CITES TREE SPECIES PROGRAMME

Conservation and Sustainable Management of *Osyris lanceolata*, for Economic Development in East Africa

Final report for Output 3.2: Conducting a detailed study on production, harvesting, processing, transport, trade, control and monitoring of *Osyris lanceolata* with a view of establishing a fair tracking/control system

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TABLE OF CONTENTS

TABLE OF FIGURES

LIST OF TABLES

ACRONYMS AND SYNONYMS

ACP FLEGT:	African, Caribbean and Pacific countries Forest Law Enforcement, Governance and Trade
CITES:	Convention on the International Trade in Endangered Species of Wild Fauna and Flora
CoP:	Conference of Parties
EA:	East Africa
EC:	European Commission
EU:	European Union
FMU:	Forest Management Unit
ITTO:	International Tropical Timber Organization
IUCN:	World Alliance for Nature/International Union for Nature Conservation
KEFRI:	Kenya Forestry Research Institute
KFS:	Kenya Forest Service
KRA:	Kenya Revenue Authority
KWS:	Kenya Wildlife Service
LC:	Least Concern (IUCN Category)
NDFs:	Non Detriment Finding studies
NMK:	National Museums of Kenya
POWO:	Plants of the World Online database

SUMMARY

This report presents findings of field studies undertaken from April to May, 2022, to inform Non Detriment Findings studies for *Osyris lanceolata* population from forests in Narok County in South Eastern Kenya. Data was collected about standing stock and production, harvesting, processing, transport, trade, control and monitoring. This was to specifically inform NDF steps 4-8 (conservation concerns, biological risk, assessment of harvest impacts, trade impacts and management measures in place) and to augment information provided by consultants. The dryland forests in Narok have been cited as major sources of *O. lanceolata* in cross-border trade. The trip extended, to parts of South Eastern Kenya, to augment data on production, harvesting, processing, transport, trade, control and monitoring along *O. lanceolata* trade routes and to proximate border points. Specific sites visited included Narok, Oloitoktok, Namanga, Taita Taveta, Mombasa and Nairobi Kenya. During the visit, data was collected with reference to the Narok population and consignments of Osyris transiting through the respective ports of exit. Information was collected with the help of a questionnaire based on: CITES CoP 15 Doc. 16.3, CITES CoP 15 Doc.16.7 (Rev. CoP 17) Annex 1. Informants were mainly Community leaders and members, resource users and field officers in charge of managing forest resources, trade officers and other relevant stakeholders. Notes and opinions were also noted. For NDF steps 1, 2 and 3, reports are available and key findings by the consultants are provided. No previous NDF had been prepared for Osyris population in South Eastern Kenya and Narok. Hence the need to proceed with this first NDF for this particular population. NDF steps 4-8 were undertaken through project activity 3.1 and 3.2. The information for activity 3.2 was analyzed and is presented in this report. Notes collected have been used to explain the trends observed in the field and opinions included in the recommendations.

1.0 INTRODUCTION

1.1 Non Detriment Findings (NDF)

According to Articles II, III, and IV of the Convention, Parties shall only allow trade in specimens of species included in Appendices I and II in accordance with its provisions. An export permit shall only be granted when a Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of the species being traded (i.e. non-detriment finding or NDF), an essential requirement for CITES implementation;

In Resolution Conf. 10.3 (Designation and role of the Scientific Authorities), the Conference of the Parties recommends that:

> c) Management Authorities not issue any export or import permit, or certificate of introduction from the sea, for species listed in the Appendices without first obtaining the appropriate Scientific Authority findings or advice (NDF);
>
> and
>
> h) the findings and advice of the Scientific Authority of the country of export be based on the scientific review of available information on the population status, distribution, population trend, harvest and other biological and ecological factors, as appropriate, and trade information relating to the species concerned;

Scientific Authorities of exporting countries, and sometimes also of importing countries, are continually challenged to define whether a particular export will be detrimental to the survival of a species, thus the need for non-legally binding guidelines, methodologies and other documents to assist in making non-detriment findings to improve the implementation of the Convention;

NDFs are at the core of the role of CITES in ensuring the sustainability of trade in wild species and a diversity of methodologies for NDFs exist, including the outputs of the Cancun workshop and the experience of the Parties.

Following some regional and species-specific workshops, exercises have been developed on technical and biological aspects of making NDFs. These exercises have been successful in compiling relevant information and methodologies needed to formulate NDFs for some plant and animal species, thus providing single-species guidance. Now, Parties need to build on these efforts in the light of current experience.

1.2 Production of *Osyris lanceolata* in Kenya

1.2.1 Identification and Biology of *O. lanceolata*

Osyris lanceolata Hochst. & Steud., (Santalaceae), commonly known as East African sandalwood, is hemi-parasitic androdioecious multi-stemmed small tree or shrub. The great variation in leaf size and shape has elicited a considerable synonymy (about 21 accepted Synonyms) (POWO, 2019; The Plant List, 2013; African Plant Database, 2012). It is distributed in almost all regions of

tropical East Africa and is widespread in Africa from Algeria to Ethiopia and south to South Africa; Europe (Iberian Peninsula and Balearic Is.), Asia (India to China), and Socotra (Polhill, 2005, African Plant Database, 2012).

The species grows in upland dry evergreen forest and mist forest, with associated bushland and grassland, extending down rivers and from there marginally into deciduous woodland; It is found in the altitudinal range (50–)900–2700 m (Polhill, 2005). It is usually found in rocky places, or where original vegetation has been cleared; forest margins; grassland; and rocky thickets and usually associated with shrubs of woody species, including *Apodytes dimidiata*, *Brachystegia spiciformis*, *Catha edulis*, *Clutia benguelensis*, *Combretum spp*, *Euclea divinorum*, *Harrisonoa abbysinica*, *Juniperus*, *Lantana camara*, *Maytenus acuminata*, *Podocarpus*, *Rhus natalensis* among others.

