7-4-2016

HCV Analysis

Analysis of the High Conservation Value areas of Kwamdulu and Kwaraguru estates, Tanzania

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List of Acronyms and Abbreviations

CITES – Convention on International Trade in Endangered Species

CoC – Chain of Custody

FSC – Forest Stewardship Council

GSBA – Globally Significant Biodiversity Area

HCV – High Conservation Value

IFL – Intact Forest Landscape

IUCN – International Union for Conservation of Nature

PEFC - Program for the Endorsement of Forest Certification schemes.

RTE – Rare, threatened or endangered

SEIA – Social and Environmental Impact Assessment

SFI – SFI Tanzania Ltd.

UNESCO – United Nations Educational, Scientific and Cultural Organization

1. Introduction

Form and SFI Tanzania Ltd. has commissioned Form international to conduct a High Conservation Value analysis to contribute to the sustainable implementation of the company's reforestation activities in Kwamdulu and Kwaraguru estates, Tanga Region, Tanzania. FSC developed the HCV concept as part of its standard (Principle 9) to ensure maintenance of significant or critical environmental and social values in the context of forest certification[1].

1.1. Form international

Form international is a Dutch consultancy firm established in 1992. It offers advice on forest management, certification and technical assistance to plantation establishment and management. Form international has extensive experience in tropical forest management, mainly in West and Central Africa, and is also active in Europe on Chain-of-Custody (CoC) certification and PEFC conformity assessments.

Form international advises branch organizations, international timber and forest companies, NGO's and many other organizations that play a role in the direct or indirect amelioration of forest management. Using a pragmatic approach, Form international's knowledge and experience in the field of sustainable forest management and certification is translated into a concrete advice ready to be implemented in the day-to-day forest operations of her clients.

1.2. Form Tanzania and SFI Tanzania

SFI Tanzania acquired two sisal estates in 2013: Kwaruguru Estate and Kwamdulu Estate. Together they comprise a total area of 9,150 ha of which around 2,000 ha is covered with productive sisal. SFI and Form Tanzania has the aim to develop on two major pillars: Sisal and Forest Plantations.

The current sisal plantations will be combined with sustainable commercial timber plantations, based on the successful concept of SFI daughter company Form Ghana Ltd (www.formghana.com). In Tanzania and worldwide, natural forests and existing plantation forests are not able to meet the tropical hardwood demand. In Tanzania, the area of forest plantations planted by private companies is still relatively small. This provides excellent growth opportunities for Form/SFI Tanzania.

1.2.1. Sisal plantations

In the coming years, SFI Tanzania aims to increase the production of sisal on the current ca. 2,000ha of productive sisal area by improved management and maintenance. If possible, the sisal area will also be expanded.

1.2.2. Forest plantations

Form Tanzania aims to establish timber plantations on land that is not used for sisal plantations. The establishment and management of the timber plantation will be conform the FSC Principles and Criteria for responsible forest management.

1.3. High Conservation Value Analysis

[1] From: Common Guidance for the Identification of High Conservation Values (2013), HCV Resource Network

According to FSC principles, an FSC certified company should ensure 'maintenance of high conservation value areas – to maintain or enhance the attributes which define such forests.' These High Conservation Value (HCV) areas first have to be identified in the project area before they can be maintained or enhanced. The Forest Stewardship Council (FSC™) has provided a definition for High Conservation Value Areas, with 6 'High Conservation Values' that was adopted for this study (see below).

FSC™ definition of HCV

High Conservation Value areas possess one or more of the following attributes:

1. Forests containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endemism, endangered species, refugia);
2. Forests containing globally, regionally or nationally significant large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance;
3. Forests that are in or contain rare, threatened or endangered ecosystems;
4. Forests that provide basic services of nature in critical situations (e.g. watershed protection, erosion control);
5. Forests fundamental to meeting basic needs of local communities (e.g. subsistence, health);
6. Forests critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities).

Source: adapted from FSC-STD-01-001 (version 4-0) EN

1.4. Report outline

This report presents an analysis of the presence (or absence) of these six HCV attributes in Kwamdulu and Kwaraguru estates. Chapter 2 describes the applied methodology for this assessment. A general overview of the area is presented in chapter 3 covering the abiotic, social and biological characteristics of Kwamdulu and Kwaraguru Estates. In chapter 4, the presence or absence of each of the 6 HCVs are assessed. The report ends with a conclusion and recommendations of the HCV analysis which are captured in chapter 5.

2. Methodology

For the correct interpretation of the six HCVs, the Common Guidance for the Identification of High Conservation Values, elaborated by the HCV Resource Network, was applied during the identification. The study employed field research, literature review and stakeholder consultation to obtain the required data for these analyses.

2.1. Field research

A number of field studies have been used during this HCV analysis:

- Social and Environmental Impact Assessment (SEIA) (Westerlaan, 2014)
- Soil Reconnaissance Report of 3 estates in Tanzania (Scholten, 2012)
- Water Quality Analysis (Westerlaan & de Wolf, 2014)
- Resources Inventory at Kwamdulu and Kwaraguru Estates (EnviroPlanners Ltd. 2014)
- Biodiversity Report (EnviroPlanners, 2014)
- Socio-economic study (Westerlaan, 2014)

The SEIA consists of an environmental assessment and a socio-economic assessment including a stakeholder consultation. The environmental assessment was carried out by the College of African Wildlife Management (Mweka), through EnviroPlanners (2014) and contains information on land use stratification, vegetation (species and characteristics) and fauna (mammals, birds, reptiles). The hydrological characteristics of the area and the water quality is determined in the hydrological assessment and further described in the SEIA. The socio-economic study outlines the characteristics of the social environment around the estates. The results of all the preparatory studies were used as input for the SEIA.

For the methodology of the field surveys, refer to Appendix A-D.

2.2. Literature

A variety of documents and databases have been used to verify the protection status of the area and the species encountered in Kwamdulu and Kwaraguru Estates:

- Literature on biodiversity (in the vicinity of Kwamdulu and Kwaraguru estates)
- Map of Protected Areas in Tanzania[2]
- IUCN Red List online database
- The Wildlife Conservation Act (2013) and related Government Notices
- The Environmental Management Act (2004)
- CITES Appendices
- Birdlife International[3]
- Kwamdulu soil report (National Soil Service Mlingano, 1988)

It was verified whether or not Kwamdulu and Kwaraguru estates were positioned close to a protected area using a map that indicated Tanzania's National Parks (Appendix F) and a map of Intact Forest Landscapes (Appendix G). Also, the proximity to an Important Bird Area was checked with a map depicting Tanzania's Important Bird Areas, see Appendix H.

[2] http://www.protectedplanet.net/country/TZ
[3] http://www.birdlife.org/datazone/country/tanzania

The conservation status of each encountered species was assessed using the IUCN Red List online database[4] and the CITES listings. The IUCN Red List distinguishes seven categories for indicating the vulnerability of a species:

- Least concern
- Nearly threatened
- Vulnerable
- Endangered
- Critically endangered
- Extinct in the wild
- Extinct

These respond to certain criteria linked to the tendency of their populations, the size and structure of the population and to their geographical distribution. “Threatened species” include fauna classified as vulnerable, endangered or critically endangered (IUCN, 2011).

2.3. Stakeholder consultation

Stakeholders were consulted on two levels:

- Stakeholder consultation performed by Westerlaan (2014) as part of the SEIA
- Specific feedback on this HCV analysis

Stakeholders from renowned Tanzanian and international organisations will be asked for their input, comments and suggestions. The feedback will be processed to improve the report.

[4] http://www.iucnredlist.org/

3. Characteristics of Kwamdulu and Kwaraguru Sisal Estates

3.1. Study area

This HCV analysis concerns two areas: Kwamdulu Sisal Estate and Kwaraguru Sisal Estate, both located in Tanga Region, Tanzania (see figure 3.1). The characteristics of the estates, as described below, are deducted from the SEIA report (Westerlaan 2014).

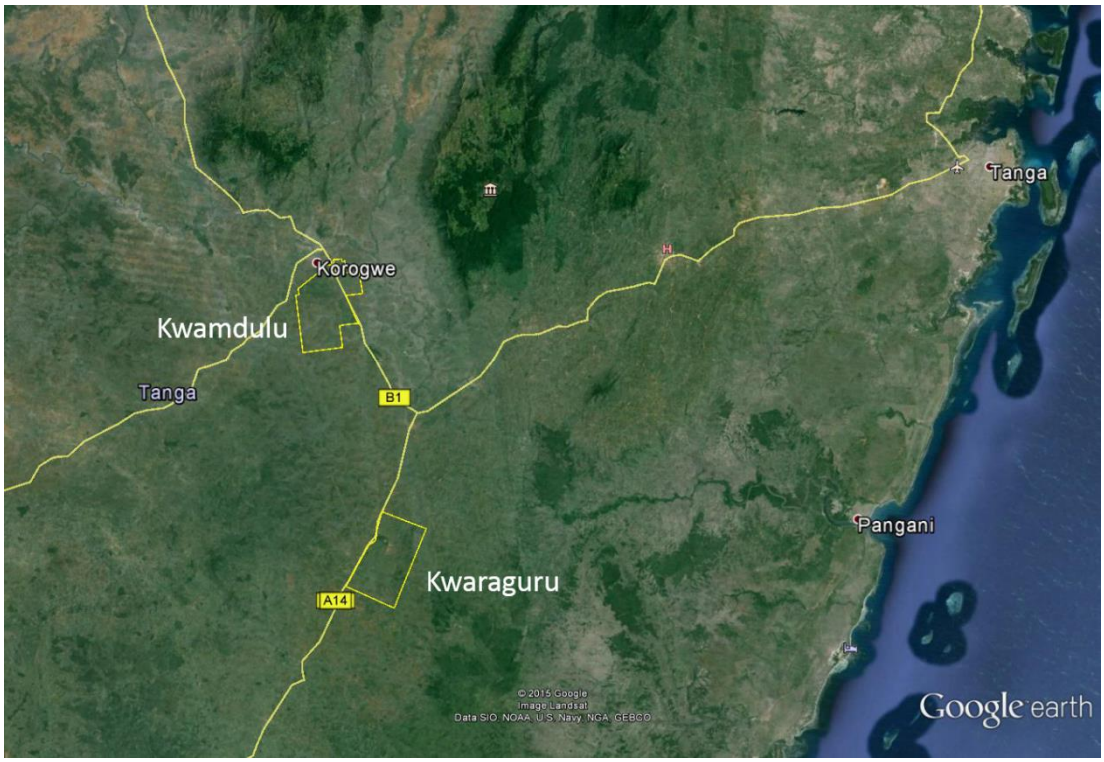

Figure 3.1. *Location of Kwamdulu and Kwaraguru Estate in Tanga Region.*

Kwamdulu estate

Kwamdulu Estate (also referred to as Kwamduru Estate) is located approximately 1.5km south of Korogwe. The estate belongs largely to the Korogwe Town Council while the part south of the Mnyuzi River belongs to Handeni District. Kwamdulu Estate is about 5 km wide (East-West) and about 9 km long (North-South) and covers a total surface of about 4,640 ha, divided into 10 ha blocks (200x500m).

Kwamngumi mtaa (‘street’/ neighbourhood of Korogwe town) borders the Estate on the north. South-westwards directly along the B1 tarmac road, the villages Kwakombo and Mandera can be found. Slightly off-road to the west Rujera hamlet is located. More remotely at the south-eastern corner of Kwamdulu Estate the hamlets Kikwajuni and Kwamaligo are situated.

