MINISTRY OF WATER AND ENVIRONMENT

FOREST SECTOR SUPPORT DEPARTMENT (FSSD)

PRODUCTION, TRADE, PROCESSING, MONITORING AND CONTROL OF THE EAST AFRICAN SANDALWOOD, *OSYRIS LANCEOLATA* IN UGANDA

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List of Acronyms

ACEMD	African Centre for Energy and Mineral Development
CITES	Convention on International Trade in Endangered Species
CTSP	CITES Tree Species Programme
CoP	Conference of Parties
CSOs	Civil Society Organizations
DEO	District Environment Officer
DFO	District Forestry Officer
DFS	District Forestry Services
DLGs	District Local Governments
DNRO	District Natural Resources Office
DPC	District Police Commandant
DPP	Director of Public Prosecutions
EAC	East African Community
EIA	Environmental Impact Assessment
ESO	External Security Organization
FGD	Focus Group Discussion
FIEFOC	Farm Income Enhancement and Forestry Conservation Programme
FSSD	Forestry Sector Support Department
GIZ	German Agency for International Cooperation
KADF	Karamoja Development Forum
MEACA	Ministry of East African Affairs
MoTIC	Ministry of Trade, Industry and Cooperatives
MTWA	Ministry of Tourism, Wildlife and Antiquities
MWE	Ministry of Water and Environment
NaFORRI	National Forestry Resources Research Institute
NDF	Non-Detrimental Finding
NEMA	National Environment Management Authority
NFA	National Forestry Authority
NGOs	Non-Governmental Organizations
NUSAF	The Northern Uganda Social Action Fund
REDD+	Reducing Emissions from Deforestation and forest Degradation
SBAL	Sky Beam Africa Limited
UPDF	Uganda People's Defence Force
URA	Uganda Revenue Authority
USA	United States of America
UWA	Uganda Wildlife Authority
UWIL	Uganda Wood Impex Limited

Executive Summary

In Uganda, the East African Sandalwood, *Osyris lanceolata*, has been majorly recorded in the Karamoja region. In this area, Sandalwood has for over time been mainly used for herbal, firewood and construction purposes. Following the ban on harvesting and trade of Sandalwood in Kenya in 2007, commercial trade of Sandalwood began in Uganda around 2011, with the establishment of Sky Beam Africa Limited in Tororo district. Sandalwood and its products were majorly exported to European and Asian countries for the manufacture of perfume, pharmaceuticals, and cosmetics among others. This period was marked with unsustainable harvesting and unregulated trade in Sandalwood, and as a result, the population of *O. lanceolata* decreased greatly. The trade in raw Sandalwood was banned in Uganda in 2016 following the listing of the species in Appendix II of the CITES and irregularities associated with smuggling the raw sandalwood from neighbouring countries. Despite the ban, cases of illegal trade have been cited to continue in Uganda. On this basis, the Ministry of Water, through the Forest Sector Support Department under the CITES Tree Species Programme, carried out a study in selected districts of the Karamoja and Elgon regions, to understand the current use, trade, processing, production, and regulation of Sandalwood trade in Uganda. The study utilized literature reviews, individual interview, key informant interviews, focus group discussions, and field observations to capture the information about the species.

The study revealed that; Sandalwood is used for oil production, research, firewood, construction, herbal medicine, beverage, and also charcoal burning. There was no recorded legal trade in Uganda's Sandalwood although cases of illegal trade were cited. Uganda Wood Impex Limited, a company that trades in Sandalwood in Uganda, sources its raw materials from South Sudan and the Democratic Republic of Congo. Handling of illegal traders and the impounded Sandalwood is not clear and incidences of political interference have been recorded. The responsible stakeholders and institutions in Uganda have limited capacity to monitor and control illegal trade of Sandalwood. The reported gaps and challenges in monitoring and controlling the illegal trade in Sandalwood include limited enforcement; corruption; lack of a well-established system for tracking; limited facilitation of monitoring officials; political interference; and limited awareness of Sandalwood among the law enforcers. Despite the government ban on the trade of Ugandan sourced raw Sandalwood in Uganda, the current unregulated local uses of the species especially for fuelwood and construction, the persistence of illegal trade in the species, and the low rate of regeneration of the species, may threaten the survival of the species in the wild. Therefore, the study recommends recruitment of more staff under the DFS and other local structures; strengthening the enforcement and deployment of environmental police at district level; sensitization of communities, district personnel and other relevant stakeholders; assessment of hotspot areas for Sandalwood; revive and build the capacity of environmental committees at the sub-county level; provide logistical support to the District Natural Resources Office, specifically for monitoring the illegal trade of Sandalwood; empower and support communities to plant more trees to reduce pressure on Sandalwood; conduct more research about the species; develop and implement regulations/ordinances on the harvesting, trade, processing and production of Sandalwood in Uganda.

CHAPTER ONE: INTRODUCTION

1.1 Background

The East African Sandalwood, *Osyris lanceolata* is an evergreen shrub. It belongs to family Santalaceae and grows to a height of 1-7 metres (m) depending on the soils, climatic conditions and genetic variation (Mutisya, 2020). The species is drought tolerant, grows on poor sites mostly on rocky ridges, mountain slopes, margins of evergreen bushlands, grasslands and thickets (Andiego et al., 2019). The species is a hemiparasite that gains water and nutrients from the host plant (Page et al., 2012). Host plants such as *Rhus natalensis* and *Dodonaea viscosa* promote the early growth of *O.lanceolata* in terms of height, diameter and the overall root and shoot biomass (Mwang'ingo et al., 2005). *O. lanceolata* is a perennial and can survive for more than 50 years in its natural stand (Andiego et al., 2019) and can take about 15-20 years to grow to an optimal size (Page et al., 2012). The altitudinal range of the species is 900-2700 metres above sea level. In Uganda, Sandalwood has been mainly recorded in Karamoja sub-region in the districts of Nakapiripirit, Kotido, Kaabong, Amudat, Moroto and around Mountain Elgon in Bukwo, Kapchorwa and Kween.

Sandalwood has over centuries been traded for its fragrance, medicinal value, religious value and wood carving potential. The main traded products include aromatic oils extracted from the heartwood, timber for handicrafts, and saw dust for making incense. The oil is useful in perfumery, pharmaceutical, cosmetics, medical and local cultural practices. Following the decline in the availability of *Santalum album* (Indian Sandalwood) in the early 1990s, *O. lanceolata* entered the international market as a substitute for the traditional Sandalwood oil originally sourced from Asia and Australia. The oil from the East African Sandalwood (also referred to as false Sandalwood) has been found to have comparable similarities with the oil from the true Sandalwood (species of genus *Santalum*) though of different quality.

O. lanceolata is categorized as wild flora and is majorly harvested from the wild, private farms or communal lands. In most cases, the harvesting of Sandalwood is highly unsustainable and destructive because it involves excavating the roots, cutting of stems and, heartwood. The heartwood is used for extraction of essential oil, the stem for timber and wood carving. The roots are believed to contain more oil per unit weight (Mwang'ingo et al., 2008); and the female trees are preferred when harvesting and these are also believed to contain higher oil content than the male species. This destabilizes the species reproduction capacity, threatens its genetic pool and the future availability of the resource (Andiego et al., 2019).

Although no clear records exist on the trade of *O. lanceolata*, it is estimated that about 1,000 tonnes are annually harvested from Africa and mostly from East Africa. The destination countries of the East African Sandalwood and its products are mainly India, France, United Kingdom, United States of America, Germany, South Africa, United Arab Emirates, among

others. Sandalwood oil is one of the most expensive oils worldwide (Teklehaimanot et al., 2004). In Uganda, one kilogramme of refined and processed oil for *O. lanceolata* costs between US$600 and US$900 whereas the same quantity in Kenya costs between Kshs. 80,000 and Kshs. 100,000 (Mutisya, 2020). The limited supply of Sandalwood coupled with high demand and escalating prices of Sandalwood oil from the traditional source countries have led to exploitation and decline of the East African Sandalwood.

In East Africa, commercial trade in Sandalwood started from Tanzania in 2004, then to Kenya in 2006 and spread to South Sudan and Uganda in 2011. Harvesting and trading in Sandalwood in Kenya was banned in 2007 via Legal Notice No 3176 of 2007. Uganda was then looked at as an alternative option for harvesting and trading in Sandalwood. Consequently, Sky Beam Africa Limited (SBAL) was established in Tororo district in 2010 to trade and export Sandalwood and its products. During the period of her operation, SBAL heavily exploited the East African Sandalwood, which was sourced from Uganda, Kenya, Tanzania, DRC, and South Sudan. The climax period of unregulated and uncoordinated trade in Sandalwood in Uganda was between 2011 and 2015. The harvesting and trade in raw Sandalwood was banned in Uganda in 2016 in response to several reports of illegal Sandalwood smuggled mainly from Kenya transiting through Uganda as well as putting Decisions 16.153 & 16.154 of the Conference of Parties (CoP) to the CITES into force in Uganda.

Despite the government ban on the trade of Sandalwood in Uganda, there are still cases of illegal trafficking and trade of Sandalwood and this can be evidenced by the recent seizures and confiscation by the law enforcement agencies. Currently, there is no legal trade in Uganda's Sandalwood, however, there is a company called Uganda Wood Impex Limited that is licensed to trade in Sandalwood and its products from Uganda but it sources most of the Sandalwood from the Democratic Republic of Congo (DRC) and South Sudan. Sky Beam Africa Limited is equally permitted to legally import and process Sandalwood at their Tororo plant as long as the re-export is not raw sandalwood.

Following the need to understand the harvesting, processing, transport, trade, uses, regulation, and look-alike species of Sandalwood in Uganda, the Ministry of Water and Environment (MWE) through the Forest Sector Support Department (FSSD) carried out a study in Moroto, Nakapiripirit, Bukwo districts that constitute the corridor where the species has been reported to grow. Tororo and Kalungu districts were also purposively studied because Sandalwood processing factories (SBAL and UWIL respectively) are located in these districts (Figure 1). Institutions relevant to the monitoring and control of illegal trade in the species were also involved in the study. This activity contributes knowledge that is required in ensuring that trade and utilization of the species both at national and international levels, is non-detrimental to its survival in the wild. The information generated is vital in the establishment of a fair tracking/control system for *Osyris lanceolata.*

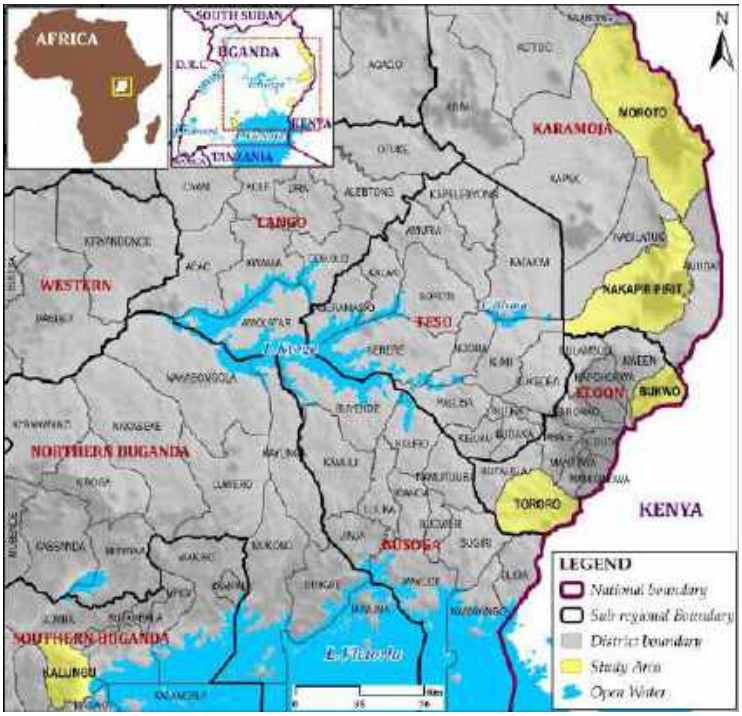

Figure 1: Districts selected for the study

1.2 Regulatory and Institutional Framework

This section highlights some of the legal, regulatory and institutional framework that guide and aid research, sensitization, protection, monitoring, and control of trade in *Osyris lanceolata* in Uganda.

1.2.1 Regulatory Framework

A. **<u>The Convention on Biological Diversity, 1992:</u>** Its major objectives include conservation of biological diversity, sustainable use of its components, and fair & equitable sharing of the benefits arising from commercial and other utilization of genetic resources. Article 7 and 10 of the convention highlight the need to identify components of biological diversity important for conservation and sustainable use; monitor the components of biological diversity identified; identify activities that may have adverse effects of the components of biological diversity; and support local populations to develop and implement remedial action in degraded areas where biological diversity has been reduced.

B. **<u>The Convention on International Trade of Endangered Species (CITES), 1973:</u>** It aims at ensuring that international trade in specimens of wild animal and plant species does not threaten their survival. Uganda ratified the CITES in 1991 and acknowledged the need for international co-operation to combat trade in endangered species. At the 16th meeting of the Conference of Parties (CoP) to CITES, Bangkok, Thailand, 2013, the populations of *Osyris lanceolata* of East African countries were listed in Appendix II. The listing followed consultations among the Eastern African range States and submission by Kenya of a

proposal to the CoP, to include the East African Sandalwood in Appendix II. The Conference of the Parties, alongside the species listing, adopted Decisions 16.153 & 16.154 on actions for implementation to enhance the conservation of the species across its range. Therefore, it is a fundamental obligation of CITES member countries to present a non-detriment finding (NDF) prior to any export of a product listed in Appendix II of the Convention.

C. **The United Nations Framework Convention on Climate Change, 1992:** It aims to stabilize atmospheric greenhouse gas concentrations at levels that would prevent dangerous anthropogenic interference with the climate system within a timeframe sufficient to allow ecosystems to adapt naturally to climate change. The convention recommends member countries to promote sustainable management, promote and cooperate in the conservation and enhancement, as appropriate, of sinks and reservoirs of all greenhouse gases not controlled by the Montreal Protocol, including biomass, forests and oceans, as well as other terrestrial, coastal and marine ecosystems.

D. **The Constitution of Uganda, 1995:** Paragraph XXVII of the National Objectives and Directive Principles of State Policy mandates the government to take all possible measures to prevent or minimize damage and destruction to land, air, and water resources resulting from pollution or other causes. The utilization of the natural resources of Uganda shall be managed in such a way as to meet the development and environmental needs of present and future generations.

E. **The National Environment Act, 2019:** Section 56 of the Act permits the National Environment Management Authority, in close collaboration with the lead agency, to identify and map out hilly and mountainous areas at risk from environmental degradation, natural processes or natural disasters. The risk may occur when the vegetation cover has been removed or is likely to be removed from the area at a faster rate than it is being replaced. The lead agency shall take measures to plant trees and other vegetation in any priority areas which are within the limits of its jurisdiction and not subject to any personal interest in the land. Sections 59 and 64 also permit the Authority, in close collaboration with the lead agency, to issue guidelines and prescribe measures for the management of biological diversity and forests in Uganda.

F. **The National Forestry and Tree Planting Act, 2003:** Section 30 of the Act mandates the minister and the district council to declare by statutory order and reserve a tree species of international, national or local importance that is endangered, rare or threatened. The reserved tree species shall be subject to such controls as the minister and the district council may specify in the order. Section 44 of the Act also highlights that a person who exports or attempts to export timber without a licence, commits an offence and is liable, on conviction, to a fine not exceeding thirty currency points or imprisonment for a term not exceeding three years or both.