O. lanceolata flowers throughout the year with peak flowering observed between January to April and August to December (Kamondo *et al*., 2014; Beentje 1994). The fruits ripen between May and September (Aoko, 2009). It is not a prolific seeder (Kamondo *et al.*, 2014), and in a study in Kibwezi, the tree is said to produce seeds in the rainy season (Ochanda, 2014). A mature tree was reported to produce up to 14kgs of seeds annually, with 50% of the seeds lost to pest attack (Ochanda, 2014).

O. lanceolata seeds at the end of the rain season and therefore immediate germination upon seed maturation is limited by water scarcity. This, combined with the recalcitrant nature of the seeds plays a major role in dictating the rate of natural regeneration in the wild. In addition, the seeds are highly predated on by birds and beetles (*Dismegistus sargumeus*) and suffer high pathogenic attack (Herrera, 1988; Mwang'ingo *et al*., 2004). In their studies, Mbuya *et al.*, (1994) and Msanga, (1998) reported poor and sporadic seed germination hardly reaching 50% in a spread period of upto six weeks and attributed this low success to the species' seed dormancy. In nature, germination is likely compromised by unsteady or scanty rainfall.

The root and stem of *O. lanceolata* are the points of interest in this species, as these are the parts traded internationally. *O. lanceolata* relies on host plants to overcome the limiting resources of its physical environment, water and nutrients (Kamondo *et al*., 2014; Herrera, 1988). It is said to have a poor root system (Kamondo *et al*., 2014) that is quite massive compared to its stem (Ochanda, 2014). This observation agrees with Herrera's (1988) work in which he observed extensive areas of contact with host plants and the presence of haustorium producing roots. Sandalwoods show different growth patterns on different host species. The export market sources the rootstock and part of the mature stem near the soil surface and shape does not seem to matter.

1.2.2 World distribution of the species

The native range of the species is Canary Islands, S. Iberian Peninsula Balearic Is., Sahara to S. Africa, Socotra, Indian Subcontinent to S. China and Indo-China Fig. 1). In Africa, it is widespread from Algeria to Ethiopia and South to South Africa.

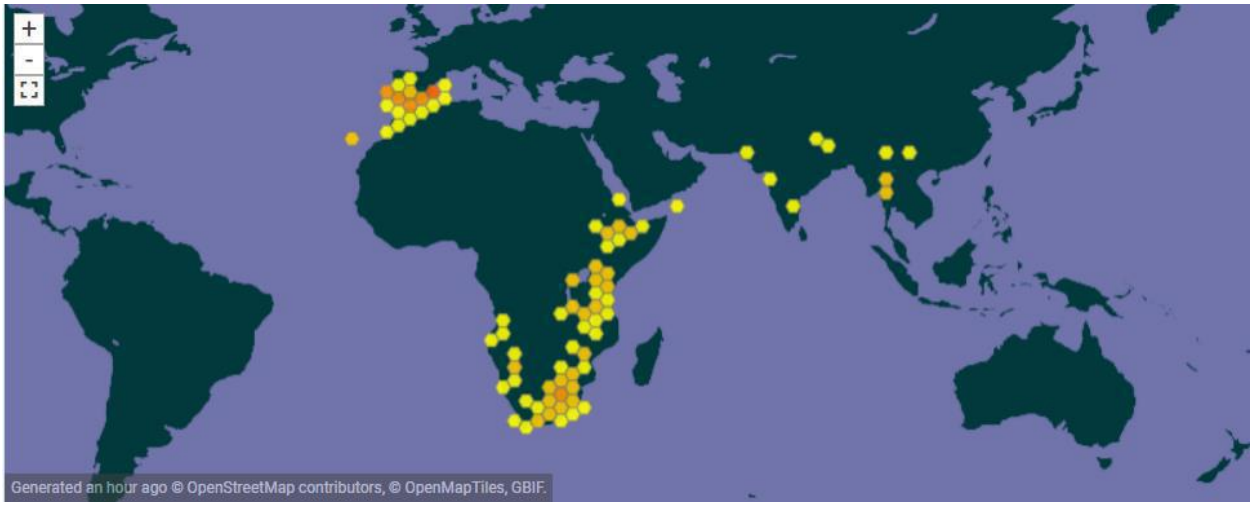

Figure 1. Geo-referenced records of Osyris lanceolata. (Source: GBIF.org).

1.2.3 Distribution of *O. lanceolata* in Kenya

In Kenya, *O. lanceolata* is found in North Eastern province to Mt Kulal, Taita, Central and much of the Eastern province, westwards through much of the Rift valley to the South and to Western Kenya. It grows in rocky sites, in forest margins, evergreen bushland, grassland and thickets at altitude ranging from 900 - 2550 (Beentje, 1994), with mean annual rainfall of 600 to 1600 mm (Kamondo *et al*., 2014). However, research done by Ochanda (2014) in Kibwezi established that the species was seen to prefer cooler areas around the hills with rocky volcanic soils/ash known as 'kivuthii' in Kamba with predominant soil type of ash, andisols and alfisols, and becomes abundant as one ascends Chyulu hills, compared to low areas, becoming more abundant in the forest, contrary to reports that it preferred disturbed areas.

The species grows in areas whose natural typical vegetation is dry woodland and bushland in ecological zone IV (Fig. 2), dry forest and moist woodland in ecological zone III and moist to dry forest in ecological zone II (Kamondo *et al*., 2014).

