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SFI Tanzania Ltd. Management Plan

Kwamdulu & Kwaraguru Estate, Tanzania

Client

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Acronyms and Abbreviations

DBH	Diameter at Breast Height
FSC™	Forest Stewardship Council™
ha	hectares
kg	kilogram
m	meter(s)
mm	millimetre(s)
NTFPs	Non-Timber Forest Products

Part I: SFI Tanzania Ltd.

1. Introduction

SFI Tanzania Ltd. is a sustainable investment company that manages two sisal estates in Tanzania. Besides growing and producing sisal SFI Tanzania established also woodlots on a portion of the estates. Form Tanzania provides forestry-related services to SFI Tanzania, including technical evaluations, soil surveys, selection of appropriate species and provenances, nursery management, and advice on planting and maintenance.

Considering their close cooperation, SFI Tanzania and Form Tanzania are referred to as 'the company', or 'SFI Tanzania' in this document, unless otherwise specified.

The principal activities of the company are to establish and manage large-scale sisal and woodlots in a sustainable way through upscaling and improvement of the sisal production and afforestation of fallow land on the sisal estates.

In 2013, SFI Tanzania acquired two sisal estates in Tanzania; Kwaraguru and Kwamdulu Estate, near Korogwe and Segera respectively, with a total area of 9,145ha. The two estates are property of SFI Tanzania and registered in Tanzania's land registry[1]. SFI Tanzania aims to develop these estates by planting both sisal (*Agave sisalana*) and trees,such as Eucalyptus (*Eucalyptus sp.*), Teak (*Tectona grandis*) and based on their performance probably also other tree species.

SFI Tanzania commissioned Form international, a Dutch consultancy firm, to elaborate a management plan for the company's activities on Kwamdulu and Kwaraguru Estates. This management plan is the basis of the Environmental and Social Management Plan (ESMP), complemented with company procedures and other documents. The management plan is based on the outcomes of the Social and Environmental Impact Assessment, and incorporates the conclusions from the High Conservation Value Analysis.

1.1. Management documentation

The management plan describes the approach of SFI Tanzania to all activities, the long-term planning, and the management objectives of the company. The management plan is complemented with a set of procedures that provides more detailed guidelines on standard operations. Throughout this document, reference is made to these procedures. See Procedure 1 for the document structure and an overview of the various procedures and other documents in use by the company.

To keep track of management changes, the company applies a monitoring system, outlined in Procedure 08 Monitoring. Monitoring is planned according to the annual Monitoring Plan and monitoring results are used to update the management plan.

The management plan is updated at least every five years. Not only monitoring results are incorporated, but also other new information from the field or other sources, such as changing environment, new legislation or stakeholder meetings.

[1] Title to Leasehold Land No. 13759 (Kwamdulu Estate Lushoto, Tanga survey plan no E2 3/1/7340, dated 13 August 2007) and Certificate of Occupancy Title No.6580 (Land office number 104315 land located at Kwaraguru Estate Farm No.319, dated 26 December 1989).

1.2. Report structure

This management plan is divided into 3 parts: I) SFI Tanzania Ltd., II) Sisal and III) Forestry.

Part I includes the introduction (chapter 1) and a description of the characteristics of the company (chapter 2), including the approach regarding sustainability, and both the physical and socio-economic environment (chapter 3). The company's approach to social and environmental management is outlined in chapter 4 and 5 respectively. Chapter 6 covers the monitoring program for improvement of company management, and chapter 7 describes how the company deals with the management of various risks, including prevention of illegal activities, fire management and control of pests.

Part II is dedicated to the various aspects of the sisal operations of the company, including plantation management and fibre production. Part III is dedicated to the various aspects of the forestry operations, including species selection and applied silvicultural systems.

2. Company characteristics

2.1. Company structure

SFI Tanzania is owned by SFI BV, a Dutch holding company that has been created for the specific purpose of managing agricultural and forestry businesses.

Form Tanzania aims to establish woodlots on the unused portions of the estates as well as to develop forestry in the region and, in a broader sense, market potential for sustainable forest establishment and management services.

Form international is contracted by SFI Tanzania to provide Management and Technical Assistance on product marketing, sustainability certification, Environmental & Social issues, Research & Development and other topics. Form international is a Dutch forestry consultancy, established in 1992. The firm is specialized in consultancy services for the practical implementation of forestry and forest industry projects and has extensive global experience in forest management. Form international provides long term Management and Technical Assistance (MTA) to SFI Tanzania, with clear targets and responsibilities regarding performance levels.

The organisational structure of SFI Tanzania Ltd. is represented in an organigram (Annex C).

2.2. Legal compliances

SFI Tanzania Ltd. is a national limited liability private company based in Korogwe, Tanga, Tanzania and duly registered at the Business Registration and Licensing Agency (BRELA) number 98144 which was issued on 27 March 2013.

Form Tanzania Ltd. is a national limited liability private company based in Korogwe, Tanga, Tanzania and duly registered at the Business Registration and Licensing Agency (BRELA) number 101868 which was issued on 23 August 2013.

The estates are legally owned by SFI Tanzania Ltd. with a 99 years right of occupancy, title number 13759 for Kwamdulu estate and title number 6580 for Kwaraguru estate.

The company implements its activities according to the applicable national legislation and international conventions. Procedure 5 describes in detail how this is realised by the company.

2.3. Objectives

The main objective of SFI Tanzania is to become a financially independent and self-sustaining business.

SFI Tanzania aims to fully develop the 9,145 ha on the two estates with a mixture of sisal, forestry, conservation areas and high quality infrastructure in accordance with

the company's Corporate Responsibility policy. The following objectives have been set for the company for the period until 2030.

Sisal plantations
In the coming years, SFI Tanzania aims to develop and increase the production of the existing sisal areas and expand the area planted with sisal. This will partly be rejuvenation of old sisal fields and partly new sisal planting on fallow land.

Woodlots
SFI Tanzania aim to establish woodlots on fallow land in accordance with the FSC Principles & Criteria for sustainable forest management.

Conservation area
Some areas will be allocated for conservation purposes. This includes remnant forest patches and buffer zones along water bodies. The conservation areas will be maintained, protected and, where needed, restored.

2.4. Estate characteristics

2.4.1. Estate history

In the 1960s, sisal plantations were created on a large scale in Tanzania, making the country the largest producer of sisal. The Tanga region was the centre of Tanzanian sisal production with 73 plantations, responsible for two-third of the nation's sisal production (Hartemink, 1995)[2].

Kwamdulu and Kwaraguru Estates were established long before that, in 1935 (P. Hol, pers.com.). Several sisal companies have managed the estate in the 80 years up to now, including Amboni Group of Estates owned by Swiss nationals. In 1967, the large majority of Tanzanian sisal plantations was nationalized, but not those owned by Amboni. Later in 2000, both Kwaraguru and Kwamdulu Estates were sold to the Greek M/s Alex Dembeniotis & Co. At the beginning of the 21st century, Dominion Plantations Ltd owned the Estates which were later sold to Sagera Estate Ltd. (Tenga, 2008)[3]. In 2013, SFI Tanzania bought the two Estates from Sagera Estate Ltd.

2.4.2. Kwamdulu estate

Kwamdulu Estate (see Annex A), also referred to as Kwamduru Estate, is located approximately 1.5km south of Korogwe. The part north of the Mnyuzi River falls within the Korogwe Town Council while the part south of the Mnyuzi River falls within the Handeni District. Kwamdulu Estate is about 5km wide (East-West) and about 9km long (North-South) and covers a total surface of about 4,640ha. As can be observed on the map the estate is surrounded by several small villages.

At the northern part of Kwamdulu estate at the tarmac road, the main offices are situated on the factory terrain with the sisal factory, a workshop, stores and a clinic. On the opposite site of the road the tree nursery is located. At Kwamdulu Estate

[2]Hartemink, A.E., (1995) *Soil fertility decline under sisal cultivation in Tanzania.* International Soil Reference and Information Centre Wageningen, Technical Paper No 28, ISBN 90-6672-064-6.
[3] Tenga, M.G., (2008) *Sisal Industry in Tanzania Since Colonial Era - Uncovered Modern Slavery to Liberation*., Xlibris Corp.

there are two workers' camps: one near the factory terrain and one further south, west of Kwakombo. Management houses are built near the factory area.