G. **The National Forest Plan, 2011/12-2021/22:** The plan is the framework for implementation of the forestry policy and programmes by government and stakeholders in the forest sector. The plan aims to achieve sustainable increases in economic, social and environmental benefits from forests and trees by all the people of Uganda, especially the poor and vulnerable. It recognizes the need to protect forests that have endangered or threatened tree species as well as cooperation among East African member states in activities relating to development, conservation, sustainable management and utilization of forests, trees, and trade in forest products.

H. **The Uganda Wildlife Act, Chapter 200:** Section 67 of the Act highlights that a person who imports, exports or reexports or attempts to import or reexport a threatened or protected plant species from the wild without producing a valid permit to the customs officer or through a customs port, commits an offence. Any person who is convicted of an offence under section 66 or 67 or under regulations made under section 67 is liable to a fine of not less than ten million shillings or to imprisonment for a term of not less than seven years, and in any case the fine shall not be less than the value of the specimen involved in the commission of the offence.

1.2.2 Institutional Framework

1. **Forest Sector Support Department (FSSD):** FSSD is under the Directorate of Environmental Affairs (DEA) of the Ministry of Water and Environment (MWE). FSSD is the CITES Scientific Authority for plants of wild origin and is in charge of managing and overseeing forestry sector development in Uganda. The department is mandated to provide support to the forestry sector on range of aspects including forest policy planning and formulation, technical backstopping of the district forest services, sector co-ordination, regulation of trade in forest products, gazettement among others. The department aims to effectively co-ordinate, guide and supervise Uganda's forestry sector and contribute to the rational and sustainable utilization, development, effective management, safeguard of forestry resources, for social welfare and economic development.
2. **National Forestry Authority (NFA):** NFA is an autonomous agency under the Ministry of Water and Environment (MWE). NFA is mandated to manage Central Forest Reserves on a sustainable basis and to supply high quality forestry-related products and services to government, local communities and the private sector. Some populations of *Osyris lanceolata* have been recorded in protected areas such as Mount Moroto National Park. Therefore, NFA should protect and regulate the utilization and trade of Sandalwood occurring in central forest reserves.
3. **National Forestry Resources Research Institute (NaFORRI):** NaFORRI is mandated to undertake research in all aspects of forestry. Research in NaFORRI aims at increasing the benefits derived from trees and forests through conservation and sustainable management

of the forest and tree resources. NaFORRI should conduct research on suitable mechanisms of propagation of *Osyris lanceolata* for domestication purposes as well as sustainable utilization of the species to improve the livelihoods of communities.

4. **The CITES Management Authority of Uganda:** The Authority is housed under the Ministry of Tourism, Wildlife and Antiquities. The Authority is responsible for issuing CITES permits for wildlife species which are found in Appendix I, II, and III of CITES. The Authority seeks advisory services from the Scientific Authority for plants of wild origin, FSSD on licencing a company or an individual to trade in a threatened species or species that are not necessarily threatened with extinction but may become so unless trade is closely controlled. *Osyris lanceolata* is listed under Appendix II of the Convention on International Trade in Endangered Species (CITES) and therefore, trade in this species requires a CITES permit in Uganda.
5. **Uganda Wildlife Authority (UWA):** UWA is a semi-autonomous government agency that conserves and manages Uganda's wildlife for the people of Uganda and the whole world. UWA is mandated to ensure sustainable management of wildlife resources and supervise wildlife activities in Uganda both within and outside the protected areas. UWA is also Uganda's CITES Scientific Authority for wild fauna. Since the East African Sandalwood occurs mostly in the wild and protected areas, UWA should strengthen its capacity to protect and regulate the trade and utilization of this species.
6. **Ministry of Trade, Industry and Cooperatives (MoTIC):** The Ministry is mandated to formulate, review and support policies, strategies, plans and programs that promote and ensure expansion and diversification of trade, cooperatives, environmentally sustainable industrialization, appropriate technology development and transfer to generate wealth for poverty eradication and benefit the country socially and economically. The external trade department of the ministry is responsible for developing, coordinating, regulating, promoting and facilitating domestic and external trade with particular emphasis on export promotion and access to regional and international markets. Therefore, the ministry through its external trade department should monitor and control the trade in Sandalwood and its products.
7. **Ministry of East African Community Affairs (MEACA):** The East African Community (EAC) is an inter-governmental organization mandated by the governments of Burundi, Kenya, Rwanda, Uganda and Tanzania to spearhead the East African economic, social and political integration agenda. The department of economic affairs of the ministry deals in customs and trade investments among others. Since trade in Sandalwood is regional involving many countries of the EAC, the MEACA in close negotiation with other member states should develop and implement policies/regulations that monitor and control the trade of *Osyris lanceolata*.
8. **District Local Governments (DLGs):** According to the local government act of 1997, management of natural resources is devolved to district local government. The District

Forest Services (DFS) which falls under DLG, is responsible for management of local government forests, community forests and forests on private land in their respective areas of jurisdiction as well as extension of services related to forestry products. The DFS is supported by the Forest Sector Support Department (FSSD) of the Ministry of Water and Environment. Owing to the fact that some population of Sandalwood is found on private and community land, the DFS should enhance its capacity in protecting, trading and monitoring the local utilization of the species.

9. **The Uganda Free Zones Authority** is an institution under the supervision of the Ministry of Finance, Planning and Economic Development. The Authority was established following the Free Zones Act of 2014. The body is responsible for the establishment, development, management, marketing, maintenance, supervision and control of free zones. The body is also responsible for licensing developers who demonstrate capacity to develop free zones, and have a large export base of their processed products. The Uganda Wood Impex Limited was licensed to trade in Sandalwood under this arrangement.
10. **Civil Society Organizations (CSOs), Non-governmental Organizations (NGOs) and the Private Sector:** These play a critical role in protecting the environment and natural resources. The ministry should work in close collaboration with these partners to sensitize the public about the values of *Osyris lanceolata*, dangers of trading in the species, sustainable utilization of the resource, strategies of protecting the species in the wild and domesticating it.

CHAPTER TWO: METHODOLOGY

The study to understand production, harvesting, processing, transport, trade, control and monitoring of *O. lanceolata* in Uganda utilized both literature review and field-based (key informant interviews, focused group discussions and field observations) methods of data collection.

2.1 Literature Review

A systematic review and synthesis of information from technical reports and research articles (with a focus on *O. lanceolata)*, majorly within the Eastern African range states was conducted to understand the growth form, harvesting, trade, processing, local uses, control and monitoring of *O. lanceolata*. To understand the legal and institutional provisions that guide and aid research, sensitization, production, harvesting, protection, monitoring, and control of trade in the species, relevant regulatory and institutional frameworks were also reviewed. This further enabled the research to gain context under which different control and monitoring activities are implemented.

2.2 Key Informant Interviews (KIIs)

Key informant interviews with key stakeholders were conducted at the district and national level. The key informants/stakeholders were selected basing on their expert knowledge or involvement in the species' production, processing, transportation, trade, monitoring and control. For every district, the key informants included the District Natural Resources Officer (DNRO), the District Forestry Officer (DFO), the District Environment Officer (DEO), the Forest Ranger, the District Police Commandant (DPC), Herbalists, local leaders, Charcoal makers, and Village Elders. Interviews were also held with selected NGOs such as CARITAS International that implements environment activities in the sampled districts.

At the national level, physical and phone interviews were held with stakeholders from the CITES Management Authority, National Forestry Authority (NFA), National Forestry Resources Research Institute (NaFORRI), and, Uganda Wood Impex Limited. The key informant interviews (Figure 2) provided information on the production, processing, trade, transport, local uses, monitoring and control of Sandalwood in informants' areas of jurisdiction.

Figure 2: KII with the District Natural Resources Officer of Moroto district

2.3 Focus Group Discussions (FGDs)

In each district, a Focus Group Discussion (FGD) of about 8-14 people was held in one of the sub-counties that was involved in the production, trade and processing of Sandalwood. The FGDs included the District Forest Officer, police officers, charcoal makers and traders, herbalists, local leaders, village elders, and selected community members (Figure 3). Information about the local use, processing, trade, regulation, protection, and transport of *O. lanceolata* were discussed during the FGDs.

Figure 3: An FGD at Kapsukut Village, Riwo Town Council, Bukwo district

2.4 Field Observation

Under the guidance of the district stakeholders such as the District Forestry Officer and local leaders, field visits were made to sites that were reported to have Sandalwood (Figure 4). During the field visits, the growth form, harvesting, processing and use of Sandalwood were observed.

Figure 4: The Forestry Officer of the Ministry of Water and Environment understanding the host plants of O. lanceolata

CHAPTER THREE: FINDINGS

3.1 Location, Uses, and Host Plants of Sandalwood in Uganda

3.1.1 Location and Host Plants of Sandalwood in Uganda

In Moroto district, Sandalwood is mainly found in Tapac sub-county; in Nakapiripirit district, the species is located majorly in Nakapiripirit Town Council, Morita, Tokora, and Kakomongole sub-counties; in Bukwo district, Sandalwood is found mainly in Riwo, Brim, Tulel, Kamet and Kortek sub-counties. The local names of Sandalwood in Tapeth, Akarimajong, and Kupusabiny languages are "*Ethinikook*", "*Lomanang*", and "*Munya chematyo*" respectively.

Most of the Sandalwood in these areas is found in the wild and at higher elevations of about 1300-1760 metres above sea level. The species in these areas are shrubs, in a height range of 1-5 metres, they are sparsely distributed within the area. The species grow in close association with other plant species (Host plants) (Figure 5) and these include *Rhus natalensis, Euclea divinorum, Ozoroa insignia, Entada abbysinica, Acacia mellifera,* and *Carissa edulis*.

Figure 5: Sandalwood in association with the host plants in Tapac sub-county, Moroto district

3.1.2 Uses of Sandalwood in Uganda

The study established that Sandalwood harvested from Uganda and that imported from neighbouring countries (mostly South Sudan and DRC) is mainly used for;

- Extraction of oil for export. Sandalwood oil was noted to be mostly exported to Europe, India and France where it is used in the manufacture of perfumes, cosmetics and other fragrances.
- Research and learning purposes. Universities and research institutions conduct studies on Sandalwood in relation to its distribution, inventory, propagation, growth form among others.
- Sandalwood is used as firewood for cooking and burning charcoal. The species can burn for a long time when cooking food and it supports the burning of other wet tree species when burning charcoal. However, because of its small size, the species is not preferred for charcoal making.
- The liquid from the Sandalwood ash is added to some sauces such as beans as a tenderizing agent.
- The bark of Sandalwood is crushed and used for beverage.
- The locals believe that the leaves of Sandalwood boost milk production in cattle and increase the chances of a cow producing two calves.
- It is used as a local herb for curing internal and body pain, diarrhoea, pneumonia, flu, cough, dysentery, and boosts sexual power. The locals also use it as first-aid for patients that have had unsafe abortion. The herbalists believe that use of Sandalwood makes their medicine more potent/effective.

- Construction of houses and fencing of compounds (Figure 6). The poles or stands from Sandalwood are used by local people for providing support to houses and fences. These are believed to be resistant to termite attack.

Figure 6: Sandalwood poles used for fencing a homestead in Tapac sub-county in Moroto district

3.2 Trade of Sandalwood in Uganda

The commercial trade of Sandalwood in Uganda began around 2010 following the ban on the harvesting and trade of Sandalwood in Kenya in 2007. Most of the traders during this period came from the East African coast and these engaged with the local communities in the Karamoja and Elgon regions to begin the trade in Sandalwood. The climax period of the trade and lager scale harvesting of Sandalwood in Uganda was between 2011 and 2015. The trade was reportedly high, uncoordinated, unregulated and it led to overexploitation and decline of the species in this area. The harvested Sandalwood would be exported to Kenya where it was processed and exported to destination countries of India, Germany, France, USA among others. Some of the Sandalwood was also exported to Zanzibar where it was used in the manufacture of a perfume called "*Gift of Zanzibar*". The key informants revealed that 1 ton (an estimate of 1 TATA lorry) of freshly harvested Sandalwood from the wild would cost between UGX. 700,000 and UGX. 1 million. After transporting the same quantity of Sandalwood to a landing site in Namayingo district, the product would fetch about UGX. 5 million; and if one ferried the same quantity of Sandalwood to Mukingo Island, Kisumu, Kenya, it would be sold at about UGX. 23 million. Due to the high demand, heavy profits, and over exploitation of Sandalwood in Uganda, the species had greatly reduced by 2013 and the harvesting and trade in Sandalwood from Uganda was later banned in 2016 following the listing of the species in Appendix II of the CITES.

3.2.1 Companies licensed to trade in Sandalwood in Uganda

Two (2) companies are known to be/have been legally registered to trade in Sandalwood from Uganda i.e., Sky Beam Africa Limited (SBAL) and Uganda Wood Impex Limited (UWIL). SBAL

closed its operations in Uganda in 2019 while UWIL is still operating its businesses from Uganda in Kalungu district.

Sky Beam Africa Limited (SBAL) was established in Tororo district around 2008. The major purpose of its establishment was to produce Sandalwood oil for export. According to the Environmental Impact Assessment (EIA) carried out on behalf of SBAL, Sandalwood was to be sourced from the Karamoja region in Uganda, specifically Tapac Sub county in Moroto District and the company was required to revegetate the species through supporting activities such as raising Sandalwood nursery beds and supporting general tree planting activities to reduce community dependence of Sandalwood for firewood. Through regular visits and audits, it was reported that the District Natural Resources office and NEMA found out that SBAL did not fulfil any of the commitments stipulated in the EIA report. Instead, they were relying on illegally harvested Sandalwood from Karamoja region as well as importing it from DRC, South Sudan, Kenya, Tanzania and New Caledonia through porous border points. Based on this, NEMA did not renew their working license in 2018. The company was given an ultimatum of six (6) months to finish their Ugandan sourced stocks, thus the company closed off its operations in 2019. However, they were also given the option to continue operating the factory exclusively based on imported raw materials.

Uganda Wood Impex Limited (UWIL) was licensed by the CITES Management Authority in 2015 to trade in Sandalwood after securing a Uganda Free Zones investment license. The company is located in Kalungu district and also has offices in Kampala. The company is permitted to import Sandalwood from South Sudan and Democratic Republic of Congo. The company deals in Sandalwood chips, Heart wood, powder, wood and Sandalwood oil for export.

3.2.2 Illegal trade of Sandalwood in Uganda

Due to bureaucratic structures of accessing Sandalwood from Karamoja region, which majorly included holding meetings with several leaders at different levels, Sky Beam Africa Limited opted to work with local people (illegal trade agents) within the community to buy Sandalwood. The agents would harvest the whole Sandalwood tree including the roots and this would be transported to the factory in Tororo where each kilogram was bought at Ush.25000 (including transportation cost).

In some cases, the field and audit teams found records of Sandalwood harvesting and transport at the district local governments of Karamoja region especially in Moroto district. However, when they consulted the villages where Sandalwood harvest had been reported, no such records of Sandalwood harvest and transport were found. The local people would reveal how they had been given money to sign documents falsely indicating that they had sold Sandalwood trees out of their areas. This was an indicator that Sandalwood was being sourced from somewhere else.

Despite the government ban on the trade of Sandalwood in Uganda, there are still cases of illegal trafficking and trade of Sandalwood in Uganda and this can be evidenced by the recent seizures and confiscation by the law enforcement agencies.

