



A PLATFORM FOR STAKEHOLDERS IN AFRICAN FORESTRY

FOREST PLANTATIONS AND WOODLOTS IN EASTERN AND NORTH EASTERN AFRICAN COUNTRIES - A REGIONAL OVERVIEW



AFRICAN FOREST FORUM WORKING PAPER SERIES

Copyright © African Forest Forum 2011

All rights reserved

African Forest Forum

P.O. Box 30030 00100 Nairobi GPO KENYA

Tel: 254 20 7623900

Fax: +254 20 30677-00100

www.afforum.org

Disclaimer

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the African Forest Forum concerning the legal status of any country, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries regarding its economic system or degree of development. Excerpts may be reproduced without authorization, on condition that the source is indicated. Views expressed in this publication do not necessarily reflect those of the African Forest Forum.

FOREST PLANTATIONS AND WOODLOTS IN THE EASTERN AND NORTH EASTERN AFRICAN COUNTRIES

A REGIONAL OVERVIEW

by

Prof. S.A.O. Chamshama

DECEMBER 2011

CONTENTS

_Toc313715034

ACRONYMS	5
ACKNOWLEDGEMENTS	6
PREFACE	7
EXECUTIVE SUMMARY	9
1. INTRODUCTION	13
2. FOREST PLANTATIONS SITUATION	17
2.1 Historical background	17
2.2 Location, areas and species composition	17
2.3 Plantation management	19
2.3.1 Establishment	19
2.3.2 Weeding	21
2.3.3 Pruning	21
2.3.4 Thinning	21
2.3.5 Forest health.....	22
2.3.6 Maintaining long term site productivity	23
2.3.7 Growth, yield and rotation age	23
2.4 Forest plantation expansion.....	24
2.4.1 New areas available for forest plantation expansion	24
2.4.2 Stakeholder views on establishment, expansion and improved management of forest plantations.....	24
2.4.3 Prospects for and constraints to forest plantation development and expansion	25
3. OUT-GROWER SCHEMES AND OTHER WOODLOTS	26
3.1 Extent and impacts of out-grower schemes/other woodlots	27
3.2 Factors shaping growth of out-grower schemes and other woodlots	28
3.3 Suggestions for improvement of out-grower schemes	28
4. FOREST AND TREE TENURE	29
4.1 Current forest/tree tenure systems.....	29
4.2 Impacts of forest/tree tenure on poverty alleviation and SFM.....	30
4.3 Suggestions for improvement of tenure reforms.....	31
5. FINANCIAL AND HUMAN RESOURCES FOR PLANTATIONS AND OUT-GROWERS/ WOODLOTS	32
5.1 Current financing mechanisms	32
5.2 Potential financing mechanisms	34
5.3 Human resources	34
5.4 Other resources	35
6. INCENTIVES FOR PLANTATION ESTABLISHMENT BY PUBLIC/PRIVATE SECTOR AND OUT-GROWERS/OTHER WOODLOTS	35
6.1 The concept of incentives and rationale behind incentives	36
6.2 Current incentives: impacts and effectiveness.....	36
6.3 Suggestions for improvement of incentives.....	37
7. SUPPLY AND DEMAND OF FOREST PRODUCTS	38
7.1 Supply scenarios and projections	38
7.2 Demand scenarios and projections	39
7.3 Consumer prices	40
7.4 Forest products trade	41
8. FOREST ROYALTIES AND OTHER REVENUES	42
8.1 Forest royalties and licences	43
8.1.1 Structure and amount of forest royalties and licences.....	43
8.1.2 Suggestions for improvement of forest charges and licences	44
8.2 Forest concessions/permits.....	44
8.2.1 Current concessionaires/permit holders	44
8.2.2 Monitoring of compliance	45
8.2.3 Suggestions for improvement of concessions/permits.....	45

8.3 Administration of forestry revenue system	45
8.3.1 The process of setting forest royalties and taxes.....	45
8.3.2 Monitoring and collection of revenue	45
8.3.3 Total forest revenue collection.....	46
8.3.4 Suggestions for improvement of revenue collection systems	46
9. PROCESSING OF PRODUCE	47
9.1 Ownership and types of industries	47
9.2 Raw material supply and quality.....	48
9.3 Constraints facing the sub-sector	48
9.4 Potential for future investment.....	49
10. SOCIO-ECONOMIC AND ENVIRONMENTAL CONTRIBUTIONS OF FORESTS	49
10.1 Current and potential income	49
10.2 Current and potential employment	50
10.3 Plantations in forest conservation	50
11. CONCLUSIONS AND WAY FORWARD.....	51
11.1 Conclusions	51
11.2 Recommendations/Way forward	51
REFERENCES	54
ANNEX 1: TERMS OF REFERENCE	57
ANNEX 2: PRUNING SCHEDULES	58
ANNEX 3: THINNING SCHEDULES.....	60
ANNEX 4: PRINCIPLES OF PARTNERSHIPS	63
ANNEX 5: FORESTRY INCENTIVES	67

ACRONYMS

AAC	Annual Allowable Cut
AFF	African Forest Forum
CBFM	Community Based Forest Management
CDM	Clean Development Mechanism
CIFOR	Centre for International Forestry Research
CFU	Carbon Finance Unit
DP	Development Partners
DRC	Democratic Republic of Congo
FAO	Food and Agriculture Organization of the United Nations
FCPF	Forest Carbon Partnership Facility
ha	hectare
IPM	Integrated Pest Management
JFM	Joint Forest Management
JI	Joint Implementation
m	metre
MIS	Management Information System
mm	Millimetre
NFFS	National Forestry Financing Strategy
NGOs	Non Governmental Organisations
NIPF	Non Industrial Private Forests
NWFPS	Non Wood Forest Products
OECD	Organization for Economic Cooperation Development
PES	Payment for Environmental Services
PFM	Participatory Forest Management
REDD	Reduced Emissions from Deforestation and forest Degradation
SFM	Sustainable Forest Management
SPGS	Sawlog Production Grant Scheme (Uganda)
SMFEs	Small and medium size forest enterprises
ToF	Trees on Farm
ToR	Terms of Reference
TZS	Tanzania Shillings
VCS	Voluntary Carbon Standard
WB	World Bank
Yr	Year

ACKNOWLEDGEMENTS

I wish to thank the African Forest Forum (AFF) for contracting me to be the Lead Consultant for this assignment. I wish in this respect to thank Prof. Godwin Kowero, the Executive Secretary, of AFF, for his effective guidance and support. I wish also to thank other staff of AFF Secretariat for their administrative and professional support.

This report is based on country reports made by national consultants. I wish to express my gratitude to the consultants for their work and cooperation, thus, to Dr. A. Gaafar (Republic of Sudan and Republic of South Sudan), Prof. J. R. S. Kaboggoza (Uganda), Prof. J. Nduwamungu (Rwanda and Burundi), Mr. M. Bekele (Ethiopia), the late Dr. W. Mathu (Kenya) and Prof. Y. M. Ngaga (Tanzania).

I wish to thank Prof. S. Iddi (Sokoine University of Agriculture) for reviewing the country reports as well as the regional synthesis report. I also thank all national consultants for their valuable comments on the regional report. Dr. Bjorn Lundgren is sincerely thanked for his invaluable work in editing the national and regional reports.

I would also like to express my thanks to all stakeholders: community members; staff from the government, private sector and international organisations in all countries for their cooperation and for contributing relevant information used in this study. Very useful inputs were also obtained during the national/regional workshop held in Nairobi, Kenya, December 13-14, 2011. I thank all workshop participants for their attendance and for their contributions.

While I acknowledge with thanks all those who availed information during the conduct of this study, I however remain solely responsible for any omission and errors of interpretation.

PREFACE

Forest plantation development in the study countries of Burundi, Ethiopia, Kenya, Rwanda, Sudan (i.e. Republic of Sudan and Republic of South Sudan, hereafter Sudan is used to represent both), Tanzania and Uganda was in most cases preceded by species and provenance trials mainly of exotic tree species during the period late 1800s, mainly in South Africa, then later in the early to mid 1900s in the rest of the region. Successful results from species/provenance trials led to large scale planting during the period 1920-1960. The justifications for plantation development in these countries have been the growth superiority and product uniformity attributes of plantations over those of useful, but normally slow growing, but ecologically valuable indigenous tree species in natural forests. Plantations also have the ability to provide affordable wood for industry and wood-based products for consumers. In addition, tree plantations are often the most rational way of producing some non-wood forest products, for rehabilitation of degraded areas and improvement of watersheds, and for meeting environmental quality objectives such as windbreaks, shelterbelts and, more recently, carbon sequestration.

The continuing population increase in the countries under study and in the world, and the concomitant social and economic development, will increase demand for and consumption of wood products. This demand can only be met by establishment and improved silvicultural management of plantations as production from the natural forests dwindles due to deforestation which is a major problem in the region. Though forestry plantations are certainly not the *sole* solution to the protection of natural tropical forests, they offer the best available solution to help provide an alternative supply of timbers and wood with minimum demand on land. They can, if carried out properly, be complementary to and release pressure on natural forests as suppliers of quality timber.

In the 1970s and 1980s, emphasis was also put on the establishment of woodlots as individual or community forestry undertakings, and for environmental rehabilitation due to increasing public concern over the rapid deforestation in many tropical countries. The woodlots showed, and continue to show, high variability in performance (productivity and quality) due to various factors. The foregoing notwithstanding, in some countries of the region, woodlots and trees on farm (ToF) today form an integral part of a variety of agro-ecosystems. As supplies of wood and NWFPs from natural forests decline, woodlots and ToF have become a major source of these products. They are thus playing a significant role in the livelihoods of communities and national economies. They provide a range of benefits, from ecosystem services to wood and NWFPs.

Establishment of forest industries in the region dates back to the colonial era. Initially, saw mills were established to utilise natural forest timber, but later expanded to utilise plantation timber. Other industries established to utilise plantation timber, mainly during the post colonial era, include chip board, fibre board, ply wood and pulp and paper factories.

Investment in forest plantations in the period 1960s to 1980s was done with support from development partners or international banks in most countries. The emphasis was on industrial plantations in the 1950s to 60s, in the 1970s emphasis shifted to establishment of woodlots as social or community forestry and in the 1980s the environmental side of social forestry was reinforced by increasing public concern regarding rapid deforestation in many tropical countries. After maturity of the plantations, support also went to development of wood industries.

Plantation programmes, especially the public sector plantations in the study countries, face various challenges and have been on the decline, particularly in the last two decades due to weakening public forest services as a result of diminishing priority given to them in the face of economic reforms such as structural adjustment programmes, and declining development partner interest in funding forestry activities. For the woodlots, there are various challenges which limit their potential to provide products and services. These include poor germplasm quality, poor woodlot management techniques, lack of value addition and lack of market information and marketing channels. On the other hand, forest industries have suffered from poor management and lack of resources to replace obsolete machinery resulting in low and inefficient productivity in addition to low quality products and, consequently, low profit margins.

The purpose of the study was to analyse and report on the current status, challenges, opportunities and options for developing, as well as ensuring better management of, existing forest plantations and woodlots in the region. Another purpose has been to highlight the potential of the forest

plantations and woodlots sub-sector to become an attractive option for both the public and private sector investments, including to individual farmers. Other aspects which, in various ways, influence sustainable forest management (SFM) were also studied. These include forest and tree tenure, incentives, wood supply and demand, forest royalties and other revenues, processing of produce and socio-economic and environmental contributions of forests. It is hoped that the information contained in this report will be useful for effective planning of future interventions geared towards better and sustainable management of forest plantations and woodlots in the study region.

EXECUTIVE SUMMARY

Background

This report presents the current status, challenges, opportunities and options for developing, as well as ensuring better management of, existing forest plantations and woodlots in Burundi, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda. The objective is to explore opportunities to turn the forest plantations and woodlots sub-sector into an attractive option for both public and private sector investments, as well as to individual farmers, while at the same time contributing to sustainable forest management. We also discuss forest and tree tenure, incentives, wood supply and demand, forest royalties and other revenues, processing of produce and socio economic and environmental contributions of forests. Data were mainly obtained by desk studies and to a lesser extent field visits. This study was plagued by incomplete, outdated and often unreliable data in all the study countries. This limitation notwithstanding, it is the belief and conviction of the consultants that have been involved with the study that the information obtained and analysed reasonably well reflects the actual situation in the study countries.

Main findings

1. Overall, public forest plantations dominate the region with a coverage of c. 1 288 000 ha compared to c. 220 500 ha for private sector plantations. This should be compared to the total area of the seven studied countries of 507 839 000 ha. Public sector plantations are characterised by planting and replanting backlogs, low intensity site preparation techniques, poor quality and productivity (in most situations 2 – 16 m³/ha⁻¹yr⁻¹) due to use of un-improved seed and low survival due to poor species-site matching and delayed or low intensity site preparation and weeding. It is also noted that most plantations are poorly stocked, are irregularly pruned and thinned, are exposed to fire, disease and pest attacks, and generally suffer illegal felling and encroachments.
2. Despite availability of land in some countries, public sector industrial forest plantation expansion ceased at the end of external support. The main problem has been inadequate funding for maintenance and expansion of forest plantations.
3. Private sector forest plantations are more recent in most countries and still limited but are better managed. However, the overall investment climate is still not very conducive.
4. Due to the recent nature of private sector forest plantations, there are few out-grower schemes (270 ha). On the other hand, individual woodlots are widespread in all the study countries, covering c. 2 million ha, though information on their extent is unreliable. They have become a major source of wood and non wood forest products (NWFPs). They are thus playing increasingly significant roles in the livelihoods of communities and in national economies. Most woodlots have poor quality trees due to use of seed of low genetic quality. Silvicultural advice is also limited and thus management activities are based on farmers' experience resulting in trees of poor quality for timber.
5. Despite recent reforms devolving forest ownership and management to communities and other stakeholders, major ownership and management in most countries remains with governments (70-94%). It is only in Rwanda and Uganda that 61% and 64% respectively of the land is privately owned. Overall, centralised management of natural forests is poor, leading to deforestation and degradation. This is, among other things, due to low staffing levels, lack of motivation caused by poor working conditions (e.g. lack of transport and adequate field work budgets) and relatively low salaries. Some positive outcomes of tenure reform, e.g. community based forest management (CBFM), include improved livelihoods and forest condition.
6. Industrial forestry plantations and woodlot funding has mainly been from government resources, as development partner funding has been declining over the years. Overall funding has not been adequate with a wide difference between countries (US\$ 5.5 to 38.0 million in 2009/10) leading to the abandonment of various operations in forest plantations and very limited support to the woodlots. Human resources are also limited in terms of numbers and qualifications - from a total of graduates and skilled labour of just below 170 (in Burundi) to just below 8 000 (in Ethiopia).

7. There are limited direct incentives (free seedlings to farmers, cost of establishment, grants, tax concessions, lease of government land) and indirect ones (research information, training and extension) in forestry which hamper significant private sector and community involvement in forest plantation and woodlot establishment in the region.

8. Except for Tanzania during the period 2015 and 2020, future forest products demand scenarios by far exceed future supply scenarios (2015, 2020, 2025 and 2030). There has not been much effort in the region to reverse this state of affairs.

9. There is a wide variation between countries in local consumer prices of forest products (e.g. for plantation sawn timber price ranges between 85 and 450 US\$/m³).

10. The main exports from the region include sawn wood, roundwood and NWFPs. The main imports include sawn wood, paper and paper boards, furniture and wood based panels. Information on the value of imports and exports was not available.

11. Forest royalties are low (10 - 141 US\$/m³ depending on species) and largely arbitrarily determined with minimal recognition of market value. Total revenue collection is also low (5 - 132 million US\$ in 2010) and there are leakages due to shortage of staff, lack of operational funds and transport facilities to undertake effective monitoring and revenue collection.

12. Forest industries in the region mainly undertake primary processing with limited secondary processing. Most equipment is obsolete resulting in low recovery and products of poor quality.

13. Well managed forest plantations provide environmental services (soil and water protection, rehabilitation of degraded lands, restoration of landscapes and carbon sequestration) and provision of social services and livelihood support (income generation, employment and recreation). On the other hand, poorly designed plantations have resulted in soil erosion, reduced biodiversity and reduced mean annual stream flow.

Recommendations/way forward

The following recommendations as ways forward arose from this study:

1. Forest plantation situation

- High standards of silviculture and tree improvement: forestry plantations must be properly managed by sound selection of species, provenances or hybrid materials of high genetic quality and by use of appropriate and timely silvicultural practices so that they become extremely productive and producing high quality wood. Due to poor management of public industrial and energy plantations, there should be consideration to devolve forest management responsibilities and lease the plantations to the private sector.
- Forest plantation expansion: for countries with available land for new planting, Governments should provide a favourable investment and operating climate for the private sector to get involved with plantation establishment and management. For countries where land is limiting, out-grower schemes and other woodlots should be supported to assume a much greater role in tree growing.

2. Out-grower schemes

- To enable out-grower schemes to continue contributing to sustainable development of the sector in the future, the guidelines, criteria and indicators of best practice in out-grower schemes developed by FAO and CIFOR should be used.

3. Forest and tree tenure

- FAO's principles to reform tenure should be used to ensure unambiguous, equitable and enforceable tenure rights (communal, public and private) in forest areas and strengthen incentives for SFM.

4. Financing and human resources

- Governments and other stakeholders should develop comprehensive national forestry financing strategies (NFFS) which will create mechanisms and conditions for expanding and diversifying the financial basis for forest plantations and woodlots and SFM in general, by making the existing financing system more efficient and complementing it with new and/or innovative opportunities.
- Governments and other stakeholders should build up human resource capacity (managerial, technical and vocational) for forest plantations. There should also be improvement of extension services to support woodlots establishment by individuals and communities.
- Countries of the region should collaborate in research, capacity building and information exchange (lessons learnt, best practices, etc.) to enhance cost sharing and achieve economies of scale.

5. Incentives for plantation establishment by public/private sector and out-growers/other woodlots

- The NFFS proposed in section 4 will also cover direct and indirect incentives for plantation establishment by public/private sector and out-grower/other woodlots.

6. Supply and demand of forest produces

- Action on recommendations 1 and 2 will increase wood supply and close the supply-demand gap over time.
- There should be concerted efforts to develop human and financial capacity to collect, analyse and document forest produce supply and demand data for informed decision making.

7. Forest royalties and other revenue

- Stumpage fees should not be administratively determined; they should rather be determined using economic principles so that they more accurately reflect the market prices of round wood.
- Staff strength should be improved by recruitment, professional competence, proper remuneration and deployment to lower administrative levels. The staff should also be provided with transport and other facilities for effective implementation of the law enforcement and monitoring and collection of revenue.
- There is a need for regular forest inventories to provide accurate and up-to-date information for Forestry Departments to make informed decisions on resource utilisation.
- In order to ensure the co-operation of rural communities in forest revenue generation, forest adjacent communities should take part in monitoring of harvesting of wood and NWFPs, and village governments should get a share of the revenue.
- Development of national forest certification schemes, a market-led system for ensuring SFM and demonstrating to stakeholders in an objective manner that a certain forest area is sustainably managed. This, alongside chain of custody certification, is necessary to secure access to potential markets in Europe. It will improve the transparency of timber business, thereby reducing irregularities with special reference to illegal operations which will be useful outcome for the purpose of improving revenue collection.
- A centralised Management Information System (MIS) to take care of challenges on available forest revenue data and information should be established in the study countries. The MIS will consolidate and store harvesting and revenue collection data and reports.

8. Processing of produce

- Governments should support forest industries in the form of an enabling environment and appropriate incentives. Such support would ensure improvements in energy efficiency; lower waste production and ensure resource conservation; use of safe and environmentally

compatible materials; safe working conditions; and human resource capacity. This would lead to improvements in productivity and quality and thus improved profitability.

- For SMFEs, supportive policies should be in place. These include tax incentives, access to affordable microfinance, commercial infrastructure (roads, market access and information), secure tenure and capacity development.
- Development of technical standards and codes for wood and NWFPs.
- Research on wood properties of lesser utilised indigenous tree species.
- Protect SMFEs by limiting foreign investment in primary timber milling.
- Private sector players should form national and regional associations (includes those involved in forest management). The small players should be supported to form associations and cooperatives.

9. Socio-economic and environmental contributions of forests

- Location of forest plantations in the landscape: studies should be carried out to identify where trees should be placed and managed in the landscape to produce the best environmental outcomes.
- Forest plantation designs should ensure biodiversity and soil and water conservation by retaining individual natural forest trees or patches within the plantation, in water courses, ridges and steep areas.
- Valuation of forest resources: studies should be carried out to determine the value of forest resources so as to provide a full accounting and justification to invest in SFM.

10. General recommendation

- Securing accurate data for all aspects of this study was a big problem in terms of availability and reliability. This is a critical problem in all the study countries. This issue should urgently be addressed in order to have adequate bases for planning and development of the forest sectors in the countries.

1. INTRODUCTION

Background

Forest plantation development in the study countries of Burundi, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda was, in most cases, preceded by species and provenance trials, mainly of exotic tree species, starting in the late 1800s in South Africa, then later in the early to mid 1900s in the rest of the region. Successful results from species and provenance trials led to large scale planting during the period 1920-1960, and also continued to broaden the species range and improve productivity of the various species.

The justifications for plantation development have been the growth superiority and product uniformity attributes of plantations over natural forest tree species. Other factors opposing natural forest management for timber include (FAO, 2009a): expense in managing forests on a sustained basis, particularly as accessibility becomes increasingly difficult; competition with tropical hardwoods extracted from non-sustained sources that do not bear the costs of sustained management; high species diversity with few commercial species; incentives to maintain forest cover free of exploitation as climate-change mitigation and as biodiversity and ecosystem conservation measures; and lack of understanding of sustainable management in complex tropical forests. Plantations also have the ability to provide affordable wood for industry and wood-based products for consumers. This offsets pressure for wood production from natural forests and vulnerable forest ecosystems to allow them to be managed for conservation, protection and recreation purposes (FAO, 2005; FAO, 2006; Carle and Holmgren, 2008). The added benefits of wood products over competing products (cement, plastics, and metal products) are that they are renewable and are energy efficient and environmentally friendly (Carle and Holmgren, 2008; FAO, 2009b). In addition, tree plantations are often the most rational way of producing some non-wood forest products (NWFPs) (Carle *et al.*, 2002). Well managed forest plantations can also contribute positively towards provision of environmental and social services and livelihood support (Carle *et al.*, 2002; FAO, 2009b).