2.4.3. Kwaraguru estate

Kwaraguru Estate (see annex B) is located in Handeni District, about 20km south of Segera along the A14 road. It is comprised of a northern and a southern block divided by the big dam that is fed by the seasonal Kandoza stream. Kwaraguru Estate is about 5.5km wide (East-West) and about 8km long (North-South) and covers a total surface of 4,505ha. Segera is the nearest town to Kwaraguru Estate. Various villages are located along the A14 tarmac road further south: Kwedizinga, Taula (with its various hamlets) and Kabuku. As can be observed on the map smaller settlements are found on the eastern and southern border of the estate.

At Kwaraguru estate, the buildings are concentrated at the factory area with the sisal factory, offices, a workshop, stores, a clinic and the workers' camp all located in the middle of the estate.

2.4.4. Infrastructure and compartments

On both estates there are offices, stores, workshops and other relevant infrastructure. The offices at Kwamdulu estate are also used as the company head office. Additionally, there is a fully functional sisal factory on each estate that comprises of a decorticator, drying lines, brushrooms and store for finished goods.

There is a number of main roads that run through or along the edges of the plantation. Some of them were already present before SFI and Form Tanzania were established, others were constructed by the company. The company plans to expand the road network as plantation establishment progresses. Road construction and maintenance will take into account the minimization of soil erosion (see also P 21 Road construction and maintenance).

The estates are divided into blocks (sisal) and compartments (forestry). Blocks and compartments are management units, unique in species, plant year and location. The difference is the size. Sisal blocks are usually 10-15ha, and forestry compartments are usually larger (25-40ha). Management regimes are defined per block or compartment.

Table 1 *SFI Tanzania planted areas end 2016*

Planting	Kwamdulu area (ha)	Kwaraguru area (ha)
Sisal (immature)	229,8	424,8
Sisal (mature)	1148,5	950,8
Sisal (old)	110,0	382,8
Forestry (teak)	159,4	11,7
Forestry (eucalyptus)	34,3	30,0

2.5. Sustainability approach

SFI Tanzania envisions to carry out its activities in a socially, ecologically and economically responsible way. The figure below gives an overview of the company's sustainability concept that is applied on both estates.

***Table 2**. SFI Tanzania sustainability concept*

Social	Ecological	Economical
• Creating local employment • Training and good working conditions for employees • Contributing to development of the local communities • Attract outgrowers • Boost local economy	• Conservation of buffer zones along waterways • Conservation of biodiversity • Conservation of water and soils • Positive influence on global carbon balance	• 2-pillar approach: revenues from sisal and forestry • Continuous revenues from sisal • Increasing yields due to quality improvement of sisal production • Respond to declining supply and growing demand for sustainable timber • High yield, short rotation forestry

High quality on a technical as well as on a social and environmental level is the key to success for SFI Tanzania. The core values and the sustainability concept are elaborated in the company's Corporate Responsibility Policy, which is available upon request for interested parties. The approach to sustainable management of the company's sisal and forestry plantings is outlined in the sections below.

2.5.1. Social sustainability

SFI Tanzania ensures that the rights of all employees are respected, that employees receive fair and competitive wages and that national employment laws are adhered to. Opportunities are provided to improve their skills and offer a clear path for staff to progress their career within the company. Strict Health and Safety Guidelines ensure a safe working environment.

SFI Tanzania aims to maintain good relations with all stakeholders, including fringing communities, government officials and institutions. This is effectuated through proper stakeholder engagement planning and an effective social monitoring system.

SFI Tanzania established an outgrower system of at least 60 participating farmers. Neighbouring communities use the land for collection of NTFPs and farming. People can farm or intercrop on the estates after signing an agreement with the company.

2.5.2. Ecological sustainability

By site-species matching, the company ensures optimal growth conditions. The ecological values of the management area are conserved and, where possible, enhanced. Buffer zones are protected and actively restored through enrichment planting where necessary. Remnant forest patches and sensitive sites are identified as conservation areas and protected.

Through its management of sisal plantations and the sustainable establishment of a plantation forest on fallow lands, the company expects to generate the following ecological benefits:

- Restore nutrient cycling

- Improve soil conservation
- Increase the water retention capacity of the area
- Improve water quality in the natural water bodies
- Shift the micro-climate towards a forest climate in the forest stands
- Increase above- and belowground biomass in the forest stands
- Promote biodiversity

2.5.3. Economical sustainability

A combination of sisal and different tree species (Teak, Eucalyptus and possibly others) and different rotations is chosen to be more flexible in response to market changes. Diversification of product lines reduces risks related to market changes and increases economic sustainability. Short rotation sisal plantations generate annual revenues from fibre sales on the international market, while the woodlots generate income in the medium and longer term through clear-felling and thinning operations. The various species and products supply different markets and thus make the company less dependent on a single product.

3. Characteristics of the environment

In this chapter, some background information is given on the project area. The physical environment (i.e. topography, climate, soils, hydrography and biodiversity) is described, followed by a summary of the socio-economic environment (i.e. neighbouring communities and employment). Information included in this chapter is based on the Social and Environmental Impact Assessment conducted by P. Westerlaan and EnviroPlanners (2014), unless otherwise specified.

3.1. Physical environment

3.1.1. Topography

Both Kwamdulu Sisal Estate and Kwaraguru Sisal Estate are located in Tanga Region, Tanzania, at an altitude of 250-350m above sea level. Lying between the coastal area and the mountainous area, both estates are situated in the uplands (cf. Hartemink, 1997)[4] and fall within the Pangani watershed. The topography is undulating to rolling.

3.1.2. Climate

Tanga region has a bi-modal rainfall pattern with a large rainy season in April-May and a small rainy season from October to December. Mean annual rainfall is 1,000-1,200 mm per year, with considerable variation from one year to the other. Average annual temperature is 26ºC with minor fluctuations (Hartemink, 1997)[4].

3.1.3. Soils

According to Mlingano (2016)[5] the nature and distribution of soils of Kwaraguru estate conform to a well-developed catena on a peneplane landscape. Whereas dominant soils on ridge summits and upper slopes are ferralitic, those on the lower ridge side slopes belong to the high activity clays with high base saturation. Dominant soils of the valleys are a complex of both high and low activity clays. The major soil types have a low pH, low fertility status and high (toxic) values of Al, Fe and Mn.
According to the soil report drafted by Hans Scholten (2012)[6], the soils in Kwamdulu estate can be described according to the landscape characteristics; upland, valleys and hill crests.
The red upland soils are very deep, well drained clay with favourable physical properties, but a very low fertility status and a relatively low pH. The soils on the hill crests are strongly acidic, have a very low effective capacity to retain nutrients and are extremely low in calcium, potassium, phosphate and other nutrients. These soils have high (toxic) aluminium saturation values and cover about 19% of the area.

3.1.4. Hydrography

[4]Hartemink, A.E. (1997) *Soil fertility decline in some major soil groupings under permanent cropping in Tanga region, Tanzania*, Geoderma, 75: 215-229.
[5] Mlingano, Agricultural Research Institute (2016) Soils of Kwaraguru sisal estate and their suitability for cultivation of hybrid sisal, Handeni district, Tanga region.
[6] Scholten, J.H.M., (2012), Soil reconnaissance mission to 3 estates in Tanzania. Humisphere, September 2012.