- In 2019, a truck carrying about 700kg of Sandalwood was impounded in Sironko district. The suspects were found with a Sandalwood movement permit indicating that the species was being transported to Masaka for laboratory testing activities. The permit had been issued by the District Natural Resources Officer (DNRO) of Amudat district. The suspects were arrested by Sironko police and later released on police bond. However, the Sandalwood somehow disappeared from the impounded truck at a police station and it was alleged to have been replaced with other firewood species.
- In 2019, a car was impounded in Amudat district with about 500kg of Sandalwood transporting it to Kenya.
- In 2018, about 50 tons of Sandalwood were impounded at Malaba trade point. The wood was illegally imported from Kenya. This case was left to be handled by URA customs for further prosecution.
- In 2017, about 20 tons of Sandalwood were impounded in Tororo district. The wood was handed over to a team of people from National Forestry Authority (NFA). In the same year, about 2 tons of Sandalwood were seized in Busitema and these were handed over to NFA.
- In 2016, a lorry carrying 1 ton of Sandalwood was arrested from Chesowel in Bukwo district. The driver refused to stop and the police officers were compelled to shot at the car tyres. The case was immediately handled by the state house of Uganda.

3.2.3 Handling of culprits for Sandalwood illegal trade

Generally, the handling of illegal traders and the impounded Sandalwood was reportedly unclear. Several key informants noted that whenever Sandalwood was impounded, enforcement teams from several institutions such as NFA, Uganda Police, State house took over the cases. The local government enforcement teams argue that they report cases of Sandalwood illegal trade to line institutions for further handling and prosecution. Some of the illegal traders of Sandalwood are brought to police but these later receive police bonds and the cases are dropped after some time. For charcoal dealers, they are always prosecuted, fined and warned not to repeat the activity. Public auctioning of the charcoal is done and the money is deposited to the account of the district.

3.3 Harvesting of Sandalwood in Uganda

Currently, harvesting of sandalwood in Uganda is done by the communities for various purposes highlighted in section 3.1.2. Depending on the purpose, any part of the species can be harvested. The people that majorly harvest Sandalwood in Uganda include the herbalists, charcoal burners/makers, and local people for building and firewood needs. The Focus Group Discussion in Bukwo district revealed that herbalists can harvest enough Sandalwood that can be used for a period of 2 months. The charcoal burners/makers harvest tree species for burning charcoal from the bush every week, but their target is not always Sandalwood due to its scarcity

and size (Figure 7). They use the Sandalwood mainly to ignite other tree species in the process of burning charcoal because it burns longer and maintains the fire.

Figure 7: Stamps of harvested Sandalwood in Tapac sub-county, Moroto district

Uganda Wood Impex Limited (UWIL) majorly sources its Sandalwood from the Democratic Republic of Congo (DRC). Through an interview, it was revealed that the company uses about 20 to 30 tons of Sandalwood every month, which translates into 240-360 tons of Sandalwood per year. UWIL purchases each kilogramme of Sandalwood from the source mostly in DRC at UGX. 300 and it incurs the transportation cost. The company incurs about US$50,000 to buy and transport 30 tons of Sandalwood from DRC to the company base in Kalungu. For Sky Beam Africa Limited (SBAL), the amount of Sandalwood sourced/consumed was not known. The DNRO reported that the company could not declare information to his office. When asked about how much the company was consuming per unit period, the DFO of Tororo district was quoted to have said that *''…those people were not declaring the quantities they were harvesting even when we asked for the documents, because they knew that whatever information they revealed would inform taxation…''*

It was also reported that Sky Beam Africa Limited did not support any regeneration activities of Sandalwood in Karamoja as initially agreed with NEMA in the EIA report as well as the MOU with Moroto District Local Government. The nursery structure was set up in Tapac at Tapac Sub County headquarters but no seedlings were ever raised from there. On the other end, Uganda Wood Impex Limited (UWIL) have a plan of investing about US$50,000 to US$100,000 in supporting tree planting activities including Sandalwood in Uganda.

3.4 Processing and production of Sandalwood in Uganda

The processing of sandalwood was reported to depend on specific purposes/uses and these vary locally and commercially.

3.4.1 Local processing of Sandalwood

The part of sandalwood to be used depends on the purpose such as the ailment to be treated.

- For herbal purposes, the leaves, bark and roots of sandalwood are mixed with other local tree species such as aloe vera and boiled. The boiled liquid is cooled at room temperature and then administered to the patient later on.
- For usage as beverage, the bark of sandalwood is preferred and this is debarked from the species, dried, pounded into ash, and then mixed with hot water for drinking.
- For tenderizing use, the pounded ash is mixed with cold water and sieved, the resultant liquid is kept for application in the sauce.

3.4.2 Commercial processing of Sandalwood

Sandalwood is debarked and cleaned to remove its bark, nodes, and the soil. The debarked Sandalwood is cut into small pieces and crushed into powder/ash using machines. The powdered Sandalwood is parked tightly in metallic containers/cylinders and sealed firmly. The containers are subjected to very high temperature using firewood collected from other local plant species such as Eucalyptus. The heating process continues for about 1 day (24 hours). The steam generated from the heated powder is captured using pipes and cooled to form a liquid product known as Sandalwood oil. The oil is collected, filtered and parked ready for export.

The major product at Uganda Wood Impex Limited is Sandalwood oil and they produce about 100-200kg of Sandalwood oil per month. 5kg of Sandalwood produce 1kg of Sandalwood oil; however, this depends on the quality of the wood. Sandalwood oil costs between US$600 and US$900 per kilogramme. Other products of Sandalwood produced by UWIL include;

* Sandalwood sap which costs US$4 per kg
* Sandalwood chips which cost US$35 per kg
* Heart wood which cost US$15 per kg
* Sandalwood powder which cost US$30 per kg

The major waste product generated after processing Sandalwood is dump woody materials and Sandalwood powder. UWIL dries and packs the generated powder in a container for export as Sandalwood powder. SBAL used to dump and heap the wood remains outside the factory and it would be burnt to ashes after drying up.

Sandalwood oil and other Sandalwood products are normally exported to India, France, United Kingdom, United States of America, Germany, South Africa, United Arab Emirates, among others.

3.5 Monitoring and control of trade in Sandalwood in Uganda

Monitoring and control of trade in Sandalwood in Uganda is charged with different institutions at the national and local levels. At the national level, the institutions include Forest Sector Support Department (FSSD), National Forestry Authority (NFA), CITES Management Authority Under the Ministry of Wildlife, Tourism and Antiquities, Uganda Wildlife Authority (UWA), Uganda Revenue Authority (URA), and Environmental Police. At the district (local)

level, there is the District Natural Resources Office (DNRO), the District Forestry Services (DFS) and the District Police Office. The mandates of these institutions are highlighted in section 1.2. Despite the presence of such structures at the national and local levels, Uganda lacks a well-established system of tracking/monitoring and control of the trade in Sandalwood. This can be attributed to the porous nature of the borders especially the Kayoro boarder point in Kayoro sub county, Busia district and along River Malaba in Mela sub county, Tororo district. Other limiting factors include the remote ecological distribution of the species as well as limited infrastructural capacity of the respective entities.

The reported monitoring and control of illegal trade is not limited to Sandalwood but also other forestry products especially from threatened tree species. The district officials revealed that monitoring is done twice a month and also when alerted by community members about illegal trade in Sandalwood, charcoal, and any threatened tree species. During monitoring, road blocks are mounted on main roads as well as routes thought to be used by illegal traders. Monitoring and control of illegal trade in Sandalwood is complex because the business is secretive, lucrative and highly sophisticated. For such reasons, the local leaders in Tororo district relied on a local intelligence network comprised of the DFS officials, police officers, community leaders, concerned citizens and few workers within the SBAL. The local people provided information to the local leaders about any suspicious activities. Through this network, the leaders were able to acquire timely information and on average, 2-3 cases of illegal trade in Sandalwood would be recorded in a year.

3.5.1 Capacity in monitoring and control of illegal trade in Sandalwood in Uganda

The responsible stakeholders and institutions in Uganda have limited capacity to monitor and control illegal trade of Sandalwood. The study showed that few people both at the district and community level are able to identify Sandalwood (the leaves, bark and roots) and its uses. The people that could vividly identify Sandalwood were the District Forestry Officer, the Forest Ranger, herbalists, Charcoal dealers/makers, and elderly people of the community. One village leader, was quoted to have said that "…*we do not know much about other good uses of that tree but if told by the government to conserve it, I can easily mobilize my people and they do so*".

At the district level, no specific trainings or financial support are directed towards monitoring and control of illegal trade in Sandalwood in Uganda. The trainings held are mostly concerned with environmental protection, river bank restoration and management, tree planting, disaster preparedness and management among others. These trainings are sometimes organized by District Natural Resources Office, NGOs, and programmes such as NUSAF, REDD+, FIEFOC among others. Although the trainings offer knowledge that is applicable in the monitoring and control of Sandalwood, they are rarely held and when organized, the senior officers are majorly considered for training.

3.5.2 Measures implemented to monitor and control illegal trade in Sandalwood

The government and other development partners have implemented several activities geared towards environmental protection. Some of the partners include World Vision, PLAN

International, GIZ, ACEMD, Mercy corps, KADF, CARITAS International. Additionally, CTSP funded "Conservation and Sustainable Management of Osyris lanceolata, for Economic Development in East Africa" project is being implemented in Uganda. The following measures were reported to have been implemented in Uganda to generally protect and conserve the environment, including protecting Sandalwood in the wild;

- Sensitization and support of communities to plant exotic and indigenous tree species to reduce the pressure on Sandalwood for firewood.
- Building the capacity of local communities to establish tree nursery beds of Eucalyptus, Grevillea, Pine among others on private farms.
- Implementation of bye-laws on tree cutting, bush burning, charcoal burning and environmental protection. For example, Nakapiripirit district has an ordinance on food security and environmental protection, 2012.
- Mounting road blocks on both major roads as well as routes sought to be used by illegal traders. Checks are made to establish trucks carrying threatened forestry products, Sandalwood and Charcoal.
- Establishment of the national wildlife crime coordination task force which includes different government law enforcement agencies such as NFA, DPP, UWA, Police, Customs, ESO, Immigrations, UPDF, Wildlife Conservation Department-MTWA, and NEMA. The taskforce nominates a focal point person for different regions to increase coordination of the activities with the aim of increasing intelligence on trade in threatened spp, but also eliminate sectorial mismanagement of cases of illegal trade.

3.5.3 Gaps in monitoring and control of illegal trade in Sandalwood in Uganda

The following were the reported gaps in monitoring and control of illegal trade in Sandalwood in Uganda;

- There are no guidelines, regulations or ordinances/bye-laws to regulate the harvesting, production, and trade of Sandalwood in Uganda.
- There is limited enforcement in the monitoring and control of trade in Sandalwood. The frequency, personnel and materials such as motor bikes and vehicles, for monitoring trade in Sandalwood are few.
- There is political interference in handling cases for Sandalwood illegal trade. Political leaders at the district and national levels have been reported to influence prosecution of culprits of Sandalwood illegal trade.
- There is corruption in the management of Sandalwood illegal trade. Cases have been recorded where culprits of illegal trade are released on police bond, cases dropped, and the impounded Sandalwood sold illegally.
- There is no established system of tracking or monitoring the trade in Sandalwood.
- Limited training of the relevant stakeholders regarding the identification, monitoring and control of illegal trade in Sandalwood.

3.5.4 Challenges in monitoring and control of illegal trade in Sandalwood in Uganda

The following are the challenges encountered by the enforcement team in monitoring and control of illegal trade in Sandalwood in Uganda.

- There is limited access to information regarding the compliance of legal traders. The legally registered companies hardly declare the sources of Sandalwood, the production capacity, and products exported.
- The complex nature of the illegal Sandalwood trade. The illegal traders easily adjust to different forms of concealment to hide their products in transit and avoid being caught. They regularly change to different routes and have a large network of informants in the local areas.
- The lack of environmental police/guards at local districts obscures monitors from interfacing with illegal traders, who are in most cases armed with guns and bows.
- There is limited facilitation in terms of motorcycles, fuel, and other logistical support such as field allowances for the monitoring teams.
- There is political interference in curbing of illegal trade in Sandalwood. The informants also reported high corruption levels within government since the trade activities are very lucrative and the traders are willing to pay large sums of money to compromise the prosecution processes.
- There is limited staffing in the monitoring of trade activities of Sandalwood, therefore, some of the illegal activities go unnoticed.
- There is limited awareness of Sandalwood among the law enforcers. The study showed that some of the enforcement team cannot identify Sandalwood and do not know the implications of the trade on the survival of the species.
- Due to high poverty levels in the communities of Karamoja, the local people connive with illegal traders to harvest and sell the species and obtain immediate survival.
- The monitors use motorcycles in the field compared to illegal traders who use trucks, lorries and in most cases move in groups. It is therefore difficult for the monitors to stop the illegal traders along the way.
- The porous nature of international borders makes it difficult to restrict illegal movement of materials between countries.
- Endless civil unrest in neighbor countries often limit engagement of different responsible institutions in these countries when suspects of illegal sandalwood trade are apprehended.

CHAPTER FOUR: CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

Despite the government ban on the trade of Sandalwood in Uganda, the current unregulated local uses of the species especially for fuelwood and construction, the persistence of illegal trade in the species, and the low rate of regeneration of the species, may threaten the survival of the species in the wild. Therefore, there is a need to engage the relevant stakeholders to effectively regulate the use and trade in the species and increase the populations of the species in Uganda.

4.2 Recommendations

- More staff should be recruited under the District Forestry Services (DFS) and other local structures to increase the monitoring and control of illegal trade in Sandalwood. The DFS should also be empowered to extend forestry services to the local communities.
- Strengthen the enforcement and deploy environmental police at district level to further reinforce the regulation of illegal trade in Sandalwood.
- Sensitize the local people, district personnel and other relevant stakeholders about the identification, value, protection, monitoring and control of illegal trade in Sandalwood.
- A systematic survey should be carried out about the hotspots of Sandalwood in the country, and where possible, community-led management of the species should be promoted.
- Revive and build the capacity of environmental committees at the sub-county level. These can help in the protection of the species as well as monitoring its illegal trade at the local level.
- Provide logistical support such as vehicles, motor bikes, and allowances to the District Natural Resources Office, specifically for monitoring the illegal trade of Sandalwood.
- The communities should be empowered and supported to plant more indigenous and exotic tree species to reduce the pressure on Sandalwood for firewood and construction. In the same line, the government should increase the budget for tree planting and establishment of tree nurseries.
- Research should be conducted by research institutions and the academia about the propagation, threats, host plants, and genetic diversity of Sandalwood in Uganda.
- Regulations/bye-laws/ordinances on the harvesting, trade, processing and production of Sandalwood should be developed and implemented at the national and local levels.
- The government should provide incentives for people/communities that protect trees/environment. This can motivate other individuals/communities to emulate.
- Establish nurseries of Sandalwood in the host districts to aid the restoration of the harvested species in the wild, protected areas, private and communal lands.
- Promote the conservation of Sandalwood host plants to enhance its survival.
- FSSD under MWE should administratively lock the Harmonized System (HS) code for Sandalwood to effectively regulate the illegal trade.