The continuing high population increase in the study countries and in most of the world and the concomitant social and economic development will increase demand for and consumption of wood products. This demand can only be met by establishment and improved silvicultural management of plantations as production from natural forests dwindles due to deforestation, which is a major problem in the region. Though forest plantations are not the sole solution to protect natural tropical forests, they offer the best available solution to help provide an alternative supply of timber and wood with minimum demand on land. They can, if carried out properly, be complementary to, and release pressure on, natural forests as suppliers of quality timber (Evans and Wood, 1993).

In the 1970s and 1980s, emphasis was also put on the establishment of woodlots as individual or community forestry undertakings, and for environmental rehabilitation purposes as a result of increasing concern over the rapid deforestation in many tropical countries. The woodlots showed, and continue to show, high variability in performance due to the following (Arnold, 1984; Jackson, 1984; Taylor and Soumare; 1984; Jagger *et al.*, 2003; Malimbwi *et al.* 2010):

- projects being based on the perceptions and priorities of planners and foresters followed by project implementation in a socio-cultural context where perceptions and priorities are often quite different;
- development partner initiatives and priorities, which were often not Forestry Department priorities;
- limited political commitment, as a result of which the level of funding provided to the forestry sector has been meagre;
- limited/lack of trained technicians and extension staff, leading to poor species choice and management techniques;
- tree planting and management occurring when farm labour is most in demand resulting in neglect of these activities;

- in some cases, adequate market studies have not preceded plantation establishment and the sale of resulting products may be considerably more difficult than originally estimated; and,
- communal planting efforts have sometimes been plagued by lack of adequate attention to details of the eventual distribution of the products.

The foregoing notwithstanding, in some countries of the region, woodlots and trees on farm (ToF) today form an integral part of a variety of agro-ecosystems. As supplies of wood and NWFPs from natural forests decline, woodlots and ToF have become a major source of these products. They are thus playing a significant role in the livelihoods of communities and national economies. They provide a range of benefits, from ecosystem services to wood and NWFPs.

Establishment of forest industries in the region dates back to the colonial era. Initially, saw mills were established to utilise natural forest timber, but later expanded to utilise plantation timber. Other industries established to utilise plantation timber, mainly during the post colonial era, include chip board, fibre board, ply wood, and pulp and paper factories.

Investment in forest plantations in the period 1960s to 1980s was, in most countries, done with the support of development partners or international banks, with an emphasis on industrial plantations in the 1950s to 1960s, which shifted to establishment of woodlots as social or community forestry in the 1970s, and then to environmental aspects of forests and agroforestry in the 1980s (Persson, 2003). After maturity of the plantations, support was also extended to the development of wood industries.

Plantation programmes, especially public sector plantations in the study countries, face many challenges and have been on the decline, particularly in the last two decades. Some plantations have had negative economic, environmental, social, or cultural impacts due to poor site/species or provenance matching; inadequate silviculture resulting in poor growth, hygiene, volume yields, and economic returns; changes in soil and water status; and alienation of customary lands leading to conflicts (ITTO, 1993; Carle *et al.*, 2002). These negative impacts can be minimised by prudent planning, management, utilisation, and marketing (Carle *et al.*, 2002). Also, there has been weakening public forest services as a result of diminishing priority given to them in the face of economic reforms such as structural adjustment programmes, and declining development partner interest in funding forestry activities. For the woodlots, there are various challenges which limit their potential to provide products and services. These include poor germplasm quality, poor woodlot management techniques, lack of value addition and lack of market information and marketing channels. On the other hand, forest industries have suffered from poor management and lack of resources to replace obsolete machinery resulting in low and inefficient productivity in addition to low quality products and, consequently, low profit margins.

In light of this, it is important to reassess plantation forestry, woodlots and forest industry programmes in the study countries with a view to map out the way forward in improving their performance so that they contribute to poverty alleviation, economic development and environmental stability. Other aspects, which, in various ways, influence SFM were also assessed.

Objectives of the Study

The purposes of the study were to analyse and report on the current status, challenges, opportunities and options for developing, as well as ensuring better management of, existing forest plantations and woodlots in the region, and also to turn the forest plantation and woodlot sub-sector into an attractive option for both public and private sector investments, including for individual farmers. Other aspects studied included forest and tree tenure, incentives, wood supply and demand, forest royalties and other revenues, processing of produce and socio economic and environmental contributions of forests.

Scope and Coverage

The report covers a total of seven countries, the five Eastern African countries of Burundi, Kenya, Rwanda, Tanzania and Uganda, and two North Eastern African countries of Ethiopia and Sudan (Figure 1). Since the studies were completed, Sudan split into two countries (in July 2011), and it has only been possible to divide the statistics for some parameters on the two new countries in the Sudan country report. In this synthesis report, most figures refer to the old, undivided country.

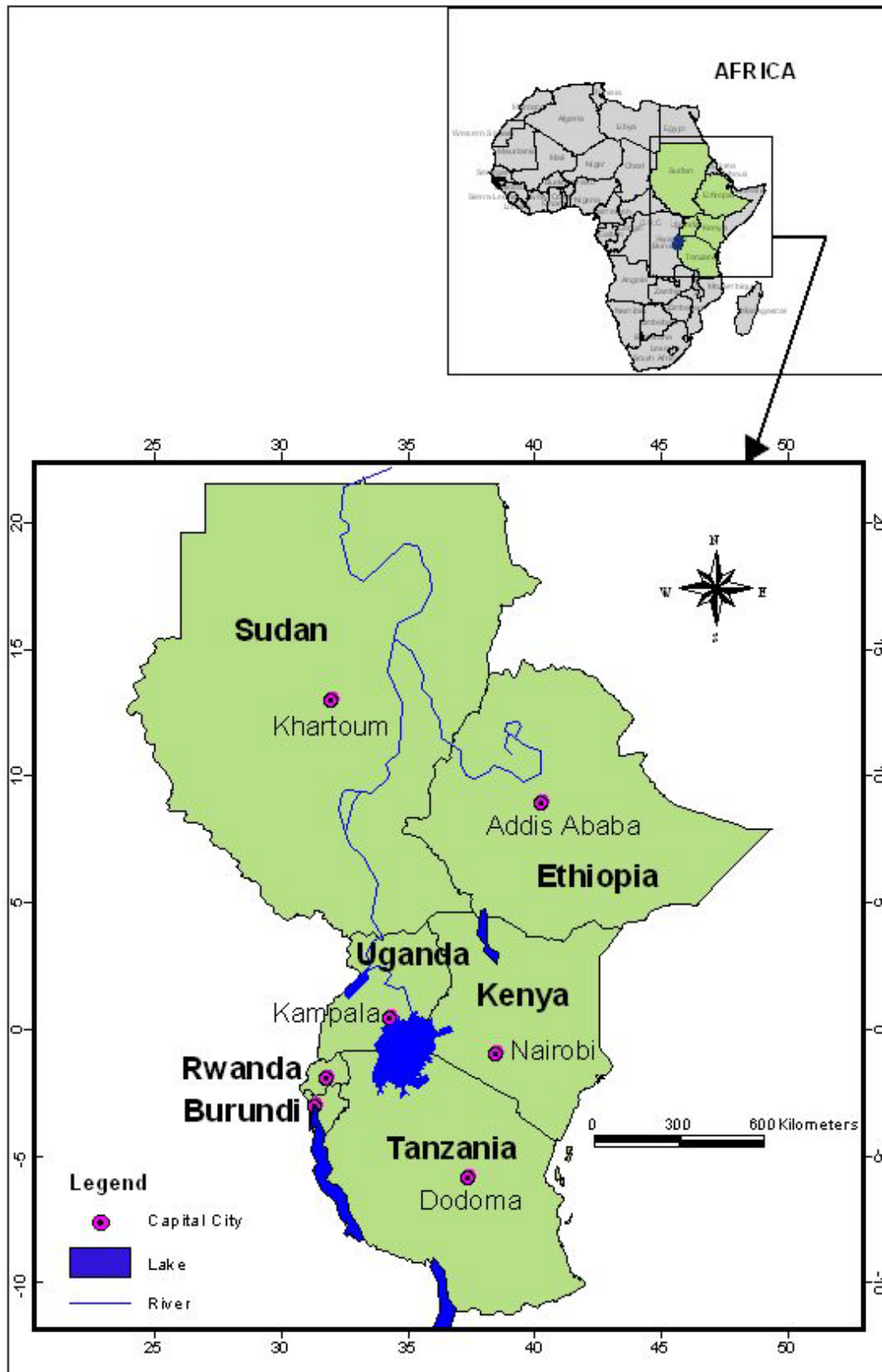


Figure 1: Map showing study countries

Basic data on countries with regard to area, population, economic outlook, state of forest and tree resources, and their annual changes are shown in Table 1. Overall, except for population growth rate and percent rural population, there are notable differences between countries in terms of population density, economic outlook, forest resources and annual change in forest resources. With regard to forest resources, there are two extremes, with Rwanda showing a net gain while Tanzania has the largest loss in forest area during the period. Both direct and indirect causes of deforestation and degradation contribute to the forest loss in the various countries.

The main focus of the report is forest plantations and woodlots: the present situation with regard to areas, species composition, management, financial and human resources and incentive mechanisms. The socio-economic and environmental contributions of forests are also highlighted as well as lessons learnt, constraints and opportunities. In addition, other aspects which in various ways influence SFM are discussed.

These include: forest and tree tenure, wood supply and demand, forest royalties and other revenues, processing of produce and socio economic and environmental contributions of forests. The audience of this report is all those involved with plantations/woodlots management, forest industries and forest management in general. These include policy makers, private sector companies, communities and forestry professionals. The detailed terms of reference (ToR) for the study are shown in Annex 1.

Table 1. Basic data on study countries: land area, population, economic outlook, state of forest and tree resources and annual change. Source: FAO (2011), Country Reports (2011).

Country	Land area (1000 ha)	Population tot. in 1000s (growth %)	Population people/km ² (% rural)	GDP US\$/cap (growth %)	Forest area total 2010 (change/y) both in 1000 ha
Burundi	2 568	8 074 (3.0)	314 (90)	383 (4.5)	172 (-3)
Ethiopia	100 000	80 713 (2.6)	81 (83)	869 (11.3)	12 296 (-141)
Kenya	56 914	38 765 (2.7)	68 (78)	1 551 (1.7)	3 467 (-12)
Rwanda	2 467	9 721 (2.8)	394 (82)	1 027 (11.2)	435 (+9)
Sudan	237 600	41 348 (2.3)	17 (57)	2 155 (8.3)	69 949 (-54)
Tanzania	88 580	42 484 (2.9)	48 (75)	1 301 (7.5)	33 428 (-403)
Uganda	19 710	31 657 (3.3)	161 (87)	1 166 (9.5)	2 988(-88)

Approach to the Study

The study was based largely on secondary information, but also included some primary data collected through interviews with stakeholders (government, private sector and inter-national organisations officials, traders and communities), using a questionnaire survey, and through visits to forest plantations and industries.

Secondary sources included forest plantation programmes' and Forestry Departments' annual reports, technical reports, scientific publications, web pages, and official data from governments, the private sector and international organisations.

In each country, a national consultant was responsible for data collection and preparation of a country report. A regional workshop was held and country reports and the regional synthesis report were presented and discussed. This report incorporates comments and suggestions from the workshop participants and others who reviewed the draft report.

Structure of the Report

The rest of the report is structured as follows:

Chapter 2 presents an overview of forest plantations including areas, trends, species composition and management techniques, growth and yield as well as plantation expansion.

Chapter 3 is on out-growers and woodlots: their extent, impacts and factors shaping their growth and suggestions for improvement.

Chapter 4 reviews forest and tree tenure systems: the current systems and their impacts on livelihoods and SFM and suggestions for improvement.

Chapter 5 presents current financing and human resources for forest plantations and woodlots as well as potential financing mechanisms.

Chapter 6 focuses on incentives for plantation/woodlot establishment: their impacts and effectiveness and suggestions for improvement.

Chapter 7 is on supply and demand scenarios as well as projections and prices and trade on forest products.

Chapter 8 is on forest royalties and other revenues, specifically the current forest royalties and licences, concessions and permits and administration of the forest revenue system and proposals for improvement.

Chapter 9 focuses on processing of produce: existing forest industries, raw material supply and quality, constraints facing the sub-sector and potential for future investment.

Socio-economic and environmental contributions of forests are discussed in **chapter 10**.

Finally, the last **chapter 11** offers a set of conclusions and recommendations on actions that might be taken by various actors. Several annexes are presented to enhance the descriptions in the text.

2. FOREST PLANTATIONS SITUATION

The success of any plantation depends largely on adoption of appropriate silvicultural practices, which consist of various treatments applied to forest plantations to maintain and enhance their utility for any purpose. Appropriate and timely silvicultural practices, also called *good forestry practice*, determine the pattern and quality of tree development, thereby modifying both the quality and the quantity of end products. It is this effect on quality and quantity of the end products that makes silvicultural practices important in forest management. After presenting a historical background, and location, areas and species planted, this chapter reviews silvicultural practices used in the region. Other aspects presented include areas available for plantation expansion, stakeholder views on establishment, expansion and improved management of forest plantations, and lastly prospects for and constraints to forest plantation development and expansion.

2.1 Historical background

Large scale establishment of industrial forest plantations in the study countries started at different times during the period 1911-1960. Plantation development was motivated by the realisation that the indigenous forests with very slow growth and difficulty in propagation would not meet future wood and NWFPs requirements. In most countries, investment in forest plantations in the period 1960s to 1980s was done with development partner and World Bank support, thereafter most development partner support was directed to individual and community woodlots to meet wood requirements and/or for environmental considerations. The pace of industrial plantation development was high during the time when there was external support but slowed down drastically thereafter on account of financial constraints by governments. Limited government funding has also affected plantation management, resulting in neglect of some tending operations. Private sector industrial plantation development on the other hand is more recent in most countries peaking up mainly in the 1990s.

2.2 Location, areas and species composition

Location of industrial forestry plantations took cognisance of several aspects, including suitable climatic and soil conditions for the various tree species and the need to meet wood requirements of the various parts of the countries to minimise transport costs. There were only limited economic considerations at that time, while political considerations were sometimes used to decide where plantations should be located.

The total areas of industrial forest plantations in the study countries are shown in Table 2. Overall, the total areas of forest plantations in the study countries (c. 1.5 million ha) are low compared to the total land areas of the seven countries of 507 839 000 ha, or 0.3%. There are also limited

areas of private sector plantations (220 500 ha) as these have only recently started in some countries. Table 3 shows plantation areas by management objectives. Overall, in all countries commercial forest plantations have been established mainly for sawn wood production. Other uses include pulp wood, woodfuel, poles, NWFPs, conservation and, more recently, for carbon sequestration under the Clean Development Mechanism (CDM).

Public sector plantations face various degrees of encroachments and excisions but, in most cases, information is lacking. The biggest excision has been reported in Kenya, where around 50 000 ha of public sector plantations are reported to have been excised (Bertram, 2003).

Table 2. Areas (ha) of forest plantations in the Eastern and North Eastern African study countries.

Owner	Burundi	Ethiopia	Kenya	Rwanda	Sudan ¹	Tanzania	Uganda
Public	80 829	190 400	125 000	138 348	654 340	84 615	14 140
Private	4 226	-	-	2 058	126 075	40 000	48 090
Total (rounded)	85 100	190 400	125 000	140 400	780 400	124 600	62 200

1) Figures for Sudan include *gum arabic* plantations, but not naturally growing and managed gum gardens.

Table 3. Commercial plantation areas (ha) by management objectives in the Eastern and North Eastern African study countries in 2009. * Data not available.

Country/ owner	Saw timber	Pulp- wood	Fuel- wood	NWFPs	Poles	Conser- vation	CDM	Total (rounded)
Burundi								
Public sector	49 671							80 800
Private sector	1 056							4 200
Ethiopia								
Public sector	114 600	15 000	19 100	-	41 700	-	-	190 400
Kenya								
Public sector	*	*	*	*	*	*	*	125 000
Rwanda¹								
Public sector	35 877	-	29 526	-	-	-	-	65 400
Private sector	-	-	2 058	-	-	-	-	2 100
Sudan								
Public sector	*	*	*	*	*	*	*	654 300
Private sector	-	-	50 575	75 500	-	-	-	126 100
Tanzania								
Public sector	69 269	10 395	136	-	-	4 815	-	84 600
Private sector	31 500	-	-	-	-	-	8 500	40 000
Uganda								
Public sector	*	*	*	*	*	*	*	14 100
Private sector	*	*	*	*	*	*	*	48 100

1) For Rwanda, only plantations with ownership records available

When the study countries commenced establishment of industrial forest plantations, fewer species/provenances were initially used and species/provenance tests continued with the objective of broadening the genetic base and increasing species diversity. The foregoing notwithstanding, to date several countries in the region have their forest plantations dominated by a few tree species. For example, in Kenya, *Cupressus lusitanica* comprises 54% of the plantation area followed by pines at 24%. In Ethiopia, the main species in the plantations are Eucalypts covering 56% and *C. lusitanica* which covers 32% of the total area, respectively, followed by *Juniperus procera* (2%), *Pinus patula* (1.8%) and other species (8%). In Sudan the dominant plantation species are Acacias, viz. *A. senegal* (for gum Arabic production) and *A. nilotica* for timber and other utility wood. In Tanzania, pines are the dominant species in most of the government and private plantations with about 78% of the total area planted and the remaining 22% is shared among hardwoods and other softwood species. In Rwanda, *Eucalyptus* spp (*E. globulus*, *E. maidenii*, *E. grandis*, *E. saligna*, *E. camaldulensis*, *E. tereticornis*, *E. maculata*, *E. dunnii*, *E. microcorys*) cover over 55% of the area. In Uganda, *Pinus caribaea* and *E. grandis* are the main plantation species. Countries should emphasise species diversification as it is generally acknowledged that this may

serve as an insurance against pests, diseases and climatic fluctuations. Additionally, this may result in increased market security through species and product diversification.

2.3 Plantation management

2.3.1 Establishment

Seed sources

When large-scale establishment of plantations started in countries of the region, seed requirements were initially met by importation from countries where the various species are indigenous (e.g. Central America, Mexico and Australia) or from South Africa, which had a longer experience with plantation forestry. Later, local seed sources, i.e. seed stands (essentially an interim seed source) and seed orchards were established for the major tree species. Local seed sources continued to be supplemented by importation to meet domestic demand. Today, seed orchards are few in the countries of the region, and where they exist, they are mainly unrogued first generation (i.e. have not undergone further improvement after initial establishment as grafts or seedlings) and most seed thus continue to be obtained from seed stands (Table 4). In isolated cases, improved clones of Eucalypts are used. Due to the predominant use of un-improved seed, most public forest plantations in the region constitute a significant proportion of trees of low productivity and quality. On the other hand, most of the few private sector plantations use improved seed or clones.

Table 4. Seed/planting material for forest plantations in the Eastern and North Eastern African study countries.

Country	Source of planting material					
	Old clear felled trees	Seed stands	Seed orchards	Improved clones	Natural forests	Seed imports
Burundi		✓	✓			✓
Ethiopia	✓				✓	✓
Kenya		✓	✓	✓		
Rwanda		✓				✓
Sudan		✓				
Tanzania	✓	✓	✓	✓	✓	✓
Uganda		✓		✓		✓

Nursery techniques

Early nursery research in the region concentrated on germination techniques, soil mixtures, fertiliser types and levels and control of nursery insect pests and pathogens for the various tree species. Nursery techniques are now well developed in the study countries. However, in view of the current climate change effects which make tropical climate more variable and extreme events more severe, drought hardening techniques should be used even in areas formally considered humid and thus not requiring drought hardy seedlings so that survival and early growth are not negatively affected by possible climate effects (Chamshama and Nshubemuki, 2011).

Land preparation and pitting

Land (site) preparation is carried out with the objective of securing both high survival and rapid early growth because of improved soil moisture relations caused by reduced weed competition and increased water infiltration and storage. There is wide variation on the intensity of site preparation in the region. Complete site preparation (ploughing and harrowing) or using herbicides is rare. Most public sector plantations were established through the 'taungya' system where farmers or squatters were given temporary rights to clear, cultivate and grow agricultural crops in the forest land, and in return plant and tend tree seedlings until canopy closure. Other site preparation techniques include strip and spot cultivation, and slash burning. Overall, due to low intensity site preparation in the region, tree survival and growth have been reported to be low.

Spacing

Tree spacing plays an important role in tree growth as it influences the quantity and quality of wood produced (Zobel *et al.*, 1987; Evans, 1992). It also influences costs of various operations such as planting, beating up and weeding, timing of thinning, selection of final crop and rotation age. The choice of initial spacing depends on many factors, e.g. the site, the species, and the objectives of the management, such as the number of trees desired at the time of thinning and at the end of rotational age, and the expected size of trees to be harvested (Iddi *et al.*, 1996).

Spacing used in the region varies depending on the management objectives (Table 5). These spacings are within the levels used worldwide. A spacing of 3.0 x 3.0 m for sawlogs is used in several study countries. This spacing gives an optimum combination of average tree volume (piece size) and total volume to be harvested in a commercial thinning operation (FBD, 2003). The spacing allows a delayed and merchantable first thinning as well as fewer thinnings, a desirable option given the financial constraints for performing thinning in most countries.

Table 5. Initial spacing used in forest plantations in the Eastern and North Eastern African study countries.