Both sisal estates are part of the Pangani River catchment area and are drained by various smaller rivers and streams. The Pangani River (locally referred to as the Ruvu River) originates from Mount Kilimanjaro and flows eastwards into the Indian Ocean. Water quality of the river is getting worse upstream due to industrial waste and expansion of agricultural activities.
The southern part of Kwamdulu Estate is crossed by the Mnyuzi River Valley. The Mnyuzi River is currently a seasonal stream. Other water bodies within the estate are the Section 2 Dam, Chandarua and Kwamaruala wells and the sisal waste water pond, also referred to as Section 1 Dam. Then there is the pipeline supplying Pangani River water to the sisal factory area.
In the middle of Kwaraguru Estate lies the Kwaraguru Dam that is fed by the Kandoza seasonal stream. Other water sources within Kwaraguru Estate are the Kabuku Dam, the Animal Dam, and the pipeline with Pangani River water. There is also a borehole on the estate that is no longer in use. Finally, there is Jan's dam about 1km downstream from the factory and which replaced the sisal waste water pond near the sisal factory.
In 2016 a water filtration system has been installed at both estates, which supplies the factory areas and labour camps with clean drinking water.
The suitability of the various other water sources on both estates for domestic use has been determined in a water quality study[7]. At both estates there are several water sources that have the potential to serve as sources for domestic use but treatment is needed to improve the quality of water from these sources (e.g. filtration, sedimentation).

3.1.5. Biodiversity

The information in this section is derived from the biodiversity assessment conducted by EnviroPlanners[8]. This section starts with an indication of the various vegetation types per estate. Then the most relevant results of the biodiversity study are presented with a part on flora and a part on fauna identified within the project areas.

Flora
24 different tree species have been identified in Kwamdulu estate, and 29 in Kwaraguru estate. Most common species are trees *Markhamia spp., Acacia polyacantha*, *Acacia robusta* and several species of the genus *Albizia*. Besides the tree species identified in the biodiversity study, there are many large Bombax trees (*Rhodognaphalon schumannianum*), planted along the main plantation road at Kwamdulu estate ("Bombax Allee").
African Blackwood (*Dalbergia melanoxylon)* is the only species on the estates that is listed on the IUCN Red List, classified as near threatened (lower risk). The tree was found on Kwamdulu estate. No species were found that were listed on the CITES appendices.
From interviews with local communities, it was derived that in the past there were a lot of big trees, such as mininga (Bloodwood – *Pterocarpus angolensis*), mvule (African Teak – *Milicia excelsa*), misufi (Wild kapok – *Bombax rhodognaphalon*), misezi (Dubard – *Manilkara sulcata*) and miembe (Mango trees – *Mangifera indica*), but nowadays there are few left. Suggested reasons are human activities, such as logging for timber, charcoal making and agricultural activities.

[7]Westerlaan, P. (2014) Water Quality Analysis Kwamdulu and Kwaraguru Estates
[8]Resources inventory - An input for Environmental Impact Assessment ofproposed teak plantation at Kwamdulu and Kwaraguru Estates Korogwe and Handeni Districts in Tanga Region forSFI Tanzania Ltd., July 2014

32 and 35 different shrub species have been identified in Kwamdulu and Kwaraguru estate, respectively. The most abundant shrub species in Kwamdulu was *Harrisonia abyssinica*, and in Kwaraguru *Flueggea virosa.* None of the identified shrub species are listed on the IUCN Red List, or in the CITES appendices.
38 and 30 different herb species have been identified in Kwamdulu and Kwaraguru estate respectively. The most frequently identified species was *Commelina benghalensis*, in both estates. Some plant species that were identified on the estates, such as *Lantana camara* and *Solanum incanum*, may show invasive behaviour.

Fauna

Fauna included in the biodiversity study are birds, mammals and reptiles.
A total of 111 bird species from 49 families was recorded in the two estates (102 and 106 in Kwamdulu and Kwaraguru respectively). One-third of the bird species in both estates were recorded across all habitat types (sisal, fallow land, Teak, indigenous forest). Other species were restricted to sisal (21% in Kwamdulu; 11% in Kwaraguru), fallow land (14% in Kwamdulu; 8% in Kwaraguru), Teak (6% in Kwamdulu) or forest (10% in Kwaraguru).
Two of the recorded species were classified as near threatened on the IUCN Red List: *Terathopius ecaudatus* (Bateleur) and *Coracias garrulous* (European roller). The European Roller is also the only migratory bird identified. A total of 12 recorded bird species was listed in Appendix II of the CITES list. One of the birds was on Appendix I of the CITES list: *Falco peregrinus* (Peregrine falcon).
In total, signs or sightings of 8 different mammal species (at least 30 individuals) have been observed on the estates. All are classified as Least Concern according to the IUCN Red List. Two species are included in CITES Appendix II: the African Civet and the Velvet Monkey. Main species identified are Duiker, African hare and African civet. The Duiker and African hare are typical species that live in grassland/ bushland habitat. The African civet is a generalist.
Six species of reptiles (24 individuals) were observed on the estates. The Rock Python was the only species listed under CITES Appendix II. None of the observed reptiles was on the IUCN Red List.

3.2. Socio-economic environment

3.2.1. Neighbouring communities

The neighbouring communities are presented on the maps in Annex A and B. Approximately 10,000 and 15,000 people neighbour Kwamdulu Estate and Kwaraguru Estate respectively. Although the majority of the current working population (farmers) did not receive more education than primary school, it seems that today the majority of students continues with secondary school. A general trend in Tanga Region is that (educated) young adults leave their village to work in the city[9]. Most surrounding settlements are easily accessible, except for some remote hamlets.

The majority of the population around both estates has no access to motorized transport, and a big part of the population has no cell phone. This limits the access to transport in case of emergency situations. The nearest hospital is located in Korogwe, a significant distance for the communities neighbouring Kwaraguru estate. However, both estates have a clinic offering medical services to SFI Tanzania workers and to the neighbouring communities. Among the most prevalent illnesses are stomach problems, malaria and, to a lesser known extent, HIV.

Farming is the main source of livelihood for all communities surrounding the estates. Besides growing crops like maize, beans, cassava and oranges, nearly all households keep livestock, mostly chickens, goats and ducks. In addition to farming, various items are collected in both estates, such as medicinal plants, fish, wild fruits and vegetables, and water.

Semi-nomadic groups (Mang'ati) irregularly cross the estates with their cattle. No traditional migratory routes exist for these groups in the region.

3.2.2. Involvement of people in company's activities

SFI Tanzania is a significant employer for the inhabitants of the neighbouring communities. Housing facilities are provided to the workers at the worker camps on the estates.

Farmers can farm on the estates, either on fallow (unplanted) land, or intercrop with the planted sisal and trees, after signing a farming and intercropping agreement. Farmers can also chose to participate in the outgrower scheme where they grow trees on a small portion of their own land as an additional future source of income. Planting material and training is offered by the company, and the participants are responsible for planting and maintenance.

[9]Tanga Regional Socio-Economic Profile, 2008, National Bureau of Statistics and Tanga Regional Commissioner's Office, coordinated by Ministry of Planning, Economy and Empowerment, January 2008.

4. Environmental management

The focus of environmental management is on managing water, soils and biodiversity. As a conservation baseline, the following measures are taken:

- Large indigenous trees (DBH > 20 cm) are conserved
- Remnant forest patches on the estates are conserved
- A significant area will be set aside for conservation, including buffer zones
- Along water bodies, buffer zones will be maintained or restored
- Avoidance of soil erosion by soil cover and proper road construction.

Below a brief outline of the conservation policies. A detailed description is provided in the Conservation Procedure (P16).

4.1. Water management

Water bodies will be protected by buffer zones to safeguard water quality, and to promote a regular water flow and a healthy aquatic ecology. As water from streams and dams is used by local people for domestic purposes, water quality and availability are important factors in people´s health and livelihood. Buffer vegetation will be established and/or maintained along rivers and water bodies. Natural regeneration will be used to improve the vegetation of the buffer zones.

4.2. Soil management

The company aims to prevent erosion, soil acidification, soil fertility loss and pollution with agro-chemicals. The company assures impact mitigation by following best practice guidelines for plantation establishment and management, road construction, soil fertility management and pollution control (see next section on use of chemicals). Well-drained roads will be constructed, minimizing soil erosion.

