆ To voluntarily participate into firebreaks construction work around their properties adjacent to protected areas.
- ◆ Implementing the fire management plan
- ◆ Report in good time to MRNFR management any uncontrolled fires in the area.

6.1.19.6.5 Districts Council

(Rungwe, Mbeya, Makete District Councils)

- ◆ To approve the fire management plan and by-laws
- ◆ To contribute (in kind and cash) into successful implementation of the fire management plan and enforcement of the by-laws.
- ◆ Work to incorporate fire management initiatives into other development efforts in the area.
- ◆ To participate into various meetings, trainings, workshops, etc. regarding sustainable fire management initiatives in the area.
- ◆ Mobilize volunteers for firefighting from different areas when fire is out of control

6.1.19.6.6 Tanzania Forest Services (TFS) Agency

- ◆ To approve the fire management plan and by-laws
- ◆ To contribute (in kind and cash) into successful implementation of the fire management plan.
- ◆ Work to incorporate fire management initiatives into other development efforts in the area.

3.7.7 TANAPA (Kitulo National Park)

- ◆ To approve the fire management plan and by-laws
- ◆ To contribute (in kind and cash) into successful implementation of the fire management plan.
- ◆ Work to incorporate fire management initiatives into other development efforts in the area.

6.1.19.6.7 Non-Governmental Organizations

- ◆ Provide technical assistance especially in implementation of the fire management plan and by-laws.
- ◆ Organize and provide support for meetings and awareness campaigns on fire management for communities, MRNFR staff and other stakeholders.
- ◆ Support implementation of fire management plan, recoding and monitoring of fire management work and give technical input whenever necessary.
- ◆ Support training of MRNFR staff and communities in fire management procedures and techniques.
- ◆ Support MRNFR and surrounding communities with equipment and materials to assist in fire prevention, suppression, recoding and monitoring efforts.

6.2 STRATEGY FOR INVASIVE SPECIES CONTROL IN MT RUNGWE NATURE RESERVE

6.2.1 Introduction

An 'invasive species' is defined as a species that is i) non-native (or alien) to the ecosystem under consideration and ii) whose introduction causes or is likely to cause economic or environmental harm or harm to human health. This definition covers all organisms, including vascular plants, animals (including invertebrates), fungi, bacteria and viruses. In many instances, invasive species become pests by out-competing or preying upon endemic species. Tanzania and other East African countries have experienced major ecological problems with invasive plants and animals that have been introduced by humans. The following are some of the challenges that have led to inadequate control of invasive species

- ◆ Shortage and inaccessibility of information on invasive species and best practice management
- ◆ Lack of awareness of the impacts of invasive species
- ◆ Insufficient networking, coordination and collaboration
- ◆ Inadequate legislation, regulations, cross-sectoral policies, and enforcement
- ◆ Shortage of trained personnel and inadequate facilities
- ◆ Insufficient funding

6.2.2 Impact of invasive species on natural ecosystems

There is wide literature on the impact of invasive species on natural ecosystems, some of the main impacts are discussed below.

6.2.3 Species extinctions and community structure

Invasive effects on native biodiversity and community structure are well known, but few studies have examined the mechanisms that lead to these effects. Invasive species may alter community structure through exploitation competition (indirect interactions such as resource use), and interference competition (direct interactions such as allelopathy in plants). Invasive impacts on other species interactions, including predation, herbivory, parasitism, and mutualisms, can change the abundance of species with certain key traits that influence ecosystem processes.

Changes in species and community structure can affect ecosystem services both directly and indirectly. Direct effects include the decline in abundance of economically valuable species, in particular those used for food, forage, fiber, fuel, or medicine. Aesthetic values are commonly lost with the arrival of "nuisance species" such as invasive vines or aquatic floating plants. Invasives that disrupt mutualisms pose risks particularly for pollination and natural pest control services. Indirect effects include a potential decline in ecosystem resistance and resilience to change as synergistic interactions among invaders can accelerate negative impacts and consequent degradation of ecosystem services and facilitate more invasion.

6.2.4 Energy, nutrient and water cycling

Invasive species affect energy flows through changes in trophic interactions, food webs and keystone species. Productivity can be altered by invasive species that use resources more efficiently, or that eliminate a prominent life form. Changes in decomposition rates, such as might occur if an invasive species altered litter chemistry, can affect nutrient cycling as well. Nutrient cycling can also be altered by invasive plants that fix nitrogen, leach chemicals that inhibit nitrogen fixation by other species, release compounds that alter nutrient availability or retention, including nitrogen and phosphorus, and alter topsoil erosion or fire frequency.

Invasive plant species have been shown to alter hydrological cycles by changing evapotranspiration rates and timing, runoff, and water table levels. Impacts are greatest when the invaders differ from natives in traits such as transpiration rate, leaf area index, photosynthetic tissue biomass, rooting depth, and phenology. Changes to water cycles may affect both water supply and regulation. Well-studied examples of invasive plants using more water than do native plants, and thus decreasing the water supply for humans.

6.2.5 Disturbance regime, climate, and physical habitat

Several invasive species alter disturbance regimes (including fire, erosion, and flooding), or act as agents of disturbance themselves, particularly in soil disturbance. Fire enhancement can occur when grasses invade shrub lands and increase fire frequency, extent, or intensity, whereas fire suppression is more likely to occur when trees invade grassland and decrease fine fuel load and fire spread. These impacts are significant since they can cause a shift in ecosystem type and related species.

Maintenance of climate and atmospheric composition, both ecosystem services, are two of the least-studied mechanisms, perhaps because changes can occur over large temporal and spatial scales. On a smaller scale, experiments have shown that even a handful of invasive plants can alter a given microclimate. Invasive species may alter atmospheric composition by changing rates of carbon dioxide sequestration, or the emission of volatile organic compounds and other biologically important gases.

In altering the physical habitat, both plant and animal invaders are capable of outcompeting natives and taking over habitat, and certain invaders additionally make the habitat less suitable for other species. Invasive plants may decrease the suitability of soil for other species by secreting salts by acidifying the soil, or by releasing novel chemical compounds, as in allelopathy.

6.2.6 Invasive species in Southern Highlands

In the southern Highlands of Tanzania, invasive alien plants, especially trees and shrubs, are a

significant threat to the conservation of biodiversity and other ecosystem services. Key among the protected areas affected is Mt Rungwe Nature Reserve (MRNFR) and Kitulo National Park (KNP). In KNP invasive species including eucalyptus, wattle and pine are invading former grassland areas creating stands of exotic species. This has resulted in loss of habitats for many wildlife species, and at the same time, threatening the catchment value of the park. Some of the natural vegetation in particular orchids are slowly being eliminated by invasive species leading to a significant decline in the beautiful scenery of the park.

In MRNFR invasive alien plants are arguably the most significant threat to the conservation of the Reserve's biodiversity. The most widespread invasive plant species in the Reserve is *Pinus patula* followed by eucalypts (*Eucalyptus* sp.). These species have historically been grown in plantations and small farms as for timber in areas surrounding the Reserve. Many citizens regard the trees as attractive, fast growing and economically beneficial. For these reasons many of the attempts to introduce alien plant control programs have been controversial.

While piloting REDD+ Readiness in the southern highlands of Tanzania, WCS intended to avoid planting any exotic species (pines and eucalyptus) in villages as part of woodlots program. This act encountered a negative reaction from communities who decided to stop providing land for plant any other native plant species. Communities around protected areas considered the avoidance of planting pines and eucalyptus as going against social safeguard. The native species are not preferred as they take long time to mature. At the same time land is very scarce in areas around reserves, where each family has a small plot of land for food and cash-crops. This drives the preference for the fast growing exotic species as compared to the slow growing native once.

6.2.7 Situation analysis

Plantation forestry in Tanzania started during the German rule where a number of plantations were planted with the total size of 80 ha. The establishment of plantations continued during the British rule where some of 3,683ha of plantations were planted. The purpose of the British government was to replace trees cut during the German rule and to replant areas cleared by cultivators. During that time, i.e. before and up to the Second World War, the main indigenous tree species planted were Cedar (*Juniperus procera*), Podo (*Podocarpus gracilior*), E.A. Camphor (*Ocotea usambarensis*), Mvule (*Milicia excelsa*), Cordia (*Cordia abyssinica*) and various mangroves, while exotic species included teak (*Tectona grandis*), Cassia and Eucalyptus spp. (Mtuy, 1996). Also, it was at this time that pilot plantings with various exotic species started at Olmotonyi, Rongai, Mbeya, Mufindi and Shume. After World War II, in the late 1940s, proper afforestation and reforestation plans were drawn up which resulted in the establishment of the present softwood and hardwood plantations (Mtuy, 1996).

It was also realized that the rate of growth of indigenous trees was slow and it was therefore decided that fast growing exotic tree species be planted instead to complement production

from natural forests. This resulted in mass planting of pines and eucalyptus. Later in the 1950s it was noted that the area under plantation was small and supply of plantation grown wood for export purposes was in deficit. This led to establishment of plantations across the country as seen today. Since then, the area under plantations has increased over time.

6.2.8 Pine and eucalyptus propagation in MRNFR

Significant for MRNFR is Kiwira Forest Plantation which was established in 1960 with the objectives of ensuring sustainable supply of forest products and services to the forest based industries and communities as a whole. It is on the Northern side of Mt Rungwe Natural Reserve and has the size of 2,784 ha. The plantation is primarily *Pinus patula* was established from two blocks, Rungwe and Livingstone ranges. Several villagers around the area have also established their own pine plantations. KFP and the neighboring villages are regarded as the primary sources of pine invading MRNFR.

Pinus patula is serotinous and carry large numbers of seeds in cones or follicles in the canopy of the trees. The species reproduces through small, light wind-dispersed seeds. The species can readily spread to forest gaps, grassland and shrub land. More prone are fire-climax grasslands and woodlands or any post fire environments.

By far the largest propagator of pines spreading to MRNFR is Kiwira Pine Plantation in the Northern side of Mt Rungwe Nature Reserve¹¹. It is hypothesized that prevailing northerly winds blow seeds up from the plantation where they settle and easily take root in the temperate and fertile conditions found at higher elevations on Mt Rungwe. It is important to note that the mode of spread of the species in the Reserve is not fully understood therefore it is important to investigate this in order to develop strategies that will minimize continued propagation of the *P. patula* in MRNFR.

Eucalyptus in the MRNFR were introduced and propagated by human as source of fuel wood, poles and boundary marking. In some sections of the reserve the species was used to mark the boundary between the Reserve and the community and given its invasive capabilities the species has extended into the reserve. Eucalypts is known to grow faster than other species on the same site. This rapid growth has been associated with greater consumption of water and nutrients.

6.2.9 Values of pine and eucalyptus

Table 13: Benefits of eucalyptus and pine in the Mt Rungwe area

Value	Description
Additional carbon sinks	Pine and eucalyptus being big trees have high carbon value. Grown in the right areas they provide one of the possible strategies in fighting global warming by sequestration of more carbon.
Source of fuel wood and construction	Pines and eucalyptus are a good source of construction material. Tanzania as a developing country in need of timber for construction of building, electric power lines and furniture. Timber from these trees is also important for various purposes in rural areas including fencing, building houses, bridges etc. This also aides to alleviate the pressure of cutting indigenous forests for timber.
Source of income and employment	In all parts of the world the demand for timber is high, and surpasses the supply. Timber from these trees provide export earnings for the country as well as local farmers involved in timber production. The existing plantations are providing employment for some of the locals in the Rungwe area. Many of the farmers in the area have established their own lots plantations from which they are generating revenues.

6.2.10 Impact of invasive species on MRNFR ecosystem

The impact of uncontrolled invasive species is threatening the integrity of important habitats in MRNFR. They are completely changing grasslands to stands of exotic species resulting in shrinking of habitats for many animal species. The proliferation of these invasive species is also changing the hydrological regime of the area thus threatening the catchment value of the Reserve. Eventually the invasive species will significantly affect the tourism potential of the Reserve which is seen as one of the potential revenue sources. Major threats of exotic species to reserves in southern highlands include:

<ul style="list-style-type: none"> • Habitat loss • Loss of biodiversity • Soil erosion or disturbance • Alteration of soil moisture and salinity levels • Alteration of nutrient levels in soil 	<ul style="list-style-type: none"> • Increase in fire frequency and intensity • Hybridization with native species and • Alteration of food chains • Impact on hydrological regimes • Loss of tourism potential due to degraded botanical, wildlife, and landscape scenery
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6.2.2 Distribution and Abundance

Recent surveys have indicated the largest area occupied by *P. patula* is the northern side of MRNFR Adjacent Kiwira Pine Plantation. Currently the estimated area under pine in this section is 427 ha. Pine in this part of the Reserve established in two ways i) pines that TFS planted inside MRNFR covering 227 ha. This was done accidentally some 25 years ago due to unclear boundary between the Reserve and the plantation. Today this area is maintained as part of pine plantation (ii) pines that are propagated by fire in the grasslands of the Reserve.

This turned most grasslands in northern part of the Reserve to pine forests. This occurred in early 2000s, now most of the pines can be clear felled ~ 5 years from now.

Areas around Mt Rungwe crater and Rungwe peak primarily grassland area are also highly affected by pine invasion. Currently pine has not completely invaded these grasslands but if not controlled they is scope for continued invasion. The rocky areas around the crater and peak are equally affected. Before colonization by pine these areas were open kopje.

Mwaikole area in the western side of the Reserve has also seen high levels of pine. Mwaikole is a grassland mosaic area forming headwaters of a number of streams that flows into river Kiwira (including river Kipoke, Mnyerere and Katalalifu). Records show pines started to colonize the Mwaikole area 20 years ago. It is believed they were introduced by hunters who used to hunt in that area. At present there are pines of up to 65 cm DBH – verified.

Generally, pines are all over Rungwe in varying abundance. Most affected are grassland areas, satellite images have indicated that areas that were grassland some 20 years ago, have now been fully or partially invaded by pines. Other areas around the Reserve have seen pine invasion from village farms. The most affected areas are the forest edges adjacent to farms.

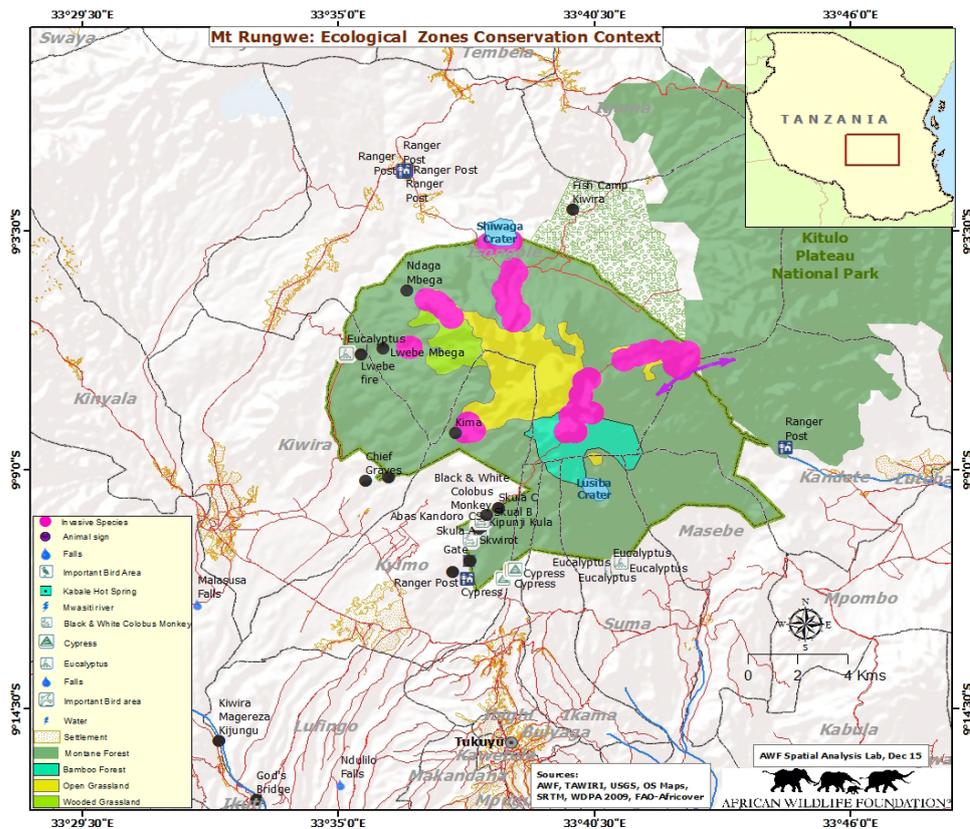


Figure 5: Map showing main areas invaded by *P. patula* in MRNFR as of October 2015.

6.2.3 Management vision for invasive species in MRNFR

The MRNFR management has set out a vision that focuses on maintaining and restoring natural vegetation as its primary objective. Tanzania Forest Service (TFS) has an overriding mandate to conserve Tanzania's biodiversity, landscapes, and associated heritage assets on the land that they control. This is interpreted in the purpose of MRNFR, 'to protect the unique, biologically important natural ecosystems and maintain genetic resources, natural processes and cultural values in an undisturbed, dynamic and evolutionary state for present and future generations.

The restoration of degraded habitats, including the removal or control of "all alien flora", is seen as key to maintaining biodiversity within MRNFR. Currently, the focus is on invasive woody plants, and "secondary" non-woody invasive plants will receive attention in the future. Where non-invasive alien plants occur within the Reserve, especially at the plateau site, it is recognized that they need to be managed accordingly so that biodiversity is not compromised.

6.2.4 Management responses

The threat posed by invasive alien plants was recognized by botanists as early as 2004. Although few campaigns were adequately documented, evidence shows that poor understanding of the ecology of invasive species, as well as a shortage of funds for clearing them, led to failure to control the pine. TFS has always wanted and was ready to remove the exotic species. A number of teams were sent in to investigate and evaluate the causes of pine and eucalyptus propagation, extent of propagation and the way forward. A number of recommendations were put forward however due to lack of funding they have not been acted on.

With support from USAID under Southern Highlands and Ruaha Katavi Protection Program (SHARPP) WCS will be able to eliminate exotic species in most parts of Mt. Rungwe Nature Reserve. SHARPP is a five years funding program where its first three years among other things, involves the removal of exotic species in the Mt Rungwe Nature Reserve as well as in the adjacent Kitulo National Park.

6.2.5 Invasive species management

An integrated approach involving the combined use of a range of methods is usually necessary to control invasive alien plants effectively. The various methods that are available are usually classified as: mechanical methods (felling, removing of invading alien plants, often in conjunction with burning); chemical methods (using environmentally safe herbicides); and biological control (using species-specific insects and diseases from the alien plants country of origin). Approaches available for integrated control depend on the species under consideration, features of the invaded systems, the availability of resources and other factors.

6.1.5.1 Invasive species control methods

In the approaches toward the control of invasive species responses need to be aligned with the different stages of spread. The stages can be divided into four broad categories i) arrival ii) adaptation and establishment iii) an exponential growth phase iv) a phase where alien plants have invaded and dominated the available area. It is in the exponential growth stage of weed spread that integrated control programmes find a logical home. Prevention, and early detection and eradication, are more appropriate for the first two stages, while options may be severely limited once weed populations reach the final stage of total ecosystem domination. Elements of integrated control usually involve a combination of at least two of the primary elements of control mechanical, chemical and biological. Each of these is described briefly below.

6.1.5.2 Mechanical control

Mechanical control options include the physical felling or uprooting of plants, their removal from the site, often in combination with burning. When fire is used, it can be applied in conjunction with physical control. 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 labor-intensive and thus expensive to use in extensive and dense infestations, or in remote or rugged areas.

i) Chemical control

Herbicides can be applied to prevent sprouting of cut stumps, or to kill seedlings after felling or burning. Herbicides can target, for example, grasses or broad-leaved species, leaving other plants unharmed. However, there are legitimate concerns over the use of herbicides in terms of potential environmental impacts. Although newer herbicides tend to be less toxic, have shorter residence times, and are more specific, concerns over detrimental environmental impacts still remain. The use of chemical control is often governed by legislation, and the effective and safe use of herbicides requires a relatively high level of training; both of these factors can restrict the use of chemical control on a large scale.

ii) Biological control

Biological control involves using 'natural enemies' and/or diseases, from the alien plants region of origin. Most invasive alien plants show no exponential propagation behaviour in their natural ranges or their ability to grow vigorously and produce huge amounts of seeds is kept in check by a host of co-evolved organisms. Biological control has potential benefits, including potential cost-effectiveness, and the fact that it is (usually) environmentally benign. Concerns have raised about the potentially negative effects on non-target plants, on weeds that may have important commercial value and the risk of the control species becoming invasive as well. Any application of biological control methods will require approval from authorities.