Country	Type of end product	Initial spacing (m)
Burundi	All saw logs, thinnings for poles	2 x 3, 2.5 x 3, 2.75 x 2.75, 3 x 3
Ethiopia	Poles Saw logs	2 x 2 2.5 x 2.5
Kenya	Pulp wood logs Saw logs	1 x 1 2.5 x 2.5
Rwanda	Poles Saw logs	2 x 2 2.5 x 2.5, 3 x 3
Sudan	Saw logs and rail sleepers	2 x 2, 3 x 3
Tanzania	Pulp wood logs and poles Saw logs	2 x 2 2.5 x 2.5, 3 x 2, 3 x 3, 4 x 2
Uganda	Poles All saw logs	2 x 2 2.7 x 2.7, 3 x 2.5, 3 x 3, 3 x 2, 4 x 3, 3.5 x 3.5, 4 x 4

Pitting, planting and beating up

Proper pitting and planting is necessary to ensure high initial survival and growth. Large pits are generally used: 30 - 40 cm in both depth and diameter. While proper planting techniques are followed in the region, the main problem in public sector forest plantations has been low re-planting rates leading to backlogs (Table 6). With mortality over 20%, replacement of casualties should be done within the first month after planting. This is rarely done.

Table 6. Annual replanting rates and replanting backlogs (ha) in forest plantations in the Eastern and North Eastern African study countries in 2009.

Country	Annual coppicing areas	Annual re-planting rate	Replanting backlog
Burundi	1 800	*	*
Ethiopia	767	559	Nil
Kenya	*	6 000	Nil
Rwanda	-	-	-
Sudan	*	*	*
Tanzania	*	*	*
Uganda	*	*	*

* Data not available.

2.3.2 Weeding

Weeding is the action of reducing or eliminating the competition for light, moisture and nutrients from undesirable species which have grown around seedlings or young trees, the objective being to improve early survival and growth. Weeding in the region ranges from intensive (chemicals or clean weeding by taungya farmers) to low intensity (spot, strip or slashing) with definite impacts on seedling survival and growth. Often, spot and strip weedings are used. Even though less intensive weeding techniques are used, weeding backlogs have been reported in some countries, especially in public sector plantations (Table 7). In the rest of the countries, weeding backlogs were reported to exist but data was not available.

Table 7. Weeded areas and weeding backlogs (ha) in the Eastern and North Eastern African study countries in 2009.

Country	Weeded areas	Weeding backlog
Burundi	*	*
Ethiopia	3 582	25
Kenya	*	*
Rwanda	7 414	None
Sudan	*	*
Tanzania	*	*
Uganda	*	*

* Data not available.

2.3.3 Pruning

Pruning is a deliberate removal, preferably while still live, of some of the branches from the lower trunk (bole) of a tree, with an objective of reducing knots in sawn timber and similar finished products (SAIF, 2000).

Countries in the region have developed pruning schedules based on research results or adapted with modifications from other countries (Annex 2). Despite the presence of the pruning schedules, countries have reported pruning backlogs mainly in public sector plantations, though data on areas is in most cases not available (Table 8). Inadequate operational funds have been pointed out as the main reason for these backlogs.

Table 8. Areas (ha) pruned and pruning backlogs in the Eastern and North Eastern African study countries in 2009.

Country	Pruned area	Pruning backlog
Burundi	*	*
Ethiopia	450	*
Kenya	*	*
Rwanda	*	*
Sudan	7 000 - 8 000	*
Tanzania	*	*
Uganda	2 100	1 600

* Data not available.

2.3.4 Thinning

Artificial thinning is the removal of a proportion of individual living trees from a stand before clearfelling (SAIF, 2000). It is generally understood to take place after the onset of competition. The major objectives of thinning are (Evans, 1992; SAIF, 2000): to reduce the number of trees in a stand so that the remaining ones have more space for crown and root development to encourage

stem diameter increment and reach a utilisable size sooner; to remove trees of poor form; prevent severe stress which may induce pests, diseases and stand instability; and to provide an intermediate financial return from sale of wood from thinnings. More trees are initially established than the required final crop, mainly to ensure sufficient trees from which the final crop can be selected, enhance early canopy closure to suppress weed growth and to utilise the site better (SAIF, 2000).

While thinning is an important silvicultural operation, which must be done timely and at the right intensity, the country reports show that thinning operations in many public plantations do not follow the prescribed schedules shown in Annex 3. Where thinnings have been carried out, they have been fewer and lighter than recommended, resulting in the standing volume being distributed on too many small trees rather than fewer ones of greater value per cubic metre (Table 9). The main reasons given for the neglect of thinnings include shortage of funds, lack of markets for small logs from thinnings, lack of plantation management skills and experience, foresters' traditional attitude against waste and lack of processing plants.

Table 9. Areas (ha) thinned and thinning backlogs in the Eastern and North Eastern African study countries in 2009.

Country	Thinned area	Thinning backlog
Burundi	*	*
Ethiopia	272	32
Kenya	*	8 000
Rwanda	*	*
Sudan	2 000	*
Tanzania	*	*
Uganda	*	1 530

* Data not available.

2.3.5 Forest health

The control of forest fires, insects, pathogens and animals is critical to maintaining the health and productivity of forest plantations. Country reports show that there is inadequate capacity to monitor forest health and, consequently, there is limited information on species and areas affected by fires, insects, pathogens and animals (Table 10). Although there are some examples where plantations have faced major disease or insect problems that have stopped the use of a particular species, diseases and pests have not caused such widespread damage as to seriously question plantation silviculture as a practice (Evans and Wood, 1993). The foregoing notwithstanding, effective monitoring and protection of forests against damaging pests and diseases must be an integral part of forest management.

Table 10. Areas (ha) of forest plantations reported to have been affected by fires, insects, diseases, invasive species and other disturbances in the Eastern and North Eastern African study countries in 2005-2009.

Country	Forest fire	Insects	Diseases	Invasive species	Other disturbances
Burundi	8 900	*	*	*	*
Ethiopia	*	*	4 370	*	*
Kenya	*	*	*	*	*
Rwanda	*	*	*	*	*
Sudan	*	*	*	*	*
Tanzania	6 000	*	*	*	*
Uganda	650	*	*	*	*

*Data not available.

Although some introduced multipurpose trees and shrubs in agroforestry systems, e.g. *Prosopis juliflora* and *Leucaena spp.*, have become invasive in some ecosystems, there is no information that forest plantation tree species have become invasive. Nevertheless, great care is required to

ensure that exotic tree species serve the economic purposes for which they were introduced and do not escape and cause unanticipated negative effects on native ecosystems (FAO, 2003).

Integrated pest management (IPM), which relies on sound selection of species, provenances or hybrid materials with genetic traits tolerant to damaging biotic agents, improved silviculture and actions of natural enemies and cultural control can substantially reduce the risk of insect, disease and other pest outbreaks (FAO, 2006). IPM programmes are also economically sustainable as they reduce the planted forest manager's dependence on expensive procured inputs. However, in instances of major outbreaks, use of chemicals may be necessary (FAO, 2006).

2.3.6 Maintaining long term site productivity

There are limited efforts to maintain long term productivity of forest sites in the region. For sloping terrain, there have not been efforts to control soil erosion. In areas being clearfelled, there are no harvesting plans which results in random movement of harvesting equipment, and sometimes harvesting is done during the wet season resulting in soil compaction. Slash disposal after harvesting is done by burning in some countries. A recent study at Shume, North Eastern Tanzania, for example, has shown that slash disposal by burning resulted in significant reduction of early growth of *Pinus patula* (Mugasha *et al.*, 2006). This is due to leaching or surface movement of the ash from burning which is rich in base nutrients. Further, hot burns (>300°C) result in volatilisation of nitrogen (N) and sulphur (S). Other effects are loss in organic matter, degradation in soil structure, reduction in macropores, erosion by wind and raindrops and decreased infiltration rates due to fire induced water repellence (SAIF, 1994).

2.3.7 Growth, yield and rotation age

There is diverse performance of forest plantation species in the region. In a few situations, outstanding performance has been observed ($60 \text{ m}^3/\text{ha}^{-1}\text{yr}^{-1}$) while poor to average performance ($2 - 15 \text{ m}^3/\text{ha}^{-1}\text{yr}^{-1}$) has been noted in most situations (Table 11). The large variability found in productivity is mainly due to species/provenance selection, genetic improvement, species-site matching and cultural practices (Vichnevetskaia, 1997; FAO, 2001b; FAO, 2001c). Overall however, tree increments in the region are low. With intensive breeding and high standards of silviculture, several Eucalyptus and Pine species in Brazil and South Africa have been shown to have MAI of up $50 \text{ m}^3/\text{ha}^{-1}\text{yr}^{-1}$ with a rotation length of 25 years (FAO, 2001c). With shorter rotations, increments beyond this are common (FAO, 2001c).

Table 11. Growth and rotation length of selected tree species in the Eastern and North Eastern African study countries.

Country	Tree species	Rotation length, years	MAI $\text{m}^3/\text{ha}/\text{yr}$
Burundi	<i>Eucalyptus spp.</i>	25	10.6-60
	<i>Pinus patula</i>	30	21.4
	<i>Callitris spp.</i>	30	1.9-9
	<i>Cupressus lusitanica</i>	30	6.6
	<i>Grevillea robusta</i>	30	8.9
Ethiopia	<i>C. lusitanica</i>	26-30	6-22
	<i>P. patula</i>	26-30	16
	<i>Eucalyptus spp.</i>	7-18	12-25.7
Kenya	<i>C. lusitanica</i>	40	24
	<i>P. patula</i>	30	24
Rwanda	<i>Acacia melanoxylon</i>	*	15.0
	<i>Callitris robusta</i>	*	5.8
	<i>Cupressus lusitanica</i>	*	6.8
	<i>Eucalyptus spp.</i>	*	6.9
	<i>Grevillea robusta</i>	*	10.0
	<i>Pinus spp.</i>	*	13.1
Sudan	<i>Acacia nilotica</i>	25-30	7.4-22.6
	<i>C. lusitanica</i>	25-30	3.9-20
	<i>Eucalyptus microtheca</i>	8+6+6+6	4-9.8
	<i>Tectona grandis</i>	30+	5-8
	<i>Pinus radiata</i>		24

	<i>Acacia seyal</i> <i>Prosopis chilensis</i> <i>Acacia mellifera</i> <i>Balanites aegyptica</i>	15-20	0.4-1.0 7 0.6-1.0 0.5
Tanzania	<i>C. lusitanica</i> <i>P. patula</i>	25-30 25-30	12-25 20-25
Uganda	<i>Pinus caribaea</i> <i>Eucalyptus grandis</i>	20-25 12 or 20-25	26 25

*Data not available.

2.4 Forest plantation expansion

To meet the increasing domestic and international demands for wood and wood products requires increasing productivity of existing sites and opening new areas for forest plantations. New areas available for plantation expansion in the region; stakeholder views on establishment, expansion and improved management of forest plantations; and constraints and opportunities for plantation expansion are explored in the following sections.

2.4.1 New areas available for forest plantation expansion

While some countries have land available for expansion of forest plantations by the state and the private sector, land is not there in others (Table 12). Sudan has the largest area available for expansion of plantations. The area indicated for Tanzania is for existing public and private forest plantations. More land can be available through negotiations with villages. All land that is owned by villages is divided into two main categories: general land, which is land that can be transferred for investment, and village land for their own use. Limited land availability for forest plantations in some countries is due to high population pressure and the need to conserve the few remaining indigenous forested areas as water and biodiversity conservation areas. The main opportunity for forest plantation expansion in these countries is through individual and community woodlots.

Table 12. Land available/set aside for plantation expansion in the Eastern and North Eastern African study countries.

Country	Sector	Approx. areas of available land (ha)	Suitable tree species for afforestation
Burundi	-	-	-
Ethiopia	-	2 100	<i>C. lusitanica</i> , <i>P. patula</i> , <i>G. robusta</i> , <i>Eucalyptus spp.</i>
Kenya	-	-	-
Rwanda	-	-	-
Sudan	-	8 410 000	<i>Acacia nilotica</i> , <i>A. senegal</i> , <i>A. seyal</i> , <i>C. lusitanica</i> , <i>Eucalyptus spp.</i>
Tanzania	Public Private	56 600 110 500	Pines, Cypress, Eucalyptus
Uganda	-	154 100	Pines, Eucalyptus

2.4.2 Stakeholder views on establishment, expansion and improved management of forest plantations

There are some negative perceptions by some stakeholders in the region that growing trees in plantations or woodlots, and especially exotics, consume too much water and thus reduce the amount of water that flows through the catchment and reduce productivity of agricultural lands. High water consumption of trees has been shown in various studies (e.g. Scott *et al.* 1998, Gerrand *et al.* 2003, Farley *et al.*, 2005; Vanclay, 2008). A recent global synthesis of the effect of afforestation on water yield which analysed 26 catchment data with 504 observations (Farley *et al.* 2005) showed that runoff decreased consistently and substantially with afforestation across the entire data. As pointed out in chapter one of this report, forest plantations are key to meeting the increasing demand for wood and NWFPs. Forest managers and extension staff should identify where trees should be placed in the landscape and how they should be managed to produce the

best environmental outcomes i.e. minimising water use and increasing water use efficiency. In this regard, research inputs are necessary.

Though early efforts to establish forest plantations were done by governments, later on, following forest policy and forest act reviews, the participation of the private sector in forest plantation establishment and management was encouraged. As a consequence, there has been some establishment of forest plantations by the private sector and this is continuing. However, as pointed out in the following section, the environment is not yet fully enabling for the private sector to play a significant role in industrial forest plantation establishment and management. For example, in some study countries, private sector investors are hampered by long and tedious land acquisition procedures, lack of effective communication between the private sector representatives and Government authorities, as well as lack of data on available land for investments (i.e. reliable data on most potential areas and opportunities to expand plantation areas in the future).

Efforts to privatise or involve the private sector in development and management of existing government industrial forest plantations have been going on in some countries. However, lack of institutional frameworks, negative perceptions on privatisation, and lack of political will, have made it difficult for any of the government forest plantations to be privatised or engage the private sector in development and management.

2.4.3 Prospects for and constraints to forest plantation development and expansion

The level of investment in industrial forest plantations is highly correlated with the business climate and the returns on investment that are likely to be achieved i.e. presence of an attractive environment for plantation investment (so called climate of enterprise). The factors affecting investments in industrial forest plantations occur at three levels as indicated by ITTO (2009):

(a) Supra-sectoral factors are the macroeconomic and other general factors that affect business profitability in all sectors of a national economy (growth of GDP, foreign exchange rates, interest rates, free trade agreements, political stability, government transparency, fiscal policy, and implementation of policies and measures);

(b) Inter sectoral factors are those related to other economic sectors that affect the profitability of investments in the forest-industrial business (economic infrastructure: transportation, energy/utility; social infrastructure: water, sanitation, education and health; licenses and permits; labour: labour laws and contracts, wages, labour productivity and qualification; access to credit, justice and law enforcement; capital gain policy; land/resource tenure: land tenure, land market, land use as collateral; sectoral policies; environment policies and restrictions, agriculture policies and restrictions); and,

(c) Intra-sectoral factors are those factors within the forest sector that affect the profitability of forest-related investments (forest resources availability, subsidies and financial mechanisms, trade restrictions on forest products, markets, entrepreneurial development service, forest vocational land i.e. land suitable and available for forestry, legal and institutional basis).

Overall, intra-sectoral factors are determinant for an investor while supra-sectoral factors, although important, are usually beyond the control of investors or the policy settings within the forest sector (ITTO, 2009). A perception on risks for private sector investment in industrial forest plantation in individual countries is summarised in Table 13. Overall, all countries in the region except Sudan have medium to high risk for investment in industrial forest plantations (a total of 30 factors were considered). Poor ranking in the factors affecting investment increases risk and generates additional costs for investors, thereby making forest plantations less attractive as a business opportunity. Governments' actions are urgent to reverse this situation though there has been some progress in some aspects like forest policies and forest acts reviews. The main opportunity for industrial forest plantation development is the availability of suitable areas for tree planting in some of the study countries.

Table 13. Perception, as assessed by country consultants, of risks for private sector investments in industrial forest plantation in the Eastern and North Eastern African study countries. Adapted from ITTO (2009).

Risk factors	Risk degree for forest investment		
	Low	Medium	High
SUPRA (Macro-economy)			
Growth of GDP	E/K	S/T/U	B/R
Exchange Rate	B/K/R	S	E/T/U
Interest rate	K/S	U	B/E/R/T
Free Trade Agreements	B/E/K/U	T	R/S
Political Stability and Government Transparency	U	S/T	B/E/K/R
Governance issues		S	B/E/K/R/T/U
Fiscal Policy	S	E/K/U	B/R/T
INTER SECTOR			
Economic infrastructure			
– Transportation	S	E/K/U	B/R/T
– Energy/Utility	S/U	K	B/E/R/T
Social infrastructure: (water, sanitation, education, health)	B/E/R	K/S/T/U	
Licenses and permits	E/S/U	K/T	B/R
Labour			
– Laws and labour contracts	S/U	E/K/T	B/R
– Wages	S/U	B/E/K/T	R
– Labour productivity	S	B/E/K/T/U	R
– Labour qualification	S	E/K/T/U	B/R
Access to credit	U	B/K/R	E/S/T
Justice and law enforcement	S	U	B/E/K/R/T
Capital gain policy		E/K/S/T/U	B/R
Land and resource tenure			
– Land tenure	S	T/U	B/E/K/R
– Land market	S	T	B/E/K/R/U
– Land use as collateral	B	S/T	E/K/R/U
Sectoral policies			
– Environment policies and restrictions	S	T	B/E/K/R/U
– Agricultural policies and restrictions		S/T	B/E/K/R/U
INTRA-SECTOR			
Forest Resources (availability)	S	T/U	B/E/K/R
Subsidies and Financial Mechanisms		B/E/K/R/S/T	U
Trade Restrictions (on forest products)	S	K/U	B/E/R/T
Markets	S/U	E/T	B/K/R
Entrepreneurial Development Service	B/S	E/K/T	R/U
Forest Vocation Land (land suitable and available for forest)	S	T/U	B/E/K/R
Legal and Institutional Basis	S	E/T/U	B/K/R

B=Burundi; E=Ethiopia; K=Kenya; R=Rwanda; S=Sudan; T=Tanzania; U=Uganda; A country can only select one risk option for each factor.

3. OUT-GROWER SCHEMES AND OTHER WOODLOTS

An out-grower scheme is defined as a contractual partnership between growers or landholders and a company for the production of commercial forest products (FAO, 2001a). There is a wide range of partnerships between companies and communities with different arrangements between the growers and processors, such as (FAO, 2009b):

- Partnerships in which growers are largely responsible for production, with the company guaranteeing that it will purchase the product at harvest time;
- Partnerships in which the company is largely responsible for production, paying landholders market prices for their wood allocation;
- Land lease agreements in which landholders are not greatly involved in the plantation management; and,
- Arrangements where the forest company and the landholder share the production and the market responsibilities and the risks, dividing the returns in proportion to the level of inputs.

Indeed, forestry development, whether in industrialised or non-industrialised countries often occurs because of positive partnerships between forest companies and out-growers. These company-out-grower partnerships can be designed to ensure forest plantation management that has sustainable productivity (and profitability), social and environmental sustainability. Other than woodlots and plantations established under out-grower schemes, woodlots are also established by individual farmers and communities using their own, government or development partner resources for various products, e.g. woodfuel, building poles, sawn timber or environmental services. This chapter reviews existing company-out-grower partnerships as well as other woodlots in the study areas, their extent and impact, success factors, shortcomings and factors that could favour rapid out-grower and other woodlot expansion by individuals and communities.

3.1 Extent and impacts of out-grower schemes/other woodlots

While out-grower schemes are more recent because of the rather new interest of private companies in acquiring their wood needs through such mechanisms, woodlots *per se* are several decades old. Most of the initial establishment of community woodlots was done with development partner support and, when this ended, no significant government support was ensured. Though there were mixed results with woodlots due to various reasons, woodlots in all the study countries are now playing a significant role in the livelihoods of communities and national economies. However, the extent of woodlots and impacts on livelihoods and SFM remain little known. Table 14 shows the extent of out-grower and other woodlots in some of the study countries.

Table 14. Extent of out-growers and other woodlots (ha) in the Eastern and North Eastern African study countries.

Type of woodlot	Countries						
	Burundi	Ethiopia	Kenya	Rwanda	Sudan	Tanzania	Uganda
Out-growers	-	-	-	-	-	270	1 240
Gum Arabic gardens	-	-	-	-	630 250	-	-
Other woodlots	61 000	781 600	*	122 100	69 500	140 000	20 000
Total (rounded)	61 000	782 000	*	122 000	700 000	140 000	21 000

*Data not available.

Elsewhere, like in South Africa where out-grower schemes have been in existence for a long time, they have been shown to have positive impacts on sustainable livelihoods and environmental services (FAO, 2009b). They diversify farm production; offer an additional income and employment possibilities for local communities. The viability and attractiveness of this plantation development option are demonstrated by the increased involvement of private landowners and communities in South Africa and the rapid rate of increase of growers in the country. Box 1 describes a Kilombero Valley Teak Company (Tanzania) out-grower scheme.

Box 1: Kilombero Valley Teak Company (Tanzania) Out-grower scheme.

The Kilombero Valley Teak Company (KVTC) is a private company established in 1992 with the aim to develop social and environmentally responsible forestry and create a long term (export) business. KVTC is the largest private teak plantation project in Africa. A total area of 8 200 ha has been established since 1993

and the last planting was done in 2011. In addition, KVTC protects and manages over 20 000 ha of native forests and wetlands and a wide range of wildlife and flora. As KVTC is certified to comply with the ISO 14001:2004 standard, procedures and rigorous monitoring systems are in place to ensure continued improvement in environmental performance. In 2002, the company started a Village Out-Grower Project and later an Individual Out-grower arrangement where teak plantations are annually being established in the associated villages and individual plots. KVTC finances the establishment and maintenance of these new teak plantations and guarantees a market at a minimum age of 15 years for the trees. So far, a total of about 270 ha have been planted under the out-grower scheme.

