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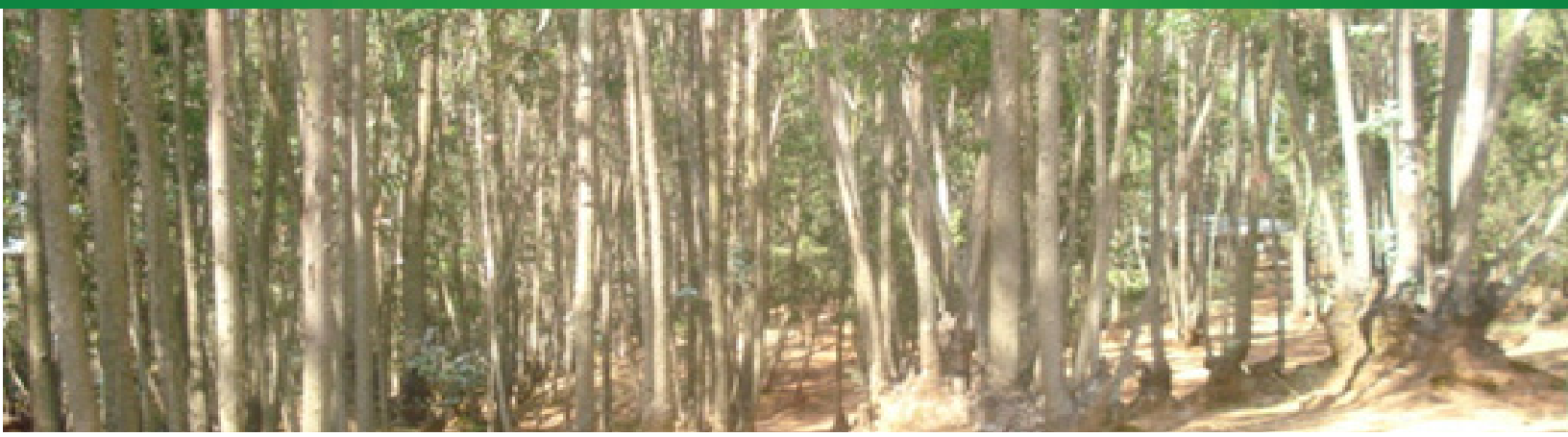
FOREST PLANTATIONS AND WOODLOTS IN ETHIOPIA



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FOREST PLANTATIONS AND WOODLOTS IN

ETHIOPIA

by

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Abbreviations and acronyms

BERSMP	Bale Eco-Region Sustainable Management Programme
CDM	Clean Development Mechanisms
CIDA	Canadian International Development Agency
COMESA	Common Market for Eastern and Southern Africa
CIFOR	Centre for International Forestry Research
CSA	Central Statistical Authority
DBH	Diameter at Breast Height
EARO	Ethiopian Agricultural Research Organization
EC	European Commission
EFAP	Ethiopian Forest Action Plan
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
Ha	Hectare
ILO	International Labour Organization
Kg	Kilogramme
M^3	Cubic Meter
MAI	Mean Annual Increment
MDG	Millennium Development Goals
MoA	Ministry of Agriculture
NGO	Non-Governmental Organizations
NORAD	Norwegian Agency for Development Cooperation
NTFP	Non-timber Forest Product
OFWE	Oromia Forest and Wild life Enterprise
PA	Peasant Association
PASDEP	Plan for Accelerated and Sustainable Development to End Poverty
PFM	Participatory Forest Management
PLC	Private Limited Company
REDD	Reducing Emission from Forest Degradation and Deforestation
SFM	Sustainable Forest Management
UAE	United Arab Emirates
UNDP	United Nations Development Programme
UNSO	Sudano-Sahelian Office of the United Nations
UN-WFP	United Nations World Food Programme
USD	United States Dollars
WBISPP	Woody Biomass Inventory and Strategic Planning Project

Preface

Ethiopia's forest resources are rapidly disappearing as a result of the ever-increasing demand both for firewood, and crop and grazing land, stimulated by a rapidly growing population. Agricultural expansion, clearing of land for settlements and commecrial farming have contributed to the problem. It is agrravated by the increase in the production of charcoal and timber and management capacity.

Conservation and sustainable use of forest resources are priorities for the Government of Ethiopia. National policies and strategies have been developed. Despite these, the government has been unable to ensure the protection and proper use of the natural and plantation forests. Of the total land area, only 4% is covered with forests with an estimated deforestation rate of 140,000 ha per year. The area of natural forest that is currently available for wood production is diminishing. The country is becoming dependent upon wood product imports mainly sawn wood, paper and ply wood.

Large areas of industrial forest plantations were established in the 1970s with Donor support which is discontinued. Poor management have reduced plantation productivity considerably. Thinning and pruning has not been conducted regularily. They could not achieve the objective set to reduce the pressure on the remaining natural forests. Despite all these, timber harvesting is shifting from natural forests to plantations and trees outside forests. They are expected to be increasingly important sources of industrial wood in the future.

Under the current management practices, plantation forests cannot produce enough forest products to meet the national demand. There is also little room for expansion of plantations on public land due to the high competition for land.

This study was undertaken to document information on the current status of plantations and woodlots in Ethiopia, the challenges and opportunities they faced and future options available for improvement of their management.

The study includes data on the current public and private sector plantation forests, their status, types and distribution and area coverage. The management status and the major limiting factors for better management of forest plantations and woodlots have been reviewed as well as other factors that influence sustainable forest management.

Finally, I gratefully acknowledge the financial support of the African Forest Forum to undertake this study. I am also grateful to the many foresters, sawmill managers, forest managers and experts that provided me with the required information. The support made by the Lead Consultant is also acknowledged.

Executive summary

Ethiopia is a landlocked country situated in East Africa between 3-15° N latitude and 33-48° E longitude covering an area of about 1.2 million square kilometres. The population is 80.7 million. The economy is predominantly rural with the agricultural sector providing employment for about 85% of the population and accounts for c. 90% of its exports.

Altitudes range from the highest peak at Ras Dejen, 4620 m above sea level, down to the depression of the Kobar Sink (Afar Depression), about 110 m below sea level. Temperatures vary from as high as 47°C in the Afar depression to as low as 10°C in the highlands. The average annual rainfall of the lowland areas in the south, southeast, east and northeast is below 500 mm, whereas some areas of the highlands receive over 2000 mm.

Eleven major soil types cover about 87% of the land. The cambisols that cover 13% of the country are the most common soil type, followed by lithosols covering 12%. Other soil types include vertisols (10%), xerosols (8.5%), acrisols (8%), luvisols (6%), xelonchakes (5%), regosols (4%) and yermosols (3%).

Natural forests and woodlands cover 12.3 million ha, down from 15.1 million ha in 1990. Of this area, the remaining closed natural forests is 4.12 million ha or 3.37% of Ethiopia's land area. Between 1990 and 2005, Ethiopia lost over 2 million ha of her forests with an average annual loss of 140,000 ha.

Currently, ownership of natural forests is public. Plantations are held by the public, individual farmers and communities. Industrial plantations are 100% publicly owned, while non-industrial plantations are partly publicly owned and partly privately owned.

The importance of the plantation sector is increasing as the demand for raw materials is rising and the supply from the natural forests is decreasing. The forest plantation area has increased from an estimated 190 000 ha in 1990 to c. 972 000 ha today. Of this area, c. 190 000 ha are classified as commercial plantations and the remaining 80% are non-industrial plantations. Ethiopia started large scale industrial plantations with the primary purpose of supplying industrial round wood for the production of sawn wood, wood-based panels and wood pulp in the early 1970s with support from the Swedish government.

Commercial plantations are mainly exotic tree species with only a few indigenous species in some of the National Forest Priority Areas. The average annual area of plantation establishment is about 3 700 ha, which is far below the required area for ensuring a sustainable supply of forest products. Plantations are not expected to provide the multiple uses and services which used to be available from the natural forests. The supply of industrial wood from plantations is of poor quality due to the current deficient management practices. Most seed procurement is carried out from natural forests and plantations which are set aside as seed stands and from the central seed store of the Forestry Research Institute. Forest plantations are managed on a plant-clear fell-replant cycle, except where coppicing species are used. Varying spacing is used but all commercial plantations use a spacing of 2 x 2 m. The routine maintenance operations - weeding, cleaning, pruning and thinning - are often neglected with negative consequences for productivity and quality.

The Ministry of Agriculture (MoA) in collaboration with national and international organisations made efforts to implement community tree planting programmes in the early 1980s. The average yield from plantation forests is estimated at 10-14 m^3/ha/year.

Estimates of mean annual increment (MAI) in Ethiopian *Eucalyptus* woodlots are 10-20 m^3/ha/year, depending on site productivity. Estimates for coniferous plantation species range from 4.2 m^3/ha/year on low potential sites to 12 m^3/ha/year on high potential sites. Productivity of energy plantations of *Eucalyptus* is estimated to range from 9-12 m^3/ha/year. The current growing stock from industrial forest plantations is estimated at 22.3 million m^3.

The annual forest plantation harvest is estimated at c. 173 000 m^3. Plantation forests are estimated to supply 50% of the total industrial round wood production per year. For most coniferous softwoods, such as pines, the rotation period varies from 26 to 30 years. For eucalypts, it ranges from 10 to 18 years depending on the purpose of planting.

Community woodlots are also common in Ethiopia. Their history goes back to the second half of the 1970s. Because of the lack of active consultation and participation of local communities, many of these were poorly established, rarely maintained, and at the change of government many perished. From the lessons learnt, the current government has shifted away from centralised management of woodlot resources with the objective to enable resource users to have greater decision making power over the management. Therefore, old and newly established woodlots have been placed under the management of communities and villages.

According to the current constitution, land is a common property of the nations, nationalities and peoples of Ethiopia and shall not be subject to sale or to other means of exchange. Accordingly, the natural forests are owned by the state and administered by Regional Agricultural Offices and by OFWE in case of Oromia regional state.

Current financing of forestry activities is mainly from domestic sources including government revenue collected in the form of charges, fees and levies from taxes and duties. Most forestry activities are not able to mobilise adequate public funding for the sector since forest enterprises are not yet strong enough to cover expenses, except in the Oromia region where revenues from forests are important sources of funding.

Private sector investments have been limited to conventional extractive industries and export products. Forestry activities are undertaken in the informal sector where forests and trees play a major role in providing livelihoods for rural communities and the urban poor.

There is an opportunity to fund forestry through carbon sequestration financial inflows. The Bale Eco-Region Sustainable Management Programme (BERSMP) has been exploring the possibility of establishing a “reduced emission from deforestation and degradation” (REDD) project over an area of 600 000 ha based on participatory management of forests with communities in the Bale mountains where a huge potential for Clean Development Mechanism (CDM) and REDD is reported to exist. This forest has been identified as a suitable project area for REDD. Implementation of REDD can bring huge benefits to local communities through payment for environmental services and other mechanisms.