4.3. Waste Management

The company produces several types of waste that should be treated in different ways. Therefore a clear strategy on waste management has been developed by the company to structure the waste flows and minimize waste production (refer P 09 Waste Management). Production of domestic waste is reduced by raising workers' awareness on hygiene and spilling.

4.4. Use of chemicals

As part of the SFI Tanzania sustainability policy, chemical use on the estates is kept to a minimum. Use and management of chemicals is covered by P 15 Responsible Use of Chemicals, which aims to minimize application. Mechanical weeding is used where possible. For those cases where chemicals are used, the type of chemicals used will be in line with FSC requirements. Personnel that apply chemicals will receive proper training and equipment to minimise health and environmental risks.

4.5. Biodiversity

SFI Tanzania already has a set of measures to conserve and enhance the biodiversity values in the area under their management, including conservation of remnant forest patches, and establishment and restoration of buffer zones. As the conservation areas develop over time, they are expected to become richer in wildlife and vegetation diversity. The buffer zone vegetation is also intended to act as a wildlife corridor within the estates.

With afforestation of fallow land it is expected that certain ecosystem services will be improved, e.g. water quality and climate regulation. The conservation of bigger indigenous tree species and the protection of wildlife can potentially increase the ecological value of the estates.

4.6. High Conservation Value Forests

From the High Conservation Value analysis[10], it can be concluded that the ecological, historical, cultural and social values of Kwamdulu and Kwaraguru Sisal Estates are limited, and cannot be classified as 'high conservation'. The forest vegetation on the estates is highly degraded and the remaining bushland is distributed in small patches. No High Conservation Value areas have been identified in Kwamdulu and Kwaraguru Sisal Estates.

[10] Tollenaar, M.L. (2015) Analysis of the High Conservation Value areas of Kwamdulu and Kwaraguru estates, Tanzania

5. Social aspect management

5.1. Stakeholder engagement

Stakeholder engagement is considered a very important part of the business at SFI Tanzania. The relations with fringing communities as well as government institutions, research institutes, NGOs and other parties are managed carefully by the Senior Management of the company. The P 04-10 Communications policy has been elaborated to outline the approach of the company in managing their stakeholder relations.

For handling grievances from employees or external parties or individuals, a Grievance Redress Mechanism has been developed.

5.2. Rights of local communities

The surrounding communities and the residents of the worker camps have the right to make use of the estates for their livelihoods. The specific use rights are outlined below. Specifications on prohibited activities on the estates are provided in Procedure P 17 Prevention of Illegal Activities.

Burial grounds
In the neighbourhood of the worker camps there are several burial grounds, which are depicted on the maps (Annex A and B). The company will leave these burial grounds untouched and ensures unrestricted access for workers and family members.

Collection of firewood
The company allows the collection of firewood for domestic purposes.

Collection of Non-Timber Forest Products (NTFPs)
SFI Tanzania allows the collection of NTFPs for domestic purposes.

Farming and intercropping
A permit system is developed to control farming and intercropping on the estates. People from fringing communities are allowed to farm within the estates if they comply with regulations stipulated in the agreement.

Fishing
Fishing on the estates is permitted for domestic purposes.

Grazing
Grazing by goats and sheep is allowed on the estate. On the contrary, grazing by cattle is not allowed on the estates, since it will cause damage to the plantations. Grazing is controlled by security personnel of the company.

Markets
Informal, small-scale markets are allowed to be held on pay-days, twice a month, at the welfare centres on the estates.

Use of road network

The road network on the estate is freely available to all those passing through the estate.

Water use
Use of water for domestic purposes is permitted on the estates.

5.3. Support of local infrastructure and facilities

There are several ways in which SFI Tanzania supports local infrastructure and facilities. The most prominent aspects are elaborated in more detail below.

Clinics
At both estates the company operates a clinic which serves the worker camps and neighbouring communities. The clinic at Kwaraguru is shared with the government, while the clinic at Kwamdulu is 100% company property. The company supports the clinics with the supply of materials and with training of staff.

Schools
At both estates there is a school and both staff and materials are supplied by the government. SFI Tanzania supports the schools with light maintenance of the buildings, access to water and some basic material supplies.

Water supply
The worker camps at the estates are supplied with clean water from the water filtration plants operated by SFI Tanzania. Additionally, the pipeline supplying Kwamdulu estate is also supplying the communities along the pipeline with water.

5.4. Outgrowers and intercroppers

An outgrower project is initiated by the company to involve local communities in tree planting. Small-scale forestry is introduced to local farmers that live around the estates. After signing an outgrower agreement, the participating farmers plant a small patch of land with tree seedlings provided by the company. The participants are trained by company staff on how to establish a woodlot on their land. Once the trees have grown to maturity, the company will have the first right of purchase of the timber.

Both employees and farmers that live around the estates are invited to intercrop between the trees and sisal plants. These people are granted access to free farmland, and the company benefits from their presence because they weed and maintain their farm. The cooperation is formalized in a farming and intercropping agreement. The rights and responsibilities of the farmers and the company are stipulated in this agreement. The agreement also applies to farmers that grow their crops on fallow parts of the estate. For these farmers, a restriction on the size of the farmland applies. Opportunities are explored for the optimization of the sisal intercropping system.

The intercropping and outgrowing systems are described in detail in P 20 Intercropping and Outgrowing.

5.5. Employment and training

SFI Tanzania is committed to ensure that all staff have access to learning, development and training opportunities which enable them to have the appropriate knowledge and skills to carry out their role within the organisation, and to develop their talents in any ways that fit with the organisation's development to meet its strategic objectives.

Employment
For the employment of workers, priority is given to inhabitants of the area surrounding the estates. The workers are employed under the national labour standards for the agricultural sector and the International Labour Organisation (ILO) standards. Additional information can be found in the P 04 Human Resources Policy

Safety
Safety is of the utmost importance to SFI Tanzania, see details in P 06 Health and Safety Policy. To ensure that everybody works in a safe manner in a safe environment, three approaches are used:

- the workplace is periodically monitored to assess its safety
- personnel is trained in the safe use of equipment and in safe working techniques
- personnel use individual protective gear

First aid
Annual first aid training is provided to all first aiders. First aid kits are available at working sites or at least in the vicinity. There are enough kits in order to provide optimal help in case of an emergency.
In order to be able to rapidly evacuate any injured or gravely ill person, transport will be available (refer P 06 Health and Safety Policy)

Training
Professional training in all elements of the company's operations, as well as training on FSC certification.

Students
Students from various schools and institutions receive training from company staff. They are fully accommodated by SFI Tanzania.

6. Monitoring and evaluation

Monitoring and evaluation of plantation and management performance is essential to assure that set management objectives are met. SFI Tanzania has established a monitoring system to be able to evaluate its performance and adapt its management when necessary. The monitoring system consists of several activities aimed at collecting different types of information. The method of monitoring depends on what is best suited per type of information.

The monitoring activities are described in detail in Procedure 08 Monitoring. A monitoring plan is written annually, outlining the monitoring activities per year.

The data of the various monitoring activities are used to evaluate the overall performance and effectiveness of the management. If necessary, corrective action can be taken based on the monitoring results, including adaptation of the management plan.

Form international writes an annual monitoring report, of which a summary will be published on the website: www.sfitanzania.com.

7. Risk management

7.1. Political opposition

The political environment is key in the long-term business sustainability of the company. It determines the viability of the business as a whole, because of legislation, taxes and land ownership. The strategy of the company is to strive towards an enabling environment through the highest levels of legal compliance, high level management of relationships with the several political stakeholders, as well as through secure and well-defined land titles.

7.2. Pests and diseases

Pests and diseases can cause considerable damage. The company has therefore developed a strategy to minimise the effects of pests. This strategy is elaborated in Procedure 18 Integrated Pest Management. Species are selected that are relatively resistant to known pests and diseases. By planting different species and varieties, the risk is spread. Stands are monitored on a regular basis.

7.3. Unauthorized activities

Unauthorized activities on the estates include settling, hunting, trapping, felling, burning, or planting food crops without consent of the company. SFI Tanzania's approach is directed at prevention, by awareness raising of the local population, and control through patrols by security guards. This approach is described in Procedure 17 Prevention of Illegal Activities.