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STAKEHOLDERS AND INSTITUTIONS CONSULTED

- District Natural Resources Officers, District Forest Officers, District Environmental Officers, District Police Commandants and the Forest Ranger of Bukwo, Moroto, Nakapiripirit and Tororo districts
- Herbalists
- Local leaders
- Charcoal makers
- Village elders
- CITES Management Authority
- National Forestry Authority
- National Forestry Resources Research Institute
- Uganda Revenue Authority
- Uganda Wood Impex Limited

Document-based tracking system

Prepared by

Forestry Sector Support Department

Ministry of Water and Environment (MWE)

UGANDA

July 2021

Acronyms

CITES	International Trade in Endangered Species of Wild Fauna and Flora
RFID	Radio-frequency identification
ITTO	The International Tropical Timber Organization
USA	United states of America
UNODC	United Nations Office on Drugs and Crime
MWE	Ministry of Water and Environment
DFS	District Forest Services
FSSD	Forest Sector Support Division

Scope

This document is based on the need to develop tracking system of *O. lanceolata* due to the high level of illegal harvesting and trade on in Uganda that has threatened its continued survival in the field.

Owing to this trend, the Ministry of Water and Environment commissioned an individual study to develop document tracking system for the species in order to ease its traceability and compliance to the national and international (CITES) laws and policies in Uganda.

Summary

This document suggests technologies that can be used on tracking *O. lanceolata* logs, wood and wood products from their points of origin in the forest to the factories where they are processed into wood products and to the final exit boarder points within Uganda. The main aim of the document is to provide information useful to individuals and organizations responsible for implementing, and maintaining the document tracking system for *O. lanceolata* wood and its products.

The study looked at case studies from Ghana-West Africa, Sweden in Europe and USA in North America to make choices on the most suitable, cost effective and applicable, tools, technologies and systems fit for Uganda's scenario. Two methods have been suggested (conventional labels and Radio-frequency identification (RFID) labels) with the former being recommended for Uganda given her field situation.

A number of suggested documents to be used in the *O. lanceolata* wood and products document tracking system are provided in appendices 1-5 as can be deemed necessary.

Introduction

Illegal exploitation of forest resources and its trade support many formal and informal sectors in developing countries where local economies depend on such natural resources. Although many legal instruments have been established to combat such illegal activities, practical control mechanisms to prove the legality and identify the geographic origin of wood and wood products are still lacking. In fact, a number of countries in West Africa have now embraced the system of using DNA fingerprints and stable isotopes to trace for the geographical origins and legality of their woods and wood products (ITTO 2012, Degen *et al.*, 2017). Such hi-tech methods including the simpler ones like document-based tracking system are still lacking in our country Uganda and yet their deployment would save illegal harvest and trad of most tree species from being endangered in the wild.

Osyris lanceolata (Sandalwood), an indigenous species in East Africa is one of such species which is suffering from these scenarios in Uganda to the extent that its conservation status is now rated as threatened and being listed in Appendix II of the Convention on International Trade in Endangered Species (CITES) in Resolution Conf. 9.24 (Rev. CoP16) in 2013. Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival (UNODC 2016). This means that some nature of trade in *O. lanceolata* is permissible in Uganda and therefore measures for its control and traceability must be put in place.

The species has been reported in Eastern and North Eastern parts of Sebei and Karamoja subregion although the available populations have been decimated by illegal trade and habitat loss (MWE 2021). In some of the districts where the species is commonly found, there are limited restrictions on collection from the wild, since local demand is too small to have a negative impact on the species. But since experience has shown that commercial and foreign demands can lead to overharvesting, the species is CITES listed. The problem comes when criminals circumvent the CITES system and wild sourced *O. lanceolata* are smuggled.

Due to its over exploitation in the wild, Ministry of Water and Environment slapped a ban on its harvest and trade in 2018 owing to its rampant illegal trade in the region for commercial extraction of its valuable oil. The booming illegal harvesting, movement and trade of *O. lanceolata* wood and products in East African region coupled with the unknown sources and routes calls for an immediate intervention of developing a robust and efficient tracking system to trace the legality of the sources of *O. lanceolata* wood and its products. This will go a long way to reduce illegal harvesting, transportation and trade of the species in Uganda and the neighboring countries that act as exit/entry routes.

Cognizant to this, MWE commissioned a study to generate a document-based tracking system for *O. lanceolata* products in Uganda. The objective of the document is to enable the government of Uganda (MWE), small and medium enterprises keep track of *O. Lanceolata* wood and other products to prove that such products come from a legal source. The document suggests three approaches for tracing *O. Lanceolata* such as log/wood tagging, measurement of volumes by DFOs of respective source districts and a post harvest stock survey to achieve an effective wood tracking system for legality assurance along its chain of custody.

O. Lanceolata wood supply and the chain of custody

In a forestry context, the "wood supply chain" may be regarded as a series of handling and processing stages that begin with standing trees in the forest and end with final wood products. The ownership and control aspect of the *O. Lanceolata* wood supply chain is referred to as the "chain of custody"—the custodial sequence that occurs as ownership or control of the *O. Lanceolata* wood supply is transferred from one custodian to another along the supply chain. A "chain of custody system" or Tracking system (To be used interchangeably in this section), comprises of a set of technologies, procedures, and documents that are used to provide information useful for managing the wood supply chain. Using a well-designed tracing system, the manager of a wood supply chain (or of any link in that chain) should be able to determine where the *O. Lanceolata* wood supply is coming from, where it is at any point in time, where it is intended to go, and when it is scheduled to arrive there. Also available should be information on species and volumes and the system should be able to trace the *O. Lanceolata* wood back to its origin so that this information can be tied directly to forest management. When properly applied, tracing can be used to expose the wood theft and to prevent scrupulous operators from mixing illegally sourced *O. Lanceolata wood* with others of legal origin, a practice known as "wood laundering". Tracing systems are thus essential components of any effort to reduce illegal harvesting. But they are also of direct financial benefit to the forest industry because of the information they provide to managers, both in the forest and in manufacturing facilities. Such systems are widely used in many other industries for purposes such as quality management, safety, and financial control, and they can provide the same benefits to the forest industry in Uganda. To be effective, tracing systems for *O. Lanceolata* wood and processed products must be based on the principles of identification, segregation, and documentation:

- **Identification**

  O. Lanceolata wood or other products must be identified using some type of labelling technology. Product identification is one of the simplest ways of tracing

a product. By using a mark or label of some kind the product is clearly identified as being from a particular source. However, there are two problems that need to be considered when using identification for chain of custody in the wood supply chain. Firstly, the material will undergo many changes as it progresses through the supply chain (e.g., from log to sawn timber to furniture) and the identification marks may be lost. Therefore, identification is often only effective for one stage in the process. Secondly, identifying marks and labels can be forged. Therefore, either identification must be combined with segregation and documentation as discussed below, or a more sophisticated labelling approach that is difficult to forge is required.

- ✓ Hammer or scribe marks: Commonly used to mark individual logs, mainly for large sawmill or plywood logs.
- ✓ Paint: Ranges from a simple colour painted on the end of a log or piece of sawn timber to allow easy identification, to high-tech chemical tracer paints used to mark and track logs and wood products.
- ✓ Labels: Most simple are painted words or letters or written labels attached to a log, a pallet load of sawn wood, etc. More sophisticated labels include barcodes which can be linked electronically to documentation.
- ✓ Tracing material: Radio transmitters, micro tags, chemical paints, isotope marking, etc.

Segregation

Segregation works by physically separating the material of interest from any other similar material with which it might become mixed. It is a very effective method for preventing accidental mixing, but is rarely sufficient on its own to prevent fraud. There are many ways in which segregation is used. They include:

BETWEEN processing stages:

- ✓ A particular truck only carries logs from a single harvesting location, preventing accidental mixing with logs from an unknown source.
- ✓ Trucks carrying logs from a harvesting site or concession are only allowed to use predefined routes, ensuring that they are not accidentally confused with trucks carrying logs from unknown sources.
- ✓ A truck only loads logs from legal sources, ensuring that no mixing of legal and illegal logs can occur during loading or unloading.

WITHIN processing stages:

- ✓ Separate storage areas in a log yard: It is already common practice to segregate logs by species, size, and quality in log yards. This can be extended to segregation of, for example, logs from a known legal source from those obtained through third parties.
- ✓ Separate production lines within a factory: Where a processing facility has more than one production line doing the same thing, specific lines can be dedicated to processing only a certain type of product (e.g., wood from known legal sources) to reduce the potential for accidental mixing.
- ✓ Separate processing facilities: By deciding that a particular processing facility such as a mill or a factory will use only one type of raw material (e.g., only logs from legal sources) the chain of custody is greatly simplified since it only needs to be in place up to the point of entry of the raw material to the facility and then again from the point where the product leaves the facility. There is no need for any tracing within the processing facility.
- ✓ Separation in time can also be used, for example, by using a batch system so that where only one production line is available it is used first to process wood from a known source, and then the next batch is from an unknown source.

❖ **Documentation and records**

The labels affixed to the wood or other products must be keyed to documentation so that information on wood volume, species, and other attributes is available to managers of the supply chain. Documentation and record keeping are essential to all chains of custody. Often ‘documents’ are now computerized and ‘records’ are contained in electronic databases but the principle remains the same. In fact, the increased use of computerized data and records can contribute to a more effective and secure chain of custody in many situations. For the purposes of this document, a document is anything that is written. This may include a bill of loading or a procedure for performing an activity. A record is an instance of a document that describes an activity or measurement at a particular point in time. A huge range of documents and records can be used as part of a *O. lanceolata* tracking system. The types of documents used include:

- ✓ Documents related to harvesting such as inventory, harvesting block records, harvesting permits, sales documents, tree information (Appendix 1).

- ✓ Transport documentation such as permits, loading records, transport dockets, weighbridge information, and customs documents.
- ✓ Process records such as goods-in records, stock control, batch records. Most organizations already have many types of documents and, wherever possible existing documents and record-keeping systems should be used in developing the *O. lanceolata* tracking system. However, when the required documents are not available it may be necessary to adapt or even develop the required documents.

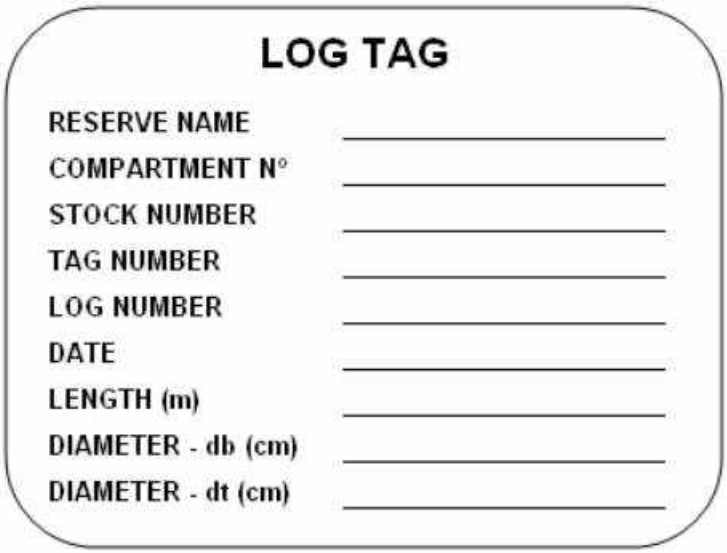
Labelling technologies

Although a wide range of labelling options is available for *O. Lanceolata* wood/product tracking systems, most of these labelling technologies are not perfect, but some two types have proved more effective and these are:

a) Conventional labels

This technology is made of paper or plastic on which barcode information has been imprinted (de la Rochfordière 2002). they are probably the best all-around choice for chain of custody systems in the forest sector. Such labels are more difficult to counterfeit than lower technology labels. They can be scanned electronically or read manually if necessary. They are typically affixed to logs or other products with staples, and experience suggests that 1-5% of the labels will become detached during transport or handling. Procedures must therefore accommodate the fact that some logs will arrive at the destination without labels.

Figure 1 Tag produced by Signumat with removable tag.



The tag number must be pre-printed on the tag and there must be an additional space for entering the TIF number. There must be a space for inserting the stump tag number.

Figure 2: Document log tag for labelling

In south and central Sweden paper tags are used instead of stamping a number. The paper tags are attached to log ends and contain information about seller, buyer and the WO. The number of tags should, like with the stamped marks in northern Sweden, be attached in a sufficient number to make sure that each truck-load will contain at least one marked log.

Figure x. Marked log ends (left) and paper tags (right).

When the timber is loaded on trucks (which is the normal case) at the roadside it is the responsibility of the person loading the truck to check that each load contains marked logs.

Figure 3: A Screenshot two types of log labelling used in Sweden. The wordings give details of their application and conditions. Such methods could also be applied in Uganda.

b) Radio-frequency identification (RFID) labels

This technology represents a more advanced technology that holds considerable promise for use in *O. Lanceolata* wood tracking systems. However, currently, they are too expensive to use for labelling individual products in the field.

To be most effective, labelling technologies selected for use in a tracking system should facilitate rapid collection of large amounts of data that can be electronically time stamped and cross-checked against records made at other checkpoints in order to detect (and deter) tampering. In particular, labels that can be scanned electronically such as those that have been imprinted with bar codes or that can be accessed using radio signals such as RFID labels offer significant advantages over other types of labels. As with all technological systems, however, it is essential to have a manual backup for times when the technology fails. The manual backup must be designed so that data captured manually can be entered into the electronic system as soon as the capability has been restored. However, owing to its high technological and cost requirements, this document recommends "Conventional labels" for *O. Lanceolata* in Uganda

Proposed *O. lanceolata* tracking system in Uganda

Conventional labelling system of *O. Lanceolata* tracking system has been proposed in this document for its simplicity and efficiency for consideration by MWE. Its aim is to tighten the planning controls on *O. Lanceolata* utilisation and at the same time to ensure that the interests of the communities and land owners are fully taken into account through the specification of the Social Responsibility Agreements. This is important in getting information from the harvester where he/she intends to harvest from, in case of private land and or protected area for a pre-assessment to delineate the coup and determine the allowable cut for licensing and traceability (Bennet and van Hensbergen 2011).

This document therefore proposes measures to increase Uganda's capacity to control illegal harvesting, movement and trade in *O. Lanceolata* wood and products. The measures include compliance and licensing for all *O. Lanceolata* wood harvests and product trade. The established system checks compliance with the laws governing forestry in Uganda and monitors legal compliance through the production chain from the field to the border point of exportation. The system will improve the traceability of *O. Lanceolata* wood and products from the forest where it was harvested until the point of export. When enhanced with digital technology uploaded with all the required location and tree information codes, it will also be able to deliver the verification information to the central control center (MWE) to assure that the product is of legal origin within Uganda. The system is based on bar coded tree and wood tags which are scanned by hand held computers which contain a GPS locator so that information is linked to a geographical location with a high level of precision (+/-10m). The *O. Lanceolata wood* information is recorded and this is automatically uploaded to a central computer database where it can be verified. Wood measurements are taken and recorded on the

system. When measurements are taken in transit control points, the measures are correlated with the original measurement in order to detect anomalies.

While data on quantities is very important, it is not sufficient on its own to secure the wood supply chain. The second part of a reliable chain of custody is the management of critical control points. Critical control points are all the points in the supply chain where unauthorized material could enter or leave the system (e.g., where illegal product could be introduced).

Implementation of *O. Lanceolata* tracking

- Within the forest

Information on quantities: Information on the amount of product in the forest is provided by good forest inventory data including standing volumes and diameter size distributions. Corresponding information on what has been harvested is provided by records such as log grades and dimensions. This information needs to be systematically collected and compared. One must take into account to control/manage critical points like forest exit.