Financial and human resources for the forestry sector are minimal except when established as a forest enterprise. Reforms are under way to establish forest enterprises which are autonomous with mandates to generate revenue and use the same for development of the forests. This reform will enable the sector to integrate forest development with forest industries.

There is a huge gap between demand and supply of forest products and services in Ethiopia. The demand for wood fuel as of 2009 is 77 million m^3 against 9.3 million m^3 of sustainable supply. It is the non timber forest products (NTFPs) that have export values. Trade in NTFPs is an important contributor to agricultural and economic development through the revenue it generates for government and the income it provides to rural livelihoods. Bee products, apart from their central role of providing food for the households, are indirectly used for commercial purpose for income earning. Beekeeping generates income for the people through sales of honey and beeswaxes.

Currently, stumpage fees are collected by the existing forest enterprise and deposited in the account opened for this purpose. Different regional governments have different stumpage fee estimates. There is no uniform stumpage to be paid. It is done through bidding by the existing enterprise so the wood gets better prices. Permits/licenses to use forest products are issued by the regional ministry of trade to small and medium forest enterprises with no regard to the regional bureau of agriculture. Revenue from plantation forests for the year 2009 was estimated at 5.5 million USD. Revenues from incense and gums were estimated at c. 9.6 million USD and from beeswax 19.8 million USD for 2009 alone.

Most forestry activities, such as charcoal and wood fuel production are conducted informally without any license. Charcoal trade is characterised by weak law enforcement. There is a low capacity to enforce regulations and effectively collect revenue.

Concessions are given for the production of incense and gum. While ownership of the woodlands and shrublands remain with the government, the rights to tap and manage the resource usually are allocated to private companies.

Growth Domestic Product (GDP) calculations do not take into account the value of forest products that are traded informally. Neither does it take into account the positive influence of forests on

agricultural production. The official GDP figures used therefore do not reflect the true economic importance of the forest sector in the national economy.

The contributions of forests and woodlands to the national economy through production of gums and incense, medicinal plants, honey and beeswax is quite considerable. Ethiopia exported c. 16 000 tonnes of natural gum and incense between 1996 and 2003. The annual honey production is estimated to range between 30 000 and 50 000 tonnes. Ethiopia is also one of the five big wax exporters to the world market, with an annual production estimated at 5 000 tonnes.

Medicinal plants also play an important role in the Ethiopian healthcare. About 1 000 plant species are documented as being used in traditional medicines. The total value added to the economy from traditional medicine in the year 2005 was estimated at USD 210 million. About 56 000 tonnes of medicinal plants harvested, mainly from wild plants, are used per annum in Ethiopia.

Most forestry operations are undertaken in rural Ethiopia, and a large number of labourers are required for the operation of forest nurseries, afforestation, and construction and maintenance of roads. Land preparation, production of planting materials and planting and maintenance are important sources of employment. About 50% of the labour force is employed in fuel wood and charcoal production and collection, 34% in forest plantation work, and 2% of the work force is employed in forest industries.

Sawmilling is the main forest industry in Ethiopia. The main product from saw mills is sawn timber which is used in carpentry, joinery and construction. The forest industries are dominated by primary processing with limited value adding. Sawmills are characterised by low utilisation capacity, obsolete equipment resulting in low recovery rates and large amounts of waste. There are seven chip board factories, one in Awassa, two in Addis Alem, three around Addis Ababa and one in the Tigray region. All are huge with an average capacity of 150 m^3 per day. The particle board factory of Awassa has a capacity of 140 m^3 per day. They produce up to 75 000 m^3 per year. The capacity of the particle board mill in Mychew is 70 000 m^3 per year. There are three paper producing industries which use imported pulp and waste paper as raw material.

Raw material supply has not been a problem after the integration of saw mills with plantation forests for the forest enterprise since 2007. The majority use logs from plantation forests since they are dominated by mobile sawmills. Despite this, the quality of plantation logs is very low mainly due to past management practices which were constrained by lack of financial resources since the sector was not allowed to utilise revenue for forest management.

Information available on the existing forest resource base is not reliable. It has to be a priority for Ethiopia to generate reliable and regular information on forest and tree resources including plantation forests.

Despite the increase in area of forest plantations, there is no silvicultural operations that have followed the original plans and many plantations are now over-mature and of poor quality mainly due to the financial problems to undertake maintenance operation.

Demand for wood will continue to increase for the foreseeable future, due to continued increases in population and income. There is an expanding domestic market for poles, fuel wood, paper and wood based panel products. There is, therefore, a comparative advantage for developing short rotation fast-growing plantations on farm and in small woodlots.

The continued deforestation and forest degradation reveals that conventional approaches that are in use to manage the forests in Ethiopia have not been able to guarantee the conservation of these resources. Ownership rights must be legally recognised and assisted by building capacity of the beneficiaries in planning and implementing management plans of forests, assesses available resources, and develop marketing information and strategy.

Most forestry activities have continued to depend on external financial assistance instead of developing economically independent entities. Sustainable NTFP harvesting and commercialisation contribute to poverty alleviation and sustainable livelihoods for people living in and around forests. There are also high export opportunities and potentials for the NTFPs.

Natural forests are coming to be valued less for their potential production of industrial round wood than for their ecosystem services such as watershed protection, and bio-diversity conservation.

Currently, the planning, administration and management of industrial forest plantations and wood processing plants are separate, except in the newly established Oromia Forest & Wildlife Enterprise. This mutually exclusive management and administration have affected both the industry and the forest plantation sectors. The sector has financial problems which lead to inefficiency in management. The institutional changes that involve the establishment of forest enterprises that incorporates forest development and utilisation and the financial autonomy given to the enterprises is commendable. It will create a linkage of plantations to the wood processing industries. It should be promoted to other regional states in the country.

There is no reliable and up to date information on forest and tree resources regarding areas, locations, species, wood volumes and growth. The status and trends of forest industries is not well documented. Organising and documenting reliable information is helpful for improving and planning the management of forest resources and monitoring changes. This study is therefore conducted with the objective to address these deficiencies in information. The study is based on a literature review and field data collected through contractual agreements made with the regional forestry experts.

The future plan will take into account organising and documenting reliable information on forest resources of the country through data base establishment and limit the involvement of the public sector in forestry and enhance the involvement of the private sector in forest plantations.

Effective forest revenue systems should be in place in that forest revenue that is generated from all marketed forest goods and services to be reinvested in the sector for the sustainable production of forest goods and services.

The importance of NTFPs for the economy and nutrition of rural households should be highlighted and integrated in all food security programmes.

There is a need for a comprehensive wood processing industries rehabilitation study. This will help to evaluate the processing units in the area of performance and technical capacity.

There are opportunities to improve technology and replace outdated old mills by new ones.

1. Introduction

1.1 Background

Ethiopia is a landlocked country situated in East Africa between 3-15° N latitude and 33-48° E longitude covering an area of about 1.2 million square kilometres. With an estimated population of 80.7 million, Ethiopia is the second most populous country in Africa. The economy is predominantly rural with the agricultural sector providing employment for about 85% of the population and 90% of the country's export value. The economy had registered encouraging but mixed results, with a negative Gross Domestic Product (GDP) growth rate of -3.3 % 2002/03, followed by a strong positive performance of 11.9% and 10.6% growth during the subsequent two years, 2003/04 and 2004/05 (PASDEP, 2007). During 2002/03-2004/05, annual real GDP growth averaged 6.4%. The country is a federal state divided into nine regions, largely on the basis of ethnic differences.

It is a country of great geographical diversity with altitudes ranging from the highest peak at Ras Dejen, 4620 m above sea level, down to the depression of the Kobar Sink (Afar Depression), about 110 m below sea level. The climatic conditions of the country vary with topography. Temperature varies from as high as 47°C in the Afar depression to as low as 10°C in the highlands. The amount and pattern of rainfall varies across the country with an average annual rainfall of the lowland areas in the south, southeast, east, and northeast of below 500 mm, whereas some areas of the highland receive over 2000 mm. The Great Rift Valley separates the western and south-eastern highlands, and the highlands on each side give way to vast semi-arid lowland areas in the east and west, especially in the south of the country (EFAP, 1994).

Eleven major soil types cover about 87% of the land. Cambisols, which cover 13% of the country, is the most common soil type, followed by lithosols covering 12%. Other soil types include vertisols (10%), xerosols (8.5%), acrisols (8%), luvisols (6%), xelonchakes (5%), regosols (4%) and yermosols (3%) (Thomas and Bekele, 2002).

Ethiopia's flora and fauna resources are uniquely diverse. The flora comprises about 6 500-7 000 species of higher plants out of which 12% are endemic (EARO, 2008).

Natural forests and woodlands covered 15.1 million ha in 1990. This area declined to 13.7 million ha in 2000. In 2005, the forest cover had further declined and was estimated to cover 13.0 million ha. In other words, Ethiopia lost over 2 million ha of her forests, with an annual average loss of 140 000 ha (FAO, 2010) between 1990 and 2005. Currently, the area is estimated at 12.3 million Ha, c. 11.9 % of the total land area. Of this, the remaining closed natural high forests is 4.12 million ha or 3.37% of Ethiopia's land area (Table 1).

Table 1. Deforestation rates from 1990-2010. Source: FAO (2010).

Type of vegetation	Area in 1000 hectares in			
	1990	2000	2005	2010
Forest	15,144	13,705	13,000	12,295
Woodland	44,650	44,650	44,650	44,650

The area of forest is unevenly distributed in the country. Oromia, Southern Nations and Nationalities Regional State and Gambella region account for 95% of the total high forest area (WBISPP, 2004).

The estimated total growing stock in the forest and wooded land is estimated at 285 million m^3 and the commercial growing stock is 25% of this estimate which is 71.2 million m^3 (FAO, 2010). The growing stock per hectare is estimated at 21.9 m^3 which indicates that high forests are under stocked and producing below capacity. The estimated loss per annum is 1.1 million m^3 (FAO, 2010).

The major issue is the annual destruction of the natural forest for agricultural expansion. This is estimated to currently total about 59,000 ha per annum in the three main forested regional states of Oromia, Southern nations, nationalities and Gambella only (WBISPP, 2004).

Oromia regional state which contained over 50% of the high forest in the country is estimated to have lost 31% of its forest as a result of agricultural expansion. The total forest cover loss from 1990 to 2015 is estimated to be in the range of 803 000 ha (WBISPP, 2004).

Currently, ownership of natural forests is public. Plantation ownership ranges from government to individual farmers and communities. Industrial plantations are 100% publicly owned, while the non-industrial plantations are both publicly and privately owned. These forests supply local people with products such as fuel wood and construction wood, as well as other intangible benefits.