7.4. Fire management

Fire is a great risk to the sisal and forestry plantings. Traditionally, people use fire as a means of clearing land, for the collection of honey and for hunting, which poses a risk to the plantings. The company's fire management aims to reduce fire risk and focuses on four main strategies: fuel load reduction, fire breaks, establishment and training of fire teams, and awareness raising on the risks of fire to local people. These strategies are described in detail in the Procedure 19 Firefighting and Prevention.

7.5. Water conservation

Water shortage is a great risk to the company operations as well as the communities in the surrounding area. Therefore the company aims to conserve the available water as much as possible through recycling and cleaning of water, as well as through keeping the available water as much as possible in those places on the estates where it can still be used. Buffer zones will help to conserve the water quality through prevention of influx of sediment. The channelization of streams

flowing out of the estates will be avoided, since this will lead to quick loss of available water from the area.

7.6. Soil conservation

Vegetative cover of the soils will be promoted to reduce erosion and loss of fertility. Where possible bare soil will therefore be avoided and good soil management practices will be promoted.

7.7. Wind breaks

To minimize the drying of the area, windbreaks are established on the estates. This will reduce evaporation and will establish a more stable micro-climate at the estates. An additional effect will be that the younger planted trees are less vulnerable for windfall, which is more likely to occur in a changing climate.

Part II: Sisal

8. Sisal management

8.1. Sisal management strategy

SFI Tanzania aims to become a leader in Tanzanian sisal production, supplying volumes of a high quality product which is produced sustainably. SFI Tanzania has a good starting point with more than 3200 hectares of planted sisal (end 2016), a significant area of available fallow land, and 2 operating factories. Also the market provides a good starting point, since there is a high demand for sisal fibres being a good and more sustainable alternative for synthetic fibres.

However, there are also some serious threats which need to be addressed in order to ensure a sustainable business model. The estates are currently planted with almost only the hybrid 11648. Additionally, the planted area is degrading due to the continuous harvesting without proper soil recuperation.

The sisal processing is also facing some threats which need to be addressed to ensure a long-term and sustainable business. The processing facilities are old and need to be renovated, which will take a significant investment. The decortication process is very water consuming, which poses a risk of water shortage in dryer periods. Additionally, it is also highly polluting due to the huge amounts of waste which is generated, both in solid and liquid form.

8.2. Nursery material

8.2.1. Hybrids

Variation in hybrids with improved yield. Currently all commercial sisal on the estates are planted with hybrid 11648. Opportunities to plant other sisal provenances will be explored for the purpose of growth and yield improvement.

8.2.2. Planting material

Quality and uniformity of sisal planting material is very important to the performance of the crop over its life. Bulbils are small plantlets that form on the lateral branches of a sisal inflorescence (pole) once it ceases to produce leaves. They vary in size from 5 to 15 cm and are the most promising means to achieve good and uniform planting material.

The use of suckers also has advantages as suckers are always available in mature sisal plantations and is less costly, especially since de-suckering mature sisal is recommended. Grading of suckers on size is however important to ensure a uniform crop.

8.3. Sisal field management

The details of sisal growing operations are described in the procedure P 13 Sisal growing. Sisal cannot stand wet soils and also black-cotton soils should not be planted.

8.3.1. Fertilization

Application of sisal waste and fertilizers have positive effects on sisal yields as shown by previous research by Mlingano. Application of sisal waste back into sisal fields is also strongly recommended and will be investigated.

8.3.2. Pests and diseases

The most important insect pest of sisal in East Africa is the sisal weevil (*Scyphophorus interstitialis*).The best way to control the weevil is to destruct breeding grounds, the use of traps or use of chemicals in severe cases.
The most important disease affecting Hybrid 11648 is Korogwe leaf spot (KLS). Occurrence seems to be less intense in sisal fields with adequate soil fertility and effective weed control measures.
Other diseases are banding disease, purple leaf tip role disease, chlorosis and leaf wrinkle and are caused by nutritional factors.
Damage to sisal is also caused by monkeys and baboons, especially on the fringes of a sisal plantation adjacent to indigenous bush. This is controlled by security guards.

8.3.3. Intercropping

Intercropping in between sisal rows is being practiced and will further be considered as it is a significant contributor to the livelihood of the surrounding communities. Care must be taken that the use of soil resources by crops like maize does not offset the advantages gained from weed control.

8.4. Sisal harvest

Once sisal plants are 2-3 years old, leaf cutting starts and the leaf cutting operation affects plant growth and total leaf production. Three factors affect performance of the sisal plantation:

- Stage of plant growth at which first cutting starts
- Frequency of cutting, or cutting cycle
- Severity of cutting (how many leaves are removed)

During the first cut, sand leaves (lowest leaves) are removed and discarded as they do not produce line fibre. Leaf cutting frequency is dependent on variety of species as well as climatic and soil conditions.

The number of metres of green leaf per ton of line fibre recovered is the standard measurement of fibre productivity in the sisal industry. The average annual fibre

yield/ha is also recorded and compared to industry norms. Currently the yields on Kwamdulu and Kwaraguru are much lower than Tanzania national average yields due to poor soil fertility. This will be addressed together with support from Mlingano Research Institute by applying sisal waste, lime and fertilizers.
A typical sisal estate will have mature sisal, immature sisal (less than 3 years old), as well as old sisal. Old sisal is still under production, although production levels are usually lower and might depend more on management of suckers. However, old sisal is important as it is the source of new planting material in the form of bulbils.

8.5. Sisal decortication

Sisal line fibre is found in the fleshy tissue of the leaf and separation of these fibres involves mechanical crushing and scraping. This process is called decortication. SFI sisal estates have 3 fixed decorticating machines which consists of two wheels or drums with blunt beater blades attached to the drums. An adjustable concave plate is set so that the beater blades clear it by about the thickness of a leaf and water is used to direct the fibres and wash away fibres and waste. Sisal leaves are fed onto the rope feed and are transported to the drum by a series of wheels. Electric motors are used to drive the decorticator. Several brands of decortication machines are available such as Krupp, Corona, and Stork. However, these machines are old and need continuous maintenance and rebuilding. Therefore, a major focus of management is to obtain sufficient spare parts and to completely renew the electrical motors.

Sisal decortication results in production of large quantities of waste material. Approximately 95% of the sisal leaf is discharged as waste effluent. Studies to reduce pollution and utilizing the sisal waste are currently being done by investigating the potential for biogas, using sisal waste as fertilizer and more effective waste ponds. Decortication also uses large volumes of water and management is investigating options to recycle water for decorticating.

The details of sisal processing are described in procedure P 14 Sisal processing.

8.6. Dry fibre and brushing

The line fibre market requires fibre that is long, clean and white. Fresh green leaves are easier to decorticate than older leaves. After decortication the wet fibre is taken to the drying lines where basic sorting is carried out according to length and colour. Sun drying helps to bleach the sisal.
Brushing is the process that follows drying and in this process the dried fibre is free into individual strands and combed to remove impurities and dust. The combed out short fibres are used to make “tow”.
The brushed fibre is graded and baled separately. Grading is based on length, colour, and presence of impurities. Length being the predominant factor. Since different grades have different prices it is the aim of management to produce the

maximum volume of the best quality possible (either 3L, No.2 or UG grade, followed by SSUG, TOW1 and UF). Sisal fibre is than baled into 250kg bales for export and 200 kg bales for Tow. Upon request of customers bale size may vary, and bales of 100kg are produced.

Part III: Forestry

9. Forest management

9.1. Tree species selection

Species and hybrid clones are selected for planting based on field trials. Teak (*Tectona grandis*) and various Eucalyptus hybrids have been selected for further planting based on promising results in the trials. The silviculture and commercial performance of Teak and Eucalyptus are well-known and the marketing potential is good.
Other species such as Pine (*Pinus caribaea*), Grevillea (*Grevillea robusta*), Pink cedar (*Acrocarpus fraxinifolius*), Spanish cedar (*Cedrela odorata*), and a selection of indigenous tree species are planted in the trials.

