
ENVIRONMENTAL MANAGEMENT PLAN (EMP)



PROPOSED BUSH CONTROL AND VELD MANAGEMENT ON FARM UITHOU No. 366, OMAHEKE REGION

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DOCUMENT INFORMATION

Title	Environmental Management Plan (EMP) to implement bush control activities on Farm Uithou 366
Activity	Land use and Development Activities
Location	Farm Uithou No. 366, Omaheke Region in Central East Namibia
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Executive Summary

Moringa Enviro Consultants was commissioned by the Farm Owner of Farm Uithou 366 in the Omaheke Region to develop an Environmental Management Plan (EMP) to implement bush control activities on the farm. Bush encroachment remains a major agricultural problem in Namibia, covering about 45 million hectares of the country's savannas, and reducing livestock productivity significantly. Consequently, problem bush presents opportunities for farmers to benefit from their commercial utilization.

Farm Uithou No. 366 is a commercial beef production farm that has its productivity compromised by infestation of invader bush. The veld in most areas of the farm is degraded and is overgrown with undesirable bush encroachment species. Along with various other factors, this poses a serious threat to livestock farming. The farm owner reckons the importance of veld improvement through the introduction of bush control activities on the farm. The overall objective is to implement bush control measures on Farm Uithou to be able to maintain a relatively open area for livestock grazing. Such an approach will enable the farm to become productive, profitable and self-sustaining with no need for external subsidisation.

It is expected that some impacts may develop during implementation of bush control activities on the farm which may pose a risk with regards to the environment. The aim of the EMP is to provide guidelines and a framework to direct implementation of the activities on the farm. The identified mitigation measures which, if implemented, could significantly reduce the negative impacts and enhance positive impacts associated with the project.

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LIST OF ACRONYMS

BID	Background Information Document
CRR	Comments and Responses Report
DSR	Draft Scoping Report
EAP	Environmental Assessment Practitioner
ECC	Environmental Clearance Certificate
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMA	Environmental Management Act (Act No. 7 of 2007)
EMP	Environmental Management Plan
FSR	Final Scoping Report
Ha	Hectares
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome
HPV	High Pollution Vulnerable
I&Aps	Interested and Affected Parties
MAP	Mean Annual Precipitation
MET: DEA	Ministry of Environment and Tourism: Directorate of Environmental Affairs
PPP	Public Participation Process
ToR	Terms of Reference

CHAPTER 1

1. INTRODUCTION

Bush encroachment can be defined as thickening of aggressive undesired woody species, resulting in an imbalance of the grass: bush ratio, a decrease in biodiversity, a decrease in carrying capacity and eventual economic losses. The phenomenon of bush encroachment in Namibian savannas is regarded as part of the desertification process since the increase in the extent and density of woody vegetation occurs at the expense of other desirable grasses and forbs, resulting in an alarming reduction in productivity.

It is generally accepted that the decline in the carrying capacity of Namibia's rangelands could be anything from 100% or more. The overriding problem caused by high densities of invader bush is its absolute superiority in competing for water in the upper layers of the soil. It is of utmost importance that the productivity of our natural rangelands is maintained at the highest possible level. Namibia cannot afford to have a biological system where, because of bush encroachment and a veld in poor condition, more than 50% of the annual rainfall is lost. The practical implication is that, even if a farm gets 300mm of rain, it will effectively be reduced to 150mm. The frequency of artificial droughts created in this way cannot be afforded.

The owner (Mr. N. Tjozongoro) of Farm Uithou No. 366 intends to implement bush control and veld management activities on his farm. Farm Uithou No. 366's current productivity is below production potential due to historical farming practices that resulted in veld deterioration. The farm is currently infested by encroacher bush and urgent veld improvement measures are required to stimulate recovery.

1.1. Project Background

The semi-arid natural conditions on Farm Uithou has a potential for a good beef cattle production up to 300 Large Stock Units (LSU). However, the current veld productivity is nowhere near its production potential as it has historically been incorrectly managed. Resulting to this is evident veld degradation, poor veld conditions and low farm productivity. There remain few pockets of better veld conditions on the farm, but urgent action is required to address bush encroachment and improve veld conditions

on Farm Uithou. This is to ensure that the farm become profitable and self-sustaining with no need for subsidisation.

The main species causing the encroachment problem are *Acacia mellifera* (Black thorn), *Dichrostachys cineria* (Sickle bush), *Terminalia sericea* (Silver terminalia). The project objective is to establish appropriate systems for diverse and sustainable land management on Farm Uithou No. 366. The approach that is to be employed is bush thinning with an option of producing charcoal as well as active veld management activities that include erosion control and post thinning monitoring activities. Processing of the problem bush into charcoal will also serve as a source of income and job creation opportunity for the surrounding communities.

Moringa Environmental Consultants was appointed to undertake the requisite Environmental Impact Assessment. The Scoping process sets out to investigate the potential significant positive and negative biophysical and socio-economic impacts associated with project. In addition to reporting on the potential impacts, the Scoping process also serves to provide an opportunity for Interested and Affected Parties (I&APs) to provide comments/concerns and participate in the process.

1.2. Project Motivation (Need and Desirability)

Section 8 (g) of the EMA requires *“a description of the need and desirability of the proposed listed activity and any identified alternatives to the proposed activity”*.

It is estimated that approximately 26 million hectares, located in the north-central and central regions, are covered by encroacher bush (De-bushing Project, 2017). This phenomenon sees indigenous thorny bush and shrub species growing in such abundance that it increasingly suppresses the growth of grass, reduces biodiversity, and impacts the penetration of rainwater required to recharge underground water resources. With reference to ‘the Forestry and Environmental Authorisations Process for Bush Harvesting Projects’ (MAWF & MET, 2017), *“Namibia used to be a land of open savannas. Now, more than half of the country is covered by thorny and impenetrable bush, greatly reducing the productivity of our land. As well as decreasing the carrying capacity of rangelands, encroacher bush also has a catastrophic effect on Namibia’s water resources, drastically decreasing water inflow into underground reserves. For these*

reasons, the Government of Namibia has committed itself to combat bush encroachment so that our rangelands can be restored". Farm Uithou is no exception to this phenomenon, hence the proposal by the farm owner to implement bush control and veld management activities. The map below indicates that approximately 55% of the country is encroached by bush. The study area is located in the district that is most encroached by bush.