Despite this, there is no reliable and up to date information on forest and tree resources regarding areas, locations, species, wood volumes and growth. The status and trends of forest industries is not well documented. Organising and documenting reliable information is helpful for improving and planning the management of forest resources and monitoring changes. This study is therefore conducted with the objective to address these gaps in information.

1.2 Objectives of the study

As per the Terms of Reference, the objectives were to:

- Study the current public and private forest plantation situation, with respect to the distribution and location of plantations, species planted and sources of seedlings and seeds, age distribution of tree species, their management and quality of stands;
- Determine supply scenarios and demand projections (2015, 2020, 2025, 2030) of plantation wood volumes and trends (by tree species, private and public sources), including prices of local and imported timber and wood products and sources of such products;
- Evaluate the current revenue collection systems, revenues collected annually during the last 5-10 years, licensing/concession procedures, forest and tree tenure, management arrangements and pricing mechanisms for round wood and industrial forest products;
- Provide income and employment data during the last 5-10 years and estimate the potential for income generation and employment creation (2015, 2020, 2025, 2030);
- Evaluate and propose incentives that could favour rapid forest plantation establishment by public and private sectors, and out grower's schemes;
- Provide options for establishment, expansion and improved management of public and private forest plantations, including ways to overcome existing and potential constraints; and,
- Evaluate the processing of industrial round wood from the plantations, its current and potential capacity, wood raw material supply and the status of wood based industries.

1.3 Scope and coverage

The study attempts to cover all the regional states in the country with more emphasis on regions with the potential to establish forest plantations and with high forest cover. It tries to collect data on the current public and private sector plantation forests, their status, types and distribution and area coverage. It also covers their management status and the major limiting factors for better management of plantations.

It also covers annual replanting rates, growth and yield from both natural and plantation forests. Plantation and natural forests wood supply scenarios and demand projection for different forest products are also assessed. Existing forest tenure arrangements and their impacts including the incentive mechanisms for promoting the private sector in forest plantation expansion are addressed. Assessment of revenue collection systems and potential income generation and employment creation opportunities for the forestry sector are covered. Processing of industrial round wood and other products from plantation forest and natural forests is also included in the review work.

1.4 Approach to the study

The study is based on a literature review and field data collected through contractual agreements made with the regional forestry experts. Further, consultations were made with managers of wood based industries and non-timber forest products (NTFPs) trading organisations to gather information regarding forest industry and NTFPs. The study focused on regions with high forest potential, especially for plantation forestry.

1.5 Structure of the report

The report is organized in ten main chapters, thus:

Chapter 1 gives a brief introduction of the study, the objectives and the methodology employed for data generation.
Chapter 2 describes the forest plantations situations, their extent, status and distribution and the management practices.
Chapter 3 describes the extent and impacts of woodlots and the factors that affect and impact the growth of woodlots.
Chapter 4 deals with the current forest/tree tenure systems and the impacts of the system on poverty and food security and suggestions for improvement of tenure system.
Chapter 5 reviews the current and potential financing mechanisms and the available manpower for plantation forests rehabilitation and management.
Chapter 6 assesses the incentives for plantation establishment, their impacts, effectiveness and suggestions for improvement of incentives.
Chapter 7 deals with the demand and supply of forest products including projections and forest products trade that include both import and export.
Chapter 8 deals with forest revenue systems.
Chapter 9 deals with the socio-economic and environmental contributions of forests.
Chapter 10 deals with forest industries, and,
Chapter 11 provides conclusions and way forward.

2. Forest plantations situation

2.1 Historical background

In response to the decline of the natural forest area, Ethiopia started large scale industrial plantations with the primary purpose of supplying industrial round wood for the production of sawn wood, wood-based panels and wood pulp in the early 1970s with support from Sweden.

The area of forest plantations was estimated at 189 000 ha in 1990 (FAO, 1990). In 2000, the area of plantation increased to 216 000 ha and in 2005 to 419 000 ha. Currently, the estimate is 972 000 ha based on compiled data in 2010.

Of the total area of plantation forests, 190 400 ha, or c. 20%, are classified as commercial plantations that produce timber for sawn wood and poles. The age class structure contains large areas in old age classes reflecting the decreasing rates of plantation establishment in recent years. The remaining 80% are non-industrial plantations, mainly woodlots and trees on farm. These plantations produce fuelwood and construction timber, as well as NTFPs.

The current rate of plantation forest development is not encouraging and their management is also deficient. They are fragmented and mixed with many tree species with little or no commercial value. The area of plantations in relation to total forest area of the country increased from 3.2% in 1990 to 3.8% in 2005 (FAO, 2005).

2.2 Location, areas and species composition

Plantations are mainly made up of exotic tree species with few indigenous trees in some of the National Forest Priority Areas. The main species in these plantations are *Eucalyptus sp*. covering

56% and *Cupressus lusitanica* covering 32 % of the total area, followed by *Juniperus procera (*2%), *Pinus patula* (1.8 %), and other species (8 %).

The major regional states that account for the majority of the total forest plantation area are Oromia, Amhara, the Southern Nations and Nationalities Peoples Regional State, and Tigray. These are also the regions with major commercial forest plantations (Table 2).

Table 2. Industrial plantation forest area in ha by species and region. Source: data collected in 2010 from regional bureaus of agriculture.

Regional states	Eucalypts	Cypress	Juniper	Pines	Grevillea	Others	Total area
Oromia	29 700	32 100	4 400	3 500	1 300	7 800	**78 800**
Amhara	18 000	23 400	300	100	-	2 800	**44 600**
Southern	20 300	7 000	-	-	-	-	**27 300**
Tigray	39 700	-	-	-	-	-	**39 700**
Total	**107 700**	**62 500**	**4 700**	**3 600**	**1 300**	**10 600**	**190 400**

Non-industrial forests that include woodlots, community plantations and peri-urban plantations are mainly located in the Amhara regional state. They are dominated by *Eucalyptus sp.* (Table 3).

Table 3. Non-industrial plantation forest area in ha by region. Source: data collected in 2010 from regional bureaus of agriculture.

Regional states	Area of non-industrial plantations/ woodlots); ha	Area of peri-urban plantations; ha
Oromia	27 800	26 700
Amhara	639 400	**-**
Southern	64 000	**-**
Tigray	23 700	-
Total	**754 900**	**26 700**

Plantation forests managed for the production of sawn wood dominate and cover more than 50% of the total area (Table 4).

Table 4. Area of forest by management objectives and region. Source: Data collected in 2010 from regional bureaus of agriculture.

Regional states	Sawn timber ha	Poles ha	Fuelwood ha	Pulp wood Ha	Total area ha
Oromia	36 100	29 700	13 000		78 800
Amhara	11 500	12 000	6 100	15 000	44 600
Southern	27 300				27 300
Tigray	39 700				39 700
Total	**114 600**	**41 700**	**19 100**	**15 000**	**190 400**

There is lack of data indicating age distribution of trees in forest plantations as well as encroached areas of forest plantations.

2.3 Plantation management

2.3.1 Establishment

Potted seedlings are used in all commercial plantations. Most seed procurement is carried out from natural forests and plantations and not from seed orchards. The genetic history of most plantations

is not very well known. There is also a problem of species provenance-site matching. This is clearly seen in the Bale and Arsi regions. Due to these and other problems in nursery, planting and post planting activities, the performance of most established plantations is very poor (EARO, 2008).

Site preparation is through manual clearing and the slashed vegetation is usually burned. When planting, slash and litter is cleared in a circle of 50 cm radius around the planting position to ensure proper quality planting and to facilitate subsequent weeding operations. Pits measuring 40 cm in diameter and 40 cm in depth are prepared with a hoe, and seedlings are planted.

Planting begins with the onset of the rainy season and no fertilisation is applied. Planting is at a spacing of 2 x 2 m. In some commercial plantations a spacing of 2.5 x 2.5 m is also used.

The annual replanting rate is 560 ha (Table 5). The average area of new planting for commercial purpose is about 3 700 ha per year which is far below the required area for ensuring a sustainable supply of forest products. With these low rates of re-planting and new plantation establishment, plantations are not expected to provide the multiple uses and services which used to be available from natural forests. The supply of industrial wood from the plantations would be of poor quality due to the current low management practices. The annual coppicing area is estimated at c. 750 ha in 2009 (Table 6).

Assuming that the establishment continues at the rate of 3 700 ha per year throughout the period to 2020, the area of industrial forest plantations is expected to increase to about 218 000 ha in 2020. Most of this increase is likely to be fast growing and short rotation plantations.

Table 5. Annual replanting areas for 2009. Source: Oromia Forest & Wildlife Enterprise(2009).

Public forest plantation locations	Annual re-planting areas, ha
Bale	25
Borena Guji	56
Finfine	39
Hararge	86
Illubabor	43
Welega	38
Jimma	51
Arsi	161
Amhara	60
Southern region	-
Total	**559**

Table 6. Annual coppicing areas (ha) for the period 2005-2009. Sources: Bureau of Agriculture and Oromia Forest and Wildlife Enterprise.

Public forest plantation locations	2005	2006	2007	2008	2009
Bale	60	50	40	60	30
Borena guji	35	49	50	60	40
Finfine	200	170	180	150	350
Hararege	30	20	25	30	20
Wolega	40	52	40	40	27
Illubabor	40	20	37	40	15
Jimma	25	38	42	10	5
Arsi	80	82	70	67	80
Amhara	-	-	-	-	-
Southern region	-	-	--	-	200
Total	**510**	**481**	**484**	**457**	**767**

2.3.2 Weeding

Manual ring weeding around each tree is carried out. The weeding is carried out at least once per year for the first two years. Delays in weeding result in reduced survival and growth. Total area weeded is estimated at 3 600 ha in 2009. The backlog is not more than 25 ha per year (Table 7).

Table 7. Areas weeded and weeding backlog 2009. Source: Oromia Forest & Wildlife Enterprise.

Public forest plantation locations	Weeded area, ha	Weeding backlog, ha
Arsi forest	479	10
Finfine	525	15
Borena Guji	56	
Hararge	154	
Bale	17	
Wolega	386	
Jimma	1 350	
Illubabor	530	
Amhara	85	
Total	**3 582**	**25**

2.3.3 Pruning

There are pruning schedules but they are not followed due to budgetary constraints in the non-industrial plantations. The commercial plantations do regular pruning and the pruned area is on average 450 ha annually as shown in Table 8 and there is no reported back-log. The pruning schedule for different exotic tree species is indicated in Table 9.

Table 8. Areas pruned 2009. Sources: Regional bureaus of agriculture and Oromia Forest & Wildlife Enterprise.