SFI Tanzania does not make use of genetically modified organisms (GMO) for their planting material and will not introduce new species to the region in order to avoid introducing pests or invasive species.

9.1.1. Teak

One of the two principal plantation species planted by SFI Tanzania is Teak (*Tectona grandis*). A number of factors justify its use from a technical and economical perspective. The main factors are outlined below.

Species justification
Because of the physical and aesthetic qualities of the wood, Teak is a much desired timber species with a good commercial value. Teak has a relatively fast growth rate, which strengthens the sustainable business case. For many indigenous timber tree species, the growth rate is unknown. This makes it challenging to make a viable business case for those species.

Experience with the silviculture of Teak plantations started in the 19th century (Behaghel, 1999)[11].This longstanding practise has resulted in sound management guidelines and good yield prognoses. Form Tanzania can build on the experience of sister company Form Ghana Ltd. that has a long track record with Teak production. This provides a solid technical basis for the production of Teak.

As an exotic tree species in Tanzania, Teak does not suffer much from diseases. The limited risk of diseases is further mitigated through careful site selection. On suitable sites, trees are healthier and therefore more resistant to pests and diseases (Keogh and Pentsil, 2001)[12]. Due to the low susceptibility of Teak to diseases, normally no chemical treatments are required for pest control. Teak is planted on deep, fertile and level soils which are relatively insensitive to erosion.

The risk of invasiveness of Teak trees is low, given that dispersal distance of Teak seeds is limited. Because the demand for light is high, invasion is prevented by densely vegetated areas (e.g. high grass). In order to further minimize the risk of invasion, no Teak is planted in the buffer zones and ecologically valuable areas.

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[11]Behaghel (1999) *Etats des plantations de teck (Tectona grandis) dans le monde.* Deuxième partie, la filière du teck. Bois et Forêt des Tropiques, No 262 (4).
[12]Keogh, R.M. and M.Y. Pentsil (2001)*Teak in Ghana – A best practice field guide.* Forest Plantation Development Centre.

The presence of buffer zones and fire breaks around the woodlots further inhibits the spread of Teak outside estate boundaries.

Site-species matching
The optimal climate conditions for Teak are a mean annual temperature between 22 and 27ºC, and an annual precipitation between 1200 and 2000mm per year (Keogh and Pentsil, 2001)[13]. With temperatures of 26ºC with minor fluctuations (Hartemink, 1997)[14] the estates have the required temperatures for Teak. The mean annual rainfall of 1,000-1,200mm is the very minimum of the recommended rainfall range, although having rainfall a little less than the amount that is needed for maximum growth is good for the health of the trees and the quality of the timber.

Provenances
Teak seed used are from two provenances in Tanzania: Mtibwa and Lunguza. Depending on the growth performance more provenances might be tested.

9.1.2. Eucalyptus

The other principal tree plantation species planted by SFI Tanzania is Eucalyptus (*Eucalyptus* spp.). Justification of this species from a technical and economical perspective is outlined below, as well as identification of potential risks related to the planting of Eucalyptus.

Species justification
Eucalyptus is a common species in forestry all around the world, delivering high quality products such as sawn timber, poles, and pulp for paper manufacturing. Eucalyptus has a very good growth rate that outcompetes almost any other plantation timber species. In Tanzania, Eucalyptus is planted on a large scale. Two of the companies that plant Eucalyptus in Tanzania are FSC-certified, emphasizing the potential for sustainable plantation management with this species.

Potential risks
Eucalyptus has a reputation of high water use. This is however largely variable, depending on the species/hybrid, climate (rainfall and solar radiation), soil type and depth, vegetative cover, tree growth stage, wood density, and tree rooting depth[15]. To reduce the drying effect, SFI Tanzania will not plant Eucalyptus on wet and sensitive areas. Wetlands and riparian zones are identified and properly delineated and no trees are planted in these areas. A buffer will be kept unplanted along wetlands, rivers and dams.

Eucalyptus is relatively fire resistant. In order to mitigate the risk of fire spread, proper fire management will be done using fire belts, small blocks of plantings, proper roads and weeding inside compartments to reduce fuel load. Fires will be carefully monitored.

[13]Keogh, R.M. and M.Y. Pentsil (2001)*Teak in Ghana – A best practice field guide.* Forest Plantation Development Centre.
[14] Hartemink, A.E. (1997) *Soil fertility decline in some major soil groupings under permanent cropping in Tanga region, Tanzania*, Geoderma, 75: 215-229.
[15] Kilimo Trust (2011) *Eucalyptus Hybrid Clones in East Africa*; Meeting the Demand for Wood through Clonal Forestry Technology. Occassional Paper No.1

Eucalyptus is a medium invasive species depending on the hybrid, and therefore care will be taken to prevent spreading of Eucalyptus into neighbouring areas by weeding and monitoring.

Site-species matching
The Eucalyptus hybrids that are planted by SFI Tanzania are suited for growing in areas with mean annual rainfall above 750mm and at an elevation of less than 1700m.a.s.l[16]. The estates of SFI Tanzania get a mean annual rainfall of 1,000-1,200mm, which is normally sufficient for this species.

Site selection for Eucalyptus will be done based on soil information. Sites with sensitive soils will not be planted with Eucalyptus, but rather with Teak or other (indigenous) species. Steep slopes will not be planted to prevent soil erosion.

Provenances
The most popular Eucalyptus hybrids worldwide, which are also planted at SFI Tanzania estates, are those of *E. grandis* crossed with *E. camaldulensis* (GCs). Hybrids of these two species combine the fast growth of *E. grandis* and the drought tolerance of *E. camaldulensis*. Other Eucalyptus hybrids such as *E.grandis* x *E. tereticornis* (GxT) and *E.grandis* x *E. urophylla* (GxU) are tested by the company. Eucalyptus seedlings are currently purchased from the Tanzania Forestry Research centre (Tafori), close to Kwamdulu estate.

9.1.3. Other tree species

Besides Teak and Eucalyptus, some indigenous tree species will be planted. Indigenous species and other potentially commercial tree species will be planted as seedlings in research trials

9.1.4. Buffer zone vegetation

Buffer zone vegetation will be established through natural regeneration and/or maintained along all permanent water bodies[17]. There are no permanent streams on the estates. For dams and reservoirs, the company maintains a buffer zone of 60m between the shore/river bank and the woodlots. For seasonal streams, a plant-free zone will be respected with a minimum width of 5-10m on each side.

9.2. Tree nursery

There is a tree nursery on Kwamdulu with an annual capacity of about one million seedlings. Details on nursery operations are presented in Procedure 11 Tree Nursery. Watering is done both manually and through the installed irrigation system with water pumped up from the nearby Pangani (Ruvu) River. The seedlings get various phytosanitary treatments such as the application of fertilizer (both organic and chemical), and the use of pesticide against termites.

9.3. Silvicultural systems

[16] P.O. Oballa, P.K.A. Konuche, M.N. Muchiri and B.N. Kigomo (2010) *Facts on growing and use of Eucalyptus in Kenya.*Kenya Forestry Research Institute
[17]Distances are based on the Sustainable Agriculture Standard (Version 3.0, 2010), since these regulations will in the future probably apply for sisal. The FSC standard does not prescribe the specific distances, but has buffer zones as a general requirement.

The full description of the silvicultural systems applied by SFI Tanzania is given in Procedure 12 Forestry. Below is a brief outline of the main operations.

9.3.1. Management strategy

Each species is managed according to a selected silvicultural regime. Rotation time is chosen based on growth rate and final products. For Eucalyptus a short rotation is considered for the production of poles, and for Teak a longer rotation is adopted to produce high-value sawlogs.

Yield tables for Teak are developed based on growth performance of the Teak stand in Kwaraguru. For Eucalyptus yield tables from South Africa and Tanzania are modified to describe the expected growth on the estates.