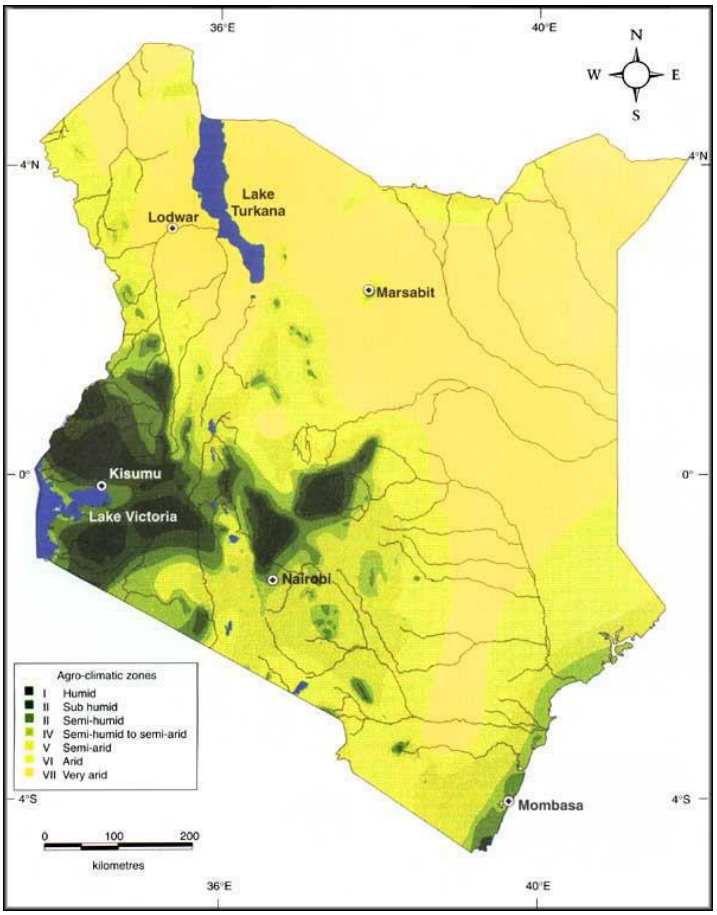

Figure 2. Agro-ecological zones of Kenya (Maundu et al., 1999).

1.3 Uses of *O. lanceolata*

Osyris lanceolata has many uses, in its distribution range in Kenya and internationally. Among the local uses, roots and bark are infused as teas or tonic in soups, and fruits are eaten as emergency food (Gachathi, 1989; Beentje; 1994; Orwa et al., 2009). Roots and heartwood extracts have medicinal, palliative and preservative properties (Anon., 1950; Orwa et al., 2009; Ochanda, 2011). The wood is very hard, strong and heavy and is used for carvings, kitchen mortars and pestles, pegs, for poles and bed frames and burns hot, so it is also used as firewood (Orwa et al., 2009).

The main products in international trade are essential oils, fragrances, cosmetics and toiletries, containing the Sandalwood oil, handicrafts made from the timber and sawdust used in the manufacture of cones or incense sticks (Ochanda, 2011; Mumbu et al., 2019; Orwa et al., 2009). As a substitute for other "sandalwood" producing genera i.e. *Santalum* and *Pterocarpus* species that are currently in short, supply.

The extraction of essential oil from root stocks and stem wood, for international cosmeceutical use is the main reason that *O. lanceolata* has been over-exploited, heavily threatening it in Kenya and the East African range states (Mabatuk & Wesangula, 2015; Bekele et al., 2019). Therefore, *O. lanceolata* trees have combined benefits for local and international markets as medicinal plants, for aromatic oil and durable wood.

1.4 Harvesting of *O lanceolata*

Kenya lacks accurate data on harvesting of *O. lanceolata* both for subsistence use and for commercial exploitation and to inform sustainable harvesting. A handful of studies have been conducted in Kenya to assess the population status of *O. lanceolata*. They include (Mukonyi *et al*., 2011), on conservation and use (Ochanda *et al*., 2011; Mumbu et al., 2019). For market data, a study conducted in some local peri-urban markets in South Eastern Kenya, in 2018 returned *O. lanceolata* as the most frequently traded medicinal plant (Ann Mwaura Pers. Comm.). Other market data from border towns shows that *O. lanceolata* is among the 20 widely traded species (Lusweti *et al*., 2018) in biotrade. The resource status and its future market prospects remain largely unknown, because not all populations and biotrade markets have been considered.

While there is little research on the dictates of plant age on quantity and quality of oil content, the local community reportedly believe the older the tree the higher the quantity and quality with trees >60 years having the best content (Ochanda 2014). However, (Kamondo *et al*. 2012) posit that, trees 15 – 20 years old and above would be good targets for seed collection and oil production.

The harvesting practice is usually by debarking for subsistence consumption and uprooting of root stocks for export trade. The product is often disguised as firewood. Debarking, if not managed can decimate local populations. Worse, the complete removal of the mature rootstock including the collar, removes seed sources, leading to population decline and habitat destruction.

1.5 Processing and Biochemistry of the species

Osyris lanceolata is exported as raw wood stocks or semi-processed wooden chippings, almost the crude product, which fetches very low prices. Local people and middlemen believe that female plants yield better quality oil that is more scented and of higher medicinal value. However, Studies done in Kenya and elsewhere, though limited, have established that there is no significant variation in oil yield and quality between male and female plants within population (Mwang'ingo *et al*. 2010; Aoko 2009). Hence, influence of geographical location on quantity and quality of oil and composition of its active ingredients remain inconclusive. Mwang'ingo *et al*. (2003) found that wood portions close to the ground had higher quantity and quality oil decreasing towards the root and shoot tips. In addition, they established that populations in relatively arid climates produced better quality and quantity of oil than in humid climates.