Table 1: Example of field document for *O. Lanceolata* tracking

	Number of stems per Ha. by							
Location/ compartment/ Coup	**Diameter (30 cm high) size class(m)**					**Basal area (m^2/ha)**	**Stem height (m)**	**Volume (m^3/ha)**
Total								

- While on transportation from the forest to factory or exit border point

Securing the chain of custody of logs being transported to the mill or being sent for export is one of the most difficult challenges facing the wood products industry. One reason for this is that unlike later stages, this stage is usually remote, spread over large distances, and poorly monitored. Therefore, it is the stage where both the system and the technology may need to be relatively complex in order to ensure reliability. Forest to the factory or customs exit point of custody can include:

Information on quantities: Information on the quantity of logs/wood should be recorded in the forest as discussed above, and again at the point of reception (e.g., the factory yard or the customs). These numbers should then be compared. In addition, information on quantities,

particularly volumes or weights, is often required for transportation by truck and this information should also be used wherever possible.

Managing critical control points: The whole journey from the forest to the factory or exit border point includes the potential for mixing and should be treated as a critical control point. There are many different ways of controlling this, ranging from sophisticated marking of individual logs using high-tech labels or markers to simple, document-based systems for low-value wood based on control of transport.

- Moving material between processors

Chain of custody between processors tends to be controlled by comparing information on what the supplier sells with information on what the customer purchases. This is usually done from order forms, sales documents, invoices and transport documents including customs declarations where available. However, it is also possible to use segregation, such as packing product on pallets, in containers or in boxes, simultaneously with identification through labelling of products (Dykstra *et al.*, 2002).

RECOMMENDATIONS

1) There is need for labelling and tracking *O. lanceolate* logs/wood and its finished products at a batch level without individual marking since the logs/wood are often of small sizes, taking several pieces to fill a truck, making it tedious and costly to label individual pieces. Documentation should consider total volume in a batch of logs loaded in a truck and barcode labels secured on three or five bigger logs/pieces to avoid lost tags due to transportation.
2) *O. lanceolate* logs/wood and wood product tracking should be embedded into the existing physical infrastructure and need to be adapted to conditions present on the ground. It is therefore important in the planning phase of implementing systems that developers have a good understanding of these on the ground conditions (e.g. quality and availability of internet connections) and whether any considerations need to be made before the tracking system can begin to be implemented;
3) When computerized system is to be used, backup system using paper-based systems shall be important. In such a way, staff shall have to be trained on this computerized system for efficiency and effectiveness.
4) The security measures required for the systems and additional verification methods need to be chosen according to the situation in-country and locally on the ground.

Additional verification methods such genetic and isotopic sampling may become necessary if the instances of fraud encountered are high;

5) Use of barcodes and handheld PCs for data capturing processes are well developed and have reached the operational stage in forestry and many other sectors. This standard method should always be considered before moving to more advanced tags or data capturing methods
6) Only tracking systems cannot overcome weak governance. They are embedded into the legal system in Uganda. If the legal systems are weak then *O. lanceolate* logs/wood and products tracking systems on their own will not be able to reduce fraud and combat illegal harvest, movement and trade in Uganda.

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Appendices

Appendix 1: Example of tree information form

Tree information

No.:

Company_____ **Property mark**_____
Reserve_____ **Compartment**_____
District_____ **Locality mark**_____ **Landowner**_____

Stock survey No.	Tag No.	Species	species code	Tree/stem height	Stem diameter (30 cm)	Volume (m3)

Recorded by_____
Designation_____
Date:_____
_

Verified by_____
Designation_____
Date:_____

Appendix 2: Log information form

Log information Form

No.:

Company_____ **Property mark**_____

Reserve_____ **Compartment**_____ **Concession**_____

District_____ **Locality mark**_____ **Landowner**_____

Stock survey No./ Tree No.	**Tag No.**	**Log No.**	**Log length**	**Log diameter (cm)**	**Volume (m3)**
Total No. of logs:_____		Total Volume:_____			

Recorded by_____

Designation_____

Date:_____

Verified by_____

Designation_____

Date:_____

Appendix 3: Log measurement and conveyance certificate

Log measurement and conveyance certificate

No.:

Company_____ **Owner's name**_____

Property mark_____ **Vehicle regn No.**_____ **Check point**_____

Forest_____ **Destination**_____ **Locality mark**_____ **ID No.**_____

Stock No.	**Tree No.**	**No. of Logs**	**Average length**	**Average diameter (cm)**	**Volume (m3)**

Logs have been measured and recorded by:

_____

Forest Officer's signature

In the presence of:

_____

Company representative's signature

Verified by:

_____

District Forest Officer 's sign and stamp

Appendix 4: *O. lanceolata* movement permit

Movement permit/Way bill No: _____ Date_____	
District start_____	Destination_____
Vehicle registration No_____	Driver's name_____
Trip No_____	Property mark_____
Species loaded_____	Type of label_____
Mark used_____	
Volume/Quantity of logs/wood loaded_____ Vehicle mileage at start_____	Start time_____
Authorized officer's name_____ Signature and stamp_____ Date_____	

Appendix 5: Proposed Tracking document for *O.lanceolata* movement in Uganda. This can be uploaded into a software and used online for tracking wood and products within the country.

General Information	
Date:_____	Species:_____
Batch number:_____	Species code:_____
General product features	
Feature item:	**Feature Value**
Volume	_____
Company	_____
Tree ID	_____
Verification date	_____
Transportation document number	_____
Compartment number	_____
Consention number	_____
District of harvest	_____
Geographical location (GPS points)	_____
Truck registration number	_____
Consignment unit GTS ID	_____
Consignment order number	_____
Invoice number	_____
Issuing officer's name	_____
Verification officers' name	_____
References	
Reference to:_____	Reference from:_____
Commodity type:_____	Quantity:_____

Source: *Modified from the Global Traceability Solutions*

*This form needs to be accompanied with CITES permit

OSYRIS LANCEOLATA (EAST AFRICAN SANDALWOOD) IN UGANDA: STANDING STOCK AND UTILIZATION PRACTICES

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Summary

At its 16th Conference of Parties (CoP16) in 2013, the Convention on International Trade in Endangered Species (CITES) listed the east African Sandalwood (*Osyris lanceolata* Hochst. & Steud) in Appendix II as a threatened species. In response, the ministry of Water and Environment (MWE) first burned the exportation. Furthermore, the ministry launched this study to determine the standing stock and harvesting practices in order to set harvesting quarters. Hence, the objective of this study was to conduct stock inventory of *O. lanceolata* in selected districts of Uganda in order to better understand its distribution and standing density its geographic range in Uganda and also identify the utilization practices. The study was conducted in the nine districts of the Karamoja sub-region, known to host bulk of the species. Stock inventories were conducted using 1-ha plots located in various vegetation types complemented by key informant interviews to determine the harvesting, trade and utilization practices. Generally, the local communities are not aware of value of *O. lanceolata* as a raw material for essential oil. Hence, the tree is mostly harvested for charcoal and fuelwood. *O. lanceolata* was found to exist in five out of the nine sampled districts. At a density of 20±2 individuals per ha, basal area of 0.12 ± 0.03 m^2/ha and volume of 14.45 m^3/ha, the current standing stock is deemed low to sustain commercial production of raw material for sandalwood oil. Given the slow growing nature of this species and the continued harvesting for charcoal and other local uses, it is presumed that even in the next 10 years, Uganda would not have enough volume of *O. lanceolata* to engage in commercial production of sandalwood oil. Based on the observed stocks, it was recommended to halt exploitation to allow for significant regeneration. It is also recommended that propagation and domestication efforts be promoted to hasten increase in standing stock. Capacity building of district staff and local community to identify *O. lanceolata* and community sensitization could help monitoring trade and utilization.

Keywords: *Osyris lanceolata;* Abundance; *Harvesting; Trade, Uganda.*

1.0 BACKGROUND

The East African Sandalwood (*Osyris lanceolata* Hochst. & Steud) is a threatened species listed in Appendix II of the Convention on International Trade in Endangered Species (CITES) at CoP16 in 2013. The species is known to be indigenous to East Africa. In Uganda, it thrives along the Kenya-Uganda boarder regions in Sebei and Karamoja sub regions. The species has also been reported to be existing in Kigezi region and suspected also to exist along the cattle corridor of Nakasongola–Kiruhura. In all these cases, there is lack of empirical evidence to ascertain the species standing stock. Yet, recently, the species gained popularity due to the commercial value of its oil. Increasing demand for the oil from *O. lanceolata* has resulted into its over-exploitation in the wild. Some studies (e.g. Mukonyi et al., 2011) have shown the concentration of Sandalwood oil is higher in the roots than the trunk and this has led to the harvesting of the whole plant. This has significantly increased the threat of extinction of the species. Despite the known commercial importance coupled with its local importance, the current standing stock of *O. lanceolata* in Uganda is not known.

Like many woodland tree species, *O. lanceolata* serves many purposes including fuel wood, medicine, animal food, cultural and ecosystem services such as providing shade as well as soil and water conservation. In order to conserve and protect the value of this specie for now and future generations, there is need to conduct tree inventories. Tree stock inventory is the first step in conserving any plant or animal species. Thus, it is imperative to conduct tree stock inventories for all tree species especially those in the wild and of economic importance since this provides data for planning, monitoring, evaluation, research, growth and yield. Such assessment can ensure sustainable yield and prevent extinction of economic tree species like *O. lanceolata*.

Upon this premise, FSSD engaged NaFORRI to conduct stock inventory of *O. lanceolata* in selected districts of Uganda in order to better understand its distribution and standing density. Through the tree stock inventory, attempts are made to describe quantity, quality, and stocking density of the trees in their habitat as well as many characteristics of land upon which the trees are growing towards the efficient and sustainable management of the species. The outcome of this information may include designing harvesting quarters, zoning of harvesting areas, surveillance regimes of major trade routes, and developing guidelines on harvesting and

propagation methods. The aim of this study was to generate information on the basis of which MWE will design conservation strategies and plans for *O. lanceolata* in Uganda.

Specifically, the study intended to:

- Determine the distribution and standing stock of *O. lanceolata* in selected sites in Uganda
- Determine the yield and inform the harvesting quota of *O. lanceolata* in Uganda.

2.0 STUDY AREA AND METHODOLOGY

The study was conducted in the Karamoja and Elgon regions of Uganda where *O. lanceolata* is reported to exist (Eggeling and Dale, 1962). Karamoja lies between latitudes 1° 30′ and 4° N, and longitudes 33° 30′ and 35° E in north-eastern Uganda. Specifically, in Karamoja region, eight districts were sampled i.e., Nakapiripirit, Amudat, Moroto, Napak, Kotido, Abim, Kaabong and Karenga while in the Elgon region, Bukwo District was considered (Figure 1). Bukwo District is located on the northern slopes of Mt Elgon between latitudes 1° 16’ 0’’N and longitudes 34° 44’ 0’’E.

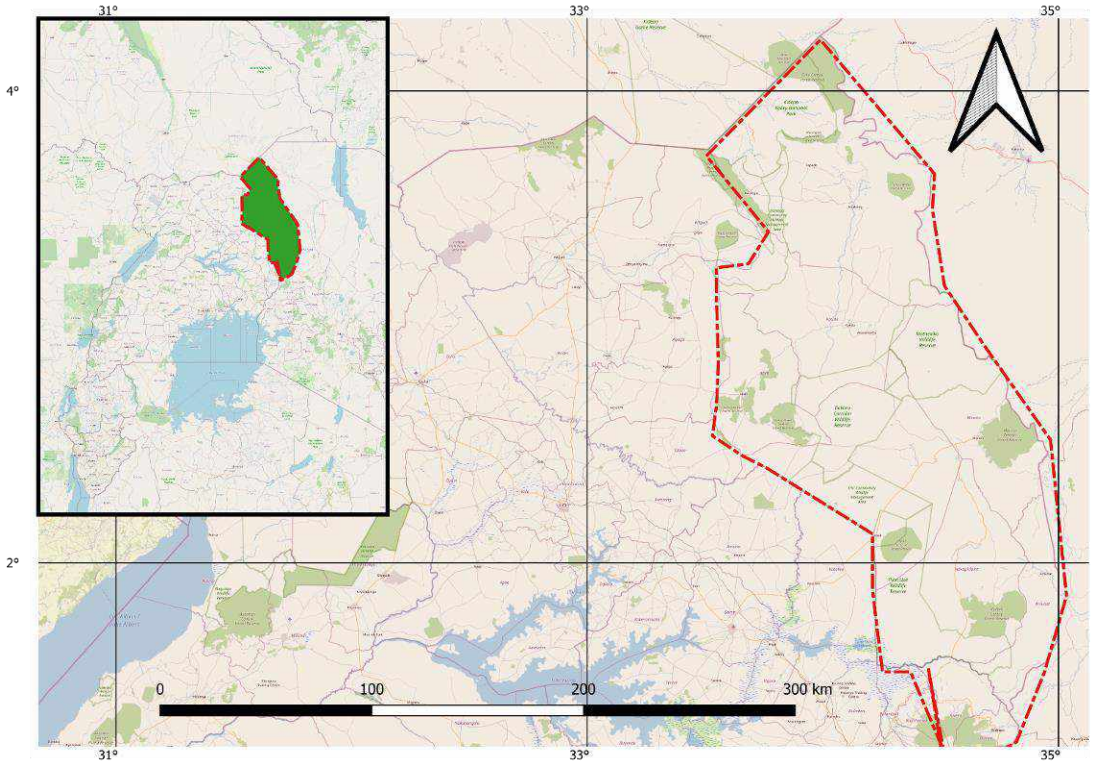

Figure 1: Map of Uganda (inset) showing the study area (expanded view outlined with red dashes)

2.1 Description of the study area

2.1.1 Topography and climate

Karamoja region is generally flat but the elevation is lower in the west and higher in the east. The region has a few isolated mountains that are largely the remainder of much older mountains. Inselbergs, outcrops of basement rocks, are present throughout the Karamoja landscape. The mountains consist of rock and crystalline basement. Many mountains in Karamoja's periphery are over 3000 m, including Mount Kadam, Napaka and Moroto (Dopeth Project, 2015). The climate in Karamoja region is semi-arid and it experiences sporadic unimodal rainfall patterns with one long rainy season, which runs from March/April to September/October and a hot dry season from November to March. The average rainfall ranges between 700 and 1000mm per year. This annual total rainfall makes the region characterized as a sub-humid system. The temperatures in the region are high, ranging from a maximum of 28 to 32.5 °C to an average minimum of between 15 and 18 °C.

The altitude of Bukwo ranges from between 1200 – 4500 m.a.s.l, with relatively flat areas in the north-eastern part of the district and the hilly parts in the western part which is rugged all the way to Mt. Elgon (Bukwo District HRVP, 2016). Relatedly temperatures are higher is the north-eastern part and lower in the hilly western part. Nonetheless, temperatures are generally low due to the high altitude and the average temperature is 23°C. Just like Karamoja, Bukwo experiences unimodal rainfall pattern with an average of 920 – 1650 mm per annum. There is one long rainy season commencing from March/April and ending in October/November with the peak season in the months of June and August. The climate is tropical humid and the highest humidity levels are experienced in the rainy season and the lowest in the dry season.