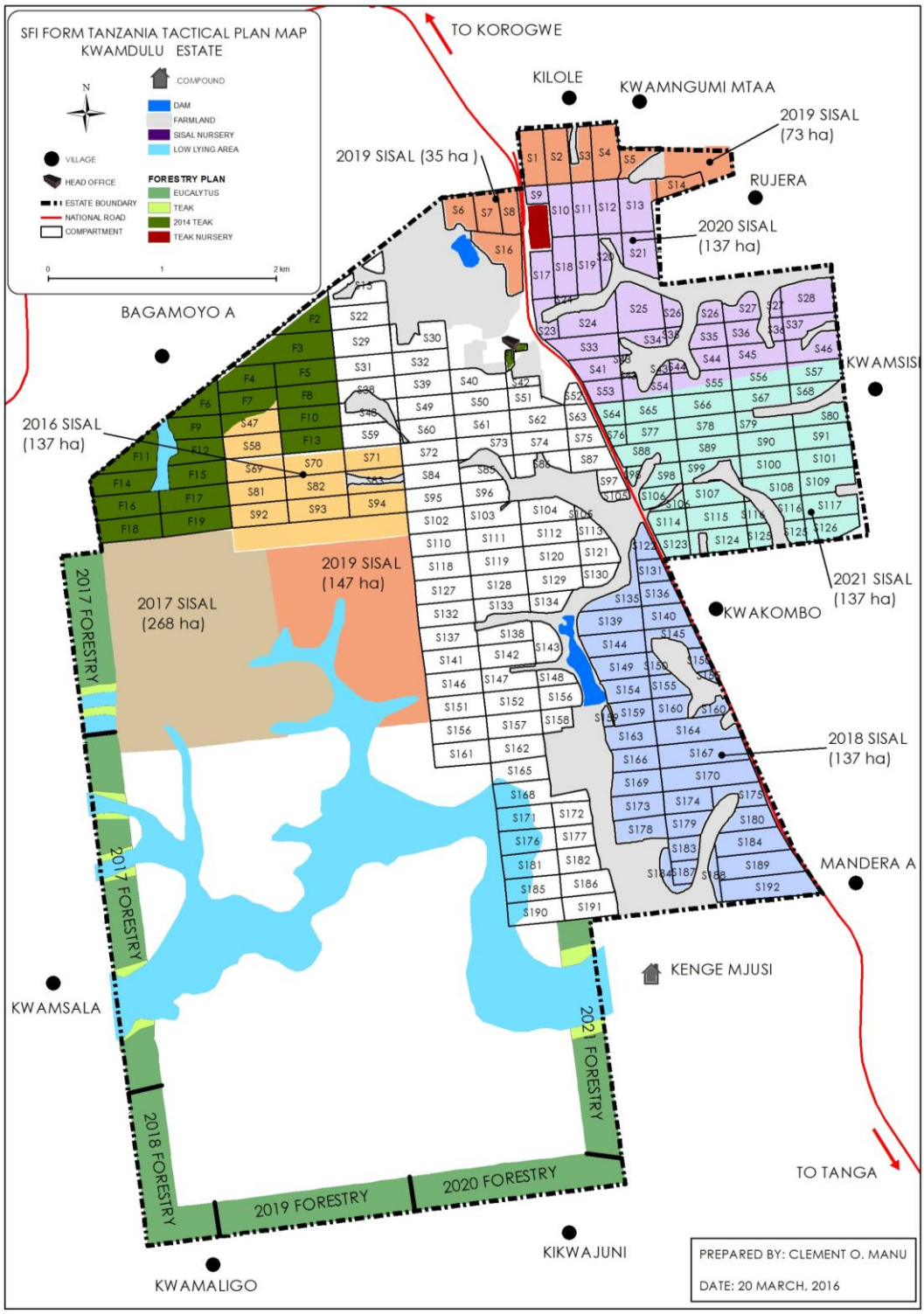

Figure 3.2. *Kwamdulu Estate overview map.*

At the northern part of Kwamdulu estate at the tarmac road, the main office is situated on the factory terrain with the sisal factory, a workshop, a store and a dispensary. On the opposite site of the road the tree nursery is located. At Kwamdulu estate 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.

Kwaraguru estate

Kwaraguru Estate is located in Handeni District, about 20 km 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 Kandoza stream (seasonally). Kwaraguru Estate is about 5.5km wide (East-West) and about 8 km long (North-South) and covers a total surface of 4,508 ha, divided into 15 ha blocks (300x500m).

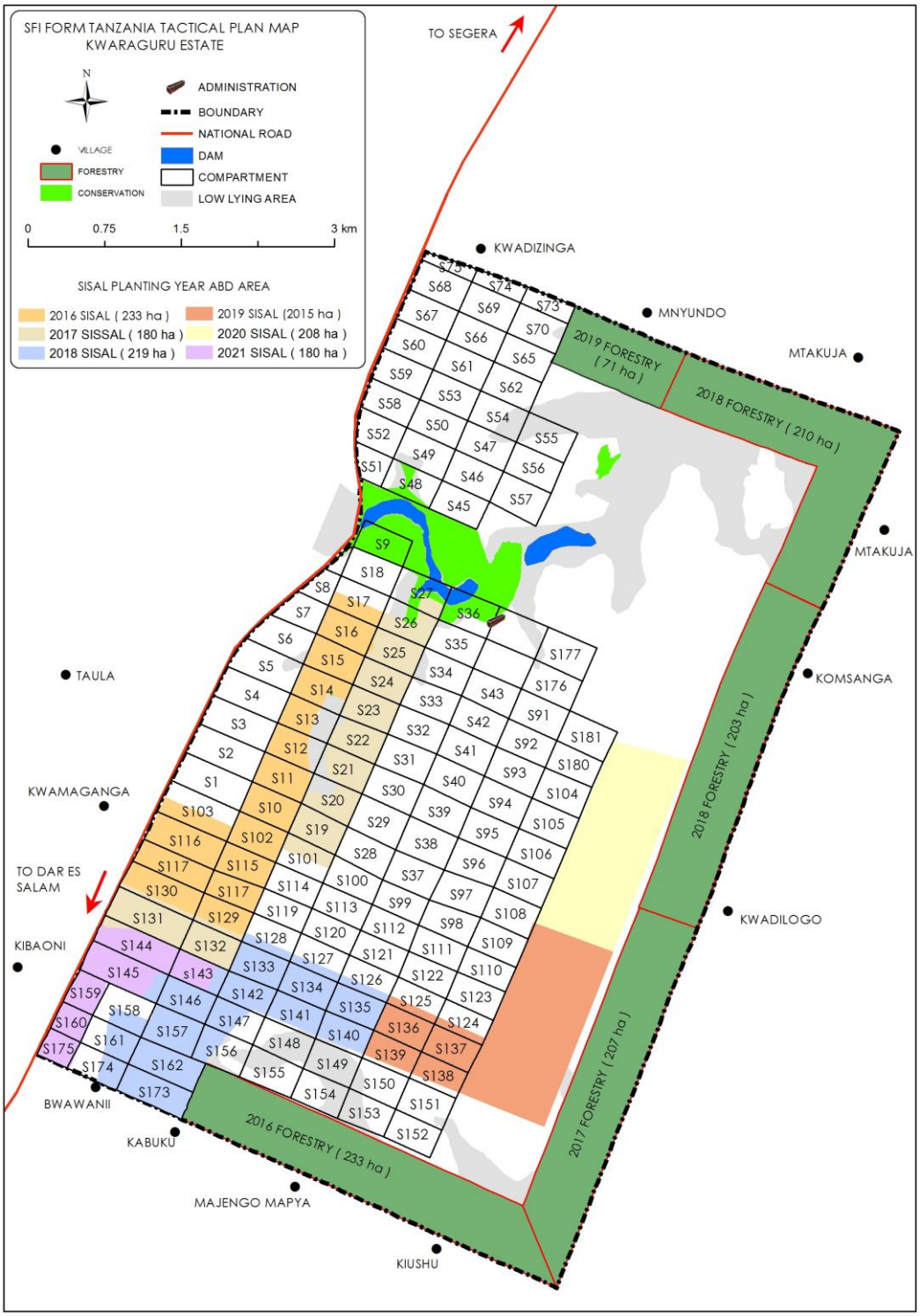

Figure 3.3. *Kwaraguru Estate overview map.*

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. Smaller settlements are found on the eastern and southern border of the estate: Mtakuja, Kwediloko, Kiushu and Kabuku Nº 1.

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

3.1.1. Historical context

In the 1960s large-scale sisal plantations were established in Tanzania, making the country the largest producer of sisal. Tanga Region was the centre of sisal production with 73 plantations, responsible for two-third of the nation's sisal production[5].

Kwamdulu and Kwaraguru Estates were established long before that, in 1935 (P. Hol, pers.com.). Several sisal companies have been active 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.[6]. In 2013, SFI Tanzania bought the two Estates from Sagera Estate Ltd.

3.2. Abiotic environment

3.2.1. Physical environment

Lying between the coastal area and the mountainous area, both estates are situated in the uplands at an altitude of 250-350 meter above sea level and fall within the Pangani river catchment area[7]. The topography is undulating to rolling.

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 next. Average annual temperature is 26ºC with minor fluctuations[6].

3.2.2. Soils

A soil survey was carried out by Scholten in 2012 based on available soil maps and literature, a field visit and augerings. During the socio-economic study carried out in April 2014, neighbouring communities were asked about their views on soil fertility.

Kwamdulu estate

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[5] 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.

[6] Tenga, M.G., (2008), "Sisal Industry in Tanzania Since Colonial Era - Uncovered Modern Slavery to Liberation", *Xlibris Corp.*

[7] Hartemink, A.E., (1997), "Soil fertility decline in some major soil groupings under permanent cropping in Tanga region, Tanzania", *Geoderma*, **75**: 215-229.

The upland soils of Kwamdulu estate are very deep (rootable depth more than 150 cm, usually more than 200 cm), well drained, red ferralitic clays derived from gneiss rock. In the valleys soils are poorly drained alluvial and colluvial sandy clays. The red upland soils have favourable physical properties for sisal and teak, but a very low fertility status. Their pH is usually 5-6 at the surface and 4.5-5 in the subsoil. Plant nutrients like phosphate and calcium are very low; potassium is extremely low. The organic matter in the soils has a high capacity to retain moisture and nutrients.

The soils on the hill crests are very strongly acid (pH 4.5-5), 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. It is unknown whether lime has been applied on these hillcrests. Although in the suitability rating classified as unsuitable for sisal, it was observed in the field that these areas are planted with sisal.

Kwaraguru estate
For Kwaruguru estate no survey has been carried out in the past, so no detailed soil suitability data were available. Two augerings have been performed which showed uniform deep red soils more than 150cm deep, without any obstruction to roots. As this soil type was similar to that of Kwamdulu estate, it is assume to have the same suitability status for sisal and teak planting as Kwamdulu Estate[8]. Also, the soil management recommendations of Kwamdulu estate apply to Kwaraguru estate.

3.2.3. Hydrography

Both sisal estates are part of the Pangani River catchment area and 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 Bwanyama 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 the sisal waste water pond near the sisal factory.

Most people depend on water from the Pangani (Ruvu) River that reaches the villages and labour camps through a water pipe. Water from the Section 2 Dam and the Kwaraguru Dam is also used for drinking and other domestic purposes.