6.2.2 Principles in Invasive Plant Management

6.1.15.1 Prevention

The first line of defence for invasive species is prevention. The most cost-effective and complete approach to combating invasive species is to keep them from becoming established in the first place. At a minimum, MRNFR management should take the following steps to prevent unwanted or accidental introductions.

- ❖ MRNFR management should develop a 'watch list' of species to be on alert for. Patrol staff should be trained to recognize highly invasive plants
- ❖ Clean equipment before transporting it between properties or habitats, especially when used in areas with known invasive species.
- ❖ Do not plant or propagate known or potential invasive species.
- ❖ Remove invasive species from designed landscapes before they spread into minimally managed habitats and natural areas.
- ❖ Recently exposed or disturbed areas in the Reserve should be monitored where necessary, quickly revegetated with native species.
- ❖ Management should give control efforts along the Reserve boundary and roads high priority as they are a conduit for invasive seed
- ❖ When new construction or invasive removal is planned, soil disturbance should be minimized and disturbed areas should be monitored, revegetated with native species and treat invasives as necessary,
- ❖ Monitor new plantings, whether within Reserve boundary, surrounding farms, or elsewhere, for invasives that may have been present in soils.
- ❖ Work with surrounding communities and other neighbours to encourage these practices

TFS will have to work with various stakeholders to ensure there are prevention mechanisms on the ground. These stakeholders include first and foremost the village governments around MRNFR, village environmental committees, international and local NGO's, and Rungwe District Council. These stakeholders will have to ensure that the suggested prevention procedures are enforced.

6.1.15.2 Early detection and rapid response

When prevention fails, the MRNFR management must detect and act on the species of concern before they become established and spread. There is need to reduce red tape between MRNFR management and TFS. The conservator should be empowered to take the necessary actions without the need of long chain of consultation that can delay responses. MRNFR management has to: -

- ❖ Monitor all properties regularly for potential introductions, especially near trails, roads, property boundaries (especially at points where there is abutting development), and disturbed areas.

- ❖ Train all field and farm staff on invasive species identification.
- ❖ Engage VECs, Community Forest Guards and other volunteers to serve as “Weed Watchers.”
- ❖ Remove, using best management practices, any new invasive species detected.
- ❖ Use least-disruptive techniques to remove and appropriately dispose of any debris.
- ❖ Monitor location to ensure completeness of removal

6.1.15.3 Control, Management, and Monitoring

Some invasive species may be too widespread to fully eradicate using current methods. However, control and management efforts can slow and/or reduce their impacts. The MRNFR management has to reduce or eradicate established invasive species populations and limit any potential for future spread. To achieve this management should consider the following.

- ❖ Conduct annual invasive species inventories in the Reserve and surrounding areas to determine which species are present and the size and locations of their populations and assess management progress since the previous inventory.
 - High resolution satellite imagery is an effective way and useful in estimating the extent and composition of invaded areas and the at risk habitats.
- ❖ Identify sensitive species (state-listed and at-risk) and priority habitats.
- ❖ Prioritize control of those species that are threatening key habitats, rare species or priority community types, or are known to compromise the ecological integrity of habitats beyond competition with native species
- ❖ Monitor control projects to ensure success of treatments.
- ❖ Review recent research and the organization’s own control projects to develop best management practices.
- ❖ Restore native plant communities in areas heavily degraded by invasive to reduce the risk of future invasions.

6.1.15.4 Education and public awareness

Although public awareness on the negative impacts of invasive species is increasing, education is crucial for the long-term success of efforts at prevention and management. Strategies to reduce the impacts of invasive species must communicate the role of humans in facilitating their establishment and spread, their detrimental impacts on native biota, and their effect on the environment. MRNFR management must ensure communities are aware by providing opportunities for their involvement in control programmes as well as ensuring they are informed. Among other actions the management should consider the following,

- ❖ Provide information to the public on invasive species control efforts (i.e., why we are doing what we are doing).
- ❖ Engage volunteers to assist with hands-on control efforts.

6.2.2 Long-term control

Once an infestation expands to a critical threshold, eradication becomes impossible or impractical. If the infestation can be contained, slowed down, or maintained within acceptable levels, long-term control may be warranted. Successful control of well-established infestations requires an integrated, multi-year approach using multiple techniques. Monitoring is essential and follow-up treatment is necessary to ensure depletion of the seed bank.

6.2.3 Restoration and rehabilitation

Invasive species can disrupt complex ecological relationships involving soil fungi, pollinators, nutrient cycling and disturbance regimes. In some instances, once invasive species are removed, native communities can recover without further intervention, provided best management practices prevent re-invasion. However, in cases of severe degradation, natural recovery processes can be overwhelmed by invasive species and active restoration is required. Although restoration efforts have common elements, each area is unique. An intervention must be guided by site-specific considerations and analysis. However, some generalizations can be made.

When soil is disturbed, and especially if it is left bare, it must be re-vegetated with appropriate species to prevent soil loss and reinvasion. Before undertaking such an effort, it is important to ensure that the site is suitable for your management goals.

- ❖ Are the site conditions appropriate for the system to be restored?
- ❖ Is a native seed bank present?
- ❖ Can the restored ecological processes be maintained?

6.2.2 Prioritization and site-led plan

Before management techniques can efficiently be implemented, invasive species of concern must first be prioritized. Each species must be assessed to determine level of threat to the ecological health of wild lands through evaluation of its ecological impact, ability to invade natural vegetation communities and current extent of its invasion. Management can adapt or develop a criterion for prioritization and this will be essential in developing a comprehensive site-led plan of action. Below are some of the steps to consider in prioritization and development of a site-led plan.

Step 1 – Determine species invasiveness

When prioritizing control efforts, several factors need to be considered, including the biology of the species, the size of the infestation, and suitable control to use at the particular time, as these control gets improves with time. Rank the invasive species based on the species'

- ◆ biological and ecological characteristics,
- ◆ ecological impact,
- ◆ current distribution/abundance,

- ◆ trend in distribution/abundance, and
- ◆ management difficulty.

Species are ranked high, medium, low, and insignificant. Many of the invasive species in MRNFR have not been evaluated with the rank protocol. Prioritization in MRNFR was simple due to the proliferation of *P. patula* and *Eucalyptus* sp. in the reserve. The full ecological impacts of the species in the Reserve are yet to be investigated and understood. However, some of the impacts such as replacement of natural vegetation are easily recognisable and their magnitude and the rate at which they are occurring warrant the selection of these species as a high priority for management action.

Step 2 – Evaluate the Habitat

The second step is to evaluate the habitat(s) where the invasive is occurring. MRNFR management should consider the following

- ◆ Is the habitat primarily a biodiversity conservation area?
- ◆ Is the habitat a priority natural community?
- ◆ Is the habitat an important tourism area in the forest?
- ◆ What matrix is the target habitat within? (Cultural, agricultural, second growth, etc.)
- ◆ Are the surrounding habitats dominated by invasives?
- ◆ Are the surrounding habitats relatively free from invasive species?

Step 3 – Determine if an effective control method exists

Determine the best control method that can eliminate the invasive species or successfully reduce the presence of the species; whether there is a control method that is suitable for the site; and if the proposed method is feasible (do we have the necessary resources to control the invasives at this site?). Some of the methods that have been applied in control of *P. patula* and eucalyptus are presented in Table 2 below. Also discussed is their potential applicability and limitations in MRNFR.

Mt Rungwe Nature Reserve is an important biodiversity area with rare, endemic and endangered species sensitive to disturbances. The Reserve is also catchment area providing water to surrounding villages, towns and farmlands. The methods to be used on control of *P. patula*, *Eucalyptus* sp. or any other invasive species in the Reserve should be very sensitive to these values. Additionally, given the urgency of the situation the methods should also be readily available and cost effective. Thus among the possible methods mechanical control was identified as the most preferred way forward. Carried out properly it has minimal risk for negative impacts on the environment, can be applied immediately and leaves the water free of any potential forms of pollution.

Table 14: Methods that have been used in control of Pinus and eucalyptus species in other places

Category	Method	Location	Description	Limitations and Applicability in MRNFR
Mechanical	Felling and stumping of pine trees and sweeping of seedlings and seeds	Kitulo National Park, Tanzania	Due to the sensitive nature of the area as a water catchment for the region and the urgency of the exercise this method has proved to be useful and effective.	Labour intensive and requires resources for equipment for cutting, stumping and transporting. Must be accompanied by intensive monitoring as seedlings will germinate
	Felling trees, ring barking the trees and/or uprooting saplings	Nyanga National Park, Zimbabwe	<i>Pinus patula</i> is one of the most aggressive invaders of the afro montane forest and grasslands in the Eastern Highlands of Zimbabwe	
Biological	Use of seed- and cone-feeding insect and mite agents	South Africa	(i) because seed reduction has the potential of decreasing the invasiveness of alien plants (ii) because of the problem of regrowth of the trees, mainly from seeds, in areas previously cleared	<i>P. Patula</i> is a species of economic importance to the region and the country as a whole. There is a risk in which control agents can then spread outside the reserve to neighbouring pine plantations.
Chemical	Use of chemicals to control eucalyptus	Nyanga, Zimbabwe	Chemical control is used to destroy stumps of gums to stop further coppicing	Not clear which specific herbicides were used. Managers and herbicide operators must have a basic understanding of how herbicides function, as this will guide the correct selection of herbicides for different purposes and plants.

6.2.2 Monitoring, adaptive management and education

Determining optimal treatments is an on-going task. Strategies must be adapted to incorporate knowledge gained by assessing the results of control efforts and from research. Learning from your own experiences and sharing your observations with others is a very important aspect of addressing invasive species impacts.

6.2.3 Standardized record keeping

The Reserve should have a centralized database on invasive species. The use of GIS and SMART will enhance monitoring and data collection on invasive species. This should assist in early detection, rapid response and long term monitoring. The database should capture lists of all invasive species in the reserve, ecological assessments of the species, coverage maps, prioritization criteria and lists, treatments etc.

6.2.4 Standard operating procedures

In addition to information provided in the preceding sections, in order to streamline treatment and monitoring activities, MRNFR management should follow a set of standard operating procedures for removal of invasive species. Presented here are procedures that have been developed based on information gathered and recommendations made from past surveys and mapping of affected areas in the Reserve. Were there exist information gaps for certain areas it is recommended that management should conduct surveys and map the areas. Remote sensing can also assist in producing maps which can then be compared with field surveys to determine what role remote sensing can play. These standard operating procedures formed the basis for formulation of actions to be implemented in removal of priority invasive species in the Reserve.

6.2.5 Invasive Species Removal Procedures

6.1.5.1 Stock determination

Stocktaking is essential to in determining the size of invasion. It also helps to make good judgment on how to handle the wood produced in the removal process. Were resources to carry out removal process are limited, stock taking can assist to know whether the wood stock in the reserve can finance its removal by selling the logs to villagers and business people. It can also highlight illegal removal of the species by people timber poachers whose actions result in further proliferation by scattering the seeds. Determining the stock will also help TFS to develop a mechanism to share the benefit of the harvested pines.

6.1.5.2 Training

It is critical that a defined team(s) be put together to undertake the process of removing

invasive species. Each member of the team should undergo hands-on training on identifying and treatment methods of the invasive species of concern. The team should be aware of the operational procedures and the risks and costs involved if any of the procedures are not followed. MRNFR management should carefully assemble a team to undergo this training with possible candidates coming from MRNFR staff and identified community members. Two teams consisting of seven members are proposed for the work of removing trees and another team for transporting the timber from harvested sites.

6.1.5.3 Target areas for removal

There are two areas of priority concern in removing invasive species in MRNFR,

- i) Area that was planted deliberately. It has been agreed that the areas where pine were introduced as part of Kiwira Plantation – 427ha will be harvested, clear-felling by 2021. After harvesting the area will be enriched and maintained as part of nature reserve with nature vegetation. MRNFR management will develop appropriate restoration procedures that will help to ensure the area is naturalized.
- ii) All pines and eucalyptus in other parts of the Reserve, will be removed immediately. TFS will have to take stock where after which the process of removal of the exotic species will start.

All key sites within area (ii) will be marked and their extent determined. Management will design a systematic framework for removal of pine. This framework should direct how the area will be divided, plot sizes, techniques to be used in each plot given the varying topography of the area, time of removal, number of people to be involved and their roles etc.

6.2.2 Procedure on the plot

Provided here are procedures to guide operations at plot level. However, these can be adjusted depending on situations on the ground.

- a) *Removal team:* Each team of seven members will consist of i) team leader - the leader will be responsible for all operations at plot level, adherence to procedures, measurements recording and reporting; ii) Tree cutters (iii) seed & seedling removers - who will collect seeds and uproot any visible invasive seedlings.
- b) *Plots:* management will design and determine the sizes of plots to be used in each section identified for harvesting. The plots will be clearly marked using GPS points as well as physical markers for operations. Each team will be allocated plots for removal of invasive species.
- c) *Measurements and recording:* for each section marked for removal of invasive species 30 % of the plots will be used for recording and taking measurements. In each of these plots recording and measurements will include number of trees (invasive species), DBH, tree height, seedling density, original vegetation, topography and other parameters.
- d) *Seedling sweeping:* after recording and all measurements removal action will start with uprooting of all invasive seedlings in the plot. This will also include picking of all visible

seeds and depositing them into polythene bags.

e) *Felling, pruning and cutting*: after sweeping seedlings, tree invasive trees will be cut using chain saws. Tree branches will be pruned on site and sorted for collection. Trees with DBH of 10cm and more will be cut into pieces of 12 foot (3.65 m). These will be ready to be used for timber. All trees with DBH less than 10cm, will be cut into small pieces for fuel wood. All trees cut will be recorded. Seeds will be picked again once the plot is cleared of the timber.

6.2.2 Transporting timber from harvesting sites

Only pruned and well cut timber or fuel wood will be transported from harvested sites. Logs will be transported defined points outside the Reserve where communities can access them. MRNFR management will have to determine the best of transporting the timber from the Reserve in particular that coming from high altitudes.

6.2.3 Community involvement

Communities around the Reserve will engaged in the process of removing invasive species. Some will be part of the clearing, transporting and weeding teams. Where necessary community members will be trained to handle the various tasks to be completed. Community members will be encouraged to volunteer for any work that does not require specialized training. Where payment is required TFS and MRNFR management can consider using the timber or fuel wood generated from the harvesting.

6.2.4 Beneficiaries

Removal of invasive *P. patula* and eucalyptus from MRNFR provides an opportunity for TFS to generate revenue but also more importantly provides an opportunity to extend benefits to surrounding communities. TFS and MRNFR management will decided on how to distribute all timber and fuelwood generated from the harvesting. Such benefits can be extended to institutions and disadvantaged people in the surrounding areas.

6.2.5 Procedures for Restoration in Cleared Areas

The goal of restoration is to re-establish the natural physical and biological components and processes of disturbed areas to a close approximation of their prior condition. In many cases, controlling undesired species does not lead to a desired plant community. A variety of other objectives may also be met by creating desired plant communities including increasing native species diversity, increasing habitat for wildlife, improving soil and water quality, and reducing reinvasion.

Some of the common methods that have been applied in restoration and preventing re-invasions

include prescribed grazing, mowing, weeding, erosion control, prescribed burning, seeding and planting. Although restoration efforts have common elements, each area is unique. Any restoration work in areas freed of invasive species in MRNFR will be guided by site-specific considerations and analysis. Some of the possible methods are briefly discussed below.

6.1.5.1 Continued Weeding

The first line of ensuring recovery on areas cleared off invasive species is continued weeding of invasive species. Removing invasives often disturbs the soil surface giving a strong advantage to opportunistic species as plants colonize the newly vacated growing space. MRNFR management will develop a schedule (plan of monitoring plan) for weeding cleared areas. Some sites will only require continued weeding without any other interventions while others will require additional restorative actions.

6.1.5.2 Seeding

In some areas weeding only will not be enough, planting native trees, shrubs, grasses and wildflowers to restore the plant diversity might be needed. TFS has enough knowledge and capacity in forestry, thus seeding will be one of the best options for revegetating affected areas in MRNFR. If revegetation is the appropriate option there should be proper investigation to determine the suitable native plant species for each site.

Replacement planting should be undertaken in the same year as invasive species removal. This will provide the native species with an edge in recapturing the growing space made available by weeding out invasive species. Where invasive plants are removed from stream banks or flood plains or from steep slopes, replanting renews protection against soil erosion. This necessitates the need for nursery development to produce tree seedlings. Nursery development has already been included as a priority activity in the MRNFR 2016 – 2021 management plan.

6.1.5.3 Prescribed Grazing

TFS and MRNFR management can consider the possibility of prescribed grazing in some of the grasslands in MRNFR as a way of post pine harvest treatment. This will be one of the best options as the grasslands of Mt Rungwe have traditionally been maintained by grazing. In most part it was illegal grazing where villages sent and left their livestock in the reserve.

6.2.6 Indicators of performance

A number of indicators will be used to track performance and success of the exercise of removing invasive species in the Reserve. These indicators are meant to ensure implementation of the invasive removal programme is on track and adjust as soon as possible if need be. This

framework should be developed prior to commencing the exercise and should be applied as removal is going on. Some of the indicators to be followed include;

- i) *Area cleared of invasive species* - The success of the work will be measured by size of land cleared off exotic species in the reserve. The target is complete eradication of the targeted species from the Reserve area. However, this will take time and thus this indicator serves to track progress to achieve the target.
- ii) *Clearance thoroughness* – The thoroughness of clearing teams will be supervised. This will involve monitoring plots cleared by the different teams in order to check for thoroughness in removal of trees, shrubs, seedlings or seeds.
- iii) *Involvement of communities* - Adjacent communities are an integral part of reserve management as well as control of invasive species in and around the Reserve. Thus their involvement in this exercise is critical for long term control of the species through education as well as interest through benefits.

6.2.2 Monitoring and evaluation

6.1.2.1 Monitoring

Monitoring is a critical component in management of invasive species and restoration of affected areas. Monitoring consists of repeated measurement over time. Observed changes can then be used to evaluate, quantitatively, rates of spread and/or efficacy of control and management activities. Management plans can and should be adjusted based on feedback from monitoring. Monitoring can be used to meet a variety of objectives, including:

- ◆ Assessing the impact of management intervention activities
- ◆ Detecting invasives in uninfected areas
- ◆ Assessing the impact of invasives on the ecosystem
- ◆ Assessing the effects of management activities on the ecosystem
- ◆ Evaluating response of native plant communities

Monitoring intensity may vary, depending on resource availability and priorities. Due to the limiting resources in MRNFR it will be critical to assess the monitoring needs for each site. For some sites low intensity monitoring will be appropriate while other will require medium or high intensity monitoring due to the extent of invasion and vulnerability to re-invasion. Low intensity monitoring will be able to detect new invasions and assess effectiveness of control measures. High intensity monitoring will be able to address all the objectives above however this will be limited by resources.

Low intensity monitoring will include the following actions:

- ◆ Annual surveys to determine change and deduce trends
- ◆ Consolidate information on control measures.

- ◆ Conduct annual surveys of areas considered vulnerable to invasion but not yet infested.
- ◆ Identify non-target impacts

High intensity monitoring is most appropriate for assessing large scale programmes as well as environmentally sensitive areas. In high level intensity monitoring efforts, the following elements should be included:

- ◆ Results of low level monitoring (as above)
- ◆ Increases in the monitoring frequency to 2-4 times per year
- ◆ Establishment of test plots to compare different control methods (timing, rates and methods)
- ◆ Use of databases, remote sensing and GIS
- ◆ Statistical analysis
- ◆ Determination of impacts of invasives and/or control measures on sensitive species, other native species, indicator species, listed species, and general non-target species

6.1.2.1 Evaluation

Evaluation using monitoring data is used to determine if implementation is achieving planning objectives. Analysis of monitoring data can be used to determine program efficacy. Evaluation of the invasive species removal programme in MRNFR should answer additional questions, including the following:

- ◆ Was implementation consistent with planning and priority efforts?
- ◆ What were the impacts (direct, indirect, cumulative, positive and negative) to non-targets, including listed threatened and endangered species?
- ◆ How can the program be improved?

