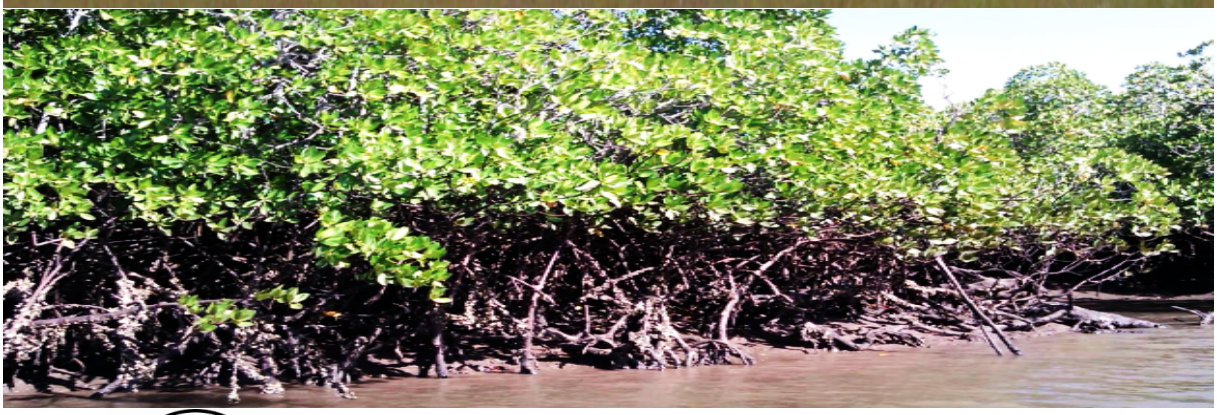
The United Republic of Tanzania

Tanzania Forest Services Agency

Agence Française de Développement

Draft Report

Feasibility Study on Enhancing Management of State Forest Plantations and Mangroves Forest Reserves in Tanzania



August 2022

EXECUTIVE SUMMARY

Background

Forest resources in Tanzania mainland cover about 48.1 million hectares (mil ha) equivalent to 55% of total land surface area. Tanzania Forest Services (TFS) manages those owned by the Central Government (15.84 mil ha) and those in general lands (2.4 mil ha) and include woodlands, water catchment forests (montane and lowland forests), mangroves and forest plantations. However, the forests have been constantly threatened by anthropogenic activities posing a big challenge to the government partly due to weak resource management caused by inadequate financial and human resources.

Currently, the total forest plantation area is estimated to be 583,691 ha. Out of the total plantation area, planted area under TFS is 117,864 ha, large private plantation companies own about 50,827 ha while individual woodlots occupy about 415,000 ha. Although TFS has registered some increase in forest plantation area in recent years, still the plantations face many challenges in terms of low planting rates and low quality and productivity mainly due to inadequate funding.

Mangroves of Tanzania cover about 158,100 ha, which is equivalent to 5% of forests in the country. Despite their outstanding ecological and economical relevance, they face challenges including: encroachment for various development activities, invasive species and inadequate financial resources to implement mangrove management activities.

Due to the aforementioned plantation challenges, TFS prepared a concept note and a business plan for the development of three state-owned forest plantations, namely Mtibwa, Silayo and Wino. To finance the project, The Government of the United Republic of Tanzania (URT) approached *Agence Française pour le Développement* (AFD) for funding. However, during the discussions, an additional component emerged on mangroves conservation, ecotourism and community livelihoods improvement.

The objective of this assignment is to provide the necessary elements for the project's approval by the Government of the URT, represented by the Ministry of Finance and Planning (MoFP), and by the Board of AFD Steering Committee. The specific tasks of this assignment are: (i) A review of the current situation of TFS in its capacity of project owner and the project concept note considered as a prefeasibility study provided by TFS for the three plantation forests (ii) Develop a prefeasibility study for biodiversity conservation in mangroves ecosystems.

Project Objectives

The global objective of the project is to enhance the contribution of Tanzanian forests (including mangroves), to the equilibrium between economic growth, poverty reduction and improved environmental conservation.

The specific objectivest are:

a) To increase forest stock and forest cover through improved planting materials and protection of growing forest stocks in expansion areas of selected forest plantations.

b) To strengthen strengthen coastal biodiversity and ecosystem services through protection, rehabilitation of degraded mangrove areas, including with development of ecotourism services.
c) To improve sustainable livelihood of the forest adjacent communities through supporting conservation based and eco-tourism economic activities.
d) To develop sustainable revenue base for TFS and strenghthen TFS capacity to manage forest resources in selected plantatations, mangroves and nature forest reserves.

Project Components
To address the indicated objectives, the project strategy and content will cover three components:

Component 1: Strengthening of tree planting and management of Tree Seed Collection Centers. This component involves a feasibility for expansion of plantation area in three forests of Mtibwa, Silayo and Wino. In addition, the component involves strengthening of Tree Seed Collection Centres and tree breeding technology.

Component 2: Enhance coastal ecosystems and their biodiversity. This component involves a prefeasibility study of Kilwa and Rufiji Delta mangrove management blocks for improved biodiversity conservation, potential for eco-tourism and community livelihood improvement; and

Component 3: Strengthening institutional capacity. This component includes personnel capacity and skills and resources capacity (infrastructure and equipment), paying special attention to wildfire management. The component is limited to the three forest plantations.

Methodology
The methodology used included literature review and field visits for interviews with stakeholders using questionnaires/checklists and Focus Group Discussions. Data was collected on plantation establishment and management techniques, tree seed production and quality, costs of plantation establishment and tending, harvestable volume and prices; mangrove stakeholders and their interventions, ecosystem pressures and vulnerabilities, opportunities for ecotourism and economic activities; current and required human resources, infrastructure and technology; and project and gender risks and mitigation measures. Collected data was analysed using standard procedures.

Project Interventions
For Component 1, the following activities will be carried out: Establishment of 6 first generation seed orchards of various tree species; establishment of 6 second generation seed orchards of various tree species; establishment of 10 species trials and one progeny trial; establishment of 3 modern nurseries; short and long term training of tree seed to technical and professional staff and procurement of tree climbing gears; expansion of plantations in Mtibwa (500 ha per year), Silayo (3,000 ha per year) and Wino (1000 ha per year) totalling 22,500 ha in 5 years using softwood and hardwood tree species. Establishment and management techniques will be as directed in Technical Order No. 1 of 2021.

For Component 2, the following will be done: Strengthening forest protection; strengthening community participation and developing alternative livelihoods and sustainable economic activities; restoring the degraded mangroves; carrying out feasibility study for ecotourism attractions and REDD projects for the mangroves. REDD project for the Rufiji Delta can potentially generate Carbon credits of 1,485,905 tCO_2 eq per year which can potentially generate revenues of TZS 17,459,383,750 annually, while Kilwa can potentially generate Carbon credits of 684,641 tCO_2 eq per year worthTZS 8,044, 532,573 annually.

For Component 3, the following activities will be carried: New staff requirement of 86 professional/technical staff and 76 other staff for both plantations and mangroves; staff training in firefighting and GIS and tree seeds; construction of 52 buildings of different categories, 27 motorcycles and 24 vehicles; heavy machinery requirements of the plantations total 22; fire fighting infrastructure and equipment including fire towers (10), dams (9), complete radio call system for each plantation (3), weather equipment for each range to be planted (5), bakkie sakkie (7), fire fighting vehicles (5), water bowzers (5), fire alarms (10), backup pumps (100), fire beaters (200), Drip touch (13), Personal Protection Clothing (PPC) (250), Fire hoes (150), Binoculars (10) and GPS (10).

Economic and Financial Analysis of Forest Plantations

Initial budget estimation for these activities was about TZS 77.15 bil, however, the budget increased to TZS 98.57bil (Eur 41,595) after making a more critical analysis of information from a survey done in three forest plantations which revealed that costs of fire protection and roads construction and maintenance were underestimated in the initial budget. The Internal Rate of Return (IRR) for implementation of Silayo forest plantation project was found to be 13.35%, while for Wino was 13.82% and Mtibwa 19.74%. These IRRs are above bank borrowing rate of 9%, revealing that the project implementation will be profitable. Sensitivity analysis revealed that even if costs of production would increase by 20% during the project implementation period, the project will remain to be profitable because IRR for the three sites were still greater that the bank borrowing rate.

Project Risks

During the implementation of this project, the following risks are likely to happen: Climate change, social, environmental, and technical. A risk assessment register has been developed and some measures to be taken to reduce the likelihood of the occurrence of the risks are provided.

Monitoring and Evaluation (M&E)

The M&E of the Project will be the primary responsibility of the Project Coordinator and TFS (Planning Section). The existing M&E frameworks within TFS will be used to monitor and assess the implementation of this project as well as additional frameworks as directed by the Project Steering Committee.

Project Implementation

The Project Components will be managed by a Project Coordination Unit under TFS. The Project components will be implemented by TFS staff and other stakeholders as found appropriate, directly supervised by the Plantation and Mangrove Conservators. However, some of the initial activities such as project operation, procurement, financial

management manual, will require engagement short term experts. There will be a Project Steering Committee that will be the decision-making body of the project.

Sustainability

The project will enhance enviromental, institutional, financial, and social sustainability in various ways including retention of patches of natural forests, engagement of communities in woodlot establishment and management, income-generating activities, increased infrastructure, employment to adjacent communities, involvement of stakeholders in project activities, and Corporate Social Responsibility (CSR). In addition, TFS will continue project activities at the same planting rates at the end of the 5 year loan period, using funds that were previously allocated to planting in expansion areas in some forest plantations which have now been fully planted.

Local Content Opportunities (LCO)

The Project will enhance LCO by ensuring that goods and equipment that are locally manufactured are purchased for the project, provided that they meet the required standards and quality. Further, Forestry Service Providers and Local Construction Companies will be involved in relevant project activities following the normal procurement procedures.

Legal, Regulatory and Tax Aspects

The Project will comply with all statutory, regulatory and tax requirements of the country. Relevant AFD loan requirements as agreed with the Government of Tanzania will also be complied.

Conclusion

This feasibility study has shown that there is a favourable environment in terms of climate, land availability, economic growth, population growth and existence of a functioning forestry sector. The economic and financial analysis of the plantations and capacity building components shows significant positive returns for the investment.

Prefeasibility study for Kilwa and Rufiji Delta mangrove forest reserves has indicated existence of potential opportunities which could be tapped to address mangrove conservation challenges and improve the government income and community livelihoods.

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AFD	Agence Française de Développement (AFD)
AGB	Above ground biomass
BGB	Below ground biomass
Bil	Billion
BMU	Beach Management Unit
CC	Conservation Commissioner
CO_2	Carbon dioxide
CITES	Convention on International Trade of Endangered Species
CRMM	Complaint and Redress Management Mechanism
CSR	Corporate Social Responsibility
Dbh	Diameter at breast height
DBSS	Directorate of Business Support Services
DRM	Directorate of Resource Management
DRMU	Directorate of Resource Marketing & Utilization
DTSP	Directorate of Tree Seed Production
ESMF	Environmental and Social Management Framework
ESS	Environmental and Social Standards
FBD	Forestry and Beekeeping Division
FDT	Forestry Development Trust
FGD	Focus Group Discussion
FPIC	Free and Prior Informed Concent
GIS	Geographic Information System
ha	Hectare
HQ	Headquarters
IAS	Invasive Alien Species
ICT	Information and Communication Technology
ILO	International Labour Organization
ITTO	International Timber Trade Organisation
IRR	Internal Rate of Return
IUCN	International Union for Nature Conservation
LGA	Local Government Authority
m.a.s.l	Meters above sea level
MoFP	Ministry of Finance and Planning
MNRT	Ministry of Natural Resources and Tourism
Mil	Million
NAFORMA	National Forest Resources Monitoring and Assessment
NGO	Non Governmental Organization
NPV	Net Present Value
NTFPs	Non Timber Forest Products
PAD	Project Appraisal Document

PCU	Project Coordination Unit
PFP	Participatory Forestry Programme
PPC	Personal Protection Clothing
PS	Performance Standards
PFP	Private Forestry Programme
PMU	Project Management Units
REDD	Reducing Emissions from Deforestation and forest Degradation
SDGs	Sustainable Development Goals
SOC	Soil organic Carbon
SSO	Seedling Seed Orchard
SSMT	Species-Site Matching Tool
SUA	Sokoine University of Agriculture
SWOC-AR	Strengths, Weaknesses, Opportunities, Challenges, Aspirations and Results
t	Tonne
TAFORI	Tanzania Forestry Research Institute
TAWA	Tanzania Wildlife Authority
TFS	Tanzania Forest Services Agency
ToR	Terms of Reference
TZS	Tanzanian Shillings
UNCCD	United nations Convention on Combating Desertification
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNEP	United Nations Environmental Programme
US$	United States Dollar
VICOBA	Village Community Bank
VNRC	Village Natural Resources Committee
WWF	World Wide Fund for Nature

1. INTRODUCTION

1.1 Forest Resource Base

Forest resources in Tanzania mainland cover about 48.1 million hectares (mil ha) equivalent to 55% of total land surface area. The main types of forests are montane (2.1%), lowland (3.4%), mangroves (0.3%), plantations (1.2%) and woodlands mainly Miombo woodlands (93%) (MNRT, 2015). Protection forests (water catchment areas, biodiversity hotspots and mangroves) cover 28.09 mil ha (58.4% of all forests), and harvesting is not allowed, while 20 mil ha (41.6% of all forests) are production forests where harvesting is allowed. Ownership of forests is 15.84 mil ha (35%) Central Government, 3.36 mil ha (7%) Local Government Authorities (LGAs), 21.6 mil ha (45%) Village Governments, 3.36 mil ha (7%) privately owned, 2.4 mil ha (5%) forests in general lands and 480,000 ha (1%) belong to others (TFS, 2020). Forests owned by the Central Government and those in general lands are managed by Tanzania Forest Services Agency (TFS) and include woodlands, water catchment forests (montane and lowland forests), mangroves and forest plantations.

Forests in Tanzania play an important role in the daily livelihoods. They are an important source of energy for cooking, building timber, traditional medicine, ecotourism, fodder, water catchments, shelter for wildlife and estuaries for fish breeding areas. Furthermore, these forests also have high biodiversity. Tanzania is ranked among the top countries in Africa in terms of the representativity of ecoregions, richness of species and extent of species endemism. There are over 10,000 plant species, hundreds of which are nationally endemic, 724 species of flora and fauna identified as threatened in the International Union for Conservation of Nature (IUCN) Red List, and 276 species of flora and fauna classified as endangered (IUCN, 2013).

However, these forests have been constantly threatened by anthropogenic activities such as illegal harvesting for timber and wood fuel, encroachment, shifting cultivation, over grazing, wildfires and invasive species. Also, there is weak resource management due to inadequate financial and human resources (MNRT, 2019). As a result of these causes, deforestation is high and is estimated at 469,420 ha per year for the period 2002-2013 (URT, 2017).

According to the National Forest Resources Monitoring and Assessment (NAFORMA) 2015 report, annual timber production is about 42.8 mil m^3, while demand is 62.3 mil m^3 causing an annual deficit of 19.5 million m^3 (MNRT, 2015). It is estimated that to meet this deficit requires annual planting of 185,000 ha up to 2030 at an annual cost of around US$ 130 million (TFS, 2021a). However, this target has never been met. The total wood volume of Tanzania mainland is 3.3 billion m^3 whereby 97% is from natural forests and only 3% is from planted trees. The shortage of timber is already evident in some parts of the country affecting sustainability of sawmilling and other wood-based industries, a threat to employment opportunities and local economies.

1.2 Current Status of Forest plantations

Large scale plantation establishment started in the 1930s. The main justification for establishment of forest plantations was to meet the increasing demand of wood products, which cannot be met by the normally slow growing, but ecologically superior indigenous tree species in natural forests. Currently, the total forest plantation area is estimated to be 583,691 ha, the largest area (210,000 – 250,000 ha) being in the

southern highlands, mostly as individual woodlots. Out of the total plantation area, planted area under TFS is 117,864 ha, large private plantation companies own about 50,827 ha while individual woodlots occupy about 415,000 ha (TFS, 2021b).

Overall, the contribution from planted trees is still small and there is a big room for expansion given the potential area which is available. In fact, Tanzania is one of the few African countries with large potential areas for expansion of forest plantations (TFS, 2021b). Despite efforts made by TFS, private commercial plantations and small-scale tree growers, the contribution of planted trees to reduce wood deficit is still insignificant. Annual hardwood and soft wood demand by active primary wood-based industries in 2020/21 were 487,722 m^3 and 1,072,610 m^3 respectively. However, only 848,933 m^3 was available from plantations and 520,327 m^3 from natural forests for harvesting at a sustainable level per year from the Central Government forest reserves and plantations (Kilongo, 2021).

TFS Agency has 23 forest plantations of which Sao Hill plantation contributes about 50% of the total area. These plantations are planted with various softwood and hardwoods tree species, mainly Pines, Teak and *Eucalyptus*. *Pinus patula* occupies about 65% of the country's planted area, followed by *P. caribaea* (13%), Teak (5%), and *P. tecunumanii* (4%). The remaining 17% is covered by *Eucalyptus* sp*, Cupressus lusitanica* and *Grevillea robusta* occupying about equal share each. Overall, tree species diversity is low. It is generally acknowledged that tree species diversification may serve as an insurance against insect pests, pathogens and climatic fluctuations.

Although TFS has registered significant increase in forest plantation area in recent years (37,420 ha in 10 years), still they face many challenges such as inadequate funding, shortage of skilled manpower, forest fires, low productivity and quality of trees in plantations, skipping of some forest operations, inadequate research and innovations which prevent the forest plantations to provide their full potential contribution to job and wealth creation, and biodiversity conservation. For example recent TFS data shows that (TFS 2021b): during the period 2017/18-2019/20, the required plantation budget was TZS 138.6 billion (bil), the allocated amount was TZS 102.7 bil while the disbursed amount was TZS 94.8 bil; during 2020/2021, 1161 and 1442 ha of plantations were affected by forest fires in Wino and Sao Hill forest plantations respectively; plantation productivity ranges 4-37.8 m^3/ha/year out of a possible 50 m^3/ha/year with improved seed and high standards of silviculture; and plantation road networks are inadequate and not well maintained. Appropriate strategies are needed to have diversified, productive and healthy forest plantations.

With regard to tree seed, TFS has recently (2018) been merged with the Tanzania Tree Seed Agency. TFS has now the responsibility of production, procurement and supply of tree seed in Tanzania, for its own plantations and other stakeholders. While the national demand for tree seed is high (about 20 t/year) and growing, TFS currently collects only about 11 tons of tree seed per year, mostly collected from seed stands not from genetically improved sources (seed orchards) (MNRT, 2021a). This has implications on quality and productivity of forest plantations. Strategies are needed to ensure adequate supply of genetically improved seed from seed orchards.

1.3 Current Status of Mangrove ecosystems

Mangroves of Tanzania cover about 158,100 ha, which is equivalent to 5% of forests in the country (MNRT, 2015). All the ten mangrove species of Eastern Africa are represented, among which *Avicennia marina, Sonneratia alba* and *Rhizophora mucronata* are abundant (Njana, 2017). Mangrove ecosystems have outstanding ecological and economical relevance, including Carbon storage, supporting other life forms, maintaining water quality and protecting the shoreline. Mangrove forests provide critical services around the globe to both human populations and the ecosystems they occupy. A hectare of mangroves is estimated to be worth between US$ 33,000 and US$ 57,000 per year in terms of the services they provide (Bochove et al., 2014). Moreover, the Carbon storage potential of mangroves is 3-5 times higher than that of tropical upland forest due to strong Carbon storage in the soil (Donato et al., 2011). Despite their importance, 50% of global mangrove cover has been lost over the last 50 years and these losses are largely attributable to human activities, mainly by palm oil plantations, rice paddies and shrimp farms (Andradi-Brown, 2021). Carbon dioxide (CO_2) released by global mangrove loss annually could be as high as the annual emissions of Australia (EDGAR, 2018). Mangrove extraction adversely impacts nursery habitat for fish and shrimp vital to the subsistence and livelihoods of coastal communities. Approximately 80% of worldwide fish catches are estimated to depend directly or indirectly on mangroves (Ellison, 2008). The main challenges facing mangroves in Tanzania include: encroachment for various development activities e.g., rice farming, salt mining, logging, cattle grazing, invasive species, inadequate financial resources to implement mangrove management activities, inadequate infrastructure, inadequate human resources, lack of cost-benefit sharing mechanism with communities, weak coordination among stakeholders, population pressure and natural factors like river floods and sand deposition.

UNEP studies found that for every dollar invested in mangrove restoration, there is a benefit of four dollars (Bochove et al., 2014). Simply put, they could be one of the most efficient, cost- effective nature-based solutions. If protected areas can enhance long-run livelihood opportunities for communities, they can potentially be a win/win solution for conservation and poverty alleviation (McNally et al., 2011). In this way, action on the indicated challenges will ensure that the socio-economic and ecological benefits of mangroves are sustained.

1.4 TFS Institutional analysis

TFS was established as a semi-autonomous Government Executive Agency under the Ministry of Natural Resources and Tourism (MNRT) through the Executive Agencies Act (Cap 245) and Government Notice No. 269/2010. TFS is led by a Conservation Commander (CC). There are four Directorates led by Deputy CCs. The Directorates are: Tree Seed Production (DTSP), Resource Marketing and Utilization (DRMU), Forest Resources Management (DRM) and Business Support Services (DBSS). Administratively, TFS is divided into seven geographical zones headed by Zone Conservation Commanders responsible for coordinating and commanding operations at the district and plantation level. Overall, this organization set up has simplified management of forests and has increased efficiency and effectiveness of operations (TFS, 2019).

The functions of TFS include: establishing and managing national natural forest and bee reserves; establishing and managing national forest plantations and apiaries;

managing forest and bee resources in general land; enforcing forest and beekeeping legislation in areas of TFS jurisdiction; providing forest and beekeeping extension services in areas of TFS jurisdiction; collecting forest and beekeeping revenues; marketing forest and bee products and services; providing high quality tree seed and other propagating materials for different end uses; conducting training to public, private individuals or institutions in the principles, procedures and techniques of nursery establishment and management, safe tree climbing, temporary seed storage and gene resource conservation; providing consultancy in matters related to the practice of the tree seed management and environmental conservation including landscaping, rehabilitation/re-vegetation of degraded land; preparing certificate of origin of seed supplied to all export and major domestic customers; and managing, improving and developing the antiquities stations. Overall, these functions are effectively being implemented as shown in the recent evaluation (TFS, 2019). However, some of the functions for example marketing, extension services, consultancy and management of forest reserves are still weak in terms of implementation.

The current staff strength of TFS is 1,993 while the requirement is 5,257. Overall, there is a total deficit of 3,264 professional and technical staff. The deficit for forest plantations is 497 staff. This staff deficit has contributed to challenges especially development and management of forest reserves and plantations. Of the existing staff, 461 are professional, 827 are technical while 303 are operational service.

The TFS owns several infrastructures which were acquired to support institutional capacity to deliver service. TFS owns land and buildings, equipment, marine vessels, plants and machinery, motor vehicles and motorcycles (See list in TFS, 2021b). The assets are inadequate. Further, some of the buildings and motor vehicles and plants are old with high costs of rehabilitation and maintenance.

1.5 Allignment with National Plans, Policies and International Frameworks

The project to enhance management of state forest plantations and mangrove forest reserves is in line with a number of policies and international obligations. Thus, there is conducive policy and legal environment for the project to realize its objectives. A number of tools such as national policies, laws, guidelines, strategic plans and some international guidelines are available to provide direction and achieve desired goals. Some of these tools include the following:

Sustainable Development Goals

Forests and Sustainable Development Goals (SDGs) recognize sustainable management of forests, combat desertification, halt and reverse land degradation and halt biodiversity loss. Relevant SDGs include goal number 1, 2, 3, 7, 13, 13, 14 and 15.

Tanzania Development Vision 2025

The project is consistent with the Tanzania Development Vision 2025 (URT, 1999). The vision emphasizes high quality livelihood by creation of wealth and equitable distribution in society through sustainable utilization of natural resources, and popular participation of all social groups in the society (URT, 1999).

National Forest Policy (1998), Forest Act No. 14 (2002), and the National Forest Policy Strategy (2021 – 2031)

The National Forest Policy (1998) (URT, 1998) emphasizes efficient and sustainable supply of forest plantation products, and conservation of biodiversity in natural forests. The Forest Act provides legal environment for the policy to operate. The National Forest Policy Implementation Strategy (MNRT, 2021b) provides a guide for all interventions of the four main issues in the policy areas and cross-cutting issues one of which is the protection and management of ecosystems and biodiversity.

Other relevant national strategies/guidelines which support the project include the Forest Technical Order No.1 of 2021 (FBD, 2021), Integrated Fire Management Guidelines for Commercial Forestry (FBD, 2019), Forest Plantations and Woodlots Technical Guidelines 2017 (FBD, 2017), and National Climate Change Strategy 2012 (URT, 2012).

National Biodiversity Strategy and Action Plan 2015 – 2020

The proposed project is in line with National Biodiversity Strategy and Action Plan (NBSAP). Tanzania is a signatory to the Convention on Biological Diversity (CBD) of 1992 having ratified it in 1996 making the country a fully-fledged party to the convention in response to international obligations to protect and conserve its biodiversity as a global resource. A key intervention by Tanzania as a response to CBD was the development of NBSAP of 2015 which realises and promotes sustainable utilisation and conservation of biodiversity (URT, 2015).

International Guidelines and Frameworks

Tanzania is a signatory of various international agreements and frameworks. These include the Convention on Biological Diversity (CBD); the United Nations Convention on Combating Desertification (UN-CCD); the United Nations Framework Convention on Climate Change (UNFCCC); the Convention on International Trade of Endangered Species (CITES); and International Timber Trade Organisation (ITTO) Guidelines for the Establishment and Sustainable Management of Planted Tropical Forests (ITTO, 1993). These are considered in the preparation of strategy documents for the management of forest plantations and mangroves.

1.6 Rationale

The above background shows that TFS has a low rate of plantation establishment due to inadequate funding and skilled manpower. Other challenges include: tending backlogs, forest fires, insect pests and pathogens attacks, low productivity and inadequate research and innovations. The management of natural forests including mangroves is also equally facing similar challenges as pointed out earlier leading to loss of biodiversity and degradation of other environmental services. This compounding situation calls for deliberate efforts to increase supply of wood materials in order to meet the deficit, reduce loss of biodiversity and environmental services. It requires significant expansion of planted areas, availability of sufficient capacity and funds, and involvement of other stakeholders including communities in the management of forest plantations and mangroves. It is against this background that the URT submitted the request to *Agence Française de Développement* (AFD) for a loan.

While the main ideas and areas of interventions have been approved as reflected in the concept note and business plan and the Terms of References (ToR), there is need to critically review and analyze the proposed interventions to identify other considerations, assurance for contribution to improved supply of raw materials,

revenue and livelihood of communities. This assignment is also meant to identify the necessary elements and preparation of a project document for approval by the government of the United Republic of Tanzania.

1.7 Structure of the Report

The rest of the report is structured as follows:

Chapter 2 presents the objective and scope of the assignment. **Chapter 3** describes the methodology and includes sites description, approach and data collection methods and analysis. **Chapter 4** gives a situation analysis of forest plantations and mangroves. **Chapter 5** is on interventions for plantations, mangroves and capacity building components. It includes activities, project logical framework, project monitoring and evaluation (M&E) system, economic and financial analysis, budget, and project implementation (plantation forests and Mangroves). **Chapter 6** focuses on project risk assessment and co-benefits and presents various project-related risks. Finally, the last chapter (**Chapter 7**) provides the conclusion of the assignment. Several Appendices are presented to enhance the descriptions in the text.

2. OBJECTIVES AND SCOPE OF ASSIGNMENT

2.1. Objectives and Tasks

The objective of this assignment is to provide the necessary elements for the project's approval by the Government of the United Republic of Tanzania, represented by the Ministry of Finance and Planning (MoFP), and by the Board of AFD Steering Committee.

The specific tasks of this assignment are:

a) A review of the current situation of TFS in its capacity of project owner and the project concept note considered as a pre-feasibility study provided by TFS for the three plantation forests; and
b) Develop pre-feasibility study for biodiversity conservation in mangroves ecosystems.

2.2 Scope of the Assignment

This assignment involves a feasibility study to enhance management of state forest plantations and a prefeasibility study for enhancing mangrove forest reserves in Tanzania. However, this assignment is confined to three components namely:

a) **Component 1:** *Strengthening of Tree Planting and Management of Tree Seed Collection Centers.* This component involves a feasibility for expansion of plantation area in three forests namely: Silayo, Mtibwa through Pagale extension area, and Wino Forest plantation (Ifinga and Mkongotema). In addition, the component involves strengthening of Tree Seed Collection Centres and tree breeding technology. The duration of the implementation of this component is 5 years;
b) **Component 2:** *Enhance coastal ecosystems and their biodiversity.* This component involves a prefeasibility study of two mangrove forest reserves namely Kilwa and Rufiji Delta mangroves for improved biodiversity conservation, potential for eco-tourism and community livelihood improvement; and
c) Component 3: *Strengthening Institutional Capacity.* This component includes personnel (capacity and skills) and resources capacity (infrastructure and equipment), paying especially attention to wild fire management. The component is limited to the three plantation forests.

2.3 Expected Outputs/Deliverables

Based on the ToR, the information obtained from the desk review and field survey, deliverables submitted or to be submitted include:

a) Inception Report

An inception report outlining in detail the Consultant understanding of the assignment, the approach and methodology to be used to undertake the assignment, tools to be used in data collection including the detailed work plan was submitted on 18 May 2022. This report was presented to the Feasibility Steering Committee for comments and approval on 23 May 2022.

b) A Draft Feasibility Report

After completion of review of documents, field visits, data analysis and summarization, this draft feasibility report was submitted on 12th July 2022 and debriefing meeting with Feasibility Steering Committee was done. This will be followed by a stakeholders' workshop to share the findings. This will provide an opportunity to stakeholders to comment on the draft feasibility study report and the proposed recommendations. Minutes of the workshop and proposed changes of the feasibility study will be prepared and submitted.

c) Project Appraisal Document (PAD)

PAD document was prepared and submitted on 1st June 2022. A revised PAD based on the feasibility study report will be submitted on 5th September 2022. Report outline will follow the standard format of AFD.

d) ESMF (Environmental and Social Management Framework) Report

ESMF report will be prepared and submitted 15 days after Feasibility Workshop. Report outline will follow the World Bank standard format.

e) **Final Feasibility Study Report**

After incorporating the stakeholders' comments on the draft feasibility report, a final feasibility report will be prepared and submitted on 5th September 2022.

3. METHODOLOGY

3.1. Project Sites

3.1.1 Mtibwa forest plantation

Mtibwa forest was gazetted through Government Notice (GN) No. 213 of 1944 while Pagale forest was gazetted through GN No. 81 of 1959 (URT, 2018a). The two reserves form Mtibwa forest plantation which is located in Mvomero District, Morogoro Region, about 95 km from Morogoro town. The plantation lies between Latitude 6^0 - 6^0 10' S and Longitude 37^0 40' - 37^0 - 45' E (Figure 1). The area receives annual average rainfall of 1200 mm. Long rains are from March to May and short rains from November to December. Temperature ranges between 28^0C and 33^0C. Altitude ranges between 300 and 520 m above sea level (m.a.s.l). Topography ranges from flat to gentle slopes. Soils are mainly alluvial, fertile and deep; rich in Calcium with pH of 5 to 8.

The forest plantation is surrounded by six villages: Dihinda, Lusanga, Kunke, Madizini, Mulumbilo, Kaole and Kidukwe. Three of these villages surround Pagale range (Mulumbilo, Dihinda and Kaole). The villages get temporary employment, firewood from thinnings, beehives which are placed in the forest, and through Corporate Social Responsibility (CSR), TFS has supported school desks, buildings and road maintenance.

Natural vegetation is mainly Miombo woodlands. The main tree species is *Brachystegia sp* with dense undergrowth grass. Other species *Acacia*, *Khaya anthotheca, Albizia gummifera, Combretum schumannii, Isoberlinia globiflora, Pterocarpus angolensis, Milicia excelsa*and *Burkea Africana*.

Large scale planting of Teak started in 1961 after trials in 1936 and 1950s. Mtibwa forest plantation occupies a total area of about 16,109.19 ha. For effective management, the area is divided into three Ranges namely, Mtibwa (894.93 ha), Lusunguru (2,264.26 ha) and Pagale (12,950 ha) (URT, 2018a). Mtibwa and Lusunguru mainly replant clearfelled areas, with plantable areas of 847.44 ha and 1,412.26 ha respectively. Pagale range has a plantable area of about 6,400 ha (555 ha planted) and other areas are for beekeeping (2000 ha), Botanic Garden (200 ha) and catchment area (4,350 ha) (URT, 2018a).