The suitability of the various water sources on both estates for domestic use has been determined in a water quality study[9]. At both estates there are several water sources

[8] Scholten, J.H.M., (2012), “SOIL RECONNAISSANCE MISSION TO 3 ESTATES IN TANZANIA”, *Humisphere*, September 2012.

[9] Westerlaan, P. (2014) Water Quality Analysis Kwamdulu and Kwaraguru Estates

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).

3.3. Social environment

3.3.1. Demographics

Basic characteristics of the settlements included in the social study are presented in table 3.1 and 3.2.

Table 3.1. *Characteristics settlements around Kwamdulu estate.*

Settlement	Type	District	# Residents (in 2013)	Age
Kwakombo	Village (Kwamsisi ward)	Korogwe	3,415	Since 1974
Mandera A	Village (Segera ward)	Handeni	2,014	Separated in 2000 (before there was 1 Mandera)
Kikwajuni	Hamlet (Mandera village, Segera ward)	Handeni	280	Since 1989
Kwamaligo	Hamlet (Mandera village, Segera ward)	Handeni	+/- 600	Since 1993
Kwamngumi	Mtaa (Kilole Ward)	Korogwe	4,060	Since 1975
Rujera (or Lujela)	Hamlet (Kilole Ward)	Korogwe	300	Since 1952

Table 3.2*. Characteristics settlements around Kwaraguru estate.*

Settlement	Type	District	# Residents (in 2013)	Age
Kwedizinga	Village (& ward)	Handeni	4,193	Since 1970
Mtakuja	Hamlet (Kwamsanga village, Mgambo ward)	Handeni	800	Since 1991
Kabuku Nº1	Village (Kabuku Ndani ward)	Handeni	?	Since 1965
Kiushu	Hamlet (Majari Mapana village, Kabuku Ndani ward)	Handeni	?	Since 1965
Kwediloko	Hamlet (Kwamsanga village, Mgambo ward)	Handeni	1,384	Since 1994
Taula	Village (Kwedizinga ward)	Handeni	5,550	Since 1964

Household size varies from 1-12 household members with an average of 5.6 (Kwamdulu) and 5.85 (Kwaraguru). A household mostly consists of a husband, wife and their children and in some cases other family members. Slightly more females than males were included in this survey. There were relatively a lot of children with the highest number of household members in the age classes 6-10, 11-15 and 16-20. Most prevalent tribes are Zigua and Sambaa. About two-third of people included in the household survey were Muslim, one-third Christian.

The majority of people were farmer (about 45%) or school-going youth (nearly 40%). Those household members that did not have a job (12.5%) were mostly young children. The majority of people completed primary school (67% around Kwamdulu estate and 58% around Kwaraguru estate), while 14% dropped out in primary school.

About 10% completed secondary school, while nearly 10% of people had no education. Over 20% of people were suffering from an illness at the time of the study. Most frequently mentioned diseases were malaria and stomach problems. Houses were mostly constructed of tree branches and mud with iron sheet roofing, alternatively cement blocks were used or the roof was made up of grasses. The majority of households had at least one bicycle, 13% of households had a motorbike, but 23% of household had no means of transportation at their disposal.

3.3.2. Farming characteristics

Average farm size was 4.8 acres for households nearby Kwamdulu estate and 5.9 acres for households surrounding Kwaraguru estate.

Around Kwamdulu estate 60% have their own farmland. In total, 38% of households (mostly from Kikwajuni, Kwamaligo and Rujera) near Kwamdulu estate have farmland within the estate boundaries ranging from 1 to 12.5 acres with an average of 4.8 acres. Finally, 17% rented relatively small areas of farmland.

Around Kwaraguru estate 73% of households have their own farmland. In the smaller, more remote settlements (Kwediloko and Mtakuja) farmers have larger farms compared to the larger settlements (Taula and Kwedizinga) with average farm sizes of 13.2 acres and 4.5 acres respectively. In Kwediloko and Mtakuja, some farmers have part of their land rented out to others. In Kabuku N°1, the majority of farmers (90%) farm within Kwaraguru estate. Farm sizes range from 1 up to 16.5 acres with an average of 6.6 acres. In none of the other villages respondents indicated to have farmland within the estate area. 10% of the households rented relatively small areas of farmland.

It seems that when the farming practices are compared, farming around Kwamdulu estate is more advanced with part of the farmers using fertilizer (36%) and more people using a tractor (27% versus 5%). Major crops planted include: maize, cassava, oranges, rice, beans, sesame and sunflower. It seems that more cash crops are grown by farmers around Kwaraguru estate which could be explained by the fact that the average farm size is larger allowing farmers to produce more than needed for subsistence farming. Farmers near Kwaraguru estate sell indeed a larger part of their total farm production and they have a higher annual income with a median of almost 3 times as much as the median for annual income of farmers near Kwamdulu (250,000 TSh versus 720,000 TSh) and a more than double average annual income (506,105 TSh versus 1.24 million TSh).

3.3.3. Ways in which nearby communities make use of estate area

Cultural activities

Kwamdulu Estate has no places that are of importance in relation to ceremonies, celebrations, festivals or sacred sites held by surrounding communities. Rather, all cultural activities are organised within the settlement (figure 3.4). However, since some of the communities (assume they) are situated within Kwamdulu Estate boundaries, naturally all cultural activities take place in that area.

Figure 3.4. *Meeting under mango tree in Kikwajuni hamlet, Kwamdulu estate.*

All communities around Kwaraguru estate indicated that no cultural activities are held within the estate area. Except that in Taula people mentioned that there are burial sites for those working and living at the Kwaraguru workers' camp site.

Farmland

In all communities near Kwamdulu estate most households have farmland within the estate area, some for over 10 years. Also perennial fruit trees like mangoes and oranges have been planted in certain farms. Livestock grazing is done in the estate as well. In Kabuku Nº1, most of the households have a piece of farmland within Kwaraguru Estate, since 1981. In Kwedizinga half of the people and in Kwediloko some people have farmland within Kwaraguru Estate, since the early 1990's. In Taula and in Mtakuja, none farm within Kwaraguru estate. Livestock grazing is done by communities from Mtakuja, Kabuku Nº1 and Taula (figure 3.5). Farmers in both estates indicated that there is no agreement between the farmers and the company for using farmland within the estate boundaries, only one respondent in the household survey told us he had a special agreement to farm for free in the Kwaraguru estate area.

Figure 3.5. *Livestock grazing in Kwamdulu estate.*

The procedure for acquiring new farmland is to ask for it at the Village Council. Hamlets have no authorities, so they go to the village where they belong to. For areas larger than 50 acres, one would have to ask for new farmland at the District level.

Collection of natural products
A variety of products is being collected in the estate areas by neighbouring communities: firewood, construction materials, bush meat (e.g. bush pig, rabbit/hare, bushbuck, antelope, dik-dik and greater grass-cutter), medicinal plants, fish from the Mnyuzi river, wild vegetables and tropical fruits, charcoal and water (collected from a stream or the dam at Kwaraguru). People from Kwedizinga indicated that products are no longer collected as Mr. Mmbando, the manager of Kwaraguru Estate, forbid the collection of items. The inhabitants of Mtakuja indicated that the management has prohibited them to go into the estate area since March 2014.

3.4. Ecological environment

This section starts with a global indication of the various vegetation types per estate. Then the results of the biodiversity study is presented with a part on flora and a part on fauna identified within the project areas.

3.4.1. Land-use on the estates

Many sisal growers use a rotational system, so that at a certain point in time only part of the sisal estate is planted with sisal. In general, the land closest to the sisal processing factory is under continuous cultivation, but the area further away is set aside as fallow land after each 10-year production cycle[10].

Currently, both estates are partly (one-third) planted with sisal and partly (two-third) left as fallow land. For both estates combined, in total roughly 3,000 ha is planted with sisal (some of which is old and unproductive) and 6,000 ha is fallow land covered with bush or woodland. Current planting areas are presented in table 3.3 below. The sections below outline the land-use at the two estates: Kwamdulu and Kwaraguru.

Table 3.3. *Planted areas on Kwamdulu and Kwaraguru Estate.*

Planted Ha	Kwamdulu	Kwaraguru	Total
Sisal	1,443	1,522	2,966
Forestry	306	11	317
Total	1,750	1,533	3,283
Estate	**Kwamdulu**	**Kwaraguru**	**Total**
Total	4,640	4,505	9,145
Open Area	**Kwamdulu**	**Kwaraguru**	**Total**
Total	2,890	2,972	5,862

Nursery Ha	Kwamdulu	Kwaraguru	Total
Sisal	10.25	10.25	20.50
Teak	7.00	-	7.00
Total	17.25	10.25	27.50

[10] Hartemink et al., 1996

Kwamdulu

The largest part (44%) is covered with fallow land that used to be sisal 24-48 years ago (figure 3.6). Some of these areas are used for the cultivation of annual crops like maize and sunflower. The vegetation consists of thick shrubs, scattered small and big trees plus grasses of various families. Nearly one-third of the area (31%) is currently planted with sisal and 25% is fallow land that has never been planted with sisal. The vegetation in this area is of thick and scattered shrubs, scattered trees and grasses of different families with some areas used for the cultivation of annual crops (SFI, 2014). In addition, a 1 ha teak plantation was planted in 2007 near the office.

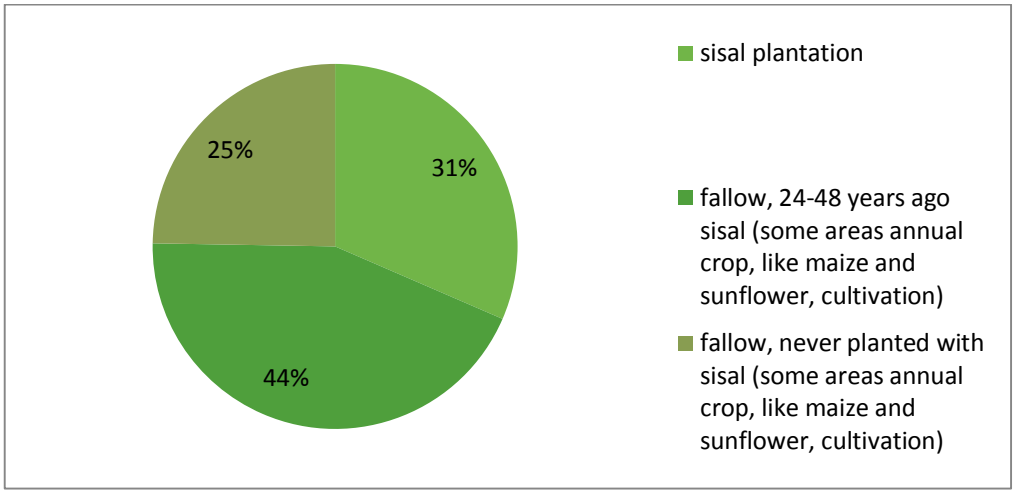

Figure 3.6. *Various land-uses in Kwamdulu estate. Source: SFI Tanzania, 2014.*

Kwaraguru

52% of the land consists of fallow land that has never been planted with sisal (figure 3.7). The vegetation comprises of degraded forest with big and small trees of various types and grasses of different families. 38% of the land is covered by sisal plantations. 8% has been planted with sisal, but is now left as fallow land for a period of approximately 10 years. The vegetation in this area consists of small grasses, shrubs and scattered sisal plants. About 2% of the area has never been planted with sisal, but annual crops like maize and sunflower have been cultivated instead. The vegetation in this area is scattered small and big trees of various types and grasses of different families. Finally, in Kwaraguru Estate a 2ha pilot teak (2002) plantation is situated on a slope of 7-8%.