6.2.22 Sustained Management

Given the context in MRNFR were sources of invasive species in particular *P. patula* are a 'permanent' part of the landscape, invasive management is a never-ending activity. This is further necessitated by the insidious and explosive nature of the species of concern which favours natural disturbance such as wild fires. Elimination of established populations of multiple invasive species has not yet been demonstrated.

Examples of eradication resulting from early detection/rapid response measures are probably numerous, but these efforts can never cease. Sustained management will be critical in MRNFR, this calls for persistence and continuity in invasive management. This will be essential to achieve a rate of control that exceeds the rate of spread.

6.3 MT RUNGWE NATURE RESERVE ECOTOURISM STRATEGY

6.1.1 INTRODUCTION

Since the 1980s, tourism has been one of the leading growth sectors in the global economy. The sector has seen significant growth in revenue and employment as well as the development of new and fledgling markets. Tourism has extensive multiplier effects with multiple businesses directly connected to tourism including transport services, property and equipment maintenance, the security business, the grocery trade, specialty trade, construction and building development services, IT services, the production of foodstuffs, food processing and waste management.

6.1.2 DIMENSIONS OF TOURISM

All tourism activities are related to one or more of the following dimensions of tourism. These are important considerations in the establishment of ecotourism in MRNFR.

- i. Attractions:* This is what draws people to a site. The attractions are the primary motivation for travelling. They may be a *primary destination* such as Mt. Rungwe peak or *secondary destinations* which are interesting places to visit on the way to a primary destination like visiting one or more of traditional forest reserved for worship around MRNFR.
- ii. Natural Resources:* Natural resources are the combination of physical features, National Parks, the climate, and the natural beauty of the area. These are the primary assets of a natural tourism attraction and must be managed in a way to protect the resource.
- iii. Culture:* A way of life which is observed through a people's religion, history, government and traditions.
- iv. Extreme Tourism:* Tourism based on high adventure activities, such as rock climbing and hand-gliding.
- v. Facilities:* When tourists arrive at attractions they require facilities to provide services. These can also be a main attraction, such as a five-star lodge.
- vi. Lodging:* Represent a variety of services from campgrounds, RV parks, motels and five star resorts.
- vii. Food & Beverage:* Not only provide basic sustenance for tourists but an important factor in the overall tourism experience.
- viii. Support Services:* Usually represented by small retail businesses providing souvenirs and personal services. Shopping can be a key part of the travel experience. Tourists seek unique and novel items which represent the area and cultures they visit
- ix. Infrastructure:* The basic services on which all tourism depends. These systems include access, roads, water and sewer systems, communication networks, medical facilities electricity, police and fire protection and roads.

6.3.2 Tourism sector in Tanzania

Tourism is one of Tanzania's most important economic sectors, contributing 17% of GDP between 2003 and 2005, second only to agriculture's 46%. While tourism's growth rate is difficult to separate out from the trade, hotels and restaurants sector in which it is classified, one estimate places its growth at 5.5% per year between 1998 and 2002, and a second at 7.4% per year between 2001 and 2006. This contrasts to the agricultural sector whose growth rate has been declining as has its share of employment (from 84% in 2001 to 76% in 2006) and GDP (from 30% in 1998 to 25% in 2006).

Despite the significant contribution of tourism to the country's economy, there exist barriers for even greater returns from tourism. Similar to other developing countries, infrastructure in Tanzania is fragmented and is in urgent need of rehabilitation if the country's development plans are to be achieved. Private investment, foreign and domestic, in tourism is directly related to the availability of adequate infrastructure including roads, water supply, telecommunications and power supply. Therefore, the provision of basic public infrastructure not only increases the flow of visitors, but also lowers the operational costs of the hoteliers which will ultimately further enhance the attractiveness of the sites as tourist destinations.

6.3.3 Situation analysis

6.3.4.1 Southern Tanzania

Southern Tanzania has a vast endowment of tourism assets. The principle draw is its national parks and reserves, which primarily offer wildlife safaris, including photographic safaris, walking safaris, night game drives, and boat safaris. The region is also home to a number of ethnic groups that can contribute to and benefit from tourism. Effectively managed, tourism in the region can increase investment, provide employment for locals, contribute to government revenue, create legitimate alternatives for sustainable utilisation, and fund better management of the region's biodiversity.

Despite its endowment of unique assets, southern Tanzania's tourism is relatively underdeveloped and attracts low volume of visitors. The region's nature-based tourism receives a small portion of the more than one million visitors per year coming to Tanzania. Southern Tanzania, accounts for less than 10% of all visitors to Tanzania's national parks and less than 1.5% of park revenue³. Occupancy rates in many southern lodges are below 50%. When compared to northern Tanzania and Zanzibar, southern Tanzania's products, including accommodation options and activities, are fewer in number, limited in variety and have poor market penetration.

Today's opportunity for Southern Tanzania is that, the major attraction Northern Tanzania's protected area circuit is becoming overcrowded, particularly the Ngorongoro Conservation Area. As a result, people are looking for alternative destinations in Tanzania. Southern Tanzania

should position itself through distinct investments strategies, improvements in infrastructures and service delivery, and coordinated marketing.

6.3.4.2 Tourism in Mbeya

Mbeya Region is located on the south-west of Tanzania mainland, commonly known as Southern highland. It borders with four Regions namely Rukwa, Tabora, Iringa and Ruvuma. Mbeya city is the largest town in the region. The city has seen growth over the past two decades with increasing population, expanding industry and a number of companies and statutory organisations setting up offices in the city to service the region. Although Mbeya city has nothing much to offer in term of tourism attractions, it acts as a regional hub important for linkages with other major cities in the country. Tourists to the region are increasingly coming through the city to and some of the attractions close the city are listed below (Table 16).

Table 16: Tourist attractions around Mbeya City

Location	Tourism attractions/products	
Mbeya Rural	<ul style="list-style-type: none"> ◆ Tourism information centre ◆ Lake Ngozi ◆ Historical tours 	<ul style="list-style-type: none"> ◆ Rift valley view ◆ Mbeya peak and Loleza peak
Kyela District Council	<ul style="list-style-type: none"> ◆ Historical and cultural tours – churches 	<ul style="list-style-type: none"> ◆ Cultural festivals ◆ Lake Nyasa
Mbozi District Council	<ul style="list-style-type: none"> ◆ Kimondo tour ◆ Bats cave tour 	<ul style="list-style-type: none"> ◆ Hot Springs
Mbarari District Council	<ul style="list-style-type: none"> ◆ Ihefu wetlands ◆ Historical tour 	<ul style="list-style-type: none"> ◆ Ruaha National Park
Chunya District Council	<ul style="list-style-type: none"> ◆ Hunters club ◆ Mining tour 	<ul style="list-style-type: none"> ◆ Museum
Momba District Council	<ul style="list-style-type: none"> ◆ Cultural heritage – old drawings ◆ Lake Rukwa 	<ul style="list-style-type: none"> ◆ Historical Tour – old churches

6.3.4.3 Tourism in Mt Rungwe Nature Reserve

MRNFR, with its volcanic peaks, volcanic creators, volcanic lakes, beautiful montane forest and montane grasslands has potential for the establishment of strong ecotourism. Additionally, MRNFR is surrounded by villages that have high culture diversity from various ethnic groups. These communities have traditional practices for the forest, varieties of dances and food types. The diversity of these ethnic groups could support cultural tourism.

There are a number of other attractions adjacent to MRNFR such as Ruaha National Park, approximately 100 Km North of Rungwe, Kitulo National Park adjacent to Rungwe, Poroto Ridge Forest Reserve adjacent Rungwe on the western side, Matema beach, 50Km south of

Rungwe, Daraja la Mungu 10Km western Rungwe, and a number of water falls in southern Rungwe and Tourism destinations in Mbeya town.

MRNFR tourism is underdeveloped and not maximising on the existing potential. A total of only 578 tourists visited the reserve between July 2014 and June 2015. Among these 78 were non-Tanzanians. Other parts of the region are beginning to see improvements in tourism however MRNFR has seen limited benefits from this. The Reserve is not well integrated into the regional tourism circuit, infrastructure investments have not fully met tourist expectations for lower travel costs, more accessibility, and higher comfort. Limited awareness of the Reserve's attractions has also prevented potential visitors from experiencing what MRNFR has to offer and thereby generating more demand.

6.3.4.4 Tourists Products Mt Rungwe Nature Reserve

MRNFR and its surroundings has a number of tourists' products as described hereafter. All of them need further development.

(i) Rungwe Peak

The peak of Mt. Rungwe stands at the altitude of 2,981m. It is reached through traversing various habitats, from lower montane grasslands, montane forest, bamboo forest at the altitude of 2400 – 2500, upper ericaceous at the altitude above 2500 and heath at the peak. Mt Rungwe peak is beautiful. From the peak one can see all areas around Rungwe. It's a tough climb, taking about three to four hours, but with high reward of views upon reaching the summit. The peak is covered with clouds most of the time, but is usually clear in the mornings.

(ii) Crater lakes

There are a number of crater lakes in and around MRNFR, some filled with water while others are dry. Inside MRNFR is Lake Lusiba and the dry-lake in the southern side. Just outside the boundary of MRNFR in the Northern side, there is Lake Ndwati near Unyamwanga village. Outside the southern boundary of MRNFR there are a series of lakes resulted from volcanic activities. The most outstanding once are the most spectacular lake Masoko and Lake Ilamba. North-eastern Rungwe inside Kitulo National Park, there is Lake Nzabwe near Kikondo village. These lakes could be developed into strong tourism products.

(iii) Beautiful habitats

MRNFR has a number of beautiful habitats that can help attract visitors. The leading of these are the montane grasslands scattered in lower altitude all around Rungwe and close to the peak. Most to the grasslands are in hilly areas, like Rungwe peak, Mwaikole on the western side or Rungwe and Unyamwanga grasslands on the northern side. A few are in plains that are flat. Among the flat surface grasslands are 'paluvalalutali' in Northern Rungwe close to Ngumbulu village. This is a grassland area of three to four kilometres in length, with the width of

up to 500m, it constitutes a variety of short grasses most of which are less than a foot in height. Rungwe Crater is the other beautiful grassland area. MRNFR grasslands are beautiful, rich in biodiversity for both flora and fauna, and they have high catchment value.

Most of MRNFR is montane forest with high biodiversity. Historically there was high level of disturbance but for the past ten years logging charcoal burning has stopped and the forest is returning to its natural state. The montane forest is characterized by deep galleys that are hard to cross and certainly, not with a car, making sections of the forest wild. The Montane forest of MRNFR are favourable for hiking, and well as wilderness tourism where a person or a team of people can disappear, camping inside the forest.

Bamboo forest covers MRNFR especially on the southern side at the altitude between 2400m and 2600 especially at (09° 08' S 33° 45' E). There is only one species of bamboo *Sinarundinaria alpina*. Bamboo is used by local villages in making basket and sometimes chairs. The area covered by bamboo has few trees and a carpet of grasslands making it one of the most favourable areas to walk. During rainy season, the bamboo zone becomes home of various amphibian species. The zone has a number of good camping sites with rivers flowing adjacent them.

(iv) Fauna of Mt Rungwe Nature Reserve

MRNFR is one of the important primates areas, which is a major draw for tourists. It has four species of primates which are sykes monkeys *Cercopithecus mitis*, Black and white colobus *Colobus angolensis sherpei*, velvet monkey *Chlorocebus pygerythrus* and Kipunji *Rungwecebus kipunji*. MRNFR is an important carnivore area having a number of genet species, cats including serval cat and leopard, mongooses, zorillars and weasels. A number of duiker species area also found here, most notable of which being Abbott's duiker *Cephalophus spadix*. MRNFR has high diversity of amphibians and reptiles.

Tourism products in areas adjacent to MRNFR:

- ◆ Lake Ngozi
- ◆ Rift Valley Meeting point
- ◆ God's Bridge
- ◆ Kapologwe water falls
- ◆ Green Tour
- ◆ Mt Livingstone Forest Reserve

6.3.4 Infrastructure challenges and airport

Briefly described here are some of the challenges crippling tourism development in MRNFR as well as the region at large.

6.3.4.1 Poor road and road networks

Most attractions in southern Tanzania are not reachable year round because of poor infrastructure. Trails are also not year round accessible for hiking. Rungwe being a mountainous area makes trails even worse because of weather and they are not maintained. Access to MRNFR is on dirt roads that are in a poor state. Most of them have trench and gullies that makes them difficult to pass. The eastern side of MRNFR is specifically difficult to reach.

6.3.4.2 Songwe International Airport

The international airport is approximately 80km from MRNFR. This ease accessibility from people outside Mbeya region and foreigners. The airport is not yet receiving international flights, thus passengers always have to come and go through Dar es Salaam. However, the daily flights are proving to be popular among the growing business sector in the region.

6.3.4.3 Poor hotel infrastructure

Areas around MRNFR – as far as Mbeya town are characterized by few hotels. The hotels have not been ranked, for which case even the few good hotels in Mbeya are not known. This limits the regions ability to host visitors.

6.3.1.1 Poor utility infrastructure

Constant electricity flow is one of the biggest challenges to small scale investors in the tourism sector. This is an inconvenience for tourists and makes business more expensive for operators.

6.3.2 Transport sector

6.3.2.1 Lack of town shuttle

There are no decent shuttle buses to MRNFR. The min buses that carry service between Mbeya town and Tukuyu are not well regulated. Some times they get full above capacity, and they do not have time table for their trip. They can delay for long time picking passengers, and sometimes they can cancel their trips if they do not have a satisfactory number of passengers. Therefore, visitors have to hire private vehicles.

6.3.2.2 Lack of proper safety measures

All daladalas do not have safety belt. Sometimes even the chairs are torn out in which case customers sits in iron bars of the chair. As for bodaboda that operates in town, they don't have hermet for customers. The very few that have hermet, are in poor conditions whereby customers exchange the hermet without any protective sheath, where they could easily exchange fungus, bacteria, lice and other pests.

6.3.2.3 Lack of waste disposing mechanism

Local commuter buses (Daladalas) do not have bins for waste disposal. Passengers dispose their litter anywhere along roads.

6.3.2.4 Lack of organised taxi system

Taxis in town are not organised, parking centers are not labelled and vehicles themselves are not labelled so anyone can use their cars as taxi. Drivers customer care is very low and few taxi drivers speak English making it difficult for tourists.

6.3.3 Types of tourism advocated for MRNFR

It is important for MRNFR to develop the type of tourism that is most conducive to the environment. MRNFR does not have big emblematic animals thus game viewing tourism is not applicable. The southern highlands of Tanzania has however a number of advantages that can help to create a strong, diversified and competitive tourism that can ensure the share of both local and international tourism, as described below. Key to consider is that MRNFR is part of the greater southern Tanzania safari circuit, in close proximity to Ruaha National Park and other major attractions. MRNFR should try to draw people from these sites by offering a unique product, such as a forest environment and hiking. People in particular seeking alternatives to vehicle safaris could be drawn to MRNFR.

6.3.3.1 Recreation tourism

MRNFR has potential to attract tourists by developing good recreational activities, such as hiking and walking. Most safaris in Tanzania are vehicle based and tourists are seeking alternatives. Likewise, the forest environment offers a different product than the savannah landscapes. This needs to be carefully designed and planned, as well as marketed. This could be marketed as a day trip until suitable lodges/tented camps are established in the area. Backpackers and hikers would stay if camping facilities or guest houses provided. The development of quality guides who know how to service tourists is critical to this product. This also provides an employment opportunity for community members who prove that they can be trained to deliver a quality service.

6.3.3.2 Cultural tourism

Getting to know a place's history and culture is referred to as cultural tourism. Tourists may attend festivals and ceremonies to gain a better understanding of the people, their beliefs and their practices. They may visit a cultural village. In northern Tanzania, tourists pay to visit Maasai Villages. In other parts of Tanzania, tourists do village walks where they learn about growing vegetables, making banana beer and crafts. These are all activities that can be added on to a main tourism attraction, but are not enough to draw tourists to the site itself.

MRNFR is rich in culture diversity coming from the local tribes including Safwa, Nyakyusa, Kinga, Bena, Wanji, Sangu, Nyamwanga, Nyiha, Malila, Ndali, Lambya and so many other tribes that are found in Mbeya. These tribes have slightly different culture and history which will be capitalized in the development of Tourism in Rungwe and Mbeya in general.

The worship of the forests 'masyeto' is a unique product that could be developed so that tourists could hear the stories of masyeto. Each tribe has their own worship forests which tell a slightly different story from their neighboring tribe. The diversity of these stories is one of the strength in developing strong culture tourism in Mbeya and could be designed as a tourism product. Cultural dances and cultural food is the other potential product that could be developed. Experience shows that visitors are impressed with Nyakyusa and Safwa cultural dances. There is a group in Uyole Mbeya that advocate cultural tourism at the Uyole Cultural Tourism Center. They should be engaged in the product development.

6.3.3.3 Ecotourism

Nature treks, bird watching and experiencing nature are all part of ecotourism. MRNFR has a chance of promoting forest based nature tourism. Hiking, Kipunji tracking and birding are some of the activities that should be pursued. Quality guides are critical to delivering this product and ensuring minimal disturbance to the Reserve's environment.

6.3.3.4 Religious tourism / Holistic tourism

It is another type of tourism where people go to a religious location or locations to follow the footsteps of their founder or to attend a religious ceremony. Catholics, for example, go on pilgrimages in the Holy Land to experience the paths where Jesus walked. There are a number of pilgrim areas in Tanzania. In Mbeya there are a number of pilgrim churches that include the Moravian Church of Tanzania that was built over 100 years ago at an area that was originally part of MRNFR.

Mbeya is full of churches of different denominations. The mosaic of these churches especially areas where they are situated in slums it can attract tourists' attention. In addition to these, there are old churches with more than one hundred years in Mbozi, Mbeya town and Rungwe. These can attract tourists.

6.3.3.5 Historical Tourism

MRNFR has a number of historical sites and stories. For example, the Moravian Church Museum at Rungwe Mission. TFS can work with the Church to include the Museum as part of the MRNFR tourism circuit. This is not a stand-alone draw for tourists, but an added activity that may appeal to a small percentage of visitors. The museum displays stories on how Mt Rungwe was shared between stakeholders where part of the forest reserve (Nkuka forest)

was given to the Moravian Church of Tanzania. There are stories that are more than 100 years of the early development of Rungwe.

6.3.3.6 Adventure tourism

Adventure tourism is a fast growing global industry catering to those who want to do more than just visit regular tourist sites. These kinds of trips involve challenging activities like rock climbing, mountain climbing and wild water rafting. MRNFR is a perfect area for adventure tourism owing to its wild areas with gullies, craters and mountain peaks. Camping sites and treks could be designed to the adventures areas and thus realize the potential of adventure tourism in southern highlands of Tanzania

6.3.4 Key objectives for eco-tourism in MRNFR

The primary product for MRNFR is its natural assets, the forest and biodiversity. This is the main draw for tourists; therefore, the primary objective for the tourism plan should be the protection of the forest and biodiversity. This is the focus of the management plan, but needs to be emphasized herein. If the natural product is not high quality, people will not visit.

The development and success of MRNFR tourism is intricately tied to regional improvements in the sector. There are a number of aspects that need a coordinated approach at regional level with collaboration among key tourism stakeholders in the area. The Regional Tourism Committee has developed a number of initiatives to address some of the challenges at macro-level. However, each site will have to develop customised plans in order to have unique products for tourists coming to the region.

Tourism in MRNFR cannot develop in isolation, thus TFS and MRNFR management should engage as much as they can regional and national authorities relevant for tourism development. Discussed here are some of the areas that need to be addressed at regional level as well as areas of focus for MRNFR.