Extracts of *O. lanceolata* wood stock, have antioxidant as well as antimicrobial activity potential as well as a number of secondary metabolites that are active ingredients, mainly agarofuran sesquiterpene polyesters, pentacyclic triterpenoids, phenols, flavonoids (Yeboah & Majinda, 2009; Yeboah *et al*., 2010; Yeboah & Majinda, 2013; Aoko, 2009; Mbunde *et al*., 2017). Yeboah *et al*. (2010) isolated 3 dihydro-β-agarofuran sesquiterpenes and 2 pentacyclic triterpenoids from chloroform extract of the root bark, all of which demonstrated antifungal activity against *Candida albicans*, and Gram positive *Bacillus subtilis* and *Staphylococcus aureus* and Gram negative *E. coli* and *Pseudomonas aeruginosa*.

1.6 Transport of *O. lanceolata* raw products

The wood stocks of *O. lanceolata* are transported using variable modes of transport. The aim is to disguise the product or hoodwink authorities in charge of transport services. At the harvest site, they are carried by porters on foot or on motor cycles to a local market for bulking. Once a substantive amount has been acquired, they are loaded on to larger capacity vehicles and transported to the designated border or factory site. The wood maybe disguised as firewood, may be carried in gunny bags or as contraband under other household products such as firewood. Cross border consignments are overtly carried in freight containers after being issued with 'documentation'. According to ACP FLEGT, in (Anon., 2013) the Kenya Plant Health Inspectorate Service has indicated that at times oil tankers are used to covertly transport Sandalwood from Kenya to Tanzania making it difficult to monitor the trade.

1.7 Trade in *O. lanceolata*

The East African Sandalwood trade in Kenya has been described as covert trade (Mabatuk & Wesangula, 2015), in which the players are unknown, but with a ready market (Mathenge et al., 2005). Indeed, accounts about trade in *O. lanceolata* before the 2000s are not readily available, but it appears that due to reduction in Santalum oil supply from the traditional source countries i.e. Australia and India, in that period, demand for *O. lanceolata* oil as a substitute or adulterant started growing. The market identified S. Africa and Tanzania (Mwang'ingo et al., 2003), India, Indonesia and Australia are the main producers of Sandalwood oil while the United States and France are the two largest importers of Sandalwood oil. The high demand for the Sandalwood oil and restricted access to traditional sources due to diminishing supply has led to demand and overexploitation of *O. Ianceolata*, as the alternative source. Also, the competing use of sandalwood for dyes and tannins in the SA Cape region may have pushed the buyers further north into Tanzania (Mwang'ingo et al. 2003; Mwang'ingo et al. 2007). As the sources diminished in the south, the interest moved further north into Kenya, specifically to the Kyulu hills in the Southern and Southeastern parts of Kenya through Kilimanjaro area (Mwang'ingo et al. 2003; Mwang'ingo et al. 2007; Machua et al., 2009). By 2004, trans-border trade in wood stocks disguised as 'firewood' between Kenya and Tanzania, was frequent as the harvesting spread further inland. The 2014 Kenya Taskforce on Wildlife Security retraces early large scale harvesting and smuggling to the Kyulu hills, Tsavo area (Mukonyi et al., 2011; Mabatuk & Wesangula, 2015). Harvesting rapidly spread to Taita, Amboseli, Kajiado, Narok, and Baringo. Subsequently to the central parts of Kenya, targeting the dry forests and woodlands in the Rift Valley in Elementaita, Baringo; then to Northern parts of Kenya including Isiolo, Samburu and Marsabit (Mukonyi et al., 2011; Mabatuk & Wesangula, 2015).

About the year 2004, the local prices for *O. lanceolata* crude wood stocks were KES 10-30 (USD 0.1-0.3) per kilogram at the farm gate and KES 700/kg (USD 0.17) in international markets (Cheboiwo et al., 2018). The farm gate price was quoted at KES 200-300 (USD 2-3) in the year 2015 (Mabatuk & Wesangula, 2015), which were quite lucrative, considering the daily casual wages then. The high prices offered, make poaching from land belonging to other persons particularly, an attractive option (Ochanda, 2011). Kenya has reported massive uncontrolled wild harvesting, while in Tanzania, a sandalwood factory in Tanga closed due to scarcity of raw

materials. There are no clear records on trade in *O. lanceolata* but it is estimated that 1, 000 tonnes are annually harvested from Africa, mostly from East Africa. Mukonyi *et al*., (2011) had projected that, the East African Sandalwood would contribute significantly to global Sandalwood oil trade in the coming 5-10 years, but this remains a mirage, due to the persistent lack of an acceptable trade management framework.

1.8 Trafficking and trade control of *O. lanceolata*

Frequent media reports in Kenya, on untenable trade volumes attracted the attention of the authorities and the 3-year ban on *O. lanceolata* harvesting was decreed in February 2007. Between 2007 and 2011, records show that over 250 tonnes of Sandalwood were illegally harvested and traded. Some consignments were confiscated in Kenya by Law enforcement agencies while in transit (Table 2). The peak of over-harvesting and illegal trade in *O. lanceolata* can be estimated to have been between years 2005 and 2009. The latest seizures in Kenya, of *O. lanceolata* materials destined for export was documented in 2018 in Mombasa, (Ann Mwaura pers. Comm. 2020), most recently in January 2020 (Citizen digital, 29 Jan. 2020).