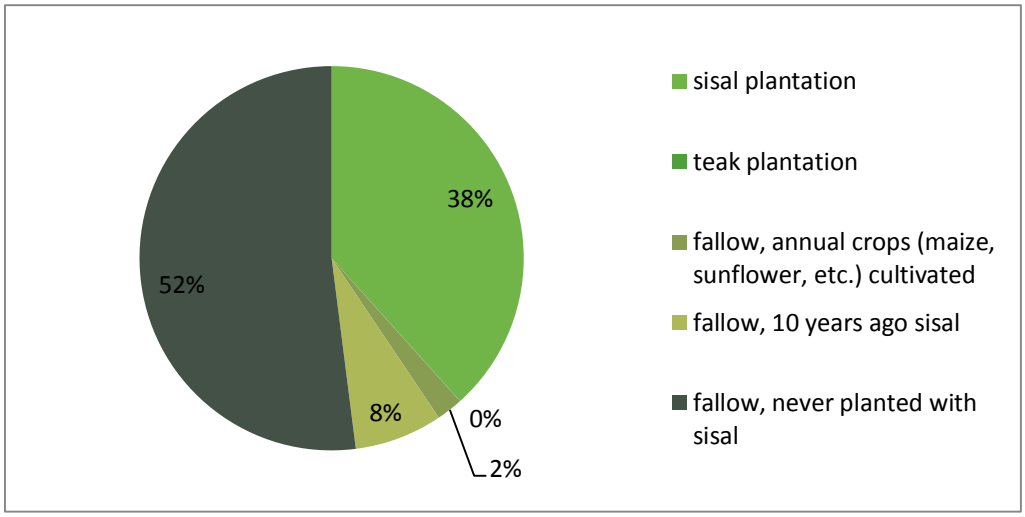

Figure 3.7. *Various land-uses in Kwaraguru estate. Source: SFI Tanzania, 2014.*

3.4.2. Land use next to the estates

Next to the estates is mainly farmland and fallow land. Farmers grow a variety of crops, as is described in section 3.3.2 of this report. After harvesting, they use fire to weed their land and provide quick nutrients for the soil. These fires form a great risk to Form Tanzania and SFI Tanzania, as they spread rapidly with the extreme draught in the dry season, and the wind from the sea.

3.4.3. Flora

For the flora inventory, nested plots were established in which trees (20x20m), shrubs (10x10m) and herbs (2x2m) were identified. 56 and 39 nested plots were established, in Kwamdulu estate and Kwaraguru estate respectively.

Trees

In both Kwamdulu estate, 24 different tree species have been identified. In Kwaraguru estate there were slightly more tree species: 29.

In both estates, most frequently observed tree was an unidentified species of the genus *Albizia* (19 times in Kwamdulu, in 11 out of 21 plots (52%), and 8 times in Kwaraguru estate, in 7 out of 44 plots (16%)). Otherwise, *Markhamia obtusifolia* was the most frequently identified tree species in Kwamdulu estate (17 times) and in Kwaraguru (6 times), where *Acacia polyacantha* and *Acacia robusta* were observed equally often (6 times).

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 evaluated by the IUCN Red List and classified as lower risk / near threatened (see Appendix E). The tree was found on Kwamdulu estate. No species were listed on the CITES appendices.

Shrubs

In Kwamdulu and Kwaraguru estate, 32 and 35 different shrub species have been identified respectively. The most frequently sighted shrub in Kwamdulu was

Harrisonia abyssinica (11 out of 21 plots (52%)), and in Kwaraguru *Flueggea virosa* (13 out of 44 plots (30%)).

None of the identified shrub species have been evaluated by the IUCN Red List, or listed in the CITES appendices.

Herbs
Respectively 38 and 30 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 recorded, such as *Lantana camara* and *Solanum incanum*, indicate invasive behaviour.

3.4.4. Fauna

Fauna included in the biodiversity study are birds, mammals and reptiles.

Birds
A total of 111 birds species representing 49 families were recorded in the two estates (figure 3.8). There was little difference between the two estates, with 102 and 106 bird species identified in Kwamdulu and Kwaraguru, respectively. One-third of bird species in both estates were recorded across all habitat types, others had been observed in two habitat types. Some birds were however 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).

Figure 3.8. *Bird inventory at old sisal plantation in Kwaraguru estate.*

Two of the recorded species were classified the Red List of the International Union for the Conservation of Nature (IUCN) as near threatened: *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 were listed in Appendix II of the CITES list. One of the birds was on Appendix I of the CITES list: *Falco peregrinus* (Peregrine falcon) (see Appendix E).

Mammals
In total, signs or sightings of 8 different mammal species (at least 30 individuals) have been observed in the study areas. 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 (see Appendix E). Main species identified are duiker, African hare and African civet. Except for the latter that is a generalist, these are typical species that live in grassland/ bushland habitat.

Reptiles
Six species of reptiles (24 individuals) were directly observed by sighting in the study area. Low detection of reptiles in the area could have been attributed to the rainy weather condition that prevailed during the study period. Sutherland (2006) states that weather conditions greatly influence reptiles' activity, detection and catch ability. Therefore the results should not be used to represent the number of reptiles' species across seasons but rather across wet season only.

The Rock Python was the only observed species that was listed under CITES Appendix II (see Appendix E). None of the observed reptiles were in the IUCN Red List.

The questionnaire survey showed that local people from the villages around Kwamdulu and Kwaraguru estates tend to see few dangerous snakes including cobras, black and green mambas, puff adders, pythons, boomslang and twig snakes. Some of the less dangerous snakes encountered in the area include blind snakes and few green snakes (colubrid).

3.4.5. Human presence and pressure

Kwamdulu
In Kwakombo and Mandera, people indicated that because of deforestation and population growth, wildlife is disappearing. There used to be a lot of pigs and medium-sized mammals, but nowadays there are few. In Kikwajuni, Rujera and Kwamngumi people indicated they see wild animals rarely, in Rujera it was explained that during the dry season they are not seen at all.

When asked about what animals were seen in the past ten years, the following were mentioned: monkeys (in Kikwajuni also big ones), dik-dik, bushbuck, bush pig, genet, snakes, hippopotamus and crocodile (in Ruvu River). These are still there today, but in fewer numbers. Probable reasons for their decline given by the communities are overhunting, population increase, human activities including deforestation and livestock grazing.

Finally, there were a lot of fish in the past and they were big, whereas nowadays they are small. One of the reasons for this is overfishing because of population growth. Further, as the river, ponds and dams have dried up there is less fish.

Kwaraguru
Communities surrounding Kwaraguru Estate rarely see wild animals in the area today. In Mtakuja, people indicated that Colobus monkeys are seen frequently though. In the past however, many wildlife species were seen in the area. Over the past 10 years the following animal species have been seen: Colobus monkey, yellow baboon, blue monkey, vervet monkey, bush pig, crested porcupine, warthog, African buffalo, bush

buck, small antelope, dik-dik, greater grass-cutter, African civet, African hare, African elephant, lion, leopard and hyena.

Main species seen nowadays are bush pig, monkeys, rabbit/ hare, African civet, bush buck, dikdik and other antelope species, whereas lion, leopard, elephant, buffalo and warthog have disappeared. Major reason mentioned by the communities for their disappearance is population increase, in the sense that the human population exceeds the land available. With an increased population, there is expansion of farmland and deforestation leading to habitat loss for wildlife species. Also, overhunting has contributed to their disappearance. Finally, there is environmental degradation by livestock grazing and deforestation resulting in climate change and desertification.

Fishing is not practiced by inhabitants of Kwedizinga and Mtakuja. Those communities that do fish (Taula, Kwediloko) indicate that the condition of fish has declined from average to poor as there are no water bodies left.

Hunting
Animals that are currently being hunted/ poached near the estate areas include small antelopes, African hare, bushbuck, bushpig and genet.

While walking the fauna transects and navigating from one vegetation plot to the next, several observations of human presence were noted. These included: farmland within Kwamdulu estate, livestock grazing, signs of charcoal making (figure 3.9), tree cutting and hunting (encounter with a hunting team).

Figure 3.9. *Signs of charcoal making in Kwamdulu estate.*

The results of the social study also show that local communities collect diverse natural products within the estate areas.

4. High Conservation Value Analysis

Based on the findings from the studies in the previous chapter, an analysis was carried out to assess the presence or absence of each of the six High Conservation Values in Kwamdulu and Kwaraguru estates. The HCV definitions and qualifications are adopted from the Common Guidance for the Identification of HCV, produced by the HCV Resource Network (October 2013).

4.1. HCV 1: Species Diversity

Definition
Concentrations of biological diversity including endemic species, and rare, threatened or endangered (RTE) species that are significant at global, regional or national levels.

The following would qualify as HCV 1:

1. A high overall species richness, diversity or uniqueness within a defined area when compared with other sites within the same biogeographic area.
2. Populations of multiple endemic or RTE species.
3. Important populations or a great abundance of individual endemic or RTE species, representing a substantial proportion of the regional, national or global population which are needed to maintain viable populations either:
    a. Year-round (e.g. key habitat for a specific species) or,
    b. Seasonally, including migratory corridors, sites for breeding, roosting or hibernation, or refuges from disturbance.
4. Small populations of individual endemic or RTE species, in cases where the national, regional or global survival of that species is critically dependent on the area in question (such species are likely to be restricted to a few remaining areas of habitat, and to be classified as Endangered (EN) or Critically Endangered (CR) on the IUCN Red List). In these cases, there is often a consensus (among many stakeholders) that every surviving individual is globally significant.
5. Sites with significant RTE species richness, or populations (including temporary concentrations) of priority species approaching those of key protected areas or other priority sites within the same biogeographic boundary.
6. Particularly important genetic variants, subspecies or varieties.

No parts of Kwamdulu and Kwaraguru estates have been set aside as a protected area nor are there any National Parks or Globally Significant Biodiversity Areas (GSBAs) bordering the estates. The closest protected area is Kamarukanga Forest Reserve, located between the 2 estates[11]. Based on satellite images and ground inventories it can be concluded that this forest reserve is heavily degraded. The nearest Intact Forest Landscape is Mount Kilimanjaro National Park, about 250km northwest of the estates[12].

In the biodiversity assessment, a number of species was encountered that was listed in the IUCN Red List and/or in the CITES Appendices. These species and their

[11] http://www.protectedplanet.net/303483
[12] http://www.intactforests.org/world.map.html

conservation status are presented in Appendix E. No endemic bird species[13], plants, reptiles or mammals[14] were found.

The habitat on the estates consists mainly of fallow land and sisal estate, mixed with agricultural land. Only on Kwaraguru Estate are patches of forest with a few remnant large trees.

The sisal plantations are very low in species richness. The weeding regime does not allow for vegetation other than some herbs and grasses. This does not provide shelter or food for animal species and is therefore not suitable as a habitat for any medium-sized or large mammal species. In addition, many animal species will avoid the sisal fields because of intensive human activity.

The fallow and cultivated land on the estates provides suitable habitat for several savannah species. It is however not unique as it is the predominant landscape surrounding the estates. The savannah species that occur on the estates will therefore not differ from those species that occur outside of the estates.