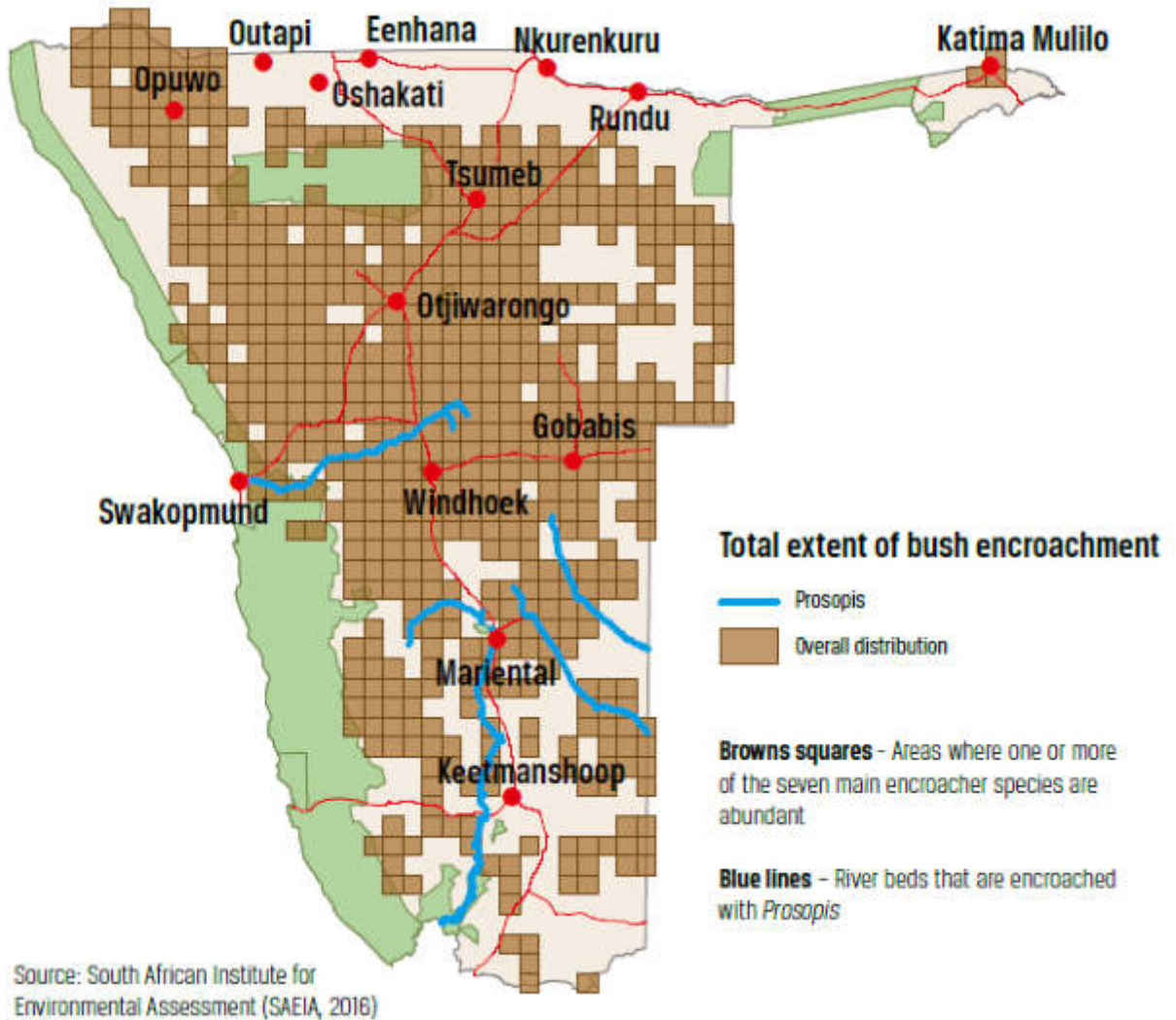


Figure 1: Distribution of dominant encroacher bush in Namibia

The agricultural sector has the potential to increase economic production provided that extensive thinning of encroacher bush is implemented. When encroacher bush has become so dense that grazing resources are seriously reduced, then the bush problem cannot be reversed without active intervention. This is done to restore

carrying capacity and restore the natural recharge potential of groundwater. Bush thinning, or de-bushing is the common approach used by farmers to control bush on their farm land. This practice however requires a concise veld management approach to prevent even a worse problem afterwards.

When managing natural resources there are two issues of concern: productivity and sustainability. Although, by definition, all savannas consist of grass and a woody component, functionally each situation is unique. Not only are there differences in physical determinants, but the biological interactions that are based on these determinants and individual species properties are unique to each spatial and temporal situation. A good knowledge of ecological functioning is required to understand how the problem originated and how to manage for any given objective and situation to achieve high productivity that is sustainable.

Post-thinning management programs will also be needed to keep the area open. If such management is neglected, it could lead to even worse problems. Methods recommended for this purpose are discussed in the text in detail. Where wood harvesting is considered, it is imperative that such operations do not become more important than ecological considerations.

1.3. Introduction to the Environmental Impact Assessment (EIA) Process

The Environmental Impact Assessment (EIA) is a systematic process used to identify and evaluate potentially significant environmental and social consequences of a proposed activity. Based on the nature and extent of the proposed development, an EIA is required in terms of the prevailing Namibian legislation i.e. the Environmental Management Act (No. 7 of 2007) {EMA} and the Environmental Impact Assessment Regulations (Government Notice 30 of 6 February 2012). Overall, an EIA provides advice on how the negative impacts can be avoided or reduced.

In general, the purpose of the EIA is to anticipate and prevent, minimise and/or manage, potential significant negative impacts on development that may:

- Cost too much money to rectify in future,
- Pose risk to lives, livelihood or health or current and future generations,
- Help to seek opportunities to optimise potential benefits of development.

1.4. Environmental Impact Assessment (EIA) Framework

MEFT together with MAWLRF simplified the EIA process for bush harvesting projects, to avoid the costly delays that hinder farmers from undertaking bush thinning activities. This process is divided into three categories. Farm Uithou covers an area that is less than 5000 hectares, therefore authorization for the proposed bush clearance activities is only limited to a concise EMP.