9.3.2. Terrain preparation

Proper soil preparation is done to prepare for planting. Ripping is done where needed, to ensure quick establishment of the seedlings. The main land preparation activities are clearing, ploughing/ripping, weeding and, in some instances, spraying. The terrain preparation is done through the following steps, depending on the initial state of the terrain: bush clearing, spraying, ploughing/ripping (where possible), pegging, and planting. The use of fire in land preparation is minimized to conserve nutrients.

9.3.3. Establishment forestry species

Teak stumps are supplied from the nursery in Kwamdulu estate and planted in prepared planting holes in the field as soon as the rains have started. Eucalyptus seedlings(cuttings), are delivered in small sachets or in unigrow seedling trays in the field. Liming and fertilizing is done where feasible and necessary.

9.3.4. Weeding

In the first years after planting, before canopy closure, weeding is very important to prevent weeds from restraining the growth of the seedlings. Weeding is carried out until canopy closure. The methods applied are: total weeding, circle weeding and strip weeding. Total weeding and strip weeding are mechanized, carried out by harrowing with a plough and weeding with a Gyramow respectively. Strip weeding may be done manually in some instances. Circle weeding is always done manually, by removing the weeds around each individual seedling or tree. The organic matter is placed back around the tree for mulching, and to suppress the growth of adamants.

9.3.5. Singling (Teak)

Some Teak stumps grow more than one stem. Individuals with multiple stems are reduced to just one stem in the years after planting. Singling might be needed in later stages as well, when forked or multiple stems are formed and this cannot be corrected for by thinning. Singling is done along with weeding.

9.3.6. Thinning and pruning

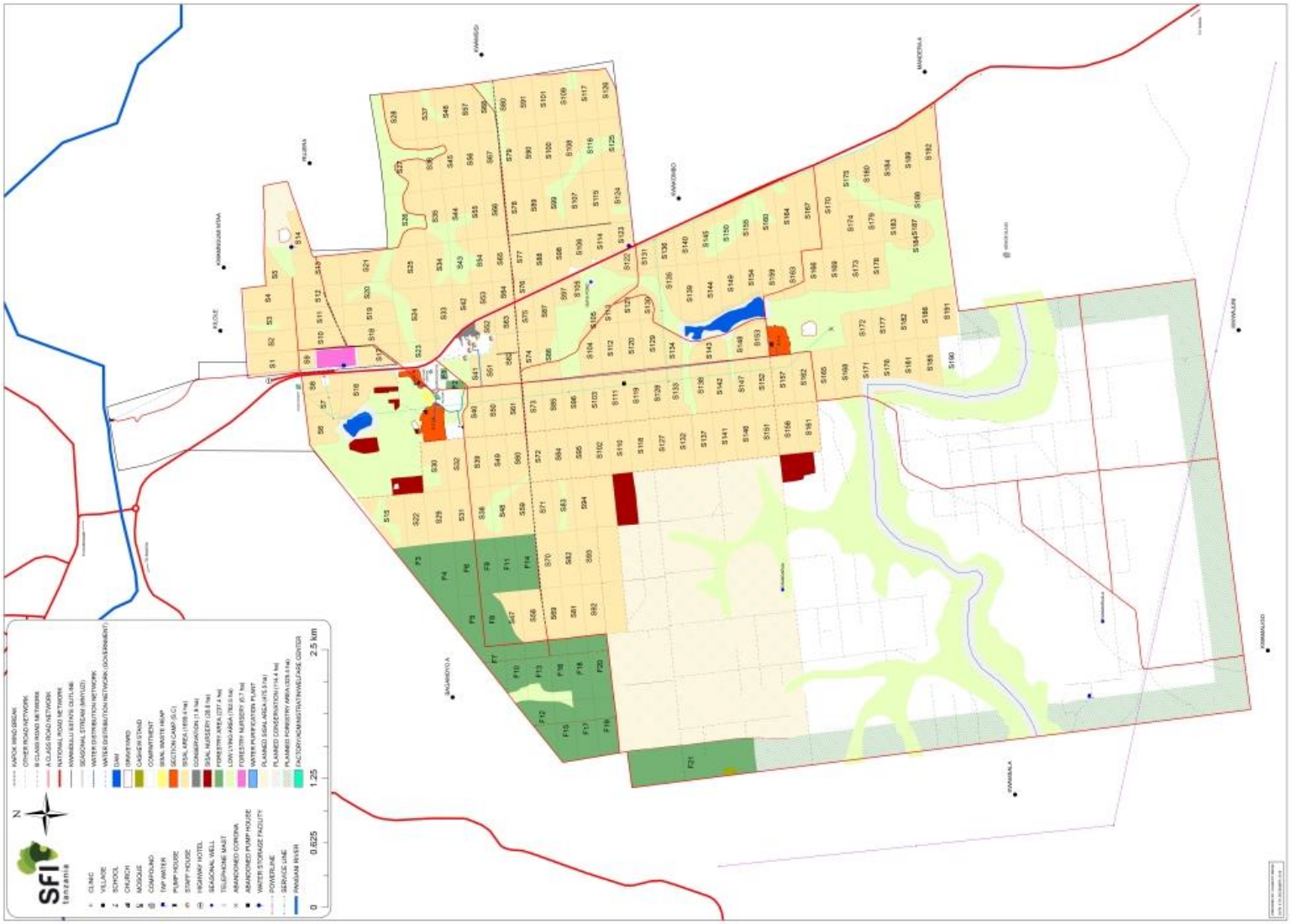
In order to positively influence the productivity of the stand, thinning is applied. Wood distribution between stem and branches can be influenced by thinning and pruning. By timely thinning and pruning the trees can be brought to optimal height growth and well-formed crowns, with little biomass going into the branches in early

life stages. Pruning is done to clean the base of the stem from branches, which leads to a higher timber quality. The moment of thinning is determined by observing canopy closure in the stand. The moment and the intensity of thinning depends on the growth performance of a stand as well as the product that is required, e.g. Eucalyptus poles.