The remnant forest in Kwaraguru Estate is interesting from a biodiversity perspective as it is the only forest left in the immediate surroundings. However, the Near-threatened bird species that were found on this estate are species that prefer savannah (Bateleur) and open woodlands (European Roller), rather than forest. 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.

It may therefore be concluded that the endangered species that were found on the estates do not depend on the estate for a unique habitat, but rather occur in the area because of the savannah characteristics.

4.2. HCV 2: Landscape-level ecosystems and mosaics

Definition
Large landscape-level ecosystems and ecosystem mosaics that are significant at global, regional or national levels, and that contain viable populations of the great majority of the naturally occurring species in natural patterns of distribution and abundance.

The following would qualify as HCV 2:

- Large areas (e.g. could be greater than 50,000 ha, but this is not a rule) that are relatively far from human settlement, roads or other access. Especially if they are among the largest such areas in a particular country or region.
- Smaller areas that provide key landscape functions such as connectivity and buffering (e.g. protected area buffer zone or a corridor linking protected areas or high quality habitat together). These smaller areas are only considered HCV 2 if they have a role in maintaining larger areas in the wider landscape.

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[13] http://avibase.bsc-eoc.org/checklist.jsp?lang=EN&region=tz&list=clements
[14] http://Intreasures.com/tanzaniam.html

- Large areas that are more natural and intact than most other such areas and which provide habitats of top predators or species with large range requirements.

Both estates are less than 5,000ha, and located close to human settlements. The estates do not provide key landscape functions as the remaining forest patches are scattered and isolated.

According to the global database of Intact Forest Landscapes (IFL)[15], developed by Greenpeace, the Rainforest Action Network and the WRI, no forest areas in the Tanga Region of Tanzania qualify as IFL.

Therefore, it can be concluded that High Conservation Value 2 is not present in Kwamdulu and Kwaraguru Estates.

4.3. HCV 3: Ecosystems and habitats

Definition
Rare, threatened, or endangered ecosystems, habitats or refugia.

Ecosystems that would qualify as HCV 3 are:

- Naturally rare because they depend on highly localized soil types, locations, hydrology or other climatic or physical features, such as some types of limestone karst forests, inselbergs, montane forest, or riverine forests in arid zones.
- Anthropogenically rare, because the extent of the ecosystem has been greatly reduced by human activities compared to their historic extent, such as natural seasonally flooded grasslands on rich soils, or fragments of primary forests in regions where almost all primary forests have been eliminated.
- Threatened or endangered (e.g. rapidly declining) due to current or proposed operations.
- Classified as threatened in national or international systems (such as the IUCN Red List of Ecosystems).

In the soil appraisal that was carried out for SFI Tanzania and Form Tanzania, no rare or special soil types were found. The estates have no particular hydrology or other physical features that would indicate presence of a localized ecosystem.

Both sisal estates have been established in 1935, hence the land has been cultivated for about 80 years. There are still some patches of forest that have never been cleared on Kwaraguru Estate. Those patches can be classified as rare because in historical times, the forest had a far wider extent. However, there are several patches of forest left in the region with similar qualities. All have been severely degraded and fragmented. The forest patches do therefore not qualify as a rare ecosystem, but for all forest species it is essential that these patches remain.

[15] http://www.intactforests.org/data.ifl.html

Form Tanzania intends to conserve existing forest patches and establish a sustainable plantation forest on both estates. The ecosystem is therefore not endangered by current or proposed operations.

It can be concluded that HCV 3 is not present in Kwamdulu and Kwaraguru estates.

4.4. HCV 4: Ecosystem Services

Definition
Basic ecosystem services in critical situations including protection of water catchments and control of erosion of vulnerable soils and slopes.

The following ecosystem services would qualify as HCV 4, in critical situations, related to:

- Managing extreme flow events, including vegetated riparian buffer zones or intact floodplains
- Maintaining downstream flow regimes
- Maintaining water quality characteristics
- Fire prevention and protection
- Protection of vulnerable soils, aquifers and fisheries
- Provision of clean water, for example where local communities depend on natural rivers and springs for drinking water, or where natural ecosystems play an important role in stabilizing steep slopes. These two values frequently occur together and the area which provides the critical services (water provision and erosion control) may overlap partially or completely.
- Protection against winds, and the regulation of humidity, rainfall and other climatic elements.
- Pollination services, for example exclusive pollination of subsistence crops provided by native bees for smallholders in the Kenyan highlands, or of commercial Durian crops by bats in SE Asia. In both cases, the pollinators are dependent on the presence of suitable forest habitat and do not survive in purely agricultural landscapes.

Including areas such as:

- Forests, wetlands and other ecosystems which provide a protective barrier against destructive fires that could threaten communities, infrastructure or other HCVs.
- Groundwater recharge zones
- Grasslands providing buffering against flooding or desertification

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As described in previous chapters, most of the land is sisal, fallow or cultivated land. Small portions of forest remain. These patches are not located on steep slopes or on vulnerable soils. The forest patches provide basic ecosystem services; they contribute

to water filtration, soil formation and nutrient cycling. However, the forest patches are too small to affect flow regimes and provide clean water to communities. All streams on the estates are seasonal. Communities therefore obtain their drinking water from nearby rivers and streams.

Aside from the forest patches, the area mainly consists of shrub- and grassland. These areas are prone to fire, lit by farmers to allow for cultivation of the soils or re-growth of grasses as pastureland for cattle. It is therefore unlikely that the shrub- and grassland patches play a major role in stabilising and controlling the ecosystem.

HCV 4 is thus not present on Kwamdulu and Kwaraguru estates.

4.5. HCV 5: Community Needs

Definition
Sites and resources fundamental for satisfying the basic necessities of local communities or indigenous peoples (for example for livelihoods, health, nutrition, water), identified through engagement with these communities or indigenous peoples.

The following would qualify as HCV 5, if they were determined to be fundamental for satisfying basic needs:

- Hunting and trapping grounds (for game, skin and furs)
- NTFPs such as nuts, berries, mushrooms medicinal plants, rattan
- Fuel for household cooking, lighting and heating
- Fish (as essential sources of proteins) and other freshwater species relied on by local communities
- Building materials (poles, thatching, timber)
- Fodder for livestock and seasonal grazing
- Water sources necessary for drinking water and sanitation
- Items which are bartered in exchange for other essential goods, or sold for cash which is then used to buy essentials including medicine or clothes, or to pay for school fees

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The primary source of food for the neighbouring communities is their farm. Additions to their farm produce like bush meat (e.g. bush pig, rabbit/hare, bushbuck, antelope, dik-dik and greater grass-cutter), medicinal plants, fish from the Mnyuzi River, wild vegetables and tropical fruits are collected from the remaining bush land.

Water is collected from rivers and streams outside the estates. On the estates are only seasonal streams that feed the larger water courses.

For fire wood, charcoal and building materials, the communities make use of the patches of forest and shrub land. As described before, these patches can be found throughout the region. The communities are not dependant on the estates for these basic necessities.

Indigenous pastoralists (Mang'ati) occasionally cross the estates in search of water or pastureland for their cattle. This does not happen on a regular basis but rather in cases of draught or general migration. This is part of the nomadic lifestyle of the Mang'ati. The estates are not fundamental to the needs of the people.

It can therefore be concluded that HCV 5 is not present on Kwamdulu and Kwaraguru Estate.

4.6. HCV 6: Cultural Values

Definition
Sites, resources, habitats and landscapes of global or national cultural, archaeological or historical significance, and/or of critical cultural, ecological, economic or religious/sacred importance for the traditional cultures of local communities or indigenous peoples, identified through engagement with these local communities or indigenous peoples

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The following would qualify as HCV 6:

- Sites recognized as having high cultural value within national policy and legislation.
- Sites with official designation by national government and/or an international agency like UNESCO.
- Sites with recognized and important historical or cultural values, even if they remain unprotected by legislation.
- Religious or sacred sites, burial grounds or sites at which traditional ceremonies take place that have importance to local or indigenous people.
- Plant or animal resources with totemic values or used in traditional ceremonies.

Based on results from the social study, conducted by P. Westerlaan in 2014, both Kwamdulu and Kwaraguru Estate have no areas that are of importance in relation to ceremonies, celebrations, festivals or sacred sites held by surrounding communities. All cultural activities are organised within the settlements.

There are the burial sites for those working and living at the Kwamdulu and Kwaraguru workers' camps; 3 in Kwamdulu and 1 in Kwaraguru. The burial grounds are located close to the workers' camps, and they are not part of the planting area. The burial grounds are considered part of the camps and therefore not part of the project area. There is no risk of disturbance of these sites.

The official designation of Kwaraguru and Kwamdulu according to the national government is sisal plantation. This designation has no high cultural values.

HCV 6 is therefore not present on Kwamdulu and Kwaraguru Estates.

5. Conclusion and management implications

Conclusion
Based on the different reports that served as input for this HCV Analysis, it can be concluded that Kwamdulu and Kwaraguru Sisal Estates have little ecological, historical, cultural and social significance. The forest vegetation on Kwaraguru Estate is highly degraded and distributed in small patches. Because of the current conditions, no High Conservation Value areas have been identified in Kwamdulu and Kwaraguru Sisal Estates.

Management implications: restoration
SFI Tanzania/Form Tanzania already has a set of measures to conserve and enhance the biodiversity values in the area under their management. Wildlife will be protected by prohibiting poaching and hunting which is controlled by the security team that patrols the area. All riparian zones will be protected and possibly assisted in their restoration. Connecting the various patches of forest through riparian zones can significantly increase the ecological value of the estates, providing suitable habitat for local flora and fauna, refugia for wildlife and a buffer for soil erosion. Management of these buffer zones is geared towards protection and restoration using indigenous species of local provenances.

Future
With reforestation of the degraded land it is expected that certain ecosystem services will be restored, e.g. water quality and climate regulation. The active reintroduction of indigenous tree species and the protection of wildlife can potentially increase the ecological value of the area managed by SFI and Form Tanzania.

Appendix A – Methodology of socio-economic study

The socio-economic study was carried out by a consultant team consisting of Ms Westerlaan of Form international B.V. (the Netherlands) and Mr. Osiah of EnviroPlanners Ltd. (United Republic of Tanzania). Data collection took place in the period between 3 and 17 April 2014 and for both estates information was gathered at different levels.

District level

At the district level, a plenary meeting was organized for the Korogwe Town Council and the Handeni District Council. Firstly, the proposed plan of company SFI Tanzania on the combination of sisal and teak plantations was presented. Secondly, the District Council members were asked to share their views concerning possible positive and negative impacts of the proposed project.

In addition, qualitative semi-structured interviews were held with key informants at the district level, namely: the Community Development Officers of both Handeni District Council and Korogwe Town Council, the Forest Officers of Handeni and Korogwe District Council and the Natural Resource Management Officer of Handeni District Council, the Agricultural Officers of Handeni and Korogwe District Council and the Korogwe Fire Service. Finally, a report was obtained from the Korogwe Town Education Officer with information on school enrolment and the number of teachers working at the different primary and secondary schools. The topics covered in these meetings are included in Annex IV.

Settlement level

For each of the two Estates, group meetings were held in surrounding settlements (see figure 1 and 2). For Kwamdulu Estate, the Estate manager contacted the ward (extension officer) of the area to announce the meeting at the village chief in the selected settlement who in turn made sure there were about 15-25 participants with an equal distribution between men and women. For Kwaraguru Estate, an employee of SFI Tanzania was instructed by the Kwaraguru Estate manager to make the necessary arrangements. Mostly, the group meetings started at 9am and lasted for 1.5 to 2.5 hours. The location varied from a church or school building to under a large tree.