6.3.5 Creating conducive environment for tourism

6.3.5.1 Policy framework to support investors and the industry

TFS should work with regional authorities and national government to address several policy related issues that are affecting the industry such as: (a) the restoration of a simple tax regime – that includes giving grace periods for start-up business; (b) simplification of licensing procedures and explain it to all potential local investors; (c) ensure electricity distribution in areas around MRNFR and reduction of the high electricity tariffs; (d) unification of the regulatory environment and creating a single authority for tourism promotion and this should be known to all potential local investors; (e) creating opportunities to promote shopping of internationally reputed branded products and entertainment; (f) simplification of the investment approval process by setting up of a “One Stop Shop” for tourism related investments; (g) streamlining

the process of alienating government land for tourism development projects; (h) attracting internationally reputed tourist hotels; and (i) environmentally friendly, clean-city concept for urban development.

6.3.5.2 Improvements to the regulatory framework

To compete in the international arena, the service standards must match the global expectations. At the same time, it is important to preserve the environment and wildlife and promote clean cities and townships. It must also be ensured that communities benefit from tourism and economic growth is supported through domestic value creation. In view of these requirements, the existing regulations /guidelines should be revisited and modified. Several new regulations/guidelines have to be introduced. International best practices should be taken into consideration.

6.3.6 Development of tourism plan and tourism guidelines

A proper, detailed tourism plan, tailored for MRNFR is required as part of the development of the Reserve. The tourism plan should include:

1. Market analysis of the type of visitor that would come to MRNFR.
2. Zonation of the forest for tourism development.
3. Identification of potential developments sites for tourism facilities including but not limited to lodges, camp-sites, view sites, trails, and picnic areas.
4. Pricing
5. Fee collection
6. Guidelines for use and activities
7. Schedule for how and when to concession potential tourism sites
8. Community involvement in tourism

In the case of MRNFR, the African Wildlife Foundation could help with this design given their tourism expertise. Guidelines would be regularly updated.

6.3.7 Product development

6.3.7.1 Tourism products development

TFS envisages developing strong tourism industry at in MRNFR. This will help generate revenue to support conservation of the forest and benefits to the local communities. This requires the development of a detailed tourism plan that includes zoning, site selection, product development and concessioning processes. The design will provide specific activities to specific areas. They will be embedded in the purpose of the establishment of MRNFR, highlighting what activities are allowed in each zone. It will include trail design, lodging, resting places, tourism management and a number of other components including the benefit to adjacent communities. The plan should also look at how the adjacent areas can be added to the tourism product, such as cultural tourism. This should be promoted holistically.

6.3.7.2 Developing infrastructure to meet tourism industry requirements

Infrastructure base of an area is the potential determinant of the attractiveness of a tourism destination. Infrastructure forms an integral part of the tourism package. For instance, road infrastructure enhances accessibility of tourists to different parts of the destination country while sound airport infrastructure ensures that tourists experience a comfortable transition from the plane into the borders of the destination country and vice versa. As such communication infrastructure allows quick and cheap communication between the origin and destination country as well as provides maximum information about the destination thereby reducing uncertainty, fear and asymmetric information. Other infrastructure such as waste water and energy among others are also believed to result in more reliable services and thus enhance the attractiveness of the destination.

6.3.7.3 Transportation infrastructure

This encompasses roads, railway, airport/ airstrips, transport facilities (vehicles, wagons, aeroplane units and balloons). Easy access to tourism destinations in terms of international transport and facilities for easy movement within the destinations are critical for the development of tourism. Transport infrastructure enables access for tourists but is also required to transport goods to tourist facilities.

Mbeya Tourism industry is characterized by poor roads and poor connections. Most of the attractions are not easily accessible, including MRNFR. Mbeya Tourism Committee is working with District Directors to ensure that all attractions are easy accessible by loose surface road. TFS need to work very closely to district directors and district councils to identify the status of infrastructure; the needs; and the budget.

6.3.7.4 Accommodation infrastructure

This includes hotels, restaurants and campsites. Good accommodation services to the tourists attract them to stay longer thus increasing income. The absence of quality food, quality rooms, customer care and recreation discourages tourists to stay at a particular area of tourism destination.

As part of the tourism planning, a market analysis should be done to determine the kind of visitor who will come to MRNFR—backpacker, low to high end tourists etc. Based on this analysis TFS will know the kind of tourists it is catering for and can then design a tourism plan that will provide the appropriate services. The tourism sites should be concessioned via a public procurement process that is competitive, enabling TFS to get the best partners.

6.3.7.5 Communication system infrastructure

This includes communication networks through internet and telecommunication systems.

Reliable internet connections, the use of online payment as well as good telephone networks are key for tourist attraction within the area. Most of international tourists pay their bills using online methods such as credit and debits cards as well as online checks. The presence of networking system in the area will enable tourists to use credit cards and on-line payments. This does two things: makes it easier for tourists and removes cash from the system, which then prevents corruption and leakage.

Mbeya tourism industry is striving to reach at the point where necessary communications systems are available in all attractions. Currently phone and internet can be accessed from most of the attractions. There are only a few remote attractions that could not easily be accessed. TFS should work to ensure that all areas adjacent MRNFR are accessible on one or another network provider.

6.3.7.6 Utility infrastructures

This utility infrastructure includes water supply and power supply. The adequate supply of electricity as well as clean water to the tourist sites is vital for the development of tourism. Good and pure water supply systems and waste disposal methods are important.

6.3.7.7 Develop human Resource requirements for tourism industry

Currently tourism industry in Mbeya region is characterized by poor service and customer care provision. Customer complaints are very common pertaining to hotels, transport, customer service and care. TFS should work with Mbeya Regional Tourism Committee to ensure service provided are up to standard. Customer care is critical. A guest can have a bad tourism experience, but if they are hosted and cared for in a positive way, it mitigates the negative experience. Efforts are underway to improve some of the components needed to deliver a high quality tourism product.

The Regional Tourism Committee is focusing on providing necessary training for four major sectors: a) Food & Beverages, b) Professional Cookery, c) Housekeeping and d) Front Office Operation. The annual requirement for the industry is about 500 graduates. Incentives should be provided to promote skills in the industry. Guides also need to be considered and training services should be offered in the region. Many high quality private sector tour operators conduct their own training. This should be considered as part of the competitive bidding for tourism development.

6.3.7.8 Develop a strong Extended Marketing Mix

6.3.7.1.1 Product

This is the actual product being sold to the consumer, whether it's a physical product, or an intangible service. In the case of products, this strategy also encompasses any services or perks that might accompany it. TFS must take into account what the customer is expecting

and needing from the product—this can be included in the market analysis, and then look to meeting those needs and expectations. The product marketing will also need to be considered. Mbeya tourism industry is striving to come up with tourism products that are unique in Tanzanian standard. Where most tourism in Tanzania is game and vehicle based, Mbeya can offer a diversified and unique product including: forest based tourism, cultural products, horse riding, natural products, and ecological products.

6.3.7.1.2 Price

Mbeya tourism industry is competing with the well-established Northern Tanzania tourism circuits. Proper pricing strategy for products is crucial to attract tourists and this should be assessed in a market analysis. Prices should be competitive but not serve as a deterrent. In new sites, consideration might be given to starting low and then increasing based on sound product delivery and customer satisfaction. This will also be key for MRNFR tourism development.

6.3.7.1.3 Promotion

In this step an analysis should be performed to develop a promotional package. Decisions regarding promotion include what medium to use including Television – internal and external, printing, brochures, etc.: as well as when and where to promote. Private sector partners will do their own promotion linked to MRNFR, therefore, this should be considered in the competitive bidding process. TFS working with the committee should develop promotional materials for MRNFR including a website, guide book, birding list and other materials. Also Mbeya region tourism will be promoted along with the southern circuit tourism to achieve a broad spectrum of destination as well as greater diversity of products, where MRNFR will benefit. Mbeya Region Tourism Committee will develop a number of promotional materials including:

- ◆ *Symbol of Mbeya Region:* This will be something that will be associated with Mbeya region. It will be a design of art of something like maize, avocado, hills that represent Mbeya region etc.
- ◆ *Sign posts:* A number of sign posts will be designed to advertise Mbeya tourism products as well as various other products
- ◆ *Upgrade Mbeya City Council Television:* Mbeya City Council's television could be an important media to advertise that attractions to local customers around Mbeya City and nearby cities
- ◆ *Upgrade Mbeya Regional website.*

6.3.7.1.4 People

It is important to recruit and train the right people, because this is who the customers will be in contact with—they are the face of the product and can make or break an experience. These include customer service representatives, sales people, and anyone else a consumer may

deal with that represents a company. For MRNFR it is critical that all staff receive customer service more so for those that are involved in tourism management.

6.3.7.1.5 Physical evidence/layout

How a product is presented to the customer, including its surroundings is very important. Especially crucial to brick and mortar stores that sell a product, they must be welcoming, easy to navigate, and if the product being sold is on the pricy side, fancier than other places. Physical structures should be conducive to the environment, therefore, architectural themes should be assessed in the tourism plan. Relevant to MRNFR is the tourist reception office and entry gates. There is need to ensure these structure is of high quality and attractive in themselves.

6.3.7.1.6 Process

Process deals with customer service, and a company's ability to offer a service, handle complaints, and foresee any issues before they actually happen. These clearly defined and efficient processes should garner customer confidence in the company's ability to handle any issues. MRNFR needs to improve in how customers are handled before, during and after their visits. Processes such as visitor, booking, entry, guiding services, security and codes of conduct need to be well defined for both management and visitors.

6.3.8 Stakeholder involvement

It is essential that TFS and MRNFR management engage a suit of stakeholder to assist in various aspects of the Reserves tourism. Some of the key stakeholders include Mbeya Tourism Committee, tourism industry, Regional Commissioners Office, Private sector, NGOs and other line agencies. There are several ongoing initiatives being implemented as well as others at conceptualization stage in the region. Below are some of the initiatives of Mbeya Tourism Committee that TFS and MRNFR stand to benefit from and should seek further engagement were necessary.

- ◆ Engaging City planners to design hotels investment areas, where good, secure and isolated hotels will be built to meet tourists' expectation
- ◆ Work with hotel service providers to improve products and services in their hotels to meet customer demand—this will also benefit their revenue
- ◆ Organize Mbeya City transport to meet tourists' expectations
- ◆ Involve tourist police to minimize tourist harassment in the region
- ◆ Attempts to regularize the pricing structure of key attractions and the initiative to introduce an electronic payment system.
- ◆ Improve access roads and other comforts at key attractions
- ◆ Developing Mbeya Region website to become more informative and of practical use to

tourists who are seeking hotel rooms, tour planning assistance, guides, vehicle hire and purchase of tickets to key attractions

- ◆ Improve the cleanliness of Mbeya City and other key tourist attractions by promoting voluntary contributions from the industry
- ◆ Effective use of media to create positive sentiments about tourism amongst the public so the tourists are better treated by the society.

6.3.9 Improve domestic tourism

While looking to the foreign tourists to generate additional foreign income to Tanzania, the increasing demand from domestic tourists must be incorporated. This should be assessed as part of the market analysis and product and pricing should be targeted at both international and domestic tourism. The Mbeya Regional Tourism Committee will look at a few alternatives to facilitate domestic tourism. Effective utilization of the guest houses owned by the government for local tourists. TFS should consider as part of the tourism planning process MRNFR the development for of guest houses and hotels that will target domestic customers, who might not afford more high-end facilities.

6.3.10 Environmental conservation

Ensuring sustainable development of the tourism industry and environmental conservation are critical components of planning. MRNFR should ensure the protection of the reserve in its natural state.

The goal of MRNFR is

'To protect the unique, biologically important rain forest ecosystem of the Mt Rungwe Nature Reserve and to maintain biodiversity, genetic resources, natural processes and cultural values in an undisturbed, dynamic and evolutionary state in order to have ecologically representative example of the Eastern Arc and Southern Rift forest ecosystem available for present and future generations as well as to enhance scientific study, environmental monitoring, environmental education, and sustainable controlled local and recreational use'.

This goal can be realized by addressing all threats to MRNFR. The major threats to the serve are Invasive species control, Poaching control, Fire control, Encroachment control and control of Wildlife trade. These are covered in this plan.

6.3.11 Partners in development of tourism in MRNFR

There are a number of key players in developing sustainable tourism in MRNFR and Mbeya Region at large. Each entity described below will play a particular role in developing the Reserve. Above and beyond the importance of each stakeholders of more importance are collaboration and participation of all concerned.

6.3.4.1. Tanzania Forest Services Agency

TFS is responsible for the management of the reserve ensuring that all rules and regulations for the establishment of the reserves are enforced. TFS sets rules and regulation for operations and enforces them in cooperation with various stakeholders. TFS has the mandate of designing tourism in MRNFR. TFS is the principle beneficiary of tourism revenue from MRNFR with the goal of some of the revenue generated to be shared with the community in accordance with TFS principles and regulations.

6.3.4.2 Local Governments

Governments have a critical role in creating the context and stimulating actions to ensure that tourism is more sustainable in the future. Local governments should become an important arena for discussions about the interpretation and implementation of sustainable development. Discussions at international and national levels reinforce the importance of local government because it is at this local level that local policy debates unfold and decisions about resource use are made. Governments should provide an environment that enables and encourages the private sector, local community, tourists and other stakeholders to respond to sustainability issues.

This can best be achieved by establishing and implementing a set of policies for tourism development and management, drawn up in concert with others. The principles of sustainable development put emphasis on local determination and implementation of policies and actions. This should be placed within a supportive national policy framework. Indeed, it is often local governments which assume much of this responsibility as they are closest to many of the problems associated with tourism development and they control most of the development planning aspects associated with tourism.

Also local governance knows with details natural resources and human capital so through the careful assessment it can plan the future to help the community in employments, local business, infrastructures etc. Local governments are faced with a range of challenges to the effective planning and management of tourism at their destination level. The most important challenge is that of integrating the management of tourism with other functions and activities of local government. The following are some of responsibilities which local governments in Mbeya region have to perform to boost tourism in the region.

6.3.5 Infrastructure provision and maintenance

Transport infrastructure shape access to the destination and travel patterns within the destination. Basic infrastructure capacity may shape the destination capacity to absorb tourist and may limit development.

6.3.5.0. Land use planning

Development assessment and strategic land use planning influences the destination quality.

Of importance to MRNFR is development of land use plans in surrounding villages. This will ensure activities carried out by communities around the Reserve are compatible with conservation thereby creating a conducive environment for tourism.

6.3.5.0. Environmental management

Protects and preserves unique environmental features of a destination and manages visitor pressures on natural resources.

6.3.5.1 Public health and safety management

Protects and enhances visitor satisfaction, destination image and quality.

6.3.5.2 Community development

Encourages a community supportive of tourism activity and enterprise. Protected areas in the region present various opportunities to co-opt communities to develop tourism and other wildlife based enterprises.

6.3.5.3 Local economic development

Encourages synergetic economic activity, the development of appropriate tourism business and support services.

6.3.5.4 Education, training and employment

Influences quality in the delivery of tourism services and facilities.

6.3.5.5 Tourism promotion and marketing

Fosters branding and destination image development.

6.3.5.6 Arts and cultural development

Encourages the development of other products that can help diversity the visitor experience, such as art and culture.

6.3.5.7 Human services

Encourages positive attitudes and improved service delivery along the whole tourism service chain.

6.3.6 The role of public-private-partnerships

The government and private sector become involved with tourism because of the impacts and

benefits it has on society at large. The public sector acts as a guardian of the national and local environment, cultures and communities. Private sector acts as the engine that drives the industry, generates revenue and brings in tourists.

6.3.7 Tourism planning

There is a need to integrate sustainable tourism planning into national and regional development plans to strengthen action on the ground and build the skills and resources needed to apply them effectively. Public policies, governance mechanisms and stakeholders' involvement should be incorporated into the framework outlined in the national and regional development plan. Planners identify and utilize legal and fiscal regimes, information, knowledge, evaluation tools, and cooperative processes among professionals and civil society.

- ◆ Tourism planning at sub-regional levels should coordinate and interact with the local level.
- ◆ Planning should be closely connected to policies for sustainable development, i.e. national sustainable development strategies, poverty reduction strategies, and local Agenda 21.
- ◆ Mbeya Region Tourism Committee defined a vision for tourism. It described the desired conditions based on local, regional and national values, existing national legislation, and the goals and objectives of management tourism.
- ◆ MRTC Planning also addressed the potential negative impacts of extensive tourism operations.
- ◆ The planning process provided important opportunities to build community and constituency engagement, to better understand changing expectations and environmental and social conditions and to support local values.
- ◆ Planning facilitates cooperation and collaboration between ministries of tourism and similar agencies, and ministries of culture, departments of conservation, and ministries of the environment.
- ◆ Planning can help build technical capacities and proficiencies of management in public conservation institutions and agencies. Building the capacity of a specialist or coordinator within the agency in charge of tourism planning is essential.

6.3.1 Tourism operation management

Tourism businesses and public institutions in charge of tourism should adopt innovative and appropriate technology to improve the efficiency of resource use (notably land, energy and water), minimize emissions of greenhouse gases (GHG), and the production of waste, while protecting biodiversity. Public and private sector involved in tourism will design a plan to ensure tourism operations and management respects the legislated and/or planned objectives related to tourism development and management.

Private and public sector in Mbeya will ensure operations uses internationally recognized

standards for sustainable tourism. The product should be promoted as sustainable as this will be an added draw to tourists. Labels on products will also be used to communicate clear information on sustainability. A wide variety of communication techniques and claims (based on sound underlying data) will be used to ensure that the public has the best possible information, delivered in the most appropriate way, which will allow them to make the most sustainable choices in their tourism selection.

6.3.2 Tourism investment

Financing from national and international organizations (public and private) dealing with investments in public infrastructure related to tourism or investments in private tourism businesses should estimate their social and environmental impacts and adopt economic measures to compensate and offset unavoidable impacts.

Regulatory instruments with fully integrated environmental and social criteria will be applied in tendering, licensing and permit-approval procedures. NEMC will be involved in the environmental impact assessment. Moreover, NEMC will help governments to build institutional capacity and develop streamlined and coordinated procedures for this purpose.

The estimation of the expected benefits of tourism development on the basis of the 'Total Economic Value' that includes ecosystem services and social accounting benefits should be considered in investments decision-making. Particular emphasis should be given to the inclusion of impacts in societies and local communities.

The criteria for sustainable investments in the tourism sector will be adopted within the spirit of the "Equator Principles." The criteria should also prioritize investments on projects developed by Small, Medium and Micro-sized Enterprises (SMMEs) that steer sustainable consumption and production processes in tourism businesses in order to facilitate the access to specific funds or financial resources by micro and small investors. The creation of new financial and investment tools or mechanisms to support SMMEs aiming at sustainability should be promoted.

6.3.3 Tourism promotion and marketing

Private sector will come up with marketing strategies that will promote the idea and need for sustainability. Existing promotion and distribution channels will emphasize sustainability as a primary option for tourism development and to influence consumer, Governments, businesses and civil society organizations will be encouraged to make all meetings, incentives, conferences and excursions activities as sustainable as possible, using both policy and technical tools to ensure responsible execution of these activities.

The 'success' of tourism destinations will be evaluated not only in terms of 'arrivals', but also in terms of economic and social benefits that stay in the destination, and in terms of limitation of the negative environmental and social impacts.

The use of local goods and services in the tourism sector, which minimizes economic leakages, will be promoted. These products and services have a strong role in leveraging additional local investment, creating employment for the local workforce and helping these actors to be competitive, while offering concrete opportunities to contribute to the conservation of the natural and cultural environment.

Opportunities provided by modern Information and Communication Technologies (ICT) to raise awareness on sustainable consumption and operations in tourism will be part of the marketing activities.

6.3.4 Capacity building

All stakeholders will be encouraged to build capacity for sustainable tourism and apply this capacity in their internal operations as well as to influence the decision of other stakeholders. Within this framework, the capacities of local communities and indigenous populations will be enhanced, while respecting their traditions, and enabling them to build sustainable, community-based initiatives. International organizations, NGOs, academia and knowledge-brokers will be engaged to support the capacity enhancement of all stakeholders, including national governments, for the achievement of sustainable tourism objectives.