Table 1:Records of confiscated Sandalwood in Kenya between 2007-2011

Station holding seized material	**Weight of Seized materials (Tonnes)**
KWS Maralal	50
KWS Tsavo West	31.361
KWS Chyulu	152.834
KWS Nakuru	22
KFS Mombasa	15
Marsabit Station	5
KFS Headquarters	5
Total	**281.195**

A crude trafficking chain for *O. lanceolata* involves about five players; harvesters (local people), linkmen/intermediaries (local people), transporters (local people), secondary buyers (Kingpin) and international pharmaceutical and cosmetic companies, and consumers (medicine, perfume companies). This covert trade chain is best illustrated in Figure 3.

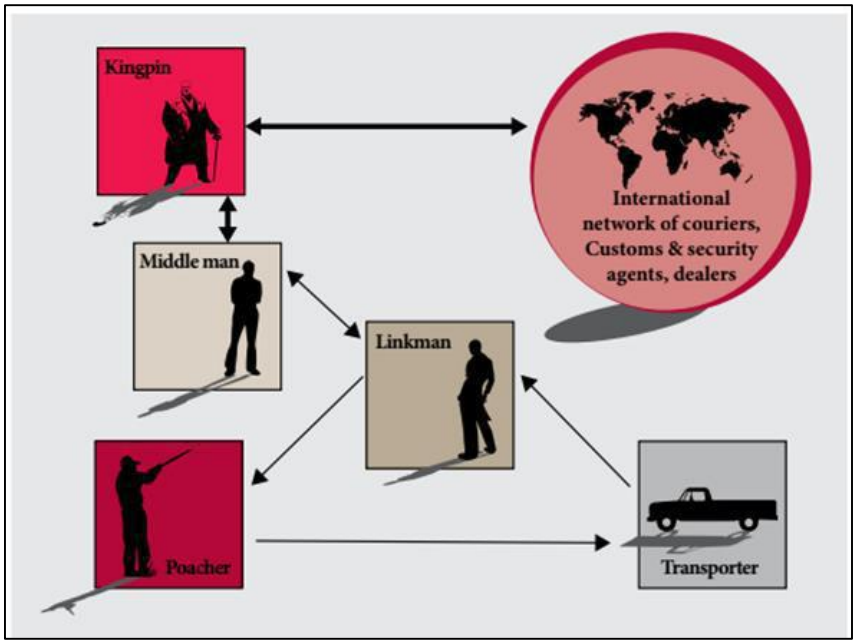

Figure 3. Illustration of the poaching and trafficking network (Weru 2016).

1.9 Monitoring and Traceability

The discordant documentation of *O. lanceolata* trade is the best indication of Kenya's lack of trade control and lack of traceability mechanisms. It is typified by the lack of authentic documentation, including no certificate of origin, inadequate description of materials in transit, miss-declaration or mislabeling, and plain fraudulent documentation (Mukonyi et al., 2011). For instance, a consignment at the port of Mombasa for re-export had papers showing its origin as Uganda, but lacking mandatory customs stamp (Solomon Kyalo pers. comm. 2020). Of particular concern for Kenya, sandalwood is semi-processed in Tanzania into chips and the product is illegally re-exported through Mombasa, Kenya, indicative of poor regional trade cooperation and control.

Traceability refers to the ability to track and trace a product along the supply chain (Andrade & Voora, 2015). In the case of EA sandalwood, traceability can give the conscious consumer the confidence that the santalum oil is sourced responsibly and sustainably from the wild or plantations. Unfortunately, law enforcement challenges with respect to *O. Ianceolata* production and trade in Kenya persist, due to weak forest law enforcement by the respective agencies.

2.0 AIM OF STUDY

Kenya had not established the population status of *O. lanceolata* to guide any level of commercial harvesting. Also, *O. Ianceolata* was and is exclusively harvested from the wild. Continuing trade without a management framework, inadequate corporation and cross-border trade regulation, makes the species vulnerable. This study therefore aimed to assess production, harvesting, processing, transport, trade, control and monitoring of Osyris lanceolata with a view of establishing a fair tracking/control system that supports a harvesting quota if proposed.

3.0 METHODOLOGY

The study area was Narok County in South Eastern Kenya, and encompassing populations of *Osyris lanceolata* in this area. This was purposively selected since it is one of the areas in Kenya where *O. lanceolata* is naturally found. Specific sites visited included Narok, Oloitoktok, Namanga, Taita Taveta, Mombasa and Nairobi Kenya. During the visit, data was collected with reference to the Narok population and consignments of Osyris transiting through the respective ports of exit. Information was collected with the help of a questionnaire based on: CITES CoP 15 Doc. 16.3, CITES CoP 16.7 (Rev. CoP 17) Annex 1, in combination with CITES Non-detriment Findings Guidance for Perennial Plants. A nine-step process to support CITES Scientific Authorities making science-based non-detriment findings (NDFs) for species listed in CITES Appendix II. Informants were mainly Community leaders and members, resource users and field officers in charge of managing forest resources, trade officers and other relevant stakeholders. Notes and opinions were also noted. The information was assessed and scored using a scale ranging from 0-6, where 0-1 represented none or minimal risk or impact, 2-3 low to moderate, 4-moderate,5 -high risk and 6- unknown.

4.0 RESULTS AND DISCUSSION

4.1 NDF steps 4-8

Figure 4 below shows aspects probed during the interviews in a radar chart.