Figure 1. *Meeting in primary school in Taula*

After a general introduction in the settlement and an explanation of the purpose of our visit, the company SFI Tanzania and its proposed plan of a combination of sisal and teak plantations was presented. Petra Westerlaan explained this in English and Meshack Osiah provided translation to Swahili. After the presentation it was verified whether all was clear or whether there were already questions at this stage. Then, the communities were asked about:

1. Basic information on the settlement (number of residents, age), its facilities (electricity, water, church/mosques, mobile phones, cooking fuel) and access to schools, health care, market etc.;
2. The ways in which the communities make use of the Estate area for farming, collection of natural products (firewood, construction material, bush meat, medicinal plants, etc.) and cultural activities;
3. The condition of certain environmental features (large trees, soil fertility, water quality and quantity etc.) in the past and now and reasons for observed changes;
4. Experience they have with previous owners of the Estates;
5. Expectation and concerns they have related to the proposed project by SFI Tanzania;
6. Interest to join SFI Tanzania (employment, intercropping, out-grower scheme).

Figure 2. *Meeting under large tree in Kikwajuni*

Again English-Swahili translation were provided by Meshack, while Petra filled out the group discussion form. After the group meeting was finished, all participants were thanked for their contribution and 5 men plus 5 women were asked to participate in an individual household questionnaire.

Household level

Individual household questionnaires were conducted to get insight in household composition, education level and occupation, health status, land ownership, agricultural production and wealth. See Annex III for the household questionnaire form. Household questionnaires were conducted in several ways:

1. Individually by Ms. Westerlaan and Mr. Osiah (Kwakombo, Mtakuja), by Mr. Osiah only (Kwamngumi, Rujera, Kwediloko and Kabuku N°1 & Kiushu) or by Ms. Westerlaan and the ward (who then functioned as a translator) around Kwamdulu Estate and parallel by Mr. Osiah (Mandera, Kikwajuni and Kwamaligo)
2. In groups of 2-5 by Petra and Meshack where after a question was asked, multiple respondents answered it for their own situation and multiple forms were filled in for each 'question round'. The latter method was developed out of lack of time and applied to Kwedizinga and Taula.

The table below shows per Estate which settlements were included in the socio-economic study. In total, 93 household surveys were conducted.

Table 1. *Settlements near Kwamdulu Estate included in socio-economic study.*

Date	Settlement	District	Number of household questionnaires conducted	Total number of people covered by household questionnaires
4 April	Kwakombo	Korogwe	10	60
5 April	Mandera	Handeni	10	66
7 April	Kikwajuni	Handeni	8	48
7 April	Kwamaligo	Handeni	6	29
9 April	Kwamngumi	Korogwe	9	47
10 April	Rujera	Korogwe	10	46
Total			**53**	**296**

Table 2. *Settlements near Kwaraguru Estate included in socio-economic study.*

Date	Settlement	District	Number of households	Total number of people covered by household questionnaires
12 April	Kwedizinga	Handeni	10	73
14 April	Mtakuja	Handeni	5	31
14 April	Kwediloko	Handeni	5	26
15 April	Kabuku No1 & Kiushu	Handeni	10	63
16 April	Taula	Handeni	10	41
Total			**40**	**234**

Data analysis

Data processing and analysis was carried out by Form international and send to EnviroPlanners for review. The information obtained from qualitative interviews with key informants and from plenary meetings at the District level were processed like minutes from a meeting: based on notes taken during the meetings, the information was written down in a structured way.

The data collected from the group meetings held in the different communities were processed per Estate where for every topic a description was distilled from the information provided by the 5 (Kwaraguru) or 6 (Kwamdulu) group discussions.

The data from the household questionnaires was entered into Excel. After data entry, a 10% quality check was performed to make sure no mistakes were made. A number of calculations was done to obtain information on the harvest per acre for every planted crop, the percentage of farm produce that was sold and the absolute revenue farmers obtained for their commercial production. The data was analysed and presented into tables and diagrams.

Appendix B – Methodology of environmental study

The College of African Wildlife Management, Mweka through EnviroPlanners Ltd were commissioned by Form International to undertake a flora and fauna inventory within Kwamdulu and Kwaraguru Sisal Estates in April, 2014. In this study, we conducted an inventory aimed at establishing a list of birds present in the areas, determining vegetation species, abundance in terms of cover and standing tree stock as well as coming up with population status of mammals and reptiles found in the area.

Prior to the actual inventory, we conducted reconnaissance in each plantation in order to get familiar with the study area(s), determine the sampling design and appropriate materials for data collection.

Fauna
A total of 16 and 17 transects were set at Kwamdulu and Kwaraguru estates respectively. Transect length at Kwaraguru varied between 2km and 5km, while at Kwamdulu it varied between 2km and 6km depending on the shape of the plantation. Inter-transect distance was 500m at both estates.

Birds
To maximize chances of birds' detection a combination of methods were employed. Line transect method was deployed to record birds within a predefined route. In order to have a comprehensive birds' checklist incidental observation method was also employed to identify birds' uncounted outside sampled areas. On top of that, nests' morphotypes, songs and calls were also used as surrogates of a true bird species. Sutherland (2006) reported that birds' calls and songs can be used to identify birds which are difficult to be physically observed in their preferred habitats[16]. This method was largely used to detect birds in the forest at Kwaraguru plantation in the Forest stratum. However, this method has some limitation in that, it is only applicable to calling and singing birds (mostly mature males). Despite that the team took with them mist nets to the field; they were not deployed since the above methods were found satisfactory to meet the inventory objectives for that assignment.

Birds flying, walking and/or perching within 50m on each side of transect were included in our study. As birds are active in the mornings and late afternoon only, data were collected from 0600hrs to 1000hrs and 1500hrs to 1800hrs.

Mammals
Transect method was deployed in an effort to estimate mammals' population size and density in Kwamdulu and Kwaraguru estates. Mammals observed within 200m on each side of transect were included in the study. On each sighting, animal species and signs were recorded as well as their perpendicular distances, GPS points and eventual remarks.

A questionnaire was also administered to three settlements (Kikwajuni, Rujera and Kwamngumi) surrounding Kwamdulu estate and five settlements around Kwaraguru estate (Kwedizinga, Mtakuja, Kwediloko, Kabuku N1 + Kiushu and Taula) so as to complement the data and information on fauna found in the area.

[16] **Sutherland, S.J., (2006).** Ecological Census Technique. Second Edition; Cambridge University Press. Pp. 189-194

Reptiles

For convenience purpose a transect method was also used to count reptiles found in the study area as suggested by Kim Howell in Glyn Davies, (2002)[17]. This method involved walking slowly within transects of varied length and fixed width of 10m on each side of the transect line. Any encountered log or rock was turned over to look for their presence. For arboreal species, we looked on the tree trunks and canopy to ascertain their presence. Despite that reptile are ectotherms and thus are not active in the early morning times they were being recorded along with birds and mammals as the starting times were ideal.

Flora

We categorised vegetation into three main growth forms which are trees, shrubs and herbs. The latter constitutes grasses, sedges and forbs. We determined vegetation abundance in terms of cover and frequency. We used cover in estimating vegetation abundance of because cover measurement is often used to grasses[18]. In addition to cover, we also used frequency to estimate vegetation abundance because it is appropriate measure to any growth form and it is fairly stable after the growing season[15].

We used stratified sampling design to position our sampling units (i.e. quadrats) because the areas constitute heterogeneous habitat types which are sisal plantation, teak plantation and fallow land. The latter was defined as i) the land that has never been planted with sisal; ii) the land that has been planted with sisal 24-48 years ago; iii) the land that has been planted with sisal but is left as fallow 10 years ago; and iv) the land where annual crops like maize and sunflower have been cultivated. These three strata are more applicable to Kwamdulu Sisal Plantation. At Kwaraguru Estate we stratified the area into sisal plantation, forest and fallow land, but the fallow land did not constitute annual crops like maize and sunflower.
Within each stratum systematic sampling design was used and a total of five (5) quadrants were established per transect whereby a distance from one quadrat to another was 200m and inter-transect distance was 500m. The same transects used to sample fauna were deployed for vegetation sampling. However, we were restricted to 1km along transect after establishment of the first quadrat at random.

It is difficult to sample plants of different growth forms (e.g. trees, shrubs and hers) using quadrat of the same size. Therefore, the square nested quadrats technique was applied to sample trees, shrubs and herbaceous in separate plots (figure 1)[19]. The three nested quadrats were laid out systematically, whereby one corner was chosen to be the starting point and four (4) wooded sticks were tied to a rope at 20m, 10m and 2m distances. Standard observation for vegetation sampling frame

[17] **Glyn E.D. (2002).** African Forest Biodiversity: a field manual for vertebrates. Earth Watch Europe. ISBN 0-9538179-4-6
[18] **Caryl, L. E., Salzer, W. D., & Willoughby, J. W., (1998).** Measuring and Monitoring Plant Populations. Bureau of Land Management, USA
[19] **Mac Aller. R., W. and Fidelibus. R., T. (1993).** Restoration in the Colorado Desert: Management Notes. Prepared for the California Department of Transportation. District 11, 2829 Juan Street, San Diego, CA, 92138

was 20m x20m quadrat for trees, 10m x10m for shrubs[20,21] and 2m x2m for herbs[13]. This flexible and multipurpose sampling method has been used over 3,000 sites for over ten years in areas like North Carolina and Savannahs vegetation[16,22,23].

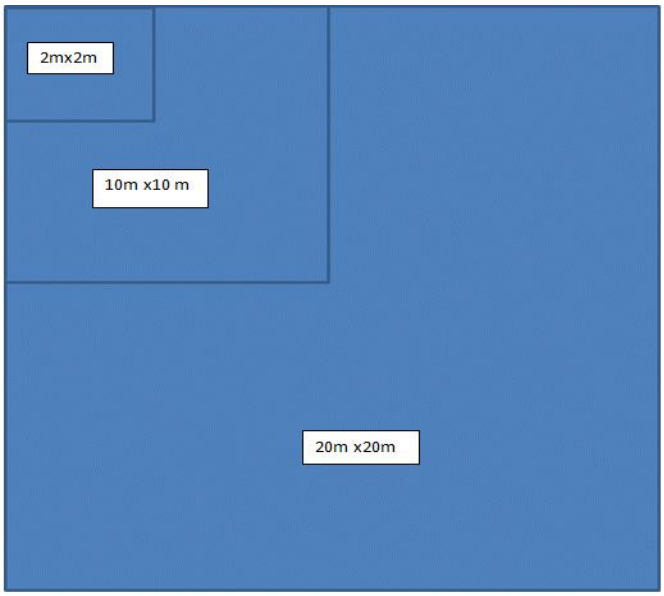


Figure 1. *Nested quadrant layout used for vegetation sampling*

A total of 56 and 39 sampling units (i.e. nested quadrats) composed of the trees, shrubs and herbs were assessed in Kwamdulu and Kwaraguru estates respectively. In each quadrat identified plant species, percentage covers, circumference using tape measure (for trees), height using clinometer (for trees) and possible remarks were recorded accordingly. Every plant shoot that was within (or touched) the quadrat line was considered. The plants covers were visually estimated based on the relative area covered by different plant species in a quadrat.

$$\%\,cover\ Spp\ A = \left(\frac{Total\ \%\ cover\ Spp\ A\ in\ all\ plots}{number\ of\ plots\ estimated}\right) \times 100$$

We also calculated frequency using the formula below

$$\%\ freq.\ Spp_1 = \left[\frac{\#\ of\ plots\ in\ which\ Spp_1\ occurs}{Total\ \#\ of\ plots\ examined}\right] \times 100$$

[20] **Cox, G., and Brown, W.C. (1990).** Laboratory manual of general ecology 6th Ed. Dubuque, Iowa.
[21] **Peet, R.K., Wentworth, T.R., and White P.S. (1998).** A Flexible, Multipurpose Method for Recording Vegetation Composition and Structure. Castanea Vol. 63, No. 3 (Sep., 1998), pp. 262-274
[22] **Bonham, C. D. (1989).** Measurements for terrestrial vegetation. New York, NY: John Wiley & Sons.
[23] **Godınez-Alvarez H., Herrick, J.E, Mattocks, M., Toledo, D., & Van Zee, J. (2009).** Comparison of three vegetation monitoring methods: Their relative utility for ecological assessment and monitoring. BUSDA-ARS Jornada Experimental Range, MSC 3JER Box 30003, New Mexico State University, Las Cruces, NM 88003, USA

We calculated tree volume (just as an index) using $\pi r^2 h$.