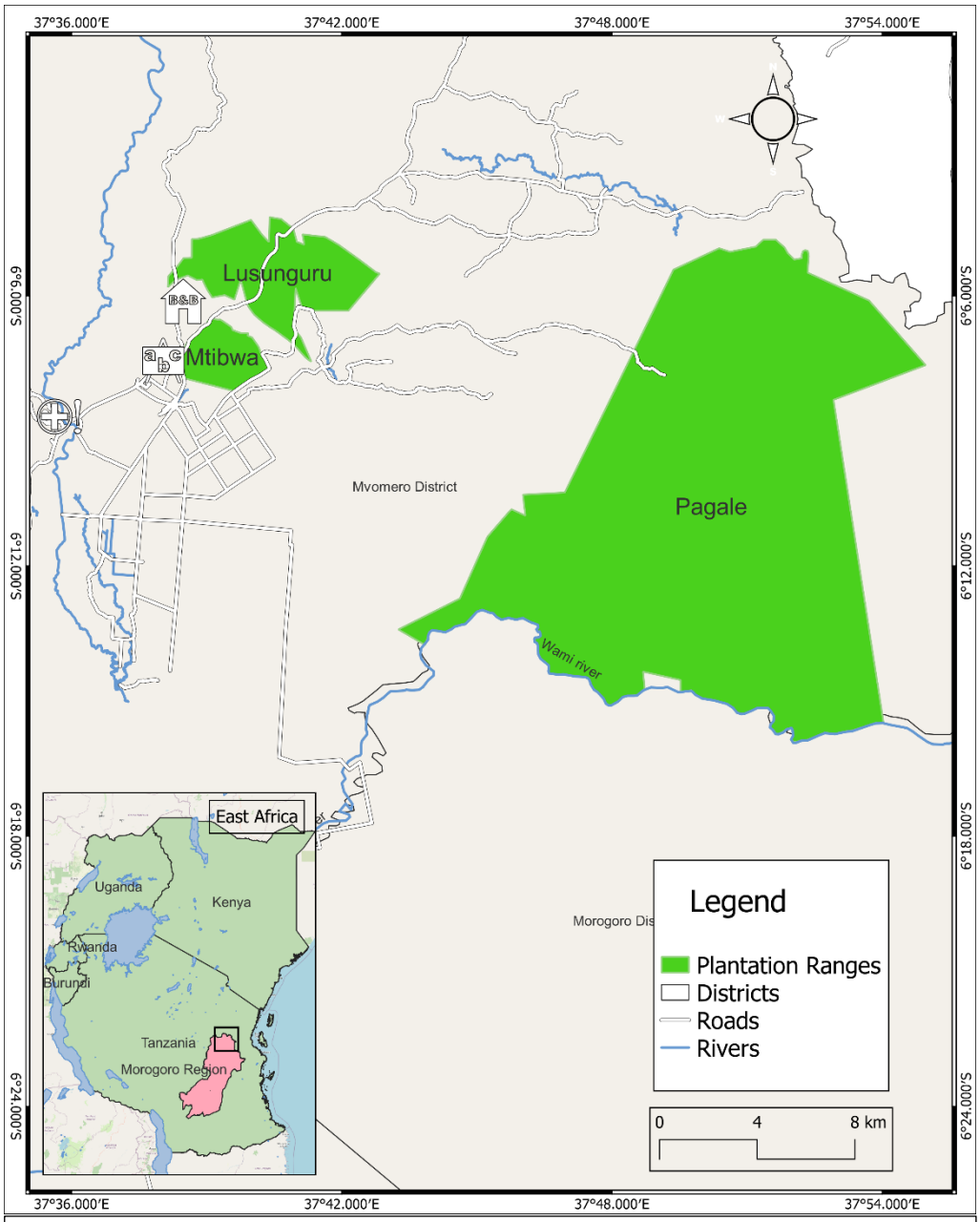


Figure 1: Map showing location of Mtibwa forest plantation

3.1.2 Silayo forest plantation

Silayo forest plantation is in Biharamulo-Kahama forest reserve which was gazetted through Government Notice (GN) No. 292 of 1954 (URT, 2018b). The forest reserve has a total area of 134,680 ha and a boundary distance of 254 km (URT, 2018b). It is located in two regions of Geita and Kagera in Chato, Bukombe and Biharamulo districts. The reserve is the major source of water to 15 rivers that drain to Lakes Victoria and Tanganyika. The forest reserve has rich biodiversity especially in the river valleys and the remaining natural forest. The natural vegetation Miombo with species *Brachystegia* spp., *Julbernadia* spp., *Pterocarpus* spp., *Sclerocarya* spp. and *Tamarindus* spp. Large part of

the forest reserve has become degraded due to anthropogenic disturbances. In late 2016's, it was decided that the highly degraded part of the reserve to be converted to a forest plantation.

The forest plantation is in Chato District. The production area is 43,181 ha and conservation area is 26,694 ha. The plantation is divided into 7 ranges namely Butengo/Rumasa, Bwanga/Kalembera, Nyakayondwa Mchangani, Matabe, Nyantimba/Nyarutefye and Sugwabageni. The plantation is located between Latitude 3^0 0'00" to 3^0 15'0" S and Longitude 31° 3'0" to 32° 0'0" E (Figure 2). The area has two rainfall peaks; the long rains begin in April whereas short rains start in December. The average rainfall is 850 mm per annum. The area has a moderate temperature of between 26.6°C to 30.5°C. The altitude ranges from 1,135 to 1,410 m.a.s.l. Most of the land surface is hilly and moderately undulating with flat bottomed and seasonally inundated valleys. Gentle, V-shaped slopes dominate the landscape. The dominant soil units of the slopes are strong brown to red yellow loamy sands with an underline laterite horizon. The soils are weak in structure but they are fertile.

The plantation is surrounded by 35 villages, and the local population benefit from the plantation in terms of temporary employment, firewood, beehives, tree seedlings and cultivation of food crops in areas not yet planted or use of Taungya in planted areas. There is also illegal grazing of livestock in the natural forest and sporadically illegal cutting of trees for poles, logs and firewood.

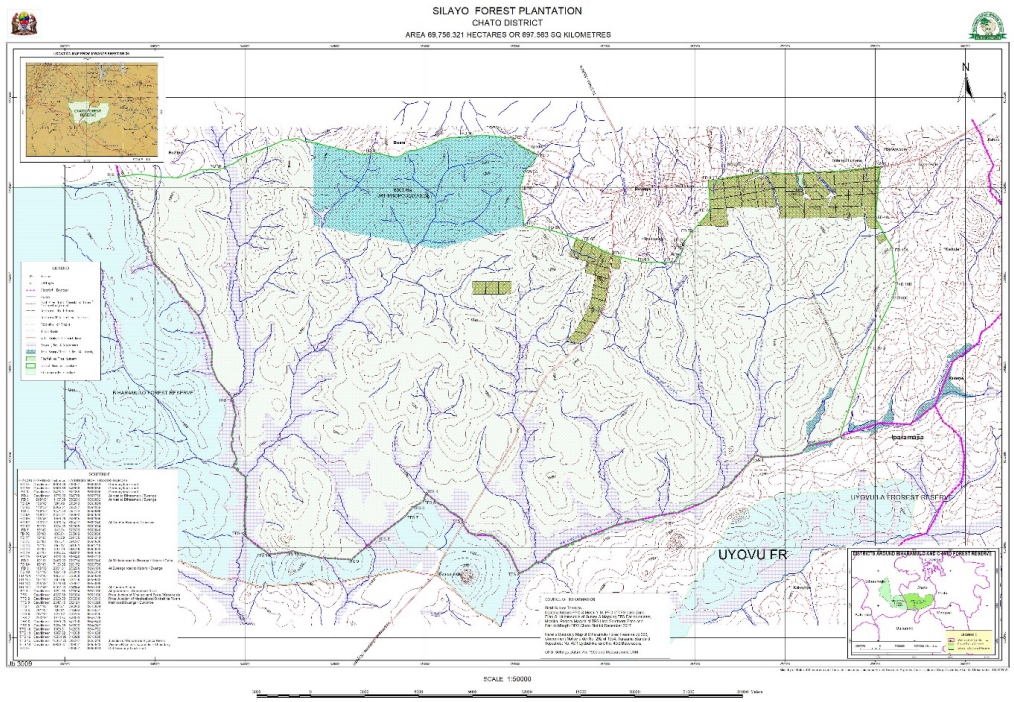


Figure 2: Map showing location of Silayo forest plantation

3.1.3 Wino forest plantation

Wino forest plantation is located in Songea district in Ruvuma Region about 135 km from Songea Municipal. The plantation has 3 Divisions. The Wino Division was gazetted as forest reserve through a Government Notice No. 109 of 1989 under Songea District Council and in 1990, the reserve was handed over to the Central Government (URT, 2018c). The land for Ifinga and Mkongotema Divisions were acquired in 2014 from Ifinga and Mkongotema villages respectively (URT, 2018c). The total expansion area is for all Divisions is 24,319.44 ha (already planted 3,690.69 ha) and conservation area is 13,140.00 ha. Wino Division lies between Latitude 09º45'30" S and Longitude 39º17'00" E while Ifinga and Mkongotema Divisions lie between Eastings 769903 and 804693 and Northings 8918220 and 8932059 (Figure 3). The area experiences long rains between December to May and dry period between May and November. The total annual rainfall ranges from 800 to 1200 mm per year. Mean temperature ranges from 13°C to 30°C. Soils are deep, reddish brown, fine textured, and moderately fertile with pH 6.0-6.5. The altitude of the area ranges from 1029 to 1337 m.a.s.l. The area is slightly hilly with both gentle and steep slopes.

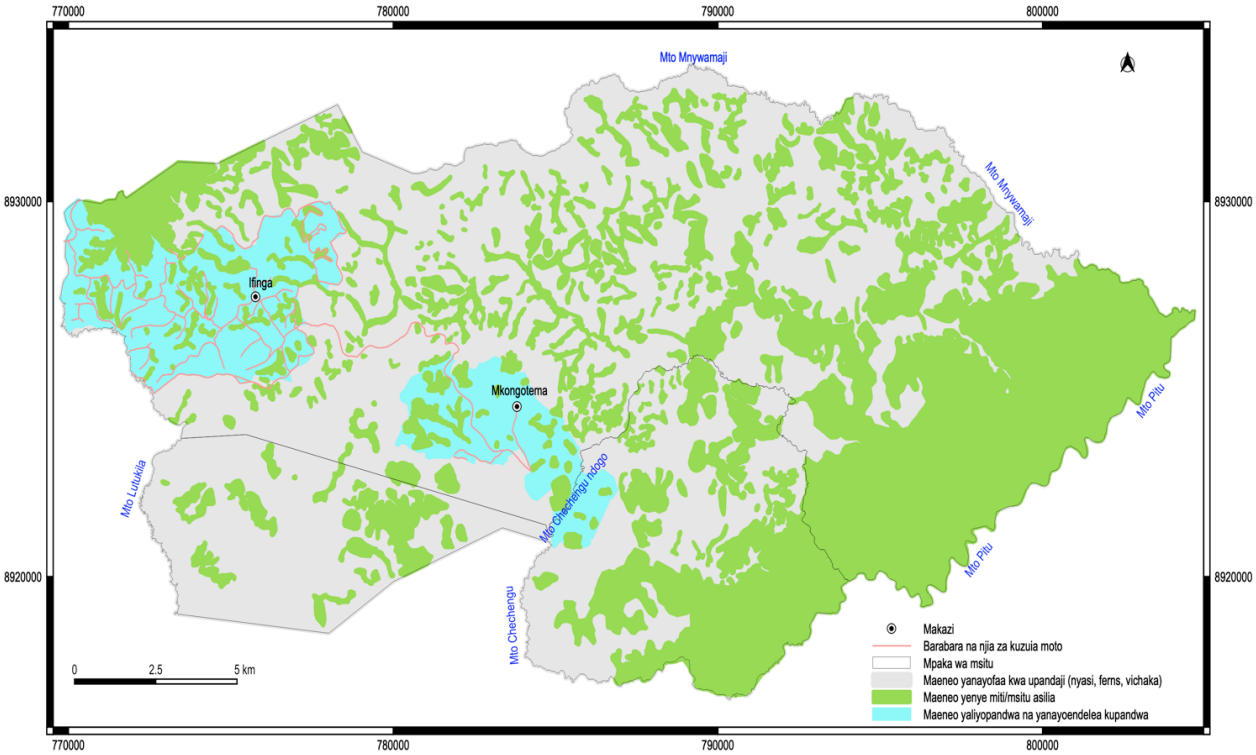


Figure 3: Map showing location of Wino forest plantation

Natural vegetation consists of isolated patches of Miombo woodlands consisting of *Albizia* spp, *Parinari curatellifolia, Catha edulis, Syzygium guineense, Vitex* spp., *Combretum* spp., *Brachystegia spiciformis, Uapaca kirkiana* and *Strychnous innocua*. Ground vegetation consists of *Aframomum angustifolium* (ferns), *Hyparrhenia* spp and *Loudentia* spp. There is moderate wildlife biodiversity consisting of few bird, reptile and mammal species.

Wino Division is surrounded by three villages Wino, Lilondo and Igasiwenga while Ifinga village is the only village close to Ifinga Division. Mkongotema Division is surrounded by four villages: Mkongotema, Magingo, Rutukila and Nderenyuma. Local communities get temporary employment and firewood from thinnings. Through CSR, Ifinga village was supported with water supply. Other CSR support includes beehives, tree seedlings, building materials to support development activities and road maintenance.

3.1.4 Kilwa mangrove forest reserve

The Kilwa mangrove forest reserve was gazetted under GN No. 21 of 1930. The Reserve is in the block 8 out of ten mangrove blocks in the country. The reserve is in Kilwa District, Coast Region. The total area of the reserve is 23,160.98 ha (URT 2019a). The reserve boundary stretches from Marendego village in the north to Mbwemkuru river in the south, In the east is the Indian Ocean and to the west, the boundary is the high tide mark of the sea. The reserve lies at Coordinates 8950825 to 9085883 S and 555699 to 538466 E (Figure 4). The reserve is bordered by thirty one villages. Rain falls from November/December to April/May, and it ranges from 800 mm to 1,400 mm, with an average of 912 mm. Kilwa is hot and humid with temperature between 22°C and 30°C with average annual temperature of 27.1°C. Altitude ranges from 0 to 885 m.a.s.l. Topography is undulating. Soils range from brownish-grey alluvials, sandy and moderately loamy, with fairly good drainage.

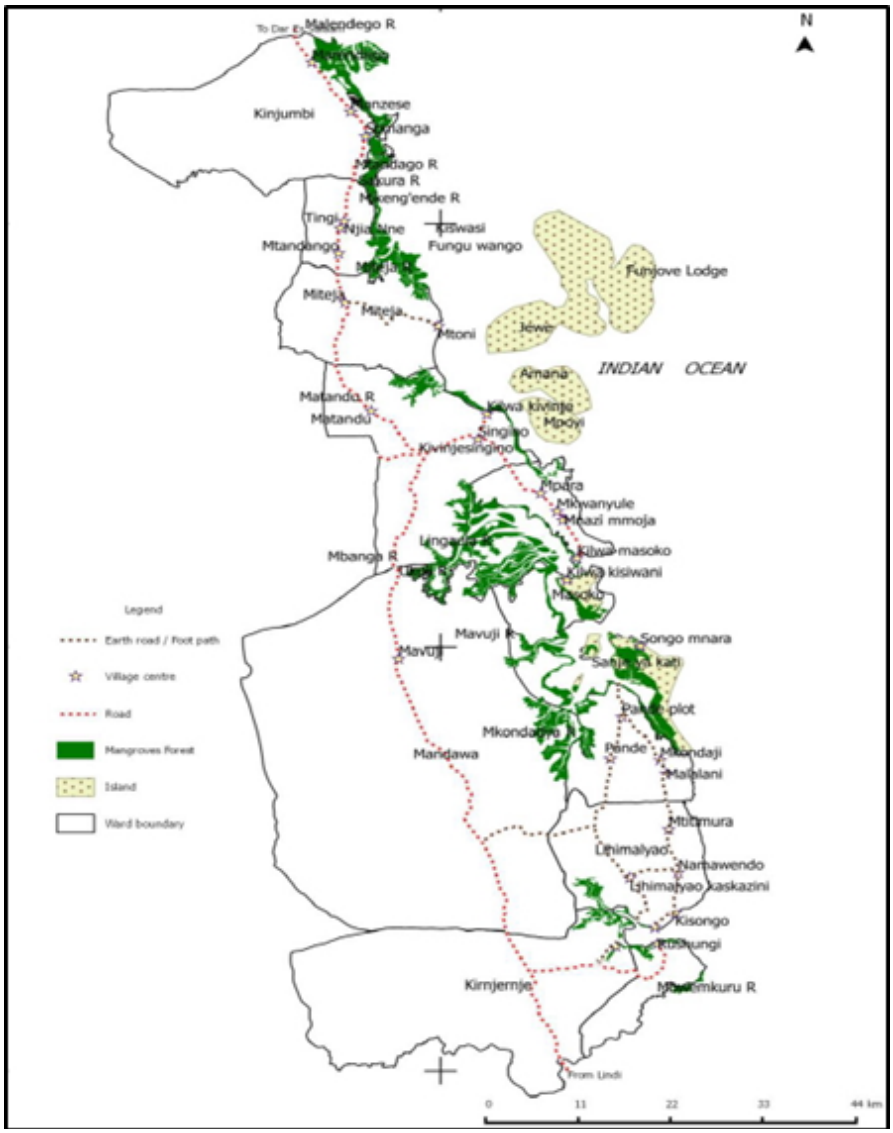


Figure 4: Map showing location of Kilwa mangroves forest reserve

The reserve was established for coastal protection, conservation of biological diversity, provision of habitat, breeding grounds and nutrients for a variety of fish and shellfish as well as production of wood and non-wood forest products for local and national use. One of the distinctive features of this area is a fringing reef system that runs parallel to the mangrove coastline. The forest is dominated by *Rhizophora mucronata*, *Ceriops tagal, sonneratia alba, Avicennia marina, Brugiera gymnorrhiza and Xylocarpus gratum* (URT 2019a). Non-mangrove tree species at the tidal end include: *Sideroxylon inerme*, *Thespecia populnea* and *Guettarda speciosa* (URT 2019a). The mangrove forests provide ecosystem for many types of birds, butterflies and moths, snail mollusc, crabs, prawn and fishes. Various types of mammals reside permanently or temporarily in mangroves forest as well as in rivers pouring waters in the ocean; these include monkeys and fresh water animals like hippo and crocodiles (URT 2019a). Kilwa has attractive beaches along the coastline and historical sites.

3.1.5 Rufiji Delta mangrove forest reserve

The Rufiji Delta mangrove forest reserve is located in Kibiti and Rufiji Districts of Coast Region. It lies between Latitudes 7°50′ and 8°03′ S and Longitudes 39°15′ and 32°17′ E (Figure 5). The mangrove forest was declared a reserve in 1928 and was gazetted under GN No. 30. The reserve covers an area of 53,255 ha and has the largest concentration of mangroves in Tanzania. Out of this, 30,000 ha are for production and 23,255 ha are for protection (URT 2019b). The eastern boundary of the reserve is the Indian Ocean while the western boundary is the high tide mark and the southern boundary is the geographical boundary between Kibiti and Kilwa districts. The northern boundary is the geographical boundary between Kibiti and Mkuranga districts. The Rufiji Delta has a total of 19 villages, nearly half of these are within the Delta and the other half are outside the Delta. About 49,000 people live in the villages in and around the delta, dependent on mangroves and associated resources exploitation such as fisheries and agriculture mainly rice farming for livelihoods (URT 2019b).

Rufiji delta receives two rainy seasons; short rains (October to December) and long rains (March to May) averaging 1200 mm per year. Temperature ranges between 24^{o}C and 31^{o}C. Altitude ranges from 0 to 500 m.a.s.l. Topography is undulating. Soils in the Delta are clay, silt and sand. Clay soil dominates with approximately 50%, followed by silt and sand.

The reserve has the highest mangrove species diversity of any site in the western Indian Ocean. It has eight mangrove species namely: *Ceriops tagal, Rhizophora mucronata, Avicenia marina, Lumnitzera racemosa, Xylocarpus granatum, Bruguiera gymnorrhiza, Soneratia alba* and *Heritiera litoralis* (URT 2019b). In addition, the Delta has diverse number of woody and non woody plants as well as various kinds of fish and crustaceans. Further, there are mammals, numerous species of birds, reptiles, amphibians, flying and non-flying insects. Some of the mammals and are plants are endangered. The entire Rufiji Delta is under Rufiji, Mafia and Kilwa Ramsar Site management since 2004. This is the first Marine Ramsar Site in East Africa.

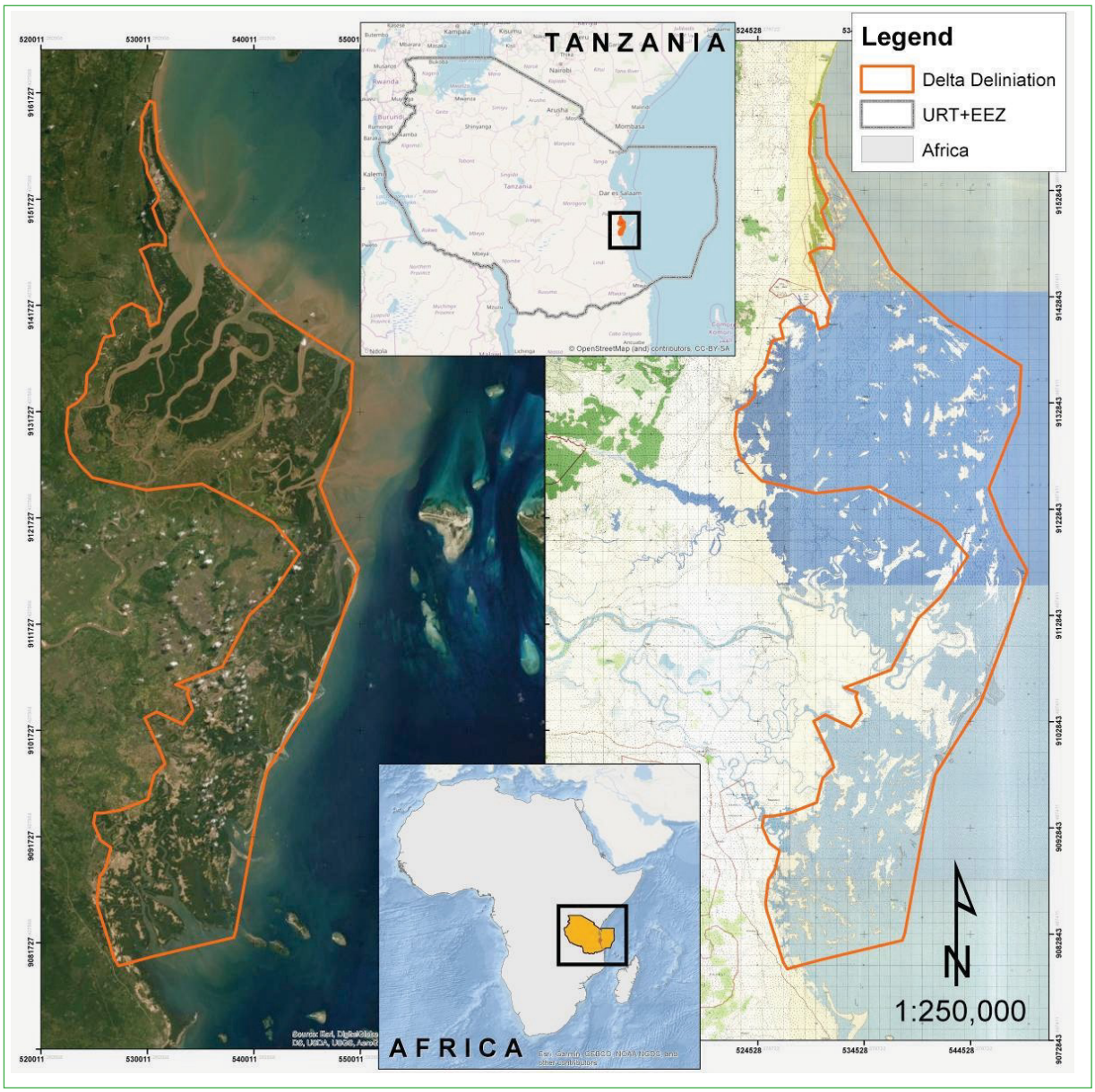


Figure 5: Map showing location of Rufiji Delta mangroves forest reserve

3.2 The Approach

Given the fact that forest plantations for investment have been chosen and the need for capacity building, the starting point was desk review and collating of available information. Among the key documents that were reviewed are the TFS concept note and business plan. This was necessary in order to get a clear picture of the available data, strengths, weaknesses, challenges and opportunities, and identify areas of emphasis during field work and additional data to be collected. Field work was conducted in the sites targeted to collect data and relevant information.

The collected data and information was analysed to produce this feasibility study report which includes the assessment of the technical and financial feasibility of the Project in the selected three forest plantation sites (C1) and the assessment of the capacity of the

TFS to implement the Project in these three sites (C3) and a prefeasibility report for the mangroves (C3).

3.3 Methodology

The methodology used included literature review and field visits for interviews with stakeholders. There were three field missions (forest plantations, tree seed centres and capacity building; mangroves; and project risks). Appendix 1 shows the itinerary and Appendix 2 shows the stakeholders met during field visits. Collected data was analysed using standard procedures.

3.3.1 Plantation establishment and management

The three plantations were visited where questionnaire (Appendix 3) was used to collect data on seeds used in plantation establishment and their levels of improvement; tree species planted and their productivity, techniques used to raise seedlings; site preparation techniques; weeding techniques; extent of undertaking proper pruning and thinning; insect pests, pathogens and invasive species attacking plantations; and extent of fire damage to plantations and challenges faced. A socio-economic analysis was also carried out, in particular to understand the communities' livelihoods and encroachment factors (Appendix 4). The checklist used to interview TFS Technical Committee members at the Headquarters (HQ) is shown in Appendix 5. The checklist used to interview other stakeholders (Policy makers, Non-governmental Organisations (NGOs), Trusts, Training and Research institutions) is shown in Appendix 6.

3.3.2 Strengthening Tree Seed Collection Centres and tree breeding technology

Interviews were held with staff of the Seed Production Station and the Directorate of Tree Seed Production on the planned activities, targets and costs as indicated in the TFS concept note and business plan. The checklist used for interview is shown in Appendix 7. Information was also collected from Plantation Conservators on tree seed availability and quality.

3.3.3 Plantation economic and financial analysis

Data collection for economic and financial analysis of the three forest plantations included expected/projected area to be planted each year, species and rotation ages based on the directives. The costs for all establishment and tending activities were captured. Such costs included seedlings production and transportation, survey and land preparation, pitting and planting, beating up, weeding, pruning, thinning and forest protection. The revenues projection for the project were derived based on products to be harvested. Volume to be harvested and prices of the products were captured. Other potential products/benefits of the plantations to increase revenues were explored for example non timber forest products, e.g. gums and resins, honey and bees products and forest Carbon. Appendix 8 shows the questionnaire used for data collection. Interviews were also held with forest products traders and processors (Checklist for interview is shown in Appendix 9).

Once the costs and benefit streams were established, economic viability of the entire project was determined based on Internal Rate of Return (IRR) or Net Present Value (NPV). Expected budget for the entire project spread over the five years, and projected cash flow were calculated and presented. The current TFS business model for the three forest plantations were evaluated with the view to identify potential areas for improvement to realize more benefits.

3.3.4 Enhancing coastal ecosystem and their biodiversity

Data collection for the pre-feasibility study included:

a) **Literature review of marine/coastal policies, existing studies and management plans**

This literature review provided an analysis of the governance arrangements for Tanzanian coastal marine ecosystems with a particular focus on mangrove forests in their various forms of protection and utilization. Appendix 10 includes a list of policies and legislative instruments and existing studies that were reviewed. The current management plans and other relevant plans addressing the two mangrove forests were reviewed and their contents in respect of biodiversity conservation, livelihoods and private sector involvement assessed in alignment with the respective ecological, socioeconomic and governance baseline studies conducted as a prerequisite for the development of the plans.

Based on the current management plans (2019-2023), Component 2 was designed to assess the possible establishment of better practices for sustainable harvesting plan, assess alternative livelihoods activities such as beekeeping and existing or planned ecotourism activities. Data was also collected on ecosystems pressures or biodiversity hotspots within each reserve to better assess opportunities and risks.

b) **Mapping of stakeholders and interventions**

A thorough literature review of key and relevant documents (Appendix 10) and consultations with key stakeholders (Checklist in Appendix 11) was done to facilitate the identification of programmes/projects implemented in the area regarding biodiversity, ecotourism in marine ecosystems and community development. The consultations also assessed the status of planned and implemented investments by different stakeholders in the areas. Also, power, influence and interest of the identified stakeholders were assessed against the objectives of the biodiversity and ecotourism development programme in the area.

c) **Mapping of ecosystem pressures and vulnerabilities**

Inputs from risks analysis were used for the identification of ecosystem pressures and vulnerability.

d) **Assessment of opportunities for ecotourism potential and economic activities**

TFS has put in place an Ecotourism Act and identified different sites with ecotourism potentials. Based on these and interview findings, an evaluation of

ecotourism potentials and other economic activities was done. This included elaboration of involvement of communities in the management of mangroves, enhancement of the conservation status, and proposal of economic activities based on ecosystem services provided by the mangroves. The outcomes of the pre-feasibility study included identification of activities and corresponding costs required to improve conservation, management and socio-welfare of communities. Moreover, the assessment of the capacity of TFS to manage the two mangrove forest reserves in term of infrastructure, skills and working facilities was done.

e) Carbon storage capacity

Carbon Emissions are estimated as a product of Activity Data and Emission Factors. In forest projects, this entail data on areas (activity data) and forest stocks (Emission Factors). When determining the Emission factors, five Carbon pools are considered. These are aboveground biomass (AGB), belowground biomass (BGB), dead wood, litter, and soil Carbon. However for mangrove ecosystems, the non-tree vegetation and litter are usually minor ecosystem components and can often be excluded from measurements without compromising the accuracy of the sample (Kauffman and Donato, 2012).

Forest stocking data was taken from the most recent literature including forest management plans. Rufiji Delta forest reserve was recently inventoried by Japhet (2021) and the results adopted by TFS in the preparation of the forest management plan for the period 2120/22 – 2025/26. Data was collected from a total of 39, 27 and 24 sample plots laid down in the Northern, Southern and Central zones of the forest respectively (Figure 6). Nested plots of 7 m or 12 m were established depending on the size of the trees. When the trees in the plot have a diameter at breast height (Dbh) of <45 cm, a plot of 7 m radius was used and when the trees have Dbh >45 cm, a plot of 12 m radius was used. In both cases, all trees of Dbh >= 5 cm alive or standing dead were measured. Small trees of Dbh 0.5 to 4.9 cm were measured in 2 m radius subplots established from the centre of the main plots.

The most recent inventory for the Kilwa mangroves forest reserve was undertaken during the preparation of the current management plan for the period 2020/21 – 2024/25. A total of 1,184 plots of 10 m radius were systematically laid out in L-shaped clusters of 8 plots each. The L-shaped clusters design was adopted from the NAFORMA as shown in Figure 7. The cluster and plots positions were pre-determined using the QGIS programme. Table 1 shows AGB and BGB from studies done in mangrove forest reserves in Tanzania and other African countries.

Figure 6: Plots layout in Rufiji Delta mangrove forest reserve (Source: Japhet, 2021)

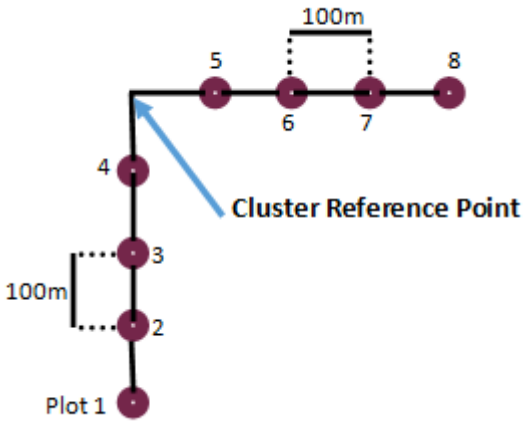


Figure 7: Cluster design

Table 1: Mangrove above and below ground biomass estimates

Author	Location	AGB tons per ha (tha^{-1})	BGB tha^{-1}
URT, 2019a	Kilwa	119	121
Japhet 2021	Rufiji	120.68	99.8
Other studies			
	Pangani	103.1	72.7
	Bagamoyo	53.4	57.5
	Rufiji	127.3	81.9
Masota et al. 2016	Lindi and Mtwara	69.0	60.3
Lupembe and Munishi 2019	Rufiji	82.86	42.98
Trettin et al. 2015	Zambezi Delta	110.7 - 482.6	
Sitoe et al. 2014	Sofala Bay, Mozambique	10.7 to 464	
Jones et al. 2014	Madagascar	146.8	

However, the two inventories considered only the AGB and BGB estimates. While the dead wood may be neglected in the estimates of this study, Soil Carbon is a significant pool in the mangroves and must be included. A study by Lupembe and Munishi (2019) estimated 98.57 tha^{-1} of Soil Organic Carbon (SOC) in the Rufiji Delta which falls within the range of 71.8 to 154.8 t C ha^{-1} reported by Matsu et al. (2012). Therefore, in this study Emission Factors to be applied are shown in Table 2.

Table 2: Emission factors used in the study

Forest Reserve	AGB tha^{-1}	BGB tha^{-1}	AGC tha^{-1}	BGC tha^{-1}	SOC tha^{-1}	Total tha^{-1}	t CO^2 eq
Rufiji Delta Forest Reserve	120.68	99.8	59.1	48.9	98.6	206.6	716.9
Kilwa Mangrove Forest Reserve	119	121	58.3	59.3	98.6	216.2	750.1

3.3.5 Strengthening institutional capacity

This Component concerns the assessment of the capacity of TFS to implement the proposed project in the three plantation sites in terms of infrastructure, skills and working facilities. In addition, this component will also strengthen wildfire management skills and practices, and support TFS in developing its capacities to be able to manage its transition for the Authority status.

The Client was interviewed using questionnaire in Appendix 12 on the following:

a) Current and required human resource capacity and skills; and
b) Current levels and conditions of infrastructure and technology and required levels. The infrastructure includes buildings (residential houses, offices, ranger posts and other buildings); machinery (motorcycles, vehicles and heavy machinery); and fire-fighting equipment and infrastructure (vehicles, trucks, fire towers, dams and other equipment).

Field verification of infrastructure, machinery and equipment was undertaken as well as levels of skills based on observations on silvicultural and other practices.

3.3.6 Project risk assessment

Project risks

Data was collected on the following risks as detailed in the ToR:

a) Country and institutional legal risks e.g. Policies change, governance, macro-economic context, stakeholders involvement and community representativeness;
b) Technical risks e.g: wildfire, insects pests and pathogens;
c) Environmental and social risks e.g. Socio-economic impacts (gender inclusion, livelihood pressure, human wildlife conflict, illegal activities); and environmental and natural resource impacts (land-slides, floods, winds, thunderstorms and climate change); governance; and gender; and
d) Climate co-benefit risk e.g. Resilience/adaptation/and mitigation to climate change.

The objective of the environmental and social risk assessment study is to meet AFD's requirements during the project and programme cycles that it finances, particularly during the examination and assessment phases. The Environmental and Social Performance Standards (PS) used were those of the World Bank/International Finance Corporation, which AFD recognizes in this area.

The achievement of this component is based on information gathering, consultation with stakeholders (Appendix 13**: Checklists for environmental, social, and gender aspects** A) and data analysis with reference to international standards. The analysis identified a series of mitigation and monitoring measures as well as institutional arrangements to be taken during project implementation to eliminate negative environmental and social risks and effects; compensate for them or reduce them to acceptable levels. Responses to environmental risks respected the hierarchy defined by the “Avoid, Reduce, Mitigate and Compensate” methodology:

a) **Avoid**: For actions with multiple options, the choice was oriented towards the option that most respects the environment (natural and social) in order to avoid risks and negative impacts;
b) **Reduce**: When the impact is unavoidable, measures are taken to reduce the risks and negative impacts to an acceptable value;
c) **Mitigate**: Once the risks and impacts have been minimized, they are mitigated; and
d) **Compensate**: When the residual impacts are significant, offset or neutralize them insofar as this is technically and financially feasible.

Social aspects covered both the population concerned and affected by the project. As mentioned in the ToR, no population displacement is expected. Attention was paid to vulnerable groups such as women and other disadvantaged groups. The affected population also included natural or legal persons, even migrants: whose land uses and

economic activities were impacted; whose cultural heritage, customs and traditions were affected; and likely to be affected positively by certain programme benefits and negatively by environmental and social impacts.