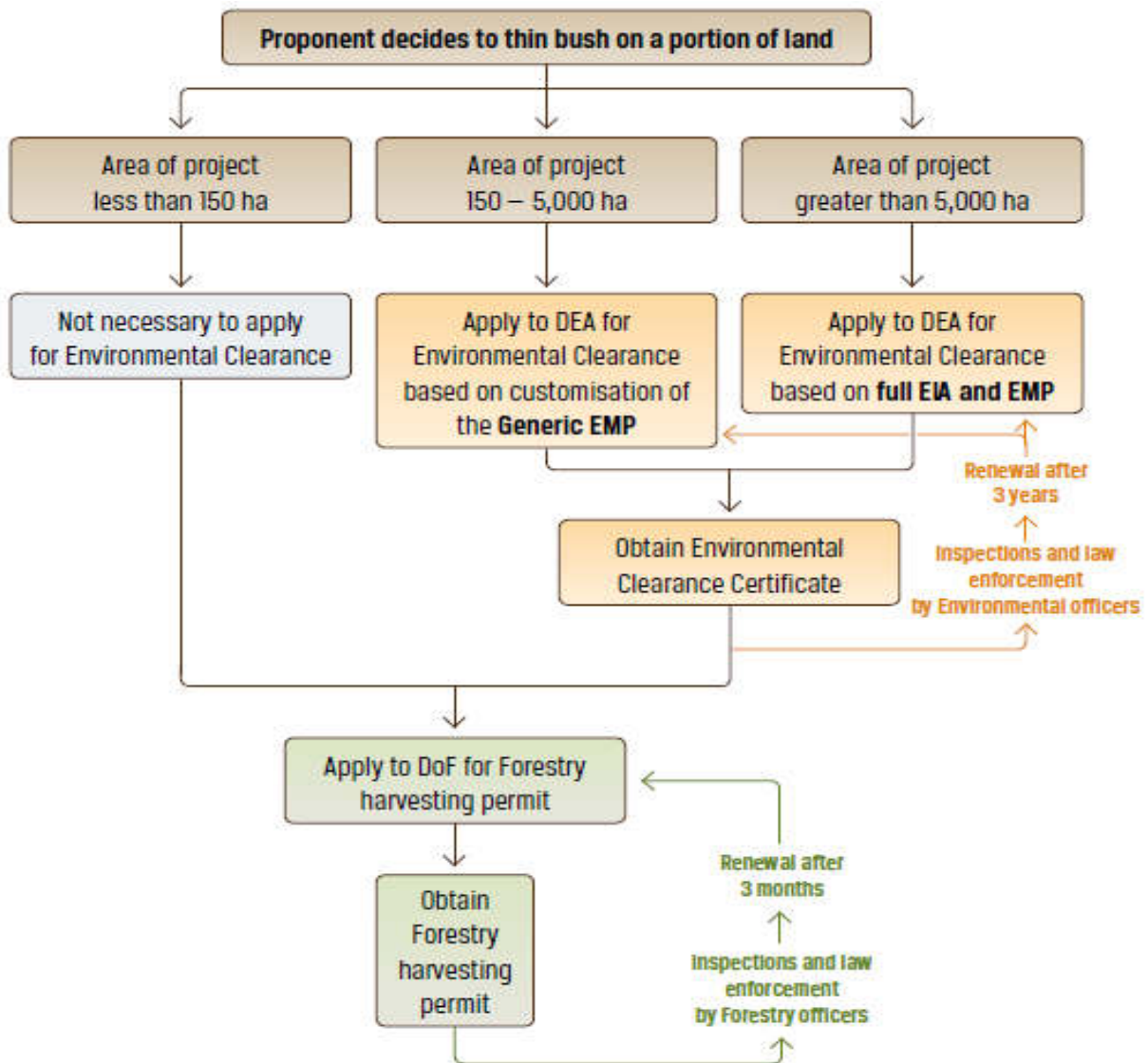


Figure 2: The combined authorisation process by MET & MAWF

The EMP report is reviewed by the Directorate of Forestry and forwarded to the Directorate of Environmental Affairs in MEFT. If the Environmental Commissioner is satisfied with the recommendations from Forestry and that the negative impacts are addressed in the report, an Environmental Clearance Certificate is issued. The certificate requires the project proponent to diligently implement the EMP.

1.5. Objectives of the EMP

- 1) Identify the key environmental issues associated with the project concept of the proposed development.
- 2) Identify mitigation measures to address environmental issues associated with the proposed development.

Part of the EIA is a public participation process (PPP) which provides opportunities for stakeholders and the public at large to engage in the process and to provide comments or express their concerns regarding the proposed project. This public participation process component is fundamental to the impact assessment process and is a key informant to decision-making. Lastly, an EMP, which will address environmental impacts identified through the process of the project, will form an integral part of the EIA Report.

1.6. The EIA Team

Moringa Environmental Consultants was appointed to carry out the Environmental Impact Assessment (EIA) and develop an Environmental Management Plan (EMP), as part of the application for an Environmental Clearance (EC) to enable issuance of the required authorizations.

1.7. Terms of Reference

This environmental analysis focuses on the following:

1. Assessment of service provision infrastructure of roads, water reticulation, sewerage systems and electricity supply;
2. Ecological impacts; and
3. Socio economic impacts

This EMP report is based on both the desktop studies, field observations as well as additional information as provided by the farm owner.

CHAPTER 2

2. PROJECT INFORMATION

2.1. Description of Proposed Activities

Bush encroachment is one of the most serious and conspicuous results or imbalances in savanna ecosystems. Along with various other factors, this poses a serious threat to livestock farming. The overall objective is to implement bush control measures on Farm Uithou to be able to maintain a relatively open area for livestock grazing. The farm is currently stocked with cattle, goats and sheep. The proposed project will consist of the components as described below:

Harvesting and processing activities of the encroacher bush including storage:

The bush harvesting activities including the harvesting equipment, responsible parties and exact locations for harvesting must still be defined. The mechanical removal of bush by means of a bulldozer is a relatively fast way to combat bush encroachment, but it can cause serious problems afterwards if the topsoil is disturbed too much.

When *Acacia melifera* is harvested for charcoal production, the smaller bushes cannot be harvested in an economically viable way and they are usually left in-situ. This method in isolation poses an enormous threat because the more effective competitors for available moisture are removed and the smaller ones will fill the vacuum so created. Browsers such as goats and game can then be introduced to utilise the regrowth; such a practice can increase production and income considerably.

Charcoal processing:

The introduction of income-generating activities such as charcoal production turns the negative results of bush fighting into an economically viable practice for farmers. A core analysis suggests that by-products from bush such as charcoal forms part of an economically sustainable process to combat unwanted bush in Namibia. Furthermore, bush control helps rehabilitate degraded ecosystems.

Indication of the impact of bush thickening on Farm Uithou





The problem bush on the farm and absence of grass.



Bush will be cut and piled up as shown above for charcoal processing



Some of the available manpower on the farm



The Kilns that are to be used for burning the chopped bush for charcoal production

Transportation and logistics of the final product:

The market for charcoal is established both at national and international level. The farmer however needs to establish a network to access such markets, thus the need for a logistics system for the products.