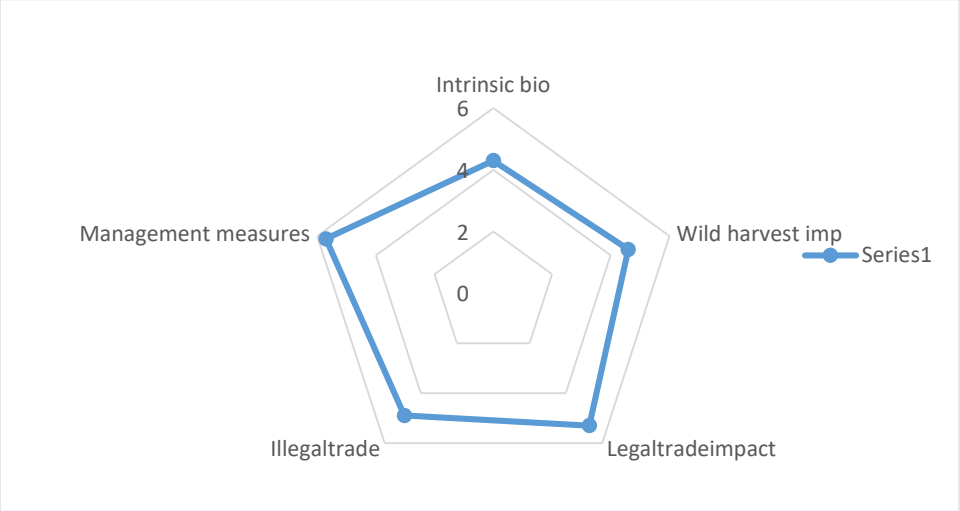

Figure 4. NDF Radar chart for O. lanceolata in Narok, Kenya.

The risk to *O. lanceolata* is moderate to high overall. However, the highest risk stems from the lack of management measures, followed by legal trade impacts, then illegal trade impacts. Trade seems to have high impacts, particularly owing to the fact that besides being sought after by international traders, it is a popular beverage sold in most local markets. Unfortunately, all the bark traded in the market is wild-harvested by local women purportedly for domestic use, but subsequently dried and diverted to local markets as a beverage. There is no license and no control or management of this practice, increasing impacts associated with it. The individual factors are subsequently discussed here below.

4.2 Conservation status assessment: Step 4

From the interviews, few respondents know the IUCN redlist status of *O. lanceolata*. According to IUCN (2020), the populations of *O. lanceolata* in Europe are considered stable. Raimondo *et al*. (2009) designated *O. lanceolata* as being of least concern (LC), after evaluating it against the five IUCN criteria. This species does not qualify for the categories Critically Endangered, Endangered, Vulnerable nor Near Threatened. In assessing the severity of conservation concern relevant to harvest area; most respondents said they considered it endangered or threatened internationally, regionally and nationally. Indeed, most respondents consider the local population mostly endangered. However, this view seems to be influenced by their proximity to information on the species in nature and conservation matters (field officers and some community members tended to describe it as endangered). Others did not seem to be aware of any conservation status assessments (ports of entry/exit).

4.3 Intrinsic Biological Risks: Step 5

Biological risks are associated with the species lifeform, parts harvested for export markets, population distribution, its reproductive capacity and the niche that it occupies. *O. lanceolata* is a shrub or small tree, that reaches mature height of about 6-8m in 15-20 years at which age it would have attained its merchantable diameter (>12cm). The parts harvested are; stem, roots/root base, bark depending on desired product/use. The Maasai community shares the species range and mostly exploits the bark of mature trees, but this is a rampant practice and this product which is used in teas is common in all local markets. Demand for bark (tea) has increased in recent times, with urban dwellers sourcing from local markets. Further, Maasai women have turned this trade into a livelihood activity that is unregulated by local authorities (Silantoi pers. Comm., 2022). Cutting and debarking, can kill the plant (Ketuta, Pers. Comm., 2022). The root base and mature branches are preferred by the export markets.

The geographic distribution of *O. lanceolata* is wide, but populations are rarely described as abundant, more or less scanty, making this factor medium to high risk. Areas where it grows include K1 in North Eastern, Baringo, Laikipia, K4 Rift Valley, Kibwezi, Kitui, Chyulu, K5 Mt. Elgon, K6; Narok county, Loita, Mara triangle, Magadi, K7; Taita, Taveta, Tsavo. In parts of Narok, specifically Lemek, access is limited by the presence of Wild animals specifically the Elephants which roams freely (Parmat Pers. Comm., 2022). However, the population size was unknown to field officers and was assessed as low (Low) and scattered, hence at high risk.

The species is habitat-specific, preferring hilly areas or rocky outcrops in dry upland and riverine forests, forest edge, riverbanks, lowland bush and in arid and semi-arid areas. This habitat is extremely vulnerable as it is not in protected areas, but mostly on communal and private land. However, since it's rocky and sloping land, it is not easily cultivated (Lilach, pers. Comm., 2022). The Species is also threatened by human livelihood activities including an ongoing land subdivision in the areas where Osyris occurs naturally and extractive activities such as charcoal burning. It is also prone to browsing by wildlife and livestock in parts of Narok, where ranching takes place (Silantoi Pers. Comm., 2022).

The reproductive capacity of *O. lanceolata* is described as low and mostly weather-dependent meaning the factor is high risk (High). It reproduces through seeds, born on the female and which are bird-dispersed. The viability of such seeds is thought to be low (Ndambuki, Pers. Comm., 2022). In some areas, it's common to find either male or female trees dominating and the opposite sex can be rare in these cases, further compromising its ability to reproduce.

O. lanceolata rarely grows alone or in pure stands, mostly in association with other species. As a hemi-parasite, it is dependent on a variety of hosts, including *Tarconanthus camphoratus, Rhus natalensis, Maytenus senegalensis, Combretum* spp. among others. It is commonly browsed by elephants, giraffes, livestock and other browsers. The main source of information was the community and level of confidence is high.

4.4 Wild harvest impacts: Step 6

On individual plants, the impact is high, due to the fact that the plant is chopped down to ground level and debarked and in extreme cases, it is extracted including the roots (uprooted).