Source: www.kvtc-tz.com

3.2 Factors shaping growth of out-grower schemes and other woodlots

The main growth factor for out-grower schemes is increased private sector companies investing in forest plantations and primary wood industry. For other woodlots, the main growth factors include availability of direct and indirect incentives as well as secure land tenure and markets for the wood produced. The following are the main constraints with regard to woodlot development:

- **Land tenure and land limitation:** The absence of well defined property rights in some villages is an impediment to farmers' investment in woodlot establishment. This has also led to various conflicts over land tenure rights. Other than land tenure, there is also land limitation for woodlots in some of the countries. Further discussions on forest tenure are presented in Chapter 4.
- **Limited extension services:** Forestry extension is limited in terms of staff numbers, capacity as well as resources to undertake extension work. Farmers are thus forced to undertake activities without using proper techniques, resulting in poor quality trees.
- **Limited financing mechanisms:** For most countries, after development partners stopped supporting woodlot projects, governments did not take over this task. Governments should consider various direct and indirect incentives to farmers to establish woodlots. Further discussion on financing and incentives is presented in Chapters 5 and 6 respectively.
- **Germplasm quality and cost:** quality germplasm is not available due to limited genetic improvement research in the region. Further, even unimproved germplasm is costly and is sometimes not easily available to the farmers.

3.3 Suggestions for improvement of out-grower schemes

The following principles developed by FAO and the Centre for International Forestry Research (FAO/CIFOR 2002) should be used to ensure mutually beneficial partnerships between corporate and smallholder partners. Details on the criteria and indicators are presented in Annex 4.

(a) Policy aspects

Principle 1: Policy and institutional frameworks are conducive to partnership and agreement within the framework of sustainable planted forest management.

Principle 2: Government's commitment in supporting the partnership schemes.

Principle 3: Transparency and broad understanding of policy.

(b) Economic aspects

Principle 1: Long-term viability of economic objectives of key stakeholders is taken into account.

Principle 2: Partnerships recognise different stakeholders' power, and create an operational negotiation/renegotiation mechanism.

(c) Socio-cultural aspects

Principle 1: The implementation of equitable partnerships satisfies social objectives of various key stakeholders.

Principle 2: Equitable partnership schemes should recognise the difference in power of stakeholders and create an operational negotiation/renegotiation mechanism.

(d) Ecological aspects

Principle 1: There is a mechanism for ecological monitoring.

Principle 2: Ecological integrity is maintained.

(e) Management aspects

Principle 1: Fair cooperation is the approach used in the management of the partnerships.

Principle 2: Partnerships encourage sustainable management of planted forests.

4. FOREST AND TREE TENURE

Tenure is a generic term referring to a variety of arrangements that allocate rights to, and often set conditions for, those who hold land (FAO 2011a). Tenure regulates access to and use of resources. Ownership refers to a particular type of tenure in which strong rights are allocated to the land holder (FAO 2011a). Forest tenure refers to the rights to forest while tree tenure refers to the rights to specific trees. Both these rights are fundamental to determining how forests are managed, protected, or neglected (Siry *et al.* 2009).

It is increasingly being recognised that secure tenure of forest resources may contribute to poverty alleviation of the millions of people who depend directly or indirectly on forest resources for their livelihoods and, more generally, to SFM. However, secure tenure on its own is not enough to achieve desired outcomes. Tenure reforms must be linked to reforms of governance arrangements and the regulatory framework (FAO 2011a). Forest and tree tenure issues in the study countries are reviewed in the following sections.

4.1 Current forest/tree tenure systems

The forest ownership situation in the study countries is shown in Table 15. In most countries, forests are mainly public and owned by central governments, ranging from 70% in Sudan to 94% in Ethiopia. Private ownership of forests is thus generally very limited in the region. Exceptions to this are Rwanda and Uganda where private ownership is high, 61% and 64% respectively. Community ownership is gaining momentum, a result of tenure reforms in various countries during the past 20 years. However, the proportion of forests owned and/or managed by local communities is still relatively small.

Table 15. Forest ownership (1000 ha) in the Eastern and North Eastern African study countries.

Type of owner	Countries						
	Burundi	Ethiopia	Kenya	Rwanda	Sudan	Tanzania	Uganda
Government	167	12 486	1 640	51	15 000	30 915	1 303
Private	65	603	70	79	6 181	40	2 301
Community	-	152	180	-	166	2 485	-
Total	232	13 241	1 890	130	21 347	33 400	3 604

Table 16 shows who uses and manages forests in the study countries. In general, as for ownership, most forests are also under Government management. In these forests, Governments often grant limited use rights, such as permits to gather dead wood and NWFPs. Overall, centralised management and protection of natural forests is poor, leading to deforestation and degradation. This is due to, among other factors, low staffing levels, lack of motivation caused by poor working conditions (e.g. lack of transport and adequate field work budgets) and relatively low salaries. Deforestation and degradation of forests also result from settlement and agricultural expansion, overgrazing, firewood and charcoal production, uncontrolled fires, timber extraction, development of infrastructure/industry, refugees and, most recently, the introduction of large scale bio-fuel plantations. These direct causes of uncontrolled deforestation and, thus, land degradation are driven by market and policy failures, rapid (and uncontrolled) population growth and rural poverty.

There is also poor management of public sector forest plantations as pointed out in Chapter 2 of this report.

Table 16. Forest management rights (1000 ha) in the Eastern and North Eastern African study countries.

Management rights	Countries						
	Burundi	Ethiopia	Kenya	Rwanda	Sudan	Tanzania	Uganda
Government	147	12 186	1 640	51	15 000	29 135	1 303
Private	65	603	70	79	6 181	40	2 301
Community	20	152	180	-	166	2 485	-
Customary/JFM	-	300	-	-	-	1 780	-
Total	232	13 241	1 890	130	21 347	33 440	3 604

Partly as a result of management challenges of forests, countries of the region have initiated forest tenure reforms in the past one to two decades to involve communities, private individuals, companies and other local groups as owners or managers of forest resources. Other factors that drive Governments to engage in tenure reforms include (Romano and Muller, 2009):

- the need to devolve management responsibilities to those who are closer to the forest and have a stake in its conservation or who may have better capacity for forest management than state institutions, and,
- to promote local economic development by providing opportunities for poor local people to generate income from management of forest resources.

4.2 Impacts of forest/tree tenure on poverty alleviation and SFM

Secure tenure of forest resources may contribute to poverty alleviation of people who depend directly or indirectly on forest resources for their livelihoods, and, more generally, also to SFM (Romano and Muller 2009, Siry *et al.*, 2009). Following tenure reforms in the past two decades, evidence is now accumulating on the impact of tenure systems on SFM and poverty alleviation. A recent study by FAO (FAO 2008) covering 11 countries (including 2 countries covered in this study (viz. Tanzania and Uganda) found that in many cases the devolution of ownership in community based forest management (CBFM) has been limited to low quality degraded forests with no immediate benefits to the communities. In Tanzania, a number of CBFM studies have since reported improved well-being of community members (Topp-Jørgensen *et al.*, 2005; Blomley and Ramadhani, 2006; Blomley *et al.*, 2007). For joint forest management (JFM), where there is no transfer of ownership but there is sharing of responsibilities and benefits, there has not been clear positive impacts on economic conditions of the local population, as forests under JFM are primarily designated for conservation or restoration purposes rather than economic ones (Topp-Jørgensen *et al.*, 2005; Blomley and Ramadhani, 2006). On the other hand, evidence is mounting that forest regeneration, biodiversity and forest growth is significantly improved when forests are managed locally by communities under CBFM and JFM (Romano and Muller, 2009; Topp-Jørgensen *et al.*, 2005; Blomley and Ramadhani, 2006; Blomley *et al.*, 2007). Box 2 shows impacts of implementing participatory forest management (PFM) in Ethiopia.

Box 2: Impact of implementing PFM in Ethiopia.

On Forest regeneration: PFM has brought about healthy regeneration of the forests. For instance, in Chillimo pre- and post-project regeneration assessments that have been conducted revealed increases of over 150% in regeneration density at forest and individual species levels.

Respect for new forest boundaries: While forests outside PFM schemes continue to degrade both in volume and in spatial coverage, those managed by local communities under PFM schemes maintained their demarcated boundaries. This has been achieved as a result of respect for shared decisions on the new boundaries, raised community awareness and committed protection.

Plantings on degraded forest parts: In some of the PFM sites, the forest user groups have exercised enrichment plantings to treat previously degraded forest sections. The groups have implemented enrichment plantings by raising seedlings of various indigenous and exotic species.

Regulation of open access: Encroachments and livestock grazing in the PFM areas have been regulated. Moreover, footpaths in the forests have faded away indicating a reduced human and livestock interference.

Minimised occurrence of fire: The protection role played by forest user groups and the gaining of legal right of ownership has significantly reduced the incidence of fire since PFM was introduced. For instance, before PFM was started in Borena, fire was a major forest management problem that occurred annually. But, following the introduction of PFM, the occurrence of fire has very much declined.

Reduction in protection costs for government: Through the strong social fencing established, PFM was able to eliminate the cost that otherwise should have been paid to forest guards, which was demonstrated ineffective in ensuring conservation of the natural forests. For instance, there were 66, 35 and 22 guards in Adaba-Dodola, Mojo and Chilimo prior to PFM implementation. Currently, there is no government paid forest guard in any of the three forest areas.

Source: Tsegaye, 2008.

For privately owned/managed forests, other than improved forest condition, some tenure holders have contributed to poverty alleviation and improved community livelihoods through employment and food production by use of the taungya system in areas opened up for tree planting (Romano and Muller, 2009). Other opportunities for poverty alleviation under private ownership/management include benefit sharing and partnership arrangements.

4.3 Suggestions for improvement of tenure reforms

The following principles developed by FAO (2011a) need to be applied when embarking on tenure reform:

Principle 1: Adaptive and multi-stakeholder approach. Effective tenure reform requires an adaptive, deliberative, reflective and multi-stakeholder approach.

Principle 2: Tenure as part of a wider reform agenda. Forest tenure reform should be implemented as part of a holistic and integrated reform agenda.

Principle 3: Social equity. All aspects of tenure reform should give attention to the empowerment of marginalised groups, particularly women and the poor.

Principle 4: Customary rights and systems. Relevant customary tenure systems should be identified, recognised and incorporated into regulatory frameworks.

Principle 5: Regulatory framework. The regulatory framework to support policy changes associated with tenure reform should be enabling as well as enforcing.

Principle 6: Tenure security. The regulatory framework should include mechanisms for making forest tenure as secure as possible.

Principle 7: Compliance procedures. Compliance procedures should be as simple as possible to minimise transaction costs and maximise the regulatory framework's enabling effects.

Principle 8: Minimum standards for forest management. A minimum standards approach should be applied when developing management plans for smallholder or community use.

Principle 9: Good governance. Forest governance systems should be transparent, accountable and participatory, including multi-stakeholder decision-making processes.

Principle 10: Capacity building. Supportive measures should be in place to ensure that all stakeholders know their rights and responsibilities and have the capacity to exercise them effectively.

5. FINANCIAL AND HUMAN RESOURCES FOR PLANTATIONS AND OUTGROWERS/WOODLOTS

Sustainable management of forest plantations, out-growers' plantations and other woodlots require, among other things, adequate financial and human resources. The adequacy of these resources in the region is presented in the following sections.

5.1 Current financing mechanisms

Information on financing for forest plantation and woodlot development was difficult to get. In this section therefore, general aspects of forestry development budgets are presented. The following are the main funding mechanisms for forestry in the region, including plantations and out-grower/woodlots:

- **Government sources:** Governments finance forestry activities through annual budgets approved by the parliament. This budget remains inadequate in all the study countries, with available funds mainly covering staff costs. For example, during the last 5 years, government funding of the Forests National Corporation of Sudan (FNC) was less than 5% of the expected 33%. For Tanzania, the government budget on forestry has consistently been less than 1% of the total national budget, far below required funding to ensure SFM.
- **Forestry Corporations/Agencies retention schemes:** Forestry Corporations, like FNC of Sudan or Agencies like the Kenya Forest Service (KFS) or Tanzania Forest Service (TFS), are allowed to retain revenue collected to finance their own activities. However, administration and management of revenue collection from forest resources is weak and the revenue collection system inefficient. In Tanzania, for example, it is estimated that only 5 to 10% of the revenue due from the forest reserves and general lands is collected. Improved revenue collection is necessary to effectively contribute to SFM.
- **Forest funds:** some countries have forest funds, like the Kenya Forest Management and Conservation Fund, the Rwanda National Forest Fund and the Tanzania Forest Fund, which are generated through retaining a certain percent of royalties to support forestry development activities. The Kenya fund is yet to be operationalised while the others are operational. Box 3 presents a brief of the Tanzania Forest Fund.

Box 3: Tanzania Forest Fund

The Tanzania Forest Fund was established by Section 79 of the Forest Act Cap 323 [R.E. 2002]. The Fund was operationalised in 2010. It was established to provide stable and long term sources of funding for conservation and sustainable management of natural resources in the country. The **objectives of the Fund** are to:

- (a) promote awareness of the importance of the protection, development and sustainable use of forest resources through public education and training;
- (b) promote and assist in the development of community forestry directed towards the conservation and protection of the forest resources of the country through the making of grants and providing advice and assistance to groups of persons wishing to form themselves into a group;
- (c) promote and fund research into forestry;
- (d) assist in enabling Tanzania to benefit from international initiatives and international funds directed towards the conservation and protection of biological diversity and the promotion of sustainable development of forest resources;
- (e) assist groups of persons and individuals to participate in any public debates and discussions on forestry and in particular to participate in processes connected with the making of an environmental impact assessment provided under section 18;
- (f) assist groups of persons and individuals to ensure compliance with the Act; and,
- (g) promote such other activities of a like nature to those set out in this section as will advance the purposes of the Act.

The **sources of the Fund** are:

- (a) levy of 2% of every prescribed fee payable under the Forest Act;
- (b) a levy of 3% of any royalty payable under the Forest Act;
- (c) grants, donations, bequests by individuals or corporate bodies, foundations, international organisations or funds within or outside the country;
- (d) any sum obtained by the sale of any forest produce confiscated;

- (e) income generated by any project financed by the fund; and,
- (f) any funds acquired from various sources.

The Forest Fund is exempted from import and other duties and from taxes and levies in respect of its operations, capital property or other transactions, deed, agreement, fees, etc.

The Trustees of the Fund were appointed in May 2011. The average amount of fund collected annually is TZS 3 billion (about US\$ 2 mill) and funds are allocated to various activities as per the objectives of the fund.

Source: Tanzania Forest Fund Secretariat, 2011

- **The private sector** finances forestry activities through their own sources, loans and/or grants.
- **Development Partners** (DP) fund various forestry activities in the region, either through the Government or NGOs. Sometimes, the funds do not flow as expected. For example, in the last 5 years, only 9% of the expected 41% of DP funds were available to support forestry activities in Sudan. Also, for Ethiopia DP funding has been decreasing over time. On the other hand, DP funding in Kenya has been increasing over time (Table 17).
- **International Organisations**, like the various United Nations agencies, fund forestry activities some of which relate to forestry plantations and woodlots.
- **International Conventions and Agreements** have funds to support various conventions and agreements, e.g. conservation of biological diversity, combating desertification, sequestration of greenhouse gases, etc.
- **Carbon finance** is growing and is an avenue for financing forestry activities. Carbon finance facilitates the financial reward through carbon credits for the reduction of greenhouse gas emissions in developing countries. Credits are awarded to countries, groups or individuals who have reduced their green house gases below their emission quota. Carbon credits can be traded in the international market at their current market price. In 2010, a private company in Tanzania was awarded carbon credits by Voluntary Carbon Standards (VCS) (Box 4).

Box 4: Green Resources Ltd Voluntary Carbon Standard Funding

Green Resources Ltd, a private forestry company in Tanzania was the first Voluntary Carbon Standard (VCS) project in the world to be validated and registered according to the VCS standard. In 2010, the company was issued carbon credits worth US\$ 830 000 for sequestering 232 264 tonnes of CO₂-equivalent. Payment was for 139 000 tonnes as 40% of the credit is kept in buffer to ensure permanence in accordance with VCS rules. The plantation is at Uchindile/Mapanda in Kilombero and Mufindi districts, Tanzania. The total area of the plantation is 4 089 ha. The species planted are *Pinus patula* and *Eucalyptus spp.*. The carbon was monitored during the period 2002-2008. Ten percent of the credit (US\$ 83 000.00 or TZS 125 million) was given to the surrounding community for development activities.

Source: Personal Communication, Green Resources Ltd Oct 12, 2011

For over 10 years now, the World Bank (WB) has been using a variety of carbon funds and facilities through the World Bank Carbon Finance Unit (CFU) to purchase project-based greenhouse gas emission reductions in developing countries and countries with economies in transition. The emission reductions are purchased within the framework of the Kyoto Protocol's Clean Development Mechanism (CDM) or Joint Implementation (JI). The carbon funds used by the WB are contributed by governments and companies in the Organisation for Economic Cooperation and Development (OECD) countries. Carbon funds and facilities under WB management have grown from US\$ 145 million to US\$ 2.3 billion since year 2000 (cited on <http://web.worldbank.org> 21.05.2011). Africa has not made good use of CDM financing. So far, less than 2% of registered CDM projects are located in Africa, while 75% are in Asia and 22% in Latin America (Green Resources, 2010).

Table 17 shows funding levels for forest plantations, woodlots and other activities in the region. Overall, there is wide variation in the budgets between countries. However, common to all, as indicated in the country reports, is the fact that allocated funds are inadequate to ensure SFM.

Table 17. Forestry management budget in the Eastern and North Eastern African study countries (US\$ Million). DP = Development Partner.

Year	Burundi		Ethiopia	Kenya		Rwanda		Sudan	Tanzania	Uganda	
	Govt	DP	Govt	Govt	DP	Govt	DP	FNC	Govt	Govt	DP
02/03	*	*	*	13.5	0.7			*	*	*	*
03/04	*	*	*	16.5	3.4			*	*	*	*
04/05	*	*	*	15.4	4.0			*	*	3.7	3.8
05/06	*	*	*	19.2	2.4			8.8 ¹	*	3.8	4.2
06/07	*	*	*	18.4	10.6			10.5	*	4.1	3.0
07/08	*	*	*	21.2	12.0			11.8	*	5.7	1.4
08/09	*	*	*	24.0	13.3			12.3	*	6.7	0.9
09/10	0.55 ³	17.4 ⁴	8.5 ²	24.0	14.0	2.7 ⁵	36.2 ⁶	12.6	9.9 ²	5.3	1.0

¹Years 2005-2009; ²Year 2009 for plantations only; ³Year 2010-2011; ⁴Year 2006-2012; ⁵Year 2007-2011; ⁶Year 2002-2013. *Data not available.

5.2 Potential financing mechanisms

Forest funds: For countries without these funds they should be established, to support forestry development activities, as central government budgetary allocations are inadequate. Improved forestry revenue collection would increase the fund amount as the main income source is a percent of royalties collected.

Provision of bank "soft" financing: Quite often, small and medium-sized forestry enterprises (SMFEs) do not have sufficient capital and access to credit facilities at appropriate interest rates. These SMFEs therefore depend on financial support. Governments should therefore create financial packages to support their activities. Currently, the 18-20% interest rate in the market does not make investment in plantations viable. Support to access long-term credit by all large and small value-adding companies could help them introduce modern technology.

Private sector investments: The current growth in private investment in forestry and the extension of the global capital market into developing country economies offer opportunities. The challenge is to redirect and channel existing private sector resources and investment vehicles and services to SFM. The private sector is increasingly involved in forest extraction and management in the study countries. Given the declining trend in public financing, private sector will be the probable source of funds to make up for the current and future shortfall of ODA and public finance in the sector. Governments still must ensure a favourable investment climate.

Carbon finance: A potential funding avenue is associated with the global initiative for Reduced Emission from Deforestation and forest Degradation (REDD+) and enhancement of the voluntary forest carbon stocks in developing countries. The premise behind REDD+ as a payment for environment services (PES) scheme is to make performance-based payments to forest owners and users who have taken some initiatives to reduce carbon emissions and increase removals. REDD+ funds are likely to come from different sources, including voluntary financial contributions (e.g., from the World Bank Forest Carbon Partnership Facility (FCPF), the UN-REDD Programme, or bilateral and multilateral initiatives) and market linked sources. Much of the debate on REDD+ today is about its architecture and how it can be included in a post-2012 climate agreement. Over 40 developing countries are already in various stages of developing strategies, policies and project pilot implementations in order to prepare themselves for REDD+ fund initiatives.

Payment for environmental services on utilities: Countries should initiate national schemes to ensure PES on utilities like water. Such payments in several Latin American countries have been an important source of funds for SFM.

5.3 Human resources

Human resource capacity in the study countries is shown in Table 18. In most countries, it was not possible to separate forest plantations staff information from the rest. For Tanzania, about 50% of all Forestry Department staff is employed in forest plantations. Private sector plantation staffing

was also not available, except for a few companies. Except for Kenya, the other countries feel that there is inadequate human resource capacity in terms of both numbers and qualifications. In Ethiopia, the deficit is 1 400 staff while in Sudan it is 1 265 graduates, 269 technicians and 10 985 guards/skilled labourers. In Rwanda, the deficit is 204 employees while in Burundi the gap is 128 graduates, 512 diploma holders, 2 048 certificate holders and 168 forest guards. Common to all countries is that the terms of service of forestry staff are poor and this contributes to corruption, and in some cases that professional foresters go to other institutions offering better packages.

Table 18. Human resource capacity in Forestry Departments in Eastern and North Eastern African study countries.

Country	Graduates	Diploma holders	Certificate holders	Skilled workers	Total
Burundi	30	42	39	56	167
Ethiopia	683	3 114	317	3 803	7 917
Kenya	264	510	1 238	3 064	5 076
Rwanda	38	9	220	-	267
Sudan	285	538	-	2 197	2 482
Tanzania	178	440	714	-	1 332
Uganda	330	290	100	100	820

5.4 Other resources

Other resources required for SFM include transport (vehicles, motorcycles and bicycles), offices and facilities (computer, printer, telephone, radio calls, photocopier and fax machines). There is variation in the availability of these resources in the study countries and locations within countries. Most are however severely constrained in terms of transport.