Veld management activities:

It is of utmost importance that the productivity of a farm is maintained at the highest possible standard. Farmers cannot afford to operate a farm system where, because of bush encroachment and poor veld conditions, more than 50% of the annual rainfall is lost. The practical implication is that, even if a farm receives 300 mm of rain, this can effectively be reduced to 150 mm due to bush encroachment impacts.

Walter's Two Layer Model states that the roots of trees are at the surface as well as the deeper layers of the soil, while the roots of grasses only occur in the top layer. If the grass layer is overutilized, it loses its competitive advantage and can no longer utilise water and nutrients effectively. This in turn results in a higher infiltration rate of water and nutrients into the subsoil. Such a scenario will benefit trees and bushes and allow them to become dominant. If a vigorous grass layer is present the opposite effect will be achieved.

Post thinning management of the veld is therefore imperative for an area that has undergone bush control. The absence of post thinning activities would simply mean that the cleared bush is able to re-establish aggressively. Case studies on many commercial farms have revealed that carrying capacities can double and even triple once bush control has been carried out. Post thinning should be considerate of the ecological considerations to maintain a balanced natural state. Continuous monitoring of the veld shall be maintained to detect early re-establishment of problem bush.

Options include an occasional controlled burn, removal of bush by hand, or the introduction of goats to browse the regenerating bush. The application of controlled veld fires could be an alternative or supplementary aftercare technique to regain grazing areas. Manual stumping or removal of re-establishing bush with either a saw or an axe is a moderately slow and labour-intensive method which is the most

common techniques used by farmers. Another type of aftercare is the introduction of goats or game to browse the regenerating bush.

The objective of rotational grazing is to ensure that paddocks receive sufficient rest during the rainy season so that the preferable grass species are allowed to grow, occupy the upper layers of the soil with roots, and become competitive for soil moisture.



Figure 3: Planning a bush control programme

2.2. Project Location

Farm Uithou 366 is located between Gobabis town and Onderaombamba settlement in Omaheke Region. It is situated along D1734 which is accessible via D1716 route and turn off from C22 Gobabis to Aminius road . See locality maps on figure 1 and 2 respectively.

2.3. Biomass evaluation

The study area consists of Arenosols interior sands, heavier and more fertile topsoil that is deposited via wind & water erosion in the Kalahari sand veld. Interior sands are fertile with a high plant nutrient content. The soils provide the best and most prolific grazing, where the grass is most palatable, green early and stays green much longer. It is for this reason that most parts of the farm are degraded due to overgrazing.

Farm Uithou is located within the acia Camelthorn savanna and shrub savanna. This type of vegetation is dominant in central and east of Namibia which in pristine conditions, is more open with grassveld interspersed with trees and large thorn trees. This region has been extensively modified over the last century through human activities and climatic fluctuations. Furthermore, due to poor grazing management, this vegetation zone has become degraded and is currently largely dominated by invader thornbush (mainly *Acacia mellifera* & *Acacia Nebrowni*). Other invader thorn trees are *Acacia hebeclada*, *Acacia reficiens*, *Acacia erubescens*, *Acacia tortilis*, *Acacia fleckii* as well as *Boscia albitrunca*, *Ziziphus mucronata* and *Philenoptera nelsii* are all common in the area.

Grass cover on the farm varies but most pioneer species are *Aristida* and *Eragrostis* while subclimax grass is composed of *Schmidtia pappophroides* and *Stipagrostis uniplumis*. Less denuded areas are dominated by perennial climax grass mainly *Anthephora pubescens*, *Brachiaria nigropedata*, *Digitaria eriantha* and *Urochloa oligotricha*.

Inspection on Farm Uithou concluded that the carrying capacity of the farm is not at its optimum as grazing quality is compromised due to bush encroachment. The grass sward on the farm is degraded, although there is potential of recovery should veld management activities be implemented. Typical signs of degradation on Farm Uithou are indicated by the following;

- Disappearance of climax grass species and being replaced by sub-climax species that are tough, less palatable and resistant to grazing. They are usually the last grass to be eaten by cattle after all palatable matter has been grazed. Such species thrive in conditions where their ecological competitors become weakened by selective over-grazing and feeding habits of cattle which subsequently increased their abundance.
- Presence of poisonous plants (*Geigeria ornativa*), a typical pioneer species of degraded sandy areas. It presents itself in areas with weakened grass sward

and is most common during spring. This plant can poison livestock if eaten in large quantities.

- Prevalence of a variety of *Acacia* species, primarily *Acacia mellifera* due to reduced competition by the dominant sub-climax grass and the effective exclusion of fires over the last couple of decades. There is an active establishment of woody seedlings, indicating that the next wave of bush encroachment is building up.
- Although some smaller pans & channels veld is also encroached by bush, it is much less dense than the deep sand areas. In patches, the vleis & channels banks are still covered in valuable riverine forest, consisting predominantly of *Acacia reficiens*.

2.4. Hydrology

Farm Uithou receives summer rainfall and is situated in the rainfall zone of 300 to 400 mm per annum. Highest average rainfall is recorded over January, February and March.

Average annual evaporation rates exceed 2 800 mm per annum, indicating that an open body of water would lose about 1.5 mm more water to evaporation than it receives by rainfall. The high evaporation rate emphasises the importance of maintaining soil surface cover to prevent desiccation and erosion.

The farm is situated in an area with moderate productive aquifers in which groundwater flows in a north-westerly direction. This is due to the farm's proximity to the Pans & rivers which provides good underground sources. Information from farmers journals revealed that due to significant bush encroachment, the level of groundwater in boreholes is much lower. Bush control activities are therefore not only beneficial to improved grazing, but it also improves groundwater yield.