Gender analysis

Data collection for gender analysis used different approaches in collecting gender disaggregated data in sampled villages around the study sites. These included desk review of relevant reports and other documents (Appendix 10), consultation with key stakeholders involved in the plantation and mangrove forests management (Appendix 13**:**

Checklists for environmental, social, and gender aspects

3B). The gender analysis was conducted using the Harvard Analytical Framework which is important in mapping gender by analysing the different interdependent roles of men and women, their rights and opportunities, power relations in decision making, participation and benefit sharing as well as access to and control over resources (i.e. land, labour, capital, social networks). The analysis identified whether gender disparities exist and extent of detriment in order to suggest remedial actions. This framework was adopted to suit the nature of the feasibility study as guided by USAID (2010) and UNDP (2001). Further, participatory approach was used to identify potential gender-related risks to achieving targets of the proposed Project, identify strengths and capacity gaps of different stakeholders and groups to participate in and to benefit from the Project.

Project climate Vulnerability and co benefits

Analysis regarding mitigation of and adaptation to climate change were carried out for Component 1 (upscaling forest plantations) but not for Component 2 (sustainable management of forest mangroves), as Component 2 is subject to a prefeasibility study and as precise activities are yet to be defined.

In terms of mitigation of climate change, the Carbon balance for Component 1 was estimated taking into account the technical specifications detailed in the three forest plantations management plans, for Mtibwa (URT, 2018a), Silayo (URT, 2018b) and Wino (URT, 2018c); the latest version (V9.3.3) of the FAO Ex-Act Tool (https://www.fao.org/in-action/epic/ex-act-tool/suite-of-tools/download/en/) and the corresponding guidelines (FAO, 2022); and the most up-to-date country-specific data and formula for estimating biomass and Carbon stocks and fluxes (Malimbwi et al., 2016).

In terms of adaptation to climate change, the definition of vulnerability and the vulnerability assessment methodology set by the IPCC were used (IPCC, 2007), and further refined in the context of vulnerability assessment of rural activities in Sub-Saharan Africa (GIZ and Climate Analytics, 2019; SalvaTerra, 2021). Among the various databases to describe current and future climate [to name only the most famous: Climate Information Portal (CIP) from the University of Cape Town (https://cip.csag.uct.ac.za/webclient2/app/#datasets); Climate Change Knowledge Portal (CCKP) from the World Bank (https://climateknowledgeportal.worldbank.org); Climate database from the Swedish Meteorological and Hydrological Institute (SMHI)(https://climateinformation.org/dap), the SMHI database was used for the following reasons:

a) It presents data from 35 global climate models from the Coupled Model Intercomparison Project Phase 5 (CMIP5). These datasets can be combined together, providing more robust projections than if they were derived from a single model;
b) The data is also available with bias correction and at a fairly fine scale (50 km x 50 km data grid. This format is called Coordinated Regional Climate Downscaling Experiment (CORDEX). These two treatments make it possible to obtain more robust projections (limitation of systematic errors on the means and better representation of extreme values); and
c) Its database is relatively easy to use compared to other sites, and allows data to be exported in the form of data tables, images or maps.

4. SITUATION ANALYSIS

4.1 Forest Plantations

4.1.1 TFS SWOC-AR analysis

The strengths, weaknesses, opportunities, challenges, aspirations and results (SWOC-AR) of TFS are shown in Table 3. Some of the plantation challenges are expected to be addressed if the proposed activities in this feasibility study are implemented.

Table 3: SWOC-AR analysis of TFS

Strengths	Weaknesses	Opportunities	Challenges	Aspirations	Results
• Political and economic stability and strong political support. • Supportive Forest policy, legislations. • Qualified and committed TFS Administration. • Existence of conservation Force/Paramilitary force. • Increasing demand for industrial timber and other wood products. • Availability of lands with suitable conditions for plantation. development. • Availability of labour. • Availability of skill mix in the market. • TFS own financial resource base to fund its operations. • Competence in silvicultural management of plantations. • Presence of forest research and training institutions. • Geographical location of the country which support market and trade of forest products. • Existence of two breeding population and two tree seed orchards.	• Inadequate recruitment of staff compared to requirement. • Lack of sustainable financing framework for plantation development. • Lack of investment in forest research and development. • Gaps in key forest data (i.e. growth rates of key plantation spp. • Limited supply of quality tree seed and other propagating materials. • Inadequate diversification, value addition of forest products. • Inadequate funding. • Inadequate plantation infrastructure. • Inadequate management knowledge for key indigenous species. • Low productivity of existing plantations. • Lack of genetically improved planting material within the country. • Lengthy land acquisition processes.	• Availability of partners willing to support forest research programmes. • Availability of land for forest expansion. • Presence of support from Development Partners and multilateral organisations. • Investors interest on tree planting. • Increased awareness on importance of forests among communities. • Good weather conditions support tree growing. • Broad range of species which can be planted (soft and hardwood). • Availability of markets for forest products. • Carbon market and payment for environmental services. • Availability of genetically improved planting material in other countries.	• Climate change (i.e. unpredictable weather-prolonged droughts etc). • Destruction of forest plantations by wildfires. • Insect pests and pathogens. • Invasion of invasive species. • Poor market development and linkages to markets.	• Highly quality, productive and diversified forest plantations. • Sizeable forest plantation area. • Ability of TFS plantations to meet raw material demand. • Availability of genetically improved germplasm planting materials within the country. • Ability of TFS to attract investments in forestry.	• Increase in productivity per unit area. • Percentage increase in plantation area. • Percentage increase in number species in TFS plantations. • Percentage increase in allowable cut. • Percentage increase in revenue accrued from plantations • Percentage increase in Investments and funding in plantation establishment and management.

4.1.2 Human resources

The current staff strength of the three forest plantations is shown is shown in Table 4. The deficit of all TFS forest plantations staff is 497 staff. This staff deficit has contributed to challenges supervision and monitoring of management activities.

Table 4: Current staff at Mtibwa, Silayo and Wino Forest plantations

Category of staff	Mtibwa	Silayo	Wino
Professional	5	5	2
Technical	14	9	7
Operational/forest guard	30	3	3

4.1.3 Buildings

The TFS owns several infrastructures which were acquired to support institutional capacity to deliver service. Buldings in the three forest plantations are shown in Table 5. Generally, buidlings are inadequate and for Mtibwa, some are old and require refurbishment.

Table 5: Buildings at Mtibwa, Silayo and Wino forest plantations

Category of building	**Mtibwa**	**Silayo**	**Wino**
Office	2	1	1
Residential	12	5	8
Ranger post	-	1	-
Hostel/dormitory	-	-	1
Rest house			1
Total	**14**	**7**	**11**

4.1.4 Motorcycles, vehicles and heavy machinery

Motorcyles and vehicles available at the three forest plantations are shown in Table **6**. Overall, these facilities are inadequate to effectively and efficiently undertake field operations. Mtibwa has one ground tractor and Wino one in bad condition, otherwise all the three plantations do not have heavy machinery for road construction and other uses.

Table 6: Current motorcycles and vehicle at Mtibwa, Silayo and Wino forest plantations

Type of vehicle	**Mtibwa**	**Silayo**	**Wino**
Motorcycles	7	3	4
4 wheel pickup	1	1	3
Land cruiser hardtop	2	1	1
Lorry long base	1	1	-
Lorry tipper	-	-	-
Nissan patrol	-	-	1
Isuzu injection	-	-	1
Total	**11**	**6**	**10**

4.1.5 TFS financial position and projections

Assessment of TFS financial management and performance is an important consideration to reflect on the strength of the Agency. TFS has strengthened its revenue collection

mechanisms through national electronic financial management platforms including Government electronic payment gateway (GePG), electronic fiscal devices, Government accounting system and Tanzania national e-procurement system (TANePS). The initiatives are giving positive results whereby the Agency realized a gradual increase in revenue collection for the past 10 years from TZS 63.75 billion in 2011/12 to 123.82 billion in 2020/21 which was equivalent to an increase of 100%, an average annual income of 99.5 billion. In addition, the projected revenue for the past five years (from 2014/15 to 2018/19) was TZS 427.6 billion while the actual revenue collection was TZS 444.8 billion. In terms of expenditure, it has also gradually grown for the past 10 years from TZS 39.82 billion in 2011/2012 to 99.22 billion in 2020/2021, an average annual expenditure of 66.7. TFS has contributed to Consolidated Fund (CF) at an avegare of TZS 23.6 billion annualy for the past 10 years (2011/12 – 2020/20210).

Notwithstanding such achievements, TFS has been challenged by inadequate finance to invest in its forest plantations. For instance, the required annual average budget by forest plantations in 2017/18; 2018/19 and 2019/20 amounted to TZS42,746,045,862, TZS47,524,480,337 and TZS 48,296,331,850, respectively. However actual allocated budget was TZS 32,250,751,228; TZS 33,973,999,891 and TZS 36,465,865,526 while disbursed funds were TZS 27,372,120,631; TZS 33,969,770,565 and TZS 33,504,348,512 respectively. This calls for additional financing for TFS forest investment expenditure especially if TFS wants to expand its forest plantations.

4.1.6 Forest plantation establishment and management

Tree seed sources and nursery techniques

At Mtibwa forest plantation, Teak seed is mainly obtained from seed stands purchased from the Tree Seed Centres but is generally of high quality as it has been selected from the original introductions from South East Asia in the 1970s. For Wino forest plantation, about 54% of the planted area used genetically improved seed and 46% used seed stand seed. For Silayo forest plantation, seed is purchased from the Tree Seed Centres and is from seed stands. Seed from seed stands results in trees of average quality and productivity. Technical Order No 1 of 2021 directs that all planting of exotic tree species must use genetically improved seed from seed orchards (FBD, 2021).

With regard to nurseries, Mtibwa forest plantation nursery during 2021/2022 produced 372,994 seedlings while the capacity is 500,000 seedlngs. Wino has 3 nurseries, one in each Division, during the period produced 737,193 seedlings while the total capacity each Division nursery is 1 mil seedlings. Silayo has one permanent nursery and two flying nurseries, during 2021/2022 produced about 2 mil seedlings, while the capacity is 4 mil seedlings. All nurseries in the three forest plantations use potted seedlings raised in polythene tubes and potting mixture based on local experimentation. All operations are manually done using casual labourers. There are no serious seedling health issues, except for Teak at Mtibwa being affected by salty water used for irrigation.

Tree species diversification

The main tree species grown in the planted area (2,814.7 ha) of Mtibwa forest plantation include Teak (95%) while the rest of the area is planted with *Cedrela ordorata, Milicia excelsa, Khaya anthotheca* and *Afzelia quanzensis*. For Silayo forest plantation, the total planted area since 2017 is 3,770 ha and *Pinus caribaea* occupies 98% and *P. tecunumanii* 2%. The total area planted at Wino is 5,538 ha and the tree species planted include *Pinus patula* (40.8%)*, P. tecumanii* (23.0%), *P. caribaea* (22.4%), *P. maximinoi* (7.5%) and others (6.3%) namely *P. kesiya, P. oocarpa, Grevillea robusta*, *Eucalyptus grandis, P. elliottii, E. maidenii* and Bamboo. Generally, tree species diversity is low at Mtibwa and Silayo and average at Wino. It is generally acknowledged that tree species diversification may serve as an insurance against insect pests, pathogens and climatic fluctuations. Additionally, this may result in increased market security through species and product diversification. The new Technical Order No 1 of 2021 directs that forest plantations should use a minimum of four tree species, and as much as possible in equal proportions area wise.

TFS in collaboration with the Forestry Development Trust (FDT), have established species/provenance trials of various tree species in Silayo and Wino forest plantations. Also there are seed orchards of *Pinus tecunumanii, P. maximinoi* and *E. saligna* at Ifinga, Wino forest plantation. Promising species will in future increase species diversification in these plantations.

Land preparation and planting

Land preparation in all the three forest plantations is done manually by casual labourers. It involves shrub/tree cutting, slashing and burning. This is low intensity site preparation and may result in low tree survival and early growth. Planting spacing depends on end use, and is based on Technical Order (FBD, 2021).

In Mtibwa forest plantation, new planting is being undertaken in Pagale range since 2018 after eviction of illegal occupants who were undertaking agriculture and livestock keeping thus causing serious deforestation and degradation of the reserve. According to the forest management plan, annual planting target in Pagale range is 500 ha. However, only 250 ha per year have been achieved due to budgetary constraints (URT, 2018a).

Planting in Silayo forest plantation started in 2017. The annual planting target for the plantation is 3,000 ha while the actual area planted per annum is 500 ha mainly due to budget constraints (URT, 2018b).

For Wino forest plantation, planting started in 2008 after some years of species and provenance trials (1968-1989). Forest management plan for the plantation indicates annual planting target of 2,500 ha. However, the forest plantation is operating at an annual average planting target of 400 ha (URT, 2018c). The main reason for not realizing the management plan target is financial limitations.

In all three forest plantations, mosaic planting is done to retain natural forests in areas with high biodiversity, catchment areas, near water courses and steep slopes. The

plantations play significant ecological functions and are sources of permanent and seasonal streams/rivers.

Weeding

In all the three forest plantations, weeding is usually manual using hand tools. It ranges from intensive (clean weeding by Taungya farmers), medium intensity (strip) to low intensity (spot and/or slashing). There are weeding backlogs at Mtibwa forest plantation due to financial constraints. Low intensity weeding and backlogs result in reduced survival and early growth.

Artificial pruning

Pruning is carried out according to Technical Order (FBD, 2021). Pruning is mainly done by pruning saws. There are pruning backlogs at Wino forest plantation due to limited budget.

Thinning

Thinning is carried out according to Technical Order No 1 of 2021 (FBD, 2021). While thinning is an important silvicultural operation, there are thinning backlogs at Mtibwa and Wino forest plantations due to budgetary constraints. Thinning is not yet due at Silayo forest plantation.

Forest fires

Silayo forest plantation has not yet been affected by forest fires. Wino forest plantation lost 605 ha of Pine in 2017 and 1161 ha in 2021. In 2020/21, Mtibwa forest plantation lost 74 ha of Teak, *Gmelina arborea, Pterocarpus angolensis* and *Khaya anthotheca*.

In the field, staff record the fires occurring within their jurisdiction, by estimating the areas burnt and extent of damage and report to the Zone and HQ levels. There is Advanced Information System at TFS HQ that could have provided accurate fire occurrence information and according to the in-charge the system is working. However, staff do not have computers for the purpose, and so are not getting necessary information from the system.

In the National Forest Policy Implementation Strategy 2021 – 2031 (MNRT, 2021b), current damages due to wildfires are not estimated, but they are mentioned as a key driver of deforestation and targets of reduction are set: "*Natural forests/plantations/woodlots areas affected by wildfire incidences reduced by 70% by June, 2031*". Dedicated resources for forest fire monitoring and fighting are planned (NB: spread over 5 budgetary lines), but the total (TZS 44 bil) is much reduced compared to the overall budget of the Strategy (TZS 21,989 bil). This is less than 0.2% of the overall budget.

In the Draft TFS Forest Plantation Development Strategy 2022-2046 (TFS, 2021b), wildfires are again mentioned as a key driver of deforestation and contrary to the National Forest Policy Implementation Strategy – their damages are estimated: "*during the year 2019/2020, information provided by Plantation Conservators showed that a total of 830*

ha were affected by forest fires". This information is based on field measurement of burned areas. Last but not the least, a target in terms of fire-fighting is set ("*Forest area affected by wild fires reduced annually by 50% by June 2046*"), but appears less ambitious than the one set in the National Forest Policy Implementation Strategy. In terms of dedicated budget, again it appears low (TZS 7 bil, i.e., 2% of the overall budget).

In the TFS Business Plan and Associated Budget for 2022/2023 Financial Year (TFS, 2022a), forest fires monitoring and fighting is mentioned in 2 places:

a) Objective C/Target 03 ("*14 million ha of natural forests reserves protected by June 2026*"). Diverse activities are planned to address the deforestation drivers (farming, grazing, pests and diseases, wildfires, etc.), including "*training on fire detection and fire-fighting […] 4,000 patrols in the forest Reserves […] 243 fire awareness meetings in 255 villages*". The total for this target C/03 is TZS 5.98 bil, but costs are shared for addressing all types of drivers, not only forest fires; and
b) Objective G/Target 03 ("*550,000 ha of plantations protected by June 2026*"). Diverse activities are planned regarding forest fires: *"Maintenance of 6,000 km of fire-lines in 20 plantations […] maintenance of 11 fire towers, creation of 2 new fire towers and 6 control centres in Sao Hill […] setting 12 stand-by fire crews (30 people per crew, 350 in total) in 5 plantations […] organising 105 fire campaign meeting in 12 plantations*". The total for this target G/03 is TZS 4.34 bil.

The total cost of activities regarding forest fires amount to TZS 5.98 (at best) + 4.34 = 10.32 bil, i.e., 8.3% of the overall budget for the financial year 2022-2023.

To sum up the above findings:

a) The forest fires situation especially for the natural forests is not well known, due to unutilized centralised and harmonised forest fire monitoring system in Tanzania;
b) The strategy in terms of fire monitoring and fire-fighting is difficult to understand, as the objectives and budget allocations differ from one document to another;
c) Activities in terms of fire monitoring are inadequately described (e.g., patrolling, fire towers, and training on fire detection). The same applies to other activities in terms of fire prevention (e.g., awareness meetings, fire campaign meetings). In terms of fire-fighting (e.g. the Biannual Plan for financial year 2022/23 refers to "*set of fire-fighting equipment*", without details and costs varying from 1,000,000 per unit, to 250,000 per unit, and up to 100,000 per unit); and
d) From the interviews with TFS field staff during the field mission, it appears that basic measures (such as the maintenance of fire-lines) are not always implemented, due to lack of budget. This finding is also outlined in the National Forest Policy Implementation Strategy 2021 – 2031: "*Fire preventive measures such as the placement and management of firebreaks are inadequately implemented in most forests*" (MNRT, 2021b).

Insect pests, pathogens and invasive alien species

With regard to insect pests and pathogens, there are no reported cases in Wino forest plantations. In Silayo, termites affect young seedlings and pesticides are used to control

them. In Mtibwa forest plantation, about 50 ha of *Grevillea robusta* has been destroyed by Termites. Also, *Senna siamea* has invaded a Teak stand at Mtibwa.

For all TFS plantations, about 25% of plantations are affected by insect pests while 9% are affected by pathogens (TFS, 2021b). These infections are not yet severe.

Plantation productivity

Productivity for Teak ranges between 7-15.5 $m^3ha^{-1}ya^{-1}$ while for *Pinus patula*, *P. caribaea*, *P. tecunumanii* and *P. kesiya* in the Southern and Lake zones range between 7-22.8 $m^3ha^{-1}ya^{-1}$ (TFS, 2012b). Productivity is generally low to average due to use of seed stand seed which has low genetic quality compared to that from seed orchards as well as low intensity silvicultural techniques resulting in reduced survival and growth.

4.1.7 Forest roads

Road network at Mtibwa forest plantation is about 75 km while the one in Silayo is 42km. Wino plantation has a road density of about Ifinga range 73 km and Mkongotema ranges of Wino forest plantation have a road density of about 90 km (Wino Division 27 km; Ifinga Division 35 km and Mkongotema Division 28 km). Overall, the road density in all the three forest plantations is low given the areas of these plantations and this increases the costs of ferrying various materials e.g., seedlings and delays reaching the plantation areas in case of forest fires.

4.2 Mangroves

4.2.1 Policy, Legal and Strategy aspects

National Forest Policy of 1998 provides Policy Statements for the management of forest reserves including mangroves. The Policy statements are:

No. (1) is on sustainable supply of forest products and services and environmental conservation;
No. (3) is on participation of stakeholders on forest management and conservation;
No. (11) is on incorporating beekeeping in management plans of forest reserves
No. (12) is on encouragement of private sector and communities in the development of forest based ecotourism;
No. (16) concerns including biodiversity conservation and management in management plans of protected forests;
No. (37) concern promotion of coordination between forest sectors and NGOs in the management of forests;
No. (38) is on ensuring enabling environment and regulatory framework for private sector involvement in forestry; and
No. (39) is on encouraging local communities' participation in forest activities.

Overall, these Policy statements have adequately covered all relevant issues regarding conservation and management of mangrove forests.

The national environmental policy of 2021 has among its policy objectives, one on enhancing conservation of aquatic systems for sustained ecological services and social

economic wellbeing. There are three (3) Policy statements on strengthening cross-sectoral coordination and collaboration; with collaboration with private sector; and strengthening transboundary coordination in the management of shared aquatic ecosystems.

Both forest and environmental policies have implementation strategies (Forest Policy Implementation Strategy 2021; Implementation Strategy for the national Environmental Policy 2021). These strategy documents indicate objectives, strategies and targets on Policy statements. Also, there is National Biodiversity Strategy and Action Plan (NBSAP) of 2015 which is a guiding document to realise and promote sustainable utilisation and conservation of biodiversity.

The Forest Act No. 14 of 2002 considers mangrove area as sensitive area and provides allowed and prohibited activities in forest reserves including mangroves as well as a list offences and penalties for defaulters. There is also GN No. 85 (2020) that provide requirements for concessioners to invest in ecotourism facilities in forest reserves including mangroves. There is a recent GN No. 59 (2022) that provides fees payable in forest reserves for various ecotourism activities.

As pointed out earlier, Tanzania is a signatory of various international agreements and frameworks as detailed in Section 1.5.

4.2.2. Mangrove Management Practices

Mangrove Reserves are managed in four (4) zones with different objectives: total protection on the shoreline and riverbanks (zone 1), sustainable harvesting beyond 60 meters to the shoreline and riverbanks (zone 2), restoration (zone 3), and an investment zone (zone 4). Current management activities are: protecting this unique ecosystem; optimizing uses of mangroves forest resources; involving adjacent communities in forest management; and enhancing Carbon sequestration by mangrove restoration.

Zone one (1) involves total protection of the mangroves (conservation of mangrove ecosystem services) where there are no human interventions. Activities that are allowed in this zone are research, and ecotourism with no extractive uses except fish farming, beekeeping, and research and education.

Zone two (2) is intended to permit controlled harvesting of poles, timber, and firewood sustainably in ecologically stable areas.

Zone three (3) includes degraded areas that are open, or with medium density which are sustainable for harvesting. The recovery is being attained through natural regeneration by restricting access or by human intervention through enrichment planting. The management of planted trees is either sole mangroves or *Taungya* system where communities are allowed to cultivate food crops before crown closure. However, the survival of planted trees has been very low (hardly 37%) due to poor tending or inadequate supervision of the *Taungya* farmers. In addition, only a few tree species have been used for restoration due to inadequate knowledge of the germination characteristics

of some of the mangrove species. Furthermore, climber species (*Derris trifoliata*) which is aggressive and covers mangrove trees' crowns should be managed to allow adequate natural regeneration and growth of planted trees.

Zone four (4) is set for ecotourism development. The zone includes areas with cultural values, beautiful sceneries, and visitor facilities.

Challenges facing mangrove forest management are detailed in Section 1.3.

4.2.3 Stakeholders, and past and ongoing interventions

There are several stakeholders involved in various activities related to mangrove management. These include government institutions and Civil Society Organizations. The stakeholders and their main activities are shown in Table 7.

Table 7: Stakeholders and their past and ongoing interventions

S/N	Stakeholder	Past and ongoing interventions
1.	MNRT/TFS	Overall, in charge of mangrove management Between 1994 – 2005 mangroves planting of 840 ha with support from NORAD through the Mangrove Management project for Rufiji Delta. Between 2006 and 2011, Marine and coastal management project funded by GEF supported the planting of 112 ha of mangroves
2.	Vice President's Office/Kibiti District Council.	Between 2015 and 2019, planted 792 ha of mangrove in Rufiji Delta
3.	District Councils	Provide a link between Village Natural Resources Committee (VNRC) and other stakeholders on joint forest management.
4.	DIDEM	The project, Dialogue Science-Decision Makers for integrated management of coastal and marine environment (DIDEM) is implemented between 2021-2023 with the aim of extracting lessons learned from research to develop dialogue on decision making in Rufiji Delta. The project is co-funded by the FFEM (French Fund for the Global Environment), the IRD, the International Development Research Centre (IDRC), the Société des Explorations de Monaco, the UNEP and UNDP
5.	Strengthening Marine Protected Areas Management in Rufiji, Mafia and Kilwa District in Tanzania	The project aims to improve the effectiveness of the management in Marine Protected Areas and associated buffer zones within the Rufiji-Mafia-Kilwa (RUMAKI) seascape in Tanzania to maintain and enhance its ecological value and livelihoods. The project is implemented between 2019-2023 by WWF /Wetlands International with financial support from Blue Action Fund
6.	TAWA	Tanzania Wildlife Authority (TAWA) is implementing ecotourism activities in Kilwa district targeting ruins, and marine ecosystem.
7.	MLFD	Ministry of Livestock and Fisheries Development (MLFD) manages the marine ecosystem through the Beach Management Units (BMUs).
8.	URT/CHEC	Government of Tanzania has entered into contract with China Habour Engineering Company (CHEC) to construct fishing port at Kilwa Masoko (Lindi region). The port will have the capacity to store 60,000 tons of fish on an annual basis, making it the largest port on the East African coast.

S/N	Stakeholder	Past and ongoing interventions
9.	Universities and research institutions	National and international research institutions carry out research and provide various consultancy services. the local institutions include Tanzania Forestry Research Institute (TAFORI), Sokoine University of Agriculture (SUA), University of Dar es Salaam (UDSM) and Tanzania Fisheries Research Institute (TAFIRI).

4.2.4 Baseline studies

A number of baseline studies have been done for Kilwa and Rufiji Delta mangrove forest reserves. These include:

a) Mapping studies including zonation and vegetation structure (Semesi, 1986); deforestation mapping (Wang et al., 2003; Monga et al., 2018);
b) Mangrove forest inventory (URT, 2019a; Japhet 2021; Masota et al. 2016; and Lupembe and Munishi, 2019);
c) Socio-economic studies (Tumbo et al., 2015; Nakamura R., 2010); and
d) Hydrology studies (Anthony et al., 2021).

These and other studies are being used during the preparation of management plans.

4.2.5 Assessment of existing management plans

The current management plans for Kilwa and Rufiji Delta Forest Reserves were prepared and approved to be used for the period 2020/21 – 2024/25 and 2021/22 – 2025/26, respectively. Generally, these management plans adopted the acceptable standard format. In addition, the plans prescribe prioritized activities that will be carried out during the planning period. However, the plans identified activities such as ecotourism, and Carbon trading but they do not indicate how these opportunities can be tapped.

On the implementation of the plan, it is noted that most of the activities planned for the first year of the management plans were not implemented mainly due to inadequate resources. In addition, harvesting was one of the identified activities which were not implemented due to a shortage of demand for poles as a result of COVID19 that affected the tourism sector. Furthermore, there are very low staffing levels in the two forests to supervise labour-intensive harvesting apart from inadequate water transport and communication equipment.

4.2.6 Opportunities of development of ecotourism potential

Rufiji Delta Mangrove Forest Reserve

Tourism activity in the Rufiji Delta Mangrove Reserve is currently absent and could be an alternative source of livelihood for TFS and communities. The main challenge is the accessibility of the delta and the lack of infrastructure. TFS wishes to initiate a development plan based on the mangrove including construction of a mangrove walk, a wharf for the reception of tourists at the Nyamisati TFS office and develop camping facilities on the scenic Jaja Island. In addition, TFS presents the delta as a site of historical interest because of German colonization marks or World War I wrecks. Nevertheless, most of them are completely sunk, buried or simply not valuable, although it may be

worthy of archaeological research. At this stage no serious marketing study exists on this tourism proposal.

Villagers of VNCR have already been able to receive researchers, but never tourists. There has sometimes been a demand, but the inhabitants are helpless with the unformalized regulations regarding possibilities of reception. There is a need for training in this regard and they desire to set up a pass to generate economic income and promote the visibility of tourist activities. Discussions are going on between TFS and VNCR to promote the development of tourism.

Kilwa Mangrove Forest Reserve

Tourism in Kilwa is fairly recent, but is steadily increasing, even during the COVID19 crisis, with a total of 4000 visitors for the year 2020/2021. It is mostly domestic tourism, focused on the ruins and the marine ecosystem, for stays of 3 days and where Kilwa Masoko is the main accommodation site. Currently, there is an unmet demand for birdwatching, mangrove walks or mangrove kayak and snorkel tours. The ruin sites generate an estimated annual income of TZS 40 mil for TAWA, which is put back into their operating budget. Ruin sites being managed by TAWA, thus TFS does not currently generate income from tourism. Visitors only cross the mangrove to access the site and only TAWA has currently capacity to tourist transport (13 permanent staff and 3 different boats).

To develop ecotourism activity in the Kilwa mangrove forest reserve and generate income, TFS wishes to:

a) Create a tourist circuit from active tourist sites to the reserve (Masoko - Kilwa Kvindji Matandu, Mtoni, Mafia Island);
b) Create a pedestrian circuit (wooden footbridge for example) within the mangroves of Kilwa Kisiwani and Songo Mnara in order to link the landing stage (to be created) to the archaeological sites managed by TAWA;
c) Develop snorkeling and kayaking activities in the coastal mangrove of Kilwa Kisiwani or Songo mara lagoon;
d) Develop accommodation and restaurant facilities at Mtoni.

Currently, at the community level, few people benefit from the tourism potential of Kilwa and Songo: 6 guides for Kilwa and 4 guides for Songo Mnara, just on land to visit the ruin sites. In addition, 11 peoples are contracted to clean and secure the ruins, all of whom are selected from the village ruins committee.

4.2.7 Other economic activities from mangroves

Rufiji Delta Mangrove Forest Reserve

An estimated 95% of the population are farmers and fishermen (Tumbo et al., 2015) and depend on the Rufiji river for their subsistence activities. In the delta agriculture and fishing are effectively geared towards food production for self-consumption but are not always sufficient. Despite the declining trends in agriculture, various studies indicate that it remains the main livelihood for many households in the lower Rufiji. In the Delta and

coastal zone, rice, cashew, and coconut cultivation are carried out (Tumbo et al., 2015). In the delta, thanks to the tide, rice cultivation is tidal and not very dependent on flooding or rainfall.

Delta water fishery targeting prawns, Clupeidae (herrings, sardina), Serranidae (groupers) and Arriidae (catfish). The fishery is mostly done in Rufiji delta and immediate coast to 10m depth, employing small canoes with mainly gillnets and long lines. Among other uses of the mangrove ecosystem, there is the traditional exploitation of wood (house-building materials, boat-building materials, fishing-gear materials, firewood for cooking and lime burning, medicine, etc.) but also beekeeping, although this last activity is rather in its infancy.

Kilwa Mangrove Forest Reserve

Agriculture is the main economic activity in Kilwa District and involves about 81% of the total population. Crops grown include rice, cashew, and coconut. With regard to mangroves, the direct uses include harvesting for house-building materials, boat-building materials, fishing-gear materials, firewood for cooking and lime burning, medicine, and fodder for livestock during the dry season (Nakamura, 2010). In addition, the natural conditions of the mangrove inland sea provide avenues for fishing activities, even for those without expensive fishing gear such as nets or boats. The mangrove inland sea seems to have been an important and traditional occupational space on Kilwa Island since a long time. Nevertheless, coral reef fishery, octopus' fishery and small pelagic fisheries (mainly Scombridae (vibua), Lethrinidae and Clupeidae (dagaa) are practiced as lucrative business. The salt farming in the tidal zone between the mangrove and the mainland is also practiced through the process of solar evaporation. The recovered salt is used for the conservation of fishing products.

The beekeeping as income generating activity is carried out by a few villagers. In 2022, this activity is carried out by nine (9) groups of villagers (20-30 hives per group). Each hive produces between 15-20 liters of honey. The villagers are trained and provided with hives by TFS. In return, they carry out surveillance activities.

The people of Kilwa District have traditionally been non-livestock keepers, except for a small stock of mainly goats and poultry. However, recently herding has been observed to increase. This is linked to the in-migration of pastoralists and agro-pastoralists to Kilwa from other parts of the country.

4.2.8. Current TFS capacities to manage the mangroves

Rufiji Delta mangrove forest reserve has two offices: Headquarter at Kibiti and ranger office at Nyamisati while Kilwa Mangrove Forest Reserve has none. Both reserves do not have staff houses. In terms of equipment, Rufiji Delta has three (3) boats (only one is serviceable) and one (1) vehicle while Kilwa has only two (2) boats which are grounded. Overall, there is inadequate facilities to manage the two big mangrove reserves.

In terms of human resources, currently there are 3 permanent staff for Rufiji Delta Mangrove Forest Reserve (1 manager, 2 forest assistants) and 5 contract workers (1 boat

driver, 1 navigator, 1 forest assistant and 2 security guards). Similarly, there are only 4 professional staff for Kilwa Mangrove Forest Reserve. Thus, human resources capacity is very low in both reserves.

5. PROJECT INTERVENTIONS

5.1 Overview of the Project

The global objective of the project is to enhance the contribution of Tanzanian forests (including mangroves), to the equilibrium between economic growth, poverty reduction and improved environmental conservation.

The specific objectivest are:

a) To increase forest stock and forest cover through improved planting materials and protection of growing forest stocks in expansion areas of selected forest plantations.
b) To strengthen strengthen coastal biodiversity and ecosystem services through protection, rehabilitation of degraded mangrove areas, including with development of ecotourism services.
c) To improve sustainable livelihood of the forest adjacent communities through supporting conservation based and eco-tourism economic activities.
d) To develop sustainable revenue base for TFS and strenghthen TFS capacity to manage forest resources in selected plantatations, mangroves and nature forest reserves.

5.2 Project Activities

5.2.1 Component 1: Strengthening of tree planting and management of Tree Seed Collection Centers

Activity 1.1. Improving tree seed quality and quantity and tree seed management

Currently, supply of tree seed for TFS plantations and other stakeholders does not meet the demand. Further, seed is collected from seed stands and therefore of low genetic quality resulting poor yield and quality of trees in plantations and woodlots. Genetic improvement of tree seed will address these challenges. Also, nurseries in the three forest plantations use polythene pots (7-10 cm lay flat diameter and 9-15 cm long) which require transporting large amounts of soil, especially when many seedlings are to be raised.

Staff of TFS Tree Seed Centers have limited capacity to establish and manage seed orchards and species/progeny trials. Also, they lack some basic equipment for seed harvesting.

The main objective of the activity is to improve the capacity of TFS to collect, produce and provide good quality tree seeds and seedlings both to the TFS plantations and to the others stakeholders with forest plantations.

A1.1.1 Establishment of first-generation seed orchards

A total of six seed orchards will be established at Mtibwa, Silayo and Wino forest plantations as shown in Table 8.