6. INCENTIVES FOR PLANTATION ESTABLISHMENT BY PUBLIC/PRIVATE SECTOR AND OUTGROWERS/OTHER WOODLOTS

In the study countries, public sector agencies have, in the past, dominated forest plantation development as well as management of natural forests. With regard to plantations, this pattern is slowly changing due to four main reasons (Enters *et al.*, 2003; Chamshama and Nwonwu, 2004):

- (i) review of Forest Policies and Forest Acts allowing devolution of forest management, to allow greater involvement of communities and the private sector in forest management;
- (ii) the performance of public sector plantations has, in most cases, been disappointing;
- (iii) budgetary constraints, especially after expiry of Development Partner support, make it difficult for most Forestry Departments to devote as large resources to forest plantations as they have in the past; and,
- (iv) problems related to weak governance structures are driving many countries to reconsider the role of government in administering forest resources and in directly implementing forest programmes.

As a consequence of these, Governments are increasingly looking toward alternative actors and policy instruments that stimulate interest in growing trees. Incentives are among the policy instruments used by Governments to stimulate investments in plantation establishment and management. This chapter presents the concept of incentives and the rationale behind incentives, incentives given in the countries of the region, their impacts and effectiveness. Finally, recommendations as a way forward are given.

6.1 The concept of incentives and rationale behind incentives

Incentives can be defined as policy instruments that increase the comparative advantage of forest plantations and thus stimulate plantation establishment and management (Enters *et al.*, 2003). A distinction is normally made between direct and indirect incentives, the former influence returns to investment directly, whereas the latter have an indirect effect through setting or changing the overall framework conditions within and outside the forest sector (Enters *et al.*, 2003). Direct incentives include inputs such as seedlings and fertilisers, grants, tax concessions, differential fees, subsidised loans and cost-sharing arrangements. Indirect incentives can be divided into variable and enabling incentives. Variable incentives are economic factors that may be shifted to affect the net returns that producers earn from plantations. They include factors such as prices, exchange rates, trade restrictions, interest rate policies, and general taxes (e.g. income tax) and subsidies. Enabling incentives are elements in the broader environment that affect decision-making. They include political and macroeconomic stability, land tenure and resource security, credible government, research support, training, extension, market support, infrastructure etc). Although direct incentives are widely accepted and practiced, the new conventional wisdom advocates use of indirect incentives as when implemented they create a favourable investment climate in which tree plantation investments may prosper (Constantino, 1995, in Haltia and Keipi, 1997).

The following reasons for use of incentives have been given (Gregersen, 1984; Haltia and Keipi, 1997):

- Modifying the social bias against forestry investments among farmers who have traditionally considered forests enemies of agricultural development;
- Increasing the rates of return on investment that may have relatively low private profitability but offer externality benefits for the society as a whole;
- Reducing the risks and uncertainty that arise during the often long periods required to recover planting and operational costs through harvest income;
- Establishment of a critical mass of plantations needed for the initial building of competitive forest industries; and,
- Acceleration ("jump starting") of the initial development of plantations for industrial or social forestry purposes.

However, in an economic sense, incentives from the public to the private sector are justified when one or both of the following conditions exist (Gregersen, 1984):

- Social benefits are greater than private benefits associated with a given private action, and,
- Social costs are less than private costs associated with the given action and social benefits are at least equal to private benefits.

6.2 Current incentives: impacts and effectiveness

A variety of incentives has been used or is currently used in the region (see Table 19).

Table 19. Incentives for forest plantation and woodlots development in the Eastern and North Eastern African study countries.

Country	Grants	Improved seedlings	Free seedlings	Tax Concessions	Lease of Govt land	Joint venture arrangements	Research and extension	Establishment cost	Handing over woodlots to farmers	Sharing plantation revenue with communities
Burundi			✓					✓		
Ethiopia			✓	✓	✓		✓		✓	✓
Kenya		✓	✓				✓			
Rwanda			✓				✓	✓		
Sudan			✓	✓			✓			
Tanzania		✓					✓			
Uganda	✓		✓	✓	✓		✓	✓		

Details in terms of types of incentives, source/period, target groups, outcomes/impacts and shortcomings are presented in Annex 5. There are significant differences in details of the schemes. Given the present limited extent of the private sector in the region, the impacts of these schemes in terms of areas planted is still small. There is also limited information on the impacts of these schemes on individual and community woodlots in the region. There are, however, a few success stories. The Uganda Sawlog Production Grant Scheme (SPGS), which commenced operations in 2004, had, by 2009, supported the establishment of 11 000 ha of Pines and Eucalypts by individuals and private companies (Box 5). Box 6 shows a woodlot establishment support programme in Burundi and Rwanda. Since 2009, a total of 4 226 ha and 3 000 ha have already been established in Burundi and Rwanda, respectively, through the project support.

Box 5: Uganda Sawlog Production Grant Scheme (SPGS)

The Sawlog Production Grant Scheme (SPGS) was started as a joint initiative between the Government of Uganda, and the European Union in 2004. In the first phase of the project (Oct. 2004 - June 2009), SPGS triggered a major interest in commercial tree planting in Uganda, with some 11 000 ha being established to the required standards. The Government of Norway has also joined in the funding of the second phase of SPGS (Sept. 2010 - 2013) and already has supported the establishment of 6 000 ha of timber plantations. This phase has an ambitious target of 30 000 ha of plantations established by the end of the project. SPGS has been a key mover in commercial plantation development by providing technical training about commercial tree growing right from establishment through tending and management. In addition, it provides a grant of UGX 850 000/ha (US\$ 307/ha) for growers in the category of 25 - 500 ha and UGX 600 000/ha (US\$ 217/ha) for growers in the category of 501 - 3 000 ha of well established plantation. The payment is made over a 3-year period. The main species planted are *Pinus caribaea* and *Eucalyptus grandis*.

Source: www.sawlog.ug

Box 6: Woodlot establishment support in Burundi and Rwanda

Sustainable Energy Production through Woodlots and Agroforestry in the Albertine Rift Project (SEW/Catalist/IFDC) in Burundi and Rwanda supports woodlot establishment by farmers in various locations in the two countries. The project which started in 2009, also operates in the Democratic Republic of Congo (DRC). Farmers provide land and about 20% of initial woodlot establishment and tending costs in the form of labour. The project provides 80% of the establishment cost. Farmers are happy about the scheme and about 4,226 ha and 3,000 ha have been established in Burundi and Rwanda respectively since the launching of the project in 2009.

Source: Nduwamungu (2011a, b)

6.3 Suggestions for improvement of incentives

The following suggestions will improve investment in forest plantations:

- Direct financial incentives are most likely to be important in the initiation stage to raise awareness and to increase the pace and scale of plantation establishment by the private sector and communities. They should, however, be targeted and temporary. Targeted means that producers should be supported to cover the marginal cost of adoption that covers the opportunity cost and temporary means that the incentives should be paid during a well-defined period to prevent any relationship of ongoing dependency between the beneficiary and the government.
- Other than direct incentives, the Governments of the region should ensure: macro-economic, political and institutional stability; access to land and clear resource tenure arrangements. Evidence from Asia and Latin America among others, shows that these factors, which create a favourable investment climate, are more important for obtaining significant levels of forest investment in plantations than direct incentives.
- In addition to improving the general economic environment for private investments, indirect incentives (research support, training, extension and possibly providing market information) may be areas where governments can make cost-effective contributions to promote private sector and out-grower/other woodlots forest plantation programmes.
- Examining incentive structures across all sectors of the economy to ensure that plantation forestry is not inappropriately disadvantaged; i.e. forest plantation investment occurs in a level playing field.

7. SUPPLY AND DEMAND OF FOREST PRODUCTS

There is an increasing global demand for forest products resulting both from increasing population and from improved living standards. On the other hand, the main supply base, i.e. natural forests are diminishing at an alarming rate due to unsustainable harvesting, other human impacts and withdrawal from production for conservation purposes, while expansion of plantations is not keeping pace. Consequently, considerable attention is given to identifying means of alleviating potential forest products shortfalls. Supply and demand studies are necessary to make informed decisions. Current supply and demand in the region and future scenarios as well as produce prices and forest products trade are presented in the following sections. Except for product prices, the other aspects were plagued by lack of available and reliable data. These limitations notwithstanding, the analyses provide fairly sound indications of the situation in the region.

7.1 Supply scenarios and projections

The supply scenarios and projections for the countries in the region are shown in Tables 20 and 21. Wood supply for various uses in comes from industrial forest plantations (public and private sector), non-industrial plantations (woodlots) and trees on farm, and from natural forests. However, in some countries natural forests and/or plantations are closed for harvesting. For all sources of wood supply, i.e. planted and natural forests, annual allowable cut (AAC) needs to be determined. However, lack of regular inventories reduces reliability of AAC estimates. National forest resources inventories underway in some countries will fill this very important information gap. Due to irregular planting arising from shortage of funds, industrial forest plantations in some countries of the region have suboptimal age structures rather than a normal forest structure where all the age classes are represented in equal shares. The implication of this is that there will be some years with wood deficits. Wood supply projections are based on various assumptions in the study countries. These include bans on harvesting of natural forests and plantations in some countries and expected expansion of forest plantations and woodlots especially by the private sector and communities respectively. Overall, the projections indicate modest increases in wood production over time. This is due to low plantation expansion in the recent past.

Table 20. Wood supply scenarios (1000 m³) in the Eastern and North Eastern African study countries in 2010.

Country	Government plantations	Private plantations	Non-industrial private forests	Natural forests	Total
Burundi	2 294	360	4 584	**	7 238
Ethiopia	377	-	-	104 017	104 394
Kenya	**	*	*	*	29 065
Rwanda	**	146	4 534	**	4 680
Sudan	*	*	*	*	11 645
Tanzania	1 150	160	180	87 700	89 190
Uganda	3 489	*	*	43 581	47 959

*Data not available.

**Forests are not harvested.

Table 21. Wood supply projections (1000 m³) in the Eastern and North Eastern African study countries to 2030.

Country	2015	2020	2025	2030
Burundi	1 900	2 425	3 095	3 949
Ethiopia	11 119	11 607	12 094	12 582
Kenya	31 443	33 975	*	*
Rwanda	3 244	5 248	5 248	5 248
Sudan	11 981	13 179	14 547	15 947
Tanzania	89 350	89 050	89 300	89 560
Uganda	51 652	57 185	63 768	73 386

*Data not available.

In some countries, natural forest supply is dwindling due to high deforestation rates and incentives to maintain forest cover free of exploitation under climate change mitigation and conservation measures. On the other hand, some of the forests have lesser known species (LKS) and some commercially unknown species.

7.2 Demand scenarios and projections

The studies have considered several factors in analysing demand scenarios and projections. These factors include the country's population, population density and growth, urbanisation, GDP per capita and GDP annual growth as well as demand factors. The main demand drivers in the region for roundwood (logs and pulpwood) include: construction sector, pulp and paper industry, furniture and joinery sector, packaging sector and utility poles for electricity transmission and telephone lines. For some study countries, wood fuel was included in the demand projection. Some of the countries also export some of the volumes. These factors are discussed in detail in the country reports. Suffice to say that the relative significance of all these factors differ from one country to another.

Taking into account the factors/demand drivers discussed above, particularly population, economic growth and urbanisation, the current demand (2010) and demand projections in the region are shown in Tables 22 and 23. A realistic scenario where economic growth and urbanisation increase the wood use per capita and that wood supply is able to respond to demand and no major substitution by other materials is taking place is assumed. In some countries, some amounts of wood products are exported.

Table 22. Wood demand scenarios (1000 m³) in the Eastern and North Eastern African study countries in 2010.

Country	Government plantations	Private plantations	NIPF	Natural forests	Total
Burundi	*	*	*	**	7 471
Ethiopia	*	*	*	*	84 600
Kenya	*	*	*	*	29 065
Rwanda	**	-	4 802	**	4 802
Sudan	*	*	*	*	11 645
Tanzania	1 150	160	180	38 650	40 140
Uganda	*	*	*	*	*

*Data not provided.

**No harvesting.

Table 23: Wood demand projections (1000 m³) in the Eastern and North Eastern African study countries to 2030.

Country	2015	2020	2025	2030
Burundi	8 661	10 040	11 474	13 045
Ethiopia	136 226	156 731	180 336	207 341
Kenya	39 924	44 830	*	*
Rwanda	5 432	6 116	6 819	7 603
Sudan	18 846	21 673	24 924	28 662
Tanzania	53 716	71 885	96 198	128 734
Uganda	2 693	3 614	5 824	10 434**

*Data not available.

**Based on plantation forests only.

Table 24 shows a wood surplus for Tanzania alone during 2015 and 2020, and wood deficits of varying magnitudes in rest of the study countries for the period 2015 to 2030. Given the slow pace of plantation and woodlot expansion in the region, such a situation should be expected.

Table 24. Wood surplus (+) or deficit (-) (supply minus demand) (1000 m³) in the Eastern and North Eastern African study countries.

Country	2015	2020	2025	2030
Burundi	-6 761	-7 615	-8 379	-9 096
Ethiopia	-125 107	-145 124	-168 242	-194 759
Kenya	-8 481	-10 855	*	*
Rwanda	-2 188	-868	-1 571	-2 355
Sudan	-6 865	-8 494	-10 377	-12 715
Tanzania	+35 634	+17 165	-6 898	-39 174
Uganda	**	**	**	**

*Data not available.

**Not computed, demand projections based on forest plantations data only.

7.3 Consumer prices

Table 25 shows consumer prices for forest products in the region (2010). Overall, there is wide variation in prices between countries and as expected local price being lower than export prices. Data was collected from a few urban centres within the countries; therefore these prices will vary greatly from one commercial centre to another, due to different transportation costs from the source of the material. For example, softwood sawn wood costing US\$ 194 in Dar es Salaam (Tanzania) would cost US\$ 246 in Arusha, 500 km away. For Kenya, a government ban on logging in forest plantations since 1999 drove the price of construction timber very high as most of it had to be sourced from across the border, mainly from Tanzania, Uganda and the Democratic Republic of Congo (DRC).

Table 25. Consumer prices (US\$) of local and imported timber and wood products in 2010 in Eastern and North Eastern African study countries.

Country/Forest product	Price (local)	Price (imported)	Countries of origin
Burundi			
Plantation industrial round wood, m ³	100-180	-	-
Plantation industrial sawn wood, m ³	85-165	-	-
Natural forest sawn wood, m ³	-	300-450	DRC, Tanzania
Ethiopia			
Plantation industrial round wood, m ³	155	No importation	-
Plantation industrial sawn wood, m ³	307	386	Australia
Natural forest industrial round wood, m ³	284	No importation	-
Natural forest sawn wood, m ³	350	No importation	-
Kenya			
Plantation industrial sawn wood, m ³	225-450	-	Local and Tanzania
Natural forest industrial sawn wood, m ³	600	-	DRC, Uganda
Rwanda			
Plantation sawn wood, m ³	100-190	-	-
Natural forest industrial sawn wood, m ³	-	260-750	DRC, Uganda
Sudan			
Plantation industrial round wood, m ³	130	767	China, S. Korea, Malaysia, Italy, Thailand, Turkey, Egypt, Emirates
Plantation industrial sawn wood, m ³	320	1306	
Pulp for paper, tons	-	331	
Paper and paper board, tons	-	700	

Tanzania			
Plantation industrial round wood, m ³	28.5 – 32.5*	No importation	-
Plantation sawn wood, m ³	194	No importation	-
Natural forest industrial round wood, m ³	80 – 100*	No importation	-
Natural forest sawn wood, m ³	445	No importation	-
Uganda			
Plantation industrial round wood, m ³	25-39	77	Sudan
Plantation sawn wood, m ³	314	143	Sudan, Rwanda
Natural forest sawn wood, m ³ ; mahogany	570	697	DRC, Sudan

*Royalty rates.

7.4 Forest products trade

Table 26 summarises forest products trade in the region in terms of volumes/weights of imported and exported products.

Table 26. Amounts of imports and exports in 2010 (m³ or tons) of forest products in the Eastern and North Eastern African study countries.

Country/commodity	Imports	Exports
Burundi		
Woodfuel, m ³	1	363
Industrial roundwood, m ³	635	3 270
Sawnwood, m ³	4 000	1 154
Wood based panels, m ³	1 455	33
Pulp for paper, tons	137	0
Paper and paperboard, tons	5 880	153
Ethiopia**		
NWFPs, tons	-	4 982
Paper/paper board, tons	55 000	-
News print, tons	7 500	-
Writing/printing paper, tons	12 000	-
Sawn wood, m ³	9 000	-
Kenya		
Softwood sawn, m ³	29 100	*
Hardwood sawn, m ³	5 900	*
Transmission poles, No	35 520	*
Rwanda		
Wood fuel, m ³	-	20
Sawn wood, m ³	12 ,000	104
Industrial round wood, m ³	1 686	110
Wood based panels, tons	3 313	192
Pulp for paper, tons	244	-
Paper and paper board, tons	4 245	2550
Sudan***		
Gum Arabic, tons	-	55 000
Other NWFPs, tons	-	3 192
Charcoal, tons	237	-
Sawn timber, tons	50 086	-
Pulp and paper, tons	153 892	-
Furniture, tons	193 530	-
Other items, tons	28 861	-
Tanzania		
Sawnwood, m ³	-	14 330
Treated poles, m ³	-	27
NWFPs, tons	-	1 112
Mpingo offcuts/furniture, tons	-	15

Uganda		
Plantation/woodlots		
Industrial round wood, m ³	26 000	1 331 000
Sawn wood, m ³	7 000	9 000
Paper and paperboard, tons	17 080	43 000
Natural forest		
Woodfuel	20 000	830 000
Industrial round wood, m ³	335 000	335 000
Sawn wood, m ³	16 000	277 000

*Data not available.

**2009 data.

***2008 data.

The countries import and export a variety of wood non-wood forest products, for example:

- **Sudan's** import of forest products is mainly wood of soft types and wood products for construction and furniture manufacture, together with paper and paper products for the printing and publication industry, and also to cover the needs of other industries. Sudan also imports a range of other wood derived products, e.g. furniture, charcoal, doors and others for buildings, etc. There is also a considerable importation of NWFPs, e.g. bamboo, fruits, pods, conditioners, etc. Gum Arabic is the main export commodity of Sudan.
- **Ethiopia** imports sawn wood, wood-based panels, veneer sheets and wood pulp products, printing and writing papers and news print. The gum Arabic/incense sub-sector of the NWFPs is well established in Ethiopia and has a significant export value. The country has produced and sold these products for decades.
- **Kenya** has a vibrant trade in timber and wood products with its neighbours (Tanzania, Uganda, DRC and Republic of Congo) though largely informal. The trade increased following the 1999 ban on logging in Kenya. In 2010, imports included softwood and hardwood timber and poles. Information on exports was not available.
- **Tanzania** has been exporting traditional products such as logs, sawn wood, floor boards, planks, sandalwood and poles until in the last few years when non-traditional products have been introduced. These include cinchona barks, carvings, furniture, jatrophia oil, palm leaves and other products. The leading forest product export item is sawn timber (rough sawn). Import data was not provided, but furniture and paper products are major imports.
- **Burundi** mainly imports sawn wood, wood based panels and paper board while the main exports are sawn wood and round wood.
- **Rwanda** mainly imports sawn wood, industrial round wood, wood based panels, pulp for paper and paper and paper board. The exports include fuelwood, sawn wood, industrial round wood, wood based panels and paper and paper board.
- **Uganda** Imports and exports industrial round wood, sawn wood, woodfuel and paper and paper products.

8. FOREST ROYALTIES AND OTHER REVENUES

Forest and tree resources represent significant natural assets used to produce a wide range of economic, environmental and social goods and services. They are used by the public and private sectors and communities to generate revenues to support SFM. For the government, forest charges are paid for the rights to produce forest products from forest areas owned by the state. The way that these charges are set, assessed and collected is referred to as the forest revenue system. The structure of charges is closely linked to the types of licences that are used to control production. Forest charges and licenses, forest concessions and the administration of forest revenue in the region are discussed in the following sections.

8.1 Forest royalties and licences

8.1.1 Structure and amount of forest royalties and licences

Licences and royalties on forest products are normally set by Forest Departments and are regularly updated when found necessary. Revisions may involve reclassification of species, list of additional species, new types of charges and general increases in rates charged. Often, these charges have been determined arbitrarily with minimal recognition of market value.

The royalty charges are paid by the traders for use of products from central government or local government forest reserves, plantations or any other specified area (e.g. general land in Tanzania or areas outside reserves in Sudan). There are various ways of charging sale of wood and NWFPs in the study countries. These include:

- **Fees based on tree volume:** used to sell standing timber with type(s) of species to be harvested and minimum diameters indicated. Charges are normally levied per m³ of wood;
- **The unit area charge:** charges are based on estimated volume per ha based on previous inventory. Forests may be classified into zones based on richness of the area in terms of: species composition; stocking; accessibility etc;
- **Fees based on number of trees:** used to sell poles and normally the minimum and maximum diameters are indicated;
- **Withies:** charges may be per load of a given number of withies. Normally maximum diameter of withies is indicated;
- **Firewood:** charged per stacked volume or head load or time allowed in the forest;
- **Charcoal:** normally charged per bag of a given weight;
- **Fibres:** charged per cubic meter or period in the forest;
- **Seedlings:** charged per seedling;
- **Charges for production of NWFPs:** Charges can be levied on NWFPs and services. Charges are normally per kilogramme. NWFPs include gum Arabic, gum olibanum, gum oppoponox, gum myrrh and honey;
- **Fees on services:** Service charges include: ecotourism fees, camping fees, research fees, siting a sawmill and operating a sawmill a forest reserve;
- **Charges on processed forest products:** charges can be levied in the registration of those involved in the processing of forest products. Other charges include value added tax (VAT) and sales tax which are normally collected by Revenue Departments and not Forestry Departments;
- **Charges on forest products trade:** charges include grading fees for exports of wood and NWFPs or for acquiring export certificate. Other charges are collected by Revenue Departments; and,
- **Other charges:** Revenue is collected from a range of other charges including the following: (i) fines and penalties if forestry laws and regulations are violated (ii) sales of seized products i.e. forest products that are produced illegally.