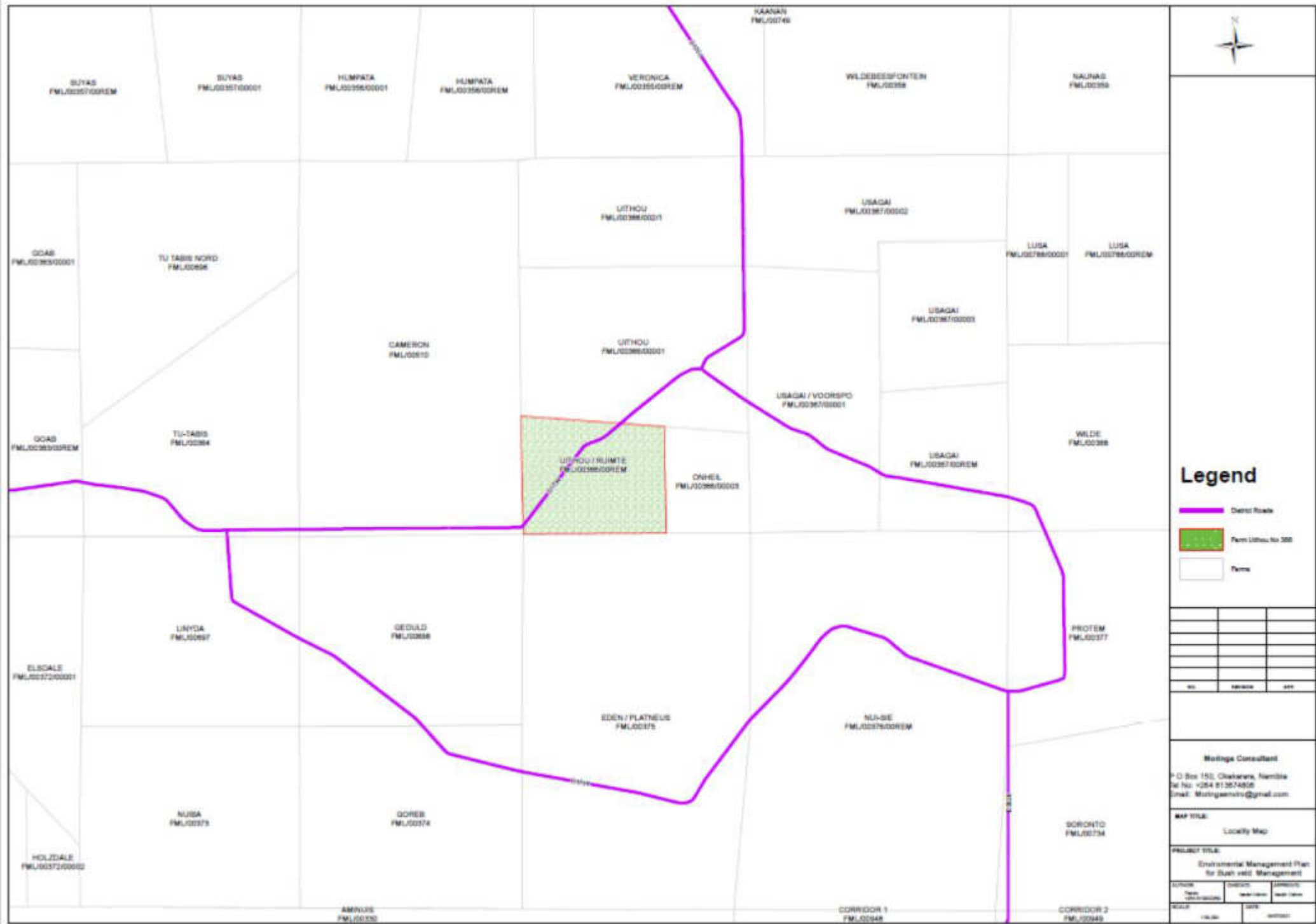
2.5. Socio-Economic Profile

Manual cutting by means of axes and saws as an initial way of combating bush as well as an aftercare measure is very labour-intensive and seems to be one of the more common ways among farmers to get rid of bush. A programme like this will not only result in higher land productivity but will also have socio-economic

benefits such as combating crime, generating income, and addressing the problem of food security.

Additionally, producing charcoal has significant potential to promote diversified income sources for farmers. There is also an opportunity to develop state-of the art bush harvesting and charcoal processing services.

Figure 4: Directions leading to Farm Uithou no 366



Legend

-  District Roads
-  Perm Uithou No 300
-  Perm

NO	REVISION	DATE

Mortgage Consultant
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MAP TITLE:
 Locality Map

PROJECT TITLE:
 Environmental Management Plan
 for Bushveld Management

DATE	BY	DATE	BY

Figure 5: Locality Map of Farm Uithou as demarcated by a yellow place marker



Legend

- Dirt Road
- Farm (Title No. 300)
- Farm

Madaga Consultant
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MAP TITLE:
Locality Map

PROJECT TITLE:
**Environmental Management Plan
 for Bush veld Management**

DATE	SCALE	PROJECT
14/03/2014	1:5000	UPPOURUNTE

2.6. ALTERNATIVES

According to the EMA & EIA Regulations alternatives must be considered during the EIA process. These Regulations state that “*alternatives, in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity.*”

No-go Alternative

The implication of the ‘No-go’ alternative on the socio-economic environment of the study area will simply be that none of the positive and or negative impacts associated with the proposed bush control activities will be realised. Similarly, the potential contributions predicted will also be negated.

The implication of the ‘No-go’ alternative on the socio-economic environment of Farm Uithou will simply mean that the status quo will prevail with the lack of grazing resources due to the impact of bush encroachment. Similarly, the potential economical benefits that can be reaped from the production of charcoal from the cleared problem bush will also be negated. As the ‘No-go’ alternative is the baseline against which potential impacts are measured as such, the *status quo* shall prevail.

CHAPTER 3

3. Legal Framework

All wood harvesting activities in an area greater than 150 hectares per annum must comply with the Environmental Management Act. This act is administered by the Environmental Commissioner in the Department of Environmental Affairs (DEA) in the Ministry of Environment and Tourism (MET).

3.1. Relevant Legislation Applicable

As the organ of state responsible for management and protection of its natural resources, the MET: DEA is committed to pursuing the principles of environmental management. Through the implementation of mitigation measures as set out in this Scoping Report and the accompanying Environmental Management Plan (EMP), the holder of the ECC shall be advocating for sound environmental management as set out in the Constitution.

The overriding theme in Namibia's policy framework is sustainable use of rangelands and combating bush encroachment for the restoration and recovery of livestock productivity. Sustainable develop encourages an integrated approach to development activities. An EIA process, although regulated by MET, it is in alignment with a host of legislation that are relevant to a specific project. The Ministry of Environment and Tourism in collaboration with the Ministry of Agriculture, Water and Forestry developed guidelines to be followed in obtaining authorisation to implement bush thinning projects. The two ministries have legal requirements that need to be complied with simultaneously for the permits to be issued.