Public forest plantation locations	Pruned area, ha	Public forest plantation locations	Pruned area, ha
Arsi forest	123	Welega	38
Finfine	54	Jimma	150
Borena Guji	48	Illubabor	17
Hararge	20	**Total**	**450**
Bale	-		

Table 9. *Cupressus lusitanica* and *Pinus patula* pruning schedules. Source: Oromia Forest & Wildlife Enterprise.

Species	Age (years)	Operation
Cupressus lusitanica	3 9	Access pruning High pruning
Pinus patula	3 5 8	Access pruning First pruning High pruning

2.3.4 Thinning

Thinning in the commercial plantations is estimated at 272 ha annually in 2009. The thinning backlog for the same year is 32 ha as indicated in Table 10. The thinning schedules for selected trees are shown in Table 11.

Table 10. Areas thinned and thinning backlog 2009. Source: Oromia Forest & Wildlife Enterprise.

Public forest plantation locations	Thinned area, Ha	Thinning backlog, ha
Arsi	101	32
Finfine	25	
Borena Guji	22	
Harage	5	
Bale		
Welega	15	
Jimma	91	
Illubabor	13	
Total	**272**	**32**

Table 11. Thinning schedule for saw logs and transmission poles production. Source: Bureaus of agriculture. OFWE (2009)

Species	Age (Years)	Operation	Harvest, m^3 per ha
Eucalyptus spp.	4	1st thinning	14
	6	2nd thinning	33
	9	3rd thinning	55
	13	4th thinning	60
	18	Main harvest	212
Cupressus lusitanica	8	1st thinning	48
	12	2nd thinning	54
	18	3rd thinning	88
	26	Main harvest	386
Pinus patula	8	1st thinning	48
	12	2nd thinning	54
	18	3rd thinning	88
	26	Main harvest	386

2.3.5 Forest health

Forest plantations of several species have suffered varying degrees of attack by disease causing agents. Plantation forests of the Arsi Forest Enterprise are among the forests that have in recent years been subjected to attack by insect pests and diseases. The most recent and notable case is the attack by the cypress aphid (*Cinara cuppressivora*), which caused widespread deaths and economic losses not only to the Arsi Forest Enterprise but also to other growers of *Cupressus lusitanica* across the country. The area affected is estimated to cover c. 3 800 ha from 2005-2009. *Pinus patula* plantations in the enterprise are reported to have been killed in large numbers causing a forced salvaging of such trees and significant economic losses to the enterprise. Some of the deaths could be ascribed to the *Armillaria* root rot disease. A leaf disease of *Eucalyptus globulus* and cypress, affecting 572 ha together of the two species, was also identified as a common disease in plantation forests in Amhara regional state.

Recently, it has been observed that a large number of pine trees have died, and are still dying, in *Pinus patula* plantations of the Arsi enterprise. Shoot blight and dieback were the common symptoms observed in these pine plantations (Kedir, 2009). Forest fire is an annual phenomenon in the woodlands and shrublands of Gambella and Benshangul-Gumuz of South West Ethiopia. It affects over 200 000 ha every year. There has been no impact on plantation forests, however.

Other forest health issues to consider include the impact of invasive trees. *Prosopis juliflora* has been introduced and become naturalised and cultivated for shade and soil conservation. The tree was introduced in the early 1980s for the purpose of soil conservation. Instead, it invaded pastoral areas by displacing native trees. It produces poisonous thorns and colonises habitats by eliminating other vegetation. The current attempt to eradicate the *Prosopis* is through mechanical removal and charcoal production.

Illegal felling is common, the control of which is beyond the capacity of the concerned institutions. Attempts were made to establish check points to control illegal movement of forest products, but they were not effective and could not be maintained.

2.3.6 Maintaining long term site productivity

Plantation site management after harvesting is not a common practice. On the other hand, cutting operations are conducted that help to minimise damage to the residual trees in plantation forest harvesting. Low impact wood extraction systems are employed. Careful re-use of extraction routes to minimize compaction and erosion is implemented. Transport of timber from the felling site to the landing is done with ground based systems (manual, animal ground skidding). Tractors are also used. Proper drainage facilities for forest access roads are constructed. Slash retention on the sites after harvesting is practiced and implemented by the forest enterprises.

2.3.7 Growth, yield and rotation age

Forest plantations are managed using a "plant, clear fell and replant" cycle except where coppicing species are planted. Apart from poor survival rates, growth rates achieved are below potential. Planted forests have not been maintained properly and investments in their maintenance have been declining. The routine maintenance operations - weeding, cleaning, pruning and thinning - are often neglected with negative consequences for productivity and quality.

The control of the public sector in plantation development has had serious negative implications for plantation forest management. Most forest plantations owned by the public sector, except under the newly established forest enterprises, have failed to effectively supply wood to the final consumers. With the exception of three forests, they have no management plans that are seriously followed and implemented. One of the regional states, Amhara Region, has over 20 million m^3 of unused stock due to many reasons which are related to poor management. Most of them have financial problems, resulting in deficient management that leads to low productivity. Public sector plantations are of poor quality with low market prices for their products.

The plantations in Ethiopia, like everywhere, are characterised by lower bio-diversity than natural forests. The dominant tree species is eucalyptus which is usually harvested at the age of 5-7 years for pole and construction materials. However, the maximum wood production is commonly attained at the age of 18 years. Mean annual increment estimates for the three most common plantation species, i.e. eucalypts, pine and cypress, range from 5 to 20 m^3/ha/year, while the top notations on favourable sites reach 24, 16 and 22 m^3/ha/year, respectively.

The total annual incremental yield in the country is estimated at 1.8 million $m^{3,}$ assuming that an industrial plantation forest's annual average increment is 10-15 m^3/ha/year.

The rotation age varies with species. For most coniferous softwoods, such as pines, the rotation period is 26-30 years. For eucalyptus, it ranges from 7 to 18 years depending on the purpose of planting.

The current growing stock of industrial forest plantations is estimated at 22.4 million m^3. On the other hand, the growing stock from non-industrial forests that include woodlots, community plantations is estimated at 39.1 million m^3 (Table 12).

Table 12. Growing stock, yield and increment of forest plantation species in 2009.
Sources: Bureaus of agriculture; Oromia Forest & Wildlife Enterprise; FOSA (2000).

Public forest plantations, locations and species	Area (ha; rounded)	Growing stock (1000 m^3)	Increment m^3/ha/yr
Arsi			
Pinus patula	300	87.2	16
Cupressus lusitanica	3 900	1 212.9	22
Eucalyptus spp.	1 800	946.8	25.7
Illubabor	17 500	873.0	18
Jimma	9 000	1 586.4	18

Borena	5 600	1 182.8	18
Bale	1 400	515.2	14
Welega	12 700	1 463.3	17
Hararge	5 000	783.9	10
Finfine	21 600	1 223.1	20
Amhara region			
Cupressus lusitanica	11 500	1 258.5	6
Eucalyptus sp	21 100	2 323.2	12
Eucalyptus sp	12 000	1 798.4	12
Tigray	39 700	3 971.7	7
Southern region	27 300	3 280.8	
Sub-total	***190 400***	***22 507.2***	
Private plantations and outgrowers			
Amhara region	639 400	31 968.0	
Oromia	54 500	2 724.7	
Southern region	64 000	3 200.0	
Tigray	23 700	1 185.9	
Sub-total	***781 600***	***39 078.6***	
Total	**972 000**	**61 585.8**	

2.4 Forest plantation expansion

2.4.1 New areas available for forest plantation expansion

New areas for forest plantation expansion are usually obtained through negotiations with local administrations and local communities, mainly due to the competition for land for agriculture and grazing. The land areas shown in Table 13 are those confirmed by the forest enterprise only. It is not the usual practice to demarcate land for plantation expansion in Ethiopia.

Table 13. Land available/set aside for plantation expansion. Source: Regional bureaus of agriculture. OFWE (2010)

Name of area	Size of available land (ha)	Suitable tree species for afforestation
Bale	97	*Cupressus lusitanica* *Grevillea robusta* *Eucalyptus spp.*
Borena Guji	262	*Cupressus lusitanica* *Grevillea robusta* *Eucalyptus spp.*
Finfine	322	*Cupressus lusitanica* *Pinus patula* *Grevillea robusta* *Eucalyptus spp.*
Hararge	324	*Cupressus lusitanica* *Grevillea robusta* *Eucalyptus spp.*
Illubabor	274	*Cupressus lusitanica* *Pinus patula* *Grevillea robusta* *Eucalyptus spp.*
Wellega	453	*Cupressus lusitanica* *Pinus patula* *Grevillea robusta* *Eucalyptus spp.*
Jimma	299	*Cupressus lusitanica* *Pinus patula* *Grevillea robusta*
Arsi	1 01	*Cupressus lusitanica* *Pinus patula* *Grevillea robusta* *Eucalyptus. spp*
Total	2, 132	

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

Due to the comparatively long-term nature of investments in forestry, private investors are less attracted. On the other hand, more involvement is reported in harvesting, processing and marketing of forest products. The government has developed policies that encourage and attract the private sector in forestry, e.g. by leasing land outside farmers' possessions to private investors that are willing to engage in activities that contribute to the improvement of the environment. However, public sector plantations have not been privatised despite the support of government to privatise plantation forests.

There is also one private limited company that is involved in plantation establishment and in the provision of raw material for a chip wood factory in the Tigray region.

2.4.3 Constraints and opportunities for plantation expansion

Increasing demand of the human population for more land for agriculture is likely to have a major effect on land availability for plantation establishment. New settlements in natural forests are increasing resulting in the conversion of forested land into agricultural and other land use systems. The few remaining high forests, with a potential for the expansion of plantation forests, are threatened by pressure from investors who are converting the forests into other land uses. The need for sustainable forest management to halt and reverse the loss of forests has been recognised and accepted by the government. However, management efforts to-date have not yielded desired results.

Despite forest policies and strategies being in place, they have not been effectively implemented. There is a lack of a clear forest strategy for the country. A national level forest strategy and policy is developed but the regional states that owns and are responsible for managing and administering the forests have not yet developed policies and strategies for forest conservation and development. There are fragmented sectors that have the responsibility for forestry and environment issues. However, they are not well linked and there are poor research-extension linkages to promote forestry. A low level of technical backstopping to promote community involvement in tree planting is another constraint.

A strategic land use planning that will facilitate and provide guidance on land use conflicts is planned to be established. In addition, private sector forest development will be encouraged through research and extension, provision of appropriate policies in the area of pricing, and by creating an increased sense of security of land and tree tenure, all of which, if implemented, would enhance opportunities for private sector investments in forestry.

Table 14 shows the perception of risks for private sector investment in industrial forest plantation development. Overall there are more medium and high risks compared to low risks. Thus more efforts by the government are needed to create a favourable environment for private sector investment in industrial forest plantations.

Table 14. Perception of risks for private sector investment in industrial forest plantation. Source: adapted from ITTO (2009).