Table 8: Establishment of seed orchards at Mtibwa, Silayo and Wino forest plantations

Site	Species	Area	Source of material
Mtibwa	*Khaya anthotheca* *Milicia excelsa*	10 ha 10 ha	Based on performance of Tanzania Forestry Research Institute (TAFORI)/TFS species trial in the area
Silayo	*P. tecunumanii* *E. saligna*	15 ha 15 ha	Based on performance of Forestry Development Trust (FDT)/TFS species trial in the area
Wino	*P. maximinoi* *E. saligna*	15 ha 15 ha	Based on performance of FDT/TFS species trial in the area

A1.1.2 Establishment of second-generation seed orchards

A total of six second generation seed orchards will be established at Silayo and Wino Forest plantations as shown in Table 9.

Table 9: Establishment of second-generation seed orchards at Silayo and Wino Forest plantations

Site	Species	Area	Source of material
Silayo	*P. tecunumanii* *P. maximinoi* *E. saligna*	@ 10 ha	Participatory Forest Programme (PFP) Seedling Seed Orchards (SSO)
Wino	*P. tecunumanii* *P. maximinoi* *E. saligna*	@ 10 ha	PFP SSO PFP SSO TFS SSO

A1.1.3 Establishment of species and progeny trials

Species trials (11) that have shown promising performance in the sites they were established will be replicated in other plantation extension areas as shown in Table 10. In addition, a progeny trial of *Tectona grandis* will be established Mtibwa forest plantation.

Table 10: Establishment of species and progeny trials at Mtibwa, Silayo and Wino forest plantations

Site	Type of trial	Tree Species	Area	Source of material
Mtibwa	Species	*Khaya senegalensis* *Pterocarpus angolensis*	@ trial 5 ha	Best performing species in trials
	Progeny	*Tectona grandis*	10 ha	TAFORI/TFS SSO
Silayo	Species	*E. saligna* *E. saligna x urophyla* *E. grandis x urophyla* *P. tecunumanii* *P. maximinoi*	@ trial 5 ha	Best performing species in trials
Wino	Species	*P. patula x maximinoi* *P. maximinoi* *P. patula x tecunumanii* *E. saligna*	@ trial 5 ha	Best performing species in trials

A1.1.4. Establishment of modern nurseries

Modern nurseries will be established at the three forest plantations.

A1.1.5. Strengthening Capacity of Tree Seed Centres

The following activities will be done to strengthen Tree Seed Centres:

a) Training of 8 professional tree climbers;
b) Short course on establishment, management and assessment of trials and SSO (theory 2 weeks and field 3 weeks);
c) Long course (MSc) in tree breeding; and
d) Procurement of 8 sets of tree climbing gears.

Activities 1.2 - 1.4. Upscaling and diversifying forest plantations in Mtibwa, Wino, and Silayo forest plantations

According to the forest management plan, annual planting target in Pagale Range is 500 ha. However, only 250 ha per year have been achieved (URT, 2018a). For Silayo forest plantation, the annual planting target is 3,000 ha while the actual area planted per annum is 500 ha (URT, 2018b). For Wino forest plantation, annual planting target is 2,500 ha. However, the forest plantation is operating at an annual average planting target of 400 ha (URT, 2018c). The main reason for the failure of all the three forest plantations to not realizing the targets is financial limitations. Therefore, financial support will make these plantations realize the planting targets.

The objective of these activities is to support the expansion of plantations in Mtibwa (Pagale Range), Silayo and Wino (Ifinga and Mkongotema Divisions).

The expansion areas, area to be planted per year and tree species to be planted for three forest plantations are summarized in Table 11.

Table 11: Expansion of forest plantations in Mtibwa, Silayo and Wino forest plantations

Name of plantation	Expansion area available (ha)	Area to be planted per year (ha)	Total area in 5 years	Tree species to be planted
Mtibwa (Pagale Range)	12,950	500	2,500	*Teak, Gmelina arborea, Cedrella ordolata, Khaya anthotheca*
Wino (Ifinga and Mkongotema Divisions)	15,000	1,000	5,000	*P. tecunumanii, P. maximinoi, P. elliottii, E. grandis, E. saligna, E. grandis x urophyla*
Silayo	43,181	3,000	15,000	*Pinus caribaea, P. tecunumanii, Eucalyptus camaldulensis, Khaya anthotheca, Maesopsis eminii*
Total	**71,131**	**4,500**	**22,500**	

Details of sub-activities
For the three forest operations, the following sub-activities will be carried out:

A (1.2-1.4).1 Establishment and operation of new nurseries
Nurseries in the three forest plantations will be expanded and modernised to meet the new annual planting targets for each forest plantation (Table 12).

Table 12: Current and required seedlings production and capacity for Mtibwa, Silayo and Wino forest plantations

Forest Plantation	Current seedlings production (2021/22)	Current nursery seedlings capacity	Required seedlings production
Mtibwa	372,994	500,000	800,000
Silayo	2,008,795	4,000,000	3,330,000
Wino	737,193	3,000,000	1,100,000
Total	**3,118,982**	**7,500,000**	**5,230,000**

As shown in Table 12, many seedlings will be raised to meet the planting target of 4,500 ha per year for the three forest plantations. For Mtibwa, a machine to reduce water salinity should be acquired, as currently some seedlings have died in the nursery because of salinity. Raising seedlings using the polythene pots (7-10 cm lay flat diameter and 9-15 cm long) (FBD, 2021) and normal potting mixtures will require ferrying large amounts of soil as well as high costs of transporting seedlings to planting sites. Use of multi-cavity trays is recommended. These use coconut peat and rice husks as potting mixture. The cost of one seedling raised using cavities in the Southern Highlands ranges from TZS 240-460.

A(1.2-1.4).2 Land preparation and tree planting
Land preparation must be total, or strip as directed in the Technical Order. Where terrain allows, mechanical site preparation should be undertaken as it generally results in higher intial survival and early growth. Proper spacing must be used. Proper pitting and planting are key to ensure high initial survival and growth.

Mosaic planting will be used where valuable indigenous tree species will be retained and high biodiversity sites, wetland areas, water sources (within 60 m), burial, archaeological, cultural and spiritual sites will not be planted. The Geographic Information System (GIS) Unit at TFS HQ will map the areas (remote sensing) in order to identify all areas to be conserved.

Planting targets
TFS has experience in planting large areas per year. Between 2014/2015 to 2021/2022, an average of 3026 ha (range 2507-3,968 ha) were planted per year at Sao Hill forest plantation alone (TFS, 2022b). Country wide, TFS plants and replants about 8,000 ha per year. Therefore, the planned targets in this report are achievable.

Choice of tree species and seed sources

Each plantation has several species to be planted exceeding the minimum 4 directed in Technical Order No 1 of 2021 (FBD, 2021). Also, it is directed that the minimum four species must as much as possible be planted in equal proportions to minimize risks against insect pests, pathogens and climate change. However, for Teak, there will more planting of this species due to its value and limited susceptibility to insect pests and pathogens, while diversification will mainly be done in replanting areas. The FDT/TFS species trials in Wino and Silayo will later inform other suitable species for planting. Also, the recently developed Site-Species Matching Tool SSMT) by FDT will ensure that species are matched to their specific planting sites for maximum survival, growth and productivity and to minimise stress and insect pests/pathogen attacks due to offsite planting (FDT, 2021). Additionally, this may result in increased market security through species and product diversification. As directed by the Technical Order of 2021, all exotic tree species seed must come from seed orchards to ensure high quality and productivity of the plantations.

A(1.2-1.4).3 Tending operations for the plantations

Complete weeding or strip weeding must be done as directed by the Technical Order. This will ensure high initial survival and early growth. The Taungya system that allows communities to grow and tend food crops during the first year after tree growing will be practiced where communities need areas for crop production. Close supervision of Taungya farmers is key to ensure that trees receive proper tending. In addition, the project will support beekeeping activities (in the natural forests and plantations) managed by TFS and others owned and managed by communities of surrounding villages. Pruning should be done as directed using pruning saws as directed in the Technical Order.

A(1.2-1.4).4 Forest patrols, fire lines setting up and maintenance

There should be regular patrols curb illegal activities. For fire lines, a width of not less than 10 m must be maintained between compartments and compartment size must not exceed 30 ha (FBD, 2021). All fire lines must be cleaned timely either manually or mechanically if terrain allows. A buffer zone of 100-200 m must be maintained from the village boundary.

A(1.2-1.4).5 Insect pests, pathogens and alien invasive species

Insect pests, pathogens and invasive alien species must be controlled when they appear as directed in the Technical Order.

A(1.2-1.4).6 Road network development and maintenance

The road network should be developed in parallel with the extension of plantations. Road construction specifications are provided in the Technical Order (FBD, 2021). Roads should also be regularly maintained so that they are passable throughout the year.

5.2.2 Component 2: Enhancing Mangrove forests ecosystem and their biodiversity

This component involves a pre-feasibility study of two mangrove forest reserves namely Kilwa and Rufiji Delta mangrove forest reserves for improved biodiversity conservation, potential for eco-tourism and community livelihood improvement.

The current management plans for these forests were prepared and approved to be used for the period 2020/21 – 2024/25 and 2021/22 – 2025/26. As stated earlier, the plans prescribe prioritized activities that will be carried out during the planning period. As such, some of these activities are considered in this prefeasibility study. Activities intended to improve mangrove forests protection and conservation including requirement for additional TFS staff, construction of buildings and procurement of vehicles and equipment were considered and included under Component 3. Objectives and activities that are in this component include:

a) Strengthening forest protection.
   A2.1.1: Installation of sign boards and beacons; and
   A2.1.2: Forest patrols.
b) Strengthening community participation and developing alternative livelihoods and sustainable economic activities.
   A2.2.1: Involve local communities in management activities and conservation;
   A2.2.2: Strengthen the beekeeping activities in each village of Kilwa and Rufiji delta mangrove forest reserves;
   A2.2.3: To support development of small-scale fish farming and crab fattening in each village of Kilwa and Rufiji delta mangrove forest reserves; and
   A2.2.4: Facilitate Kilwa and Rufiji delta mangrove forest reserves stakeholders' consultative meetings.
c) Restoration of the degraded mangroves.
   A2.3.1: Enrichment planting in degraded mangroves;
   A2.3.2 Supervision of *Taungya* system; and
   A2.3.3 Management of *Derris trifoliata.*
d) Develop tourism attractions in the mangroves.
   A2.4.1: Carry out a detailed ecotourism feasibility study.
e) Generate Carbon credits to co-finance mangrove management.
   A2.5.1: Carry out feasibility study for REDD project for Rufiji Delta mangrove forest reserve; and
   A2.5.2: Carry out feasibility study for REDD project for Kilwa mangrove forest reserve.

Objective 2.1: Strengthening forest protection

A2.1.1: Installation of sign boards and beacons

It is important that forest boundary is recognized easily in order to avoid any excuse of forest encroachment. Currently, the boundary is hard to locate and there are no

signboards to alert people on the start of forest boundary along the main paths and roads that enter the forest.

A2.1.2: Forest patrols

Forest patrols are done in order to detect offenders early enough before they have done significant damage to the forest. Effective patrols should involve neighbouring communities who have enough local knowledge of the environment. Human activities such as illegal grazing will be prohibited to promote natural regeneration.

Specific objective 2.2: Strengthening community participation and developing alternative livelihoods and sustainable economic activities

A2.2.1: Involve local communities in management activities and conservation

The management plans for both Kilwa and Kibiti Delta mangrove forest reserves consider the involvement of local communities who live in and outside these forests in the management of the forests. This is because the livelihood of these communities depends on mangrove ecosystem. These communities are organized in villages with functional VNRCs which are representatives of the villagers in the management of forest resources. These together with beekeeper's cooperatives, fish farmer's cooperatives, BMU, traders and mangrove pole/log dealers are used as a link between the people and other stakeholders. Schools, Women groups and individuals also contribute to the management.

However, for the participation of these groups in the management of the forests, they need to sign a Joint Management Agreement (JMA) between them and the Mangrove Forest Reserve management. In addition, each village will be supported to prepare and review by-laws related to the management of the mangrove forest reserve. The by-laws will be used to manage the specific area of forest reserve allocated to a particular Village for management.

A2.2.2: Strengthen the beekeeping activities in each village of Kilwa and Rufiji delta mangrove forest reserves

Beekeeping has always been an activity carried out by some mangrove inhabitants. Mangrove honey is becoming increasingly popular and Tanzanian honey seems to be recognized in the international market. This activity aims at strengthening beekeeping with the following objectives:

a) Identify national and international markets;
b) Define the marketing plan of the product: choice of the circuit and the distribution areas (place of sale, direct sale or via intermediaries, and sales network), organic label, and Fairtrade Premium;
c) Identify the relevance of grouping beekeepers in an economic interest group;
d) Develop technical skills (setting up a traceability system, beekeeping practices, and conservation techniques);
e) Facilitate the access to the material (outfits, protective clothes, smokers, and hives, extractors) and to a room for the extraction and the storage of honey; and
f) Facilitate mobility between the apiaries and the honey house.

At the same time, the training activities provided so far by TFS will be maintained and reinforced with the village communities. These trainings, which currently focus on the management of an apiary, could also include the construction of hives. A partnership with TFS to provide local communities with wood from dry forests could be established. TFS would also participate in the preservation of mangrove wood, by providing people with wood from continental forests.

A2.2.3: To support development of small scale fish farming and crab fattening in each village of Kilwa and Rufiji delta mangrove forest reserves

Short-term income generating activities are important for local people as a substitute source of income, which relate with the destruction of mangrove forests ecosystem. With the increasing population and demand for wood products, conservation could be jeopardized. Development of short-term income generating activities can help local communities to meet their needs.

Fishing is regarded as the major income generating activity to community dwelling along the coastal area at Kilwa and Rufiji Delta. The management plans of the two forests target fish farming (Prawns and Crabs) as one of the activities to improve the fishing within and outside the forests. Such initiatives are planned to be scaled up and extended to other villages.

A2.2.4: Facilitate Kilwa and Rufiji delta mangrove forest reserves stakeholders' consultative meetings

Management of mangroves involves many sectoral agents whose conservation measures need to be coordinated. The co-ordination with District Council authorities needs to be strengthened through JMA with the village adjacent to the forests. Also, TFS in managing the mangrove reserves will need to develop partnerships to integrate VNRCs and BMUs. Ecotourism development should be carried out in agreement with the Tanzanian Wildlife Authority (TAWA) and MNRT. For potential aquaculture activities (catfish, shrimps and crabs) the Ministry of Livestock and Fisheries Development will be involved. The Port Authority works with TFS on tracking illegal transport of forest produce. The linkage between TFS with these important stakeholders needs to be maintained and strengthened. In ensuring inter-sectoral linkages and cooperation, there will be stakeholders' consultative meetings each year. Through stakeholders meeting integrated management will be developed. This collaboration will focus on sustainable natural resources management and conservation.

Specific objective 2.3: Restoration of the degraded mangroves

TFS has set aside 4,221 ha and 7,000 ha of degraded mangroves to allow recovery and regeneration of mangroves in Kilwa and Rufiji Delta mangrove forest reserves, respectively. Areas with good natural regeneration will be left to naturally regenerate while areas where natural regeneration is difficult, different planting methods will be used. TFS estimates that recoveries vary from 3 - 25 years depending on the size, type and quality of the wood product desired.

According to the management plans, the following silvicultural practices will be adopted:

A2.3.1: Planting and enrichment planting in degraded mangroves

(a) Mangrove nursery establishment and management for some commercial species such as *Heritiera littoralis, Xylocarpus granatum, Ceriops tagal, Bruguiera gymnorrhiza, Sonneratia alba* and *Rhizophora mucronata*;
(b) Planting will involve establishment of mangrove mixed stands in completely cleared forest areas; and
(c) Enrichment planting using wildings and mangrove seedlings from the established nursery.

A2.3.3 Management of *Derris trifoliata*

Climber cutting (*Derris trifoliata*) in invaded areas will be done to allow natural regeneration.

A2.3.2 Supervision of Taungya system

As pointed out earlier, there is poor survival and growth of planted mangroves in area where *Taungya* system is practiced due to poor supervision. Close supervision of these areas will ensure better survival and growth of the planted mangrove seedlings.

Specific objective 2.4: Develop tourism attractions in the mangroves

A2.4.1: Carry out a detailed ecotourism feasibility study

The objective of the feasibility study is to identify possible ecotourism investment opportunities, potential markets, customer targets and proposing a development plan that defines:

a) The nature and positioning of the offer;
b) The commercial strategy to be implemented; and
c) The economic and financial set-up.

To achieve these objectives, it is necessary to:

a) Analyze TFS's strengths and weaknesses;
b) Take into account the strategic objectives of TFS;
c) Choose the target clientele and its expectations;
d) Define the positioning of TFS (services, equipment);
e) Drawing up a budget forecast;
f) Develop a financing plan;
g) Write a marketing and sales plan; and
h) Define the appropriate legal structure, particularly in the case of a public/private partnership.

Specific objective 2.5: Generate carbon credits to co-finance mangrove management

A2.5.1: Carry out feasibility study for REDD project for Rufiji Delta mangrove forest reserve

A2.5.2: Carry out feasibility study for REDD project for Kilwa mangrove forest reserve

Developing REDD projects for the Rufiji Delta and Kilwa Mangrove forest reserves is an option that can potentially generate significant amount of carbon credits from conservation, reduced forest loss and restoration. However, before embarking to the development of these suggested REDD projects it is important to carry out feasibility studies in order to deeply explore the assumptions made.

Rufiji Delta Mangrove forest reserve

Since gazettment, Rufiji Delta Mangrove forest reserve has an area of 53,255 ha. Currently, TFS stratifies this area in to Productive zone (30,000 ha) where harvesting can be done and total protection (23,255 ha) zones including the areas along riverbanks, areas facing the sea, area with species near extinct and areas prone to erosion. The total area of 53,255 ha can potentially be conserved as a forest Carbon project.

However, according to Monga et al. (2018), between 1991 and 2015, the Rufiji Delta mangroves declined from 51,941 ha to 45,519 ha. This translates to the loss of 7,736 ha in 24 years which is an annual loss of 322 ha. This decline is mainly due to clearance for rice farming which during the same period has expanded from 5,344 ha in 1991 to 12,642 ha in 2015. This is an annual loss of 304 ha, that mean rice farming contributes 94.4% of deforestation in the Delta.

As stated previously, TFS has set aside 7,000 ha of degraded mangroves to allow recovery and regeneration of mangroves by restricting access. In this zone, areas with good natural regeneration will be left to naturally regenerate while areas where natural regeneration is difficult, different planting methods will be used. TFS estimates that recoveries vary from 3 - 25 years depending on the size, type and quality of the wood product desired.

With this huge mangrove resources under threat of loss and potential for restoration, the mangroves in the Delta stands a better chance to participate in the forest Carbon trading through different implementation arrangements. Potential Carbon projects types for the mangroves of the Rufiji Delta include but not limited to:

a) Forest conservation: If this option is considered, that means TFS will suspend the harvesting and conserve the entire mangrove forests of Rufiji Delta and Kilwa. The potential Carbon benefit with this option is the remaining forest Area 45,519 ha x 716.9 tCO_2 eq per ha = 32,632,571 tCO_2 eq. If the project is of 30 years, the annual carbon benefits is 1,087,783 tCO_2 eq.
b) Reducing emission from deforestation and forest degradation (REDD): With this option TFS will conserve the remaining 45,519 ha in the Rufiji Delta, address the main driver of deforestation (rice farming) and degradation (illegal harvesting). With this option, the potential Carbon benefit is that of conserving the remaining forest area as in (a) plus that of deforestation 322 ha x 716.9 tCO_2 eq per ha = 230,841 tCO_2 eq, and if possible that of degradation. Restoration of degraded area (d) may also be included in the REDD project.
c) Improved forest management : This option includes not only those activities in (b), but also sustainable harvesting may be allowed. However, due to the nature of the mangrove and low capacity of TFS to supervise the harvesting this option may be difficulty to implement.
d) Afforestation/Reforestation and Restoration of degraded mangroves : With the intension to re-vegetate 7,000 ha of mangrove in Rufiji Kilwa, this option has a potential Carbon benefit of 7,000 x 716.9 tCO_2 eq per ha = 5,018,440 tCO_2 eq. If the project is of 30 years, the annual Carbon benefits is 167,281 tCO_2 eq.
e) Blue Carbon : the waters in the Delta and its immediate ocean harbours sea grasses, corals and salt marshes that potentially can sequester/store huge amount of Carbon if the mangroves are properly conserved.

Developing a REDD project for the Rufiji Delta is therefore an option that can potentially generate Carbon credits of 1,485,905 tCO_2 eq per year from conservation, reduced emission from deforestation and mangrove restoration. Taking a low carbon price of $ 5 per tCO_2 eq this can potentially generate revenues of TZS 17,459,383,750 annually. However, it may not be possible to halt all the deforestation and meet the restoration target within the 30 years considered in these estimates. Therefore the expected revenues from the actual Carbon project can be less.

Kilwa Mangrove Forest Reserve

According to the 2019 Forest Management Plan for Kilwa mangrove reserve, the area of this forest has increased from 22,429 ha in 2019 to 23,161 ha. With this plan, TFS intends

to manage 8,874 ha for protection, 8,823 ha for production, 4,221 ha for recovery and 1,243 ha for ecotourism and research.

Potential Carbon projects types for the mangroves of the Kilwa forest reserve include but not limited to:

a) Forest conservation: If this option is considered, that means TFS will suspend the harvesting and conserve the entire mangrove forests of Kilwa. The potential Carbon benefit with this option is the 23,161 ha X 750.1 tCO_2 eq per ha = 17,373.066 tCO_2 eq. If the project is of 30 years, the annual Carbon benefit is 579,102 tCO_2 eq.
b) Avoided forest degradation: With this option TFS will conserve the 23,161 ha and address the main driver of forest degradation (illegal harvesting). With this option the potential Carbon benefit is that of conserving the forest area as in (a) plus if possible that of degradation. Restoration of degraded area (d) may also be included in the Avoided forest degradation project.
c) Improved forest management: This option includes not only those activities in (b), but also sustainable harvesting may be allowed. However, due to the nature of the mangrove and low capacity of TFS to supervise the harvesting this option may be difficult to implement.
d) Afforestation/Reforestation and Restoration of degraded mangroves: With the intension to recover 4,221 ha of mangrove in Kilwa, this option has a potential to generate 4,221 ha X 750.1 tCO_2 eq per ha = 3,166,172 tCO_2 eq. If the project is of 30 years, the annual Carbon benefit is 105.539 tCO_2 eq.
e) Blue Carbon: the waters in the mangroves of Kilwa and its immediate ocean harbours sea grasses, corals and salt marshes that potentially can sequester/store huge amount of Carbon if the mangroves are properly conserved.

Therefore, developing a REDD project for the Kilwa Mangrove forest reserve is therefore an option that can potentially generate Carbon credits of 684,641 tCO_2 eq per year from conservation and mangrove restoration. Taking a low Carbon price of $5 per tCO_2 eq this can potentially generate revenues of TZS 8,044, 532,573 annually. However, it may not be possible to halt all the disturbances and meet restoration target within the 30 years considered in these estimates. Therefore, the expected revenues from the actual Carbon project can be less.

5.2.3 Component 3: Strengthening institutional and technical capacities of TFS

TFS has staff deficit in all its Directorates. For the forest plantations, the deficit is 497 staff while that of the two mangrove forests is 48 staff. This staff deficit has contributed to challenges especially development and management of forest plantations and conservation of mangrove forests. Also, staff lack adequate skills and knowledge to effectively undertake their duties and/or tap emerging opportunities.

As pointed out earlier, TFS owns several infrastructures (buildings, equipment, marine vessels, plants and machinery, motor vehicles and motorcycles) which were acquired to support institutional capacity to deliver service. The assets are inadequate and some of them are old and unserviceable. The objective of this component is to strengthen

institutional and technical capacities of TFS in order to effectively and efficiently manage forest plantations and mangroves.

The following activities will be carried out under this component:

Activity 3.1. Staffing and strengthening their technical capacities for the plantations and mangrove forests

A3.1.1 Additional staffing and training for TFS

Plantations

TFS will require additional staff in order to effectively and efficiently handle activities of the planned expansion of forest plantations. While salaries and other emoluments will be paid by the Government, the Project will provide training so that staff get the necessary knowledge and skills. Total new staff requirement is estimated to be 114. Requirement of professional/technical (forestry and beekeeping) is 38 (Table 13), while the rest are staff of other specializations (registry, secretaries, human resources, lawyers, accountants, procurement, medical, mechanics, plumbers, electricians, operators and drivers). Currently, there are no guidelines on staff allocation. They should be prepared as soon as possible so that staff allocation relates with management area (plantation or natural forest reserve area).

Staff training as short courses is required in the following areas: Firefighting (basic fire-fighting course for all personnel involved in fighting fires; and crew leaders' course for all supervisors); tree climbers; establishment, management and assessment of trials and SSO; AFD procurement procedures training of TFS procurement staff and remote sensing and Geographic Information System (GIS).

Table 13: Current staff and additional staff requirements for Mtibwa, Silayo and Wino forest plantations

Forest Plantation	Category of staff	Current number	Required number	Total
Mtibwa	Professional	5	-	5
	Technical	14	7	21
	Operational/forest guard	30	15	45
	Administrative	3	9	12
	Sub-total	**52**	**31**	**83**
Silayo	Professional	5	2	7
	Technical	9	17	26
	Operational	3	-	3
	Administrative	-	43	43
	Sub-total	**17**	**62**	**79**
Wino	Professional	2	2	4
	Technical	7	10	17
	Operational	3	6	9
	Administrative	3	3	6
	Sub-total	**15**	**21**	**36**
Total		**84**	**114**	**198**

Mangroves

Table **14** shows the current and required number of staff for the two mangrove forest reserves. Currently, there are 3 permanent staff for Rufiji Delta Mangrove forest reserve (1 manager, 2 forest assistants and 5 contracted workers (1 boat driver, 1 navigator, 1 forest assistant and 2 security guards). Total new staff requirement for this forest is estimated to be 34. Similarly, there are only 4 professional staff for Kilwa Mangrove forest reserve while the required additional staff are 14.

With the current staffing level, TFS is not able to fully achieve its objectives of mangrove monitoring and controlling the planned logging activity. This is particularly true considering tide impact during patrols and the difficulty of access to the narrow delta channels. In addition, within the reserve, the different regulated zones are not delimited. Harvesting in authorized areas require adequate supervision by permanent staff with dedicated technical training. Therefore, TFS need capacity building in terms of both present and recruited staff. Training should focus on TFS' patrol staff on specific technical issues such as scientific (biodiversity monitoring, and monitoring protocol applications) legal (commissioning and swearing in), technique (computer science, and navigation). In addition, reserve managers need a comprehensive training programme on how to integrate ecotourism into a protected area. This development of skills is necessary for effectiveness realization of the conservation and restoration objectives. Given the willingness of local communities to participate in the management of the reserves, they will be able to participate in some of these training sessions.

Table 14: Current staff and additional staff requirements for Rufiji Delta and Kilwa Mangrove forest reserves

Mangrove Forest	Category of staff	Current number	Required number	Total
Rufiji Delta Mangrove forest reserve	Professional	1	1	2
	Technical	2	4	6
	Operational/forest guard	-	29	28
	Administrative		1	1
	Sub-total	**3**	**34**	**37**
Kilwa Mangrove forest reserve	Professional	1	2	3
	Technical	3	3	6
	Operational	-	9	9
	Administrative	-		0
	Sub-total	**4**	**14**	**18**
	Total	**7**	**48**	**55**

A3.1.3 Strengthening the monitoring capacities of TFS

At present, GIS Unit is organised at TFS HQ level under the Forest Resource Assessment Department, which is divided into four sections namely: Forest surveying, Forest mapping production, Forest inventory, and Forest data. The Unit is composed of 8 staff, but the capacity is increasing by recruiting more high qualified technicians to improve it.

It was observed that little information is managed (boundaries of ranges and blocks with a few fields in the attribute tables) by the GIS Unit. However, GIS components and capabilities are not reflected in the forest management plans. A fully functional GIS Unit

would improve the quality analysis of forest management plans and support the decision making at plantations level.

Similarly, an Information and Communication Technologies (ICT) Department is set at TFS, including an Integrated Information Management System, without including GIS component. This ICT comprises:

a) PMIS+PMISApp: Plantation Management Information System (Compartments, Plots, Silvicultural activities – weeding, pruning, fire, nurseries, business community, harvesting, plot allocation, CSR);
b) FREMIS+FREMISApp: Forest Resources Management Information System (Forest Resources, Harvesting Allocation, Transit Pass, CSR);
c) SEEDMIS+SeedApp: Tree Seeds Management Information System (Orchards, Seed Collection, Processing, Laboratory Testing, Store, Selling, Nurseries); and
d) Honeytrack+HoneApp: Honey Traceability Management Information System (Apieries, Beekeepers, Harvesting, Management).

Other components are included in the internal TFS systems such as:

a) PBS: Planning and Budgeting System;
b) VMIS: Vehicle and Vessels Management Information System;
c) AMIS: Assets Management Information System; and
d) BI: M&E, Management Reports.

In view of the foregoing, it is relevant to build a GIS Unit under the PMIS to optimise data collecting, archiving, analysis, mapping and information sharing. As such, a capacity building programme is proposed for improving the information system in relation to the TFS Business Intelligence System.

Building on the existing architecture of the PMIS, the GIS Unit would be able to supply the spatial component and largely benefit the management and operations at the plantation level. TFS HQ would be the provider of information to the technical staff at the forest plantation level, with one or two focal points trained at plantation site for information sharing and feedback.

The support would aim at developing monitoring capacities in terms of:

a) Data collection and planning: creation and management of forest data focusing on ranges, blocks and compartments (areas, species, density, age etc.), roads and fire lines, rivers and wetlands, infrastructure, villages, insect pests and pathogen occurrence, mining activities, encroachment sites;
b) Suitability mapping for tree species based on climate/soil characteristics;
c) Management of operations: future operations to be conducted including volumes to be harvested;
d) Conservation areas: management of conservation areas;
e) Forest Interface Management: creation of a TFS internal webmapping platform and data sharing system between TFS headquarters and forest plantations; and
f) The use of high tech for monitoring implementation and protection of forest plantations and mangroves.

Activity 3.2. Strengthening the logistic capacities

A.3.2.1. Construction and refurbishment of buildings

Plantations

TFS staff need suitable residential buildings (for them and their families) and working offices or buildings. This is because the forest plantations are far away from residential areas. The field visits confirmed the number and status of existing buildings but also the requirements for new buildings. Current and required buildings for the three forest plantations are shown inTable 15. A total of 57 new buildings of different categories needs to be built. In addition, Mtibwa has 3 old buildings which require refurbishment. The rest of the buildings at Mtibwa and in the two new plantations are in good condition. Prioritization of the construction of the building will be specified in forest management plans, annual work plans and budget.

Table 15: Current buildings and additional buildings requirements for Mtibwa, Silayo and Wino forest plantations

Forest Plantation	Category of building	Current number	Required number	Total
Mtibwa	Office	2	-	2
	Residential	12	4	16
	Ranger post	-	1	1
	Hostel/dormitory	-	2	2
	Sub-total	**14**	**7**	**21**
Silayo	Office	1	1	2
	Residential	5	30	35
	Ranger post	1	8	9
	Hostel/dormitory	-	2	2
	Sub-total	**7**	**41**	**48**
Wino	Office	1	-	1
	Residential	8	3	11
	Ranger post	-	2	2
	Hostel/dormitory	1	2	3
	Rest house	1	-	1
	Sub-total	**11**	**7**	**18**
Total		**32**	**57**	**89**

Mangrove forests

TFS will improve efficiency on conservation, development, and protection of the mangroves by facilitating their presence on site through establishment of ranger posts positioned at strategic points of the reserves. The following ranger post and houses for staff are needed:

a) Rufiji delta Mangrove forest reserve: three ranger posts located in Mohoro, Kiasi and Bwejuu. These sites have been selected for their strategic location to access remote areas or for their coverage of the boat traffic in the delta. Each ranger post should have at least two staff houses, an office, and communication facilities;
b) Kilwa Mangrove forest reserve: One office at Kilwa and three ranger posts located at Somanga, Kivinje and Rushungi; and

c) The construction of a concrete wharf at Nyamisati to house TFS fleet and confiscated boats on a long-term basis. It could also be used for the development of ecotourism.

A.3.2.2. Motorcycles and vehicles

Plantations

The second important requirement in terms of logistics concerns vehicles and equipment. TFS activities in the field require a high level of mobility for staff and casual workers, on sometimes rough roads in all weather seasons. A total of 27 motorcycles and 25 vehicles will be required for forest plantation management (Table 16). These facilities will improve the capacities of TFS staff and casual workers to undertake their tasks and reach the targets in terms of new plantations and existing plantation management.

Table 16: Current and additional motorcycles and vehicle requirements for Mtibwa, Silayo and Wino forest plantations

Forest Plantation	Type of vehicle	Current number	Required number	Total
Mtibwa	Motorcycles	7	3	10
	4 wheel pickup	1	2	3
	Land cruiser hardtop	2	1	3
	Lorry long base	1	1	2
	Sub-total	**11**	**7**	**18**
Silayo	Motorcycles	3	18	21
	4-wheel pickup	1	6	7
	Land cruiser hardtop	1	4	5
	Lorry long base	1	2	3
	Lorry tipper	-	3	3
	Sub-total	**6**	**33**	**39**
Wino	Motorcycles	4	6	10
	4-wheel pickup	3	3	6
	Land cruiser hardtop	1	1	2
	Nissan patrol	1	-	1
	Isuzu injection	1	-	1
	Lorry long base	-	1	1
	Lorry tipper	-	1	1
	Sub-total	**10**	**12**	**22**
Total		**27**	**52**	**79**

Mangrove forests

Table **17** and
Table **18** show required working facilities and equipment for TFS in Rufiji Delta and Kilwa mangrove forest reserves, respectively. The acquisition of vehicles, motorcycles, patrol boats, and cargo dhow will be needed to increase the frequency of patrols and to be able to confiscate illegally harvested forest products.

Table 17: Current and additional motorcycles, vehicle and office equipment requirements for Rufiji Delta and Kilwa forest reserves

	Item	Available	Required
Rufiji Delta	Motorcycle	0	2
	Boat (with engine)	3	4
	Dhow	0	1
	Land cruiser hardtop	1	1
Kilwa	Motorcycle	0	3
	Patrol Boats	2	2
	Glass bottomed boat	0	1
	Land cruiser pick up	0	1
	Board walk	1 (200m)	1 Km

A.3.2.3. Heavy machinery

Road networks are partially established at Pagale range while at Wino, the roads in Ifinga range (73 km) and Mkongotema range (63 km) are severely bad and inadequate. The road network at Silayo are yet to be established. In view of this, the forest plantations require heavy equipment and machines in order to build and maintain roads and fire lines, transport workers, seedlings and materials. At present, the Mtibwa forest plantation has one grounded tractor, while the one at Wino is in poor condition. Silayo forest plantation has no any heavy machinery. Heavy machinery requirements of the plantations total 19 (

Table **18**).