2.1.2 Soils

The soils in Karamoja are highly variable due to lithological differences whereby the cambisols predominate the west, while the valleys and flood plains are covered with a mixture of cambisols and vertisols and the eastern highlands are covered by leptosols. Cambisols are typically well-drained sandy loams, loams and sandy soils, which are known for their reasonable fertlity and suitability for mechanized agriculture (UN FAO 2009). Vertisols are black and dark grey soils with a very high clay content. In general, these soils are low in organic matter, have a medium

moisture storage capacity and a poor drainage capacity, and are very prone to erosion. Leptosols in the far eastern highlands, at the border with Kenya are mostly sandy gravels and red sandy loams, all with a notable very low fertility. These soils hardly support any vegetation and are most suitable for extensive (migrant) pastoral activities.

The soils in Bukwo are rich and fertile volcanic soils derived agglomerate from Mount Elgon.

2.1.3 Vegetation and Land use

Karamoja region can be divided into three key livelihood zones, which are known as the Western agricultural zone, the Central agro-pastoral zone and the Eastern pastoral zone. This zoning applies to most geophysical characteristics of the region, including topography, soils, natural vegetation, precipitation and climate change scenarios. The Western wet green belt agricultural zone is characterized by hills, mountains and plains cut by valleys and rivers. The Central agro-pastoral zone is predominantly made up by undulating plains with isolated inselbergs (monolithic outcrops), seasonal rivers and gullies. The Eastern pastoral zone is a rugged terrain with gullies and rills.

Bukwo district is characterized by several land uses including subsistence farmland, which accounts for the largest part (33%) followed by tropical high forests and bushland (31%) and the rest of the landuses, i.e., broadleaved tree plantations, corniferous plantations, built up areas, commercial farmland and woodland account for 4.5%.

2.2 Data collection

For each site, qualitative data was collected using interviews and quantitative data collected using Exploratory Inventory techniques that combined transect survey and temporal sample plots.

Sampling design

2.2.1 Identification of potential survey sites

Selection of potential survey sites was informed by information from semi structured interviews combined with information from literature. Semi structured interviews were conducted with key informants who included DFOs, DNROs, NFA personnel and community members who are involved in trade. The interviews were geared towards generating information on the knowledge

of the species in the area, its location and suitable habitats, its uses and knowledge about harvesting the species for trade. Evidence from literature shows that *O. lanceolata* grows in rocky areas and is sparsely distributed hence not many people have seen this specie. However, for the districts where it is located, local government personnel and community members who were involved in its trade are likely to be knowledgeable about its location, distribution and uses. This data was used to supplement data from the stock inventory.

2.2.2 Stock inventory

Stratified sampling design was employed at ecosystem level but at site level purposive sampling design was used whereby we sampled in un cultivated bushland sites where *O. lanceolata* was believed to have existed. Transect lines running from one boarder of each district to the other were laid in potential sites for *O. lanceolata*. These transect lines were roads and to avoid the edge effect, the sample plots were established >100m from the road. Circular sample plots of radius 39.9 m size (forming approximately 5000 m^2) were established at 1 km interval between the transects. In each sample plot, we recorded: the number of *O. lanceolata* encountered, diameter of each tree at 30 cm point above the ground; total height of the tree, number of stems for each tree; any sign of harvesting, coppicing or seed regeneration; landuse type; general vegetation type; slope and aspect; altitude; and associated tree species. Also recorded was the GPS coordinates of the site where data was collected. We also collected voucher specimen from different sites for the herbarium and further phenotypic classification.

Data analysis

From the diameter and height measurements, the following variables were computed using standard procedures:

a) Standing density (trees/ha) = one hectare (m^2)/area of the plot (m^2) x number of trees counted in the plot
b) Basal area (BA) (m^2) = pi*DBH^2/40000
c) Basal area/ha (BA/ha) = one hectare (m^2)/area of the plot (m^2) x BA
d) Volume (m^3) = 0.42*BA*Height

The data was then statistically analysed in SPSS ver. 20 whereby ANOVA test with posthoc comparisons were used to compare means. Pearson's correlation tests were used to test the relationships between elevation and different growth parameters.

3.0 RESULTS

A total of sixteen key informants were interviewed, these were mainly comprised of local government personnel and other persons of interest (persons who were directly involved in the commercial harvesting or trade of *O. lanceolata*) (Photo 1). From the interviews, it was evident that this species is not known by all the relevant local government (DFOs, DNROs or DEOs) in the belt where it is deemed to exist. Hence, while some local government personnel (DFOs, DNROs, LCs, Sub-county chiefs and NFA personnel) in the districts of Bukwo, Nakapiripirit, Moroto, Amudat, and Kaabong knew about this species, those of Napak, Kotido, Abim and Karenga were not sure about the species.

Photo 1: *Consultations with key informants in: (a) NFA personnel in Abim District; (b) Forest supervisor Kaabong District; (c) Land owner in Riwa Subcounty on whose land existed O. lanceolata trees, Bukwo whose land had O. lanceolata trees; (d) Forest guide in Amudat District; (e) Out going LC5 chairperson Amudat; (f) LC1 Moruita sub-county Nakapiripirit.*

3.1 Findings from Key Informant Interviews

3.1.1 Utilisation

Although media reports indicate that *O. lanceolata* was traded commercially, this was not popular knowledge among the local people. As such, some of the local people we interacted with informally, did not know the commercial value of this species. Hence, it is not indiscriminately targeted for any economic use. Like most woodland woody species, *O. lanceolata* trees are mainly used for:

- Fuelwood;
- Charcoal;
- Fencing and construction poles;
- The charcoal is used for milk preservation;
- Leaves, roots and stem bark have medicinal value for treating stomachache, backache, joint pains, infertility in men and typhoid.
- The Karamojong also use the stem to make beautiful walking sticks (due to the brown-reddish stem);
- The species also has a cultural value. In Amudat it was mentioned that it is used during circumcision periods to separate the circumcised from the uncircumcised.

3.1.2 Distribution and abundance

According to the DFOs and DNROs with knowledge about *O. lanceolata*, the species is not uniformly distributed all over the district. It is localized to rocky areas and can be found both on hilly or low-lying areas. The responses in regards to abundance of the species varied between and within districts. For instance, the DFO, DNRO and the business man from Bukwo mentioned that this species is rare while the councilor in Riwo Sub-county in Bukwo mentioned that is abundant in the bushlands. Also, in Amudat, the out-going LC5 chairperson mentioned that the species is rare while one of our local field guides mentioned that is abundant especially in areas bordering the Pian Upe Wildlife Reserve.

3.1.3 Biology

From the KI interviews, it was mentioned that there seems to be two varieties of *O. lanceolata* or probably another species of *Osyris.* The DFO Bukwo mentioned that some of them have pointed leaves while others have round leaves. He also mentioned that the variety in Amudat is different from that in Bukwo. The DNRO Nakapiripirit mentioned that the varieties can be differentiated using the stem colour, apparently one of the varieties has a dark brown stem while the other has a creamish brown stem. However, the DNRO Nakapiripirit added that the spatial phenotypic differences observed in *O. lanceolata* trees may be due to the spatial variations in soil and climate conditions in the region. The LC1 Moruita Sub-county in Nakapiripirit mentioned that there might not be different varieties but instead there is a male and female tree (i.e., the plant is dioecious).

3.1.4 Harvesting

The local government officials mentioned that locally and is the case for must shrub woody species, people hardly fell the whole tree of *O. lanceolata* trees. The trees are mostly harvested for domestic uses or even for charcoal burning or fuelwood for selling. Even when they need the root for medicinal purposes, the local people do root pruning. They do not fell the whole tree. The KIs also mentioned that harvesting is mostly from wild populations, i.e., bushlands and communal grazing areas. Harvesting of *O. lanceolata* trees is not regulated except for some districts like Amudat where there are bylaws of harvesting woodland trees for charcoal.

3.1.5 Trade

The only districts which seemed to have been involved in trade were Bukwo, Nakapiripirit and Moroto. However, there was scanty information on the specifics of this trade. According to the local government personnel of the aforementioned districts, the issue of harvesting *O. lanceolata* trees for commercial reasons phased out by 2012. According to the DFO and one of the traders in Bukwo, commercial harvesting of *O. lanceolata* trees occurred in the sub counties bordering Amudat district where it is abundant. The DFO Moroto and Sub-county chief Tapac, mentioned that harvesting of the species for trade was done in Tapac Sub-county. Although, it has been said that some of the *O. lanceolata* trees were coming from Nakapiripirit, the DNRO denied that there was commercial harvesting of the species in the district. He however mentioned that sometime in the year 2012, a group of Asians were asking people in the district where they could

get *O. lanceolata* trees. But the local government officials were not aware of any large-scale harvesting of this species in the district.

The out-going LC5 chairperson of Amudat, mentioned that in the years 2010-2015, there were individuals who were harvesting many trees of *O. lanceolata*, but this was done illegally. They would disguise it in other logs of firewood and most of them would take it across the border to Kenya or down south to Mbale and Masaka.

We managed to interact with one of the business men in Bukwo district who was involved in the trade of *O. lanceolata* logs and he mentioned that currently there is no trade mainly because of the restrictions on both the Kenyan and Ugandan routes. He mentioned that on the Ugandan side they would harvest from the areas neighboring Amudat District and West Pokot on the Kenyan side where it was abundant. He said that they were not particular on the age or size of the log, so they would harvest trees of any size and age. According to the trader, there was no form of processing done to the tree locally apart from removing the leaves from the branches. Once the concession arrived at Tororo factory, he said that they would remove the bark and separate the sap wood from the heart wood. He further mentioned that it was a lucrative business in that they would spend about 300,000-600,000 Ushs for harvesting and loading and would be paid between 3.5m to 5m Ushs per fuso truck for delivering to the factory in Tororo District.

The trader also mentioned that they had a network of dealers on the Ugandan and Kenyan side whom they would collaborate with whenever they had an order.

3.1.6 Tracking and law enforcement

Phenotypic characteristics such as the flakes on the bark and the colour of the logs were used to differentiate *O. lanceolata* logs from other logs because illegal harvesters normally disguise is as firewood from common species such as *Acacia* or *Combretum spp*. According to the DFO Bukwo and DNRO Nakapiripirit, the bark is used to check if a log is of *O. lanceolata* because of the unique shape of the bark scrapes. Apparently, the stem has a pleasant scent which is distinct and can be used to track the logs. Hence, dark brown or brownish colour of the stem, the shape of the bark scrapes, the easily scrapeable bark and the scent of the wood are some of the features that are currently used by LG officials to identify logs of *O. lanceolata.*

The DFO Bukwo mentioned that besides the personnel in the environmental department at the district headquarters, they have sensitized the police officers in the area on how to differentiate the species. These are involved in law enforcement and effecting the regulations of harvesting this tree species in the area. He mentioned that in the the year 2014, they impounded 2 trucks which were transporting logs of *O. lanceolata* to Mbale, but eventually these were set free and he is not sure what became of the harvest. The outgoing LC5 Chairperson Amudat mentioned that he also involved the police force in tracking this species and impounding trucks which were transporting it.

3.2 Findings from the exploratory inventory

From the nine districts surveyed according to the proposed study area, only five were confirmed to have *O. lanceolata* trees. Hence, we purposively sampled the districts of Bukwo, Nakapiripirit, Moroto, Amudat and Kaabong (**Figure 2)**. Table 1 below shows the current status of *O. lanceolata* in the five districts.

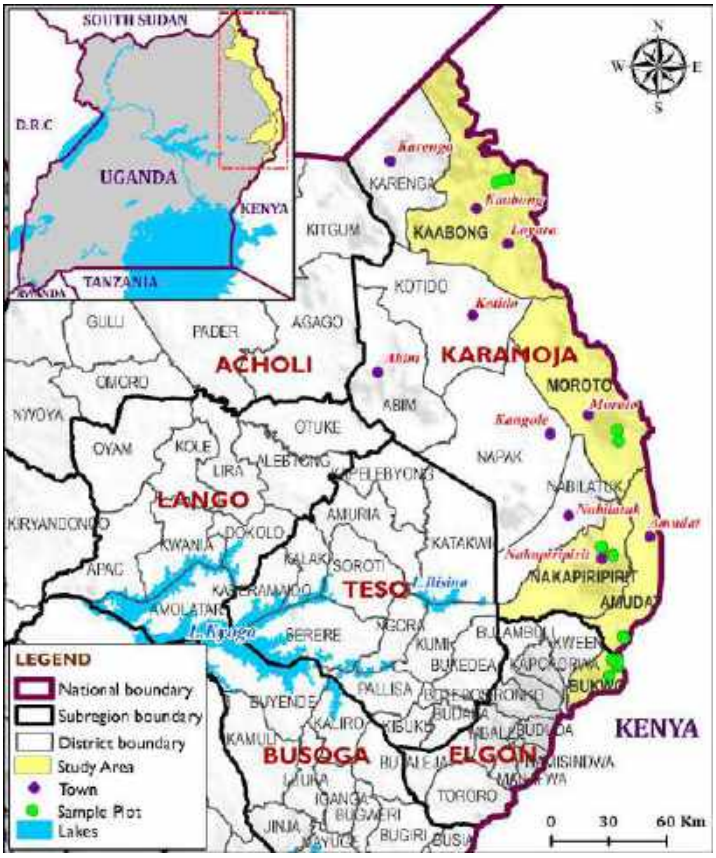

Figure 2: Distribution of the sampling sites within the study area

3.2.1 Distribution and standing stock of *O. lanceolata* in Karamoja and Elgon region

O. lanceolata trees were mainly found in rocky areas, which were void of lush vegetation at an altitudinal range of 1300-2000 masl. The standing density varied within and between districts, hence the trees are not evenly distributed. Nakapiripirit and Moroto districts have the highest standing density/ha while Amudat and Bukwo have the lowest standing density/ha of *O. lanceolata* trees (Table 1). Diameter of *O. lanceolata* trees at 30 cm height from the ground ranged from 0.8 cm to 80.6 cm with the mean being 5.23±0.29 cm (Table 1). Diameter of the trees varied within and between the districts ($F_{4,449}$=12.0, p=0.000) whereby the largest trees were recorded in Kaabong and Nakapiripirit and the smallest in Bukwo and Amudat (Table 1). Most of the trees sampled in all districts were within the smaller diameter size class, i.e., 0.5-10.5 cm (Figure 3).

Table 1: Standing stock parameters of *O. lanceolata* in the selected districts of Karamoja and Elgon regions of Uganda

District	No of trees sampled	Mean standing density/ha	DBH (cm)	Height (m)	Basal Area (m^2)/ha	Volume (m^3)/ha
Nakapiripirit	148	20±2	6.72±0.65	4.581±0.14	0.17±0.05	0.1±0.04
Kaabong	49	18±5	8.79±1.45	3.21±0.20	0.34±0.16	0.18±0.07
Moroto	95	32±7	4.40±0.27	3.38±0.14	0.07±0.02	0.02±0.004
Amudat	44	14±1	4.07±0.33	4.47±0.17	0.06±0.003	0.02±0.003
Bukwo	117	16±3	3.00±0.22	2.51±0.07	0.04±0.02	0.01±0.001

The cells represent mean ±standard error values.

Relatedly, height of the trees ranged from 1 to 10 m with the mean height of 3.64±0.07 m and this varied greatly among the districts ($F_{4,449}$=46.0, p=0.0001) (Table 1). The tallest trees were recorded in Nakapiripirit and Amudat districts. Most of the trees sampled fell within the low height class size (Figure 4).

Additionally, the mean basal area was 0.12 ± 0.03 m^2/ha. Nakapiripirit and Kaabong had the largest basal area ($F_{4,449}$=2.9, p=0.02) and highest standing volumes per ha ($F_{4,449}$=3.8, p=0.004) respectively. These were the districts with larger stems, most of which were single unharvested mature stems. Amudat, Bukwo and Moroto where harvesting is said to have taken place have the

lowest basal area and standing volume per hectare. Most of the stems in these three districts were resprouts from illegally harvested stems.