Table 1: List of triggered activities to be addressed in obtaining an ECC as per MET

Activity	Description of Activity	Activity Triggers
Activity 4: Forestry Activities	The clearance of forest areas, deforestation, afforestation, timber harvesting or any other	The project will entail clearance of invader bush, hence the need to obtain a clearance certificate.

	related activity that requires authorisation in terms of the Forest Act, 2001 (Act No. 12 of 2001)	
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Table 2: Legal requirements to obtain a forestry permit as per MAWF

Legal instrument	Activity to be undertaken
Forest Act (2001) and Regulations (2015)	Administered the Directorate of Forestry, the act governs activities which takes place classified forests and non-classified forest areas.
Harvesting Permit	A Harvesting Permit is required for any tree cutting and/ or harvesting of wood in an area greater than 15 hectares per annum. Inspection of an area to harvested is undertaken prior to permit issuance, and the permit is renewed every three months.
Transport Permit	A Transport Permit is required to convey any wood or wood products (e.g. droppers, planks, charcoal, and firewood). It is obtainable from any Forestry Office and is valid for 7 days.
Export Permit	An Export Permit is required to send any wood or wood products outside Namibia. It is obtainable from any Forestry Office and is valid for 7 days.
Marketing Permit	A Marketing permit is required to enable the producer to sell his/her products to any other party. The permit is valid for 3 months in commercial areas while in communal areas the permit is valid for 1 month only.

3.2. Environmental Management Plan (EMP) Requirements

An EMP aims to meet the requirements as legislated by the EMA Regulations, in Section 8: (j) and should include information on any proposed management, mitigation, protection or remedial measures to be undertaken. **The EMP is attached as Annexure C** of this document that should be used as a guideline throughout the

life-cycle of the project, and it may be amended as new information is made available.

CHAPTER 4

4. Impact Assessment Methodology

4.1. Assessment of Impact Significance

The significance of an impact is determined by evaluating the temporal and spatial scales and magnitude of the project and the specific activities associated with the project. The assessment of the environmental impacts should strive to be objective and impartial at all times. However, environmental assessment processes can be exposed to subjectivity inherent in attempting to measure significance.

4.2. Impact Assessment Criteria

For each impact, the **EXTENT** (spatial scale), **MAGNITUDE** and **DURATION** (time scale) would be described. These criteria would be used to ascertain the **SIGNIFICANCE** of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. The mitigation described in the Scoping Report would represent the full range of plausible and pragmatic measures.

Table 4-1: Assessment criteria for the evaluation of impacts

CRITERIA	CATEGORY	DESCRIPTION
Extent or spatial influence of impact	National	Beyond a 20km radius of the site
	Regional	Within a 20 km radius of the site
	Local	Within a 2 km radius of the centre of the site
	Site specific	On site or within the boundaries of the property

Magnitude of impact (at the indicated spatial scale)	High	Natural and/ or social functions and/ or processes are <i>severely</i> altered
	Medium	Natural and/ or social functions and/ or processes are <i>notably</i> altered
	Low	Natural and/ or social functions and/ or processes are <i>slightly</i> altered
	Very Low	Natural and/ or social functions and/ or processes are <i>negligibly</i> altered
	Zero	Natural and/ or social functions and/ or processes remain <i>unaltered</i>
Duration of impact	Zero	Zero time
	Short Term	Up to 18 months
	Medium Term	0-5 years (after operation)
	Long Term	5- 10 years (after operation)
	Permanent	More than 10 years (after operation)
Probability	Definite	Estimated greater than 95 % chance of the impact occurring.
	Very likely	Estimated 50 to 95% chance of the impact occurring
	Fairly likely	Estimated 5 to 50 % chance of the impact occurring.
	Unlikely	Estimated less than 5 % chance of the impact occurring.
	Zero	Definitely no chance of occurrence
Confidence	Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
	Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
	Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.
Reversibility	Irreversible	The activity will lead to an impact that is permanent.
	Reversible	The impact is reversible, within a period of 10 years.

4.3. Assessment of Cumulative Impacts

The Environmental Assessment Policy in Namibia requires that, cumulative environmental impacts should be considered in all environmental assessment processes. However, EIAs have traditionally failed to account for cumulative impacts, largely because of the following considerations:

- Cumulative effects may be local, regional or global in scale and dealing with such impacts requires coordinated institutional arrangements.
- Environmental assessments are typically carried out on specific developments, whereas cumulative impacts result from broader biophysical, social and economic considerations, which may not always be practical to address at the project level.

4.4. Mitigation Measures

For each impact assessed, mitigation measures have been proposed to reduce and/ or avoid negative impacts and enhance positive impacts. These mitigation measures are also incorporated into the EMP to ensure that they are implemented during the planning, construction and operational phases. The EMP (Annexure C) forms part of the Scoping Report, as such its implementation would become a binding requirement should this project be authorised.

CHAPTER 5

5. Potential Impacts and Mitigation Measures

The implementation of the proposed bush control and veld management activities and its associated infrastructure could potentially impact on the bio-physical environment, because of habitat destruction and disruption. This Environmental Management Plan has therefore been developed to guide and monitor the potential impacts resulting from the proposed activities.

5.1. Main Principles of Bush Control

- Concentrate bush control on species and individuals that are obviously part of encroacher growth and leave the others alone.
- Leave a mix of trees and bushes on the land: The veld should have a variety of tree species (including some of the encroacher species) of different sizes. They should be spaced in a way that there are some open patches and some dense patches. This provides a variety of habitats for animals and imitates the heterogeneity (patchiness) of natural landscapes.
- Thin bush in a phased approach: Avoid to “shock” the land by an abrupt change from dense bush to open veld.
- Protected plants should not be harvested. Exceptions can be made under supervision of Forestry officials in cases of high densities.
- If arboricides are being used, foliar (leaf spray) and stem-applied arboricides are recommended. Pellets should not be used, as they tend to get washed along the surface by rain and end up in non-target areas.
- Dry river beds tend to carry more and larger trees. Forestry regulations state that trees should not be thinned within 100 metres of a river course. Thinning is required in densely encroached river margins, but one should leave a higher density of trees than on the adjacent habitat. It is especially important to leave large trees along a river course. The exception to this is *Prosopis*, an exotic species that invades river beds, and should be eradicated completely.
- Training of the work force is necessary before harvesting starts. Workers need to know which trees to target and which to avoid. Work teams need to be managed so that any excessive harvesting or killing of the wrong species is noticed and corrected.

5.2. Post thinning aftercare

Nature’s response to radical bush control is often to compensate by growing more woody replacements. This is seen as re-encroachment. If encroacher bush is thinned less radically, larger individuals suppress smaller ones and less aftercare is required. The time it takes for bush-controlled land to require follow-up is highly variable. It depends on the bush control method used and natural circumstances such as rainfall and soil fertility. The land manager has to

monitor the growth of coppicing bushes and the emergence of woody seedlings to decide when aftercare is required. In bush-controlled rangeland, it is easy to see when aftercare must be applied.