Where **π** is constant 3.14, r is a tree radius at breast height (i.e. 1.3m above the ground) obtained from tree circumferences recorded in the field and ***h*** is the total tree height. This formula was used with the assumption that tree trunk have perfect cylinder.

Appendix C – Methodology of hydrological survey

Location

For Kwaraguru estate, water samples have been taken on Wednesday afternoon 17 September in the following areas (see also figure 2):

- Domestic water (Ruvu river), also used for drinking
- Kandoza stream water collected in big dam, used in sisal operations
- Animal dam (figure 1)
- Kabuku dam
- Sisal waste water pond
- Borehole, used for drinking when no other water is available

Figure 1. *Animal dam Kwaraguru Estate.*

For Kwamdulu estate, water samples have been taken on Tuesday morning 23 September in the following places (see also figure 3):

- Office (Ruvu river water by pipeline)
- Mnyuzi river (2 points)
- Kwamdulu spring
- Kwamaruala
- New camp dam
- Sisal waste water pond

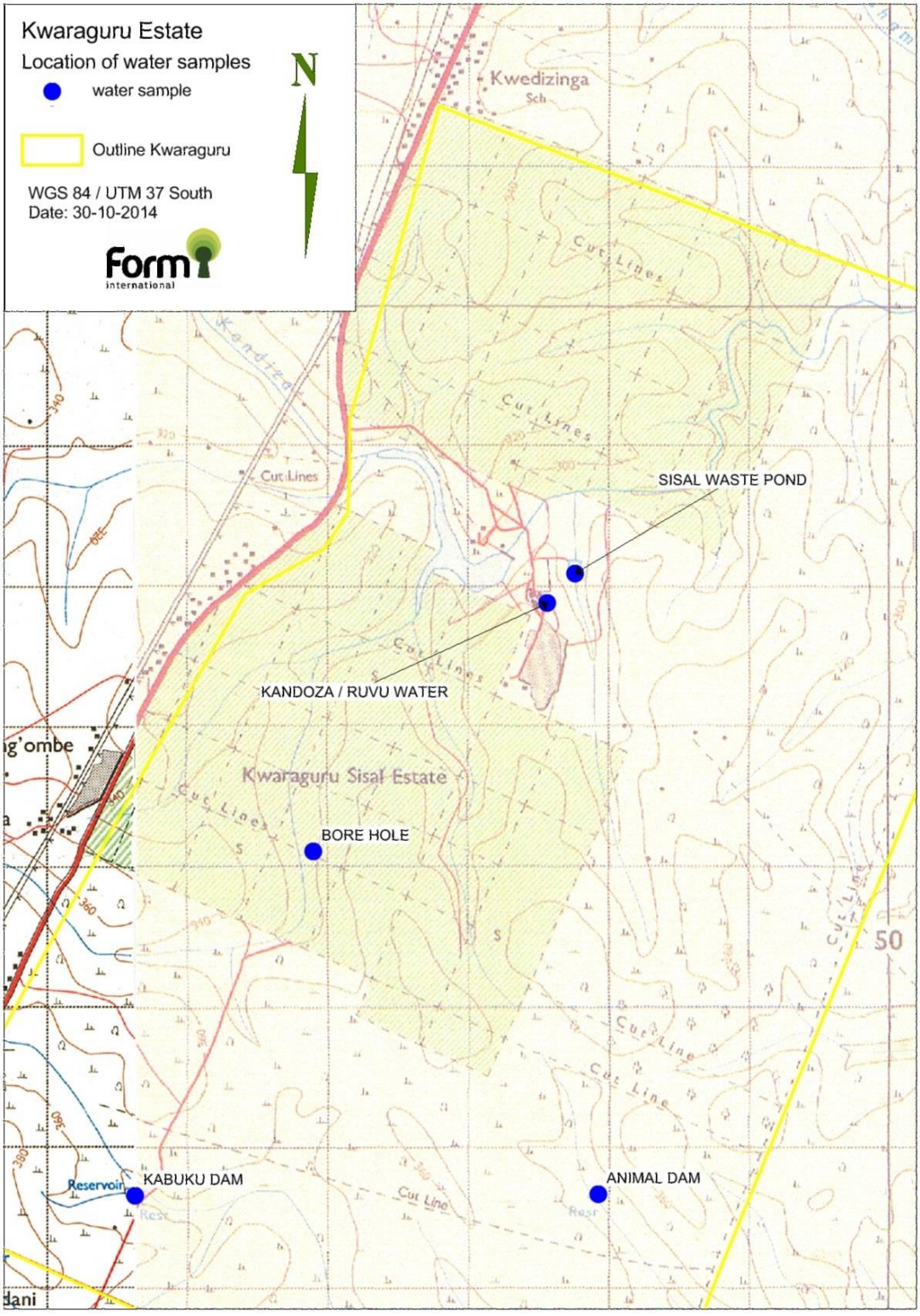


Figure 2. *Water sample location in Kwaraguru estate.*

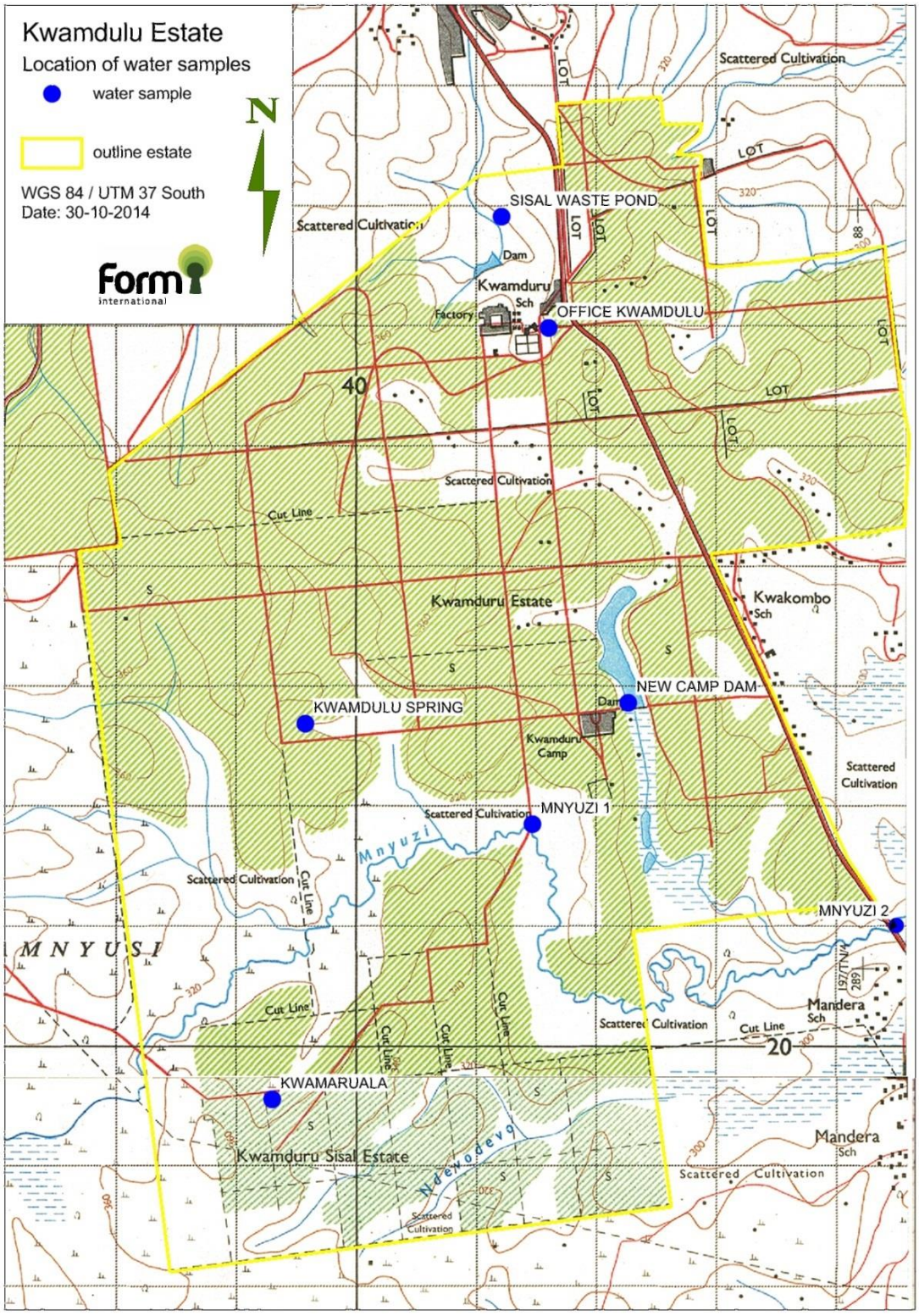


Figure 3. *Location of water samples in Kwamdulu estate.*

Method

With a GPS the exact location is taken. On the spot, a water turbidity analysis is performed using a 120 cm tube with a black and white secchi disk at the bottom (figure 4). The tube is filled with the sampling water until the secchi disk is no longer visible. Then, slowly water is released until the secchi disk becomes visible. The water level is measured and the level is rounded to the nearest full cm.

Figure 4. *Using the water turbidity tube*

A plastic 1L bottle is first rinsed with the sample water to avoid contamination and is then filled with the water sample (figure 5). On the etiquette the name of the water body and the sisal estate is written which is then placed on the bottle filled with the water sample. In total, 13 samples have been collected (6 at Kwaraguru estate and 7 at Kwamdulu estate).

Figure 5. *Collected water samples Kwamdulu estate*

The water samples were analysed by the Pangani Water Board laboratory in Tanga. For a full analysis (chemical and physical), the costs per water sample were 261,000 TSh with for waste water an extra charge of 54,000 TSh is calculated. The following parameters have been measured:

Physical analysis

- pH
- Colour (mg Pt/L)
- Turbidity (NTU)
- Settleable matter (ml/L)
- Conductivity at 25 ºC (µs/cm)
- Total dissolved solids (mg/L)

Chemical analysis domestic water (mg/L)

- Alkalinity as $CaCO_3$: phenolphthalein, total
- Hardness as $CaCO_3$: carbonate, non-carbonate, total
- Calcium
- Magnesium
- Iron
- Manganese (not for Kwamdulu samples)
- Nitrate nitrogen
- Nitrite nitrogen
- Sulphate
- Chloride
- Fluoride

Chemical analysis waste water (mg/L)

- Ammoniacal nitrogen
- Nitrate nitrogen
- Nitrite nitrogen
- Orthophosphate
- Dissolved oxygen
- BOD (5 days)

Obtained values are compared to the maximum values for safe drinking water according to the World Health Organisation.