Table 18: Current and required heavy machinery requirements for Mtibwa, Silayo and Wino forest plantations

Forest Plantation	Category of machinery	Current number	Required number	Total
Mtibwa	Tractor	1 (grounded)	1	2
	Grader	-	1	1
	Buldozer*	-	1	1
	Excavator	-	1	1
	Compactor	-	1	1
	Sub-total	**1**	**5**	**6**
Silayo	Tractor	-	5	5
	Buldozer	-	2	2
	Excavator	-	2	2
	Grader	-	2	2
	Compactor	-	1	1
	Sub-total	**-**	**12**	**12**
Wino	Tractor	1 (poor condition)	1	2
	Buldozer	-	1	1
	Excavator	-	1	1
	Grader	-	1	1
	Compactor	-	1	1
	Sub-total	**1**	**5**	**6**
Total		**2**	**22**	**24**

A.3.2.4. Strengthening capacities in terms of forest fire prevention and suppression

Based on the current situation in Tanzania with regard to preventing forest fires, as well as experiences and lessons learnt in other countries, such as Algeria (Sahar-Meddour et al., 2013), New-Zealand (NZ Forest Owners Association, 2018), or Europe (Camaia et al., 2014), fire monitoring and management measures are proposed for MNRT and TFS. In addition to Integrated Fire Management Guidelines for Commercial Forestry (URT, 2018d), a National Forest Fire Strategy and Action Plan that follow a step-wise approach, such as the ones used in Europe and Maghreb (Prevention/Pre-suppression/Suppression /Recovery) or in New Zealand (Reduction/Readiness/Response/Recovery) is required.

The current Forest Fire Strategy in Tanzania is based on the principle of "minimum damage", reflecting the technical limits of and lack of firefighting resource capability for protecting the entire forest lands from wildfires. It is necessary to improve the alert system, communication, and to intensify preventive silviculture in high-risk areas to reduce forest vulnerability to fire. Similarly, regular development of wildfire risk maps and providing adequate maintenance to existing infrastructure would help improve the organizational response to the wildfire season, potentially leading to better prevention programmes and more efficient wildfire management programmes in Tanzania.

The following sub-activities will therefore be carried out:

A3.2.4.1 Improving forest fire prevention

Forest fire prevention starts with a better identification and monitoring of forest fires. A national database combined with a GIS, both disaggregated/manipulatable by

Zones/Regions/Districts, would allow monitoring basic data about forest fires, such as the 19 criteria compiled into the European Forest Fire Information System (used by 43 countries in European, Middle East and North African countries) (Table 19).

Table 19: Forest fire criteria captured in EFFIS (Camaia et al., 2014)

Group	Data field	Field name
ID	Unique Fire identifier	FIREID
TIME OF FIRE	Date of first alert	DATEAL
	Time of first alert	TIMEAL
	Date of first intervention	DATEIN
	Time of first intervention	TIMEIN
	Date of fire extinction	DATEEX
	Time of fire extinction	TIMEEX
LOCATION OF FIRE	Province Code (national nomenclature)	PROVCODE
	NUTS3 code	NUTS3
	Commune Code (national nomenclature)	CODECOM
	Commune Name (national nomenclature)	NAMECOM
	Latitude	NORTH
	Longitude	EAST
SIZE OF FIRE (Ha)	Burned Area FOREST	BAFOR
	Burned Area OTHER WOODED LAND	BAOW
	Burned Area OTHER NATURAL LAND	BAONW
	Burned Area AGRICULTURAL LAND	BAAGR
CAUSE OF FIRE	Certainty of knowledge of Presumed Cause (EU code)	CAUSE_KNOWN
	Presumed Cause (EU categories code)	CAUSE_EU
	Presumed Cause (Country detailed categories code)	CAUSE_CO

In particular, it would be worth refining the classification of causes of forest fires (currently limited to: negligence, accidental or voluntary. While the EFFIS distinguishes 29 fire cause classes, organized into 8 groups). A more refined categorization is needed that could aid design of fire prevention programmes.

The elaboration of the National Forest Fire Strategy and Action Plan would allow selecting and prioritizing the possible measures, tools and guidelines in terms of fire prevention:

a) Sensitization and education of the public and forest users: television and radio spots, posters in public places, fire campaign meetings;
b) Reinforcement of forest surveillance: creation/maintenance of lookout tower, creation of mobile patrol, strengthening of VNRC; and
c) Creation/maintenance of passive defence: fire-lines in forest areas, 50-meters wide buffer zone around villages, 5-meters wide buffer zone in farm areas adjacent to forest.

A3.2.4.2 Improving Forest fire suppression measures

Again, the elaboration of the National Forest Fire Strategy and Action Plan would allow selecting and prioritizing the possible measures, tools and guidelines in terms of fire suppression measures:

a) Strengthening and organising human resources: forest mobile patrols (2 to 5 person crews equipped with 4WD, tanker and pump for initial fire attacks), employees staffing fire lookout towers, TFS staff responsible for coordinating forest fire prevention/suppression, members of the VNRC; and
b) Strengthening equipment and infrastructure: 4WD with 600-liters tank and high-pressure pump for initial attacks, firefighting trucks with or 3,000-liters tank and high-pressure pump for extended/spreading fires, water points in or near forests (boreholes, water tanks, rivers), basic suppression equipment (shovel, pick, fire beaters/swatters, backpack pump and a radio to inform headquarters personnel),

fire-lines, and forest access roads. In most countries, the objective for the first attack is to arrive within the first 10 minutes of the fire notification. The faster the attack, the more the chance to control the fire.

A3.2.4.3 Purchasing Forest fire-fighting infrastructure and equipment for the 3 forest plantations

At pointed out earlier, fire is one of the main threats facing forest plantations. This has been mainly due to among other reasons, inadequate fire-fighting facilities. The following fire-fighting infrastructure and equipment will be required for the three forest plantation sites: fire towers (11), dams (5), Complete radio call system for each plantation (3), weather equipment for each range to be planted (5), bakkie sakkie (5), fire fighting vehicles (5), water bowzers (5), fire alarms (10), backup pumps (160), fire beaters (200), Drip touch (13), Personal Protection Clothing (PPC) (250), Fire hoes (150), Binoculars (10) and GPS (10) (Table 20). The dam to be constructed in each range/division will store water for use during fire-fighting but also for domestic use as may be necessary. The fire-fighting equipment is in most cases based on KISHUGU (2017) and is considered the minimum required for forestry fire fighting for the Project areas. However, numbers of infrastructure and equipment has also taken into consideration ranges/divisions that are far apart as is the case for Ifinga and Mkongotema in Wino forest plantation.

Table 20: Fire infrastructure and equipment for Mtibwa, Silayo and Wino

Type of fire fighting equipment/infrastructure	Mtibwa	Silayo	Wino	Total
Fire towers	2	6	2	**10**
Water dams	1	6	2	**9**
Radio call system	Complete package	Complete package	Complete package	**3**
Weather equipment range/division	1	2	2	**5**
Bakkie Sakkie (200-700 lts)	2	3	2	**7**
Fire fighting vehicles 4000 lts	1	2	2	**5**
Water bowsers 4000 lts	1	2	2	**5**
Fire alarm	2	6	2	**10**
Back pumps Min 15 lts	20	40	40	**100**
Fire beaters	40	80	80	**200**
Drip Torch	3	4	6	**13**
PPC	50	100	100	**250**
Fire hoes	30	60	60	**150**
Binoculars	2	6	2	**10**
GPS	2	6	2	**10**

4.2 Project Logical Framework

Overall objective:
To enhance the contribution of Tanzanian forests (including mangroves), to the equilibrium between economic growth, poverty reduction and improved environmental conservation.

Specific objectives:
SO1: To increase forest stock and forest cover through improved planting materials and protection of growing forest stocks in expansion areas of selected forest plantations.
SO2: To strengthen strengthen coastal biodiversity and ecosystem services through protection, rehabilitation of degraded mangrove areas, including with development of ecotourism services.
SO3: To improve sustainable livelihood of the forest adjacent communities through supporting conservation based and eco-tourism economic activities.
SO4: To develop sustainable revenue base for TFS and strenghthen TFS capacity to manage forest resources in selected plantatations, mangroves and nature forest reserves.

Results chain (NB: C = Component / A = Activity)	Objectively verifiable indicators	Sources	Baseline and Targeted value
C1: To upscale and diversify forest plantations in three pilot Forest Reserves			
A1.1 – Improving tree seed quality and quantity and tree seed management	Numbers and areas of seed orchards and species progeny trials established	Progress reports	BV: 0 / TV: 12 seed orchards; 11 species progeny trials
	Number of modern nurseries established	Progress reports	BV: 0 / TV: 3 nurseries
	Number of staff trained in seed and tree breeding aspects	Training reports	BV: 0 / TV: 18 staff
A1.2 - Upscaling of forest plantations in the Mtibwa forest plantation	Area of new forest plantations sustainably managed	Internal GIS/DB of TFS	BV: 0 / TV: 2,500 ha
A1.3 - Upscaling of forest plantations in the Wino forest plantation	Area of new forest plantations sustainably managed	Internal GIS/DB of TFS	BV: 0 / TV: 5,000 ha
A1.4 - Upscaling of forest plantations in the Silayo forest plantation	Area of new forest plantations sustainably managed	Internal GIS/DB of TFS	BV: 0 / TV: 15,000 ha
C2: To enhance coastal ecosytems and their biodiversity			
A2.1. Strengthening forest protection	Number of beacons installed	Progress reports	BV: 0/ TV: 450 pcs
	Number of sign boards installed	Progress reports	BV: 0/ TV: 50 pcs
	Number of patrols	Progress reports	BV: 50/ TV: 190 patrols
A2.2. Strengthening community participation and developing alternative livelihoods and sustainable economic activities.	Number JFM agreement signed,	Progress reports	BV: 0/ TV: 50 agreements
	Number of consultative meetings	Progress reports	BV: 0/ TV: 20 meetings
	Number of beekeepers groups	Progress reports	BV: 0/ TV: 50 beekeepers' groups
	Number of small-scale fish/crab groups	Progress reports	BV: 0/ TV: 50 small-scale fish/crab groups
A2.3. Restoration of the degraded mangroves;	Degraded area restored	Progress reports	BV 1000 ha/ TV: 2000 ha
A2.4. Develop tourism attractions in the mangroves	Feasibility study report in place	Progress reports	BV: 0/ TV: 1
A2.5. Generate carbon credits to co-finance mangrove management	Feasibility study report in place	Progress reports	BV: 0/ TV: 1
C3: To strengthen the technical, logistic, and institutional capacities of TFS			
A3.1 - Staffing and strengthening the technical capacities of TFS, in particular: GIS/Database, forest fires monitoring and fighting; AFD procurement procedures	Number of staff recruited in plantations	Biannual and annual reports	BV: 84/ TV: 198
	Number of staff recruited in mangroves	Biannual and annual reports	BV: 7/ TV: 55
	Internal procedures for HR; procurement and financial management upgraded.		BV: 1/TV:1
	Effective & operational GIS/Database system established		BV: 1/TV:1
A3.2 - Strengthening the logistic capacities of TFS (housings, equipment, roads.)	Number of houses in forest plantations	Biannual and annual reports	BV: 32 / TV: 89 houses
	Number of houses in mangroves	Biannual and annual reports	BV: 2 / TV: 15 houses

	Number of vehicles in forest plantations	Forest management plans	BV: 27/TV 79 vehicles
	Number of vehicles and boats in mangroves	Forest management plans	BV 3: /TV 13 vehicles and boats
	Number of heavy machines in forest plantations	Forest management plans	BV:2/TV 21 heavy machinery
A3.3 - Strengthening the capacities of TFS in terms of firefighting and fire suppression	Number of staff trained in fire management Number of firefighting equipment purchased	Biannual and annual reports	BV: 84 / TV: 198 staff BV: 0/ TV: 777 fire fighting equipment

5.3. Project Monitoring and Evaluation System

Background

Monitoring and Evaluation (M&E) system is used to assess the implementation status of the Project to specifically (a) ensure that directives are implemented with the agreed timeline (b) promote efficient use of resources during Project implementation. Focus is on the result-based M&E approach to monitor and evaluate the Project implementation status.

The M&E of the Project will be the primary responsibility of the Project Coordinator and TFS (Planning Section). In addition, the MNRT should provide external evaluation of implementation of the Project.

Performance indicators and result matrix

The performance indicators are expected to provide evidence-based implementation status of the Project. They are divided into two groups i.e., output and outcome indicators. Output indicators include tree survival, mean annual increment, area planted with different species, area affected by fire, area affected by pathogens or insect pests, km of roads constructed. Outcome indicators include change in productivity and quality of plantations and change in area under different species. These indicators will be regularly updated and included in the biannual and annual reports of the project, to be used by the Steering Committee to assess the level of implementation of the project and take any necessary action.

Data collection and analysis

The Project and TFS M&E Section will collect primary and secondary data to provide evidence on the implementation status of the Project. The following ways will be used to collect data: (i) Verbal communication among different actors (ii) Performance reports prepared by relevant Sections (iii) External Auditors' reports (iv) Scheduled meetings to assess progress and implementation (v) Periodic follow up of Project implementation (vi) Correspondences between relevant offices (vii) Physical verification on Project implementation.

Monitoring and evaluation reports

M&E reports provide feedback on the Project implementation status and inform decision making at different levels. The following M&E reports will be prepared by the key actors

(i) Progress reports (monthly, quarterly, semi-annually and annually) (ii) Internal Auditors reports (quarterly) (iii) External Auditors reports (annually) (iv) Evaluation reports (mid-term and end of term of the Project).

Reports will be presented and discussed at Project level, Zonal level, Directorate level, Steering Committee level and at the Ministerial Advisory Board Level.

5.4 Economic and Financial Analysis of forest plantations

5.4.1 Silayo forest plantation

Under the Silayo forest plantation project, 3,000 ha of various Pinus trees species will be planted each year for a period of five years, making a total of 15,000 ha of new planted forest area after five years. The project will have a time horizon of 22 years, whereby, at year 22, all trees planted during year 1 to 5 will have been harvested. Products to be harvested under this project will be poles and withies during first thinning which will take place at the age of 8 years. Sawlogs will be harvested during second thinning which will be undertaken at the age of 13 years as well as during clear-felling which will be undertaken at the age of 18 years. The Internal Rate of Return (IRR) for implementation of Silayo forest plantation project was found to be 13.35% as shown in Table 21. The observed IRR (13.35%) is above bank borrowing rate of 9% (banks such as CRDB and NMB) for agricultural projects in Tanzania, revealing that the project implementation will be profitable. Sensitivity analysis was conducted for increase in costs which in recent years many items have shown a significant increase. Other parameters e.g. interest rate, were considered to be relatively stable in the projected period. However, a sensitivity analysis revealed that even if costs of production would increase by 20% during the project implementation period, the project will remain to be profitable because IRR for the project will be 11.88% which is still greater than the bank borrowing rate of 9%.

5.4.2 Wino forest plantation

Regarding Wino forest plantation project, 1,000 ha of various Pinus tree species will be planted each year for a period of five years, making a total of 5,000 ha of new planted forest area after five years. Just as for Silayo forest plantation project, Wino project will have a time horizon of 22 years, whereby, at year 22, all trees planted during year 1 to 5 will have been harvested. Products to be harvested under this project will be poles and withies during first thinning which will take place at the age of 8 years. Sawlogs will be harvested during second thinning which will be undertaken at the age of 13 years as well as during clear-felling which will be undertaken at the age of 18 years. The IRR for implementation of Wino forest plantation project was found to be 13.82% as shown in Table 21. The observed IRR (13.82%) is above bank borrowing rate of 9% (banks such as CRDB and NMB) for agricultural projects in Tanzania, revealing that the project implementation will be profitable. However, a sensitivity analysis revealed that even if costs of production would increase by 20% during the project implementation period, the project will remain to be profitable because IRR for the project will be 12.34% which is still greater than the bank borrowing rate of 9%.

5.4.3 Mtibwa Forest Plantation

Implementation of Mtibwa forest plantation project will involve planting of 500 ha of Teak trees (*Tectona grandis*) each year for a period of five years, making a total of 2,500 ha of new planted forest after five years. In comparison to Silayo and Wino Forest Plantation projects, this project will have two more years for the time horizon (i.e., 24 years), whereby, at year 24, all Teak trees planted during year 1 to 5 will have been harvested. Products to be harvested under this project will be poles during first and second thinning which will be at the age of 8 years and 13 years respectively. Sawlogs will be harvested during clear-felling which will be undertaken at the age of 20 years. The IRR for implementation of Mtibwa forest plantation project was found to be 19.74% as shown in Table 21. The observed IRR (19.74%) is above bank borrowing rate of 9% (banks such as CRDB and NMB) for agricultural projects in Tanzania, revealing that the project implementation will be profitable. However, a sensitivity analysis revealed that even if costs of production would increase by 20% during the project implementation period, the project will remain to be profitable because IRR for the project will be 18.47% which is still greater than the bank borrowing rate of 9%.

Table 21: Economic and financial analyses of Silayo, Wino and Mtibwa forest plantations

Forest Plantation		Items	Total (TZS)	Sensitivity (costs increase by 20%) TZS
I. Silayo FP	1	Costs	103,034,365,666.67	123,641,238,800.00
	2	Revenue	539,766,000,000.00	539,766,000,000.00
	3	Net-revenue	436,731,634,333.33	416,124,761,200.00
	4	Discounted Net-revenue (*r=13%)	NPV = 2,273,931,403.29	NPV= 7,720,079,780.24 (r=11%)
	5	**IRR=13.35%**		**IRR = 11.88%**
II. Wino FP	1	Costs	32,706,788,555.56	39,248,146,266.67
	2	Revenue	179,922,000,000.00	179,922,000,000.00
	3	Net-revenue	147,215,211,444.44	140,673,853,733.33
	4	Discounted Net-revenue (r=13%)	NPV = 1,706,108,688.93	NPV= 872,133,833.24 (r= 12%)
	5	**IRR= 13.82%**		**IRR = 12.34%**
III. Mtibwa FP	1	Costs	18,974,180,121.21	22,769,016,145.45
	2	Revenue	337,977,500,000.00	337,977,500,000.00
	3	Net-revenue	319,003,319,878.79	315,208,483,854.55
	4	Discounted Net-revenue (r= 19%)	NPV = 800,334,292.70	NPV = 623,372,250.92 (r = 18%)
	5	**IRR = 19.74%**		**IRR=18.47%**

5.5 Detailed Budget

TFS is intending to improve four areas of its operations, namely, (i) expand its forest plantation area by 22,500 ha (ii) strengthen Tree Seed Collection Centres and tree breeding technology, (iii) strengthen institutional capacity to manage forest plantations and tree breeding programmes, and (iv) improve management of mangroves. Initial budget estimation for these activities was about TZS 77.15 bil, however, the budget increased to TZS 98.57bil (equivalent to Eur 41,595) as shown in Table 22 after making a more critical analysis of information from a survey done in three forest plantation projects under TFS (Mtibwa, Silayo and Wino forest plantations) and the two mangrove forests which revealed that costs of fire protection and roads construction and maintenance were under estimated in the initial budget. In addition, the budget for mangrove conservation was not part of the budget presented in the concept note submitted by TFS.The survey found that the risk of fire needs to be addressed more properly by investing better in the areas of fire protection and roads construction and maintenance for the viable implementation of the three forest plantation projects and the two mangroves. However, the number of infrastructure items and quantities applied in the budget estimation are to a large extent based on those indicated in the concept note which were found to be more realistic given the size of the three forest plantations and the two mangroves targeted by this loan, and the desire by TFS to commit part of the loan for mangrove conservation. The number of infrastructure items and quantities indicated in various tables (7,8 and 9) can be used as guide for future expansion and support.

Components 1 and 3 will be financed by a concessional loan from AFD to the Government of Tanzania. In addition, AFD will provide grant of Eur 2 million to finance the mangroves that are indicated under component 3. Also, under component 3, TFS is intending to use part of the loan (equivalent to Eur 3 million) to improve management and conservation of the two mangrove forest reserves. Appendix 14 and Appendix 15 show the procurement plan and financial plan, respectively. The detailed conditions of the loan will be negotiated between AFD and the MoFP of Tanzania. Proposed schedule of disbursement flow of funds is indicated in Table 23. The proposed disbursement schedule is based on amount of funds required per year to operationalize activities as indicated in the budget in Table 22.

Table 22: Budget estimates for components 1, 2 and 3 for the Silayo, Wino and Mtibwa forest plantations expansion

Component (C) / Activity (Ax.x) / Sub-Activity (Ax.xx)	Unit	Quantity	Unit price		Total price		
			M TZS	Eur	B TZS	Th Eur	% Tot
C1: To upscale and diversify forest plantations in three pilot Forest Reserves					**63.01**	**26,587**	**63.9 %**
A1.1 – Improving tree seed quality and quantity and tree seed management					1.80	760	2%
A1.1.1 Establishment of seed orchards	Orchard	12	36.05	15,212	0.43	183	0%
A1.1.2 Establishment of species progeny trials	Trial	11	37.34	15,756	0.41	173	0%
A1.1.3 Establishment of modern nurseries	Nursery	3	228.74	96,522	0.69	290	1%
A1.1.4 Training in seed and tree breeding aspects	Staff	18	15.026	6,341	0.27	114	0%
A1.2 - Upscaling of forest plantations in the Mtibwa forest plantation	ha	2,500	2.77	1,171	6.94	2,927	7%
A1.3 - Upscaling of forest plantations in the Wino forest plantation	ha	5,000	2.66	1,121	13.29	5,607	13%
A1.4 - Upscaling of forest plantations in the Silayo forest plantation	ha	15,000	2.73	1,153	40.98	17,293	42%
C2: To sustainably manage mangrove forests in two pilot Forest Reserves			**-**	**-**	**10.39**	**4,386**	**10.5 %**
A2.1 - Strengthening forest protection					1.39	586	1%
A2.2 - Strengthening community participation and developing alternative livelihoods and sustainable economic activities				-	2.13	900	2%
A2.3 - Restoration of the degraded mangroves;				-	3.79	1,600	4%
A2.4 - Develop tourism attractions in the mangroves				-	1.66	700	2%
A2.5 - Generate carbon credits to co-finance mangrove management				-	1.42	600	1%
C3: To strengthen the technical, logistic and institutional capacities of TFS					**24.07**	**10,157**	**24.4 %**
A3.1 - Additionnal staffing for TFS and short traing for plantations and mangroves	Training	250	6	2,532	1.50	633	1.5%
A3.2 - Strengthening the monitoring capacities of TFS	Lumpsum	1	200	84,394	0.20	84	0.2%
A3.3 - Strengthening the logistic capacities of TFS					18.20	7,680	18%
A3.3.1 Construction of ranger offices (14 plantation and 6 mangroves) and 2 Offices	Building	22	100	42,197	2.20	928	2%
A3.3.2 Construction of staff houses for plantations and mangroves	Building	30	200	84,394	6.00	2,532	6%

A3.3.3 Purchase of vehicles for field activities (Pickup, LandCruisers and boats) for plantations and mangroves	Vehicle	20	200	84,394	4.00	1,688	4%
A3.3.4 Purchase of lorries (long base, tipper)	Lorry	4	500	210,986	2.00	844	2%
A3.3.5 Purchase of heavy duty machines for forest road construction	Machine	4	1000	421,971	4.00	1,688	4%
A3.4 - Strengthening TFS capacities in terms of forest fire prevention and suppression					4.17	1,760	4%
A3.4.1 Fine-tuning (elaborating) a National Forest Fire Strategy and Work Plan	Lumpsum	1	120	50,637	0.12	51	0.1%
A3.4.2 Improving forest fire prevention							
A3.4.3 Improving forest fire suppression measures							
A3.4.4 Purchasing forest fire-fighting infrastructure and equipment for the 3 FP	Per FPs	3	1350	569,661	4.05	1,709	4%
C4: To coordinate, monitor and evaluate, and audit the project					**1.10**	**465**	**1.1%**
A4.1 - Coordinating the project					0.84	355	1%
A4.2 - Monitoring and evaluating the project					0.14	60	0.1%
A4.3 - Auditing the project					0.12	50	0.1%
				TOTAL	**Total price**		
TZS/Eur exchange rate:	2,369.83	(as of July 19, 2022)			**B TZS**	**Th Eur**	**% Tot**
					98.57	**41,595**	**100%**

Table 23: Proposed schedule of disbursement flow of funds

Total price			Funding (Th Eur)			Annual needs (B TZS)				
B TZS	**Th Eur**	**% Tot**	**AFD loan**	**AFD grant**	**EU**	**Y1**	**Y2**	**Y3**	**Y4**	**Y5**
98.57	**41,595**	**100%**	**35,209**	**2000**	**4386**	**23.48**	**15.78**	**18.03**	**19.51**	**18.89**

The proposed schedule of disbursement is based on the amount of funds required for each year as indicated in the budget details in Table 22.

5.6 Project Implementation

5.6.1 Institutional and operational framework

Institutional implementation arrangement
TFS has been implementing grant projects with and without Technical Advisors. Overall, TFS management capacity has enabled successful implementation of these projects. One recent project successfully implemented by TFS is "Enhancing the forest nature reserves network for biodiversity conservation in Tanzania 2015-2020" (TFS/GEF/UNDP 2015). The grant had a value of US$ 23.1 mil. The project was positively evaluated during terminal evaluation (TFS/GEF/UNDP 2020). Indeed, establishment of a Project Coordination Unit (PCU) that is fully integrated into the Government Agency that will take responsibility for ongoing replication and scaling-up of post-project activities provides the best possible chance for project sustainability (TFS/GEF/UNDP 2020). In view of the foregoing, it is recommended that the Project Components be managed by a PCU under TFS.

The plantation and capacity building components will be implemented by TFS staff in the plantations, directly supervised by Forest Plantation Conservators. The mangroves component will also be implemented by TFS staff, directly supervised by mangroves Reserves Conservators. However, some of the initial activities such as project operation, procurement, financial management manual, will require engagement short term experts. The Conservation Commissioner (CC) will appoint a Project Coordinator who will be responsible for the overall management of the Project (Both plantations and mangroves components). The Project Coordinator will report to the Head of Forest Plantations Section on plantations matters and Head of Mangroves Section on mangroves matters. Both Sections are under the Directorate of Resource Management at TFS HQ.

Project Steering Committee
A Project Steering Committee will be established comprised of CC (Chair), Deputy CC Resource Management, In-charge of Forest Plantations at TFS HQ, In-charge of mangroves at TFS HQ, Project Coordinator (Secretary), one member each from MNRT, MoFP and AFD. This will be the decision-making body of the project. The Committee will receive and approve annual progress reports and annual work and financial plans.

Duties and responsibilities of the Project Coordinator
The duties and responsibilities of the Project Coordinator will include: mobilization of all project inputs in accordance with government procurement procedures; supervision and coordination of the work of all project staff as well as Service Providers and Civil Contractors; supervision, coordination and timely production of project reports (quarterly and annual) and submission to TFS, AFD and Steering Committee, coordination with Plantation/Mangrove Conservators on the preparation and revision of annual work and financial plans; liaising with AFD on project matters; backstopping project activities as found necessary; ensuring the timely and effective implementation of all components of the project; and undertaking inspection of field activities.

Procedures for project operation
The procedures for project operation will be normal Government procedures followed during execution of routine activities within TFS. Unless if there are specific agreed procedures by the two parties for the purpose of strengthening supervision and operation of the project and meeting the requirement of funding without jeopardizing the other existing laws of the land.

5.6.2 Sustainability

Environmental sustainability
Mosaic tree planting in the Plantations Component while retaining patches of natural forests will promote environmental sustainability, as project activities will lead to restoration of degraded patches of natural forests and thus enhance their service roles as water catchment areas and/or as biodiversity areas. For example, mosaic planting in Mbizi forest plantation in Rukwa region resulted in recovery of the degraded natural vegetation and increased water flow in a river supplying water to Sumbawanga town (TFS, 2017). Environmental sustainability will be indirectly promoted by the project through increasing timber supply from plantations and thus reducing threats to natural forests through illegal felling of trees for timber. Also, in the course of implementation of project activities, surrounding communities will gain more knowledge and skills in forest plantation and woodlot establishment and management. This will instil zeal and eagerness for engaging in woodlot establishment and management thus promoting environmental sustainability, as has occurred in areas around Sao Hill forest plantation in the southern highlands. In the Mangrove Component, improved protection will also enhance their production and service roles such as Carbon storage (3-5 times higher than tropical upland forest), supporting other life forms (e.g., nursery habitat for fish and shrimp), maintaining water quality and protecting the shoreline thus promoting environmental sustainability. Also, community income generating projects are expected to reduce pressure on the mangroves.

Institutional sustainability
The Plantation Component will also lead to achieving institutional sustainability at individual levels as skills and knowledge of TFS staff in best silvicultural practices, tree seed management, GIS, and fire protection using modern technology will be enhanced. This will lead to the replicability of these in non-project sites. The project will also contribute to improving the capacity of TFS in plantation infrastructure and equipment. For the mangroves component, staff will enhance their skills in protection, eco-tourism and recreation and promoting community income generating activities. These will later be replicated in non-project sites.

Financial sustainability
Eco-tourism and recreation activities in the mangroves component will contribute to TFS financial sustainability. For the plantations component, TFS will continue project activities at the same planting rates at the end of the 5 year loan period, using funds that were previously allocated to planting in expansion areas in some forest plantations which have now been fully planted. For example, Sao Hill has been planting about 3,000 ha per year in expansion areas which have now been fully planted (TFS, 2022b). This will ensure sustainability of project activities at the end of loan support.

Social sustainability

For the Plantations Component, social sustainability will be enhanced through involvement of communities living in villages adjacent to the forest plantations in full time and/or part time employment, Taungya farming in plantations and beekeeping activities. Also, social sustainability will be enhanced through direct involvement of forestry Service Providers and other contractors (e.g. for civil works) in project activities. For the mangroves component, social sustainability will be enhanced through involvement of the private sector, local communities and non-governmental organisations in project activities including eco-tourism and recretional activities as well as supporting local comunities in income generating activities. Local communities will also be involved in full time and/or part-time employment in mangroves project activities. It is expected that there will be replication of these interventions to non-project sites. TFS will also continue to practice corporate social responsibility (CSR) with communities surrounding the project plantations as this was found to contribute significanly in building good rapport with villages.

5.6.3 Local content opportunities

The Project will enhance local content opportunities by ensuring that goods and equipment that are locally manufactured are purchased for the project, provided that they meet the required standards and quality. Further, Local Construction Companies will be involved in relevant project activities following the normal procurement procedures. Currently, there are several Forestry Service Providers for nursery and field operations, and some large scale private commercial forestry companies in the Southern highlands are using them. TFS may also wish to use Forestry Service Providers in some of its operations. The Forestry Service Providers who are mainly graduate foresters have received relevant training provided by FDT based in Iringa.

5.6.4 Legal, regulatory and tax aspects

The TFS is a legal entity that follows the government financial regulations and standards. Since its establishment, TFS has been audited with an unqualified opinion by Controller and Auditor General on annual basis and has made all necessary contributions to the government consolidated fund.

The Project will comply with all statutory, regulatory and tax requirements of the country. Relevant AFD loan requirements as agreed with the Government of Tanzania will also be complied.

6. PROJECT RISK ASSESSMENT AND CO-BENEFITS

6.1 Country, Institutional and Legal Risks

Tanzania has remained politically stable since independence in 1961 and therefore no major risk is expected to impact the project implementation. The majority of Tanzanians are able to communicate using one language (Kiswahili) which helps to create peace and harmony among communities. In terms of governance, the country has developed a well-structured authority system from central to local level which helps to resolve challenges and issues. Global crisis (e.g., COVID19) has slowed down economic growth and increased unemployment and social welfare. However, recent interventions to boost the country economy seem to indicate positive results and hence low macroeconomic risks. The country is also trusted and has built confidence among national and international lending institutions (e.g., International Monetary Fund and the World Bank).

There shall be no or minimal institutional and legal risks due to the current TFS set up where the management of forest resources is under paramilitary system which strengthens protection. This move will also improve human resources safety and security. Further, TFS is among the recently awarded best performing institution in human resources management in public services as well as best performing institution with Information Technology and electronic M&E systems. The move to upgrade TFS to an Authority will also give it more autonomy in decision making and thus facilitate quick implementation of resolutions.

6.2 Technical risks

Currently, the main technical risk facing forest plantations is forest fire. It is expected that fire risks will be minimal given the developed fire management strategies, proposed procurement of modern firefighting technologies as well as continuous staff training and awareness activities to local communities on fire management. The forest plantations face insect-pests and pathogens attack but the levels have not been threatening. The proposed plantation sites currently have no insect-pest and pathogens attack and therefore, the risks are considered at low scale.

6.3 Market risks

No major market risks are expected because of the proven shortage of wood raw materials and the growing medium and large-scale wood industries in the country. Field survey have shown that the market for wood products is growing, and wood industries are also growing indicating that there is no expected market risk. However, there might be minimal competition of wood transmission poles with the currently introduced concrete transmission poles favoured in waterlogged areas.

6.4 Social and Environmental risks[1]

The Environmental and Social Management Framework (ESMF) is a tool for identifying and assessing the environmental and social risks of a programme and its

[1] **Note**: *for the full Social and Environmental risks assessment, please see the joint Environmental and Social Risk Assessment (ESRA), Environmental and Social Management Framework (ESMF) and Complaint Mechanism (CDM).*

components. It defines the principles, rules, guidelines and procedures for assessing environmental and social risks and impacts. It contains measures and plans to reduce, mitigate or compensate for the risks and adverse effects. The programme and each of its components must meet a number of principles as defined by the World Bank:

a) Avoid or mitigate the negative impacts of the programme/project on the population and the environment;
b) Preserve or restore biodiversity and natural habitats, and promote the rational and equitable use of natural resources and ecosystem services;
c) Promote the health and safety of workers and communities;
d) Ensure that people or communities affected by the project are not adversely affected by it and are not discriminated against, with particular attention to indigenous peoples, minorities, and disadvantaged or vulnerable segments of the population, especially where the project is likely to have adverse effects or where its development benefits are to be shared;
e) Address the impact of the project on climate change and consider the impact of climate variability on project selection, siting, planning, design, implementation and decommissioning; and
f) Optimize stakeholder engagement by increasing consultation, facilitating stakeholder participation in project activities, and strengthening the ethic of accountability.

These principles are contained in some of the Environmental and Social Standards (ESS) whose application in TFS project are discussed in Table 24 and Table 25.