It is often small, immature woody plants (mainly low coppice growth and saplings) that must be removed to return the rangeland to the bush density achieved after first control. In the interest of the environment, it would be best to practice selective aftercare with non-chemical methods that control these small woody plants so that the footprint of the land manager can be minimised. Small bush and saplings are easily removed by chopping them off about 10 cm below ground level, thus killing the whole plant. This aftercare method is quick and easy even on hard ground because the targeted woody plants are small.

1. Know the resource base: Know the perennial species of grass that naturally dominate in your area and ensure their continued vigour and abundance. This also requires knowledge of soil, nutrient hotspots and general rangeland ecology. Know the bush, its density and impact. Use indicator species to realise if rangeland is degrading, stable or improving.
2. Manage grasses for effective recovery and rest: This is the most important principle of adaptive grazing management. Perennial and preferred species of grass are usually grazed first and most intensively. They need to recover from previous grazing completely until they have set seed before being grazed again.
3. Manage for effective utilisation of grasses and shrubs: Grazing should stimulate grass production and not inhibit it. Grazing domestic livestock like cattle and some sheep breeds do not browse much. The browse component of a savanna rangeland is under-utilised while the herbaceous (grassy) component usually is over-utilised. Browser-based livestock enterprises are encouraged.
4. Enhance soil condition: For grasses to flourish, the top layer of soil has to be in good condition, allowing rainwater to infiltrate easily (proper water cycle) and binding plant nutrients so they do not leach out (proper mineral cycle). This is achieved mainly by keeping the soil well covered with living plants or mulched with dead plant litter to prevent soil erosion by wind or water.
5. Plan for droughts: By timeous reduction of the livestock stocking rate in synchrony with the advancing fodder deficit. Grow more fodder to compile a fodder bank to be used during a drought.
6. Monitor the resource base: By keeping a variety of records of the veld that inform rangeland management. The establishment of woody seedlings is an important indicator of the transition to a bushy state, requiring management intervention.
7. Plan land use infrastructure: To make sustainable rangeland management easier, e.g. by providing enough camps per herd of livestock to facilitate effective rotational grazing management that allows perennial indicator grasses to recover from grazing.

A diverse landscape

The treated landscape should not appear homogenous. After bush control, there should be thicker patches of bush and thinner. A mosaic of landscapes favours higher biodiversity that is more resilient to negative environmental impacts like climate change. There should be a mix of

tree and bush species and an adequate number of large trees that suppress woody saplings by competitive suppression. Leave the occasional bush clump of 1 to 4 hectares intact for the sake of providing shelter for those animals who seek it in dense bush clumps. Minimal soil disturbance

Bush control on steep slopes should be done extremely cautiously to avoid soil erosion. Where grass growth was stunted by dense bush, a “grass explosion” often occurs after bush control. The level at which grass production stabilises depends on the number of bush left intact, as woody plants improve soil fertility. It also depends on the abundance and vigour of perennial grasses in the post-bush grass sward: the more perennial grasses managed to establish in bush-controlled veld, the more stable its long-term grass yield and nutritive value. If perennial grass is establishing poorly, it is advisable to re-introduce seeds of grass species such as *Antheophora pubescens* and *Cenchrus ciliaris*.

5.3. Biodiversity and soil

Structural diversity of a habitat determines, in part, the availability of niches and the number of species that it can support. A Savanna habitat supports both grazers and browsers, therefore in optimum savanna, all size classes of trees should be represented, and some patches of dense bush should remain, to increase the structural diversity both vertically (different sized trees) and horizontally (open grassy areas and patches of dense bushes). The carrying capacity of a savanna area can be optimized where there is a mixture of trees, bush and grass.

The following guidelines should be applied to ensure effective bush control approaches:

- The ‘tree-equivalents’ (TEs) per hectare that remain after harvesting should be roughly 1.5 to 2 times the average annual rainfall. (A ‘tree-equivalent’ is a 1.5m single-stemmed tree, so a 3m tall tree would equal 2 tree-equivalents.) For example, in an area where average annual rainfall is 400 mm, there should be 600 - 800 tree-equivalents per hectare. In areas of sandy soils, such as the Kalahari sandveld, the tree-equivalents should be higher, at about three times the average annual rainfall. This ‘rule of thumb’ is applicable in the areas where annual average rainfall is 150 - 500 mm, and covers most of the areas in Namibia where there is severe bush encroachment.
- In areas with average rainfall greater than 450 mm, which includes most of Namibia’s woodland habitat, the density should be not be less than 3 times the average annual rainfall.
- Evergreen trees, protected species and riverine species should not be harvested.
- It is illegal to harvest trees in river beds and watercourses, and within 100 m of them. Riverine vegetation forms important habitat for fauna, and the roots stabilize the soil which helps to reduce erosion.
- Twigs, leaves and fines should be left where trees are felled. They create mulch which improves soil moisture, they provide soil organic matter, and increase soil nutrient levels.
- Relatively larger dead trees should not be harvested. They provide cavities for hole-nesting birds, and perches for raptors.

- Maintain spatial heterogeneity i.e. leave patches of dense bush, and retain a variety of size classes.

The overall objective for implementing bush control activities on a farm is to improve the quality of pasture resources without having to clear off all trees. Bush control should therefore not try to create a homogeneous environment but rather make it patchy, to create a mosaic effect.

5.4. Socio-economic benefits of bush control activities

Farm Uithou is a livestock farming area which is considered as suitable for the proposed activities. The assessment addresses the socio-economic impacts that could be caused by the proposed development and the findings as well as recommendations are provided in Table 6-1.

Table 5-1: Sensitivities to implementing bush control activities

Opportunity	DESCRIPTION	POTENTIAL IMPACT
Employment	Unemployment is a general concern for all areas in Namibia.	Positive: Creation of jobs. The intention is to make use of local recruits from the surrounding farming and communal areas of Omaheke.
Charcoal	Production of a valuable product from bush control activities.	Positive: income generated from sales of charcoal produced
Carrying capacity	Improved grazing resources resulting from increased areas for grass establishment	Positive: Provision of grazing resources that contributes to carrying capacity of the farm
Quality livestock production	The improved grazing resources results in increased livestock productivity	Positive: production of quality livestock enables the farmer to reap economical benefits from sales of such livestock.
Clearing wrong trees	High risk that non-encroacher species are harvested due to limited guidance during harvesting	Negative: clearing of non-problem trees which most are protected species. Worst case is when all trees are cleared with no attention given to sparing particular trees. This contributes to increased soil erosion and further veld degradation. Mitigation: Train all farm workers on target trees to be cleared Monitor and inspect harvesting activities.