Risks for forest investment			
	Low	**Medium**	**High**
SUPRA (Macroeconomy)			
Growth of GDP	X		
Exchange rate			X
Interest rate			X
Free trade agreements	X		
Political stability and Government transparency			X
Governance issues			X
Fiscal policy		X	
INTER SECTOR			
Economic infrastructure			
– Transportation		X	
– Energy/utility			X
Social infrastructure: (water, sanitation, education, health)	X		
Licenses and permits	X		
Labour			
– Laws and labour contracts		X	
– Wages		X	
– Labour productivity		X	
– Labour qualification		X	
Access to credit			X
Justice and law enforcement			X
Capital gain policy		X	
Land and resource tenure			
– Land tenure			X
– Land market			X
– Land use as collateral			X
Sectoral policies			
– Environment policies and restrictions			X
– Agricultural policies and restrictions			X
INTRA-SECTOR			
Forest resources (availability)			X

Subsidies and financial mechanisms		X	
Trade restrictions (on forest products)			X
Markets		X	
Entrepreneurial development service			
Forest vocation land (land suitable and available for forest)			X
Legal and institutional basis		X	

3. Out-grower schemes and other woodlots

3.1 Extent and impact of woodlots

The Ministry of Agriculture in collaboration with national and international organisations has made efforts to implement community tree planting programmes in the early 1980s (FOSA, 2000). This is to be seen as a supply enhancement measure mainly to provide fuelwood and construction material and to reclaim degraded lands. The woodlots were mainly planted through campaigns by mobilising peasants and urban dwellers. The low survival rate of plantations and the lack of maintenance resulted in the failure of many of these plantations. The problems encountered were neglected management of trees planted and no feeling of ownership of the tree resources by the community members. This resulted in plantations being illegally harvested. As of February 1989, the government handed over the community forests to the peasant associations with an estimated area of 79 500 ha (FOSA, 2000). In the case of woodlots, they are planted on small patches, generally at very high stem densities, often up to 50 000 stems per ha.

Non Governmental Organisations (NGOs) support community woodlots plantation establishment. They initiate the establishment of plantations on degraded lands and hand over to communities. They promote state-community ownership and administration of plantation forests, as well as planting forests for energy use. In the latter case, they often promote the planting of *jatropha.* Due to the lack of a land use policy, establishment of extensive plantations sometimes displace farmers which bring conflict. NGOs argue against the displacement of communities for establishing public forest plantations.

The only forest enterprise in the Oromia region has a plan to start out-growers' schemes with small-holders and enter into partnerships under a contract agreement. Until 2010, no out-grower schemes were in place in forestry in Ethiopia. Good experiences that could be captured are indicated in Box 1. On the other hand, community woodlots are not new to many Ethiopian farmers. The history goes back to the second half of the 1970s when they were introduced to the "food for work" concept in drought affected areas. It was a product of the environmental awareness that followed after one of the major famines in modern Ethiopian history (Carlsson, 2004). It also came after the seizure of power by the now defunct military-socialist government in 1974 that, among others, nationalised land in 1975 and created peasant associations (PAs) as the lowest administrative units in rural Ethiopia. These were used as an entry point for the promotion of woodlot plantations in the country.

As a strategy to promote woodlot establishment, the plantations belonged to the government and the labour contribution of the local communities in the establishment of the plantations was mainly in exchange for wages paid in kind, i.e. "food for work". This was largely financed by the United Nations World Food Programme (UN-WFP) with a value of food committed by WFP that was estimated to be slightly over half a billion USD for the period 1975-1990 (Carlsson, 2004).

Through this strategy, many community woodlots were established. Because of the lack of active consultation and participation of local communities, many of these were poorly established, rarely maintained, and at the change in government many perished.

The full management and rights of use of the plantations that survived and grew until the change of government in 1991 were transferred to the local communities. However, a number of them have been destroyed either in the transition between the two governments or immediately after the transfer to the local communities due to lack of proper rules and regulations on their use and management.

From the lessons learnt, the current government has shifted away from centralised management of woodlot resources with the objective to enable resource users to have greater decision making

power over the management. Therefore, old and newly established woodlots have been placed under the management of communities and villages. In addition, community hillsides and degraded hillsides are parcelled out to individual households for tree planting.

Since 1993 there has been a very significant increase in on-farm planting of trees, clearly related to the change of state policy on individual tree tenure. In many areas tree planting is continuing. It is estimated that there are over 800 000 ha of trees as farm woodlots in the country.

Most woodlot establishment work in the country is promoted by external organisations, mainly NGOs, together with local bureaus of agriculture. They get advice from extension agents regarding seedling planting, tending operations and other techniques.

In Tigray, almost 90% of the *tabias*, which are the lowest administrative units, have woodlots on their land. Most of the woodlots have been established since 1991. Community woodlots in Tigray have been developed through a more participatory process.

Most woodlots are managed at the village level by a village council and are used only by members of that village. The major benefits from woodlots are in the value of trees. The most commonly planted trees are eucalypts which can be sold for cash income. With an average planting density of 4 500 trees per ha and a survival rate of 64% a woodlot would be worth more than USD 10 000 (Gebremedhin *et al.,* 2000). The same case study reported that with more than 70 ha of woodlots per *tabia*, these represent a substantial contribution to the wealth of the communities. Estimates of the potential benefits from sustainable harvesting of eucalyptus poles from household managed woodlots in Tigray suggest an annual average income of USD 30 per capita.

In the same region, there is a new approach through hillside distribution systems in which communal hillside plantations are established on degraded slopes, normally with eucalyptus. This system has been in operation for over a decade now, and has been adopted by the Tigray regional government through the Bureau of Agriculture and Natural Resources as a means of allocating land in degraded hillsides to landless members of communities.

Similarly, in the Oromia region, farmers practice short rotations (2-3 years) of trees that coppice well when used for fuel wood, somewhat longer rotations (4-5 years) for short poles, and the longest rotation (7-9 years) for telegraph poles. This is practiced in the same woodlot. In addition, indigenous trees in farmer's fields are managed to obtain the maximum outputs of woody biomass through pollarding (MoA, 2004).

During the previous government many community plantations and woodlots were established in the southern region. It is estimated that there are 64,000 ha remaining in about 475 locations. These have all been formally handed over to the respective communities, and rights of use established (MoA, 2004).

The area of woodlots extent, total wood production and the species contained are summarised in Table 15. The total area of woodlots is estimated at 781 600 ha while the total wood production is c. 42 million m^3. The main species are *Eucalyptus* and *Cupressus*.

Table 15. Extent of woodlots. Source: Regional bureaus of agriculture (2011).

Types of woodlots	Total area (ha; rounded)	Total wood production (1000 m^3)	Tree species planted
Community forests	36 600	1 828.7	*Eucalyptus spp*. and *Cupressus lusitanica*
Woodlots/farm boundary trees	602 800	30 139.3	
Southern; outgrowers	64 000	3 200.0	
Tigray; outgrowers	23 700	1 185.9	
Oromia; outgrowers	54 500	5 724.7	
Total	**781 600**	**42 078.6**	

Box 1.
Good experience of out-grower schemes from South Africa which can be applied in Ethiopia with the newly established forest enterprises in Oromia and Amhara regions: Smallholder farmers can receive loans from the existing enterprises to establish plantations on their land in return for selling the timber to the forest enterprises. The forest enterprises provide a percentage of the expected revenue from the sale of the timber on an annual basis to enable the smallholder farmers to meet their financial needs.

3.2 Factors shaping growth of woodlots

The factors that significantly influence the decision to adopt woodlots as a form of land use include: tree tenure security, quality of seed, contact with extension agents and size of land holdings. Woodlots require farmers to set aside part of their land for growing trees that results in the cultivable area under food crops being reduced. Therefore, farmers with smaller plots of land may view tree planting as competing with food crops, thus reducing incentive to establish woodlots.

Control over the allocation of harvesting rights for many woodlots is limiting the economic potential of woodlots. In the case of Ethiopia, farmers have the ownership right to trees growing on his/her homestead and cultivated lands, but needs to get permission from the local government to cut the trees. This hinders the participation of the farmers in woodlot plantation.

Woodlots that are managed by households/individuals are estimated to yield higher rates of return than those managed at higher administrative levels due to greater management intensity. It has been shown that devolved woodlot management empowers resource users by providing greater autonomy regarding the management of woodlots and in particular the ability to make decisions about the harvest of woodlots products.

For the sustainability of woodlots, a continuous supply of planting material in the form of seed and seedlings is prerequisite and secure land tenure and rights over crops, including the rights to manage harvest, transport and market produced wood. The frequency of contact and technical assistance from the development agents also contributes to sustainability of woodlot plantations.

In communities living in lower potential areas, where agricultural development is difficult to achieve, development and management of community woodlots may be a key element of an effective development strategy. A recent forest policy in Ethiopia provides farmers with tax incentives that are proportionate to the number of trees they plant. Those who planted more trees will benefit through reduction of taxes on land on an annual basis. In addition, controls are lifted on pricing and marketing.

4. Forest and tree tenure

4.1 Current forest/tree tenure systems

In 1975, the government nationalised ownership of land throughout the country. The situation has been maintained by the current government. There has been a repeated redistribution of land, which has caused feelings of uncertainty among farmers and made them reluctant to invest in land improvement and tree planting. The land tenure system denies private ownership and has affected the sustainable management and development of forests and NTFPs.

According to the current constitution, land belongs to the state and citizens obtain only use rights. Article 40 of the constitution of the Federal Democratic Republic of Ethiopia affirms that *"The right to ownership of rural and urban land as well as of all natural resources is exclusively vested in the state and in the peoples of Ethiopia. Land is a common property of the nations, nationalities and peoples of Ethiopia and shall not be subject to sale or to other means of exchange."* Accordingly, the natural forests are owned by the state and administered by regional agricultural offices after the decentralisation of 1991. All natural forests, therefore, are not available for private ownership by law.

Nonetheless, the new forests development, conservation and utilisation proclamation (542/2007), which is accompanied by the country's forest policy and strategy on forest development, provides the framework for making fundamental changes to forest resource management. The new proclamation allows for forests to be designated as either private or state owned.

The existing forest management categories in public forests include (see also Table 16):

- Forests in which extractive activities are strictly forbidden;
- User rights such as permits to gather grass and dead wood and NTFPs;
- Joint forest management (JFM) with communities and short term concessions granted to cooperatives to extract gum and incense resources from natural forests; and,
- Private woodlots managed by individuals.

Table 16. Categories of ownership of forest resources. Sources: FAO (2010); Farm Africa /SoS Sahel Ethiopia (2010).