On target population, impact is high and comments included the fact that the species is decimated in areas like Taita Taveta. In Narok, 10-15% of the women who trade in herbal medicine, stock the bark of *O. lanceolata*.
Impacts on national population is assessed as medium to low. However, the impact on other species harvested in combination, look alikes and or non-target species is becoming more apparent with the suite of species now including; Olarioi, Enkoma, Olmaroroi-*Acocanthera schimperiana, Rhamnus staddo* and *Rhamnus prunioides* (Silantoi pers. Comm., 2022). *Combretum apiculatum* (Melonyie, pers. Comm., 2022), *Carissa edulis*, Osentoi-*Tarconanthus camporatus*, Enkoma (Mole, pers. comm., 2022), *Acacia* spp., and *Maytenus senegalensis*.

4.5 Trade impact: Step 7.

Kenya does not allow export of the species and has not designated any harvest quotas. Overall, impacts of illegal trade were assessed as being mostly high (High). Communities reported poaching of the species for trade (Saitabau pers. Comm., 2022). The materials are said to be piled for transport in Taita Taveta. In 2013-2014 some 11 vehicles were impounded. In 2016, 2-3 containers were seized, subsequent years, some 5-6 containers were impounded (Nyamohanga pers. Comm., 2022). Change from traditional freight vehicles to smaller vehicles including Salon cars and SUVs has been noted (Bakari, Pers. Comm. 2022). At the ports of entry/exit, control, engenders scanning and profiling containers suspected to be ferrying illegal consignments/contraband goods in transit (Sale Hassan, Pers. Comm.). There have not been any recent arrests at the Port, but there have been arrests in some areas upcountry like Nakuru following tip-off (Mwandigha pers. Comm 2022). Harvesting practice that targets complete root excavation, is destructive and limiting to regeneration, but where root boles have been left intact, coppicing has been reported.

4.6 Management measures in place: Step 8

Currently, there are no guidelines for harvesting. Local community members alluded to indigenous guidelines for bark harvesting, though undocumented (Saitabau, pers. Comm., 2022). Communities should be educated on best harvesting practice, so as to allow extraction of the different products to the local and export markets and to minimize damage to the species in the wild (Nyamohanga, pers. Comm., 2022).
Setting harvesting area: None in place, but in preparation at KWS. Local communities mostly harvest bark from plants near their homes (Saitabau, pers. Comm., 2022).
Harvest seasonality; None or unspecified, but in preparation through KWS.
Max-offtake control; None existent, but protocols in preparation by KEFRI.
Equipment control; None, farm implements are often used. Local communities use knife or machetes to harvest bark (Saitabau, pers. Comm., 2022).
Population monitoring; This species mostly occurs in communal and private land and rarely in protected areas. Therefore, it is difficult to monitor its population unless with the help of land owners.

4.7 Domestication as an alternative to wild harvesting

There are a few domestication initiatives for *O. lanceolata* in the species range States. In Kenya, KEFRI, working with local communities in selected areas of the Osyris range, is in the process of refining technology of raising Sandalwood seedlings. Domestication of Sandalwood can reduce pressure on wild populations, provide markets with sustainable stocks, generate revenues and improve livelihoods. The species is a candidate tree for agri-business and can spur income growth from the rural areas. Kenya has developed propagation technology for production of Sandalwood seedlings through seeds and air-layering in supporting domestication of this species.

5.0 CONCLUSION AND RECOMMENDATIONS

The kind of information needed to prepare a full NDF report is often difficult to obtain, the process is expensive and time-consuming. The listing of *O. lanceolata* from the three range states in EA on CITES Appendix II is a major contribution to the conservation of this species in East African countries. This act has drawn the attention of the national and international communities to the dangers of uncontrolled exploitation and export of *O. lanceolata*. A fundamental obligation of CITES member countries, prior to any export of a product listed in Appendix II of this Convention, is a non-detriment finding (NDF). This report must be issued by a credible scientific authority, which certifies that the export volume requested by the country is not detrimental to the conservation of this species in forests. Another obligation is that the CITES Management Authority must certify that the volumes exported have been legally obtained, hence documentation is key All documents require factual information.

There is still need to continue regulating the international trade in *O. Ianceolata* to ensure exploitation is not detrimental to the survival of the species in the wild, and more importantly to promote its sustainable production through domestication. Hence, the need for international cooperation within the framework of CITES.

The current state of EA sandalwood in Kenya and EA region has been contributed by inaction and bad decisions on investments in local natural resources, lack of land-use planning and bad decisions spanning decades. As a result, EA sandalwood remains at risk since global demand for sandalwood oil has not waned at all. On the contrary, demand is projected to grow as the market grows and the products find more industrial applications. This poor state of sandalwood subsector needs to be remedied. Largely, Kenya requires a sandalwood management framework and to invest in dryland forests as well as putting extra support on the domestication and commercial propagation in order to meet supply demand as well as a livelihoods support.

In addition, there is need to invoke national legislative instruments to ensure greater protection as provided for in Forest Conservation and Management Act 2016 Section 40.

With the field and media reports, *O. Ianceolata* is neither categorized as threatened nor as vulnerable as Kenya needs to craft such a framework for conservation.

Domestication programmes to supplement the wild populations, species status and ecological assessments and complimentary control measures including appropriate policies and other enablers are needed.

For the EA Sandalwood, traceability needs to be initiated which may begin with the existing records, field reports and use of new technology such as DNA Barcoding to combat illegal wildlife trade.

The EA region urgently needs to put in place the requisite collective trade policy and other enablers for sustainable exploitation to improve local livelihoods as well as ensure conservation of this tree species.