Most of individual stems which were measured and counted were coppices from harvested stems. Such harvested stems had between 3-5 coppices which were counted as individual trees if they emerged below 30 cm from above the ground. It was also noted that these coppices came from 231 main stems with 4.02 m^2 as their total basal area. Hence based on the average tree height and diameter the standing volume of *O. lanceolata* trees was estimated to be 14.446 m^3 per hectare.

The spatial variations the stocking density of *O. lanceolata* could be due to anthropogenic disturbances such as rate of harvesting for charcoal and fuel wood and variations in the aridity, soil conditions and rainfall amount in the sampled districts. It was observed that *O. lanceolata* grows mainly in rocky sites where the vegetation is not lush.

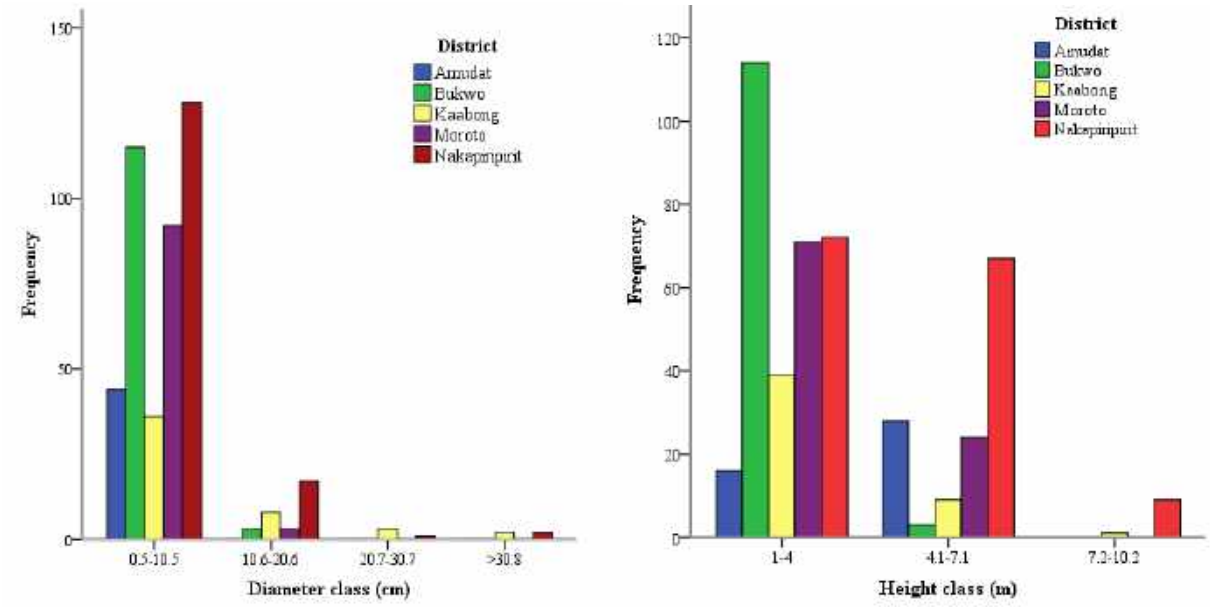

Figure 3: Diameter (Left) and Height (Right) distribution of *O. lanceolata* in the Karamoja sub-region of Uganda

3.2.2 Relationship between elevation and growth parameters

Although standing density per hectare tended to decrease with elevation, the relationship was not significant (r=-0.06, p=0.76). However, basal area and height of trees were inversely correlated to elevation albeit the relationship is weak (Pearson coefficient: for BA r=-0.484, p=0.000; for height r=-0.44, p=0.03;) (Figures 5). This suggests that at higher elevations, site occupancy or standing density reduces and the trees are shorter.

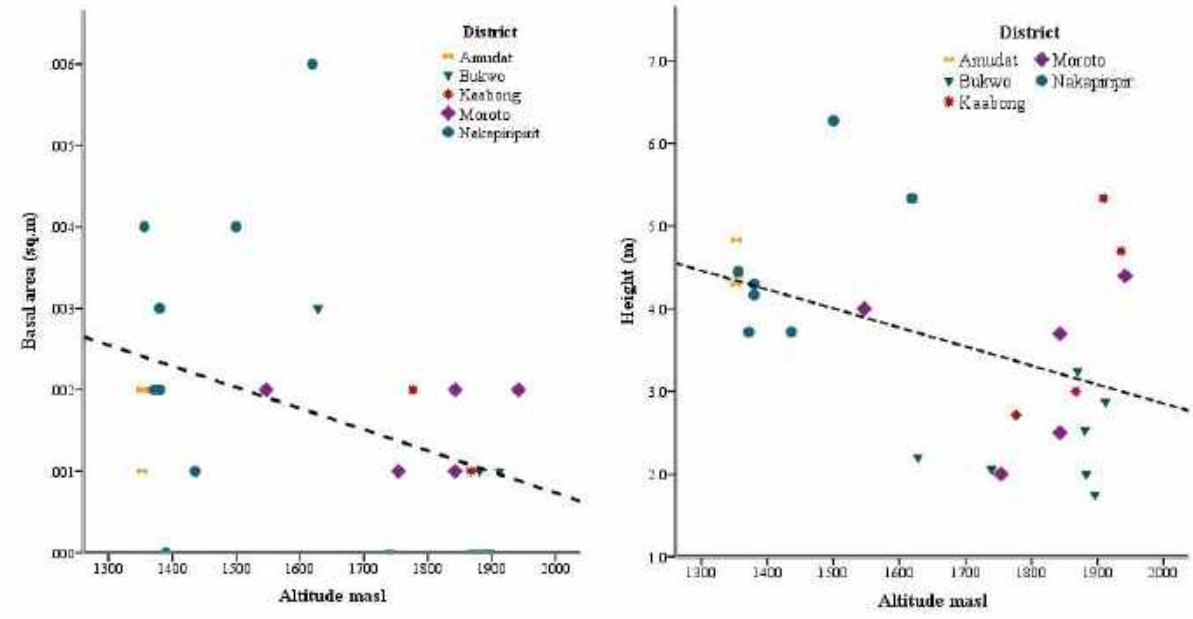

Figure 5: Relationship between Basal area (Left) and height (Right) of *Osyris lanceolata* trees and elevation in the Karamoja sub-region of Uganda

3.2.3 Yield projection

In the absence of mean annual increment data (MAI), diameter size classes were used to generate the yield projection spanning ten years (Table 2) and this is the basis for formulation of harvesting quotas. It presents the current standing volume in the different study districts per size class and yield projections. This data was used to make propositions for harvesting quotas in five-year harvesting schedules and a ten-year harvesting circle based on the slow growing nature of the tree. Nakapiripirit and Kaabong districts currently have mature trees of *O. lanceolata* of 3.72 m^3 and 2.65 m^3 per ha; scheduled as per the data as ready for harvest. However, this volume merely totals to 6.365 m^3 per ha, which cannot sustain industrial processing (Table 2).

Generally, the data shows that the standing volume per ha. is very low with equally low regeneration and recruitment to sustain commercial production in the near future. This is further confirmed by the volume recorded in the intermediate size class of the advanced growth. This may explain why there is no large-scale harvesting of *O. lanceolata* currently.

Table 2: Yield projection for *O. lanceolata* in Uganda

			Volume m^3/ha by harvesting cycle		
District	**Diameter Size class (30 cm above the ground)**	**Stand status**	**Initial**	**Year 5**	**Year 10**
Kaabong	**≥ 0.4**	Harvest	2.65	0	3.55
	0.3 – 0.4	Advanced growth	0	2.39	2.37
	0.2 – 0.3	Medium growth	1.18	1.57	0.52
	0.1 – 0.2	Mini growth	0.79	0.34	
	≤ 0.1	Recruitments	0.17		
	Total	**Stand basal area m^2/ha**	**1.43**		
Moroto	**≥ 0.4**	Harvest	0	0	0
	0.3 – 0.4	Advanced growth	0	0	1.16
	0.2 – 0.3	Medium growth	0	0.58	2.99
	0.1 – 0.2	Mini growth	0.39	1.49	
	≤ 0.1	Recruitments	0.99		
	Total	**Stand basal area m^2/ha**	**0.523**		
Nakapiripirit	**≥ 0.4**	Harvest	3.72	0	1.72
	0.3 – 0.4	Advanced growth	0	1.15	5.27
	0.2 – 0.3	Medium growth	0.57	3.51	4.40
	0.1 – 0.2	Mini growth	1.76	2.93	
	≤ 0.1	Recruitments	1.47		
	Total	**Stand basal area m^2/ha**	**1.67**		
Amudat	**≥ 0.4**	Harvest	0	0	0
	0.3 – 0.4	Advanced growth	0	0	0
	0.2 – 0.3	Medium growth	0	0	1.67
	0.1 – 0.2	Mini growth	0	0.84	
	≤ 0.1	Recruitments	0.56		
	Total	**Stand basal area m^2/ha**	**0.20**		
Bukwo	**≥ 0.4**	Harvest	0	0	0
	0.3 – 0.4	Advanced growth	0	0	0
	0.2 – 0.3	Medium growth	0	0.28	0.60
	0.1 – 0.2	Mini growth	0.09	0.37	
	≤ 0.1	Recruitments	0.19		
	Total	**Stand basal area m^2/ha**	**0.18**		

Given the slow growing nature of *O. lanceolata*, it is presumed that inclusion of MAI data might not cause significant differences in the yield projections.

3.2.3 Tree species associated with *O. lanceolata*

There was variation in the tree species associated with *O. lanceolata* across the districts sampled. The species recorded were those which were within one metre of every Osyris tree in the sample plot. In Nakapiririt, it was mainly associated with *Euclea divinorum* Hiern, *Teclea nobilis* Del., *Rhus natalensis* Krauss, *Carissa edulis* Vahl and *Combretum molle* R. Br. ex G. Don. Other tree species which were rarely associated with *O. lanceolata* in this district include: *Croton sylvaticus* Hochst., *Terminalia glaucescens* Planch. ex Benth, *Flacourtia indica* (Burm. f.) Merr., *Terminalia brownii* Fresen, *Grewia bicolor* Juss., *Balanites orbicularis* Sprague, *Ozoroa insignis* Delile, *Ximenia Americana* Linn., and *Ficus sycomorus* Linnaeus.

In Bukwo it was mainly associated with *Euclea divinorum, Rhus natalensis, Combretum molle* and *Combretum collinum* Fresen. Other trees associated with Osyris in Bukwo include: *Vachelia abyssinica* Hochst. ex Benth., *Ozoroa insignis, Vachelia hockii* (De Wild.) Seigler & Ebinger, *Senna singueana* (Delile) Lock, *Maytenus undata* (Thunb.) Blakelock, *Flacourtia indica, Rhus vulgaris, Ziziphus mouritiana* Lam., *Vachelea Senegal* Linn. In Amudat, Osyris was mainly associated with *Euclea divinorum, Combretum collinum, Rhus natalensis, Balanites orbicularis* and rarely with *Terminalia glaucescens, Ficus sycomorus, Maytenus undata,* and *Terminalia brownii*. In Moroto it was mainly associated with *Euclea divinorum, Rhus natalensis, Carissa edulis* and *Combretum molle*, and *Terminalia brownii*. In Kaabong, it was maily associated with *Rhus natalensis, Combretum collinum* and *Euclea divinorum*.

While *O. lanceolata* might be growing in close association with different tree species, it is not necessarily parasitic. There were quite a number of cases where Osyris trees were not associated with any tree species. We dug up the roots for a few random cases and found out that the roots were not growing on other species roots, they were just intertwined (Photo 2).

Photo 2: Parts of the roots of *O. lanceolata* trees (red sections).

3.2.4 Observed threats

Information from KI interviews and observations during the exploratory inventory revealed that the local community in the sampled districts do not value *O. lanceolata* trees for oil production. It was evident that the tree is not selectively harvested for any purpose. Instead, it falls victim as many other woodland species which are harvested for fuelwood and charcoal production.

Hence, besides commercial harvesting, the major threats to the *O. lanceolata* in Uganda include but not limited to:

- Land use changes: currently, this species is found in the wild, i.e. bushlands and woodlands outside protected areas and in protected areas such as Pian Upe NP and Timo CFR. Massive landuse changes outside protected areas were observed. In Bukwo and parts of Nakapiripirit bushlands are being converted to agricultural lands. In Karamoja region, the main land use change is mining. Such activities are likely to lead to further decrease of the standing stock of *O. lanceolata* trees in the region.
- Fuelwood and charcoal burning: It was observed that stems of *O. lanceolata* are harvested for fuel production (Photo 3). Although this was initially sustainable, the increased demand for charcoal in the country might negatively affect the standing stock of this species.

Photo 3: *Evidence of ongoing harvesting of O. lanceolata trees in the sampled sites*.

- Fires: Seasonal fires (Photo 4) set up by pastoral communities in preparation of new pastures might have positive and negative impacts. While fires might break seed dormancy, they can also negatively impact the regeneration of trees by burning the young resprouts or wildlings.

Photo 4: Bush fires observed during the field survey.

- Deforestation: As is the case in most parts of Uganda, deforestation of woodlands is proceeding at an alarming rate. Deforestation is closely linked to land use change, but in most cases, it happens when the nomadic groups are establishing new homesteads coupled with continuous demand of logs for fencing their homesteads.
- Climate change is another looming threat in that the localized nature of this tree species suggests that it requires specific environments.

4.0 CONCLUSION AND RECOMMENDATON

Through this study, information has been obtained on the distribution and status of *O. lanceolata* and associated utilization and trade practices. Out of the nine districts surveyed, the species was observed in five of them. It was noted that there is a significant knowledge gap in knowledge and identification of the species by technical staff at the district as well as the local community. Fortunately, a few people who know the species know it very well and are able identify it and describe its location in the wild. The species has not been domesticated although good will exists among the relevant local government personnel. As such, most of the harvesting are from wild populations. Households use the species mainly for fuelwood, charcoal, fencing, gastro-intestinal medication and cultural values. Harvesting the trees is done largely by cutting some of the stems and leaving behind stumps thereby fostering regeneration. In some cases, the entire tree is cut at near-ground level. Harvesting for charcoal and fuelwood is mainly done on a local scale and it is not indiscriminate to *O. lanceolata.* The local communities are largely not aware

Harvesting for sandalwood oil production is said to have happened during the years 2010-2014, hence during the study period, no commercial harvesting was observed. Nonetheless, the standing volume is low in that most of the trees are resprouts. With the current standing stock of 20 trees/ha, there is potential for recruitment of *O. lanceolata* trees in the suitable habitats. However, this stock and site occupancy and related volume is too low to invest in industrial production. And if local harvesting for fuelwood and charcoal is not checked, the stock is likely to stagnate at the current level.