Category of owner	Area, 1000 ha (% of total land area)
Public Plantation forests	190.4 (0.2)
Public Natural forests	11 996.0 (11.2)
Joint forest management	300.0 (0.3)
Private plantations and woodlots	602.8 (0.7)
Community woodlots	152.1 (0.2)

In 2005, the government of Ethiopia issued a Rural Land Administration and Land Use Proclamation (456/2005), which was amended in 2007. The aim was to increase tenure security, improve productivity and avoid expectations of land re-distribution. The proclamation provides that farmers will have certificates of use right to cultivated land that can be inherited or passed to others.

In the last 20+ years, the commitment of empowering local communties and decentralising decision making to local government has been growing. This is one of the emerging forest tenure arrangements and it is conducive to local management of forest resources.

Forest legislation makes provisions for establishing community forestry and implementing participatory forest management (PFM). This is sharing of responsibility and benefits. A new management system has emerged and is now in place in which local people have defined control with rights and obligations over forest resources leading to sustainable use. In this regard, communities living in and around some forest areas have already shown interest in and capability to manage forests. However, the process is slow and local people often receive user rights only of more degraded forest resources

It is FARM-Africa that initiated this management scheme back in 1996. PFM practices are widely in place in Ethiopia. There are several PFM projects and programmes covering a total area of over 300 000 ha of natural forests. Each programme involves all stakeholders in the decision making process. Forest blocks are allocated to forest dwellers. Revenue that is generated is shared between the forest user groups and the government. To this effect, nine projects/programmes have been operating in implementing Participatory Natural Resources Management.

Analysis of satellite images in Ethiopia indicated that forest cover increased by up to 15.6% between 2001 and 2006 during the time the forest blocks were under community management. On the contrary, deforestation of up to 16% was observed in the forest areas outside PFM (Tsegaye, 2008).

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

Land used by peasants is characterised by lack of tenure security, which has aggravated the problem and constrained investments in land improvement measures. The existing tenure system does not allow farmers to use land as collateral to secure credits. The number of landless households is also increasing.

The rate and level of deforestation is influenced by the security of tenure that local people possess related to forests and the level of rule enforcement related to the use of forest resources. The conditions of forests, where a system of well known property rights for the local population is in place, are better than in those areas where local people play no part in forest management.

Stakeholders are more likely to invest in forest management when ownership of the land and forest resource is clear and secure. Uncertainty about tenure and future access to resources encourage over-harvesting in the short-term and discourage investments. Without control of the land or secured future use of the trees, forest resources are often rapidly liquidated to secure income that can be invested elsewhere. The change in tree tenure through implementing PFM has had some positive impact. Encouraging results have been obtained from areas where PFM is being practised in terms of addressing forest related problems and economic benefits for rural communities. These include securing access to resources, realisation of forest conservation, better protection due to a sense of ownership, ensuring sustainable supply of forest products, creating economic incentives, increased local decision-making, and good governance (Box 2) (Tsegaye, 2008).

Box 2. Impact of implementing PFM

On Forest regeneration: PFM has brought about healthy regeneration of the forests. For instance, in Chilimo 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.

4.3 Suggestions for improvement of tenure system

An improved land tenure system would bring about land security and could encourage investments in forests, promote higher land productivity and reduce the rate of forest degradation. It is therefore important to promote greater recognition of the rights of local communities to land and tree tenure ownership and of issues related to access to resources. Present tenure shortfalls and proposals for improvement are shown in Table 17.

Table 17. Present tenure shortfalls and proposals for improvement.

Present tenure shortfalls	Proposals for improvement
Limited access to forest resources to local communities	➢ Clarify and strengthen use rights and grant access to forests ➢ Share revenue generated from the forests
Does not allow collateral to get access to bank loans	➢ Allow rural credits using the land as collateral ➢ Ownership rights should be legally recognised and support by policy statements
Does not include forest land in land certification so farmers clear forests and claim land as agriculture land for certification	➢ Include forest land in land certification and allow long term lease of forest land ➢ Apply effective legislation and awareness creation for the communities through extension service
Does not allow privatisation of forest land	➢ Allow private ownership of forest land ➢ Land titling and registration of forest lands

The following are good tree tenure practices in Ethiopia (Boxes 3 and 4).

Box 3. The Bale Eco-region Sustainable management programme

The "strengthening livelihoods and forest management project" helps forest communities reduce their reliance on timber based products and work in partnership with the government to protect the forest. The programme has been operating in the Bale massif since 2007 and brings local communities into a central role in sustainable natural resources management supported by government services. The goal of the programme is to mutually enhance the unique bio-diversity and vital ecological processes of the Bale Mountain Eco-region and the social and economic well-being of the communities dependent on the Eco-region's natural resources. It also helps communities to turn traditional activities into income generating enterprises and to take responsibility for conserving their forest habitats now and for the future.

The programme will run in two phases from 2006-2011 and work in 14 woredas. The first phase has started in four priority woredas, viz. Goba, Harena Buluk, Mena and Nensebo. The programme aims to accomplish the following outputs:

- Government and community institutional capacity strengthened for sustainable natural resources management;
- Functional and sustainable natural resource management (NRM) and conservation systems developed; and,
- Community natural resource based livelihoods diversified.

Box 4. Establishment of a Biosphere Reserve in Ethiopia

The link between biodiversity conservation and the development needs of the local communities is a central component that should be considered for future conservation practices.

Yayu coffee forest biosphere reserve is the centre of origin for the most popular coffee in the world, Arabica coffee. It is the largest and most important forest for the conservation of the wild population in the world. The forest is a National forest priority area mainly for conservation of bio-diversity and coffee genetic resources. It is located in Oromia regional state. It has three different management zones. A ***core area*** with high abundance of wild Arabica coffee and high species diversity and intact forest is excluded from any use. It is intended for conservation of wild coffee population with no human intervention.

A ***buffer zone*** which include forest areas managed by local communities, and the ***transition area*** that is an area of the biosphere reserve where sustainable development is promoted for the improvement of the livelihood of the local community. Non-destructive uses are allowed.

The biosphere reserve approach protects biodiversity, improves livelihood of the local community through innovative marketing of their products, environmentally friendly agriculture and eco-tourism. It also prompts education and research and interact with world networks.

5. Financial and human resources for plantations and woodlots

5.1 Current financing mechanisms

The current financing of forestry activities is mainly from domestic sources, including government revenue collected in the form of stumpage charges, fees and levies from taxes and duties. External official development assistance is the other source of funding. However, there has been a decrease in the level of such funding for the sector. Most development assistance in the sector has been shifted to the development of national forest programmes (nfps). Most public expenditure from domestic financing goes to recurrent expenditure rather than to investment. This recurrent expenditure mainly covers staff costs (FAO, 2003).

Most forestry activities are not able to mobilise adequate public funding from within the sector since forest enterprises are not yet strong enough to cover their expenses, with the exception of Oromia region where revenues from forests are important sources of funding.

The average level of government expenditure per hectare in the forest sector is not more than USD 2 (FAO, 2003). The budget allocated for forestry for the year 2009 for the Southern Regional State, is USD 1.3 million where forest enterprise is not in place. On the other hand, the budget allocated for a forest enterprise in Oromia ranges from USD 1 million to 10 million per year (Table 18). This difference in budget allocation is due to the establishment of forest enterprises that are capable of generating financial resources for the development of the forests. The budget allocated for the branch offices of the enterprise in Oromia is far better than the budget allocated for the whole southern region (see Table 18). The same is true for the budget allocated for forestry in the Amhara regional state which is less than USD 1 million per year.

Private sector investments have been limited to conventional extractive industries and export products. There are, however, international private sector actors that provide financial support to local NGOs through project funding.

Forestry activities are undertaken in the informal sector where forests and trees play a major role in providing livelihoods for rural communities and urban poor. The major sources of financing for forestry activities in the informal sector are in the form of own savings, reinvestment of profits and own labour. However, micro-financing plays a major role for small and medium enterprises in forestry, not least in providing working capital.

Table 18. Plantation management budgets and actual expenditures (rounded to nearest 100 USD) for 2009. Sources: Regional bureaus of agriculture (2010); Oromia Forest & Wildlife Enterprise (2010).

Public plantations	Total area in ha	Budget USD	Actual expenditure USD; recurrent
Arsi	6 007	3 770 400	2 503 800
Finfine	21 599	2 954 100	1 740 200
Bale	1 430	670 300	257 000
Borena Gujji	5 643	874 600	473 300
Hararge	4 958	571 700	200 500
Jimma	8 985	1 133 500	641 200
Illubabor	4 446	1 118 600	309 900
Welga	12 685	938 900	539 500
Amhara sites	44 550	423 000	
Southern region	1 200 500 840 38 2 100	214 600 89 400 1 113 300 47 700 357 700	214 600 89 400 1 113 300 47 700 357 700
Total	**114 981**	**14 277 800**	**8 488 100**

5.2 Potential financing mechanisms

There is research work underway to show the carbon sequestration value of forests in Ethiopia. Carbon sequestration is an opportunity to fund forestry through financial inflows. The Bale Eco-Region Sustainable Management Programme (BERSMP) has been exploring the possibility of establishing a reduced emission from deforestation and degradation over an area of 600 000 ha based on PFM of forests with communities in the Bale mountains where a huge potential for CDM and REDD+ is reported to exist. This area of forests has been identified as a suitable project area for REDD+. In addition, 3 000 ha is to be set up as a CDM eligible reforestation project to be managed by a forest enterprise and community members around the forest. Through this project, there is a possibility to generate finance through the marketing of carbon credits that could contribute to the development of the country's forest resources (Tsegaye, 2008).

Implementation of REDD+ can bring huge benefits to local communities through payment for environmental services and other mechanisms. It is also possible to develop forest projects and sell the carbon. The projects generate revenue after 10-12 years which could be sources for forest development and community development around forest areas.

It is also possible to increase the attractiveness of forest sector investments by linking them more directly to poverty reduction and sustainable livelihood concerns. Establishing biomass energy plantations could be an effective strategy for carbon mitigation and livelihood improvement of communities. As a strategy, the biomass will be shared by the communities and the carbon payments will be used to improve local food security. This could be seen from Box 5, describing the Humbo project. Farmers could be encouraged to plant trees for woodlots on their land to develop avoided deforestation schemes. In addition, creating opportunities for local communities to supply wood to small and medium forest enterprises and assist them to develop partnerships with out-growers and small woodlot owners could generate finance for forest development.

Creating market and payment mechanisms for forest related environmental services, such as watershed protection, is vital to the climate stability and ecological balance of the country and thus has great positive effects on the agricultural productivity. Grant funding to make tree growing more attractive, especially to the private sector, will facilitate and serve as incentive to private tree growers. Since there is an expanding domestic market for fuelwood, building poles and panel products, this will open the opportunity to expand and generate revenue for plantation expansion.

Large scale private companies could be a source of finance in forestry if motivated to be involved in forestry. They can borrow from Banks and revolve the money in plantation establishment and encourage others to plant.