Charges for a few tree species in the region are shown in Table 27. Overall, charges vary widely between countries. This may be due to the fact that royalties are mainly administratively set and do not accurately reflect the market prices of round wood.

Table 27. Stumpage fees (US \$ per m³) for a selection of tree species in the Eastern and North Eastern African study countries in 2010.

Tree species	Countries						
	Burundi	Ethiopia	Kenya	Rwanda ¹	Sudan	Tanzania	Uganda
<i>C. lusitanica</i>	-	70	30.0 – 37.0	-	99	15	26
<i>P. patula</i>	-	-	28.0 - 33.2	-	-	15	16
<i>J. procera</i>	-	73	-	-	-	38	-
<i>T. grandis</i>	-	-	-	-	141	122	-
<i>Eucalyptus spp.</i>	-	-	24-31	-	-	11	-
All plantation species	5	-	-	-	-	-	-
Class 1 hardwoods	-	-	-	-	141	121	57

1) No royalties set as there is no harvesting of public sector plantations since 2000. A payment of 1% of value of produce from private forests greater than 2 ha and US\$ 4 per harvesting permit and per forest products transportation permit.

8.1.2 Suggestions for improvement of forest charges and licences

The following suggestions are expected to improve forest charges and licence amounts:

- Stumpage fees should not be administratively determined; they should be determined using economic principles so that they more accurately reflect the market prices of round wood.
- Categories of forest royalties and charges are numerous in some countries. Reducing the number of different charges and payment categories need to be considered for easy implementation of forest charges and licences. The more there are different payment categories and different charges, the more complex the system is to manage and monitor.
- There is a need to regularly revise fines and penalties charged for committing offences. For some forest laws, the fines and penalties are low and this encourages illegal operations.

8.2 Forest concessions/permits

A concession is a contract between a forest owner and another party permitting the harvesting (forest utilisation contracts) and/or managing (forest management services contracts) of specified resources from a given forest area (Gray, 2002). Forest concessions may include both types of contracts; in this case the concessionaire has both rights and obligations.

8.2.1 Current concessionaires/permit holders

Most countries in the region do not have a concession system. Kenya is currently in the process of preparing procedures and guidelines for concessions, while Tanzania has already prepared these guidelines but not yet operationalised them. Ethiopia gives concessions for the production of incense and gum in areas where resources are abundant. While ownership of the woodlands and shrub lands remain with the government, the rights to tap and manage the resource are usually allocated to private companies and small cooperatives. Table 28 shows the current concessionaires. The concessions are allocated through a bidding process in which concessionaires apply through preparation of management plans and indicate their financial capacities to undertake the activities.

Table 28. Ethiopia: Forest concessionaires/permit holders 2009.

Concessionaire/permit holder	Type of forest	Concession size (ha)	Length of concession/	Forest fees
Abbebaye C.C. PLC	Woodland and shrub lands	20 000	One year	20% of sale per quintal
Genale Migs Trading P.L.C.	Woodland and shrub lands	20 000	One year	20% of sale per quintal
Darulea Nesredin	Woodland and shrub lands		One year	20% of sale per quintal
NGPME	Woodland and shrub lands	16 000-25 000	One year	20% of sale per quintal
Ambassel Trading house	Woodland and shrub lands	15 000	One year	20% of sale per quintal
BWAP Export P.L.C	Woodland and shrub lands	15 000	One year	20% of sale per quintal
Yahiya Seid Omer	Woodland and shrub lands	10 000	One year	20% of sale per quintal

8.2.2 Monitoring of compliance

In the case of Ethiopia where there are concessions for incense and gums, site forest technicians are responsible for demarcating the compartments that are to be tapped for incense and gums. The technicians also make follow-up visits to sites to monitor whether the Concessionaire is abiding by the rules and regulations agreed upon in the Concession Agreement. Monitoring reports are submitted to the Regional Forestry Enterprises.

8.2.3 Suggestions for improvement of concessions/permits

- For the countries that are developing concession procedures and guidelines, they should involve all key stakeholders in the process. This will greatly improve the content and procedures adopted for the issuance and implementation of the concessions/permits.
- Staff strength should be improved through new recruitment, professional competence strengthening, proper remuneration and deployment to lower administrative levels. Staff should also be provided with transport and other facilities for effective implementation of concession monitoring and collection of revenue.

8.3 Administration of forestry revenue system

8.3.1 The process of setting forest royalties and taxes

Setting of forest royalties and taxes is in accordance with most country's Forest Acts. The process of setting forest charges starts with Forestry Departments, Agencies, Authorities, Enterprises or Corporations making proposals to the approval authority. The proposals for royalties and taxes are set administratively or by using economic principles. There are various approval authorities, including Ministers of Finance, Ministers of Natural Resources and Agency, Authority, Corporation or Enterprise Boards. Approved charges are normally announced in government gazettes and copies circulated to all stakeholders.

8.3.2 Monitoring and collection of revenue

Forestry Department staff is responsible for the marking of compartments and the trees that will be harvested for timber or areas for NWFPs harvesting as a basis for calculating charges. These charges must be paid before logging or NWFPs harvesting commences. Forestry Department staff is also responsible for the control of logging and NWFPs harvesting and monitoring compliance with forestry rules and regulations. This is done through field checks to confirm that what has been harvested in terms of tree species, tree volumes and weight of NWFPs are as per the permit/

contract. However, due to shortage of staff, lack of funds and transport facilities, inspection is sometimes not done or is paid for by Concessionaires thus compromising the ability of Forestry Department staff to independently monitor and control the operations. Road checks/blocks are also used to check all vehicles carrying logs/NWFPs to ensure that the items are legally acquired. Legally produced logs must have a valid stamp and the official receipts must accompany the logs/NWFPs during transport. Often, such check points are few and manned by poorly remunerated staff which provides room for corruption. Consequently, there is a lot of illegal felling in the region. In Tanzania, for example, a study by Milledge *et al.* (2007) showed that the Government was nationally losing up to US\$ 58 million annually due to the under-collection of natural forest product royalties in the districts.

8.3.3 Total forest revenue collection

Total revenue collection in the study countries over a number of years is shown in Table 29. Overall, there is wide variation over years within a country with a general trend of increasing revenue, most likely due to revisions upwards of royalties and taxes as well as effectiveness of strategies to improve revenue collection. There is also a wide variation in collections between countries, a reflection of differences in resource endowments and revenue collection effectiveness.

Table 29. Total annual revenue collection trend (from royalties, licenses and penalties) (US \$ million) for the Eastern and North Eastern African study countries.

Year	Countries						
	Burundi	Ethiopia	Kenya	Rwanda	Sudan	Tanzania	Uganda
2000	*	4.23	*	*	2.76	*	*
2001	*	3.67	*	*	3.92	*	*
2002	*	3.14	*	*	3.44	*	*
2003	*	5.40	*	*	4.64	*	0.7
2004	*	6.32	*	*	7.88	4.18	1.3
2005	*	12.18	*	*	8.76	8.66	1.5
2006	2.2	6.97	*	*	10.48	6.78	2.7
2007	*	7.58	*	*	11.84	12.28	3.2
2008	*	11.26	*	*	12.76	18.25	5.7
2009	*	15.15	3.9	*	12.64	11.75	7.6
2010	0.21	16.13	9.51	*	14.64	31.08	4.8

*Data not available.

Few countries have provided information on collections versus potential revenue. The Tanzania study showed that the average annual collection for the last four financial years, when some of the recommendations to improve revenue collection started to be implemented, is TZS 24 800 billion. This is about 62% of the potential revenue (i.e. TZS 40 Billion) which could be collected according to reports by Koppers (1997) and Kobb (1999) in Ngaga (2011). The implication of these findings is that there is still about 38% of the revenue which was not collected, most of which is lost through illegal harvesting, evasion, fraud and forgery of documents. These problems have been pointed out in other study countries though the amount of leakage has not been indicated. The Tanzania study also showed that most of the revenue collected comes from royalties which contributed over 92% of the total revenue collection while registration fees contributed about 4% of the total collection. In Kenya, over 90% of the revenue comes from sale of forest plantation round wood. These findings have implications that efforts to improve revenue collection must address issues which have direct bearing on collection of royalty fees, for example, prices and scaling of logs/timber and charcoal.

8.3.4 Suggestions for improvement of revenue collection systems

The following suggestions will improve revenue collection in the study countries:

- Staff strength should be improved through new recruitment, professional competence strengthening, proper remuneration and deployment to lower administrative levels. Staff should also be provided with transport and other facilities for effective implementation of concession monitoring and collection of revenue.
- Need for forest inventories to provide accurate and up-to-date information for Forestry Departments to make informed decisions on resource utilisation.
- In order to ensure the co-operation of rural communities in forest revenue generation, neighbouring communities should take part in monitoring of harvesting of wood and NWFPs, and village governments should get a share of the revenue.
- Development of national forest certification schemes, a market-led system for ensuring SFM and demonstrating to stakeholders in an objective manner that a certain forest area is sustainably managed. This, along side a chain of custody certification is necessary to secure access to potential markets in Europe. It will improve the transparency of timber business, thereby reducing irregularities with special reference to illegal operations which will be a useful outcome for the purpose of improving revenue collection.
- Establishment of a centralised Management Information System (MIS) to take care of challenges of available forest revenue data and information in the study countries. The MIS will consolidate and store harvesting and revenue collection data and reports.

9. PROCESSING OF PRODUCE

Forest industries undertake primary and/or secondary processing of wood and NWFPs and thus add value. The industries create jobs while processed products are sold in national or international markets thus earning local and foreign exchange. Forest industries are thus important for the socio-economic development of a country. This chapter provides a review of forest industries in the study countries in terms of types of industries and ownership patterns, raw material supply and quality, constraints facing the sector, and the potential for future investment.

Due to scarcity of information on production and employment in the small and medium forest enterprises (SMFEs) in the region, they are not fully covered in this chapter. However, their contribution in terms of cash income and employment is recognised (FAO 2011b). This contribution can be enhanced by an enabling environment and appropriate incentives.

9.1 Ownership and types of industries

There is a diversity of forest industries in the region though the distribution is not even. Some countries have more industries in terms of numbers and types than others. The types of industries include: sawmills, woodworks/furniture marts and joinery, paper, wood based panels (plywood, veneer, chipboard and fibreboard), poles treatment plants and NWFPs processing plants. Table 30 shows the types, numbers and capacities of forest industries in the region. Ownership of the industries in the region is both public and private. However, before the advent of economic reforms in the 1990s, most industries in some countries were publicly owned.

Table 30. Types and current capacities of industries utilising plantation and natural forest wood and NWFPs in the Eastern and North Eastern African study countries.

Country	Type of industry	No. of industries	Current annual input capacity
Burundi	Mainly pitsawing; few small sawmills in towns	*	*
Ethiopia	Sawmills (incl. mobile sawmills)	22	1 500 - 2 000 m ³
	Paper mills	3	17 000 tons
	Chipboard	7	70 000 -75 000 m ³
	Plywood	1	2 000 m ³

Kenya	Sawmills Pulp mill	367 1	500 - 30 000 m ³ 250 000 m ³
Rwanda	Mainly pitting sawing; few small sawmills in towns Match plant	* 1	* 760 m ³
Sudan	Sawmills NWFP processing	* *	5 000 - 24 000 m ³ 40 000 tons
Tanzania	Sawmills Transmission poles Wood based panels Pulp and paper mill	512 12 3 1	5 000 - 50 000 m ³ 10 000 - 160 000 poles * 300 000 m ³
Uganda	Sawmills (one fixed mill, rest are mobile) Plywood mill Particleboard mill Pole treating plant	51 1 1 4	* * * 185 000 poles

*Data not available.

The industries in the region are dominated by primary processing with little secondary processing. There is also a dominance of SMFES, most of which operate in the informal sector. Most industries have obsolete equipment and, hence, low quality products which cannot be competitive in international markets. Sawmills are normally characterised by low conversion capacity, resulting in low recovery rates and generation of large amounts of waste. Other than use of obsolete machines, production inefficiencies are also caused by an unskilled workforce.

9.2 Raw material supply and quality

The industries get raw materials from woodlots, public and private sector industrial plantations and natural forests. As pointed out earlier, the quality of logs from the public sector plantations is generally poor due to use of low quality seed and neglect of essential silvicultural operations like pruning and thinning. For sawmills, plywood and veneer industries this results in poor products, low recovery and large amounts of waste. For natural forests, logs are also of poor quality in most situations due to a diminishing resource base arising from previous over-harvesting.

Due to bans on harvesting forest plantations in some of the countries, there is excess processing capacity in these countries compared with available resources. Excess capacity has also been caused by sub-optimal age structures of forest plantations due to replanting backlogs. Improved processing technology is necessary to ensure more efficient use of harvested wood resources and minimising waste by utilising off-cuts in further processing to provide local and export products in shaped and machined mouldings, flooring, furniture components, dowels and similar added value items (Asumadu, 2004).

For NWFPs, there is limited processing in the region. Most of the products are just cleaned and exported. Investment in processing would add value to such products and increase profit margins.

9.3 Constraints facing the sub-sector

The forest produce processing sector in the region faces a number of challenges, which limit their ability to increase the rate of processing and be competitive in the international export market. Key challenges include:

- Dwindling supply of raw material from natural forests which has gradually increased logging distances and transportation to mills and hence production costs. Lesser used species, which are abundant in countries like Tanzania, provide additional opportunities, but there is limited knowledge about their properties and utilisation options. This situation may be addressed by research and aggressive promotion of their benefits. The slow rate of creating new industrial tree plantations is also a major constraint to further processing because of the diminishing natural forest resource base.
- The majority of equipment used in the wood processing sector in the region is obsolete. This makes it impossible to manufacture products to international standards.

- Lack of government incentives and inaccessibility to trade and investment finances from the financial institutions.

9.4 Potential for future investment

The potential for future investment in plantations and processing is very high in the region. Some potential areas for future investment are the following:

- Modernisation of SMFEs and large industries. The processing industry in the region is characterised by small and medium scale sawmills using poor technology with very little or no value addition. These and the large industries need to be supported with appropriate incentives to install modern technologies. Modern technologies will result in increased efficiency and improved productivity and quality, better utilisation of raw material resulting in increased recovery rates, less wastage and better working environment.
- Drying of timber. Drying of sawn timber is currently not common in some countries, like in Tanzanian SMFEs. Most timber is sold green. Improving drying is therefore an opportunity for SMFEs as well as for larger operators, since drying of sawn timber is one of the important stages in the processing and adding value to the products; without it, there cannot be other value adding processes.
- Bio-energy in electricity production and other energy alternatives. Most wood residues can be used to produce electricity in combined heat and power plants if there is excess biomass given electricity uncertainties in most countries of the region.

10. SOCIO-ECONOMIC AND ENVIRONMENTAL CONTRIBUTIONS OF FORESTS

Forests supply wood, fibre, fuelwood and NWFPs. They also provide environmental services (soil and water protection, rehabilitation of degraded lands, restoration of landscapes and carbon sequestration) and social services and livelihood support (income generation, employment and recreation). While the value of goods is often known, that of services is, in most situations, unknown and this partly contributes to the inadequate allocation of resources by Governments to ensure SFM as the full value of the resource is often not appreciated. Sustainable management of the forest resources is therefore key so that they meet the diverse expectations of stakeholders. The contribution of forests to income generation, employment and in conservation is explored in the following sections.

10.1 Current and potential income

Both natural and planted forests provide a range of goods and services. Goods include wood and NWFPs while services include soil and water protection, rehabilitation/restoration of degraded lands, recreation, cultural and spiritual uses and carbon sequestration. Both goods and services generate income at various levels, though most of the income from goods goes unrecorded because of the informal nature of activities by communities. On the other hand, private sector information on income is difficult to obtain. Few of the services generate income because strategies are not yet in place in most countries in terms of PES. In view of the foregoing, the income figures from plantations, natural forests and industries provided by some countries in the region should be considered as a gross underestimate of the actual situation (Table 31). There is wide variation in the income between countries in the region, a reflection of differences in resource endowments as well as governance with regard to monitoring and collection of revenue. Income for the past 10 years, where provided, did not show any clear trend over the years.

With regard to potential income, predictions are difficult to make as such income depends on:

- to what extent SFM is ensured;
- implementation of NFFS; and,

- creating a favourable climate for private sector investments in forest plantations and industry.

Table 31. Income 2009 (1000 US\$) from industrial forest plantations, natural forest management, processing industries and services in the Eastern and North Eastern African study countries.

Country	Income from					Total
	Forest plantations	Natural forests	Wood industries	NWFPs	Other: penalties	
Burundi	*	*	*	*	*	*
Ethiopia	5 552	*	3 000	9 600	*	18 152
Kenya	*	*	*	*	*	*
Rwanda	*	*	*	*	*	*
Sudan	5 872	3 448	*	*	3 572	12 891
Tanzania	*	*	*	*	*	*
Uganda	*	*	*	*	*	98 293

*Data not available.

10.2 Current and potential employment

Employment in the sector is both formal and informal. The informal sector has a significant role in providing employment but statistics do not exist. Table 32 shows formal employment in the sector for countries in the region for which information was available. There is a wide variation in employment levels between countries, a reflection of resource endowments, forest plantation and industry development strategies, as well as strategies towards PES.

With regard to potential employment, as for income, predictions are difficult to make as such employment depends on:

- to what extent SFM will be ensured;
- implementation of NFFS; and,
- creating a favourable climate for private sector investment in forest plantations and industry.

Further, it is unrealistic to project future employment when the current one is not known.

Table 32. Employment in industrial forest plantations, natural forest management, processing industries and services in the Eastern and North Eastern African study countries.

Country	Employment in sectors (rounded to nearest 100)				Total
	Forest plantation	Natural forest management	Wood industries	NWFPs	
Burundi	108 000	-	56 000	-	164 000
Ethiopia	187 900	8 000	5 500	25 000	226 400
Kenya	*	*	*	*	*
Rwanda	80 100	-	21 000	-	101 100
Sudan	*	*	*	*	*
Tanzania	*	*	*	*	1 383 000
Uganda	30 000	*	*	*	1 000 000

*Data not available.

10.3 Plantations in forest conservation

When large scale plantation development started in the study countries between 1911 and 1960, most new plantations were established on areas converted from natural forests. This led to biodiversity loss as most of the natural forests have high biodiversity values. Because of the need to conserve biodiversity, forest policies of some countries now prohibit conversion of natural forests to plantations.

Notwithstanding the foregoing, forest plantations have been shown to improve biodiversity in situations where they are established on secondary forest land or on other deforested land. A number of studies have shown the catalytic effect of forest plantations on the regeneration of native woody species under their canopy and their subsequent succession as well as increased flora and fauna diversity in the plantations (Bernhard-Reversat, 2001; Senbeta and Demel, 2001; Senbeta *et al.*, 2002; Cossalter and Pye-Smith, 2003). There are, however, differences in these processes, e.g. depending on plantation species used and proximity of the plantation to any existing natural forest (Senbeta and Demel, 2001; Senbeta *et al.*, 2002; Cossalter and Pye-Smith, 2003; Montaginini *et al.*, 2005). Also, delayed or omitted silvicultural operations like pruning and thinning may result in reduced biodiversity of shade intolerant species.

Forest plantation designs that retain individual natural forest trees or patches within the plantation ensure availability of seed and seed dispersers (birds and animals) for natural regeneration, thus increasing biodiversity (Montaginini *et al.*, 2005). Other ways of increasing biodiversity under forest plantations include: maintaining a mosaic of plantation age classes with a potential value in providing a range of habitat (Gerrand *et al.*, 2003), using a mixture of species within the plantation to increase structural and functional diversity and potentially increase overall production (Gerrand *et al.*, 2003; Montaginini *et al.*, 2005), and retaining native vegetation in watercourses, ridges or steep areas (Gerrand *et al.*, 2003).

Other roles of well managed forest plantations include provision of environmental services (soil and water protection, rehabilitation of degraded or marginal lands, restoration of landscapes, habitat development and, more recently, carbon sequestration) (Carle *et al.*, 2002; FAO, 2009b). Other uses include recreational, cultural and spiritual use. Forest plantations have also been shown to play an important role in directly protecting the indigenous forests from over-utilisation, by forming a physical barrier of access to the natural forests as well as providing alternative supply of products, which has taken pressure away from the natural forests (FAO, 2005; FAO, 2009a).

Studies show that fast growing forest plantations may place significant demands on the available water resources (Scott *et al.*, 1998; Gerrand *et al.*, 2003; Farley *et al.*, 2005; Vanclay, 2008) though site specific studies are very limited, especially in the eastern and north eastern African region. Forest plantations have been shown to reduce mean annual stream flow as well as low flows thus reducing recharge to ground water and water available to downstream users (Scott *et al.* 1998, Gerrand *et al.* 2003, Farley *et al.*, 2005; Vanclay, 2008). It is thus important to identify where trees should be placed in the landscape and how they should be managed to produce the best environmental outcomes, i.e. minimising water use/increasing water use efficiency (Nambiar, 1999; Vanclay, 2008).

11. CONCLUSIONS AND WAY FORWARD

11.1 Conclusions

The main conclusion from this study is that there is no sustainable management of planted and natural forests in the region. The main consequence has been poor quality and productivity and inadequate wood from forest plantations and woodlots, and high deforestation and degradation of natural forests. The main reasons for this state of affairs are limited human and financial resources. Limited direct and indirect incentives hamper significant private sector and community involvement in forest plantation management. Urgent action to reverse this state of affairs is needed to reduce the increasing imbalance between supply and demand of forest products. On the other hand, there have been recent reforms to devolve ownership and management to communities and other stakeholders, though ownership and management largely remains with governments. Internal revenue collection is poor, leading to high leakage. Improved revenue collection and diversified sources, including PES, and investment of the revenue in forestry could reverse the equation and improve SFM.