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ANNEX 1: NDF QUESTIONNAIRE

DATA SHEET FOR NDF FOR OSYRIS LANCEOLATA IN KENYA

Species:----------Vern:----------

Name:	Phone No:	Location:	Date:

Conservation Concern

4.1 Conservation Status Assessments

Conservation Status	International	Regional	National	Information Sources Used	Threats Noted In Assessment	Confidence Level

4.2 Severity of Conservation Concern Relevant To Harvest Area

IUCN assessment	E	CR	T	LC	U

Step 5: Intrinsic Biological risks

Factor	Risks	High	Med	Low	Unk	Information Sources Used	Confidence Level
Plant lifeform							
Part(s) harvested							
Population size							
Geographic distribution							
Population size/Abundance							
Habitat specificity							
Habitat vulnerability							
Regeneration: recovery capacity							
Reproductive capacity/Regular flowering, ease of dispersal							
Role of sp. in ecosystem/other spp. Depend on it?							

Step 6: Wild Harvest impacts

Factor	Describe Impacts	High	Med	Low	Unk	Information Sources Used	Confidence Level
.1 On individual plant							
-Practice							
-Quantity							
-Frequency							
Allowable offtake							
6.2 On target population							
6.3 On national population							
on other species							
-In combination							
-Look alikes							
-Non tgt spp.							

Step 7: Trade impacts

Factor	Impacts	High	Med	Low	Unk	Information Sources Used	Confidence Level
7.1 Legal trade							
-Nos/vol/ in trade viz abundance							
-Demand/multiple uses							
-Licensing/CITES permit							
7.2 Illegal trade							
-Nos/vol/ viz abundance							
Vol and frequency of seizures							

Step 8.1: Management Measures in place

Harvest Management Measures	Information Sources Used	Confidence Level-HMLU
-Guideline for harvesting		
-Setting harv. Area		
-Harvest seasonality		
-Max off-take control		
-Equipment control		
-Population monitoring		

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ANNEX 2: NON-DETRIMENT FINDINGS (NDF) INTERVIEWS

Safari Opiyo-KFS Narok

Stephen Ndambuki-KWS Mara

Benson C. Nyamohanga- KWS Longisa

Mike Onsere-KEPHIS-Namanga

Paul Nduati-Administration Police Namanga

Edwin Rotich-Police Namanga

Moses Namuya-Customs Namanga

Samuel Kihara-KWS Namanga

Loitokitok Border

Gordon O. Anyiko-KFS Loitokitok

James Nyaga-KWS Loitokitok

Taita Taveta Border

Harun K. Makange KFS Taita Taveta

Apolinary J. Mwandigha-KFS Mombasa

L-R Khamis Bakari-KFS Mombasa, J. Mwamodenyi, KFS, Saleh Hassan-Customs Mombasa, B. Khayota NMK, M. Oluoch-NMK

ANNEX 3: CTSP REPORT WRITING AND VALIDATION WORKSHOP DRAFT AGENDA

CITES Tree Species Programme (CTSP) Report Writing and Validation Workshop. Wildlife Research and Training Institute (KWRTI) 26-28th June 2022

DRAFT AGENDA

DAY 1: 26/06/2022

Time	Subject	Facilitator
12.00 Noon	Travel from Nairobi to Naivasha	Agnes Lusweti

DAY 2: 27/06/2022

Time	Subject	Facilitator
	Session Chair: James Mwamodenyi	
0830 - 0845	Introductions	All
0845 - 0930	Opening Remarks: • National Coordinator • Regional Coordinator • Director KWRTI	 James Mwamodenyi Dr. Beatrice Khayota Dr. Patrick Omondi
0930 - 1000	Introduction and overview of the CTSP	Dr. Beatrice Khayota
1000 - 1030	**HEALTH BREAK**	
1030 -1115	Non-Detriment Findings – Draft report	Agnes Lusweti
1115 -1130	Questions & Comments	Solomon Kyalo/Dr. Beatrice Khayota
1130 -1215	*Osyris lanceolata* Inventory Draft report	Peter Gachie
1215 – 1230	Questions & Comments	
1230 - 1400	**LUNCH BREAK**	
	Session Chair: Dr. Beatrice Khayota	
1400 -1430 1430 - 1600	Video screening Report review by teams.	 All
1600	**HEALTH BREAK & END OF DAY**	

DAY 3: 28/06/2022

Time	Subject	Facilitator
	Session Chair: Fred Ojuang	
0900 - 1000	Report reviews by teams	All
1000 - 1030	**HEALTH BREAK**	
1030 - 1200	Presentations of reviewed reports	
1200 - 1230	Questions & Comments	
1230 - 1400	**LUNCH BREAK AND DEPATURE**	
1400 - 1445	Next Steps	Dr. Beatrice Khayota
1445-1500	Closing Remarks	Peter Gachie
1500	**HEALTH BREAK & END OF DAY**	

DAY 4: 29/06/2022

Time	Subject	Facilitator
0900	**DEPARTURE FOR NAIROBI**	

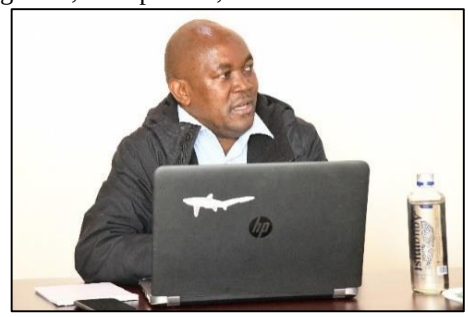
ANNEX 4: CTSP REPORT WRITING AND VALIDATION WORKSHOP PHOTOS

Workshop session

F, Ojuang-KFS, S. Kipkoech, P. Gachie KEFRI

Peter Gachie-KEFRI

Agnes Lusweti-NMK



Solomon Kyalo-KWS

Solomon Kipkoech

L-R J M Mwamodenyi-KFS, Fredrick Ojuang KFS