Box 5. Project for carbon sequestration and trading as sources of finance in Ethiopia.

The Humbo Community-based Natural Regeneration Project is Africa's first large-scale forestry project to be registered under the Clean Development Mechanism of the Kyoto Protocol. It will bring both economic and social benefits to poor communities in Ethiopia as well as environmental benefits as the project will cut an estimated 880 000 metric tons of carbon dioxide from the atmosphere over the next 30 years.

The project is established with the objective to restore natural forests. The implementation is done jointly by World Vision Ethiopia, Australia, the Ethiopian Agriculture and Rural Development Ministry and the Humbo Forest Management Group. Previously, the land has been overgrazed and cleared for fuelwood collection and was almost barren and subject to severe erosion and flooding. A management agreement involving all local stakeholders and benefiting members of the community from the project was made. They established the legal ownership of the community land and manage it for carbon, biodiversity and income producing activities to the benefit of the local population.

The project strategy is to identify existing tree and shrub root material in the soil which is then pruned, and managed to enable re-growth. Only native species are regenerated since the technique is based on genetic material already present on the sites. The existing vegetation is enriched using indigenous species, including *Acacia spp*., *Aningeria adolfi-fredericii, Podocarpus falcatus, Olea africana, Cordia africana,* and other local species. The project is expected to sequester around 0.05 Mt CO_2e by 2012 and around 0.16 Mt CO_2e by 2017. The additional income

from carbon sequestration is planned to be partly invested in local infrastructure and food security activities. This technique is also applicable to small private farms and it is expected that the knowledge will spread throughout neighbouring regions.

Specific arrangements are implemented to avoid any potential leakage that could occur due to reduced access to the area during the first years of tree growth. The strong involvement of the communities in the project and the numerous benefits created will likely increase the permanence of the regenerated forest.

5.3 Human resources

During the 1980s a forestry department existed with around 60 staff. By 1995, it had expanded into a ministry with over 300 employees before being relegated back to a department and finally to a section with less than ten foresters by 2004. Forestry is currently almost non-existent at federal level with six foresters under the newly formed forest development case team under Natural Resources management Directorate of the MoA.

The number of people working in the forestry sector is estimated at 9 000, most of which are diploma holders, estimated at 3 114. There are over 600 BSc and BA holders, 100 MSc and 5 PhD holders in the sector with many unskilled workers in the field of forest plantations. Contractual workers, including skilled labourers, are c. 3 800. Forestry research staff numbers are estimated at 7 PhD, 30 MSc and 15 BSc holders as of 2008 (see Table 19).

The capacity of the forestry sector is minimal except when established as a forest enterprise. Reforms are under way to establish forest enterprises which are autonomous with the mandates to generate revenue and use the same for development of the forests. This reform will enable the sector to integrate forest development with forest industries. This will improve the status and capacity of the sector to ensure sustainable forestry development.

Table 19. Public forest sector human resources 2009. Source: Regional Bureaus of agriculture (2010).

Category	Degree holders	Diploma holders	Certificate holders	Skilled workers	Vacancies in all cadres
Total Nos.	683	3 114	317	3 803	1 400

The forestry research centre which is organised under the Ethiopian Agricultural Research Organisation (EARO) is responsible for generating appropriate technologies for the development, sustainable use and conservation of trees and forests. Among the proposed national research programmes are forest plantations and farm forestry, and agro-forestry, including trees outside forests. The centre is actively involved in conducting research on seed technology and physiology, seedling production, and exotic species adaptation and management in plantations. Nursery and propagation techniques for more than 34 indigenous and exotic tree species have been developed. Provenance trials of several exotic tree species and on the establishment of man made plantations in all agro-ecological zones of the country. Studies on planting techniques that include ground preparation, spacing and different silvicultural treatments are underway.

Training in forestry has varied over time. Training on industrial forestry is less emphasised today, and more emphasis is given to social and environmental forestry. This has increased the knowledge of the forest experts in agro-forestry and bio-diversity conservation.

5.4 Other resources

Due to the frequent restructuring of the sector, it is not possible to have the resources allocated to the sector. Relocation and distribution of resources to other sectors makes estimates difficult.

6. Incentives for plantation establishment by public/private sectors

6.1 The rationale behind incentives

The decision to invest depends on the expected returns to investment and perceived degree of risk. Long term investments like forest plantation establishment need to provide the investor with a larger potential rate of return. Investors must have access to funds to acquire land and planting material to establish a large enough area of plantation. Information on market price for forest products and costs of silvicultural practices is limited, which reduces the incentives for plantation establishment. Investing in forestry, which is a long term investment with high capital demand, is obviously risky in nature. There is a lack of knowledge about future inputs and output prices and marketability of the final product. There are also budget constraints that make management of forests difficult. The government has to facilitate risk management strategies and improve the flow of information, including technical packages. The private and community sectors, therefore, have to be encouraged to participate through direct or indirect incentives.

6.2 Current incentives: impacts and effectiveness

The primary motivation for the private sector to plant trees is to generate financial benefits from their investment. The expected returns are usually sufficient incentives for plantation establishment and maintenance if they are coupled with financial security. Opportunities to borrow money with low interest rates from banks for investments in forest plantations are few and reduce the type of incentives in place. The incentives for plantation development in Ethiopia are summarised in Table 20.

Table 20. Incentives for plantation development.

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

The government of Ethiopia has allocated some plantations for communities to manage. Key incentives provided by the government include the provision of free seedlings and secure tenure through land certification. Profit sharing agreements between the state enterprises and community groups which attracted many small holders to tree planting are among the incentives employed. Sharing a certain percent of the profit from the total revenue generated from forest management encourages the farming communities to plant trees and protect the natural forest since their feeling

of secured ownership will be high. In addition, provision of extension services to farmers and provision of tools to private nurseries are among the incentives used.

The new regional land administrative policies allow for the issuance of land ownership certificates to land holders and owners to have the right to lease their plots to others for up to 25 years. Key incentives for planned out-growers include: capital assistance, such as seed money to start plantation establishment in tree growing and maintenance to the agreed outgrowers; guaranteed markets and assistance during the period between planting and harvesting.

The new forestry proclamation recognises private forest ownership and encourages joint state-community management of forests. It also ensures ownership security and transfer rights over lands planted with trees in accordance with the new Federal land use and land administration proclamation. Land redistribution is becoming less frequent. A recent forest policy provides farmers with tax incentives through no taxing for those involved in tree planting that are proportional to the number of trees they plant. The government also encourages the private sector to invest in forestry through lifting controls on pricing and marketing of forest products and paving the way for open and competitive markets for wood. Empowering small holders by improving their access to markets and market information, so that they can bargain for better prices (Kassa *et. al.,* 2008), is another important incentive.

To promote the export of NTFPs, the government has initiated different incentives for companies engaged in export activities. They are relieved of import duties on raw materials, equipment and machinery used to produce export products. Improvement on the time required when providing loans through extended payment periods and reduced interest rates from money borrowed has encouraged exporters. The bank also provides a three years grace period for loan repayment and collateral of 30% of the loan.

6.3 Suggestions for improvement of incentives

The high initial capital investment required to establish forest plantations and the long period between initial planting and harvesting are constraints for the involvement of the private sector in forest plantations. The competition for land for agriculture is ever increasing. A large area is normally required for a forest plantation to be commercially viable. In a country where rural communities rely on agriculture, land is one of the limiting factors for the expansion of plantation forests. The following are therefore proposed to be used as incentives to promote private sector plantation establishment:

- Availability and security of land and trees and provide license validity of 25 years for small scale private tree farming;
- Facilitate risk management strategies through extension service and capacity building on risk management;
- Improve flow of technical information, including on planting materials, yield performance and silvicultural practices and on availability of timber prices and market information over a long period;
- Create public-private partnerships for joint investments between the public and private sectors;
- Improve data quality for investment decisions;
- Grant freedom from lease payment for land that is designated for forest development;
- Ensure that private investors have access to seeds and seedlings and facilitate access to credit services; and,
- Set up a plantation forestry fund, which offers soft loans or subsidies for the costs of establishing and managing new forest plantations.

7. Supply and demand of forest products

7.1 Supply scenarios and projections

There is a huge gap between demand and supply of forest products and services in Ethiopia. The supply varies significantly among regional states. The regions with more forest area coverage have apparently excess supply of wood resources in relation to current use. Oromia, Southern region and Gambella are examples of regional states with such situations. Even within the same regional

states, the distribution of potential supply is uneven, resulting in some areas of surplus and other areas of shortage (WBISPP, 2004). Many areas are still consuming wood in excess of sustainable yield levels. The visible impact on wood stocks may be imperceptible in the short term, but there comes a critical point when stocks rapidly collapse in the face of continued unsustainable consumption. The major forest products addressed in this review are wood fuel, industrial round wood, wood-based panels, pulp and paper, and paper board products.

Currently, more than 90% of the domestic supplies of fuelwood come from diverse sources such as natural high forests and woodlands, industrial plantations and private forests (trees outside forests including woodlots). The total sustainable supply of wood fuel in 2010 amounts to approximately 9.3 million m^3. Ethiopia will remain highly dependent on wood fuel for the foreseeable future. The removal of wood from plantations and natural forests for 2009 is indicated in Table 21. In addition, wood removals from plantation forests alone from 1998-2010 is shown in Table 22.

Table 21. Wood removals (m^3; rounded to nearest 100 m^3) from plantations and natural forests for 2009. Sources: Regional Bureaus of Agriculture (2010); Oromia Forest & Wildlife Enterprise (2010)

Public plantations	Industrial roundwood	Industrial poles	Domestic poles	Firewood/ charcoal	Total
Arsi	54 500	25 000	3 300	24 800	107 600
Illubabor	24 500		6 700	3 800	35 000
Jimma	11 100		1 300	4 000	16 400
Welega	7 800	1 500	8 600	7 400	25 400
Bale	2 900	100	1 400	6 000	10 400
Hararge	3 000	800	200	700	4 700
Borena Juji	10 300	3 000	600	4 500	18 400
Finfine	76 200	25 500	27 900	29 800	159 400
Total plantations	**190 300**	**55 900**	**50 000**	**81 000**	**377 300**
Natural forest removals	**3 339 800**	**N/A**	**N/A**	**100 677 000**	**104 016 800**
Grand total	**3 530 100**	**55 900**	**50 000**	**100 758 000**	**104 394 100**

Table 22. Wood removals from plantation forests in (m^3; rounded to nearest 100 m^3) from 1998-2010 (only even years shown). Source: Regional Bureaus of Agriculture (2010).