Table 24: Environmental Risks

Topics	Required actions to avoid or mitigate the environmental and social risks of the program	In charge	Timeline	Indicators
ESS1 Assessment and Management of Environmental and Social Risks and Impacts				
Lack of implementation of protection status and incidents reporting and incident reporting (mangroves)	An electronic standard incident notification form should be designed and circulated among TFS staff. TFS staff, with the support of VNRCs and BMUs will notify all recorded incidents to the TFS mangrove manager, and this information will be collected in a database system developed and stored at TFS Headquarters. The notification will include as much information as possible regarding the accidents in question, and will indicate the measures taken	TFS mangroves manager, TFS District offices, with the support of VNRCs and BMUs, as well as possible NGOs.	Ongoing. Incidents will be reported immediately (electronic format) to the TFS mangrove manager.	-The incident electronic forms. -The database to collect and centralise incidents. - the cost-benefit analysis and feasibility study to provide the communities with wood/timber coming from TFS plantations.

Topics	**Required actions to avoid or mitigate the environmental and social risks of the program**	**In charge**	**Timeline**	**Indicators**
	without delay to deal with them. In parallel run a cost-benefit analysis and feasibility study to provide the communities with wood/timber coming from TFS plantations should be run.			
Upstream dam-induced hydrologic alterations	Run a feasibility study how to keep input flows from freshwater sources to maintain the hydrological conditions and the balance in the delta.	TFS mangrove manager TFS CC, & LGA.	As soon as possible.	-The feasibility study.
Conflicts with pastoralists over land use (plantations)	Develop a landscape analysis and planning with the local government in order to seek other areas.	TFS plantation manager and TFS District offices. Local government.	As soon as possible, and re-assessed on an annual basis (monitoring reports).	-The landscape analysis and the proposal for mitigation measures.
Offset for (partial) conversion of natural forests into monoculture plantations	Develop an offset programme to make up for the loss of biodiversity and ecological functioning/integrity.	TFS plantation manager and TFS CC.	As soon as possible, and re-assessed on an annual basis (monitoring reports).	-The offset plan, including design, implementation and monitoring.
Carbon crediting and land grabbing (mangroves)	-Develop collaborations, with the communities and inform them about what the Carbon crediting projects entail. Involve the communities from the project design/objectives setting. -Run a feasibility study to assess the total of credits that could be produced over time and the benefit sharing agreement with the communities. -all these steps should be a guarantee against eviction for tree planting/land grabbing.	TFS mangrove manager, with the support of TFS District offices. VNRCs and BMUs. Support from local NGOs.	Community consultation and information events should be carried out as soon as possible and regular informative meetings should be set up.	-The joint TFS and communities' Carbon/ER plan.
NTFPs and agroforestry (mangroves and plantations).	Development of a scheme for the production of sustainable NTFPs and/or agroforestry plots (zone 4	TFS mangrove manager, TFS plantation manager, with the support of TFS District offices.	As soon as possible, and re-assessed on	-The agroforestry scheme and technical plans for mangroves and plantations.

Topics	Required actions to avoid or mitigate the environmental and social risks of the program	In charge	Timeline	Indicators
	in mangroves), and within plantations.	Involvement of VNRCs and Beach Management Units (BMU). Support from local NGOs.	(monitoring reports)	
Irregular presence and involvement of NGOs (mangroves and plantations)	TFS to engage further with NGOS, maintain working relationships or re-establish them, especially in relation to plans (ecotourism, NTFPs) listed in this Environmental and Social risk analysis.	TFS suboffices NGOs VNRCs BMUs.	As soon as possible, and ongoing.	-Reports on meetings with NGOs. -New contracts/projects with NGOs.
Invasive Alien Species (IAS) (mangroves)	Assessment of the most impacted areas. Development of a management/control plan according to the areas	TFS mangrove manager, TFS sub offices, VNRCs and BMUs	As soon as possible, and ongoing	-The IAS management/control plan
Loss of optimum hydrological conditions for natural regeneration (mangroves)	Run a feasibility study to re-assess the landscape, i.e. evaluating the environmental conditions. It is important to analyse parameters such as substrate salinity, wave energy, slope and submersion.			-The technical plan for the restoration of the mangroves with natural regeneration and propagules or seedlings planting
ESS4: Community Health and Safety				
NTFPs (mangroves and plantations)	Run an assessment of the current NTFPs production means and supply chain (including mangrove-honey and plantation-honey). According to the results, develop a NTFPs improvement scheme. Run a cost-benefit analysis for a timber-provision scheme (plantation timber to be delivered in the mangroves).	TFS mangrove manager, TFS plantation manager, with the support of TFS District offices. Involvement of VNRCs and BMUs. Support from local NGOs.	As soon as possible, and re-assessed on (monitoring reports).	-The NTFP assessment. - The NTFP improvement scheme.
Agroforestry (mangroves and plantations)	See ESS1			
Physical exposure to tsunamis and cyclones	Reinforcement of mangroves populations and their integrity, as well as protection of coral reefs (enforcement of law to forbid use of explosives for fishing) and seagrass	TFS mangrove manager, TFS CC. Involvement of VNRCs and BMUs. Support from local NGOs.	Ongoing and as soon as possible.	-The protection and restoration plan for the mangrove- sea grass bed and coral reefs system.

Topics	Required actions to avoid or mitigate the environmental and social risks of the program	In charge	Timeline	Indicators
	to keep the impact of tidal amplitude and extreme climatic events as low as possible.			
ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement				
Carbon crediting and land grabbing (mangroves)	See ESS1			
Ecotourism	Perform a feasibility study with the support of expert external parties for the development of an ecotourism strategy and implementation plan.	TFS CC and mangrove manager. External parties specialized in ecotourism.	To be organized as soon as possible within TFS.	-The ecotourism strategy and implementation plan.
ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources				
Mangrove restoration in zones 2 and 3	Assessment of the state of degradation, with spatial planning and design of technical reforestation plans (natural regeneration and planting). Development of nurseries.	TFS mangrove manager with the support of each TFS Zonal Commander.	Land use planning should be carried out as soon as possible to determine the different areas.	-Technical reforestation plan. -Precise shapefile of all zones to be restored and under which management (natural regeneration or planting).
Invasive Alien Species (mangroves)	See ESS1			
Phase out salt pans and aquaculture, and develop sustainable alternatives (mangroves)	Run cost-benefit analysis of salt pans and aquacultures within mangroves. Assessment of the quantity of salt that can be produced by the communities in these fragile ecosystems, and to provide them through salt, aquaculture or shrimp farms schemes. Investigate the efficiency of fish-based farming systems in the areas, and possibly investigate other types of aquacultures away from the mangroves after landscape analysis.	TFS mangrove manager, with the support of TFS District offices. Support from local NGOs.	As soon as possible, and ongoing.	-The cost-benefit analysis. - The assessment of alternatives. - Report on sustainable socio-economic alternatives.
NTFPs (mangroves and plantations)	See ESS4			
Agroforestry (mangroves and plantations)	See ESS1			

Topics	**Required actions to avoid or mitigate the environmental and social risks of the program**	**In charge**	**Timeline**	**Indicators**
Remaining wetlands in plantations	Map them out (spatial analysis). Develop compensation measure for the ones that have already been planted and destroyed.	TFS plantation manager and TFS District offices. VNRCs.	As soon as possible, and re-assessed on an annual basis (monitoring reports).	-The technical plan (design and implementation, and monitoring).
Belt zones (plantations)	Assess the native species that could be selected and planted both for wildlife (lifecycle, ecological corridors) and for local communities (NTFPs production). The threatened status of each species should also be a priority-setting criteria (IUCN Red List, international or national).	TFS plantation manager and TFS District offices. VNRCs.	As soon as possible, and re-assessed on an annual basis (monitoring reports)	-The technical plan (design and implementation, and monitoring)
Offset for (partial) conversion of natural forests into monospecific plantations	See ESS1			
Physical exposure to tsunamis and cyclones	See ESS4			
Loss of optimum hydrological conditions for natural regeneration (mangroves)	See ESS1			

Table 25: Social Risks

Program E&S Risk Assessment		**Intensity**	**Duration**	**Frequency**	**Area**	**Mitigation measures and/or opportunities**	**Involved parties**	**Timeline**	**Indicators**
Risks	***Description***	***A-D***	***A-D***	***A-D***	***A-D***	***Description***			
Abuses and violations of the rights of communities	Endorse the exclusion of rural communities, from their customary lands, depriving them of their livelihoods, spiritual and medicinal practices.	B	B	B	C	- development and operationalization of Forest Adjacent Communities Forum. - mechanism that integrates the issue of the rights of communities at all stages of the program and its components - coherence of the different legal instruments. - new procedure for the demarcation and registration of land in accordance with customary land rights.	- TFS plantations/ mangroves manager - TFS officers - Local government	- As soon as possible (ASAP)	- Forest Adjacent Communities Forum. - New procedure for the demarcation and registration of land.
Land competition, land grabbing forced evictions and corruption	Generate land speculation, land grabbing or expropriation and territorial conflicts.	A	B	B	B	- ensure that there is no displacement (physical or economic) of the affected populations without the consent of the affected populations (Free and Prior Informed Consent/FIC) and a Resettlement Action Plan. - collect reliable and complete data. - Mapping should not be restricted to maps of village territories. - ensure that all use rights are clearly represented, even if they overlap and are antagonistic/ competitive/ contradictory.	- VNRCs and BMUs. - TFS plantations/ mangroves manager. - TFS officers. - Local government.	- ASAP	- Free and Prior Informed Consent (FPIC). - Resettlement Action Plan. - Map of the zone.

Program E&S Risk Assessment		**Intensity**	**Duration**	**Frequency**	**Area**	**Mitigation measures and/or opportunities**	**Involved parties**	**Timeline**	**Indicators**
Risks	***Description***	***A-D***	***A-D***	***A-D***	***A-D***	***Description***			
Increased risk of abuse of communities	Increased intimidation, violence/torture by private actors	C	C	C	C	- If appropriate, ratifies the ILO Convention 169 on Indigenous and Tribal Peoples. - role of VNRC in a better knowledge of indigenous/local populations of their rights and of possible remedies in case of abuse. - a better integration of the local populations in the projects.	- National Government (ILO convention). - PCU and Project Management Units (PMUs). - Coastal Resources Management Council (CRMC). - VNRCs and BMUs. - TFS plantations/ mangroves manager.	- ASAP	- ILO Convention 169 on Indigenous and Tribal Peoples ratification. - Database of incidents' reports. - Complaint and Redress Management Mechanism (CRMM).
Accentuation and reinforcement of social inequalities, increase in poverty, marginalization	Contribute to the acculturation of certain populations, their marginalization and the risk of worsening their food security by hindering the practice of slash and burn agriculture.	B	C	C	C	- conduct of socio-anthropological studies. - taking into account of local knowledge. - constitution of interdisciplinary and intercultural teams. - recognize customary land rights.	- National universities. - Local NGOs. - TFS plantations/ mangroves manager. - VNRCs and BMUs.	- First year of project implementation (mangroves); ASAP (plantations).	- Constitution of an interdisciplinary support team (TFS) - Studies and reports produced.
Resource degradation, land artificialization, change in land use or status leading to increased food insecurity of individuals or specific groups	Weaken the food security of rural populations, particularly local communities, by depriving them of or restricting access to their means of subsistence.	B	B	B	C	- to anticipate the potential population influx by adapting infrastructure and services. - take into account the dependence of the population on the resources of the ecosystem. - promote policies and public investments in favor of family farming. - establish an independent Observatory of civil society.	- VNRCs and BMUs. - TFS plantations/ mangroves manager. - TFS officers. - Local government.	- 2 first years of project implementation (mangroves); ASAP (plantations).	- Observatory of civil society. - Free and Prior Informed Consent (FPIC). - Policies and public investments in favour of family farming.

Program E&S Risk Assessment		**Intensity**	**Duration**	**Frequency**	**Area**	**Mitigation measures and/or opportunities**	**Involved parties**	**Timeline**	**Indicators**
Risks	***Description***	***A-D***	***A-D***	***A-D***	***A-D***	***Description***			
Degradation of cultural heritage	Degradation or destruction of sacred or symbolic places, intangible and tangible heritage, knowledge and know-how through the appropriation or exploitation of land or natural resources.	D	D		D	- Mapping in the project areas of sacred or symbolic sites and preservation of the pharmacopoeia	- VNRCs and BMUs. - TFS plantations/ mangroves manager. - National universities. - Local NGOs. - Local government.	- ASAP.	- Map of the zone.

6.5 Climate Risks

6.5.1. Vulnerability to climate change and Carbon footprint

In terms of temperature and precipitation, the 3 plantations can be characterised as follows (NB: data averaged over the 1991-2021 time series) (https://fr.climate-data.org/afrique/tanzanie) (Figure 8 and Figure 9):

a) Silayo: temperature stable and limited over the year (average: 21.1°C); significant amount of precipitation (1,060 mm/year), mostly spread over October to March;
b) Mtibwa: temperature increase during the rainy season (max 27°C in December-February / min 22°C in June-August) and limited over the year (average: 24.4°C); rainfall pattern quite similar to the one in Silayo (1,001 mm/year, same rainy season);
c) Wino: temperature increase during the rainy season (max 19°C in November-February / min 13°C in June-July) and quite low over the year (average: 16.6°C); large amount of precipitation (1,490 mm/year), mostly spread over October to March.

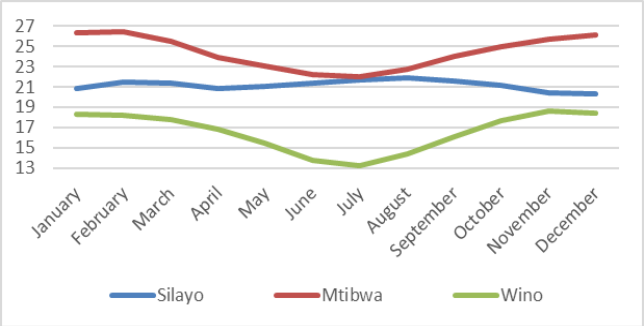


Figure 8: Current temperatures for the 3 forest plantations (climate-data.org, 2022)

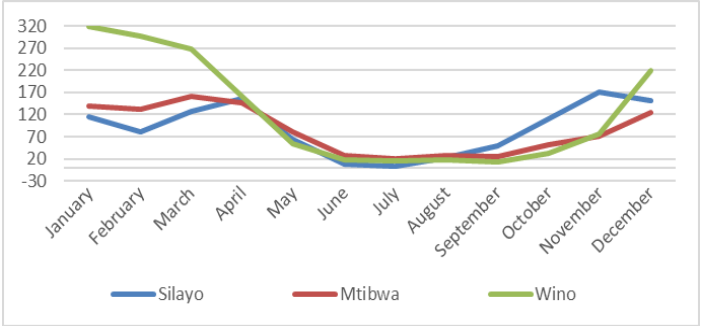


Figure 9: Current precipitation for the 3 forest plantations (climate-data.org, 2022)

As explained earlier, analysis was made of SMHI climate projections: a comparison was made of changes of key climatic variables between the recent past (1981-2010) and the near future (2041-2070) for the 3 Forest plantations, Mtibwa, Silayo, and Wino.

The RCP8.5 (RCP stands for *Representative Concentration Pathway*) was used in this study. In simple words, a climate scenario), which is the most "pessimistic" of the 4 RCPs published in 2014 by the IPCC in its 5th Global Assessment Report (IPCC, 2014), as it assumes 1,313 ppm in 2100, thus generating the "worst case scenarios". The outlines of the soon to be published IPCC 6th Global Assessment Report (https://www.ipcc.ch/report/sixth-assessment-report-cycle/) corroborates the fact that climate change is progressing faster than foreseen in the IPCC 5th Global Assessment Report. Preparing for the climate conditions projected by RCP 8.5 therefore seems pertinent and conservative.

Besides the choice of the RCP8.5, the climate projections are based on the following assumptions: average of the CMIP5 models (i.e. more confidence in considering the combined outputs of 30+ global climate models); bias correction (i.e. duly taking into account past climatic data to fine-tune the climate projections) and downscaling over Africa (i.e. CORDEX grid of 50 km x 50 km).

Of the 28 variables available, 9 were selected, those that are deemed the most relevant for analysing the impact of climate change on the forest plantations. These variables are calculated as follows: (i) Temperature (mean): the mean annual values of daily mean temperature; (ii) Max temperature (mean): the maximum yearly values of daily maximum temperature; (iii) Min temperature (mean): the minimum yearly values of daily minimum temperature, all of them averaged over a 30-year period.

The key findings are that: (i) the mean temperature may raise in the 3 locations, from +1°C to +3°C, with a East-West ascending gradient, (ii) the max temperature may even raise higher in the 3 locations, from +1°C to °5C, with the same gradient (Figure 10).

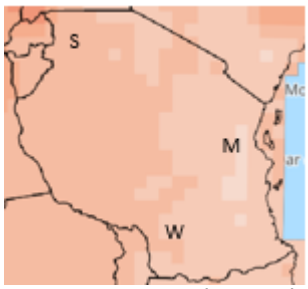
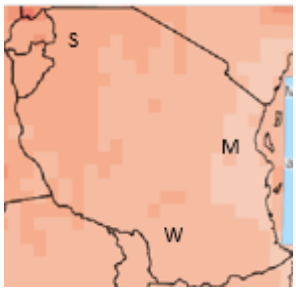
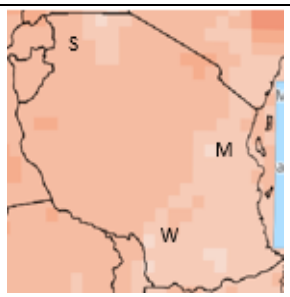
 Temperature (mean)	Mtibwa: +1 / +1,5°C Wino: +2 / +3°C Silayo: +2 / +3°C	 Max temperature (mean)	Mtibwa: +1 / +1,5°C Wino: +2 / +3°C Silayo: +4 / +5°C	 Min temperature (mean)	Mtibwa: +0,5 / +1°C Wino: +0,5 / +1°C Silayo: +1,5 / +2°C

Figure 10: Projections of changes in temperature for the 3 Forest Plantations (authors, based on SMHI, 2022)

For projections of changes in precipitations, variables are calculated as follow: (i) Precipitation (mean): mean annual values of daily precipitation averaged over a 30-year period; (ii) Longest dry spell: maximum number of consecutive dry days (daily precipitation < 1mm) over a 30-year period; (iii) Number of dry spells: number of dry periods for more than 5 days for a 30-year period.

There are no obvious, or at least simple, interpretations to these figures (Figure 11). The key findings are that (i) The mean precipitation may remain stable (-1% / +1%) above a South-East/North-West diagonal, and slightly decrease (-10% / -1%) below this diagonal, which means that the Wino plantations may suffer from a slight decrease of precipitations (ii) However, the longest dry spell may increase all over the country and especially in the 3 locations (+1% / +10%), which means the precipitations may be more concentrated in time, (iii) The number of dry spells may slightly decrease (-10% / -1%) in Wino and Mtibwa, which mean – all things considered - the dry spells may be slightly longer in the 3 locations, but less frequent in Wino and Mtibwa.

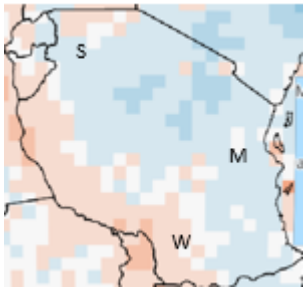
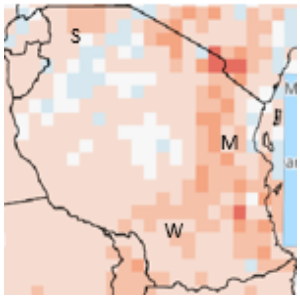
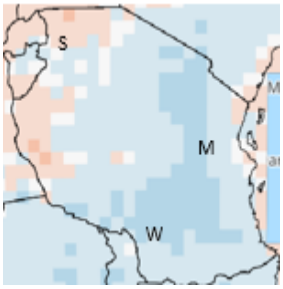
 Precipitation (mean)	Mtibwa: -1% / +1% Wino: -10% / -1% Silayo: +1% / +10%	 Longest dry spell	Mtibwa: +1% / +10% Wino: +1% / +10% Silayo: +1% / +10%	 Number of dry spells	Mtibwa: -10% / -1% Wino: -10% / -1%C Silayo: -1% / +1%

Figure 11: Projections of changes in precipitations for the 3 Forest Plantations (authors, based on SMHI, 2022)

For aridity projections, the variables are calculated as follow: (i) Effective precipitation: monthly mean values of precipitation minus actual evapotranspiration. The month of April was considered, when the rainy season ends in most parts of Tanzania; (ii) Actual aridity (mean): mean annual values of the ratio between actual evapotranspiration and precipitation for a 30-year period. This index is given as a relative change (100*(future period - reference period)/ reference period). Again, the month of April was considered; (iii) Actual aridity (mean): same as before, but averaged over the year.

The key findings are that (i) The actual aridity all over the year may slightly increase (+5% / +10%) in the East, including in Mtibwa; may remain stable (-1% / +1%) in the North-West, including in Silayo; may slightly decrease (-5% / -10%) in the South-West, including in Wino; (ii) the actual aridity in the month of April may increase (> +10%) all over the country, at the exception of its centre, including in the 3 locations; (iii) the effective precipitation in the month of April may decrease (-5% / -10%) all over the country, at the exception of its centre, including in the 3 locations (Figure 12).

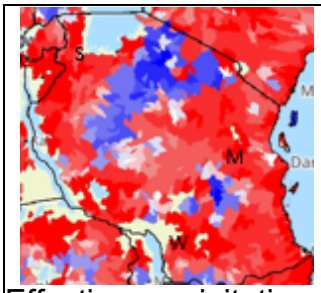
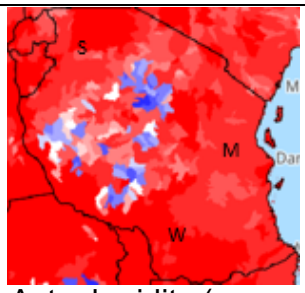
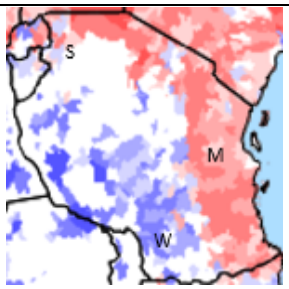
 Effective precipitation (mean. Month of April)	Mtibwa: -5% / -10% Wino: -5% / -10% Silayo: -5% / -10%	 Actual aridity (mean. Month of April)	Mtibwa: > +10% Wino: > +10% Silayo: > +10%	 Actual aridity (mean. All year)	Mtibwa: +5% / +10% Wino: -5% / -10% Silayo: -1% / +1%

Figure 12: Projections of changes in aridity for the 3 Forest Plantations (authors, based on SMHI, 2022)

6.5.2. Vulnerability to climate change

Based on the above data (current climate and projections in terms of climate change), we assessed the vulnerability of the 3 plantations to the following 4 key changes:

a) Lack of water? Will the plantations suffer from water shortage: reduced photosynthesis and therefore reduced increment, or even death of trees due to drought?

b) Excessive temperature? Will the plantations suffer from heating: reduced photosynthesis and increased respiration, therefore reduced increment? The death of trees is not likely to occur just because of excessive temperature (if not in extreme case), as the respiration allows the trees to cool down their internal temperature.
c) Excessive aridity? Aridity is the conjunction of reduce rainfall and increased temperature, leading to a disequilibrium of precipitation compared to evapotranspiration. Therefore, this key change includes the 2 precedent ones and there is no need to repeat the analysis made regarding the impacts of aridity on the plantations/trees. However, it is interesting to assess the impacts of aridity on the herbaceous vegetation, much more sensitive than trees to the effect of aridity and important in terms of forest fire outbreaks. In short, the more aridity, the more fuel on the ground, the more likely there are forest fire outbreaks.
d) Irregularities of rainfall and temperatures? These irregularities not only have impacts on the increment of the trees or the dryness of the herbaceous vegetation (2 key impacts already mentioned above), but also on the insect pests and pathogens (likelihood of occurrence and rate of expansion of existing pests and diseases, and possibly the emergence of new insect pests and pathogens).

To make the key findings easier to read in what follow, the following colour code was used to identify the risk level: low/green; medium/orange; high/red; no estimate/grey. For the Mtibwa Plantation, which may comprise 80% to 90% of *Tectona grandis* (and 10% to 20% diverse tree species), these 4 key changes were assessed, taking into account the auto-ecology of this specie (Orwa et al., 2009a).

Lack of water? *Tectona grandis* grows under a wide range of climatic and edaphic conditions. For example, in northern Togo it grows in a region with an annual rainfall of nearly 600 mm and in Bangladesh a region with close to 4,000 mm. However, its preferred range of precipitation is 1,200 to 2,500 mm/year. The current precipitation is a bit lower than his range (1,001 mm/year in average over 1991-2021), but it may stay stable in the near future (-1% / +1% in 2041-2070, under RCP8.5). The risk is assumed to be low.
Excessive temperatures? *Tectona grandis* also shows plasticity in terms of temperature, being able to grow under a wide range of mean annual temperature, from 14°C to 36°C. The current mean temperature (24.4°C) is in the middle of the range and may slightly increase in the near future (+1°C to +1.5°C in 2041-2070, under RCP8.5). The risk is assumed to be low.
Excessive aridity? Forest fire outbreaks, although not occurring systematically every year, happen in Mtibwa. According to TFS staff, the last large forest fire destroyed 200 ha. The actual aridity may increase in the near future: +5% to +10% in 2041-2070, under RCP8.5, in average for the whole year. It may even rise higher at the beginning of the rainy season: > +10% in 2041-2070, under RCP8.5, for the month of April. This being said, taking into account the forest fire outbreaks and expansion are complex to model (it depends on the ground temperature, the moisture content of the vegetation, the wind speed, the topography etc.), it is difficult to estimate the sole impact of aridity on the probability of occurrence and spread of forest fire. Being conservative (or “pessimistic”, considering the worst-case scenario), the risk can be assumed to be medium.

Rainfall and temperature irregularities? *Tectona grandis* has diverse pests and diseases: *Calothermes tectonae* (main pest, attacking the stem. No effective insecticide known), but also *Eutectona machaeralis* (Teak skeletonizer), *Xyleutes ceramicus* and *Xyleborus destruens* (woodborers), *Hyblaea puera* and *Pyrausta machaeralis* (leaf-eating caterpillars), *Neotermes tectonae* (termite), *Pseudomonas solanacearum* (bacterium attacking young seedlings), *Corticium salmonicolor* (fungi), etc. In the Mtibwa conditions, it seems insect pests and pathogens are limited: there are not highlighted in the management plan and there were not cited as major issues during our field visit. However, taking into account the facts that insect pests and pathogen outbreaks can be caused or aggravated by rainfall and temperature irregularities (e.g. pine beetle ravaging Canadian forests because of shorter and milder winter (Orwa et al., 2009b) or processionary caterpillar expanding to the North of Europe because of temperature increase) (Orwa et al., 2009b), the possibility of having the emergence or expansion of insect pests and pathogens may not be excluded. Due to the complex nature of the underlying phenomena, the risk cannot be estimated.

For the Silayo Plantation, which may comprise 80% of *Pinus caribaea* and 20% of *Eucalyptus camaldulensis*, 4 key changes were assesed, taking into account the auto-ecology of these species (Orwa et al., 2009b; 2009c).

Lack of water? *Pinus caribaea* grows best with rainfall of 2,000 to 3,000 mm/year, but it can cope with lower rainfall, up to 1,000 mm/year. *Eucalyptus camaldulensis* shows a lot of plasticity: it grows under a wide range of climatic conditions, from temperate to hot and from humid to arid zones. The length of the dry season may vary from 0 to 8 months, and the rainfall distribution from a winter maximum in southern regions to a monsoon type with summer rains in northern areas. Its range of precipitation is large: from 250 to 2,500 mm/year. In conclusion, the current and projected precipitations are fine for *Eucalyptus camaldulensis*; for *Pinus caribaea*, the current precipitation is at the lower range (1,060 mm/year in average over 1991-2021), but it may slightly increase in the near future (+1% / +10% in 2041-2070, under RCP8.5). The risk is assumed to be low.

Excessive temperatures? *Pinus caribaea* accepts a large range of mean annual temperature, from 22°C to 37°C. *Eucalyptus camaldulensis* also accepts a large range of mean annual temperature, from 21°C to 40°C. The current mean temperature (21.1°C) is at the lower side of these ranges, but it may increase in the near future (+2°C to +3°C in 2041-2070, under RCP8.5). The risk is assumed to be low.

Excessive aridity? Forest fire outbreaks, although not occurring systematically every year, happen in Silayo. The actual aridity may remain stable in the near future: -1% to +1% in 2041-2070, under RCP8.5, in average for the whole year. But, it may rise at the beginning of the rainy season: > +10% in 2041-2070, under RCP8.5, for the month of April. This being said, as explained for Mtibwa, it is difficult to estimate the sole impact of aridity on the probability of occurrence and spread of forest fire. Being conservative, the risk can be assumed to be medium.

Rainfall and temperature irregularities? *Pinus caribaea* has diverse insect pests and pathogens. The most important insect pests are bark beetles (*Dendroctonus spp, Ips calligraphus*, etc.), followed by aphids (*Pineus laevis, Cinara carolina*, etc.), leaf cutting insects (*Atta spp*.) and termites. *Pinus caribaea* also suffers from diseases caused by pathogens such as foliage blight, stem rot, stem die-back, cone rust, sap stain, heart rot and root rot. Regarding *Eucalyptus camaldulensis,* it seems quite resistant to insect pests and pathogens, but it can be attacked by insects

(termites, aphids, Eucalyptus snout beetle, Eucalyptus borer, etc.). In the Silayo conditions, it seems insect pests and pathogens are limited: there are not highlighted in the management plan and there were not cited as major issues during our field visit. But, as explained for Mtibwa, the possibility of having the emergence or expansion of insect pests and pathogens in a context of climate change characterised by rainfall and temperature irregularities may not be excluded. Due to the complex nature of the underlying phenomena, the risk cannot be estimated.

For the Wino Plantation, which may comprise diverse species of Pinus (*caribaea, kesiya, maximinoi, tecunumanii, etc.*), we assessed these 4 key changes, taking into account the auto-ecology of some of these species (Orwa et al., 2009b; 2009d).

Lack of water? *Pinus caribaea* grows best with rainfall of 2,000 to 3,000 mm/year, but it can cope with lower rainfall, up to 1,000 mm/year. *Pinus kesiya* needs less water and grows in a range of rainfall varying from 700 to 1,800 mm/year, with a pronounced dry season. The current precipitations are fine for both of them (1,490 mm/year in average over 1991-2021) and the projected precipitation either, even if it may slightly decrease in the near future (-10% / -1% in 2041-2070, under RCP8.5). The risk is assumed to be low.

Excessive temperatures? *Pinus caribaea* accepts a large range of mean annual temperature, from 22°C to 37°C. *Pinus kesiya* grows under a lower range of mean annual temperature, from 17°C to 22°C. The current mean temperature (16.6°C) is under the lower side of these ranges, but these 2 species proved to grow even under this range. In addition, the temperature may increase in the near future (+2°C to +3°C in 2041-2070, under RCP8.5). The risk is assumed to be low.

Excessive aridity? The same reasoning than for Mtibwa and Silayo applies here. Forest fire outbreaks, although not occurring systematically every year, happen in Silayo. The actual aridity may slightly decrease in the near future: -5% to -10% in 2041-2070, under RCP8.5, in average for the whole year. But, it may rise at the beginning of the rainy season: > +10% in 2041-2070, under RCP8.5, for the month of April. This being said, as explained for Mtibwa and Silayo, it is difficult to estimate the sole impact of aridity on the probability of occurrence and spread of forest fire. Being conservative, the risk can be assumed to be medium.

Rainfall and temperature irregularities? As explained for Silayo, *Pinus caribaea* has diverse insect pests and pathogens. Regarding *Pinus kesiya,* it can be attacked by bark beetles (*Ips calligraphus*), pine shoot moths (*Dioryctria rubella*), various types of shoot- and stem-boring pyralids, etc. Again, in the Wino conditions, it seems insect pests and pathogens are limited: they are not highlighted in the management plan and they were not cited as major issues during our field visit. But, the possibility of having the emergence or expansion of insect pests and pathogens in a context of rainfall and temperature irregularities may not be excluded. Due to the complex nature of the underlying phenomena, the risk cannot be estimated.

As an overall conclusion for the 3 plantations:

a) The risks posed by the lack of water (reduced increment, or even death of tree) and excessive temperature (reduced increment) appear low;
b) The risks posed by the excessive aridity (forest fire outbreaks) appear medium, reason why a specific set of fire prevention and fire-fighting measures is planned under the Component 3;
c) The risks posed by the irregularities of rainfall and temperatures (likelihood of occurrence and rate of expansion of existing insect pests and pathogens, and possibly the emergence of new insect pests and pathogens) appear difficult to

estimate, due to the complex underlying phenomena. However, these risks should be monitored and forecasted, making best use of GIS and database tools to have a real- time monitoring of insect pests and pathogens emergence and expansion in the plantations, and therefore to take the appropriate actions (biological or chemical control, sanitary cutting, change of provenances or species, etc.).

6.5.3. Carbon footprint

Using the latest version (V9.3.3) of the FAO Ex-Act Tool and the corresponding guidelines (FAO, 2022); it was possible to estimate the cumulative Carbon balance during the lifetime of the plantations (set at 20 years, including 5 years of project and 15 years of capitalization). See example of Mtibwa opposite (Figure 13):

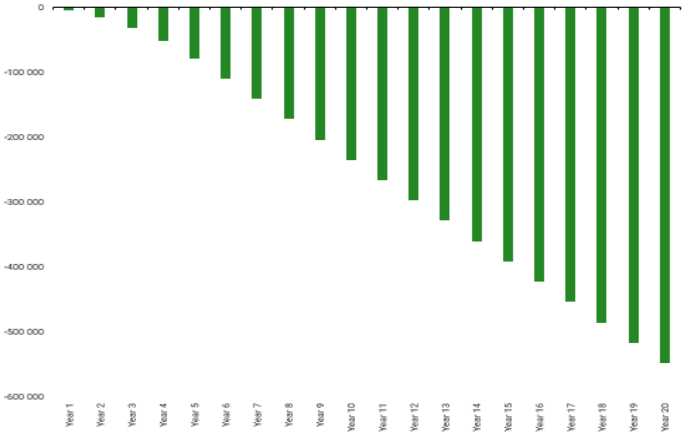


Figure 13: - Cumulative carbon balance for the Mtibwa FP (authors, 2022, using FAO EX Act tool)

For each location, the climate (tropical montane moist for Silayo / tropical moist for Wino / tropical dry for Mtibwa), the soil type (low activity clay soil for Wino and Silayo, high activity clay soil for Mtibwa), the type of plantations, etc were documented. Also it was assumed (in a conservative manner) that a loss of 10% of the plantation will occur due to forest fires.