11.2 Recommendations/Way forward

The following recommendations as a way forward arise from this study:

1. Forest plantation situation

- High standards of silviculture and tree improvement: Forest plantations must be properly managed by sound selection of species, provenances or hybrid materials of high genetic quality and by use of appropriate and timely silvicultural practices so that they become highly productive and produce high quality wood. Due to poor management of public industrial and energy plantations, there should be consideration to devolve forest management responsibilities and lease the plantations to the private sector.
- Forest plantation expansion: For countries with available land for new plantations, Governments should provide a favourable climate for the private sector to establish plantations. For countries where land is limiting, out-grower schemes and other woodlots should be supported to assume a much greater role in tree growing.

2. Out-grower schemes

- To enable out-grower schemes to continue contributing to sustainable development of the sector in the future, the guidelines, criteria and indicators of best practice in such schemes developed by FAO and CIFOR (FAO, 2002) should be used (Annex 4).

3. Forest and tree tenure

- Use the FAO principles to reform tenure. This will ensure unambiguous, equitable and enforceable tenure rights (communal, public and private) in forest areas. This will strengthen incentives for SFM.

4. Financial and human resources

- Governments and other stakeholders should develop comprehensive national forestry financing strategies which will create mechanisms and conditions for expanding and diversifying the financial basis for forest plantations and woodlots and SFM in general, by making existing financing systems more efficient and supplementing them with new and/or innovative opportunities.
- Governments and other stakeholders should build up human resource capacity for forest plantations (managerial, technical and vocational). There should also be improvement of extension services to support woodlot establishment by individuals and communities.
- Countries in the region should collaborate in research, capacity building and information exchange (lessons learnt, best practices, etc.) to enhance cost sharing and achieve economies of scale.

5. Incentives for plantation establishment by public/private sector and out-growers/other woodlots

- The national forestry financing strategy (NFFS) proposed in section 4 will also cover direct and indirect incentives for plantation establishment by public/private sector and out-grower/other woodlots.

6. Supply and demand of forest products

- Action on recommendations 1 and 2 will increase wood supply and close the supply-demand gap over time.
- There should be concerted efforts to develop human and financial capacity to collect, analyse and document forest produce supply and demand data for informed decision making.

7. Forest royalties and other revenue

- Stumpage fees should not be administratively determined, but rather by using economic principles so that they more accurately reflect the market prices of round wood.
- Staff strength should be improved through new recruitment, strengthening professional competence, and provision of proper remuneration and deployment to lower administrative

levels. Staff should also be provided with transport and other facilities for effective implementation of the law enforcement and monitoring and collection of revenue.

- There is an urgent need for forest inventories to provide accurate and up-to-date information for Forestry Departments to make informed decisions on resource utilisation.
- In order to ensure the co-operation of rural communities in forest revenue generation, neighbouring communities should take part in monitoring of harvesting of wood and NWFPs, and village governments should get a share of the revenue.
- Development of national forest certification schemes, i.e. market-led systems for ensuring SFM and demonstrating to stakeholders, such as purchasers of forest produce, in an objective manner, that a certain forest area is sustainably managed. This, alongside chain of custody certification, is necessary to secure access to potential markets in Europe. It will improve the transparency of timber business, thereby reducing irregularities, particularly illegal operations, which will be a useful outcome for the purpose of improving revenue collection.
- Establishment of a centralised Management Information System (MIS) to address challenges on available forest revenue data and information in the study countries. Such a system will consolidate and store harvesting and revenue collection data and reports.

8. Processing of produce

- Government support to forest industries in form of an enabling environment and appropriate incentives. Such support would ensure: improvements in energy efficiency; lower waste in production and ensuring resource conservation; use of safe and environmentally compatible materials; safe working conditions; and human resource capacity. This would lead to improvements in productivity and quality and thus improved profitability.
- For SMFEs, supportive policies should be in place. These include: tax incentives, access to affordable microfinance, commercial infrastructure (roads, market access and information), secure tenure and capacity development.
- Development of technical standards and codes for wood and NWFPs.
- Research on wood properties of lesser utilised indigenous tree species.
- Protect SMFEs by limiting foreign investment in primary timber milling.
- Private sector players should form national and regional associations (including those involved in forest management). The small players should be supported to form associations and cooperatives.

9. Socio-economic and environmental contributions of forests

- Location of forest plantations in the landscape: Studies to identify where trees should be placed and managed in the landscape to produce the best environmental outcomes.
- Forest plantation designs should ensure biodiversity and soil and water conservation by retaining individual natural forest trees or patches within the plantation, in water courses, ridges and steep areas.
- Valuation of forest resources: Studies to determine the value of forest resources so as to provide a full accounting and justification to invest in SFM.

10. General recommendation

- Statistics for all aspects of this study was a big problem in terms of availability and reliability. This is a critical problem in all study countries that should urgently be addressed in order to have adequate basis for planning and development of the forest sector in the countries.

REFERENCES

- Arnold, J.E.M. 1984. Forestation for local community development. *In*: Wiersum, K.F. (Ed). Strategies and designs for afforestation, reforestation and tree planting, 48-62. Proceedings of an international symposium on the occasion of 100 years of forestry education and research in the Netherlands, Wageningen, Netherlands. 432pp.
- Asumadu, K. 2004. Development of wood based industry in Sub Saharan Africa. Report prepared for AFORNET/FAO/KSLA. 52pp.
- Blomley, T., Pfliegner, K., Isango, J. and Zahabu, E. 2008. Seeing the wood for the trees: an assessment of the impacts of participatory forest management on forest condition in Tanzania. *Oryx* 42: 380-391.
- Blomley, T. and Ramadhani, H. 2006. Going to scale with participatory forest management: early lessons from Tanzania. *International Forestry Review* 8: 93-100.
- Bernhard-Reversat, F. (Ed). 2001. Effect of exotic tree plantations on plant diversity and biological soil fertility in the Congo savanna: with special reference to Eucalypts. CIFOR, Bogor, Indonesia. 71pp.
- Bertram, S. 2003. Strategic action planning in the Kenyan forest sector. Report on phase 1: review of issues. UNDP, Nairobi, Kenya. 33pp.
- Carle, J., Vuorinen, P. and Del Lungo, A. 2002. Status and trends in global forest plantation development. *Forest Products Journal* 52(7): 1-13.
- Carle, J and Holmgren, P. 2008. Wood from planted forests: A global outlook 2015-2030. *Forest Products Journal* 58(12): 6-18.
- Chamshama, S.A.O and Nwonwu, F.O.C. 2004. Lessons Learnt on Sustainable Forest Management in Africa: Case study on forest plantations in Sub-Saharan Africa. FAO, AFORNET, KSLA. 89pp.
- Chamshama, S.A.O. and Nshubemuki, L. 2011. Plantation forest management in Tanzania: Current situation and future focus. Paper presented at the forest plantations pests, insects and soil problems workshop, Kibaha, Tanzania. Feb 2011. 25pp.
- Cossalter, C. and Pye-Smith, C. 2003. Fast-wood forestry: Myths and realities. CIFOR, Jarkata, Indonesia. 50pp.
- Enters, T., Durst, P.B. and Brown, C. 2003. What does it take? The role of incentives in forest plantation development in the Asia-Pacific region. UNFF Intersessional Experts Meeting on the role of planted forests in sustainable forest management, 24-30 March 2003, New Zealand. 13pp.
- Evans, J. 1992. Plantation forestry in the tropics. Clarendon Press, Oxford, U.K. 403pp.
- Evans, J and Wood, P.J. 1993. The place of plantations in tropical forestry. Paper presented at the 14th Commonwealth Forestry Conference, held in Kuala Lumpur, Malaysia. 13- 18 September 1993. 3pp.
- FAO 2001a. Forestry out-grower schemes: A global overview. Report based on the work of D. Race and H. Desmond. Forest Plantation Thematic Papers, Working Paper 11. Forest Resources Development Service, Forest Resources Division. FAO, Rome (*unpublished*). 21pp.
- FAO 2001b. Global forest resources assessment 2000: main report. FAO Forestry Paper 140. FAO. Rome, Italy. 479pp.
- FAO 2001c. Mean annual increment of selected industrial plantation species by L. Ugalde and O. Perez. Forest Thematic Papers. Working Paper 1. Forest Resources Development Service, Forest Resources Division. FAO. Rome, Italy. (*Unpublished*). 27pp.
- FAO 2003. State of the World's Forests 2003. Food and Agriculture Organization of the United Nations, Rome, Italy. 151pp.
- FAO 2006. Responsible management of planted forests: voluntary guidelines. Planted Forests and Trees Working Paper 37/E. Rome, Italy. 73pp.
- FAO 2005. The potential for fast-growing commercial forest plantations to supply high value roundwood. Planted Forests and Trees Working Papers, Working Paper 33. Forest Resources Development Service, Forest Resources Division. FAO, Rome. 49pp.
- FAO 2009a. The future of teak and the high-grade tropical hardwood sector: Planted Forests and Trees Working Paper FP/44E. 47 pp
- FAO 2009b. Planted forests and second-generation biofuels. Linda Rosengren. Planted Forests and Trees Working Paper 42E. Forest Resources Development Service. FAO. Rome, Italy. 33pp.
- FAO 2011a. Reforming forest tenure: issues, principles and process. FAO. Rome, Italy. 92pp.
- FAO 2011b. State of the Worlds's forests. FAO, Rome, Italy. 164pp.
- FAO/CIFOR 2002. Towards equitable partnerships between corporate and small holder partners. Conference proceedings: Bogor, Indonesia. May 21-23, 2002. 197pp.
- Farley, K.A., Jobba, E.G. and Jackson, R.B. 2005. Effects of afforestation on water yield: a global synthesis with implications for policy. *Global Change Biology* (11): 1565–1576.

- FBD 2003. Technical specifications for management of forest plantations in Tanzania. Forestry and Beekeeping Division, Ministry of Natural Resources and Tourism. Dar es Salaam, Tanzania. 8pp.
- Gerrand, A., Keenan, R.J., Kanowski, P. and Stanton, R. 2003. Australian forest plantations: overview of industry, environmental and community issues and benefits. *Australian Forestry* 66: 1-8.
- Gray, J.A. 2002. Forest concession policies and revenue systems. Country experience and policy changes for sustainable tropical forestry. World Bank Technical paper No. 522. 107pp.
- Green Resources, 2010. A forestry CDM/VCS case study from Tanzania. Green Resources Ltd, Dar es Salaam, Tanzania. 7pp.
- Gregersen, H.M. 1984. Incentives for afforestation: a comparative assessment. Pp. 301-311. *In*: Wiersum, K.F. (Ed). Strategies and designs for afforestation, reforestation and tree planting. Proceedings of an international symposium on the occasion of 100 years of forestry education and research in the Netherlands, Wageningen, Netherlands. 432pp.
- Haltia, O. and Keipi, K. 1997. Financing forest investments in Latin America: The issue of incentives. Inter American Development Bank and European Investment Bank. Washington DC, USA. 22pp.
- Iddi, S., Chamshama, S.A.O. and Malimbwi, R.E. 1996. Planting spacing in Tanzania – a review. *Record No. 63*: 25-33.
- ITTO 1993. Guidelines for the establishment and sustainable management of planted tropical forests. ITTO, Policy Development 4. 46pp.
- ITTO 2009. Encouraging industrial forest plantations in the tropics: Report of a global study. ITTO Technical Series No. 33. 143pp.
- Jackson, J.K. 1984. Why do forest plantations fail? *In*: Wiersum, K.F. (Ed). Strategies and designs for afforestation, reforestation and tree planting, 277-285. Proceedings of an international symposium on the occasion of 100 years of forestry education and research in the Netherlands, Wageningen, Netherlands. 432pp.
- Jagger, P., Pender, J. and Gebremedhin, B. 2003. Woodlot devolution in northern Ethiopia: Opportunities for empowerment, smallholder income diversification, and sustainable land management. Paper presented at the international conference on rural livelihoods, forests and biodiversity. 19-23 May 2003, Bonn, Germany. 27pp.
- Malimbwi, R.E., Zahabu, E., Katani, J., Mugasha, W. and Mwembe, U. 2010. Woodlot management guidelines for smallholder farmers. UNDP/UNEP, Dar es Salaam, Tanzania. 21pp.
- Milledge, S.A.H., Gelvas, I.K. and Ahrends, A. (2007). Forestry, governance and national development: Lessons learned from a logging boom in Southern Tanzania. An Overview. TRAFFIC East/Southern Africa/Tanzania Development Partners Group/Ministry of Natural Resources of Tourism, Dar es Salaam, Tanzania. 16pp.
- Montagnini, F., Cusack, D., Petit, B. and Kanninen, M. 2005. Environmental services of native tree plantations and agroforestry systems in Central America. *Journal of Sustainable Forestry* 21 (1): 51-67.
- Mugasha, A.G., Chamshama, S.A.O. and Lupala, Z. 2006. Effect of post-harvest *Cupressus lusitanica* slash management on early growth of *Pinus patula* at Shume, Lushoto, Tanzania. Department of Forest Biology, Faculty of Forestry and Nature Conservation. Sokoine University of Agriculture, Morogoro, Tanzania. Unpublished Document. 9pp.
- Nambiar, E.K.S. 1999. Productivity and sustainability of plantation forests. *Bosque* 20(1): 9-21.
- Nduwamungu, J. 2011a. Forests and woodlots in Burundi. AFF Report. 60pp.
- Nduwamungu, J. 2011b. Forests and woodlots in Rwanda. AFF Report. 61pp.
- Ngaga, Y.M. 2011. An analytical study of public forest plantations in Tanzania. African Forest Forum, Nairobi, Kenya. 112pp.
- Person, R. 2003. Assistance to forestry: experiences and potential for improvement. CIFOR, Bogor, Indonesia. 120 pp.
- Romano, F. and Muller, E. 2009. Diversifying tenure systems: how to make it work. XIII World Forestry Congress, Buenos Aires, Argentina. 18-23 October 2009. 12pp.
- SAIF 1994. Forestry Handbook. Pretoria, South Africa. 846pp.
- SAIF 2000. South African forestry handbook vol 1. South African Institute of Forestry, V&R Printers, Pretoria, South Africa. 416pp.
- Scott, D.F., Le Maitre, D.C. and Fairbanks, D.H.K. 1998. Forestry and streamflow reductions in South Africa: A reference system for assessing extent and distribution. *Water SA* 24(3): 187-199.
- Senteba, F. and Demel, T. 2001. Regeneration of indigenous woody species in the canopies of tree plantations in central Ethiopia. *Tropical Ecology* 42: 175-185.
- Senteba, F., Demel, T. and Naslund, B.A. 2002. Native woody species regeneration in exotic tree plantations in Munessa-Shashemene forest, Ethiopia. *New Forests* 24: 131-145.

- Siry, J.P., Cubbage, F.W. and Newman, D.H. 2009. Global forest ownership: Implications for forest production, management and protection. XIII World Congress, October 18-23, 2009. Buenos Aires, Argentina. 10pp.
- Taylor, G.F. and Soumare, M. 1984. Strategies for forestry development in semi-arid tropics: lessons from Sahel. *In*: Wiersum, K.F. (Ed). Strategies and designs for afforestation, reforestation and tree planting, 137-167. Proceedings of an international symposium on the occasion of 100 years of forestry education and research in the Netherlands, Wageningen, Netherlands. 432pp.
- Tsegaye, T., 2008. Participatory Forest Management (PFM) in Ethiopia: Achievements, Opportunities and Challenges. A paper presented at the workshop "Communal Ownership of Forests" in Chilimo and Addis Ababa, November 2008. pp 1-11.
- Topp-Jørgensen, E., Poulsen, M.K., Lund, J.F. and Massao, J.J. 2005. Community-based monitoring of natural resource use and forest quality in montane forests and miombo woodlands of Tanzania. *Biodiversity and Conservation* 14: 2653-2677.
- Vanclay, J.K. 2008. Managing water use from forest plantations. *Forest Ecology and Management* 257: 385-389
- Vichnevetskaia, K. 1997. Factors affecting productivity of tropical forest plantations: Acacia, Eucalypt, Teak and Pine. Working Paper GFSS/WP/02. Global Fibre Supply Study Working Paper Series. Forests Products Division, Forestry Department. FAO, Rome, Italy. 79pp.
- Zobel, B.J., Van Wyk, G. and Stahl, P. 1987. Growing exotic forests. John Wiley & Sons. 508pp.

ANNEX 1: TERMS OF REFERENCE



Terms of Reference For Lead Consultant for Rehabilitation of Public Forest Plantations

Under the guidance of Prof. Godwin Kowero, Executive Secretary, AFF, the Lead Consultant, shall undertake the activities listed below with respect to AFF's work on "**Rehabilitation of Public Forest Plantations**" in the eastern and north-eastern African countries of Ethiopia, Kenya, Uganda, Tanzania, Rwanda and Burundi.

Specific tasks

1. Undertake a study of the current public and private forest plantations situation, specifically with respect to the distribution and location of these plantations, species planted and sources of seedlings and seeds, age distribution of tree species, their management and quality of stands, and other features.
2. Undertake market surveys to determine supply scenarios and demand projections of plantation wood volumes and trends (by tree species, private and public sources), including current cost of importing timber and wood products and sources of such products
3. Evaluate the current revenue collection systems, licensing/concession procedures, forest tenure, management arrangements and pricing mechanisms for roundwood and industrial forest products (from natural and plantation forests).
4. Estimate the potential for income generation and employment creation,
5. Evaluate and propose incentives that could favour rapid forest plantation establishment by public and private sectors, and outgrowers schemes by individual farmers. In this case consideration should also be given to:
 - ❖ Availability of appropriate land;
 - ❖ Availability of quality germplasm;
 - ❖ Financing for plantation forestry;
 - ❖ Private sector readiness in plantation forestry;
 - ❖ Policy and environmental issues, including land and forest tenure issues, biodiversity considerations, and legislation and governance issues.
 - ❖ Potential for additional revenues from carbon trade.
6. Provide options for establishment, expansion and improved management of public and private forest plantations, including ways to overcome existing and potential constraints.
7. Evaluate the processing of industrial round wood from the plantations in the individual countries, ownership, its current and potential capacity, wood raw material supply (sources, types, and adequacy), product lines and quality of produce, potential for future investment in the sub-sector, constraints facing the sub-sector, among other key considerations.
8. Make a presentation, based on this work, in a workshop that will be organised by the AFF.

Implementation

The Lead Consultant shall be engaged for five months, spread over a period of one year, and supported by a national consultant from each of the six countries. The Lead Consultant shall design the framework for the work, terms of reference for the national consultants, supervise their work, guide writing of national reports and papers based on the national reports, and organise a country workshop/meeting in each country. In addition to the individual country reports, the Lead Consultant shall prepare a synthesis on the work done in the six countries guided by the terms of reference above.

ANNEX 2: PRUNING SCHEDULES

Burundi: Pruning schedules

Tree species	1st pruning		2nd pruning		3 rd pruning	
	Age (yr)	Average pruning height (m)	Age (yr)	Average pruning height (m)	Age (yr)	Average pruning height (m)
Pinus spp. (Average)	6-8	2.2	After 1 st thinning	5.8	After 2 nd thinning	Variable depending on performance
<i>Pinus oocarpa</i>				9		
<i>Pinus caribaea</i>				8.3		
<i>Pinus patula</i>				5.7		
<i>Pinus kesiya</i>				4.9		
<i>Pinus elliottii</i>				3.5		
<i>Grevillea robusta</i>				3.7		

Ethiopia: *C. lusitanica* and *P. patula* pruning schedule

Species	Age (Years)	Operation
<i>C. lusitanica</i>	3	Access pruning
	9	High pruning
<i>Pinus patula</i>	3	Access pruning
	5	First pruning
	8	High pruning

Kenya: Pruning schedules for *C. lusitanica*, *P. patula*, and *P. radiata*

Species	Age/dominant height (m)	Pruning height from ground level	No. of stems/ha to be pruned	
			Saw timber/plywood	Pulp wood
<i>C. lusitanica</i> T. Order No. 42 (1969)	2 years 4 years 9.25 m 11.25 m 13.75 m	½ height but not over 2 m ½ height but not over 4 m 2/3 tree height 2/3 tree height 2/3 tree height Minimum 9 m Maximum 11 m	All stems All stems 553 stems 553 stems 553 stems	All stems All stems All N/A N/A
<i>P. patula</i> T. Order No. 53 (1981)	3 years 4 years 8 m 12 m 16 m	½ height + 1 whorl ½ height + 1 whorl ½ height + 1 whorl ½ height + 1 whorl 10 m	all N/A 600 600 600	N/A ALL N/A N/A N/A
<i>P. radiata</i> T. Order No. 44 (1969)	3 years 12.0 m 17.5 m 24.5 m	½ height + 1 whorl ½ height + 1 whorl ½ height + 1 whorl ½ height + 1 whorl	All 426 426 213	All All N/A N/A

Rwanda: Pruning schedules

Tree species	1 st pruning		2 nd pruning		3 rd pruning	
	Age (yr)	Height (m)	Age (yr)	Height (m)	Age (yr)	Height (m)
<i>Pinus spp.</i> and <i>Cupressus spp.</i>	3-4	2	After 1 st thinning	5	After 2 nd thinning	20-28

Sudan: Pruning schedule

Age	Pruning height	SPH to be pruned
9	5	125

Tanzania: Current pruning schedules for *P. patula* and *C. lusitanica* (spacing 3 x 3 m)

Type of pruning	Site class								
	I			II			III		
	Age (y)	Mean height (m)	Pruning height (m)	Age (y)	Mean height (m)	Pruning height (m)	Age (y)	Mean height (m)	Pruning height (m)
<i>P. patula</i>									
First (WC)	3.0	5.5	2.7	3.5	4.9	2.4	Omitted		
Second (S)	5.0	9.8	5.8	5.5	7.3	4.6	7.0	6.1	3.7
Third (S)	7.0	13.7	8.2	7.5	10.4	6.1	9.0	7.9	4.9
<i>C. lusitanica</i>									
First (WC)	1.0	2.4	1.2	2.0	2.4	1.2	Omitted		
Second (S)	3.0	6.7	3.4	4.0	5.5	2.7	5.0	4.0	2.0
Third (S)	5.0	10.1	6.7	6.0	7.3	4.9	7.0	5.2	3.4
Fourth (S)	7.0	12.8	8.5	8.0	9.1	6.1	9.0	6.4	4.3

WC= whole crop; S= selective pruning

Uganda: Pruning schedule

Pruning schedule	Pruning height (m)	Age		SPH	Comments
		Pine	Eucalyptus		
1st	2	3 to 4	1 to 2	1111	This 'access' pruning is essential
2nd	4	5 to 7	3 to 4	700	
3rd	7	8 to 10	5 to 6	500	Some growers stop here
4th	10	11 to 13	7 to 9	300	Higher pruning is costly

ANNEX 3: THINNING SCHEDULES

Burundi: Thinning schedules

Tree species	Initial stock	1st Thinning		2nd Thinning		3rd Thinning		Clear felling	
		Age (yr)	Intensity (remain)	Age (yr)	Intensity (remain)	Age (yr)	Intensity (remain)	Age (yr)	Average stock
<i>Eucalyptus spp.</i>	1 110	5-7	555	10-14	277	-	-	16-20	277
<i>Pinus spp.</i>	1 550	9	970	11	622	13	500	30	-

Ethiopia: Thinning schedule for saw logs and transmission poles production

Species	Age (Years)	Operation	Harvest m ³ per ha
<i>Eucalyptus spp.</i>	4	First thinning	14
	6	Second thinning	33
	9	Third thinning	55
	13	Fourth thinning	60
	18	Main harvest	212
<i>Cupressus lusitanica</i>	8	First thinning	48
	12	Second thinning	54
	18	Third thinning	88
	26	Main harvest	386
<i>Pinus patula</i>	8	First thinning	48
	12	Second thinning	54
	18	Third thinning	88
	26	Main harvest	386

Kenya: Thinning regime for three saw timber species.