6.3.5 Consumption of tourism products and services

Consumers will be encouraged to use locally developed products and services that generate local employment and support initiatives for social and infrastructure community development including, among others, education, health, and sanitation. Consumers should also be inspired to purchase local sustainable tourism products and services, including products such as crafts, food, etc. Guidelines for the behaviour of tourists at destinations should be promoted using networks, media and other communication channels, such as information from service providers and operators through the whole value chain of tourism.

6.3.1 Monitoring and evaluation of tourism development

Governments and businesses will set baseline and measurable targets, review progress and report towards the achievement of sustainable tourism objectives. The UNWTO guide on 'Indicators for Sustainable Tourism' will be used for examples of practical applications. Given that an activity can be acceptable in one context and very harmful in another, monitoring and evaluation approaches should be adapted to the specific context of each local destination according to resources, forms and volumes of tourism, management capacity, etc.

The concept of a 'Global Observatory on Sustainable Tourism' will be considered as an initiative to establish a network of regional, national and local observatories. Its objective would be the promotion of systematic application of monitoring and information management techniques, as well as related communication and reporting processes, supporting informed decision-making in sustainable tourism matters.

6.3.2 Travel agents

Travel agents play an important role in tourism development. Travel agency is a retail business that sells travel related products and services to customers on behalf of suppliers such as airlines, car rentals, cruise line, hotels railways, sightseeing tours and package holidays that combine several products. In addition to dealing with ordinary tourists, most travel agents have a separate department devoted to making travel arrangements for business travellers and some travel agencies specialize commercial and business travel only. There are also travel agencies that serve as general sales agents for foreign travel companies, allowing them to have offices in countries other than where their headquarters are located.

Full-service travel agency

- ◆ offering all services and products related to international and domestic travel
- ◆ is equipped to handle all types of travel such as holiday and business travel on individual or group based
- ◆ smaller agencies situated in residential areas tend to concentrate on leisure travel
- ◆ larger agencies serving commercial areas will concentrate on business travel

Corporate/ Business travel agency

- ◆ specialize solely in servicing the travel needs of the business or corporate clients, in that sense they deal with work-related and incentive travel

In-house travel agency

- ◆ differs from the corporate travel agency in the sense that they work with only one corporate account doing mainly business travel but also handling the leisure side for corporate clients

Specialty agencies

- ◆ result of specific market needs, serving the needs of market segments such as senior citizens, incentive groups or adventure travellers

Once the tourism product is developed, a targeted approach should be made to travel agents that service the type of tourists that would be interested in MRNFR.

6.3.1 Non-Governmental Organisation

NGO's are voluntary organizations that are funded by the state, foundations, business or private persons. NGO's work at local, national or international level. NGO's can play an important role in the tourism sector. They can help influence policies that support a conducive tourism product, if they have the expertise, they can help with tourism planning, design and concessioning. Some NGOs may assist in helping to fund tourism.

Role of NGO in tourism awareness

NGOs that have tourism and marketing expertise can play a critical role in helping with tourism planning, marketing and capacity development.

Role of NGO's in Mbeya

The NGO's will play a very important role at the tourist in Mbeya. NGO's will work on tourism issues based on their need to understand changes affecting the communities in which they are working due to tourism departments. Many NGOs serve as civil society watch dogs, helping to enforce rules and regulations. Their involvement may be any of the below:-

- ◆ Lack of civic amenities at the tourist in our destinations
- ◆ Increased pressure on common resources
- ◆ Due to interaction with tourists, the changes occurring in cultural modes of the local or host community.
- ◆ Sexual exploitation of children at tourist destination.
- ◆ The menace of child labour at tourist destination.
- ◆ Allowing tourist to a destination beyond its carrying capacity.
- ◆ Having an interaction with the local NGO's working on day to day issues at the tourist destination.
- ◆ Host tourist conflict

NGO's can also help with monitoring and evaluation. A number of NGOs are also involved with conservation, which is critical as this is the tourism product.

5.13 Developmental Partners

Development partners play an important role in the socio-economic development of many developing countries. This may be through budgetary support, projects/programme and technical assistance. Some DPs are directly supporting climate change related activities of civil society organizations in their area of responsibility. Some have gone an extra yard by instituting mechanisms to stimulate private sector development, particularly micro enterprises, including micro finance to fund small scale enterprises. Increasingly DPs are playing an important role in supporting implementation of mitigation of greenhouse gas emissions and promoting sustainable development.

Developmental partners are expected to play an important role in the development of tourism in Mbeya region. This will be at various stages of researching, planning and implementation of the developed tourism plans.

6.3.1 Media

6.3.1.1 Relationship between media and tourism

Media contribute to 80% of tourism revenue and tourism contributes to 25% of media's revenue. The role of tourism in media industry such as journalism is growing. In most of the universities offering journalism courses students have to do compulsorily project on tourism and its allied areas for their respective degrees. The media have a crucial role to play in putting emerging destinations. The relationship between tourism and media is vital and complex. Tourism is highly dependent on media reporting because the vast majority of travel decisions are made

by people who have never seen the destination first hand for themselves. When there is bad news or a crisis the impact on tourism can be devastating. Tourists are scared away from destinations caught in the glare of round-the-clock disaster coverage, causing communities dependent on tourism to lose their source of livelihood.

6.3.1.2 Role of Media in Tanzanian Tourism.

In Tanzania the travel journalists, media experts on travel, leading attractive, popular and branded newspapers mainly published from Tanzanian cities, and electronics media are highlighting places of tourist interest. They can help promote destinations locally and internationally.

The media industry works with hotels, travel agencies, tour operators, airlines and the various government agencies to bring revenue to the country by promoting tourism. Without the assistance of media and its support many places would have remained unexplored as the awareness about the place is very minimal to the foreigners. Even social networking sites like face book and twitter are also promoting tourism.

6.3.1.3 Impact of Media in Promoting Tourism Industry

Over the years media have contributed towards shaping tourism into a responsible industry by promoting the following good practices:

- ◆ It protects the environment and minimizes the negative social impact of tourism.
- ◆ It generates greater economic benefits for local people and enhances the well-being of host communities.
- ◆ It makes positive contributions to the conservation of natural and cultural heritage and promotes the world's diversity.
- ◆ It provides more enjoyable experiences for tourists through more meaningful connections with local people.
- ◆ It helps to understand the local cultural, social and environmental issues.

6.3.1.4 The host community

One of the core elements of tourism development is to encourage local communities' participation as it is central to the sustainability of tourism industry. Community engagement is critical to long-term success. A case study of the Barabarani village in Tanzania contributes to the understanding of community participation in tourism development by examining local communities' views on their role in tourism development. The paper triangulates both quantitative and qualitative data to bring together perspectives from the grassroots based on household questionnaire survey with some members of the local community and a two-month period of field observations in the study area, coupled with the researcher's experience with the wider community. The findings revealed that local communities want to be involved when tourism policies are being made to enable policymakers to prepare a policy that meets

stakeholders' needs and addresses their concerns. They also want to be part of tourism development decisions to ensure their needs are incorporated.

Furthermore, local communities want to have a voice in development issues (not necessarily tourism development) to enable them to protect community interests, and increase transparency and accountability, and wipe out embezzlements and abuse of offices, which are rampant acts amongst decision-makers. It is clear from the findings that people are against the prevailing top-down approach in decision making when it comes to tourism development in their areas. It also depicts the nature of the central government which controls all the forms of decision making when it comes to development and policy formulation. The study emphasizes on small scale methods in analyzing and assessing the role of local communities' views of participation from the communities themselves rather than what has been normally imposed on them.

6.3.1.5 Communities as Key Stakeholders in Tourism Development

There are different actors involved in tourism development, including private sector, government, donor agencies, civil societies and local people themselves. Local communities are regarded as important asset in tourism development as it is within their premises that these activities take place. Local communities are also regarded as legitimate and moral stakeholders in tourism development (Haukeland, 2011; Jamal and Stronza, 2009) because their interests affect and are affected by decisions of key policy makers (McCool 2009). Mayers (2005) divides stakeholders into two categories: the first are the stakeholders who affect decisions and the second category are those stakeholders who are affected by decisions.

The degree of involvement of local communities in various decision making and policy issues is determined by the extent to which they affect or are affected by these decisions and policies. In the same token, Pongponrat (2011) noted that "local tourism development requires people who are affected by tourism to be involved in both the planning process and the implementation of policies and action plans. This ensures that development meet the perceived needs of the local community" (p. 60). If decisions concerning development of tourism in a region are not made in consultation with the local communities during the design stage, it will be impossible for the local communities to be involved during implementation (Niezgoda and Czernek, 2008). Likewise, there will be little support of local communities for tourism activities. Whichever circumstances, it is vital to identify and involve key stakeholders right from the design stage. Failure to do so can cause technical or political difficulties during implementation, and can significantly influence the success and outcome of the process.

6.3.1.6 Role of Local Communities in Tourism Development

6.3.27.6.1 Policy and Decision- making

To achieve sustainable tourism development local communities' need to participate in decision-

making process. Local communities can take part in identifying and promoting tourist resources and attractions that form the basis of community tourism development—engagement in the planning process is a way to achieve this. To achieve long lasting outcome, communities need to be active participants rather than passive observers. Community participation in decision making increases people’s trust and confidence with the tourism industry. It also provides the local community with a voice in design and decision-making in order to improve plans, service delivery, and finally, promotes a sense of community by bringing together people who share common goals.

Other ways communities can be involved:

- ◆ Employment as guides and forest scouts.
- ◆ Employment in lodges.
- ◆ Providing food products to tourism facilities.
- ◆ Shareholders in tourism facilities, note that the African Wildlife Foundation has helped communities to become legitimate partners in tourism facilities.
- ◆ Owners of SMEs, such as cultural tourism.
- ◆ Spin-off businesses that cater to tourists.

6.3.27.6.1 Tanzania Tourism Board

TTB has the responsibility of overseeing all tourists’ activities in Tanzania

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Appendix 1. Annual Plan of Operation for MRNFR 2016/2017 (TSHS. “000”)

S/N	ACTIVITY DESCRIPTION	Target	Unit	CPU	2016/2017
1	PFM ACTIVITIES				
1.1	Awareness raising on PFM at district level for Mount Rungwe NR	1	meeting	13,161	13,161
1.2	Conduct awareness meetings on PFM at village level	23	meeting	486	11,178
1.3	Conduct social economic study	23	each	11,500	11,500
1.4	Training to VNRCs (Village Natural Resources Committee)	23	each	566	13,018
	SUB-TOTAL				48,857
3	TRAINING OF STAFF & COMMUNITIES				
3.3	Staff training (short courses)	5	each	2,000	2,000
3.4	Local communities (study visit)	460	each	150	13,800
3.5	CBOs (short term training)	92	each	150	2,760
3.6	Staff (Seminars, Meetings)	36	each	150	1080
3.7	Local communities (Seminars)	460	each	150	13,800
3.8	Local NGOs and CBOs (Seminars)	8	each	80	640
	SUB-TOTAL				34,080
5	EXTENSIONSERVICES & DEVELOPMENT OF ECOTOURISM				
5.1	Survey and identify eco-tourism potential sites & develop tourism plan	1	persons	30,000	30,000
5.2	Preparation of thematic map for various ecotourism sites	1	each	4,000	4,000
5.3	Preparation & distribution of leaflets (2 types)	1,500	each	3	4,500
5.4	Preparation & distribution of posters (1 type)	1,000	each	5	5,000
5.5	Preparation & distribution of brochures (2 types)	1,500	each	2	3,000
5.8	To maintain nature trails	50	km	102	5100
5.9	Establish and maintain camping sites	5	each	5,000	15,000
	SUB-TOTAL				32,600

6	DEVELOPMENT OF INFRASTRUCTURE, EQUIPMENT AND TOOLS				
6.3.1	Toyota L/Cruiser Hard Top	1	each	150,000	150,000
6.3.2	Motorbikes (125-XL Honda)	5	each	9,500	28,500
	SUB-TOTAL				178,500
6.4	Maintenance of transport facilities				
6.4.1	Toyota L/Cruiser tyre sets	50	sets	600	6,000
6.4.2	Toyota L/Cruiser Maint & service	24	each	300	1,440
6.4.3	Lorry 7 tones spare tyre sets	35	sets	700	4,900
6.4.4	Lorry 7 tones Maint. & service	15	each	350	1,050
	Motorbikes spare tyre sets	50	sets	80	800
6.4.9	Motorbikes Maint. & service	300	each	40	2400
	SUB-TOTAL				16,590
6.10.1	Construction of Administration block (HQ) with 4 offices, store, Library, Rest house, Laboratory and conference room	1	each	450,000	450,000
	SUB-TOTAL				450000
7	FOREST PROTECTION				
7.1	Joint Forest patrol and recording of illegal activities	1800	each	60	21,600
7.3	Awareness creation on forest protection, fire prevention	115	each	500	11,500
7.6	Forest fire fighting equipment	46	Set	2000	92,000
7.7	Fire line maintenance (fire prone areas)	164	km	350	57,400
	SUB-TOTAL				160,900
8	NATURAL REGENERATION - SPECIES CONSERVATION				
8.1	Establish PSP and monitoring of the threatened and endemic species	10	each	5,000	10000
	SUB-TOTAL				10,000
9	FOREST RESOURCES ASSESSMENT				
9.3	Gap and enrichment planting (10 ha)	10	ha	1,000	2000
	SUB-TOTAL				2000
10	BOUNDARY CONSOLIDATION				
10.2	Boundary tree planting	50	km	200	2000
10.4	Beacon preparation and installation/ replacement	20	each	300	2000
10.5	Boundary weeding	164	km	300	49200
10.7	Preparation and installation of sign boards	20	each	700	2800
	SUB-TOTAL				56,000
12	IMPROVE LAND USE AND SOIL CONSERVATION				
12.1	Support the communities on soil conservation measures in 23 villages	23	each	5,000	23000
	SUB-TOTAL				23000
14	MONITORING AND EVALUATION				
14.1	Annual Review of implementation (Internal)	5	each	3,000	3,000
	SUB-TOTAL				3,000

15	ADMINISTRATION AND OFFICE RUNNING				
15.1	Supporting staff salaries (10)	600	month	260	31,200
15.2	Electricity charges	60	month	200	2,400
15.3	Water charges	60	month	150	1,800
15.4	Communication expenses	60	month	500	6,000
15.5	Office running Materials	60	month	1000	12,000
15.6	Maintenance of office equipment	60	month	500	6,000
15.7	Fuel (Diesel + Petrol)	15,000	lts	2.5	7,500
	SUB-TOTAL				66,900
	GRAND TOTAL				1,082,427

Appendix 2. Work Plan and Budget for Management of Mt Rungwe Nature Reserve (2016/2017-2020/2021)

S/N	ACTIVITY DESCRIPTION	CPU & COST PER YEAR (TSHS. "000")						Total		
		Target	Unit	CPU	2016/2017	2017/2018	2018/2019		2019/2020	2020/2021
1	PFM ACTIVITIES									
1.1	Awareness raising on PFM at district level for Mount Rungwe NR	1	meeting	13,161	13,161	0	0	0	0	13,161
1.2	Conduct awareness meetings on PFM at village level	23	meeting	486	11,178		0	0	0	11,178
1.3	Conduct social economic study	23	each	11,500	11,500	0	11,500	0	0	23,000
1.4	Training to VNRCs	23	each	566	13,018	0	13,018	0	0	26,036
1.7	Revision of by-laws	23	each	500	11,500	11,500	0	0	0	11,500
1.8	Facilitate approval of by-laws by full council	23	each	150	3,450	0	0	0	0	3,450
1.9	Preparation of JFM Agreements	23	each	500	11,500	0	0	0	0	11,500
1.10	Preparation of MoU between MRNFR & adjacent villages	23	each	500	11,500	0	0	0	0	11,500
	SUB-TOTAL				48,857	37,950	13018	11,500	0	111,325
3	TRAINING OF STAFF & COMMUNITIES									
3.1	B.Sc. Level	1	each	15,000	0	0	0	0	15,000	15,000
3.2	Certificate level	1	each	7,500	0	0	0	7,500	0	7,500
3.3	Staff training	5	each	2,000	2,000	2,000	2,000	2,000	2,000	10,000
3.4	Local communities (study visit)	460	each	150	13,800	13,800	13,800	13,800	13,800	69,000
3.5	CBOs (short term training)	92	each	150	2,760	2,760	2,760	2,760	2,760	13,800
3.6	Staff (Seminars, Meetings)	36	each	150	1080	1,080	1,080	1,080	1,080	5,400
3.7	Local communities (Seminars)	460	each	150	13,800	13,800	13,800	13,800	13,800	69,000
3.8	Local NGOs & CBOs (Seminars)	8	each	80	640	640	640	640	640	3,200

SUB-TOTAL					34,080	34,080	34,080	41,580	49,080	192,900
4	COMMUNITY PROJECTS DEVELOPMENT & INTRODUCTION OF IGAS									
4.1	Assess potential viable businesses	23	group	2,000	0	20,000	20,000	6000	0	46,000
4.2	Support Beekeeping projects	200	each	100	0	10,000	10,000	0	0	20,000
4.4	Support establishment of tree nurseries in the villages (for commercial, buffer zone, on-farm planting)	23	each	3,000	0	15,000	15,000	15,000	18,000	63,000
4.5	Training of villagers on improved cooking stoves	230	pax	100	0	0	12,000	11,000		23,000
	SUB-TOTAL				0	45,000	57,000	32,000	18,000	152,000
5	EXTENSION SERVICES & DEVELOPMENT OF ECOTOURISM									
5.1	Survey & identify eco-tourism potential sites & develop a tourism plan	1	persons	30,000	30,000	0	0	0	0	30,000
5.2	Preparation of thematic map for ecotourism sites	1	each	4,000	4,000		0	0	0	4,000
5.3	Preparation & distribution of leaflets (2 types)	1,500	each	3	4,500					4,500
5.4	Preparation & distribution of posters (1 type)	1,000	each	5	5,000					5,000
5.5	Preparation & distribution of brochures (2 types)	1,500	each	2	3,000					3,000
5.6	Develop a website for the Reserve	1	each							
5.7	Preparation & distribution of stickers (3 types)	4,000	each	1	0	1,000	1,000	1,000	1,000	4,000
5.8	T-shirts for staff & VEC members	300	each	10	0	3,000	0	0	0	3,000
5.9	Maintain nature trails	50	km	102	5,100					5,100
5.10	Establish & maintain camping sites	5	each	5,000	15,000	10,000				25,000
5.11	Identify & train local tour guides	5	each	1,000		5,000				5,000
5.12	Support cultural tourism in the surrounding villages	5	each	3,000	0	9,000	6,000	0	0	15,000

5.13	Preparation of species checklist (flora & fauna) in & around the reserve	1	each	25,000	0	0	25,000	0	0	25,000
5.14	Writing articles about Mt Rungwe Nature Reserve	20	each	200	0	1,000	1,000	1,000	1,000	4,000
	SUB-TOTAL				32,600	29,000	33,000	2,000	2,000	98,600
6	DEVELOPMENT OF INFRASTRUCTURE, EQUIPMENT & TOOLS									
6.2	Road improvement	40	km	650		26,000		26,000		52,000
6.3	Procurements									0
6.3.1	Toyota L/Cruiser Hard Top	1	each	150,000	150,000	0	0	0	0	150,000
6.3.2	Toyota L/Cruiser Pick Up	1	each	150,000	0	150,000	0	0	0	150,000
6.3.3	Lorry 7 tones	1	each	75,000	0	0	75,000	0	0	75,000
6.3.2	Motorbikes (125-XL Honda)	5	each	9,500	28,500	19,000	0	0	0	47,500
6.3.3	Bicycles	46	each	150	0	6,900	0	0	0	6,900
	SUB-TOTAL				178,500	201,900	75,000	26,000	0	481,400
6.4	Maintenance of transport facilities									
6.4.1	Toyota L/Cruiser tyre sets	50	sets	600	6,000	6,000	6,000	6,000	6,000	30,000
6.4.2	Toyota L/Cruiser Maint & service	24	each	300	1,440	1,440	1,440	1,440	1,440	7,200
6.4.3	Lorry 7 tones spare tyre sets	35	sets	700	4,900	4,900	4,900	4,900	4,900	24,500
6.4.4	Lorry 7 tones Maint. & service	15	each	350	1,050	1,050	1,050	1,050	1,050	5,250
	Motorbikes spare tyre sets	50	sets	80	800	800	800	800	800	4,000
6.4.9	Motorbikes Maint. & service	300	each	40	2400	2400	2400	2400	2400	12,000
	SUB-TOTAL				16,590	16,590	16,590	16,590	16,590	82,950
6.5	Procurement of furniture for HQ (HQ Office, Library, Conference room, Laboratory, Rest house)									
6.5.1	Office Tables	20	each	600	0	12000	0	0	0	12,600
6.5.2	Office Chairs	45	each	250	0	11250	0	0	0	11,500
6.5.3	Cup boards	6	each	600	0	6000	3,600	0	0	10,200
6.5.4	Book shelves	8	each	350	0	2800	0	0	0	3,150
6.5.5	Metallic cabinet	3	each	450	0	0	1350	0	0	1,800
6.5.6	Curtains	60	set	100	0	6000	0	0	0	6,100
6.5.8	Sofa set Coach	3	set	2500	0	0	7,500	0	0	10,000
	SUB-TOTAL				0	38050	12,450	0	0	55,350
6.6	Procurement of furniture for Range offices									
6.6.1	Office Tables	6	each	150	0	900	0	0	0	900