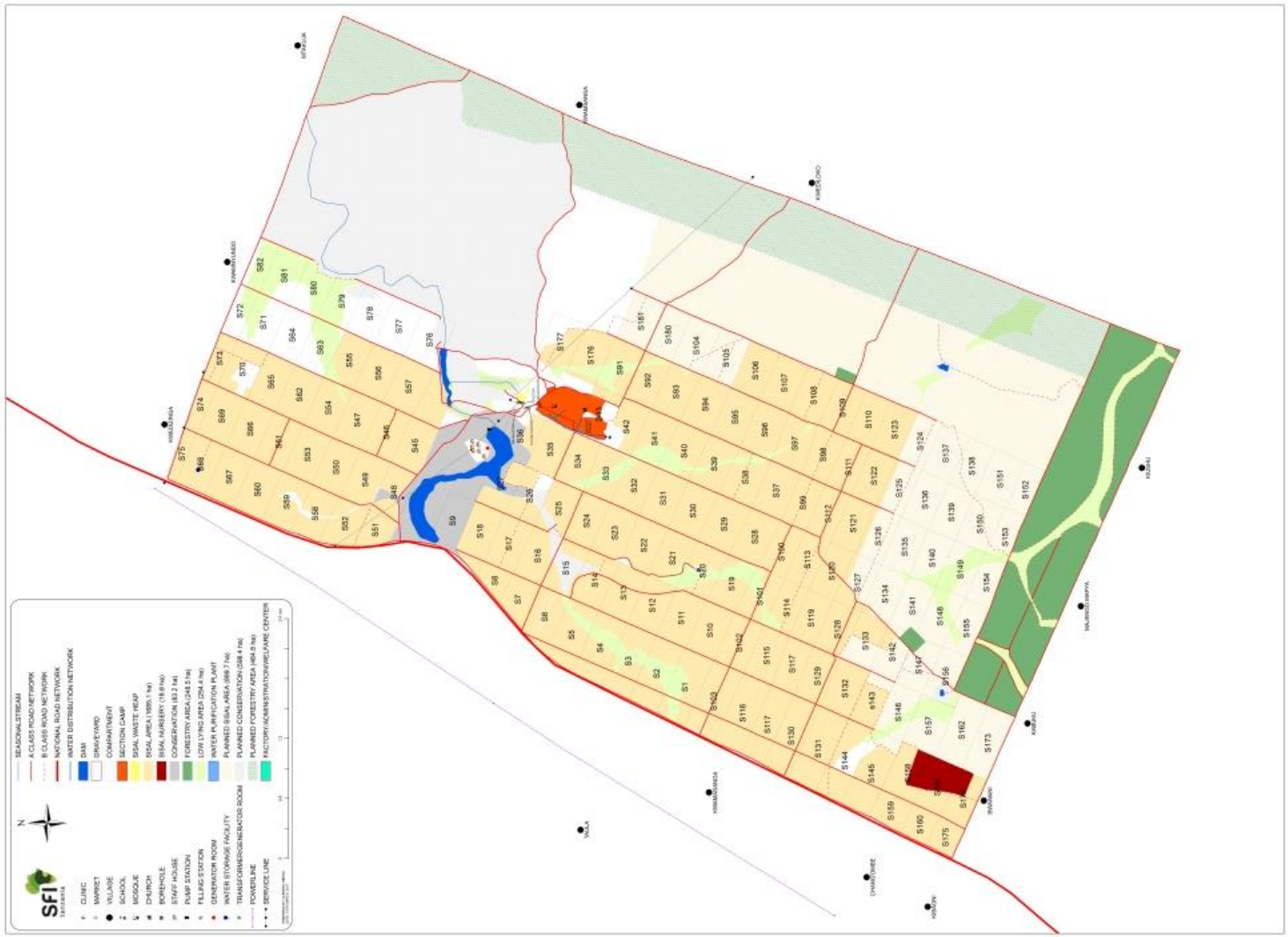
9.3.7. Harvesting

Details on harvesting will be determined when relevant.

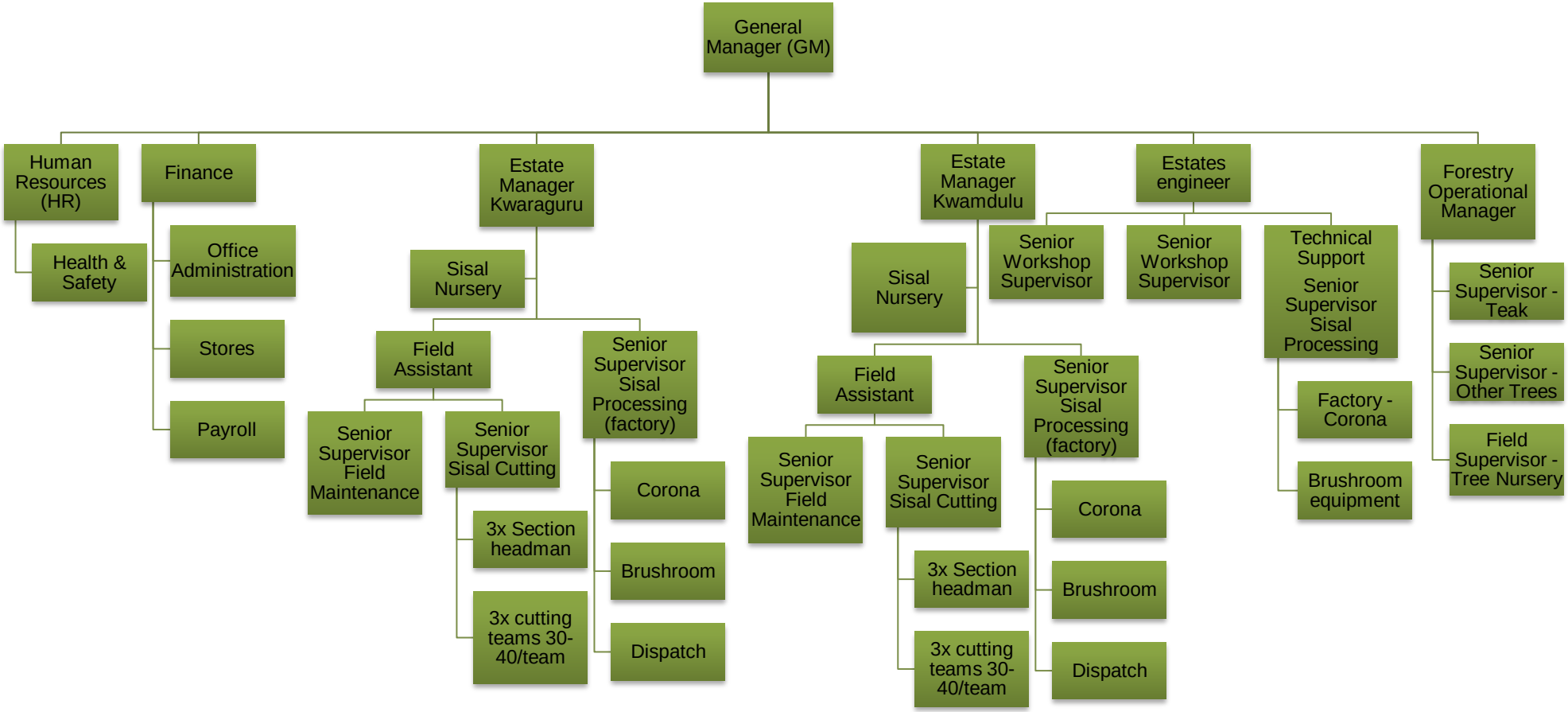
Annex A. Overview map Kwamdulu estate



Annex B. Overview map Kwaraguru estate



Annex C. Organigram



Annex D. Yield table Teak

Age (years)	N_{before} (no)	DBH (cm)	H_{dom} (m)	Volume (m^3)	Real gross volume extracted (m^3)
1	1111	0,1	0,5	0,0	
2	1111	1,0	1,5	0,0	
3	1111	2,5	2,5	0,5	
4	1111	4,0	4,0	2,0	
5	1111	6,0	6,0	6,7	
6	1111	8,0	8,0	16,0	
7	1111	10,0	10,0	31,2	
8	1111	12,0	12,0	65,6	
9	1111	13,0	13,0	83,4	16,3
10	800	14,0	14,0	75,0	
11	800	15,0	15,0	92,2	
12	800	16,0	16,0	111,9	
13	800	17,3	17,3	142,1	
14	800	17,8	17,8	153,2	50,8
15	500	18,2	18,2	102,6	
16	500	18,6	18,6	109,3	
17	500	19,0	18,9	116,2	
18	500	19,4	19,3	123,4	
19	500	19,8	19,6	130,7	
20	500	20,2	19,9	138,2	
21	500	20,6	20,2	145,8	
22	500	21,0	20,5	153,6	27,7
23	400	21,4	20,7	129,3	
24	400	21,8	21,0	135,8	
25	400	22,2	21,2	142,5	
26	400	22,6	21,5	149,3	
27	400	23,0	21,7	156,3	
28	400	23,4	21,9	163,4	
29	400	23,8	22,1	170,6	
30	400	24,2	22,3	177,9	177,9
				Total volume (m^3)	272,7
				MAI (m^3 / ha / yr)	9,1

Source: Financial model SFI and Form Tanzania.

Annex E. Yield table Eucalyptus

Age (years)	N_{before} (no)	DBH (cm)	H_{dom} (m)	Volume (m^3)	Real gross volume extracted (m^3)
1	989	2,1	1,5	0,0	
2	989	5,1	4,5	2,0	
3	989	8,5	7,5	14,0	
4	989	10,5	10,3	30,0	10,5
5	556	13,2	12,8	33,0	
6	556	14,8	14,9	50,0	
7	556	16,4	16,6	68,0	
8	556	17,7	18,4	88,0	
9	556	18,8	20,2	110,0	
10	556	19,9	21,9	132,0	
11	556	20,8	23,4	155,0	
12	556	21,5	24,9	178,1	178,1
				Total volume (m^3)	188,6
				MAI (m^3 / ha / yr)	15,7

Source: Financial model SFI and Form Tanzania.

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