		Identify and define sensitive areas in the harvesting area, and exclude them from the harvesting plan
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Encroacher bush is a threat to rangeland and utmost care must be taken when implementing a bush control programme. While it is obvious that bush encroachment is a problem that needs to be controlled, it needs to be recognised that bush control itself can carry negative impacts. Obviously, the types and severity of the impacts depend on how the bush control activities are carried out: an operation that clears away all surface vegetation using bulldozers will have very different impacts from manual selective thinning. The assessment presented here confirms that implementation of mitigation measures is expected to reduce the negative impacts to acceptable levels, while positive impacts will on average be significantly enhanced to maximize benefits for the farmer. It must be noted that encroacher bush also does play an important role in the biodiversity of the farm, thus bush should not be eradicated totally.

Table 2: Management activities to be implemented when undertaking bush control activities on Farm Uithou

Aspect	Management Objective	Management Action	Indicator	Party responsible
Communication with staff	To ensure effective and formal communication throughout the project lifespan.	All employees must be fully aware of the environmental management requirements detailed in this EMP. The Farm Owner must be informed immediately should environmental issues arise.	Records of correspondence No avoidable environmental impacts occurring due to miscommunication	All
		A copy of the EMP and ECC must be readily available for ease of reference to all requirements.		
Staff induction training and code of conduct	To ensure that staff are familiar with the management requirements for the bush control activities and conform to the prescribed EIA and Forestry Regulations	All workers must undergo induction training. The induction training must cover environmental awareness, protection of flora and fauna	Signed induction attendance register	Farm Owner
		Adopt a disciplinary system to address misdemeanours of individual staff, such as littering and illegal collection or killing of wild animals.	A reduction in the number of fines issued daily	Farm Owner
Vehicle Emissions	Reduce unnecessary greenhouse gas (GHG) emissions from poorly maintained or malfunctioning equipment	All vehicles and equipment shall be kept in good working order and serviced as required. Ensure that vehicles do not leak oil	Physical verification and routine monitoring, record of non-compliance	Farm Owner
Protection of ecological resources	Take precautions to safeguard the ecological environment	Prevent and discourage the setting of snares (poaching), indiscriminate killing of perceived dangerous species (e.g. snakes, etc.)	Physical verification and routine monitoring	Farm Owner
		Avoid damage or removal of protected tree species i.e. camel thorn trees [Forestry Act No. 12 of 2001) Adhere to all forestry legal diameter limits (25mm-180mm) Do not harvest edible bush e.g. <i>Catophractes alexandri</i> and <i>Grewia</i> species. Twigs and small branches must be left in the veld to act as mulch on denuded soils and prevent soil erosion.		

Aspect	Management Objective	Management Action	Indicator	Party responsible
Monitoring	To evaluate the effectiveness of bush control measures and implement aftercare activities	Field patrols to physically monitor regrowth and grass establishment after bush harvesting	Physical verification	Farm Owner

CHAPTER 6

6.1. PUBLIC PARTICIPATION PROCESS (PPP)

Public Participation Process aims to ensure that all persons especially neighbouring farm owners that may have a vested interest in the proposed bush control activities are informed of the project and can register their views or concerns. Consultation with the public forms an integral component of EIA as it provides Interested and or Affected Parties (I&APs) an opportunity to raise their concerns in respect to the proposed development. This investigation involves I & APs such as neighbouring farmers, business owners in the area, national, regional and local authorities, environmental groups, civic associations, and the public. I&APs identify their issues and concerns about the proposed activity which they feel should be addressed in the implementation process. The environmental management plan in return identifies possible mitigation measures that can be implemented to address the identified issues.

6.2. *The PPP Process undertaken*

The PPP for the project included hosting consultative meetings with the immediate neighbouring farm owners to inform them of the proposed project. As such, a meeting was organised by Moringa Enviro Consultants to introduce the proposed intended project and present the proposed project Background information to the affected community offer them an opportunity to provide their comments and or concerns. The PPP undertaken is summarised in Table 7 below.

Table 7-1: Summary of the PPP undertaken

Task	Details	Date
I&AP notification (relevant authorities and I&APs)		
I&AP identification	An I&AP list was developed for the project which is composed of neighboring farmers	December 2020 – January 2021
Background Information Document	A Background Information Document as well as a Comments Form were developed and distributed to the I&APs.	2020 December
I&AP consultations	Series of One on One meetings taken place at several neighbors farms during the period of to present were organized with neighboring farm owners inform them of the proposed charcoal project.	December 2020 – January - 2021

Addressing comments received	Comments as documented in the Comments Forms were obtained throughout the neighbors participation process.	December 2020 - January 2021
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To comply with the EMA (2007 and the EIA regulations of 2012, MEFT's decision on whether to issue the Environmental Clearance Certificate (ECC) or not, will be communicated to all registered I&APs.

CHAPTER 7

7. Conclusion and Recommendations

7.1 Conclusion

Minimal impacts have been identified for the proposed project as discussed in the preceding sections. The information available at this stage and the environmental assessment undertaken is regarded as acceptable to enable decision-making. The EAPs believe that the information contained within this EMP is adequate to inform MEFT: DEA and the Directorate of Forestry to be able to determine the environmental acceptability of the proposed activities.

No bush-clearing program will be successful in the long run if sound rangeland management practices are not applied. The latter should be a pre-requisite in any aftercare programs. Considering that the management of cleared areas requires constant attention, it is recommended that not more than 10% of the farm area be cleared in one bush thinning event.

7.2 Recommendations

The farm owner has to obtain a number of permits from the Directorate of Forestry before commencing with the bush control activities and production of charcoal. In theory, MEFT is obliged to conduct regular inspections on charcoal-producing commercial farms to avoid deforestation. However, the lack of capacity and human resources within the Ministry could hamper these regular inspections. There is a shortage of staff and vehicles, so inspections usually occur at random, with a focus on new producers. It is therefore recommended that the farm owner take a proactive role and maintain a continuous monitoring system on the farm.

The identified mitigation measures which, if implemented, could significantly reduce the negative impacts and enhance positive impacts associated with the project. Where appropriate, the mitigation measures, and any others, identified by MEFT: DEA could be enforced as Conditions of Approval in the ECC, should MEFT:DEA approve the project.

CHAPTER 8

8 References

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