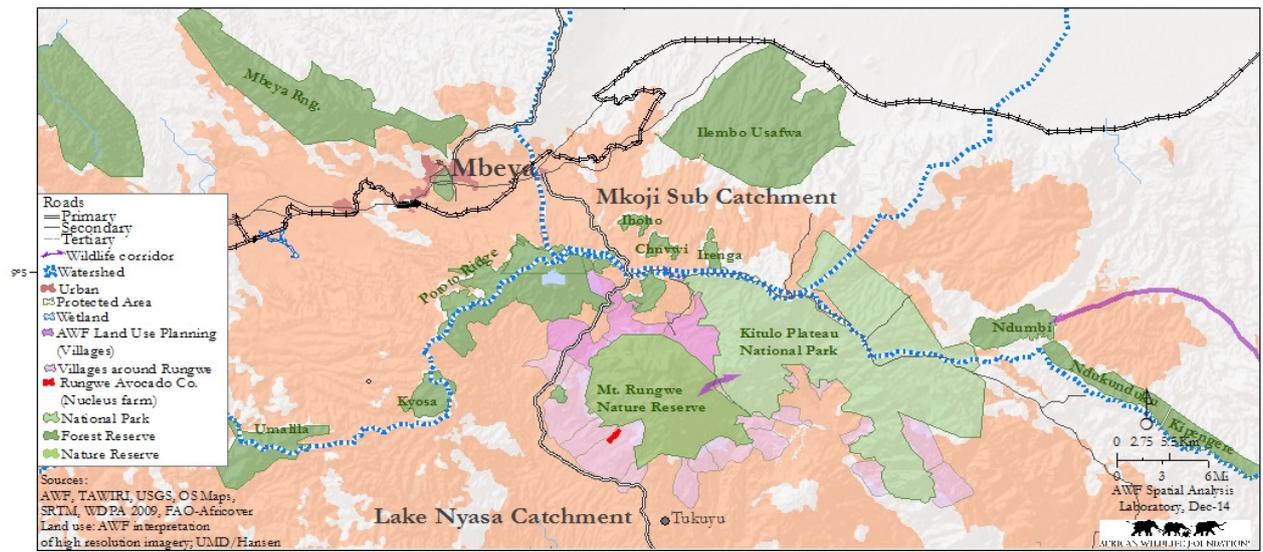
6.6.2	Office Chairs	12	each	100	0	1200	0	0	0	1,200
6.6.3	Cup boards	3	each	450	0	1350	0	0	0	1,350
6.6.4	Book shelves	3	each	250	0	750	0	0	0	750
6.6.5	Curtains	24	each	70	0	1680	0	0	0	1,680
	SUB-TOTAL				0	5880	0	0	0	5,880
6.7	Equipment for HQ (HQ office, Rest house, Library, Conference room, Laboratory)									
6.7.1	Desk top computer & UPS	6	each	10000	0	0	60,000	0	0	60,000
6.7.2	Lap top computer	6	each	1500	0	0	9000	0	0	9,000
6.7.3	Video camera digital	4	each	1500	0	0	6,000	0	0	6,000
6.7.4	Still camera digital	3	each	900	0	0	2700	0	0	2,700
6.7.5	GPS	4	each	2000	0	0	8000	0	0	8,000
6.7.6	Sunnnto clinometer	4	each	700	0	0	2800	0	0	2,800
6.7.7	Sunnnto hypsometer	4	each	700	0	0	2,800	0	0	2,800
6.7.8	Wedge prism	5	each	200	0	0	1,000	0	0	1,000
6.7.9	Printer	4	each	600	0	0	2,400	0	0	2,400
6.7.10	Photocopier	1	each	4,500	0	0	4,500	0	0	4,500
6.7.11	Binding & Lamination machine	2	each	400	0	0	800	0	0	800
6.7.12	Power point projector (Epson)	1	each	4500	0	0	4500	0	0	4,500
6.7.13	TV Set	6	each	1000	0	0	6000	0	0	6,000
6.7.14	Flip chart Board	2	each	100	0	0	200	0	0	200
6.7.15	Internet facility	1	each	10,000	0	0	10,000	0	0	10,000
	SUB-TOTAL				0	0	120,700	0	0	120,700
6.8	Equipment for Range stations									
6.8.1	Desk top computer & UPS	2	each	1,000	0	0	2,000	0	0	2,000
6.8.2	Printer	2	each	450	0	0	900	0	0	900
6.8.3	Solar panel sets	2	each	3,000	0	0	6,000	0	0	6,000
6.8.4	Still camera digital	2	each	900	0	0	1,800	0	0	1,800
6.8.5	Flip Board	2	each	70	0	0	140	0	0	140
6.9.1	Tents (2 people)	15	each	1200	0	18,000	0	0	0	18,000
6.9.2	Mattresses	40	each	70	0	2800	0	600	0	3,400
6.9.3	First aid tool kit	6	each	1,000	0	6,000	0	0	0	6,000

6.10.1	Construction of Admin HQ with 4 offices, store, Library, Rest house, Lab & conference room	1	each	450,000	450,000	0	0	0	0	0	0	450,000
6.10.2	HQ Block Maintenance	1	each	30,000	0	0	0	0	0	0	30,000	30,000
6.10.3	Project Manager house construction	1	each	200,000	0	200,000	0	0	0	0	0	200,000
6.10.4	Construction of PM house	1	each	150,000	0	0	150,000	0	0	0	0	150,000
6.11.1	Range offices construction	3	each	120,000	0	0	360,000	0	0	0	0	360,000
6.11.2	Range offices maintenance	3	each	8,000	0	0	8,000	8,000	8,000	8,000	8,000	24,000
6.11.3	Range in charge houses construction	3	each	120,000	0	0	0	0	0	360,000	0	360,000
6.11.4	Range I/C house maintenance	3	each	8,000	0	0	8,000	8,000	8,000	8,000	8,000	24,000
	SUB-TOTAL				450,000	226,800	536,840	376,600	46,000	1,636,240		
7	FOREST PROTECTION											
7.1	Joint Forest patrol & recording of illegal activities	1800	each	60	21,600	21,600	21,600	21,600	21,600	21,600	21,600	108,000
7.3	Awareness creation on forest protection, fire prevention	115	each	500	11,500	11,500	11,500	11,500	11,500	11,500	11,500	57,500
7.4	Preparation of forest fire prevention plans	1	each	15,000	0	15,000	0	0	0	0	0	15,000
7.6	Forest fire-fighting equipment	46	Set	2,000	92,000	0	0	0	0	0	0	92,000
7.7	Fire line maintenance (fire prone areas)	164	km	350	57,400	57,400	57,400	57,400	57,400	57,400	57,400	287,000
	SUB-TOTAL				160,900	83,900	68,900	68,900	68,900	68,900	68,900	451,500
8	NATURAL REGENERATION - SPECIES CONSERVATION											
8.1	Establish PSP & monitoring of the threatened & endemic species	10	each	5,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	50,000

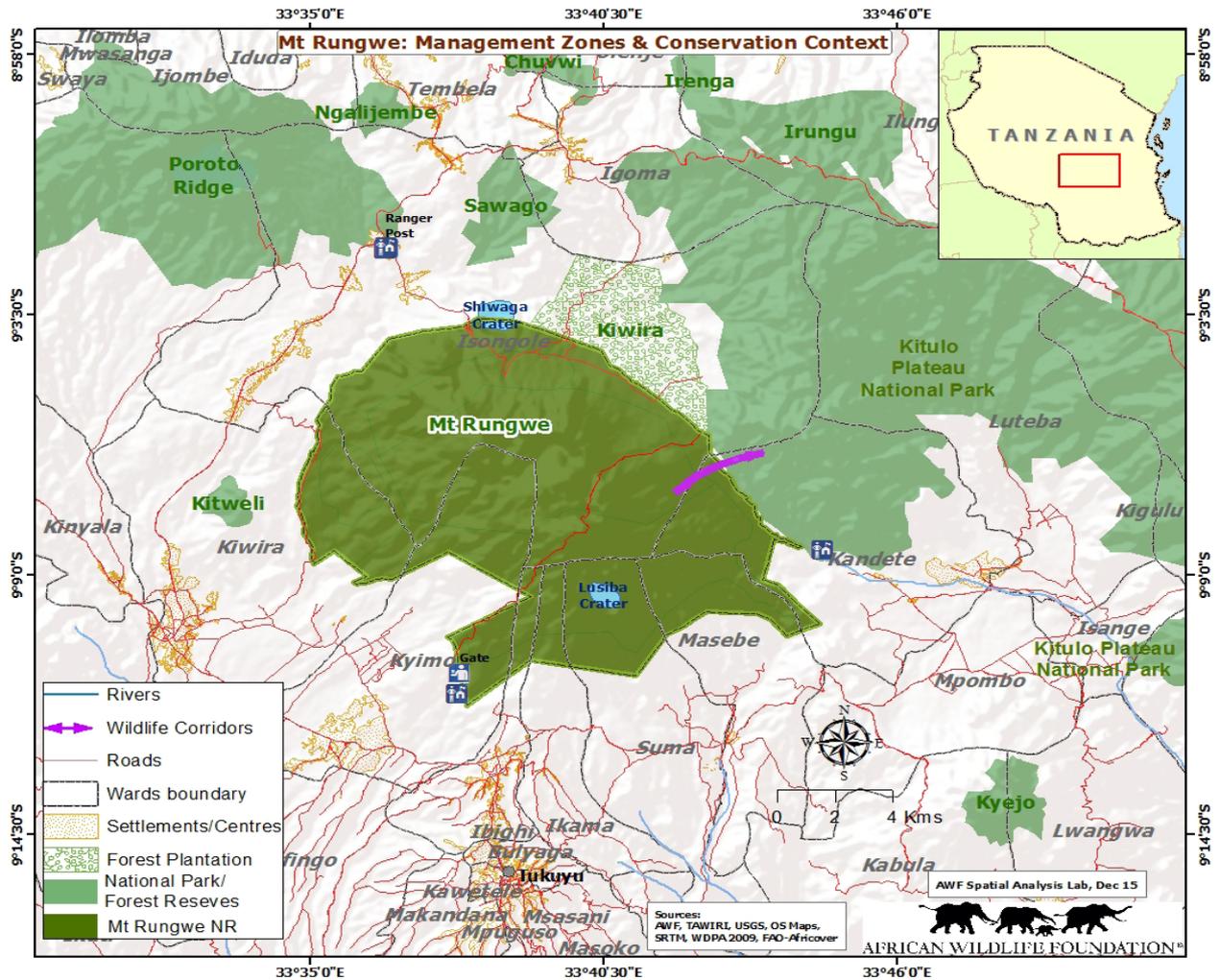
8.2	Conduct basic inventories & mapping of localities	1	each	30,000	0	30,000	0	0	0	0	30,000	0	0	0	30,000
	SUB-TOTAL				10,000	40,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	80,000
9	FOREST RESOURCES ASSESSMENT														
9.1	Biodiversity resources assessment	1	each	50,000	0		0	50,000		0				50,000	50,000
9.2	Research on problem species (invasive)	1	each	30,000	0	0	30,000			0				0	30,000
9.3	Gap & Enrichment planting (10 ha)	10	ha	1,000	2000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	10,000
	SUB-TOTAL				2000	2,000	32,000	52,000	2,000	2,000	2,000	2,000	2,000	2,000	90,000
10	BOUNDARY CONSOLIDATION														
10.2	Boundary tree planting	50	km	200	2000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	10,000
10.4	Beacon preparation & installation/replacement	20	each	300	2000	2,000	2,000								6,000
10.5	Boundary weeding	164	km	300	49200	49,200	49,200	49,200	49,200	49,200	49,200	49,200	49,200	49,200	246,000
10.7	Preparation & installation of sign boards	20	each	700	2800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	14,000
	SUB-TOTAL				56,000	56,000	56,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	276,000
11	FOREST ZONATION														
11.1	Demarcation & zonation of Nature reserve into management zones	1	map	30000	0	30000	0	0	0	0	0	0	0	0	30,000
	SUB-TOTAL				0	30000	0	0	0	0	0	0	0	0	30,000
12	IMPROVE L&USE & SOIL CONSERVATION														
12.1	Support the communities on soil conservation measures in 23 villages	23	each	5,000	23000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	115,000
	SUB-TOTAL				23000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	115,000
14	MONITORING & EVALUATION														
14.1	Annual Review of implementation (Internal)	5	each	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	15,000
	SUB-TOTAL				3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	15,000

15 ADMINISTRATION & OFFICE RUNNING											
15.1	Supporting staff salaries (10)	600	month	260	31,200	31,200	31,200	31,200	31,200	31,200	156,000
15.2	Electricity charges	60	month	200	2,400	2,400	2,400	2,400	2,400	2,400	12,000
15.3	Water charges	60	month	150	1,800	1,800	1,800	1,800	1,800	1,800	9,000
15.4	Communication expenses	60	month	500	6,000	6,000	6,000	6,000	6,000	6,000	30,000
15.5	Office running Materials	60	month	1000	12,000	12,000	12,000	12,000	12,000	12,000	60,000
15.6	Maintenance of office equipment	60	month	500	6,000	6,000	6,000	6,000	6,000	6,000	30,000
15.7	Fuel (Diesel + Petrol)	15,000	lts	2.5	7,500	7,500	7,500	7,500	7,500	45,000	75,000
	SUB-TOTAL				66,900	66,900	66,900	66,900	66,900	104,400	372,000
	GRAND TOTAL	Target	Unit	CPU	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	Grand Total	
					1,082,427	940,050	1,158,478	784,070	396,970	4,366,845	

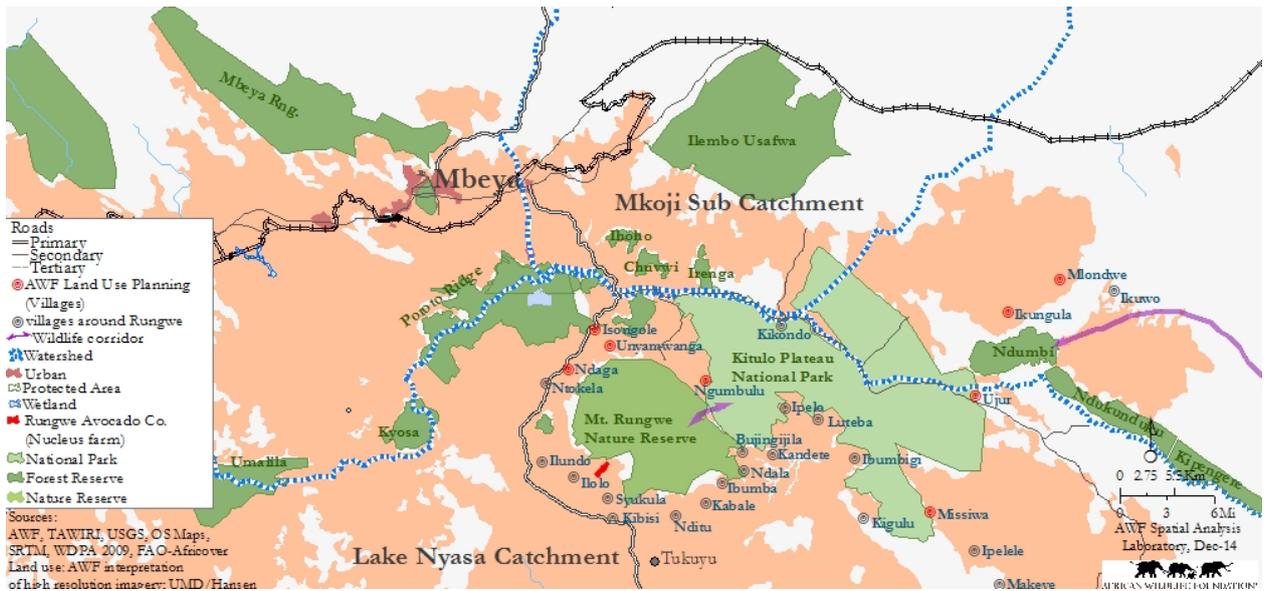
Appendix 3. Mt. Rungwe Nature Forest Reserve Maps



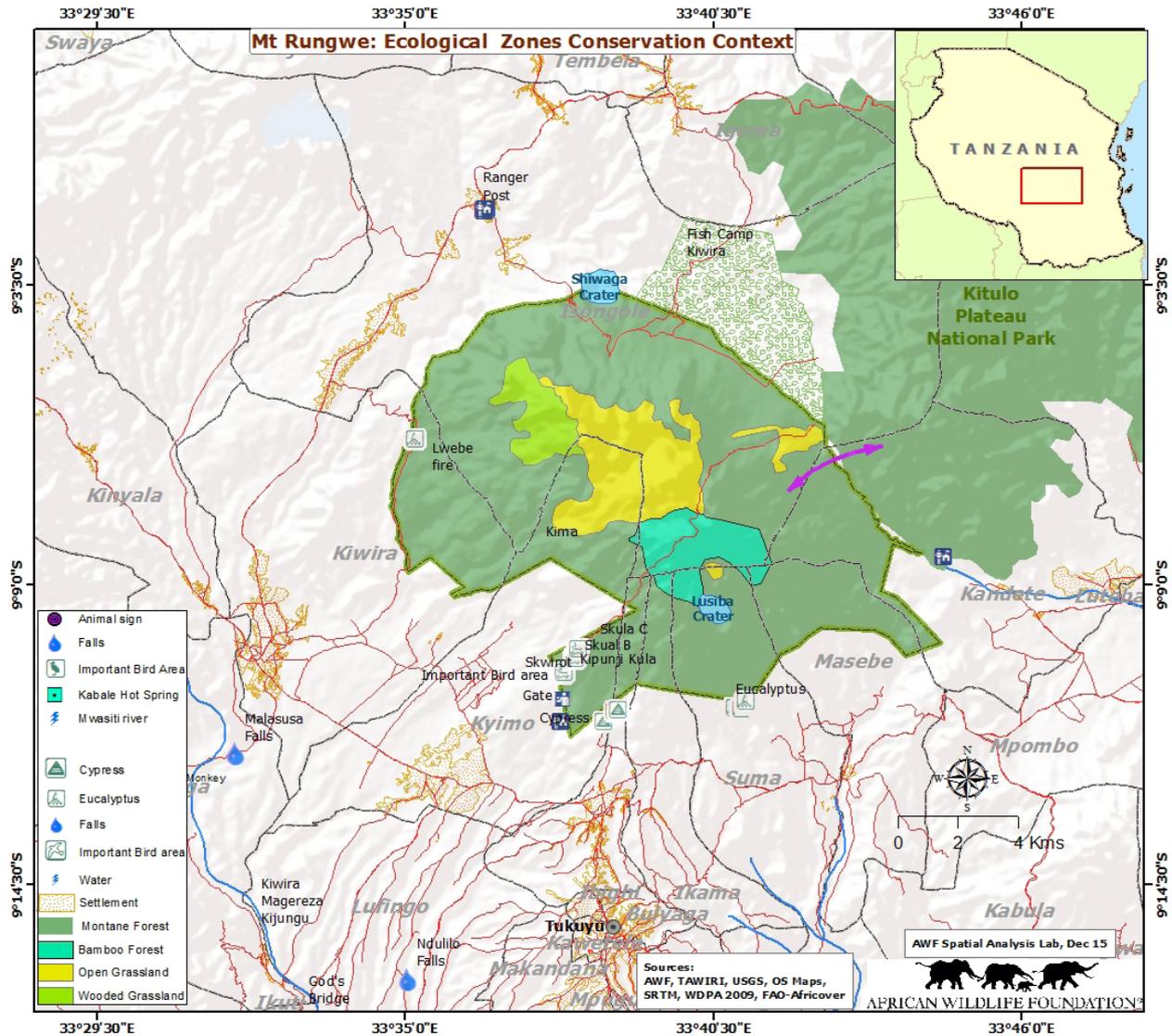
Tanzania Southern Highlands Conservation context



Location of Mt Rungwe and other protected areas in the region



Villages bordering and surrounding Mt Rungwe Nature Reserve



Main Ecological zones in MRNFR

Appendix Appendix 4: Fauna Species of Conservation Concern in Mt Rungwe Nature Reserve Appendix .