Species	Treatment	Dominant height or age at thinning	Stem/ha after thinning	
			No.	% of planting
<i>Cupressus lusitanica</i> T. O No. 42 (1969)	Establishment 2.5x2.5m	11.25 m but not before the age of 6 yrs. 5 yrs after 1 st thinning 10 yrs after 1 st thinning 15 yrs after 1 st thinning	1 600	55.5
	1 st thinning		888	
	2 nd thinning		533	
	3 rd thinning		355	
	4 th thinning		266	
<i>Pinus patula</i> T. O No. 53 (1981)	Establishment 2.5x2.5m	Before 1981 After 1981 16 m 5 yrs after 1 st thinning 10 yrs after 1 st thinning 15 yrs after 1 st thinning (plywood plantations only)	1,600	54.0
	Planting		1,110	
	1 st thinning		600	
	2 nd thinning		400	
	3 rd thinning		250	
	4 th thinning		170	
<i>Pinus radiata</i> T. O No. 44 (1969)	Establishment 2.5x2.5m	12 m 17.5 m 7 yrs after 2 nd thinning 13 yrs after 2 nd thinning	1600	53.3
	1 st thinning		853	
	2 nd thinning		426	
	3 rd thinning		266	
	4 th thinning		213	

Rwanda: Thinning schedules at UGZ1. Initial density 1 600 stems/ha.

Tree species	1 st Thinning		2 nd Thinning		3 rd Thinning		Clear felling	
	Age (yr)	Intensity	Age (yr)	Intensity	Age (yr)	Intensity	Age (yr)	Intensity
<i>Pinus patula</i>	7-10	650	10-14	350	14-19	250	28-38	250

Rwanda: Thinning schedules at UGZ2. Initial density: 1111 stems/ha

Tree species	1 st Thinning		2 nd Thinning		3 rd Thinning		Clear felling	
	Age (yr)	Intensity	Age (yr)	Intensity	Age (yr)	Intensity	Age (yr)	Intensity
<i>Pinus patula</i>	5-6	450	9-10	200	13-14	100	25-35	250

Rwanda: Recommended silvicultural model for *Pinus patula* plantations

Parameters	Intervention age (years)			
	5	8	12	25
Type of intervention	1 st Thinning	2 nd Thinning	3 rd Thinning	Clear felling
Total production (m ³ ha ⁻¹)	50	110	188	397
Thinning percent	50%	40%	24%	-
Extracted volume (m ³ ha ⁻¹)	25	34	31	307
Fuelwood (m ³ ha ⁻¹)	25 (100%)	30 (89%)	23 (75%)	127 (40%)
Timber (m ³ ha ⁻¹)	-	4 (11%)	8 (25%)	180 (60%)

Sudan: Thinning schedule for *Acacia nilotica* and *Cupressus lusitanica* plantations

Species	Age/years	Initial stocking	Final stocking
<i>Acacia nilotica</i> and <i>Cupressus lusitanica</i>	6	2 000 – 2 100	600
	9	1 400 – 1 500	450
	12	1 050 – 1 150	400
	15	650 – 750	350
	20	300 - 325	200
	30	100 - 125	

Tanzania: Thinning regimes for different tree species in industrial forest plantations

Species	Age (Years)	Stems per ha (SPH)
<i>Pinus caribaea</i> <i>P. elliottii</i> <i>P. patula</i> <i>P. tecunumanii</i> <i>Cupressus lusitanica</i>	0 10 15 25-30	(3x3m spacing) 1 111 650 400 0
<i>Tectona grandis</i>	0 5 10 15 30-40	(2.5x2.5m spacing) 1 600 800 400 300 0

Uganda: Thinning Schedules for Eucalyptus and pines.

Species	Thinning	Age(years)	Residue	Comment
Sawlog Production Grant Scheme				
Pinus spp	1st	4 – 6	700	
	2nd	6 – 9	500	
	3rd	9 – 10	300	
Eucalyptus spp	1st	1 – 2	700	
	2nd	3 – 4	500	
	3rd	5 – 7	300	
National Forestry Authority				
Pinus spp	1st	4 – 6	700-800	Commercial thinning
	2nd	10 -12	400	
Eucalyptus spp	1st	2 – 3	750	
	2nd	4 - 5	455	
	3rd	6 – 8	300	

ANNEX 4: PRINCIPLES OF PARTNERSHIPS

(SOURCE: FAO/CIFOR, 2002)

POLICY ASPECTS

Criteria	Indicators
Principle 1: Policy and institutional frameworks are conducive to partnership and agreement within the framework of sustainable planted forest management	
Intersectoral policies that are coherent with the policies on planted forest development	Conducive policies for planted forest development
	Other forestry policies that are coherent with forest plantation development policies
	Effective instruments for intersectoral coordination on land management with respect to plantation development
Conducive policy on land and crop tenure	Coherent intersectoral land tenure policies at the national and regional levels
	Coherent rules on land tenure between national and local communities
Precautionary policies	Regional policies on landscape management and fire mitigation
Principle 2: Government's commitment in supporting the partnership schemes	
Simplified bureaucratic processes/requirements	No policy disincentives to growing and harvesting
	Capacity, relevance and coordination of government departments
	Accessible Legislation and certification for smaller companies
	An enabling government policy for all stakeholders
	Conducive tax policy
Institutionalizing of the role of mediator/facilitator ("champion agency")	An established national forest industry forum
	Clarity of government roles between facilitator and regulator
Catering for different product development needs	Appropriate but not artificial government incentives (e.g. soft loans and tax breaks)
Supportive local and national government	No conflicting policy between central and local authorities
	Enforcement, not just policy statement
Principle 3: Transparency and broad understanding of policy	
Companies and communities that are better able to understand and utilize policy and other legal instruments	Wide information distribution on laws regulations and policies
	A common understanding by all parties to work together on the same policy

ECONOMIC ASPECTS

Criteria	Indicators
Principle 1: Long-term viability of economic objectives of key stakeholders are taken into account	
The scheme maintains a commercial focus of key stakeholders' interest, and/or is commercially viable for key stakeholders	Increasing comparative advantages (both smallholders/tree growers and corporates gain fair and equitable benefits)
	Available markets for smallholder partners' planted timber
	Available markets for company partner's products (realistic choice of products and activities)
	Income and land use/mixed cropping diversity options available to bridge the waiting period between planting and timber harvesting (diversified income streams for farmers)
Economic risks are anticipated and forecasted	A certain proportion of revenues from the main wood crops is reinvested to sustain the planted forest and the partnership scheme (an effective reinvestment mechanism)
	Adequate definition and identification of community needs

	Adequate definition and identification of community costs, especially opportunity costs
	Contingency plans (diversifying products to reduce risks, species match site and market)
	Absolute clarity of growers on economic implications (risks shared not equally but equitably, both parties prepare to accept risks)
There is a measurement of economic improvement at micro and regional levels	Improvement of market standing by participating corporates
	Accessible markets by corporates and smallholder partners
	Community members' access to associated income-generation options (e.g. secondary processing and service industries)
There is a monitoring of economic benefits and research results by independent third parties	Benefit sharing that can change with changing inputs
	The possibility to renegotiate based on fair accounts of contributed inputs
	Accessible information on changes in estimation of possible returns to key partners
Principle 2: Partnerships recognize different stakeholders' power, and create an operational negotiation/renegotiation mechanism	
Fair accounts of inputs from both parties as the basis for setting up: benefit-sharing agreement, timber buying from smallholders/tree growers, and cost-efficiency management of small-scale harvesting and processing operations	A fair benefit-sharing agreement for equitable distribution of benefits
	A mechanism for economic power-sharing in negotiations
	Systems for determining economic shares within stakeholder groups
A fair valuation of stakeholders' inputs	The consideration of non-monetary inputs
	Well-recorded economics inputs by both parties with transparent financial records and information
	"sweat equity" contributed by communities and smallholder/tree growers, ³ considered as valid as "financial equity"
Transparent economic-related information available to all stakeholders or information that is circulated transparently	Accessible market information is accessible to all stakeholders
	Tree growers (both those organized on the basis of those producing from communal land, and individual smallholders) with sustainable access to and skills-training in interpreting market information

SOCIO-CULTURAL ASPECTS

Criteria	Indicators
Principle 1: The implementation of equitable partnerships satisfy social objectives of various key stakeholders	
Various social objectives of key stakeholders met and recognized in the agreement to optimize the adoption of equitable partnerships	The acknowledgement in the management plan of wider livelihood objectives of tree growers partner and, if possible, the negotiation in the contract for support for community development
	Effective knowledge system established such that individuals within communities are empowered to incorporate their social needs in the negotiation process of agreements and management plans
	Long-term land status/rights that have been transparently settled before the establishment of the planted forest and included in the negotiation of the agreement and the management plan. Agreements should not entrench inequities in land tenure and access
	Local socio-cultural needs of key stakeholders as part of the negotiation process (e.g. those relating to religion, the transfer of the rights of contracted timber to children, and respect of the traditional values of lands)
	Acknowledgement in the contractual discussions of the local ethics, cultural, customs and traditions (possible trade-offs)
	Monitoring of social objectives clearly indicated in the agreement and management plan

The diverse nature of local livelihoods of tree growers partner is secured and enhanced (buffered from risk)	Schemes provide direct benefits such as products, credit etc.; management plans may also take into account the wide range of livelihood options of a community and its farmers (e.g. on-farm tree species diversity)
Principle 2: Equitable partnership schemes should recognize the difference in power of stakeholders and create an operational negotiation/renegotiation mechanism	
Greater equity of power is achieved, if necessary, with support of third parties prior to negotiation processes	Conflict resolution clauses in contract and MOUs with third parties
	The possibility to re-negotiate the agreement at defined intervals
Strong institutional frameworks are devised and implemented	Mechanisms to facilitate greater parity between negotiating parties
	A special unit in the company to work with both the broader community and individual smallholders (i.e. where appropriate: robust/recognized representative structures at the community level; company staff could improve their skills and performance in smallholder and community-oriented extension services, that are backed up by career opportunities)
	Good functioning of grassroots organizations
	Institutional development in communities beyond the community and other stakeholders
	Fair organizational capacities of both parties
	Institutionalized collective bargaining
	Resources for capacity-building

ECOLOGICAL ASPECTS

Criteria	Indicators
Principle 1: There is a mechanism for ecological monitoring	
Environmental management plan jointly compiled and implemented	Environmental accountability is enforced and ensured
	Sufficient knowledge and awareness among community members of misconduct in managing schemes' plantations
Ecological parameters jointly identified by stakeholders and met before initiation of project	Proper planning, risk analysis and monitoring to mitigate impacts
Balance between social and ecological integrity	Freedom for tree growers (smallholder and community) to combine multiple land use practices
Principle 2: Ecological integrity is maintained	
The ecosystem function is maintained or enhanced	The adverse impacts of planted forest practices maintained within critical limits as defined by regional conservation objectives
	Rehabilitation of degraded lands
	Species diversity maintained or enhanced at the plot, landscape and regional levels (increasing landscape diversity)
Ecological risks are minimized	Plans for fire prevention
	Maintenance of water quantity and quality (downstream water use considered)
	There is a freedom of choice of tree planting by smallholders, however in the development of planted forests on communal lands, planting is focused on underutilized lands or degraded lands
	Environmental disturbance decreased or minimized (e.g. roads for harvesting and road routing discussed with communities as part of management plan to combine possible social and market benefits of roads)
	Positive and negative impacts on wildlife and plant biodiversity taken into account

MANAGEMENT ASPECTS

Criteria	Indicators
Principle 1: Fair cooperation is the approach used in the management of the partnerships	
Clear agreement among key stakeholders developed through a participatory process	Participatory socialization process (common objectives of stakeholders reached through negotiation)
	Simple, effective and efficient contract mechanisms
	Agreement that is negotiated, documented and disseminated in a transparent manner
	Clear understanding and implementation of the duties in balance with rights as stated in the agreement document (terms of the agreement are respected, agreement negotiated and witnessed with formal and informal village/community leaders' clear rights and obligations)
A clear management plan is designed through a participatory process among key stakeholders	A management plan that is well understood by key stakeholders (clear prioritized objectives, responsibilities of stakeholders and implementation dates; better integrated planted forest management under partnership schemes in local development plans).
	more local adaptation of contracts and plans (reliance on autonomy of field staff; management's obligation to deliver on promises; ease of interpretation of management plan to both parties)
A management plan is being effectively implemented by ensuring the development of effective knowledge systems between stakeholders	Knowledge from implementing partners sought and incorporated into the management plan (including company Basic Operation Procedures and market information and indigenous knowledge that is recognized and incorporated into management plans - e.g. soil fertility indicators, pest control)
	Communities empowered to formulate their own expectations, requirements and demands prior to agreement negotiations - creation of equal platforms of negotiation (special unit in companies created to work with communities)
	Information on management plan that is accessible to all stakeholders
	Jointly developed technological and managerial innovations giving rise to new partnership arrangements
	Planted forests should be managed to meet market demands (not just to maximize wood biomass)
	Well-documented project plan (implementation dates, responsibilities of stakeholders, and naming of project leader in each stakeholder group)
Mechanisms to ensure transparent and accountable application of agreement and management plan within the community and between partners	Clear schedule of monitoring the application of the principles, criteria and indicators of sustainable plantation forest management
	Clear monitoring objectives of the management plan on every schedule
	Agreement negotiated and witnessed by both formal and informal leaders of the community, including representatives of marginalized groups - women, ethnic minorities, the poor and the landless - (depending on the situation, landless people often have some type of land use rights)
Mechanisms for accountability and transparency within the community	Wide dissemination of agreement and management plan through posters, radio and other conventional mass media in evidence
	Mechanisms for information distribution that are programmed and systematic (formalizing links with other key stakeholders such as local and national government and third parties by Memoranda of Understanding [MOU])
Mechanisms for accountability and transparency between stakeholders	
Principle 2: Partnerships encourage sustainable management of planted forests	
Rules and guidelines of good practice in establishing planted forests that are being adhered to in the partnership	Codes of practice of sustainable management of planted forests taken into account within the management plan
	The management plan is implemented following the codes of practice
	Available rules and guidance for good practice (both parties understand criteria and indicators of sustainable planted forest management, Silviculture Basic Operation Procedures as part of the contract, species matching site and available market germplasm)

ANNEX 5: FORESTRY INCENTIVES

(Tables were not provided for Sudan and Tanzania)

Burundi: Incentives for plantation development

Type of incentive	Brief description of incentive	Source and period	Target group	Outcomes/impacts & shortcomings
Annual free seedlings distribution	Free seedlings are distributed during the tree planting season throughout the country.	Government and projects annually	All interested people particularly rural farmers particularly in proximity of protected areas	Thousands of trees are distributed and planted annually. But due to poor follow up or planting techniques there are low survival rates.
Assistance to establish woodlots	Farmers provide land and about 20% of initial woodlot establishment and tending costs (in the form of labour).	SEW/Catalist/IFDC since 2009. The project works also in DRC and Rwanda.	Farmers in some Provinces where projects are operational (Bujumbura, Mwaro, Bururi, Muramvya, Karuzi, Kayanza)	Farmers are happy about the scheme and about 4 250 ha have been established since the launching of the project in 2009.

Ethiopia: Incentives for plantation development

Type of incentive	Brief description of incentive	Source and period	Target group	Outcomes/impacts & shortcomings
Direct	Long term leasing period for land to be used for plantation establishment	Government and for 25 years	Private investors	Encourage the private sector to involve in plantation forestry
Direct	Free supply of seedlings	Government and during plantation season	Farming communities and Urban dwellers	Encourage the farming communities to plant trees
Indirect	Free markets and pricing policy	Government	Private investors in tree planting	Plant more trees due to market value of trees
Direct	Opportunity to get loan from banks	Government and Credit associations	Private investors in forestry	Encourage tree planting
Direct	Handing over of woodlot plantations to farmers	Government	Farmers	
Direct	Sharing of revenue with communities from sale of forest products from forest plantations	Government	Farming communities in and around the forest	The forests are better conserved and more area coverage
Direct	Free from tax payment on imports for forestry related activities	Government and as long as they are involved in the work	Private investors	Motivate others to participate in the activity

Kenya: Incentives for plantation development

Type of incentive	Brief description of incentive	Source and period	Target group	Outcomes/impacts & shortcomings
Policy/land and tree tenure reforms	PFM involving local communities in decision-making and the management of public forest plantations	Forest Act 2005 The Environment Management and Conservation Act-1999 Continuous	Private sector and local communities	Communities have embraced tree planting as demonstrated by the heavy demand for tree seedlings and the many private and communal woodlots and plantations seen all over the country.
Provision of training and extension services	Providing training and Tree seedlings	Kenya Forest Service-Forest Extension Unit Continuous	Private sector and local communities	As above

Financial support	Constituency Development Fund (CDF); Forest Management and Conservation Fund (FMC)	Government and development partners, through devolved governance mechanisms Continuous	Private sector and local communities	As above. Financing of plantation forestry activities by private and community parties remains a major constraint
Pilot technological innovations	Tree Biotechnology Programme providing improved seed,	A Kenya Forestry Research Institute Programme funded by JICA- 2003 to 2010	Private sector and local communities	As above

Rwanda: Incentives for plantation development

Type of incentive	Brief description of incentive	Source and period	Target group	Outcomes/impacts & shortcomings
Annual free seedlings distribution	Free seedlings are distributed especially during the annual tree planting week.	Government and projects annually	All interested people particularly smallholder farmers	Many trees planted annually. However due to poor follow up there is low survival rates. Some seedlings are also not planted and thus wasted
Assistance to establish woodlots	Farmers provide land and about 20% of initial woodlot establishment and tending costs (in the form of labour).	SEW/CATALIST/IFDC since 2009. The project works also in DRC and Burundi.	Farmers in selected Districts where the project is operational	Farmers are enthusiastic about the scheme and about 3000 ha have been established since launching in 2009.
Assistance to establish woodlots	Farmers make contracts with CHDI on keeping planted trees and are paid for it.	Clinton Hunter Development Initiative (CHDI) since 2008	Farmers in selected Districts where the project is operational who accept to make contract	The CHDI has so far assisted planting of about 2 million seedlings since 2008.

Uganda: Incentives for plantation development

Type of incentive	Brief description of incentive	Source and period	Target group	Outcomes/impacts & shortcomings
Access to Land and assets thereon	Provision and ease of access to land by the government to willing investors and tree farmers	Ministry of Water and Environment/NFA; Plantation rotation period	Investors in the forestry sector related business especially plantations and eco-tourism	Misuse of land breaching of contracts
Security of tenure of land	Protection of the assets of investors in general	Government of the Republic of Uganda-Uganda Investment Authority; Business life span	Big investors including forestry sector investments	
Financial support	Through the Saw Log Production Grant Scheme (SPGS): The scheme provides a direct subsidy (grant) for private timber growers	Development partners and GoU coordinated by Saw-log Production Grant Scheme; Establishment stages	Big plantation developers (25 ha and above)	Sustainability challenges and investor level.
Operational license fees	Negotiated license fee rates e.g. eco-tourism. Open Competitive bidding for licenses	Ministry of Water and Environment/NFA; Onset of business	Foreign and local investors	

Strategic Partnerships	Partnerships agreements and Collaborative Forest Management (CFM) arrangement including Memoranda of Understanding. Joint management ventures with the NFA.	Government agencies and parastatals e.g. Uganda investment Authority, NFA, Uganda Wildlife Authority; Viable Business duration/life time		
Tax exemptions	The Income Tax Act under section 21 (1) (u) exempts interest earned by a financial institution on a loan granted to any person for the purpose of forestry among others from withholding tax.	Government agencies and parastatals e.g. Uganda Investment Authority, Government treasury, Uganda Revenue Authority; Viable Business duration/life time	Foreign and local investors	

African Forest Forum



Contact us at:

African Forest Forum

P.O. Box 30677-00100 Nairobi GPO KENYA

Tel: +254 20 722 4203 Fax: +254 20 722 4001

www.afforum.org