Appendix D – Methodology of soil survey

Data for the soil survey were obtained from the soil reconnaissance assessment in Kwamdulu and Kwaraguru estates near Korogwe and Kilimangwido estate near Pangani, executed in September 2012 by Hans Scholten. Paul Hol and Mans Vroom (Form international) were present during the mission.

The following reports were obtained from the International Soil Reference and Information Centre (ISRIC);

- Soils of Kwamdulu Estate and their potential for hybrid sisal cultivation. National Soil Service Mlingano, Tanzania (1988).
- Soils of Mwera Estate and their potential for hybrid sisal cultivation. National Soil Service, Mlingano, Tanzania (1988).
- The potential for hybrid sisal cultivation of four Amboni Estates in Tanga region. National Soil Service, Mlingano, Tanzania (1988).
- Hartemink, Alfred E, (1995). Soil fertility decline under sisal cultivation in Tanzania. ISRIC Technical paper no 28.
- Soil map of Korogwe district
- Soil map of Handeni district

From the reports of Kwamdulu and Mwera estates the soil map 1:20.000 were missing. The soil map of Kwamdulu was however found in the office of the estate. A copy of the soil map of Mwera estate was obtained from Mlingano Institute.

During the mission Mr. Joseph Mbogoni and Mr. Godson Urassa from the Mlingano Institute have been consulted. According Mr. Mbogoni Kwamdulu and Kwaraguru estates are part of the same soil unit of the recently updated soil map of East Tanzania which is part of the project to produce a map with agro-ecological zones of Tanzania. Mr Mbogoni supplied additional information about this soil unit. A paper copy of the soil map of Mwera estate and digital copies of some district soil maps were supplied by Mlingano Institute.

The study was carried out to map out the soil units. A total of 7 auger examination borings were made. At each examination point, the soils were examined and identified. The measured parameters included soil texture and colour. The GPS coordinates were taken from each of the augerings.

In Kwaraguru estate a pilot teak plantation is situated on a slope of 7 to 8%. Here two soil augerings have been made, one just above the plantation and one just down slope the plantation.

In Kilimangwido estate a soil survey has never been carried out. However, in the neighboring Mwera estate, which has a similar position near the coastline, a detailed soil survey has been carried out in 1988. From the survey report of that estate valuable data could be obtained. During the field visit a quick reconnaissance has been carried out and 5 auger-hole observations were made in order to identify the soil types.

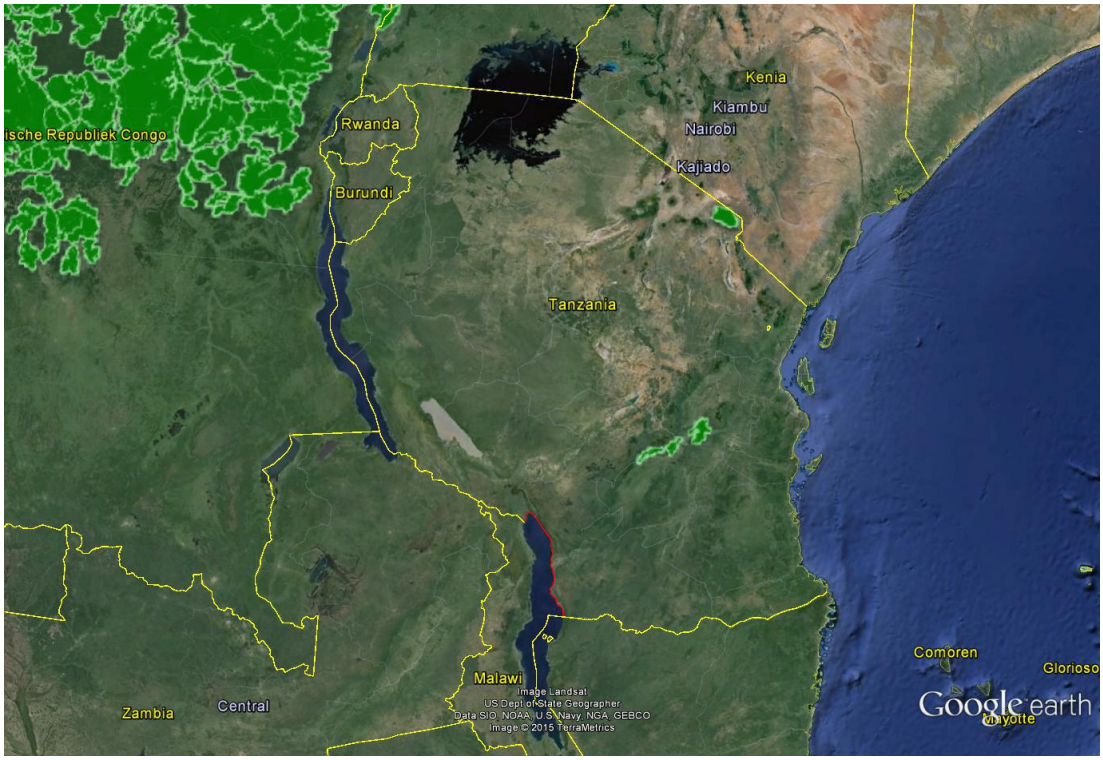
In Kwamdulu, no augerings have been done, but rather a study from 1988 has been used to verify soil quality. During the survey in 1988, 12 sites in this unit have been sampled and analyzed for toxic aluminum.

Appendix E – List of protected species found in Kwamdulu and Kwaraguru estates.

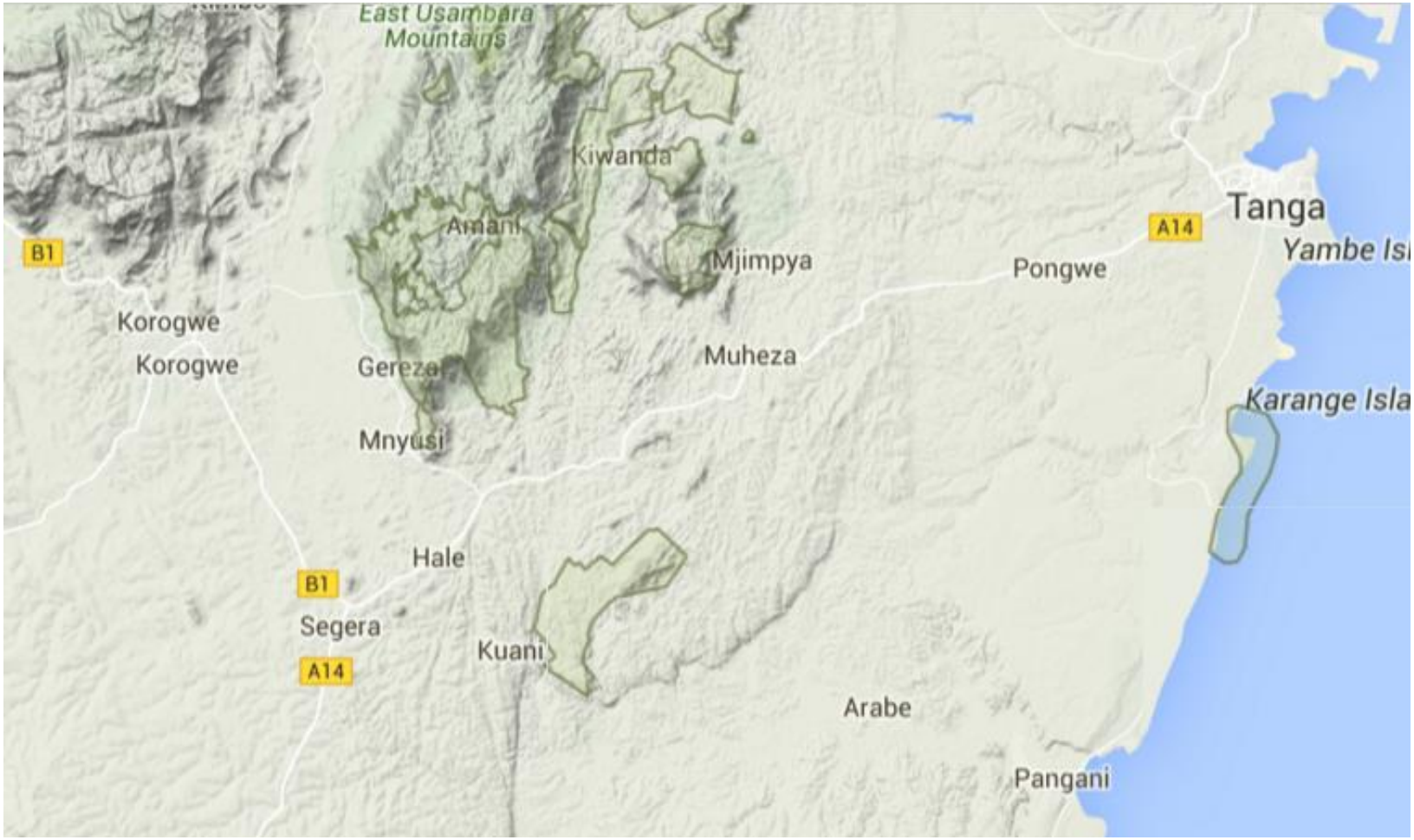
Class	Common name	Genus	Species	IUCN Conservation Status	CITES Listing	Kwamdulu	Kwaraguru
Birds	Black shouldered Kite	*Elanus*	*caeruleus*		Appendix II	x	x
	African Marsh Harrier	*Circus*	*ranivorus*		Appendix II	x	
	Eastern Chanting Goshawk	*Melierax*	*poliopterus*		Appendix II		x
	Lizard Buzzard	*Kaupifalco*	*monogrammicus*		Appendix II	x	x
	African Goshawk	*Accipiter*	*tachiro*		Appendix II		x
	African Harrier-Hawk	*Polyboroides*	*typus*		Appendix II	x	x
	Augur Buzzard	*Buteo*	*augur*		Appendix II	x	x
	Common Buzzard	*Buteo*	*buteo*		Appendix II	x	x
	Bateleur	*Terathopius*	*ecaudatus*	Near Threatened	Appendix II	x	x
	Long-crested Eagle	*Lophaetus*	*occipitalis*		Appendix II	x	x
	Lesser Kestrel	*Falco*	*naumanni*		Appendix II	x	x
	Peregrine Falcon	*Falco*	*peregrinus*		Appendix I	x	x
	Eurasian Hobby	*Falco*	*subbuteo*		Appendix II		x
	European Roller	*Coracias*	*garrulus*	Near Threatened		x	x
Mammals	African Civet	*Civettictis*	*civetta*		Appendix II	x	x
	Velvet Monkey	*Chlorocebus*	*pygerythus*		Appendix II		x
Reptiles	Rock Python	*Python*	*sabae*		Appendix II	x	
Trees	African Blackwood	*Dalbergia*	*melanoxylon*	Low Risk/Near Threatened		x	

Appendix F – Map of National Parks in Tanzania

Appendix G – Map of Intact Forest Landscapes in Tanzania



Appendix H – Map of Important Bird Areas in Tanzania



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