Restricted-range faunal species of Mt Rungwe:

SH= Southern Highlands, Udz = Udzungwa, Nyk = Nyika

Name	Species	Status	Location
Mammals			
Kipunji	<i>Rungwecebus kipunji</i>	Critically Endangered (IUCN)	SH + Udz endemic
Abbott's duicker	<i>Cephalophus spadix</i>	Vulnerable (IUCN)	Tanzania endemic
Rungwe galago	<i>Galagoides sp. Nov.</i>	New species	SH endemic
Sharpe's black and white colobus	<i>Colobus angolensis sharpei</i>		SH + Udz endemic race
Giant elephant shrew	<i>Rhynchocyon cimei hendersoni</i>		SH endemic sub-sp
Tanganyika mountain squirrel	<i>Paraxerus lucifer lucifer</i>		SH + Nyk endemic sub-sp
Leopard	<i>Panthera pardus</i>	CITES appendix 1	
Birds			
Blue swallow	<i>Hirundo atrocaerulea</i>	Vulnerable (IUCN)	
Iringa akalati	<i>Sheppardia lowei</i>	Vulnerable (IUCN)	SH + Udz endemic
Kipengere seedeater	<i>Serinus melanochrous</i>	Near Threatened (IUCN)	SH endemic
Uhehe fiscal	<i>Lanius marwizi</i>		SH + Udz endemic
Mountain marsh widow bird	<i>Euplectes psammocromius</i>		SH endemic
Southern mountain greenbul	<i>Andropadus f. fusciceps</i>		SH endemic sub-sp
Shelley's greenbul	<i>Andropadus m. masukuensis</i>		SH endemic sub-sp
Reptiles			
Angulated dwarf gecko	<i>Lygodactylus angularis</i>		SH + Nyk endemic
Uporoto horned chameleon	<i>Chameleo fueleborni</i>		SH endemic
Ukinga hornless chameleon	<i>Chameleo incornutus</i>		SH endemic
Tubercle-nosed chameleon	<i>Chameleo tempeli</i>		SH + Udz endemic
Pitless pygmy chameleon	<i>Rhampoeon nchisiensis</i>		SH + Nyk endemic
Black limbless skink	<i>Melanoseps ater ater</i>		SH + Nyk endemic
Ukinga montane skink	<i>Mabuya brauni</i>		SH endemic

Mt Rungwe bush viper	<i>Atheris rungweensis</i>		Tanzania endemic
Name	Species	Status	Location
Amphibia			
Rungwe rain frog	<i>Probreviceps rungweensis</i>		SH endemic
Rungwe puddle frog	<i>Phrynobatrachus rungweensis</i>		SH endemic
Kinga puddle frog	<i>Phrynobatrachus ukingensis</i>		SH endemic
Barbour's tree frog	<i>Leptopelis barbouri</i>		SH + Udz endemic
Fish			
Rungwe Tilapia	<i>Astatotilapia sp nov.</i>	New species	SH endemic
Lepidoptera			
Butterflies			
	<i>Charaxes congdoni</i>		SH + Udz endemic
	<i>Neocoenyrta fueleborni</i>		SH + Udz endemic
	<i>Alaena bicolora</i>		SH endemic
	<i>Uranothauma pseudocrawshayi</i>		SH + Udz endemic
	<i>Mitisella congdoni</i>		SH endemic
	<i>Chondrolepis obscurior</i>		SH + Udz endemic
	<i>Chondrolepis similis</i>		SH + Udz endemic
Diplopoda			
Oxydesmidae	<i>Irigius rungwe</i>		Rungwe endemic
Arachnida			
Linyphiidae	<i>Bursellia paghi</i>		Rungwe + Kitulo endemic
	<i>Callitrichia pileata</i>		Rungwe + Kitulo endemic
	<i>Elgonia rungweensis</i>		Rungwe + Kitulo endemic
	<i>Lepthyphantes howelli</i>		Rungwe + Kitulo endemic
	<i>Oedothorax usitatus</i>		Rungwe + Kitulo endemic
	<i>Walckenaeria tanzaniensis</i>		Rungwe + Kitulo endemic

Appendix 4. Mt. Rungwe Nature Reserve Conservation Targets and Threat Analysis Purpose of the Mt Rungwe Nature Reserve

The reserve purpose statement provides the present-day rationale as to why MRNFR is considered important enough to merit nature reserve status. Within the context of developing the management plan, the reaffirmation and refinement of the reserve purpose statement provided a solid foundation for focusing the entire planning effort, as well as for the ongoing management of MRNFR.

To conserve key ecosystems and species of Mt Rungwe Nature Reserve for continued provision of ecosystem services for the betterment of present and future generations of Tanzania and the global community

Subsidiary components of the reserve purpose are to:

- ◆ conserve biodiversity, genetic resources and natural processes
- ◆ protect and promote cultural and traditional values
- ◆ improve the livelihoods of adjacent communities
- ◆ facilitate greater environmental amelioration
- ◆ comply with national and global environmental management conventions

MRNFR Exceptional Values

The exceptional resource values (ERVs) consists of key biophysical and cultural characteristics and attributes of MRNFR which are considered unique, critical for its existence as well as relevant to the socio-economic and cultural aspects of the area. Six categories of ERVs were identified for MRNFR (Table 17). The exceptional resource values were used to help identify the reserve purpose, the management issues and opportunities.

Table 17: MRNFR exceptional resource values

Category	Exceptional resource value
Natural	Montane forest, Rare, endemic and globally important flora and fauna, Unique biogeographical value, Considerable biodiversity
Scenic	Rungwe peak, Crater lakes, Wilderness character, Beautiful grasslands
Social	Water catchment, Source of non-timber forest products
Cultural	Traditional cultural sites, Ecotourism
Economical	Ecotourism, Carbon trading
Education/Research	Gene pool/bank, Unique biogeography

MRNFR Conservation Targets

Conservation targets (CTs) depict the ecological systems, communities and species and scenic values that are identified as priorities for conservation. When effectively and collectively managed, CTs targets reflect and maintain the overall health of the ecosystem. Identifying CTs for the reserve allows for management strategies to be focused on key elements but at

the same time ensures conservation of subsidiary systems, communities and species that have not been prioritised. MRNFRN ecosystem management targets are grouped into three ecosystem categories and briefly summarised below (Table 18). Equally important are the key ecological attributes (KEAs) of each target. A key ecological attribute is an aspect of a target's biology or ecology that if present, defines a healthy target and if missing or altered, would lead to the outright loss or extreme degradation of that target over time.

Table 18: Conservation targets in MRNFR, rational for their selection and KEAs

Target	Rational	Key Ecological Attributes	
Species	Kipunji	Critically Endangered with severely fragmented populations MRNFR has the largest known population of the species	Population size Distribution Reproductive success Food availability
	Abbot's duiker (<i>Cephalophus spadix</i>)	Endangered Decreasing population Endemic to Tanzania Locally extinct in some locations where it was recorded previously.	Population size Populations structure Distribution Reproductive success
	Mt Rungwe's biodiversity	Rare and endemic species Important ecological processes	Composition Structure, Function
Habitats	Montane Forest	Remnant of once extensive Eastern Arc & Southern Rift forest Endemic floral species Habitat to rare and endemic fauna	Forest size Species composition Forest structure, Function
	Grassland	Habitat for faunal species	Species composition Fire regime, Extent
Systems	Water catchment and ecosystem services	River headwaters Water tower Water supply to surrounding communities	Water quality River headwater integrity Function, Connectivity to other biodiversity areas

MRNFR Ecosystem Threats

Planning is largely about finding solutions to challenges and concerns and their identification is an important step in the process. The 2008 – 2013 management plan identified a number of direct threats and indicated their magnitude based on their impact on the selected CTs. An analysis was carried out to determine the status of key threats to targets in MRNFR (Table 19). Based on the analysis most of the threats to targets have reduced and a few threats have emerged. Emerging threats include retaliatory killings due to crop raiding and Sulphur dioxide, a natural occurrence but resulting in death of animals and affects people.

Table 19: Status of direct threats for each target in MRNFR

Target	Threat	Previous status		Current Status			
		Severity	Scope	Severity	Scope	Irreversibility	Rating
Kipunji	Habitat loss	V.High	V.High	Medium	Medium	Medium	Medium
	Poaching/Hunting	Med	Low	Low	Low	Medium	Low
	Retaliatory killings	-	-	Medium	Medium	Medium	Medium
Abbot's duicker	Habitat loss	V.High	V.High	Medium	Medium	Low	Low
	Poaching/Hunting	V.High	V.High	Medium	Medium	Medium	Medium
MRNFR Biodiversity	Poaching/Hunting	V.High	V.High	Medium	Medium	Medium	Medium
	Retaliatory killings	-	-	High	Medium	High	Medium
	Charcoal burning	V.High	V.High	Low	Low	High	Low
	Encroachment	Low	Med	High	Low	High	Medium
	Invasive species	High	Med	V.High	V.High	High	V.High
	Logging	V.High	V.High	Low	Low	Medium	Low
	Burning & fires	High	High	Medium	Medium	Low	Low
	Wildlife trade	High	High	Low	Low	Medium	Low
	Sulphur dioxide	-	-	?	?	-	-
Montane Forest	Invasive species	-	-	High	Medium	High	Medium
	Encroachment	-	-	V.High	Low	Medium	Low
	Logging	-	-	Low	Low	Low	Low
Crater lakes	Invasive species	-	-	V.High	V.High	Low	High
Water catchments & ecosystem services	Logging	V.High	V.High	-	-	-	-
	Charcoal burning	V.High	V.High	-	-	-	-
	Burning & fires	High	High	Low	Low	Low	Low
	Grazing	Med	Low	Low	Low	Low	Low
	Cultivation	Med	Low	-	-	-	-
	Invasive species	-	-	V.High	V.High	High	V.High

KEY

Overall threat level	Very High	High	Medium	Low
Severity (level of damage)	Destroy or eliminate target	Seriously degrade target	Moderately degrade target	Slightly impair target
Scope (geographic extent)	Very widespread or pervasive	Widespread	Localised	Very localised
Irreversibility (degree to which effects of threat can be reversed)	Unlikely target will be restored, takes > 100 yrs.	Technically yes but not affordable, takes 21-100 yrs.	Target can be restored, take 6 -20 yrs.	Target can easily be restored, takes 0 – 5 yrs.

Threat Situation Analysis

To provide a good understanding to the drivers of threats to targets in the MRNFR an analysis was carried with input from stakeholders knowledgeable of the area. Information gathered and presented here was useful in developing strategies that address the key drivers of threats and well as targeting specific areas or communities from which a particular threat or driver is emanating from. Provided here is information on causes and drivers, key locations (villages) and hotspots for each threat (Table 15 and 16).

Table 20: Information on threat drivers and key hotspots areas for each

Threat	Causes/Drivers	Location/Hotspots
Encroachment	<ul style="list-style-type: none"> ◆ Shortage of arable land ◆ Unclear boundaries ◆ Increasing population 	<ul style="list-style-type: none"> ◆ Kibisi ◆ Kyimo
Invasive species	<ul style="list-style-type: none"> ◆ Fire ◆ Kiwira Forest Plantation ◆ No buffer zone between KFP & MRNFR ◆ Lack of control measures 	<ul style="list-style-type: none"> ◆ Ngumbulu, Unyamwanga ◆ Ndwati village, Mbeye village, Ndaga village, Ilundo
Sulphur dioxide	<ul style="list-style-type: none"> ◆ Natural 	<ul style="list-style-type: none"> ◆ Ilundo ◆ Unyamwanga (Shiwaga)
Boundary issues	<ul style="list-style-type: none"> ◆ Pine invasion distorted boundary with KFP ◆ Lack of involvement of stakeholders in MRNFR management ◆ Lack of collaboration & communication barriers 	<ul style="list-style-type: none"> ◆ Kiwira Forest Plantation ◆ Kibisi ◆ Ilundo
Habitat loss	<ul style="list-style-type: none"> ◆ Hunters clear forest in order to clear ways / tracks ◆ Invasive species outcompeting indigenous species 	<p>In MRNFR areas which borders</p> <ul style="list-style-type: none"> ◆ Unyamwanga, Ndaga, Ngumbulu, Ilundo, Ntokela, Kibisi
Wildfire	<ul style="list-style-type: none"> ◆ Honey harvesting ◆ Field preparation/clearing 	All 16 villages which directly border MRNFR
Destruction of water sources	<ul style="list-style-type: none"> ◆ Poor agriculture practices leading to siltation & erosion ◆ Abstraction of water from rivers to farms ◆ Sand harvesting – need for income sand sold for building 	All 16 villages which directly border MRNFR

Table 21: Drivers of extractive threats, targeted species and key hotspots areas for each

Threat	Causes/Drivers	Targeted Species	Methods	Location
Wildlife trade	<ul style="list-style-type: none"> ◆ Need for income ◆ Ornamental purposes ◆ For research & zoos in other countries 	<ul style="list-style-type: none"> ◆ Orchids ◆ Birds, Swallow tail ◆ Three horned chameleon, ◆ Butterflies 	<ul style="list-style-type: none"> ◆ Digging ◆ Uprooting ◆ Mist net 	<ul style="list-style-type: none"> ◆ Ngumbulu ◆ Syukula ◆ Ilundo ◆ Ilolo, Ndaga ◆ Bujingijila
Retaliatory killings	<ul style="list-style-type: none"> ◆ Human wildlife conflict ◆ Crop raiding ◆ Agricultural encroachment ◆ Hard edges ◆ Ignorance 	<ul style="list-style-type: none"> ◆ Kipunji, Francolins ◆ Bush pig, Rock hyrax, Giant rats ◆ Abbot's duiker ◆ Black-and-white colobus monkey, ◆ Blue monkey, 	<ul style="list-style-type: none"> ◆ Snares ◆ Pit traps ◆ Traps ◆ Dogs ◆ Manati? ◆ Spears 	<ul style="list-style-type: none"> ◆ Bujingijila ◆ Ngumbulu ◆ Ilundo ◆ Unyamwanga ◆ Syukula ◆ Ndala ◆ Ndaga
Poaching/ Hunting	<ul style="list-style-type: none"> ◆ Domestic consumption ◆ Commercial (trophies) ◆ Medicinal purposes ◆ Poverty ◆ For traditional dancing regalia 	<ul style="list-style-type: none"> ◆ Kipunji, Bush pig, Abbot's duiker, Rock hyrax ◆ Black-and-white colobus monkey ◆ Blue monkey ◆ Pangolin (kwale) ◆ Doves, Serval cat ◆ Porcupine, Dik dik, Honey 	<ul style="list-style-type: none"> ◆ Manati? ◆ Dogs ◆ Pit traps ◆ Traps ◆ Snares ◆ Spears 	<ul style="list-style-type: none"> ◆ Bujingijila, Ngumbulu ◆ Ndala, Ibumba ◆ Ilundo, Syukula ◆ Ndaga, Ilolo ◆ Unyamwanga ◆ Mwanzanzi ◆ Kimondo village
Charcoal burning	<ul style="list-style-type: none"> ◆ Commercial purposes ◆ Domestic use ◆ Poverty ◆ Unemployment 	<ul style="list-style-type: none"> ◆ Milingoti, ◆ <i>Canabis spp</i>, ◆ <i>Olea capensis</i> ◆ <i>Albizia schimperiana</i> ◆ Mizibhi (nyakusa) 	<ul style="list-style-type: none"> ◆ Traditional charcoal kiln 	<ul style="list-style-type: none"> ◆ Ngumbulu ◆ Ilundo, Syukula ◆ Kibisi ◆ Unyamwanga ◆ Ndaga, Ibumba
Illegal tree/plant harvesting	<ul style="list-style-type: none"> ◆ Building material ◆ To earn income ◆ Handcraft (wooden spoons and handles) ◆ Timber ◆ Traditional medicine ◆ Domestic use 	<ul style="list-style-type: none"> ◆ Mushroom ◆ Orchids ◆ Camphor ◆ <i>Pinus patula</i> ◆ Eucalyptus ◆ <i>Hagenia abyssinica</i> 	<ul style="list-style-type: none"> ◆ Pit sawing ◆ Bench machine ◆ Debarking ◆ Chain sawing ◆ Axe 	<ul style="list-style-type: none"> ◆ Kibisi, ◆ Ngumbulu ◆ Ilundo

Appendix 5: Conservation Target Monitoring Plan and Key Research Areas

It is critical to assess the viability (health) of the set conservation targets. Key Ecological Attributes (KEA) are defined as aspects of the conservation target's biology or ecology that if missing or altered would lead to the loss of that target over time. Indicators are defined as measurement entities related to a specific information need. Key characteristics of indicators considered here include that they should be measurable, precise, consistent and sensitive.

The viability assessment uses a rating scale that was constructed with available evidence and/or expert opinion to determine the current status of conservation target (where the target is today) and the desired status of the target (where we would like it to be in the future). This desired status is the goal for the various management actions to be implemented. The full rating criteria for most of the targets will be completed in the fullness of time as more data becomes available.

MRNFR ecosystem monitoring plan

Conservation Target 1: Kipunji						
KEAs	Indicator of change	Method of measurement	Collection frequency	Baseline data collected	Indicator ratings	
					Current Status	Future
Population size	Number of animals	Census, data from patrols	Every 3 years	Yes	-	-
Food availability	Animal condition	Physical observation	Annually	Yes	-	-
Habitat availability	Area of habitat	Point-centred quarter	Annually	-		
Connectivity of available habitats	Movement of animals	Long term monitoring, data from patrols	Every two years	Yes		
Population health	Prevalence of diseases	Observational monitoring	Ongoing	Yes		
Conservation Target 2: Abbott's duiker						
Distribution	Presence in areas previously not recorded	Survey using transects, data from patrols	Annually	Yes		
Abundance	Population increase	Survey using transects	Every 3 years	Yes		
Population health	Viable population size	Survey using transects	Annually			
Food species and diversity	Presence of food species	Vegetation sampling	Every 3 years	Yes		

Conservation target 3: Mt Rungwe Biodiversity						
KEAs	Indicator of change	Method of measurement	Collection frequency	Baseline data collected	Indicator ratings	
					Current Status	FDS
Fauna sps. composition	Presence & abundance of indicator sps.	Surveys & monitoring	Every 3 years	No		
Floral sps. composition	Presence & abundance of indicator sps.	Surveys & monitoring	Every 3 years	No		

Guilds	Presence & abundance of guild indicator sps.	Surveys & monitoring	Every 3 years	No		
Conservation Target 4: Montane Forest						
Species composition	Presence & abundance of indicator sps.	Surveys & monitoring	Every 3 years	No		
Floristics	Dominant species	Surveys & monitoring	Every 3 years	Yes		
Forest extent	Area and size	Satellite imagery, ground truthing	Every 3 years	No		
Structure	Canopy cover	Plot based, plotless sampling	Every 3 years	No		
Above ground biomass	Canopy height, stand basal area	Vegetation monitoring plots	Every 5 years	?		
Conservation Target 5: Grassland						
Species composition	Indicator species	Plot based, plotless sampling	Every 3 years	Yes		
Fire regime	Fire frequency/severity	Fire records	Annually	Yes		
Extent	Area covered	Satellite imagery, ground truthing	Annually	Yes		
Conservation Target 6: Water and catchment values						
Water quality	Physiochemical & biological indicators	Water sampling, lab analysis	Quarterly	No		
Water flow	Flow rates of major streams	Survey	Every 2 years	No		
Wetland area	Wetland sizes	Ground water survey using fixed markers	Annually	No		
Species composition in streams	Presence & abundance of indicator species	Benthic sampling, biomonitoring	Annually	No		
Rainfall	Rainfall amount & months of occurrence	Rain gauges	Monthly	Yes		

MRNFR Key Ecological Research Areas

The main research topics that have been identified and prioritized and also included/reflected in the objectives and targets laid out in the above sections are given below (Box 1).