The harvesting cycles proposed would only attain the estimated volumes if there is no harvesting (complete protection) of the current standing stock in the respective districts. Generally, the findings from the calculations reveal that the current volume is not sustainable for commercial

production and even after 10 years we will not have attained the right volumes to sustain industrial production. To this end, we recommend the following:

- There is need to raise awareness about the species, in terms of its value and its status in the wild. This would enhance its protection and conservation locally and nationally.
- Commercial harvesting should be called off until probably after 20 or so years to allow recovery of *O. lanceolata* stock in the country.
- Protection of the species outside protected areas should be encouraged by controlling its harvest for fuelwood, construction or other local uses.
- Domestication strategies of this species should be devised in order to enhance its conservation for now and future generations.
- Systematic data on different environmental variables such as soil quality, rainfall etc. is needed to fully understand the distribution of *O. lanceolata* in Uganda.
- Permanent sample plots should be established in the protected areas like Pian Upe and Timo CFR to allow data collection on mean annual increment and other environmental variables like climate and soil data.
- The strategic objective of the conservation of *O. lanceolata* is to ensure the sustainable supply of known and potential benefits. To achieve this, government and other actors should give due consideration to the full range of stakeholders of the species and the habitat, including the social, political and cultural environment in which conservation actions should be taken. The dynamic nature of ecosystems should also be given due consideration, especially, and the population growth and climate change and potential measures to adapt to these changing conditions.
- Further investigations are required to ascertain whether the species is parasitic and whether there are other varieties of *O. lanceolata* in Uganda.

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Strategy for improving management of *Osyris lanceolata* in Uganda

Prepared by

Forestry Sector Support Department

Ministry of Water and Environment (MWE)

UGANDA

July 2021

Acronyms

CITES	International Trade in Endangered Species of Wild Fauna and Flora
MWE	Ministry of Water and Environment
LUC	Land Use Commission
NaFORRI	National Forestry Resources Research Institute
NabuinZARDI	Nabuin Zonal Agricultural Research and Development Institute
FMNR	Farmer Managed Natural Regeneration

Summary

This Strategy sets out fundamental practices to provide a coherent and effective management approaches for Uganda's *Osyris lanceolata* and its habitat. It explains the country's obligations under the law and its intended methods of tree management and promotes best management practices to ensure its conservation. The document complements the available legal frameworks that protects and ensure sustainable use of the resource in the country.

The Aim of the strategy is to ensure improved management of *O. lanceolata* for its long-term benefits by 'encouraging best practices, safeguarding habitats, maintaining the species, extending tree cover, and reducing risks'. This strategy explains the rationale behind our policies and how the government of Uganda through Ministry of Water and Environment will manage the species in compliance with the available laws of Uganda. It highlights eight best management practices (conservation and recovery strategy, consider biodiversity issues in budgeting, policy and decision-making, increase knowledge of O. lanceolata and its natural environment, enhance education and public awareness, strengthen stakeholder partnerships and promote international collaboration, coppice management and species monitoring, vigilance and law enforcement and agroforestry) to ensure long term conservation of the species in Uganda.

The Strategy will need to be reviewed and updated within a 5–10-year time frame to ensure it remains relevant in relation to public opinion, changing legislation, national standards and best practice guidance. Throughout this document, facts relating to the status of the species were taken from MWE's inventory report of 2021.

Introduction

Osyris lanceolata is an important tree species owing to its commercially useful oil with nice fragrance, used in the cosmetic industry. The importance of this product has resulted in its over exploitation in the wild leading to illegal trade of its products. The species has now been declared as threatened and listed in Appendix II of the Convention on International Trade in Endangered Species (CITES) at CoP16 of 2013.

Subsequently, because of the overwhelming threats poised on *O. lanceolata* in the wild by human activities, Ministry of Water and Environment conducted an inventory across the natural habitat of the species in Uganda to determine its status and harvesting practices in order to facilitate setting strategies for its management (MWE 2021). This is supported by the National Forestry Policy 2001 and the National Forestry and Tree Planting Act 2003.

The Aim of the strategy is to ensure improved management of *O. lanceolata* for its long-term benefits by 'encouraging best practices, safeguarding habitats, maintaining the species, extending tree cover, and reducing risks'. This strategy explains the rationale behind our policies and how the government of Uganda through Ministry of Water and Environment will manage the species in compliance with the available laws of Uganda. It highlights eight best management practices (conservation and recovery strategy, consider biodiversity issues in budgeting, policy and decision-making, increase knowledge of O. lanceolata and its natural environment, enhance education and public awareness, strengthen stakeholder partnerships and promote international collaboration, coppice management and species monitoring, vigilance and law enforcement and agroforestry) to ensure long term conservation of the species in Uganda.

The strategy therefore sets out fundamental practices to provide a coherent and effective management approaches for Uganda's *O. lanceolata* and its habitat. It explains the country's obligations under the laws and its intended methods for the species' sustainable management to ensure its conservation. It is however important to note that total protection may endanger the species, since local communities whom *O. lanceolata* grow on their land will see that they benefit nothing from it and therefore may opt to change the land use of the habitat to a more direct benefiting ventures. This shall in retrospect call for more proactive action to sensitise the communities while encouraging benefit sharing where there is any licensed harvesting from their land.

O. lanceolata distribution in Uganda

The recent stand inventory of the species conducted by MWE identified five districts (Bukwo, Nakapiripirit, Amudat, Moroto and Kaabong) where *O. lanceolata* naturally grows (Dopeth Project, 2015 and MWE stock inventory report 2021). The report indicated varying distribution in plant size class and space and further still, threats (exploitation and habitat degradation). This variation has therefore provoked this strategy to categorize the distribution areas into two categories: "Category A"; These are areas where the species is at high risk or the habitat is in a high risk of being degraded through land use changes. These are areas basically found along the border lines with Kenya where illegal exploitation and trade is rampant. Whereas "Category B"; in this document represents areas where the species is at low risk or the habitat is in a low risk of being degraded through land use changes. Category B' areas are majorly located within protected areas like National parks, Wildlife reserves, Game reserves, Forest reserves, high mountainous places and far to reach inlands which do not make economic sense to harvest from. Each of the aforementioned categories shall therefore require a different management practices fit for it to ensure proper management of *O. lanceolata.*

Figure 1: Map of Uganda showing distribution of *O. lanceolata* in the districts marked yellow.
Source: MWE *O. lanceolata* inventory report 2021.

Higher threats were reported in the districts of Amudat, Bukwo and Moroto thus being put in category A'. Nakapiripirit and Kaabong had low or even no human threats in addition to protected areas, therefore being put in category B'. The MWE report (2021) concluded that *O. lanceolata* had generally declined in the wild, with one of the causes being over exploitation and trade on the species due to the lack of strategic management of the species. By developing this strategy for the management of *O. lanceolata* in Uganda, it is considered that the planned best management practices shall deliver the species enhancement and protection for sustained social, economic and

ecological benefits of the community, Uganda as a country and the international communities at large (LUC 2016).

Strategies for managing *O. lanceolata* in Uganda

The management of tree populations is most effective if carried out strategically, rather than in a reactive or sporadic way. A coordinated approach, where stakeholders are fully engaged, is cost affective and ensures that continuity of tree benefits is achieved (AVDC 2009).

The *O. lanceolata* management strategy has identified 7 main best practices described below.

Strategies and actions

This document outlines five strategies and respective action plans that shall work towards achieving sustainable management or conservation goals of *O. lanceolata* in Uganda.

Strategy 1: *O. lanceolata* conservation and recovery strategy

This strategy aims at conserving *O. lanceolata* 's habitats and ecosystems for long-term sustainability so that Ugandans can benefit from their multiple functions. Concerted efforts should be made to protect existing populations, habitats and ecosystems. There should be recovery plans aiming at re-establishing the species where they once existed. Other plans should aim at exploring other sites outside its natural range as an ex-situ effort for scaling out/up.

Required actions:

- Implement species conservation and recovery programmes
- Rehabilitate areas that have previously been degraded
- Extend green corridors to counter fragmentation
- Develop *O. lanceolata* special management plans for those populations in protected areas for their conservation
- Foster access and benefit sharing with the communities/land owners to ensure that the species conservation is considered when granting access to traders
- Establish *O. lanceolata* trials, demonstration/experimental plots outside its natural range to seek opportunities for ex-situ conservation and possibilities for commercial plantation establishments in a larger scale.

There is therefore, an urgent need to conserve the species in its natural habitats, rescue them from areas undergoing land use changes; and increase their numbers through seed planting, cuttings and

tissue culture and keeping them in secure areas for protection as an ex-situ conservation strategy. This calls for concerted efforts to protect existing populations and or individuals for posterity.

Habitats can be enhanced by replanting degraded areas, developing and/or improving established plantations. These activities can be carried out in conjunction with other agencies, so that sufficient stands of *O. lanceolata* are available across the country.

Strategy 2: Consider biodiversity issues in budgeting, policy and decision-making

Natural resource management is a very demanding efforts more so to a developing country like Uganda as the multi-sectoral use of natural resources becomes increasingly more complex, requiring the balancing of development, public health and conservation goals. In fact, all the raw materials for any developmental venture are got from natural resources like forests and trees, and yet budgetary allocations do not match the requirements to manage these resources sustainably owing to the much pressure imposed by the communities and the private sector.

It is therefore important to have strong policies protecting *O. lanceolata* in Uganda backed by reasonable budgetary allocations and sound decisions at all levels. Such decisions start right from the local communities who are at the fore front in its protection and management.

Plate 1: Community members discussing on how best they can sustainably manage shea trees in Amuru district. An example of lower level decision making on natural resources in their areas. One of the key output of such decisions is a bi-law for the protection so the species. Such can also be adopted as a strategy for *O. lanceolata* management.

Strategy 3: Increase knowledge of *O. lanceolata* and its natural environment

Keen knowledge of how the key ecosystems respond to our activities will enable us to conserve and use them in a sustainable manner. It is essential that we conduct periodic stand inventories to determine the stand growth performance over time including ecological research in this era of climate change.

Actions:

- Encourage and facilitate research in ecosystem and *O. lanceolata* conservation, the interactions between the species and its physical environment, *O. lanceolata* valuation studies and the impact of climate change on the species
- Monitor the health of *O. lanceolata* as part of the management process
- Compile case studies on and assess best silvicultural practices implemented in the experimental plots

Strategy 4: Enhance education and public awareness

Knowledge and awareness are pre-requisites for action, hence communication on *O. lanceolata* issues is critical in driving public involvement. Effective communication will create greater awareness, interest in *O. lanceolata* and instil a sense of natural liking for the species.

Actions:

- Increase appreciation, awareness and understanding of *O. lanceolata* through public seminars, meetings, workshops shows and events and print, audio-visual and social media
- Promote volunteerism through biodiversity interest groups
- Incorporate elements of biodiversity conservation into the curricula of all levels of education
- The public can also participate in conservation education efforts conducted by organisations and interest groups.

Strategy 5: Strengthen stakeholder partnerships and promote international collaboration

The most effective mode of operation for natural resource conservation is by engaging all stakeholders like private and public sectors (government agencies, academia, schools, conservation groups and private corporations), in a strategic partnership arrangement. Such partnerships should be pursued domestically and internationally as natural resource issues cut across sectors and transcend national boundaries.

Plate 2: *O. lanceolata* stakeholders' group photo taken infront of Nabuin Zonal Agricultural Research and Development Institute in Nabilatuk district in Feb. 2020. The stakeholders comprised of participants from Makerere University, NaFORRI, NabuinZARDI, Moroto, Amudat and Nakapiripirit district local governments.

Actions:

- Engage in participatory resource management arrangement with the local community/groups
- Encourage active participation in the stewardship of *O. lanceolata* for all sectors
- Promote partnerships with regional and international organisations.
- Stakeholder meetings to protect the species to take part in a wider consultation to provide inputs and share ideas on potential priorities to be used to inform management efforts.
- Need to generate bi- Laws to improve the protection of the species in the wild from illegal and over exploitation.

Strategy 6: Coppice management

O. lanceolata mainly grows in rocky soils and in association with a number of woody species across its habitat. As it was noted in the MWE (2021), the species rarely regenerates by seed, rather by coppicing which calls for application of techniques for coppice management.

Actions

- Once a tree for harvesting has been identified, cutting must be carried out as low as possible (≤ 30 cm from above the ground as appropriate).
- The cuts left on the stumps must be smooth and slanting downwards to avoid desiccation and encourage coppicing.
- Mulch, cultivate the surrounding soil and protect the young shoots from any threats

- *O. lanceolata* has a tendency of over sprouting. The extra shoots must therefore be thinned to allow the selected ones grow rapidly to the required utilizable size.
- Coppicing rotation can be maintained up to when the stems shall reach required harvesting size roughly between 7-10 depending upon the conditions of the location, soil, altitude and management intervention given. Figure 2 below gives clear illustration of what has been narrated above.

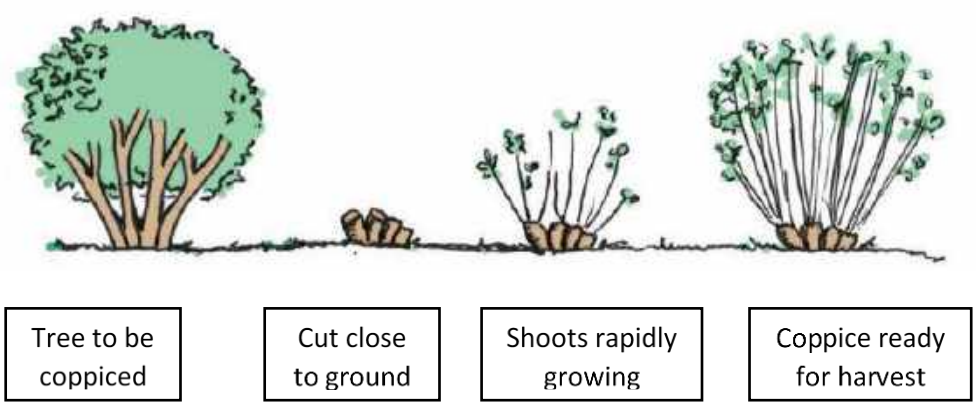

Figure 2: Illustration of harvesting and coppice management of *O. lanceolata.*

Strategy 7: Species monitoring, vigilance and law enforcement

Uganda has well established structures in most of the districts where *O. lanceolata* grows. It is therefore incumbent upon the District Natural Resource Officers, District Forest Officers, District Environment Officers to protect the species within their areas of jurisdiction. Community vigilantes should be set in hotspot areas to inform, alert and watch over the species in their areas.

With the available policies, laws and regulation, law enforcement measures should be observed where culprits must be apprehended and handed over to court to act as an example for the rest.

In this way, the offices of Uganda police, local council offices should be made use of, right from lower levels in villages to the office of district chairperson five.

Strategy 8: Agroforestry approach

There is a large number of *O. lanceolata* stands found within private lands and with rampant land clearance for agriculture, the species is cleared by the intending farmers and yet the species could be managed with the crops under agroforestry arrangement (Yatich *et al.,* 2014). Once the community have been sensitized and they appreciate the importance of the species, they can identify and protect the species while clearing their land. In fact, this system is used for shea trees in Eastern, Northern and West Nile regions of Uganda where shea trees form a parkland dotted with mature trees across its range (Gwali *et al.,* 2011). Consequently, farmers in the sandal wood growing areas

could practice the same and also promote farmer managed natural regeneration (FMNR) in their gardens to boost growth and increase stem density.

Conclusion

This national strategy and the proposed actions described in this document will guide Forest Officers to employ an effective, integrated, comprehensive, and science-based approach for improving management of *O. lanceolata* in Uganda. The document focuses on developing priority operational activities supported by scientific research to achieve results on the ground against *O. lanceolata* threat. By effectively executing this strategy, we can fulfill our commitment to sustainably manage the species for posterity. In the process of fully executing this strategy, we must monitor our progress and make the appropriate corrections on our course to the future.

We are the custodians of this God given resource - *O. lanceolata*. Let us protect it.

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