The net carbon balance over 20 years (gains due to plantations – losses due to forest fires) are as follow: -547,112 $t_{eq}CO_2$ for Mtibwa, -2,226,600 $t_{eq}CO_2$ for Silayo and -885,871 for Wino $t_{eq}CO_2$, thus a total of -3,659,583 $t_{eq}CO_2$ for the 3 plantations.

6.6 Gender Related Risks

Minimal gender risks are expected from the TFS project since in its operations gender consideration is the key aspect observed as per the country institutional and legal frameworks. Emphasis on improving livelihood of both men, women and youth which in turn lead to improved social issues like education, health, and transport and water accessibility have been addressed by forest policy and strategic interventions. All in all, most of the existing regulations, policies and programmes emphasize on gender balance by considering the need of both men and women in terms of their living conditions and access to resources. For example, according to URT (2002), a village land forest management committee has to be established and required to consider gender balance in its member's composition. URT (1998) social framework emphasizes that in implementing beekeeping activities, women's workload has to be reduced through introduction and promotion of modern and appropriate technology and by imparting technological skills to communities.

Some gender disparities have been noted in the TFS project sites in terms of transportation barrier limiting women participation in some places, gender stereotypes in forestry activities with women being discouraged for tough jobs, economic barrier due to poverty among gender groups especially women and youth. Political barriers were not mentioned at all in visited sites. Therefore TFS will need to pay attention on these disparities to attain gender equality in its implemented activities.

For TFS to implement the planned project successfully, there will be a need to mainstream gender issues in the various planned interventions and activities to attain the gender equality. Both men and women expect the planned TFS project to benefit communities around as sources of employment to generate income and offset poverty

as well as protect the environment and regulate climate. The planned interventions thus, should consider the needs of both women, men including youth to ensure inclusiveness in terms of gender equality to access resources (i.e. work, wages, power, health, wellbeing, security, knowledge/education, mobility and time) because of roles attributed to the different groups. The expectations are different in the sense that men seems to target involvement in activities which will give them more profits like tending operations and patrols, while women expect to be more in the nurseries and planting activities whose wage is low but time consuming. According to Kiptot and Franzel (2011), women's rights to tree products are often limited to products that are considered to have little or no commercial value; while men reserve higher value products for themselves. Similarly, Beaujon et al. (2017) noted that forest resource use is differentiated by gender where by men control wood production and commercialization, while women make use of products that are usually less profitable.

To make gender more relevant, TFS will need to promote employment of women and youth as per their gender segregated roles and reward accordingly since these groups were reported to be the most vulnerable around the plantations and mangrove forests. Results from the field observed that despite the fact that both youth, women and men have equal chances of being employed as casual labourers by TFS in plantations and mangroves forests, there are certain type of activities which segregate other groups. For example, in nursery activities the majority (70%) were mentioned to be women, site clearance and preparations for planting the majority were men 98%), transportation of seedlings to various planting sites and tending operations (pruning, thinning) as well as protection (fire patrols and fighting) the majority (70%) were men.

It is also essential for TFS to continue distributing work as per division of labour by gender by considering prevailing norms and values around the plantation and mangroves forests. Results also noted some gender norms and traditions in firefighting activities which TFS will need to take them into consideration to ensure equality. For example at Wino plantation, it was reported that pregnancy women were not allowed to fight fire while their spouses were not allowed to talk in the fighting process. The belief behind is that fire management will be difficult. Thus men need to break these traditional norms by following some procedures before they engage in the firefighting activity. Restrictions for pregnancy women seem to make sense when it comes to issues of health security. On the other hand, the belief on their male counterparts should have to be taken positively as long as the aims of firefighting is to extinguish it and stop the spread. This means TFS projects should promote the equal social value of women and men in terms of femininity and masculinity.

6.7 Gender analysis

From the gender mapping analysis, it has been observed that TFS will need to consider the different interdependent roles of men and women, their rights and opportunities in implementing the planned projects. In both plantation and mangroves forests, gender will need to be considered in activities and opportunities related to site preparation, planting, tending operations, patrols for protection as well as domestic workers to take care of staff working in various sections.

Table 26 shows the overall proportion of men and women in participation to plantation and mangroves forests which TFS planned projects will need to pay attention.

Table 26: Proportion of men and women participating in plantation and mangrove forest activities

Activity	Gender proportions (%)	
	Men	women
Land preparation and fire breaks construction	100	0
Patrol – including fire and other encroachments	100	0
Tending operations – pruning, thinning	60	40
Planting and weeding	30	70
Cooking for labour of the plantation/mangroves	20	80
Carrying logs during harvest	100	0

In the activities mentioned in

Table 26, TFS seems to consider gender in terms of access and control of the opportunities. However, the observed gender roles will need to be considered. According to FAO (2013) and Sunderland et al. (2013), women as users of forest products and guardians of traditional knowledge, have always been involved in forestry, but their access to forest resources and benefits and participation in forest management is limited compared to men's despite the fact that trees are more important to women, who depend on them for their families' food security, income generation and cooking fuel.

According to a World Bank (2018), gender structural and behaviour may be barriers to women's participation in forest resource management programmes. Structural barriers are often set by political institutions, legal frameworks and economic systems. They include: limited infrastructure that requires multiple hours or days of travel to reach a working place; complex and costly application processes; lack of an integral gender perspective in planned activities; absence of representation in decision-making forums; poverty traps for women and woman-headed households and educational disadvantage. Behavioural barriers are revealed by behavioural science diagnostics and intensify the above structural barriers. They include: time scarcity arising from the double burden of work; financial scarcity that inhibits satisfaction of basic needs; and aspiration scarcity arising from gender norms that fix women's social identities around their households and children.

These could be some of the factors to hinder women participation the TFS planned projects and therefore women shouldn't be ignored to ensure project effectiveness by producing positive impact on women's and their families' ways of life; avoiding marginalizing women's specific and necessary knowledge; reducing the gender gap in forest communities and the forestry sector; strengthening equalities in plantation and mangroves access and control and in participation and influence in decision making; and improving relations between men and women, particularly when social and economic benefits are not equally distributed among community members. This will in turn act as a change catalyst to improve the plantation and mangroves forest resource sustainability and conflict management.

To ensure equal control of resources, it is important for TFS to promote equal participation of women and men in decision-making in the field of the project implementation. Participation of women in decision making was noted to be poor due to poor road networks to reach worksites as well as the existing socio-cultural norms where women are not supposed to decide once men have done so. TFS project will need to improve road networks in project sites like Ifinga village around Wino plantation where men and women fail to benefit directly from the plantation activities due to transportation barriers. The TFS Project will need also to consider promoting access of women in activities where they are under-represented and sensitization to eliminate gender stereotypes and roles through capacity building on gender issues. TFS may also invest in introducing technological changes that reduce workload and time in various plantation and mangroves forests value chains, in order to enhance women's participation in certain activities and make optimal use of their time away from home.

Gender networks in plantations and mangroves forests were found to exist which assist in improving the socio-economic status of both men and women as well as youth. These included Village fire groups around Wino plantation, conservation groups (e.g. BMU in Mangroves), and beekeeping groups, as well as village serving and credit groups commonly known as Village Community Banks (VICOBA). TFS project will need to venture into these groups by supporting them in terms of capacity building and access to support from other stakeholders in forestry for effectiveness.

Men and women around the plantation and mangroves forests were found to be aware of laws/regulations/guidelines pertaining to sustainable management of forest resources, however the major disparity was on compliance which differed from one gender group to another depending on awareness. TFS will be required to sensitize both men and women in project implementation sites on the need to understand and abide to various legal frameworks for impacts to be realized.

To improve the implementation of the forthcoming TFS project, men and women in communities around plantations and mangroves forests had views on the need for TFS to improve information and communication among stakeholders on benefits accruing from the Project. For example, it was noted during Focus Group Discussion (FGD) that rarely information reached all the gender groups. This makes men benefit more from the opportunities emerging under TFS than their women counterparts. TFS will need also to strengthen its cooperation with villages around through the VNRC and Fire Fighting Committees. Employment opportunities should first of all consider men and women around the project site before searching others from outside especially on some posts like fire towers.

TFS Projects also will need also to strengthen its CSR by contributing to the development of villages around especially supporting socio-economic activities like schools and health centers which have impacts to the lives of both men and women as well as youth. In implementing the Project also, TFS should consider motivating both men and women in firefighting activities by allocating more resources in the activity during budgeting to support training, firefighting equipment and some wages for the activities afterwards. For examples, it was noted during FGD at Ifinga village around Wino plantation, Marendego village around mangroves forests and Mtibwa-Pagale plantation lack of legally formed VNRCs. In implementing its Project, TFS will

need to support formation of these committees in order to strengthen conservation activities.

Men and women around the plantation and mangroves forests suggested the need of the TFS projects to assist them in improving entrepreneurial skills in order to improve their socio-economic status and in turn reduce destructive activities in the forest resources. TFS Project for example will need to capacitate men and women around plantations and mangrove forests in other income generating activities like beekeeping, poultry, and forest products processing value addition to improve their socio-economic status.

7 CONCLUSION

Tanzania's plantation forestry sector makes up less than a quarter of a percent of the world's scale. However, it is well positioned for a well-developed commercial forestry sector in terms of the potential to meet domestic demand and export. Currently, TFS has an area available for plantation expansion from the existing plantations approximately 174,192 ha, and another potential area for establishment of new plantations of about 450,000 ha. TFS has not been able to fully utilize this land area largely due to inadequate funds. The feasibility study to enhance management of state forest plantation and mangrove forest reserves has shown that there is a favourable environment in terms of climate, land availability, economic growth, population growth and existence of a functioning forestry sector. There is potential to engage the government, private sector, donors and communities to participate in management and benefits from the forest plantations. Therefore, the decision by TFS to take a loan for improved management of existing plantations and establishment of new ones is a milestone towards exploiting untapped opportunities to promote, consolidate and ensure growth of the forestry sector. This is evidenced by the economic and financial analysis of the project which has indicated significant positive returns for the investment.

Prefeasibility study for Kilwa and Rufiji Delta mangrove forest reserves has indicated existence of potential opportunities which could be tapped to address mangrove conservation challenges.

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APPENDICES

Appendix 1: Itinerary

Appendix 1A: Itinerary for Plantations and Capacity Building Team to Mtibwa and Wino forest plantations

Day and Date	Activity
Tue 10.5.2022	Joint Venture French Consultants travel Dsm-Morogoro
Wed 11.5.2022	Travel Morogoro to Mvomero District Offices: meet District Adminstrative Secretary; TFS District Staff; District Council Forestry and Game staff
	Travel Mvomero Dsitrict Offices to Mtibwa: meet Plantation Conservator and staff
Thur 12.5.2022	Interviews with Villagers and Village leaders surrounding the forest plantation (Dihinda, Mlumbilo, Kunke, Kaole); Visit Pagale Range
	Travel Mtibwa – Iringa
Fri 13.5.2022	Visit Forestry Development Trust Visit Sao Hill forest plantation Visit Green Resources Ltd Travel Iringa-Songea
Sat 14.5.2022	Pay Courtesy call: Songea District Commissioner; Meet Madaba District Executive Officer and Ruvuma Regional Natural Resources Officer; Visit Wino and Ifinga plantations and TFS/FDT Trials
Sun 15.5.2022	Interview Plantation Conservator and staff; Interviews Lilondo and Wino Villagers and Village Leaders Travel Wino-Iringa
Mon 16.5.2022	Travel Iringa-Morogoro Meet: Head of Tree Seed Station Morogoro, Director, National Carbon Monitoring Centre; Director General Tanzania Forestry Research Institute Travel Morogoro-Dsm
Tue 17.5.2022	Meet TFS Technical Committee members Debriefing meeting with AFD Country Representative and AFD Paris
Wed 18.5.2022	Debriefing meeting with Conservation Commissioner
	Travel back to France and Morogoro

Appendix 1B: Itinerary for Plantations and Capacity Building Team to Silayo forest plantation

Day and Date	Activity
Sun 8.5.2022	Traveling and arrival in Dar es Salaam
Mon 9.5.2022	Field work preparation and discussion on tools/instruments for data collection
Tue 10.5.2022	Travel to Silayo forest plantation
Tue 10.5.2022	Courtesy call to Chato District Commissioner
Wed 11.5.2022	Field work at Silayo FP – visiting various sites of the plantation
Thur 12.5.2022	Field work – meetings and interviews with villages surrounding the plantation • Lumasa village • Igando village • Butengo village

Fri 13.5.2022	Field visits to natural forest conservation areas and mining sites (outside the plantation area)
Sat 14.5.2022	Field visits to timber traders and sawmills
Sun 15.5.2022	Meeting with TFS-Lake zone officers in Mwanza City
Sun 15.5.2022	Travel by flight to Dar es Salaam
Mon 16.5.2022	Field visits to timber traders in Dar es Salaam
Tue 17.5.2022	Debriefing meeting with TFS HQ Senior Staff and AFD-Dar es Salam
Wed 18.5.2022	Debriefing meeting with Conservation Commissioner, TFS Travel back to France and Morogoro

Appendix 1C: Itinerary Mangroves Team

Day and Date	Activity
Wed 23.5.2022	Inception meeting at TFS HQ in Dar es Salam Travel to Rufiji Delta Visit of TFS Kibiti local office/meeting with Mangrove Forest Manager
Thur 24.5.2022	**Presentation by TFS of Rufiji Delta Mangrove Forest Reserve** Meeting with Col. Abbas Ahmed Abbas, District commissionner (DC) Meeting with Nyamisati VNRC members at mangrove office Visit the northern part- Arms 1, 2 and 3. Passed through : 1. Kikunya River, near the office 2. Mkambe mkubwa river system 3. Mkamba mdugo river system 4. Simbauranga River 5. Saninga River (a site that can be reached by walking through the canopy) at the sub-village of Saninga
Fri 25.5.2022	**Presentation by TFS of Rufiji Delta Mangrove Forest Reserve** Visit of the southern half - arms 9 and 10 Passed through : 1. Mohoro river 2. Saw other small villages and sub villages of the delta like Rua, Ulaya on the way 3. Jaja delta island 4. Jaja beekeeping site 5. Jaja Kiongoroni 6. Mangrove harvesting sites along the Kidango Chekundu river (tributary) 7. Two river system (Mohoro river, Jaja river). Travel to Kilwa
Sat 26.5.2022	**Presentation by TFS of Kilwa Mangrove Forest Reserve** Visit of TFS Kilwa local office/meeting with Mangrove Forest Manager Meeting with Zainab Rashidi Kawawa, DC for Kilwa) Visit of TAWA local office/meeting with Mercy Exson Mbogelah, Conservation Officer

	Visit the southern part of the reserve. Passed through : - Important coral reef - Sangonara lagoon - Kilwa Kiwasani (including ruins) - Songo Mara
Sun 27.5.2022	**Presentation by TFS of Kilwa Mangrove Forest Reserve** Visit the northern part of the reserve. Passed through 1. Mtoni village 2. Kilwa TFS Office/Meeting with Beekeeping Unit
Mon 28.5.2022	Trip to Dar es Salaam Work on the inception report
Tue 29.5.2022	Work on the inception report
Wed 30.5.2022	Meeting with EU representatives in Dar es Salaam Meeting in AFD Tanzania office (with Amandine Cremel and also Frederique Willard via video conference) Flight back to France and drive to Morogoro

Appendix 1D: Itinerary for Project Risk and Gender Assessment Team in Mtibwa, Rufiji-Kilwa Mangroves, Wino and Silayo

Day and Date	**Activity**
Tue 30.05.2022	Traveling and arrival in Njombe district
Wed 1.6.2022	Arrival at Madaba district - Courtesy call to District Commissioner
	Field work at Wino plantation – Interview and discussion at Wino village
Thur 02.06.2022	Field work at Wino plantation – Interview and discussion at Ifinga village
Frid 03.06.2022	Fielwork – Interview and discussion at Wino TFS – Management
Sat 04.06.2022	Debriefing meeting with TFS HQ Senior Staff at Wino TFS and traveling back to Njombe district
Sun 05.06.2022	Travel back to Morogoro
Thur 09.06.2022	France and FORCONSULT Team arrival at Dar es salaam
Frid 10.06.2022	Travel and arrival at Kibiti district - Courtesy call to TFS and District Commissioner
Sat 11.06.2022	Field work at Rufiji Delta Mangroves – Interview and discussion at Nyamisati village
Mon 12.06.2022	Field work at Kilwa Mangroves – Interview and discussion at Marendego village
	Field work at Kilwa Mangroves – Interview and discussion at Somanga village
Tue 13.06.2022	Travel back to Dar es salaam – meeting with TFS HQ staff – plantations and Mangroves incharge
Wed 14.06.2022	Travel back to Morogoro region
Thur 15.06.2022	Travel to Mtibwa Forest plantation – courstecy call TFS & DC
	Field work at Pagale range plantation – Interview and discussion at Kunke village
Frid 16.06.2022	Field work at Pagale range plantation – Interview and discussion at Luhimbilo village

	Travel back to Morogoro
Sat. 17.06.2022	Conclusion Meeting France and FORCONSULT experts Travel to Dar es salaam
Sun 18.06.2022	France Experts travel back to France
Sat 02.07.2022	FORCONSULT expert travel to Chato district
Sun 03.07.2022	Arrival at Katoro, Geita district
Mon 04.07.2022	Courtesy call TFS – Silayo Plantation and DC
	Discussion and interview with TFS conservators
Tues 05.07.2022	Field work interviews with selected villagers surrounding the plantation from Lumasa and Igando villages
Wed 06.07.2022	Travel back to Morogoro

Appendix 2: Persons Met

S/N	Name/Organization	Position	Telephone/Email
	MNRT		
	Dr. E.E. Mwakalukwa	Director, FBD	ezekiel.mwakalukwa@maliasili.go.tz
	AFD		
	Ms. S. Mouen	Director, AFD Tanzania	mouens@afd.fr
	Ms. W. Frederique	AFD, Paris	
	TFS-HQ		
	Prof. D. Silayo	Conservation Commissioner, TFS	dos.silayo@tfs.go.tz
	H.J. Msuya	ACC-BR	Hussein.msuya2@tfs.go.tz
	Dr. A. Masota	Ag. DRM	abelmasota@tfs.go.tz
	Dr. H.H. Katety	Ag. DTSP	hamzakatety@tfs.go.tz
	S.S. Beleko	Ag. DMRU	
	Hon. D. Mng'ong'o	Legal Services Manager	david.mungongo@tfs.go.tz
	H.G. Kipanha	ICT Manager	harold.chipanha@tfs.go.tz
	F.V.A. Sima	PCOI	franksima@gmail.com
	J.J. Sendwa	PCOI	joseph.sendwa@tfs.go.tz
	K.A. Siwa	SFO	kombosiwa@yahoo.com
	Ms. D. Ruheta	COI	ruhetad@gmail.com
	Ms. G. Buchukundi	SBO	grace.buchukundi@tfs.go.tz
	Ms. R. Sabida	COI	rosemary.sabida@tfs.go.tz
	Ms. M. Mrutu	PFO	mariam.mrutu@tfs.go.tz
	Ms. T. Ntemo	PCOI	tjntemo@yahoo.com
	T.H. Kilaga	SPRO	tulizokilaga@gmail.com
	Ms. Z.S. Bwugwa	PCOI	bwugwashabani@gmail.com
	Ms. M. Chassama	MPR	martha.chassama@tfs.go.tz

	D. Malogo	Ag. HOPC	deogratius.malogo@tfs.go.tz
	Ms. T. Kamote	BOM	theresia.charles@tfs.go.tz
	Ms. F. Kundy	SBO	kundyfrida@hotmail.com
	P. Nyahende	SCO	peternyahende@tfs.go.tz
	V. Tarimo	COI	Venance.tarimo@tfs.go.tz
	K. Ally	PBOII	Kassim.ramadhani@tfs.go.tz
	K. Fella	CAI	kelvinfella@yahoo.com
	K. Solyambingu	BAII	hajisoly92@gmail.com
	Ms. M. Kapina	SCO	marykapina@yahoo.com
	M. Hamza		mussa.iddi@tfs.go.tz
	MVOMERO DISTRICT COMMISSIONER'S OFFICE		
	F. Mang'ula	District Administrative Secretary	0765031304
	MVOMERO DISTRICT COUNCIL		
	L.V. Haule	Forest Officer	0768154043
	P.M. Lazaro	Game Officer	0789657202
	TFS MVOMERO DISTRICT		
	S.P. Rwamugira	DFC	0767357454
	C.T. Chelela	FO	0717222001
	M.C. Mbago	FO	0752721813
	MTIBWA FOREST PLANTATION AND TFS EASTERN ZONE		
	A. Mchomvu	Plantation Conservator	0715555254
	H.R. Kimaro	AFC	0765468190
	K. Mangachi	PFA	0719535766
	D.M. Elias	BAII	0682074937
	H. Saad	FA	0713746997
	J. Moshi	FA	0762405354
	Z.P. Yahaya	FOII	0716454305
	M.Y. Rashid	Accountant	0715683434
	S.K. Burenga	Asst Zonal Manager	eastern@tfs.go.tz
	COMMUNITIES AROUND MTIBWA FOREST PLANTATION		
	V. Manyama	Farmer, Dihinda village	0656290201
	J. Lugida	Pastoralist, Mlumbilo	0789940398
	L.M. Kilale	Farmer, Dihinda	0678915144
	Y. Mngoya	Chair, Pastoralists, Mlumbilo	0786721563
	Ms. M. M. Mwasimba	Farmer, Member Village Council, Kunke	0654511875
	G. Mtani	Farmer and Chair, VNRC, Kunke	0622119430

	M. Mwau	Chair, pastoralists, Kaole village	0625671380
	I. Sendege	Farmer/livestock keeper, Kaole village	0762902228
	FORESTRY DEVELOPMENT TRUST (FDT), IRINGA		
	Dr. B. Okeowo	Deputy Director	0758238808
	W. Mato	Deputy Director	0767781882
	R. Mack	Gatsby, Kenya	+254740874718
	B. Ntiruhungwa	Manager	0753756363
	I. Singo	Manager	0715718990
	N. Msika	M&E Expert	0763159176
	R. Mgeni	Researcher-tree breeding	0759177576
	S. Shaaban	-do-	0753299023
	SAO HILL FOREST PLANTATION		
	I.Lupala	Asst Plantation Conservator	0753080700
	GREEN RESOURCES LTD, PLANTATION AND SAWMILL		
	G. Bottger	General Manager, Sao Hill Industries	george.bottger@greenresources.no
	H. Hamilton	General Manager, Plantations	Hampus.hamilton@greenresources.no
	SONGEA DISTRICT COMMISSIONER'S OFFICE		
	Hon. P. Mgema	DC, Songea	
	A. Chale	RNRO	0713772400
	MADABA DISTRICT COUNCIL		
	Hon. T.T. Mlelwa	DC Chairman	0756875119
	Adv. S.I. Mohamedi	DED, Madaba	0756853242
	WINO FOREST PLANTATION		
	Ms. Glory Kasmir	Plantation Conservator	
	P.B. Mlacha	Conservator Ranger II	0767385030
	M. Yange	PC Ranger I	0629218295
	P. M. Wandira	CR	0766690896
	COMMUNITIES AROUND WINO FOREST PLANTATION		
	Plantation Aspects		
	S. Mtewele	Chair, Lilondo village	00757108356
	D.G. Kitaponda	Ag. Chair, Wino village	0622414231
	T. O. Challe	VEO, Lilondo	0757823749

	Ms. S.C Mkanula	VEO, Wino	0621865120
	E.D. Mng'ong'o	Lilondo	0744372617
	E. B. Msigwa	Lilondo	0622872879
	F.G. Mlimila	Lilondo	0745169818
	B.G. Knack	Lilondo	0624550126
	H.D. Wayotile	Wino	0621262458
	H.G. Wella	Wino	0626096337
	O. Mbogoro	Wino	0627906844
	N. Sapula	Wino	0625672044
	O. Mwenda	Wino	0626131809
	M.R. Mgaya	Wino	0757424231
	B.P. Mng'ong'o	Lilondo	0765263013
	Ms. P. Mkawe	Lilondo	-
	Ms. D. Mkorongo	Wino	-
	K. Muhanji	Wino	-
	Gender & SESA		
	Waziri Lufungulo	Wino	
	Odino Mwenda	Wino	
	Mfariji Mbilinyi	Wino	
	Antelma Mfutse	Wino	
	Novatus Sapula	Wino	
	Bankii Yao	Wino	
	Kaspari Mhanje	Wino	
	Pastory Mhanje	Wino	
	Justo Kalinga	Wino	
	Edina Mahiga	Wino	
	Cornel E. Mgaya	Ifinga	
	Roman Hungi	Ifinga	
	John Makweta	Ifinga	
	Dickson A. Kazimoto	Ifinga	
	Yusta M. Mpangile	Ifinga	
	Ditran Boyimanda	Ifinga	
	TREE SEED STATION MOROGORO		
	Ms F. Senya	Centre Head	0626528169
	E. Nyambwa	Biotechnologist	0787544352
	NATIONAL CARBON MONITORING CENTRE, SUA		
	Prof. E. Zahabu	Director	0752596503
	TANZANIA FORESTRY RESEARCH INSTITUTE		
	Dr. U. Msalilwa	Representing DG	0782975909

	CHATO DISTRICT COMMISSIONER'S OFFICE		
	Ms. Martha Mkupasi	Chato District Commissioner	
	SILAYO FOREST PLANTATION AND TFS LAKE ZONE		
	Mr. Bakari Mohamed	Principal Forest officer, TFS Lake zone In charge	
	Mr. Thomas Moshi	Senior Forest Officer, TFS Lake zone Assistant In charge	
	Mr. Said Singano	Lake zone, Senior Forest Officer.	
	Mr. Baraka M. Mlaponi	Ag. District Forest Conservator, Chato District.	
	Mr. Patrick A. Mbughi	Assistant Forest Plantation Conservator, Silayo Forest Plantation.	
	Mr. Juma M. Mdoe	Beekeeping Manager, Silayo Forest Plantation.	
	Mr. Salehe M. Kivambe	Accountant, Silayo Forest Plantation.	
	Mr. Libent R. Elizeus	Forest protection In charge, Silayo Forest Plantation.	
	FOREST INDUSTRIES - DSM		
	Mr. Balbir Singh Saini	Jaffery Industries Saini Ltd, Dar es Salaam	
	Mr. Manpreet K. grewal	Grewal Sawmills, Dar es Salaam	
	RISK ASSESSMENT: MANGROVE FOREST RESERVES KIBITI		
	Mr. Ntilicha	DF Conservator	0713870337
	Mr. Steven Chembero	Ass. DFC	0688809477
	COMMUNITIES AROUND KIBITI MANGROVE FOREST RESERVE		
	Hamada Mpangwa	Nyamisati	
	Hassan Monelo	Nyamisati	
	Said Mapande	Nyamisati	
	Amiri Omary	Nyamisati	
	Hamisi Mketo	Nyamisati	
	Shaban M. Mohamed	Nyamisati	

	Hadji S. Hadji	Nyamisati	
	Adballah Dadi	Nyamisati	
	Zaidath Mapande	Nyamisati	
	Joha A. Mbaule	Nyamisati	
	Hadija Ramadhani	Nyamisati	
	Kuruthum Mketo	Nyamisati	
	Salma Hassan	Nyamisati	
	MANGROVE FOREST RESERVES - KILWA		
	Abbas Said Abbas	DF Conservator	0714987812
	Danford Mwaiteleke	TFS Z/Conservator	0625930312
	COMMUNITIES AROUND KILWA MANGROVE FOREST RESERVE		
	Omary Mcharo	Marendego Village	
	Salum Mpulu	Marendego Village	
	Shaban Mbwana	Marendego Village	
	Yahaya Mohamed	Marendego Village	
	Tabia Kolome	Marendego Village	
	Salma Mpuga	Marendego Village	
	Bahati Kipende	Marendego Village	
	Rehema Lusonzo	Marendego Village	
	Ally Abdallah	Marendego Village	
	Juma Makula	Marendego Village	
	Adam Njaule	Marendego Village	
	Abdallah Mtunyungu	Marendego Village	
	Mohamed Abdallah	Marendego Village	
	Ally Mkongoro	Marendego Village	
	Mohamed B. Mketo	Marendego Village	
	MANGROVES MANAGEMENT FIELD TRIP		
	Frank V.A. Sima	TFS HQ Mangroves Incharge	Frank.sima@tfs.go-tz
	Everest Nashanda	Mangroves expert (Retired)	
	Col. Abbas Ahmed Abbas	DC Kibiti District	
	Mathew N. Ntilicha	TFS District Conservation Officer, Kibiti district	
	Rasuli Msuya	Nyamisati Mangrove Office incharge	
	Milongo Sanga	District administrative secretary	
	Abdallah A. Ndomondo	Councellor, Nyamisati, VNRC	
	Haji S. Haji	Ward Executive, Nyamisati, VNRC	

	Nelson J. Betese	VNRC Nyamisati, Village Executive Officer	
	Ahmada M. Mpangwa	VNRC Nyamisati, Village Chair	
	Hassani Hamisi	VNRC Secretary, Nyamisati	
	Abdallah Kasimu Dadi	VNRC member, Nyamisati	
	Faswali Ramadhani	VNRC member, Nyamisati	
	Yassin Juma	VNRC member, Nyamisati	
	Johari Ndonga	VNRC member, Nyamisati	
	Frédérique Willers	AFD	
	Amandine Cremel	AFD	
	Zainab Rashid Kawawa	DC Kilwa	kawawazaynab@gmail.com
	Mercy Exson Mbogelah	Incharge ruins of Kilwa Kisiwani and Songo Mnara world heritage	mbogelahmercy@gmail.com
	Andrew Lupala	Kilwa Conservation officer Beekeeping zone	
	Abasi Saidi	Kilwa District Forest Conservator	
	D. Mwaiteleke	Mangroves management Coordinator	
	Stéphanie Duvail	IRD, Mozambique	stephanie.duvail@ird.fr
	Olivier Hamerlynck	Senior Researcher, National Museums of Kenya	olivier.hamerlynck@gmail.com
	Makala Jasper	CEO, Mpingo Conservation Project	jasper.makala@mpingoconservation.org
	Charles Meshack	CEO, Tanzania Forest Conservation Group	Cmeshack@tfcg.or.tz
	Fredrick Mhina Mngube	Executive Director, Wetlands East Africa	fmngube@wetlands-eafrica.org
	PERSONS MET HQ: Risk Assessement and Gender		
	Frank V.A. Sima	TFS HQ Mangroves Incharge	Frank.sima@tfs.go-tz
	Mr. Maeda	TFS HQ Plantations Incharge	
	PERSONS MET SILAYO: Risk Assessement and Gender		

	Mr. Bakari Mohamed	Principal Forest officer, TFS Lake zone In charge	
	Mr. Thomas Moshi	Senior Forest Officer, TFS Lake zone Assistant In charge	
	PERSONS MET MTIBWA: Risk Assessement and Gender		
	Mchomvu	Plantation Conservator	0715555254
	H.R. Kimaro	AFC	0765468190
	COMMUNITIES AROUND MTIBWA PLANTATIONS		
	MLUMBILO VILLAGE		
	Hassani Kijindile	Mwenyekiti wa kijiji	
	Joseph Dominick	VNRC	
	Aman Said	VNRC	
	Wilbert Mayala	Kaya	
	Enenedeus Mdesa	Kaya	
	Justine chamoto	VNRC	
	Anitha Kajindaso	Kaya	
	Roisi Daneil	Kaya	
	Ester Mtupa	VNRC	
	Richard Magari	Mtendaji wa kijiji	
	Buhatwa R. Matage	Mtendaji wa Kata	
	KUKE VILLAGE		
	Naboti Philipo	Mwenyekiti wa kijiji	
	Baraka Adam	Afisa Mtendaji	
	Fedius Nyagawe	Mjumbe vnrc	
	Nicholaus Chaula	Kaya	
	Elibariki Bagango	Kaya	
	Leornadi Msigale	Katibu VNRC	
	Lukas Mbata	Mwenyekiti VNRC	
	Mwajubu Issa	Asikari VNRC	
	Emliana Kiaga	Kaya	
	Mariaumu HAJI	Kaya	

Appendix 3: Questionnaire on Plantation Establishment, Management and Roads

Checklist/Questionnaire Number _____

Basic information

Date: _____ Name of interviewer: _____
Name of Plantation_____ District _____
Region _____Zone_____
Name of respondent: _____ Sex: *Codes: 1=Male, 2=Female;*
Position of respondent: _____
Phone No._____

A: Plantation establishment and management

1. What is the planted area, expansion area, conservation area and potential area of your plantation (ha)?
   (a) Planted area _____
   (b) Expansion area _____
   (c) Conservation area _____
   (d) Other uses (e.g. settlements)_____
   (e) Potential area (An area that can be acquired for forest plantation in the future) _____

2. What are the sources of your seed and approximate area planted with the seed sources?
   (a) Area planted using seed stand source_____
   (b) Area planted using seed orchard source (local or imported)_____

3. What techniques are used to raise seedlings? Will you continue using these techniques in the planned plantation expansion if successful with a loan?

4. If successful with the loan request for expansion of the plantation, which seed sources, species and end uses will be used?

S/N	Seed Source	Tree species to be planted	Proposed end use

5. What techniques are used to prepare sites for tree planting? Will you continue with these techniques in the planned plantation expansion if successful with a loan?
   _____
   _____
   _____

6. What weeding techniques and frequency (weedings per year) do you use? Any backlogs during 2020/21? Will you continue with these weeding techniques in the planned expansion if successful with a loan?

_____
_____
_____

7. (a) Which pruning regime and equipment do you use to do pruning? Any pruning backlog during 2020/21?

_____
_____
_____

7. (a) Which regime do you use to do thinning? Any thinning backlog during 2020/21?_____
_____
_____

8. (a) What insect pests, pathogens and invasive have attacked your plantation (current status)? What is the area affected?

S/N	Type of Insect Pests, Pathogens and Invasive Species	Tree Species	Area Affected (ha)	Action Taken

(b) What is the average compartment size in your plantation?

_____

(c) What is the width of fire lines within the plantation and in the boundary?

_____

(d) What is the extent of fire damage to the plantation during 2020/21?

Tree Species	Area burnt (ha)	Area salvaged (Merchantable) (ha)	Volume salvaged (m^3)

(c). What actions are you taking to minimize fire damage? And what are the challenges?