Box 1: Preliminary priority research identified for Mt Rungwe Nature Reserve
1. Biological survey in & around the reserve, establishing status of rare, endangered & endemic flora and fauna
2. Climate change impacts, projections, adaptation & mitigation measures
Fauna
3. The status of mammal species
4. Abbott's duicker, census, distribution & movement, and monitoring
5. Kipunji census, habituation and monitoring
6. Research into alternative PAC methodologies focused on crop raiding
Vegetation
7. Vegetation mapping, extent and seasonal dynamics
8. Study the phenology and distribution of bamboo in the reserve
9. Human-wildlife interaction, key conflict species and hotspot areas
10. Mitigation methods to human-wildlife conflicts
11. Study on rare, endangered and endemic tree species for targeted planting by local communities
12. Extent & impact of invasive species and mechanisms to suppress <i>P. patula</i> spread into the reserve
13. Carbon stock monitoring
Small Fauna Taxa
14. An assessment of diversity, distribution, and abundance of herps, birds, amphibians
15. An assessment of invertebrate community
16. Assess the impacts of fire on vegetation communities
Water
17. Hydrological study for MRNFR and surrounding, also assessing water volumes flowing from MRNFR and abstraction
18. Evaluate range and extent of water ecosystem services coming from MRNFR
19. River monitoring, channel integrity and water physiochemical and biological parameters

Appendix 6.: Steps for implementation of Smart - Cybertracker in MRNFR

Cybertracker-MART can play a valuable role in MRNFR for patrols and also potentially for ecological monitoring (collecting data along transects for wildlife abundance/density, etc.). The steps for implementation would be broadly as below:

Ensure buy in by TFS	Ensure buy-in by conservator & TFS. Engage management on how SMART-CT can facilitate & strengthen their law enforcement monitoring program. CT-SMART included as part of this management plan.	MRMR, AWF GIS
Identify data to be collected	<ul style="list-style-type: none"> a. Start with existing data collection program (e.g., data sheets, etc.). b. Identify Rungwe gaps/needs. c. Identify compatibility needs with broader Tanzanian protected area authorities or regional SMART-CT programs. Need for future cross-comparisons with other SMART-CT sites in Tanzania & the region. 	AWF GIS, WCS, MRNFR
Establish SMART Data Model	Establish SMART data model (DM) that addresses issues above. The Data Model dictates what & how information is collected in Cybertracker & organized in SMART. E.g., species & threat lists, demographics of species observations, etc.	AWF GIS
Acquire equipment	<ul style="list-style-type: none"> a. Computer with internet at office to download & manage data b. Smart phones—About USD 150-300 each (current market rates). Only need about 1-2 smart phones per patrol. c. Battery packs—about \$35/each. Will enable phone to be charged about 3 times. Extends ability of patrols to stay in field for longer periods. Recommend >1 per smart phone. 	MRNFR, TFS
Train PA staff.	<ul style="list-style-type: none"> a. Introduce all to SMART-CT & Rungwe data model Train rangers in Cybertracker (~2.5 days). b. This need not include ALL rangers. The trained rangers can train others thereafter. Trainer to ranger ratio about 1:15 (less if less experienced trainer). c. Train data managers in SMART & Cybertracker (~4 days). Trainer to ranger ratio about 1:10 (less if less experienced trainer). 	AWF GIS, WCS
Rollout	<ul style="list-style-type: none"> a. Start patrols. b. Share data & inform AWF GIS of issues for backstopping/troubleshooting. 	AWF GIS, WCS
Refresher training	Refresher training-A month or so late to review data collected, ensure queries & reporting are happening, troubleshoot, & ensure overall smooth operation	AWF GIS, WCS, MRNFR

Appendix 6: Planning Process Events & participants

CPT. W = Core Planning Team Workshop

Stake. W = Stakeholders Workshop 1

Stake. W = Stakeholders Workshop 2

Comm. W = Community Workshop

Ecol/Tourism/Oper. = Ecology, Tourism & Operations

Name	Affiliation	Position	Planning Events						
			CPT. W1	Stake. W1	Comm. W	Res Map.	Ecol/Tour/Oper	Stake. W2	
Edgar J Isaya	TFS SHZ	Forest Officer RA	✓	✓	✓	✓	✓	✓	
Eric Mgaya	MRNFR	Forest Officer	✓	✓	✓	✓			
Seleman M Thobias	MRNFR	Assistant Conservator	✓	✓	✓				
Enock Tunzo	MRNFR	Forest Officer	✓	✓	✓	✓		✓	
Peter Chibwaye	Rungwe DC	District Natural Resources Officer	✓	✓	✓			✓	
Joseph Butuyuyu	Regional Secretariat	R. Natural Resource Advisor	✓	✓	✓			✓	
Rabiel Masha	Rungwe	DTO-Rungwe	✓	✓	✓			✓	
Judica Kibona	Mbeya	Regional Game Advisor	✓	✓	✓			✓	
Remus Mkongwe	Kitulo National Park	Park Warden (Tourism)	✓	✓	✓				
Zabron Mtwewe	Kitulo National Park	Outreach Programme Warden	✓	✓	✓			✓	
Sophy Machaga	WCS	Research	✓	✓	✓				
Godlisten Matilya	AWF	Project Manager	✓	✓	✓			✓	
Eric Reson	AWF	Ecologist	✓						
Susan Sekirime	AWF	M & E Programme Officer	✓						
Margaret Njoroge	AWF	Director Project Management	✓						
Laura Shapalis	AWF	Project Management	✓						
Edwin Tambara	AWF	Conservation Planner	✓	✓	✓			✓	
Cosmas Likonoka	AWF	Driver	✓	✓	✓			✓	
Raymond Haule	AWF	Driver	✓	✓	✓			✓	
Anna T. Tenga	Kandete	Ward Executive Officer		✓	✓				
Sam Mwakaparo	Ukukwe	Division Officer		✓	✓				

Appendix 7. Activity plan and Budgets

Actions	Management activities	Y1	Y2	Y3	Y4	Y5	Milestone	5 Year Budget	1 st Year Budget
Invasive species stock determination	Determine <i>P. patula</i> and eucalyptus stock in MRNFR						Stock of invasive species in MRNFR known		
	Determine timber and firewood volume and total value to be produced from invasive species						Timber and fuelwood volume known Total value known		
Acquire equipment for removal of invasives	Acquire equipment for invasive species removal (Table 3 below)						Equipment acquired		
Recruit and train two removal teams	Recruit community members						Community members identified and recruited		
	Constitute removal teams with at least seven people from community and MRNFR staff						Two removal teams		
	Train removal teams on invasive species removal procedures outlined in the plan and handling of equipment						Two removal teams trained		
Determine target areas	Consolidate information on extent of invasive species in the reserve						Map of invasive species, Report		
	Identify areas for priority action						Priority list of areas for action		
	Design a systematic framework for removal of pine. How area is divided, plot sizes, techniques to be used in each plot given the varying topography of the area, time of removal, number of people to be involved and their roles etc.						Framework for removal developed		
Remove invasive species from the reserve	Refine plot procedures and customise for each terrain/habitat in the Reserve						Areas under invasive species reduced & under control		
	Mechanically remove <i>P. patula</i> from the reserve including uprooting of seedlings following plot procedures						Removal process commenced		
	Process cut timber and fuelwood on site						Timber and fuelwood transported to areas where end users can access		

Monitor invasive species in MRNFR	Develop monitoring plan for invasive species								
	Establish monitoring plots were <i>P. patula</i> has been removed							Monitoring plots, reports	
	Clearly establish rehabilitation interventions that should be applied to each area based on monitoring data							Formerly invaded areas rehabilitated	
	Introduce use of remote sensing, GIS and SMART to improve data collection and analysis							Remote sensing maps and SMART analysed data	
	Survey other invasive species in the reserve and develop monitoring plan								
	Continuously weed out <i>P. patula</i> & other opportunistic invasive species from cleared areas							No invasion or new seedlings in cleared areas	
	Promote natural succession in areas that do not require any rehabilitation interventions							Natural succession taking place, invasives weeded out	
	Plant indigenous trees/grass in cleared areas as necessary							Trees/grass planted	
	Map out all sources of <i>P. patula</i> seeds outside the reserve							Maps of pine plantations outside reserve	
	Establish <i>P. patula</i> mode of dispersal into the reserve							Report with recommendations	
Document & map out all sources of <i>P. patula</i> & mode of dispersal	Investigate & implement appropriate methods to suppress future dispersal of <i>P. patula</i> into the reserve							Spread of <i>P. patula</i> suppressed	

Appendix 10: Equipment for invasive species removal in MRNFR

Item	No. Desired	No. in Inventory	No. Needed	Cost per item	Total Cost (Tshs)
Chain saws	1	0	1	2,000,000	2,000,000
Shovels	100	0	100	15000	1,500,000
Hoes	100	0	100	8000	800,000
Axe	50	0	50	10000	500,000
Pangas	100	0	100	5000	500,000
Racks	30	0	30	5000	150,000
Polythene ropes	150	0	150	3500	525,000
Gum boots	50	0	50	25000	1,250,000
Gloves	50	0	50	5000	250,000
Hard Hats	50	0	50	20000	1,000,000
Polythene bags	200	0	200	1500	300,000
Overalls	50	0	50	50000	2,500,000
Total					11,275,000

Appendix 9. Fire fighting equipment for MRNFR

Item	No. Desired	No. in Inventory	No. Needed	Cost per item (Tshs)	Total Cost (Tshs)
Fire fighting shovel	30	0	30	10,000/-	300,000/-
Hoes	50	12	38	8,000/-	304,000/-
Axe	25	0	25	10,000/-	250,000/-
Pangas	50	15	35	5,000/-	175,000/-
Fire racks	40	0	40	5,000/-	200,000/-
Jerry cans for water	25	0	25	15,000/-	375,000/-
Gum boots	50	0	50	15,000/-	750,000/-
Backpack fire fighting pumps	25	0	25	150,000/-	3,750,000/-
Gloves	50	0	50	10,000/-	500,000/-
Binoculars for lookouts	10	0	10	350,000/-	3,500,000/-
Fire fighting uniforms	100	0	100	150,000/-	15,000,000/-
Backpacks	50	0	50	50,000/-	250,000/-
Hard Hats	100	0	100	20,000/-	2,000,000/-
Total					27,354,000/-
Item	No. Desired	No. in Inventory	No. Needed	Cost per item	Total Cost

Appendix 10. Fire fighting equipment for 23 villages

Item	No. Desired @village	No. in Inventory @village	No. Needed @village	No. of villages	Cost per item	Total Cost
Fire fighting shovel	18	0	18	23	10,000/-	4,140,000/-
Hoes	20	0	20	23	8,000/-	3,680,000/-
Axe	5	0	5	23	10,000/-	1,150,000/-
Pangas	18	0	18	23	5,000/-	2,070,000/-
Fire racks	15	0	15	23	5,000/-	1,725,000/-
Jerry cans for water	10	0	10	23	15,000/-	3,450,000/-
Gum boots	20	0	20	23	15,000/-	6,900,000/-
Backpack fire fighting pumps	15	0	15	23	150,000/-	51,750,000/-
Gloves	20	0	20	23	10,000/-	4,600,000/-
Binoculars for lookouts	2	0	2	23	350,000/-	16,100,000/-
Fire fighting uniforms	20	0	20	23	150,000/-	69,000,000/-
Backpacks	18	0	18	23	50,000/-	20,700,000/-
Hard Hats	20	0	20	23	20,000/-	9,200,000/-
Total						194,465,000/-

Appendix 11. Targets and indicators for MRNFR Tourism Development

Output	Target	Activity	Indicator	Supervisor	Budget
Tourism Plan	A detailed tourism plan for MRNFR	Identify a partner, like AWF, that can develop a tourism plan	A detailed MRNFR tourism plan	TFS	
Market Analysis	An analysis that determines who will visit MRNFR & the type of product they desire	Identify a partner, like AWF, that can complete a market analysis	Market Analysis report	TFS	
Revenue Collection	Develop revenue collection process & procedures for MRNFR	Establish a mechanism for revenue collection	Revenue collected & accounted for & supporting MRNFR operations.	TFS	
Improved regulatory frameworks	Having policies that work for communities & investors by June 2018	Collect suggestions to stakeholders that will improve policies	Published suggestions to improve policies	TFS	
MRNFR tourism developments guidelines	Development of tourism guidelines by June 2017 as part of the Plan	Meetings, workshops & seminars to produce guidelines	Tourism guidelines in use	TFS	
Improved Tourists products	By 2020 all tourists products in & around MRNFR Reserve are well developed	Ensuring there are enough staff for MRNFR	Number of staffs of MRRN	TFS	
		Identify all tourists attractions in Rungwe DC & surrounding reserves	Number of tourist destinations in Rungwe	TFS	
		Awareness to local communities	Number of people trained	TFS	
		Designing rest houses & resting posts	Annual number of rest houses designed	Rungwe DC	
		Meetings various stakeholder to improve tourism	Minutes of meetings	TFS	
		Land use planning & gazettement of attractions around Rungwe—protecting the buffer	Number of attractions gazetted	RTC	
		Developing facilities for tourists as per the tourism plan & competitive process	Number of facilities developed	RTC	
		Tourism trails around Rungwe	Number of tourism trails developed in Rungwe	TFS	
Improved Tourists products	By 2020 all tourists products in & around MRNFR Reserve are well developed	Conservation & management of all attractions	Annual list of conservation activities performed in the reserve	RTC	
		Design & develop special areas for cultural tourism, linked to MRNFR & part of broader marketing plan	Number of areas planned	KTC	

Transport infrastructures	By 2020 All entrances to MRNFR are accessed by SUV's	Road maintenance around MRNFR	Number of road & trails maintained	TFS	
Involving local communities in ensuring positive tourism product	Local communities are integrated in the tourism sector by 2025	Roads & paths construction to the attractions	Additional number of attractions that are accessible	DC	
		Organize town & city transport services	Measures to insure comfortable town transport are in place	MRTC	
		Training of the local communities on tourism & product delivery	(1) local community training manual (2) Annual number of people trained (3) annual number of local new organizations	MRTC / TFS	
		Establish guidelines to involve local communities	number of guidelines to involve local communities	MRTC	

Appendix 12. Targets and Indicators for Mbeya Region Tourism Development

Output	Target	Activity	Indicator	Supervisor	Budget
Products	MRNFR become a focal center for diversified, planned & well developed tourists products by 2025	Establish guidelines for products developments	Products guidelines in place by 2018	TFS	
		Land use planning to design establishments	Number of areas planned	MRTC	
		Gazettement & development of products according to guidelines	(1) number of products gazette (2) number of new products in the market	MRTC / TFS	
Price	Work with private sector to ensure reasonable pricing	Ensure products are up to standard defined in the guideline	Annual number of inspections	MRTC / TFS	
Promotion	Develop promotion plan	Regular meeting with service providers to ensure reasonable pricing MRNFR & Mbeya region has promotional plan	Minutes of meetings Plan	MRTC	

Promotion	Business owners utilizes Mbeya Regional Website	Mbeya Regional Website is running & populated with adverts to tourists attractions	Number of companies that uses Mbeya Regional Website	MRTC	
Place	All products in Mbeya Regional are accessible through strong network of infrastructure by 2010	Regular update of the website	Number of new material in the regional website	MRTC	
Process	Handle correctly all customer complaints	Build roads, rails & air strips to ensure products accessibility & distribution	Annual number of roads, railways & airstrips built	MRTC / TFS	
Improve Marketing Mix	All products & service providers utilizes marketing mix	Establish guidelines for handling & reporting customer complaints	(1) guidelines for handling & reporting customer complaints are in use (2) number of complaints properly addressed	MRTC / TFS	
City Cleanliness	Mbeya Region leads in Tanzania in cleanliness by 2020	Train service products & service providers on extended marketing mix	(1) number of people trained on extended marketing mix	MRTC / TFS	
Communication system infrastructure	Ensure accessibility & easy of communities to access communications services	Guidelines to improve cleanliness	(a) Number of guidelines for cleanliness (2) Mbeya region ranks as a clean city	Mbeya CC	
Developing utility infrastructure	Improve utilities distribution in villages around MRNFR	Regional Tourism Committee visiting various providers	Number of minutes of meetings by various communication services providers - by 2018	MRTC	
Air transport	Improved Songwe airport to fit international standard by 2020	Distribute electricity to all villages Villages around MRNFR are supplied with clean & waste water system	number of new areas electrified Number of new areas with water & sewage system	TANESCO Rungwe DC	
Railway Transport	Improved Railway Transport by 2025	Meetings with TAA to improve airport & services at Songwe Meetings with MNRT to improve services at Songwe	(1) Minutes of Meetings with TAA & MNRT by December 2018 (2) List of services improved (3) List of new products	MTRNR	
Special town shuttle	Comfortable & safe town shuttles introduced by 2020	Planning meetings with TAZARA authority Planning meetings with Ministry of Transport	Minutes of meetings (1) Number of meetings done (2) Number of improved products (3) number of improved services	MTRNR MRTC	
		Planning meetings	Minutes of meetings	MRTC	
		Planning meetings	Number of comfortable & safe town shuttles introduced	MRTC	

Taxi services	Mbeya City surpasses all other cities in Tanzania by having well organized taxi services	<p>Laboring all taxi & taxi stations</p> <p>Developing guidelines for taxi drivers in Mbeya town</p> <p>Checking & screening taxi's regularly</p>	All taxi & taxi stations in Mbeya city are labeled by 2020	MRTC	
Meeting the human resource gap in accommodation	At least 75% of service providers in Mbeya city are well trained qualified people by 2025	<p>Establish guidelines for service providers</p> <p>Encourage building of colleges</p> <p>Improve training manual</p>	<p>Service provision guideline in place</p> <p>Number of new colleges introduced</p> <p>Numbers & types of improved training manual</p>	MRTC	
	By 2020 MRNFR has qualified staff that will be able to handle activities & tourism industry	<p>Hire ecologist for Mt Rungwe Nature Reserve</p> <p>Hire Tourism officer for MTRNR</p> <p>Training to current TFS staff on tourist handling</p> <p>Hire a complaint manager</p>	<p>MTRNR has ecologist who manages conservation activities</p> <p>MTRNR has tourism coordinator</p> <p>All staffs of MTRNR handles tourists professionally</p> <p>All tourist complaints are addressed</p>	TFS	
Accommodation infrastructure	Mbeya City & Municipals around Mbeya have hotels that meets international standards that are graded by 2025	Land use planning for all area of private & public areas	Number of areas planned	MRTC	
		Develop guidelines for construction of hotels that will ensure good standard, consistency with the environment & compliance with all plans & regulations	Hotel contraction guidelines in place		
		Grade & upgrade the current hotels	Number of hotels graded		
		Design areas for building hotels with specific preferences	Specific areas for building hotels are		
	By 2020 TFS allocates areas for tourism facility construction in / & adjacent to MRNFR as per the tourism plan & zonation scheme	Ensure that hotel building permits are given timely	Number of new hotel permits		
		Planning hotel sites	List of hotel sites		
		Ensure that building permits are given timely	Number of new facility permits	TFS	