_____
_____
_____

B. Plantation roads

1. What methods are used for forest road construction in your plantation?

_____

_____

2. What is the current road network and condition in your plantation?
   _____

   _____

3. What road network is optimal in the planned plantation expansion if successful with a loan?
   _____

   _____

Appendix 4: Checklist for Communities Living Adjacent to the Plantations

Basic information
Date: _____ Name of interviewer: _____
Name of Forest_____ District _____
Region _____Zone_____
Name of respondent: _____ Sex: *Codes: 1=Male, 2=Female;*
Position of respondent: _____
Phone No._____

1. What are your main livelihood activities?
2. Participation of communities/village leaders in management of the plantation. What activities are you involved in forest plantation management?
3. What other activities would you like to be involved in, but you not currently involved?
4. How communities benefit from the plantation.
5. How the plantation has affected their livelihood positively or negatively.
6. Relationship of the communities with the plantation.
7. Any challenges they face as a result of the presence of the plantation.
8. Identify forest extension services available or provided to create both awareness and best forest management practices
9. What are the extension services that you would like to get?
10. Identify income generating activities for the adjacent communities
11. What activities are undertaken to improve law enforcement of the FR?

Appendix 5: Checklist for TFS Technical Staff

Checklist Number _____
Basic information
Date: _____ Name of interviewer: _____
Names of respondents; Positions, Phone numbers, emails

1. What guidelines do you use to plan human resource requirements?
2. What guideline do use to determine optimum road density in forest plantations?
3. Figures in concept note and business plan for Silayo forest plantation targets differ: annual planting of 2500 vs 3000 ha per year. Which is the correct figure?
4. Technical Order No 1 of 2021 requires the planting of at least 4 species in almost equal proportions to increase tree species diversity. All proposed

expansion areas have less than the required number of species. Why are you not following the Technical Order?

5. Do you prefer the project to operate separately or be mainstreamed within the current TFS framework?
6. Any suggestions of advanced fire-fighting equipment you intend to buy and advanced techniques you plan to use?
7. Are your annual planting targets achievable?
8. Why are you not using mixed species in plantations?
9. Why do you prohibit grazing in areas yet to be planted?
10. Are you involved in Carbon markets?

Appendix 6: Checklist for other Stakeholders (MNRT, Private Plantations, FDT, PFP, TAFORI, SUA

Checklist Number _____
Basic information
Date: _____ Name of interviewer: _____
Name of respondent: _____ Sex: *Codes: 1=Male, 2=Female;*
Position of respondent: _____
Phone No._____

MNRT (Forestry and Beekeeping Division (FBD))

1. If successful with a loan, TFS plans to expand mainly Teak on grounds it fetches alot more revenue than softwoods. This is against Technical Order No 1 of 2021 which says plantations must have at least 4 species for diversification and minimizing risks against pests, pathogens and climatic fluctuations. Any views on this?
2. Any suggestions/recommendations on what they should do to ensure successful implementation of project activities if successful with a loan?
3. How should the project be managed? a separate project within TFS with Project Coordinator or be mainstreamed into the current setting?, or have a Technical Advisor?.

Private Plantations, FDT, Private Forestry Programme (PFP), Tanzania Forestry Research Institute (TAFORI), Sokoine University of Agriculture (SUA)

1. What are the main activities of your organisation?
2. What do you think TFS can learn from your organization, if successful with a loan application to significantly expand its forest plantations.
3. Any other recommendations of what TFS could do to ensure that successful implementation of planned activities.
4. Is there any collaboration with TFS, and potential for more collaboration?

Appendix 7: Checklist for Directorate of Tree Seed Production and Tree Seed Centres

Table 2 of the concept note shows that the following activities will be carried out:

i. To establish and manage tree seed banks of 3000 tree species by 2025;
ii. To make survey to identify and manage 500 new tree seed sources of various species by 2025;
iii. To collect 20 tonnes of tree seeds annually and test seed quality of 3000 tree species by 2025.

While the budget table indicates that TFS will carry out tree improvement for diversification of species and importation of planting materials (over project time) and strengthen tree seeds collection centres.

1. Given the above scenario, what activities are actually planned and their costs?
2. The targets look ambitious and the costs are very high. Will they be achieved?

3. Looks like there is very little tree improvement in the planned activities. Can you explain the expected levels of tree improvement?
4. What will be done to strengthen the tree seed centres?

Appendix 8: Checklist for Economic and Financial Analysis for TFS Forest Plantations

Checklist/Questionnaire Number _____
Basic information
Date: _____ Name of interviewer: _____
Name of Plantation_____ District _____
Region _____Zone_____
Name of respondent: _____ Sex: *Codes: 1=Male, 2=Female;*
Position of respondent: _____
Phone number: _____

1. Forest enterprise activity costs (in Tanzanian shillings per hectare- TZS/ha)

Activities		**Species**							
A: Nursery	**Units**	P. patula	P. caribaea	P. tecunumanii	E. camaldulensis	T. grandis (Teak)	Maesopsis Eminii	Khaya anthotheca	Other spp.
Planting material raising (Please specify; seedlings/cuttings/ clones etc.....)	TZS/ ha								
Acquisition/purchase of planting material (Please specify; seedlings/cuttings/ clones etc.....)	TZS/ ha								
B: Plantation	**Units**	**Species**							
		P. patula	P. cari	P. tecunumanii	E. Camaldulensis	T. grandis	Maesopsis	Khaya	Other

				bae a			(Tea k)	Emi nii	anthot heca	spp .
Land acquisition		TZS/ ha								
Survey and compartmentation (including forest boundary, zones/ divisions/compart ment demarcation and plantation mapping)		TZS/ ha								
Logistical materials (Please specify.....)		TZS/ ha								
Road const ructio n and maint enan ce	New roads constructi on	TZS/ ha								
	Maintenan ce of roads	TZS/ ha								
Land preparation		TZS/ ha								
Transportation of planting material to plantation		TZS/ ha								
Pitting and planting		TZS/ ha								
Beating-up (gap filling)		TZS/ ha								
Natural regeneration (Managing regenerants /coppices)		TZS/ ha								
Weeding		TZS/ ha								
Pruning		TZS/ ha								
Fores t prote ction	Forest patrols	TZS/ ha								
	Fire protection	TZS/ ha								

and patrols	Pest and diseases protection	TZS/ ha								
	Others	TZS/ ha								
Harvesting of wood products	1st Thinning	TZS/ ha								
	2nd Thinning	TZS/ ha								
	Clear felling	TZS/ ha								
Harvesting of non-wood products	Carbon sequestration project implementation costs	TZS/ ha								
	Gums & Resins	TZS/ ha								
	Honey									
	Others specify.....	TZS/ ha								

2. Revenue from harvesting of wood and non-wood forest products (in Tanzanian shillings per hectare -TZS/ha)

Item	**Specify products** to be harvested e.g., Electric poles, sawlogs etc.	Units	**Species**							
			P. patula	P. caribaea	P. tecunumanii	E. Camaldulensis	T. grandis (Teak)	Maesopsis Eminii	Khaya anthotheca	Other spp.
1st Thinning		TZS /ha								
2nd Thinning		TZS /ha								
Clear felling		TZS /ha								
Non-wood	Carbon	TZS /ha								
	Gums & Resins	TZS /ha								
	Honey	TZS /ha								

	Others specify..	TZS /ha								

3. Other general information

Item		**Unit**	**Species**							
			P. patula	P. caribaea	P. tecunumanii	E. Camaldulensis	T. grandis (Teak)	Maesopsis Eminii	Khaya anthotheca	Other spp.
Planting spacing		Meter (m)								
Yield per ha and product prices	1st Thinning	m^3/ha								
	Prices of products	TZS/ha								
	2nd Thinning	m^3/ha								
	Prices of products	TZS/ha								
	Clear felling	m^3/ha								
	Prices of products	TZS/ha								
Annual harvesting quantities of non-wood (e.g., Gums & Resins, Honey, Carbon etc.)		Specify units..... e.g., tons of carbon, or tons of honey etc								
Any other forest enterprise activity? Show quantities of produce, costs and revenue.										

Appendix 9: Checklist: Markets - Domestic and External Markets and Traders

Checklist Number ……...

1. Basic information

Date: …… .... Name of interviewer: …
District.....Region.....Zone.....
Name of respondent: ……..... Sex: *Codes: 1=Male, 2=Female*
Position of respondent : ……

Forest products, traders and markets

1) Indicate demand of forest products
2) Indicate sources of forest products
3) Indicate prices of forest products
4) Indicate quantity of sawtimber sold
5) Indicate transportation means of your products and cost
6) Do you have problems/challenges related to trade?
7) What are your views regarding quality of products you buy/sell?
8) What are the sources of market information both internal and external?
9) What opportunities are there regarding trade of forest products in the region?
10) Do you have problems related to trade?
11) What are your views regarding quality of products you buy/trade on?

Forest industries

12) Number of saw milling industries and potential growth rate
13) Number of other industries
14) Sources of raw materials to forest industries
15) Demand and supply of forest products
16) Prices of forest produce
17) Quantity (domestic demand, export, imports,)
18) Transportation of forest products

Appendix 10: Reviewed Literature

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Appendix 11: Checklist and questionnaire for Mangrove Forest Reserves

Basic information

Date: _____ Name of interviewer: _____
Name of Forest_____ District _____

Region _____Zone_____
Name of respondent: _____ Sex: *Codes: 1=Male, 2=Female;*
Position of respondent: _____
Phone No._____

A. Mangrove forest reserves conservators

1. Participation of communities/village leaders in addressing joint forest management especially in areas where collaboration is feasible- how do they participate and what could be done more?
2. What are the biodiversity enhancement activities which communities can participate?
3. Identify forest extension services available or provided to create both awareness and best forest management practices
4. What are available ecotourism activities in mangroves? What are potential ecotourism activities in mangroves?
5. What are other innovative forest-based enterprises in Mangroves? If not available, what are the possible innovative forest-based enterprises?
6. Identify other income generating activities for the adjacent communities
7. What are the conservation challenges in the mangroves?
8. What activities are undertaken to improve law enforcement of the FR?
9. What capacity do you have in term of mobility equipment i.e., boats, vehicles, motor vehicles, innovative equipment (drone for ex), human resources
10. What are the sources of funding for the implementation of mangrove reserve management plans? TFS? Province? NGO's ?

S/N	Type of Equipment	Current number	Current condition	Required number

11. What is the current human resources capacity?

S/N	Categories	Current number	Skills	Required number/skills
1	Certificate			
2	Diploma			
3	BSc			
4	MSc			
5	PhD			
6	Operational staff			
7	Others			

12. What is the number and condition of buildings and what is the requirement?

S/N	Type of building	Current number	Current condition	Required number

13. What are the main stakeholders involved and their roles in mangrove conservation?

S/N	Stakeholder	Roles

B. Programme/project/NGO/CBO leaders

1. Participation of communities/village leaders in addressing joint forest management especially in areas where collaboration is feasible- how do they participate and what could be done more?
2. What are the biodiversity enhancement activities which communities can participate?
3. Identify forest extension services available or provided to create both awareness and best forest management practices
4. What are available ecotourism activities in mangroves? What are potential ecotourism activities in mangroves?
5. What are other innovative forest-based enterprises in Mangroves? If not available, what are the possible innovative forest-based enterprises?
6. Identify other income generating activities for the adjacent communities
7. What are the conservation challenges in the mangroves?
8. What activities are undertaken to improve law enforcement of the FR?

9. What are the main stakeholders involved and their roles in mangrove conservation?

S/N	Stakeholder	Roles

C. Communities

12. What activities are you involved in mangrove forest reserve management?
13. What other activities would you like to be involved in, but you not currently involved?
14. What forest extension services do you receive?
15. What are the extension services that you would like to get?
16. What are available ecotourism activities in mangroves?
17. To what extent are you involved in ecotourism activities?
18. What are potential ecotourism activities in mangroves?
19. What income generating activities are you engaged in?
20. What are the conservation challenges in the mangroves?
21. How can these challenges be addressed?

Appendix 12: Questionnaire to Plantation Conservators/Directorate of Resource Management on Human, Infrastructure, Machinery and Equipment Capacity

Checklist/Questionnaire Number _____

Basic information

Date: _____ Name of interviewer: _____
Name of Plantation_____ District _____
Region _____Zone_____
Name of respondent: _____ Sex: *Codes: 1=Male, 2=Female;*
Position of respondent: _____
Phone No._____

1. What is the current and required human resource capacity?

S/N	Categories	Current number	Skills	Required number/skills for planned expansion
1	Certificate			
2	Diploma			
3	BSc			
4	MSc			
5	PhD			
6	Operational staff			
7	Others			

2. What is the number and condition of buildings and what is the requirement?

S/N	Type of building	Current number	Current condition	Required number for planned expansion

3. What is the number and condition of vehicles and what is the requirement?

S/N	Type of vehicle	Current number	Current condition	Required number for planned expansion

4. What is the number and condition of heavy machinery and what is the requirement?

S/N	Type of heavy machinery	Current number	Current condition	Required number for

				planned expansion

5. What is the number and condition of firefighting infrastructure, machinery and equipment?

S/N	Type of infrastructure/building/ machinery/ equipment	Current number	Current condition	Required number for planned expansion

Appendix 13: Checklists for environmental, social, and gender aspects

Appendix 13A: Environmental and Social Screening Checklist

This checklist is used by executing agency to review the potential environmental and social safeguard impacts of subprojects and determine whether the subprojects will trigger relevant safeguard policies of World Bank. It is a tool to screen, classify and evaluate the project activities during project preparation. This checklist shall be used in conjunction with Appendix 5, “Project Exclusion List”.

Name of subproject	
Location of subproject	
Owner of subproject	
Type and department of subproject	
Investment estimation	
Start and completion dates	

Part 1: Environmental Screening Checklist

Table 1 Environmental Screening Checklist

Issues	**Answer**			**If yes, it will trigger safeguard policies of World Bank**	**If yes, relevant documents shall be provided**
	Yes	No	Remarks		

Will the subproject cause significant negative environmental impact? Are these impacts sensitive, diverse or unprecedented? Please provide a brief description:				OP 4.01 Environmental assessment Category A of	Excluded from the project scope.
Is the impact beyond the project area? Is the impact of project implementation beyond the scope of planning? Are these major negative environmental impacts irreversible? Please provide a brief description:				OP 4.01 Environmental assessment Category A of	Excluded from the project scope.

Does the proposed project have little or no negative environmental impact? Please provide a brief description:				OP 4.01 Environmental assessment Category C of	No review required.
According to the above definition, the project is neither Category A nor Category C? Please provide a brief description:				OP 4.01 Environmental assessment Category B of	Limited environmental and social impact assessment or environmental and social management plan.
Will the subproject have serious negative social impact? Are these impacts sensitive, diverse or unprecedented? Please provide a brief description:				OP 4.01 Environmental assessment Category A of	Excluded from the project scope.
Will the project endanger material and cultural resources (cultural relics protection units above the county level)? Please provide a brief description:				OP 4.11 Physical cultural resources	Excluded from the project scope.
Will the project endanger cultural resources that are meaningful to the local community or town (such as the temple of the god of earth in the village)? Please provide a brief description				OP 4.11 Physical cultural resources	If yes, the site selection shall be compared and the opinions of relevant affected persons shall be solicited in advance.

Does the project involve changes or degradation of non-critical natural habitats? Please provide a brief description:				OP 4.04 Natural habitats	Environmental and social management plan
Does the project involve significant changes or degradation of critical natural habitats?				OP 4.04 Natural habitats	Excluded from the project scope.
Will a new dam be built or an existing or under construction dam be reconstructed in the subproject?				OP 4.37 Dam safety	Excluded from the project scope.
Does the project make the quality of surrounding surface water worse?				OP 4.04 Natural habitats	Strict water environment protection measures to reduce the impact on water environment
Does the project get pesticides (directly through the project, indirectly through loans, co-financing, or government counterpart funding), or may there be ways to influence pest management programs, even if the project has never been envisaged to buy pesticides?				OP4.09 Pest management	Elaborated in the framework of environmental and social impact management (pest management plan)
Does the subproject involve involuntary land acquisition, property loss or loss of sources of income and livelihood? Please provide a brief description:				OP 4.12 Involuntary resettlement	Resettlement framework
Are there ethnic minority communities in the subproject area, and will the proposed subproject bring them positive or negative impacts? Please provide a brief description:				OP 4.10 Indigenous people	Ethnic development plan

Will the project have an impact on forests or forest dependent groups? Will it affect their interaction or dependence on forests? Or is the project designed to bring change to the management or conservation of natural or planted forests? Please provide a brief description:				OP4.36 Forest	Excluded from the project scope.
Will the project have a significant impact on or cause significant changes and degradation to key natural forest areas or other natural habitats?				OP4.36 Forest	Excluded from the project scope.

Conclusions and safeguards measures required
According to OP4.01 of World Bank the subprojects are classified into Category and the following environment safeguard guarantee measures are required:

1. _____
2. _____
3. _____
4. _____

Note：Category C project does not need environmental management plan, and does not need to take environmental protection measures to mitigate the impact.
Environmental management plan shall be prepared for Category B.
Category A needs to prepare environmental impact report and environmental management plan separately, which will be excluded from the scope of this project.

Instruction for filling the environmental screening checklist
See the above table for details of the environmental and social screening checklist for subprojects. This checklist is applicable to all subproject. During the subproject review process, the following contents shall be determined according to the nature of the subproject:

1.Potential environmental and social impacts of subprojects;
2.Environmental categories of subprojects based on environmental and social impacts;
3.During preparation of subprojects, the specific action plan of subprojects must be prepared before being approved.
According to the screening results in the above table, it is determined which of the three categories A, B and C the subprojects belong to. There are three kinds of processing procedures respectively.
1.Category C projects do not need environmental management plan, and do not need to take environmental protection measures to mitigate the impact.
2.Environmental management plan and general pest management plan shall be prepared for Category B projects. If the subproject involves land acquisition and

resettlement, relevant documents shall be prepared according to the resettlement policy framework.

3.Category A subproject shall be excluded from the project.

Category A subprojects have potential significant negative environmental and social impacts, which are:

（1） Sensitive (for example, potential impacts are sensitive and may not be reversible. Such as the loss of a major natural habitat, or trigger World Bank safeguard policies, such as OP 4.04 natural habitats, OP 4.36 forest, OP 4.10 indigenous peoples, OP 4.11 physical cultural resources, OP 4.12 involuntary resettlement, etc., or when a project needs to manufacture, use, or deal with a large number of pesticide products that have an impact on the environment (OP 4.04).

（2） The impacts are diversify or unprecedented.

（3） Impacts beyond the project area (e.g., a dam, which may affect downstream communities or road construction, and may affect nearby forests and natural habitats). Review example for Category A projects.

When the impacts of subproject on natural habitat will be classified as Category A?

If the review shows that the project has the possibility of significant change or deterioration of key or other natural habitats, it is classified as Category A. Major changes are mainly caused by long-term land use or water use, resulting in complete disappearance or severe reduction of key or other natural habitats. Major changes may include loss of land; replacement of natural vegetation; permanent flooding; drainage, dredging, filling, channelization of wetlands or open-pit mining. Changes can be caused directly by project activities or through indirect mechanisms (e.g., triggering migration along the road). Deterioration is a significant change to a critical or other natural habitat that significantly reduces the ability of the natural habitat to sustain the survival of the local population.

When the impacts of subproject on forest will be classified as Category A?

If the project has potential for significant change or deterioration of natural forest, it is classified as Category A. Natural forest refers to forest land and related rivers. The biological population of its ecosystem is mainly formed by native plant and animal species. Human activities have basically not changed the main ecological functions of the area.

When the impacts of subproject on the physical cultural resources and the project will be classified as Category A?

Physical cultural resources, as defined in OP 4.11, are movable or immovable objects, such as places, structures, organizational structures, natural features and landforms, with archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Projects that may have a significant adverse impact on physical cultural resources can be classified as Category A.

How are subprojects that involve pest management policies classified as Category A?

Projects involving the production, use, or disposal of large quantities of pesticide products are classified as Category A. Its environmental impact should also take into account the impact on human health and interests.

When is it possible for a subproject involving involuntary resettlement to be classified as Category A?

The World Bank does not provide specific classification criteria related to involuntary resettlement in OP4.12. In general, projects with significant resettlement related impacts should be classified as Category A. In terms of potential significant resettlement impact, as different projects have different scope and scale, necessary judgment methods should be used. The project requires that in ecological or commercial resettlement, any project that results in the loss of more than 10% of the effective output land area of an individual is generally classified as Category a. Scale is also a factor, although sometimes the impact is relatively small. When the project affects the whole community or the vast majority of people (for example, more than 1000 people in total), the implementation capacity may be weakened and it will be classified as Category A according to the classification criteria.

When is it possible for a subproject involving indigenous peoples to be classified as Category A?

The World Bank does not provide classification criteria related to indigenous peoples. Although this policy is often used in the World Bank's team meetings on the definition of indigenous peoples in the project area, the classification criteria specifically reflect the potential negative impacts on indigenous communities. The project requires indigenous people to move, which limits their use of traditional land or resources, or will change the traditional system of indigenous people, which is usually classified as Category A.

Category B projects refer to those subprojects with regional characteristics and certain potential negative environmental and social impacts. Only a small amount of impacts is irreversible.

Category C subprojects refer to those subprojects with little or no negative environmental and social impact.

Part 2: Social screening checklist

Table 2 Social screening checklist

Issues	**Answer**			**If yes, it will trigger World Bank safeguard policy.**	**If yes, relevant documents shall be provided**
	Yes	No	Remarks		
1. **Immigration and land acquisition**					
Does the subproject require land acquisition for development (public or private, temporary or permanent)?				OP 4.12 Involuntary resettlement	Resettlement action plan
Does the subproject cause house demolition (including operating and non-operating ones) due to development?				OP 4.12 Involuntary resettlement	Resettlement action plan

Are people prohibited from using their daily economic resources (such as fishing sites, economic forests, planting land)?				OP 4.12 Involuntary resettlement	Resettlement action plan
Does the subproject result in involuntary resettlement of individuals or families?				OP 4.12 Involuntary resettlement	Resettlement action plan
Does the subproject result in temporary or permanent loss of crops, fruit trees and facilities?				OP 4.12 Involuntary resettlement	Resettlement action plan
2. **Minorities**					
Whether the subproject has affected ethnic minority communities and population				OP 4.10 Indigenous People	
3. **Employees**					
Does the subproject cause unemployment?					Reemployment plan
Does the subproject result in employee transfer?					Job transfer training
Whether the subproject causes the decrease of employee's income					

Conclusions and Safeguard Measures Required:

According to OP 4.10 and OP 4.12 of World Bank, the following social safeguard documents shall be prepared for the subproject:

1.
2.

Note：

A) if the subproject involves more than 200 people who need to be relocated, a resettlement action plan shall be prepared;
B) if the subproject involves relocation of less than 200 people, a brief resettlement action plan shall be prepared;
C) if significant social impact is expected or there are affected ethnic minority communities in the subproject area, a social evaluation is required.

Appendix 13B: Questionnaire for Interview to Assess Gender on Feasibility Study to Enhance Management of State Forest Plantations and Mangroves Forest Reserves In Tanzania

A. Personal data

1. Sex: f [ ] m [ ] 2. Age: ---------- 3. Ethnic group: ---------- 4. Education: ---------- 5. Occupation: ---------- 6. Marital status: ---------- Village name: _____ 14. Name of Plantation/Mangrove Forest reserve: _____

B. Gender perceptions and participation in plantation/Mangrove forests management

1. What roles do men and women play in management of plantation/Mangrove forests?
2. Are men and women involved in different activities related to use of plantation/Mangrove forests including forest based enterprises and products value chain?
3. What are the benefits gained by men and women from the management of plantation/Mangrove forests?
4. What is the proportion of men and women participating in activities to manage plantation/Mangrove forests?
5. What is the participation of men and women in decision making process to influence management of the plantation/Mangrove forests?
6. What mechanisms exist to ensure balanced representation of different groups (men, women and other disadvantaged groups) within the plantation/mangrove forests decision making
7. How do men and women perceive the plantation/Mangrove forests management practices, forests conditions and their living conditions in the course of implementation?

C. Gender Issues analysis

8. How do women and men access to and control plantation/Mangrove forest resources and incomes? Do you think the needs of women and men are met in participating to the plantation/Mangrove forests resource and accrued incomes?
9. How do the social structures (e.g. traditions, governance, religion, rights and status of groups) promote or impede men's and women's ability to access and manage plantation/mangrove resources?
10. What are social economic factors that affect men and women in managing plantation/Mangrove forests resources and incomes?
11. How are men and women involved in planning, designing, implementing, monitoring and evaluating plantation/Mangrove forests resource management and income generating activities in your area?
12. How do decision making and women voice heard or Have women been directly consulted during development activities?
13. What should be done with TFS in general to close the gaps between women and men for effective participation and maximization of benefits from managing plantation/Mangrove forests?

D. Gender and Plantation/Mangrove forests benefits

14. How do men and women benefit from plantation/Mangrove forests and how?
15. Do men and women have access to plantation/Mangrove forests information?

16. Who (men or women) have particular knowledge of plantation/Mangrove forests resources, e.g. where they are located, their seasons?
17. Who has control over plantation/Mangrove forests resources within the gender context?
18. Are there gender disparities in the distribution of benefits from plantation/Mangrove forests?
19. What are the key drivers for these gender disparities?
20. What strategies should be put in place to address gender disparities in the distribution of benefits from plantation/Mangrove forests?
21. What kinds of networks are men and women involved within the forestry sector under plantation/Mangrove forests management?

E. Gender Division of Labour in Plantation and Mangrove forests

Q1. a) What are the main activities and processes within the plantation and mangrove forestsmanagement?
b) Which activities/processes are preferred by women and which ones for men?
c) Can women do the activities / processes reserved for men? Are men also allowed to be involved in activities / processes reserved for women? If Yes, then to what extent?
(d) What are the traditional norms that underpin the gendered division of labour in plantation and mangrove forests management?

Gender access to and control over plantation and Mangrove forest resources

Q2: a) Gender Resource Mapping to identify resources within the plantation and Mangrove forests and diverse assets accessible and under control of women and men for livelihood improvement.
b) Identify and assess the tradition norms underpinning the gendered access to and control over plantation and Mangrove forest resources (e.g. land, labour, extension services etc)
c) What are the main resources available in the plantation/Mangrove forests?
d) Which resources are available to men? Which resources are available to women?
e) Who has access to and control over the benefits accrued?

Gender power relations in plantation and Mangrove forest Management

Q3:a) Who makes decisions over the plantation/mangrove forest resources management?
b) What is the decision making structures within the plantation/mangrove forests management?
c) How many women and men are within these structures?
d) Are there disputes about which of the sexes should use the particular plantation/mangrove resources?
e) Are there political, economic, or cultural factors affecting the gender differences in management of plantation/mangrove forests? If yes, kindly list them and explain

Gender and legal framework in Plantation and Mangrove forests

Q4: a) Are men and women aware of any laws/regulations/guidelines that regulate the plantation/mangrove forests? If so, name some of them

b) What are some of the important provisions within gender context in these laws/Regulations/guidelines?

c) Do you think these provisions apply and take into account the needs of both men and women equally?

d) Are these laws/Regulations/guidelines laws/Regulations/guidelines easy to comply by both men and women? Kindly explain.

e) What are the enabling factors for men and women to compliance with these laws/Regulations/guidelines? In other words, what encourages/promotes compliance?

f) What are the limiting factors to men and women in complying with these laws/Regulations/guidelines? Or what discourages compliance in gender context?

Gendered vulnerabilities and challenges of within the plantation/Mangrove forests

Q5: a) What are some of the challenges/constraints and barriers for men and women effective participation in the management of plantation/mangrove forests?

b) What are the risks associated with men and women participation in activities related to the management of plantation/Mangrove forests?

c) What are the strength and capacity of men and women in participation to manage and benefit from the plantation/Mangrove forests?

d) What are the views of men and women in offsetting the challenges mentioned above in 5(a)?

Appendix 14: Procurement Plan

Component (C) / Activity (Ax.x) / Sub-Activity (Ax.xx)	Types of Goods and Services to be procured	To whom?	How?
C1: To upscale and diversify forest plantations in three pilot Forest Reserves			
A1.1 – Improving tree seed quality and quantity and tree seed management			
A1.1.1 Establishment of seed orchards	Seed orchards	TFS/TAFORI	Internal Arrangements
A1.1.2 Establishment of species progeny trials	Progeny trials	TFS/TAFORI	Internal Arrangements
A1.1.3 Establishment of modern nurseries	Modern nurseries	TFS	Internal Arrangements
A1.1.4 Training in seed and tree breeding aspects	Training	External Tree Breeding Institutions	Call for bid (national/international)
A1.2 - Upscaling of forest plantations in the Mtibwa forest plantation	Forest plantations	Option 1: TFS (with local manpower) Option 2: Local contractors	Option 1: Direct/internal procurement Option 2: Call for bid (national)
A1.3 - Upscaling of forest plantations in the Wino forest plantation			
A1.4 - Upscaling of forest plantations in the Silayo forest plantation			
C2: To sustainably manage mangrove forests in two pilot Forest Reserves			
A2.1 - Strengthening forest protection	To be detailed at the feasibility stage		
A2.2 - Strengthening community participation and developing alternative livelihoods and sustainable economic activities			
A2.3 - Restoration of the degraded mangroves;			
A2.4 - Develop tourism attractions in the mangroves			
A2.5 - Generate carbon credits to co-finance mangrove management			
C3: To strengthen the technical, logistic and institutional capacities of TFS			
A3.1 - Additionnal staffing for TFS	No procurement: internal HR to be reallocated by TFS		
A3.2 - Strengthening the monitoring capacities of TFS			
A3.3 - Strengthening the logistic capacities of TFS			
A3.3.1 Construction of ranger offices	PMU staff	Tanzanian experts (from TFS)	Competitive call for experts

A3.3.2 Construction of staff houses	PMU staff	Tanzanian experts (from TFS)	Competitive call for experts
A3.3.3 Purchase of vehicles for field activities (Pickup, LandCruisers)	PMU staff	Tanzanian experts (from TFS)	Competitive call for experts
A3.3.4 Purchase of lorries (long base, tipper)	PMU staff	Tanzanian experts (from TFS)	Competitive call for experts
A3.3.5 Purchase of heavy duty machines for forest road construction	PMU staff	Tanzanian experts (from TFS)	Competitive call for experts
A3.4 - Strengthening TFS capacities in terms of forest fire prevention and suppression			
A3.4.1 Fine-tuning (elaborating) a National Forest Fire Strategy and Work Plan	Consultancy / studies	Consultancy firms	Call for bid (national/international)
A3.4.2 Improving forest fire prevention			
A3.4.3 Improving forest fire suppression measures			
A3.4.4 Purchasing forest fire-fighting infrastructure and equipment for the 3 FP	Equipement for FFPS	Firms specialised in FFPS equipement	Call for bid (national/international)
C4: To coordinate, monitor and evaluate, and audit the project			
A4.1 - Coordinating the project	PMU staff	Tanzanian experts (from TFS or not)	Competitive call for experts
A4.2 - Monitoring and evaluating the project	Mid-term and final evaluations	Consultancy firms	Call for bid (national/international)
A4.3 - Auditing the project	Annual audits	Consultancy firms	Call for bid (national/international)

Appendix 15: Financial Plan

Component (C) / Activity (Ax.x) / Sub-Activity (Ax.xx)	Funding (Th Eur)			Annual needs (B TZS)				
	AFD loan	AFD grant	EU	Y1	Y2	Y3	Y4	Y5
C1: To upscale and diversify forest plantations in three pilot Forest Reserves	**26,587**			**8.47**	**10.89**	**13.06**	**14.61**	**15.98**
A1.1 – Improving tree seed quality and quantity and tree seed management				0.36	0.36	0.36	0.36	0.36
A1.1.1 Establishment of seed orchards				0.09	36.51	0.00	0.02	7.30
A1.1.2 Establishment of species progeny trials				0.08	34.66	0.00	0.02	6.93

A1.1.3 Establishment of modern nurseries				0.14	57.91	0.00	0.03	11.58
A1.1.4 Training in seed and tree breeding aspects				0.05	22.83	0.00	0.01	4.57
A1.2 - Upscaling of forest plantations in the Mtibwa forest plantation				0.99	1.24	1.38	1.59	1.73
A1.3 - Upscaling of forest plantations in the Wino forest plantation				1.84	2.34	2.76	3.03	3.32
A1.4 - Upscaling of forest plantations in the Silayo forest plantation				5.27	6.95	8.56	9.63	10.57
C2: To sustainably manage mangrove forests in two pilot Forest Reserves			**4,386**	**1.80**	**1.80**	**1.80**	**1.80**	**1.80**
A2.1 - Strengthening forest protection								
A2.2 - Strengthening community participation and developing alternative livelihoods and sustainable economic activities				0.43	0.43	0.43	0.43	0.43
A2.3 - Restoration of the degraded mangroves;				0.76	0.76	0.76	0.76	0.76
A2.4 - Develop tourism attractions in the mangroves				0.33	0.33	0.33	0.33	0.33
A2.5 - Generate carbon credits to co-finance mangrove management				0.28	0.28	0.28	0.28	0.28
C3: To strengthen the technical, logistic and institutional capacities of TFS	**10,157**	**2,000**		**13.02**	**2.90**	**2.90**	**2.90**	**0.85**
A3.1 - Additionnal staffing for TFS and short traing for plantations and mangroves								
A3.2 - Strengthening the monitoring capacities of TFS				0.04	0.04	0.04	0.04	0.04
A3.3 - Strengthening the logistic capacities of TFS				12.05	2.05	2.05	2.05	-
A3.3.1 Construction of ranger offices (14 plantation and 6 mangroves) and 2 Offices				0.55	0.55	0.55	0.55	
A3.3.2 Construction of staff houses for plantations and mangroves				1.50	1.50	1.50	1.50	
A3.3.3 Purchase of vehicles for field activities (Pickup, LandCruisers and boats) for plantations and mangroves				4.00				
A3.3.4 Purchase of lorries (long base, tipper)				2.00				
A3.3.5 Purchase of heavy duty machines for forest road construction				4.00				

A3.4 - Strengthening TFS capacities in terms of forest fire prevention and suppression				0.93	0.81	0.81	0.81	0.81
A3.4.1 Fine-tuning (elaborating) a National Forest Fire Strategy and Work Plan				0.12				
A3.4.2 Improving forest fire prevention								
A3.4.3 Improving forest fire suppression measures								
A3.4.4 Purchasing forest fire-fighting infrastructure and equipment for the 3 FP				0.81	0.81	0.81	0.81	0.81
C4: To coordinate, monitor and evaluate, and audit the project	**465**			**0.19**	**0.19**	**0.26**	**0.19**	**0.26**
A4.1 - Coordinating the project				0.17	0.17	0.17	0.17	0.17
A4.2 - Monitoring and evaluating the project						0.07		0.07
A4.3 - Auditing the project				0.02	0.02	0.02	0.02	0.02
				Annual needs (B TZS)				
	AFD loan	**AFD grant**	**EU**	**Y1**	**Y2**	**Y3**	**Y4**	**Y5**
	35,209	**2000**	**4386**	**23.48**	**15.78**	**18.03**	**19.51**	**18.89**