Year	Industrial round wood	Transmission poles	Construction wood	Wood fuel	Lumber	Total in m^3
1998	10 200	34 200	19 900	39 100	15 200	118 600
2000	23 000	24 100	19 200	27 600	15 200	109 100
2002	17 400	31 700	12 300	28 600	14 300	104 300
2004	22 700	39 700	20 200	43 300	15 800	141 700
2006	36 500	20 000	24 800	55 100	18 600	155 000
2008	72 400	61 900	42 600	82 500	46 200	305 600
2010	35 000	32 000	55 800	95 500	29 500	247 800
Total	**552 400**	**449 100**	**389 100**	**645 800**	**250 900**	**2 287 200**

Note: the total figure also includes the uneven years, i.e. 13 years in all.

Table 23. Production, trade and consumption of wood and wood products for the period 1999 to 2009 (only uneven years shown). Sources: FAO (2010); Oromia Forest & Wildlife Enterprise (2010), Ministry of Trade (2010).

Forest products	1999	2001	2003	2005	2007	2009
From **plantations** (m^3)						
Woodfuel	39 300	25 800	39 000	44 500	79 000	86 600
Industrial roundwood	10 700	18 500	22 800	31 000	61 800	190 300
Sawn wood	25 000	25 000	30 000	60 000	60 000	75 000
From **natural forests** (1000 m^3)						
Woodfuel	85 800	88 800	91 500	94 700	97 700	100 700
Industrial roundwood	2 500	2 500	2 600	Nil	Nil	Nil
Paper and board from imported pulp (tonnes)	12 400	6 100	6 700	9 000	7 900	7 000
Gums (tonnes)	2 300	2 500	4 100	4 400	5 200	7 500
Honey (tonnes)	12 400	11 900	18 100	30 400	34 100	38 400

Fuelwood collection and selling is by far the largest activity and is carried out by household level rural producers. Women tend to dominate the fuel wood supply chain. The wood is transported by the producers to local markets on either their own backs or on a donkey. An average fuel wood collector sells between 0.5 m^3 and 1 m^3 each market day. A number of protected indigenous trees, including *Cordia africana, Hygenia abyssinia and Juniperus procera,* often find their way into fuel-wood bundles in many market places. The projected sustainable fuel wood supply is estimated to reach 8.6 million m^3 in 2030.

Industrial round wood production is one of the lowest in the world (FOSA, 2000). Most of the industrial wood come from the few plantation enterprises of the country covering c. 190 000 ha. The production of industrial round wood accounts for about 10% of the total round wood production. These low levels of production and consumption reflect the fact that the country has a very limited forest resource base, which has been, and continue to be, primarily exploited for fuelwood.

The supply of ***paper and paper board*** is lower than the demand and the gap is filled by import. There is no domestic supply of pulp in the country. Table 24 indicates the supply for paper and paper products that include import from 1999-2009.

Table 24. Supply of paper and paper products from 1999-2009 (only uneven years shown). Source: Survey of paper manufacturing factories (2010).

Products, tonnes	1999	2001	2003	2005	2007	2009
Paper and paper board, including imports	27 400	106 400	42 600	46 100	60 900	62 000
Printing and writing paper	3 000	2 000	4 000	4 000	5 000	3 000
Newsprint	4 000	6 000	8 500	10 000	12 400	9 500

In order to project the supply of wood fuel and industrial round wood from plantation forests, assuming the removal of only the annual increment for the different tree species, and taking the planned area of new plantations into account, a removal level of 15 m^3/ha/year is agreed on for estimating future supply. For natural forests, sustainable supply estimates made by EFAP (1994) are adopted.

Table 25. Supply projections for woodfuel, industrial round wood and NTFPs from plantations and natural forests 2015-2030.

Forest product	2015	2020	2025	2030
From **plantations** (1000 m³)				
Woodfuel (firewood/charcoal)	1 879	2 046	2 212	2 379
Industrial roundwood	1 253	1 364	1 475	1 586
From **natural forests** (1000 m³)				
Woodfuel (firewood/charcoal)	7 987	8 197	8 407	8 617
Incense /natural gum (tonnes)	17 900	35 800	71 700	143 400
Paper and paper boards (tones)	55 000	60 000	65 000	70 000

The deterioration of supplies from natural forests and the increasing demand for wood products have encouraged farmers to grow an increasing number of fast-growing trees such as eucalypts and cypresses. These small scale enterprises are providing the majority of the country's construction and fuel wood and are amongst the largest sources of non-agricultural employment and income to rural people in the country. There has been a major shift in consumption from hard-wood logs to logs of softwood as a result of the decline in natural forests. This will continue to increase in the future. The volume of logs coming from natural forests is today inadequate and import of softwood timbers and production of timber from softwood plantations will increase. The future will depend on the contribution of forest plantations, the growth in technology and the supply of logs from trees outside forests that include woodlots.

7.2 Demand scenarios and projections

The demand for forest products has been growing as the population levels are increasing. The demand for native timbers remains greater than for exotic species. This is due, firstly, to the level of familiarity that most forest industries have with the resources and, secondly, to the perception among consumers that they are of higher quality. While timber products such as fuelwood and scaffolding poles tend to be sourced from exotic species, such as eucalypts, those with a greater level of secondary processing such as furniture, handicrafts and tools are more likely to come from native timbers.

The demand for industrial wood will increase significantly. Large sized logs will be in short supply and there will be a shift to softwood logs. As supplies of wood and other products from natural forests decline, trees grown outside forests on homesteads and communal lands become more important.

The projected demand for wood fuel based on assumed per capita requirement is on the increase and is expected to be over 202 million m^3 in 2030. Trends indicate an overall increase in the demand for wood fuel of about 3% a year.

The potential of the forest resources to supply fuelwood on a sustainable yield basis is very low and there is an imbalance between required rural energy and the supply capacity of the forest resources. The demand therefore, is fulfilled through over exploitation of the woody vegetation.

Table 26. Demand for wood fuel, industrial wood and for NWFPs from 2001-2009 (only uneven years shown). Source: EFAP (1994).

Forest product	2001	2003	2005	2007	2009
Wood fuel (1000 m³)	60 310	64 283	68 473	72 745	77 222
Industrial wood (1000 m³)	651	746	856	981	1 124
Gums and incense (tonnes)	962	588	719	2 707	2 903

Table 27. Future demand of plantation and natural forest wood products. Sources: EFAP (1994); FOSA (2000).

Forest product	2015	2020	2025	2030
From **plantations** (1000 m³)				
Woodfuel (firewood/charcoal)	3 654	3 841	4 028	4 215
Industrial roundwood	1 600	2 000	2 400	2 800
Sawnwood	900	1 000	1 100	1 200
Paper and paper board (tonnes)	67 055	71 555	76 055	80 555
From **natural forests** (1000 m³)				
Woodfuel (firewood/charcoal)	129 800	149 600	172 500	198 800

7.3 Forest products prices

Regarding consumer prices for local and imported timber, there has been an increase in most prices. In 2009, local sawnwood cost USD 307/m³, whereas imported sold at USD 386/m³ (mainly imported from Australia). The price for honey and beeswax were USD 5 000 and USD 3 900 per tonne, respectively. The price of incense products increased from USD 130 per quintal in 2005 to USD 289 in 2010.

7.4 Forest products trade

While timber products are important domestically, it is only certain NTFPs that have export values in Ethiopia. Trade in NTFPs is an important contributor to agricultural and economic development through the revenue it generates to the government and the income it provides to rural livelihoods. Important are the gums and resins from woodlands.

The gum/incense sub-sector of the NTFPs is well established in Ethiopia and has a significant export value. The country has produced and sold these products for decades and the export quantity from 1996-2006 is estimated at 25 000 tonnes with a value of over USD 160 million. During the last decade, an average of 2 928 tonnes of gums and resins have been traded on the domestic and export markets each year, with an average annual revenue of USD 3.3 million. The major buyers of natural gum are UAE (27%), Germany (13%), China (12%), Tunisia, Yemen, Saudi Arabia, Greece and Egypt (MoA, 2004).

Ethiopia produces an estimated 26 000 tonnes of honey per year, the largest output in Africa and the tenth largest in the world, with the vast majority used locally in the making of *tej* a traditional drink. Traditional hives continue as the mainstay of production, which are time consuming to construct and give low yields (Chowdhury *et al.,* 2005).

Bee products, apart from their central role of providing food for the households, are indirectly used for commercial purposes for income earning. Beekeeping generates income for the people through sales of honey and beeswax.

Other economically significant NTFPs include bamboo, which constitute a particularly important construction material in the lowlands, as few alternatives exist. Recently, lowland bamboo (*Oxytenanthera abyssinica*) also began to be utilised for pulp and paper production while highland bamboo (*Yushania alpina*) is more favoured for furniture making and other crafts. No export data are available on bamboo products.

The current process of quality control takes place through the Quality Standards Authority of Ethiopia for honey and beeswax products. On the other hand, for incense and gums the Authority has not developed standards for the products, and there is no international standard either. Quality is therefore identified through agreement between sellers and buyers. However, there is a floor price set by the National Bank of Ethiopia. The objective is to protect the exporters from selling below the International market price. Export of natural gum, beeswax and honey products from 2000-2010 is summarized in Table 28.

Table 28. Export of natural gums, beeswax and honey products for the years 2000-2010 (only even years shown). Source: Ministry of Trade (2010).

Forest product	2000	2002	2004	2006	2008	2010
Incense and natural gum						
Volume in tonnes	2 183	1 544	3 791	3 662	2 480	4 565
Value in 1000 USD	3 416	2 510	5 079	5 661	6 900	12 700
Honey						
Volume in tonnes	1.5	3.0	15.7	15.0	17.0	17.0
Value in USD	2 980	5 980	31 440	30 000	34 000	34 000
Bees Wax						
Volume in tonnes	225	285	525	314	405	400
Value in 1000 USD	382.5	703.0	1 389.0	1 007.9	1 300.1	1 284.0

Forest products which are imported to Ethiopia are sawn wood, wood-based panels, veneer sheets and wood pulp products, printing and writing papers and newsprint. Forest products import from 1999-2009 is shown in Table 29.

Trade in forest ecosystem services (carbon, water, and bio-diversity) has the potential to add new value to the sector. Reducing emissions from deforestation and payment for environmental values could also be traded to be of use for income generation.

Table 29. Forest products import for 1999-2009 (only uneven years shown). Source: Ministry of Trade (2010).

Forest product	1999	2001	2003	2005	2007	2009
Paper and paper board (tonnes)	15 000	100 300	35 900	37 100	53 000	55 000
Newsprint (tonnes)	1 000	5 000	6 000	6 000	7 800	7 500
Writing and printing papers (tonnes)	11 000	8 000	9 000	8 000	11 000	12 000
Sawn wood (m^3)	NA	9 000	6 000	8 000	11 800	9 000

8. Forest royalties and other revenues

8.1 Forest royalties and licences

8.1.1 Structure and amount of forest stumpage and licences

The forestry sector generates revenues from State owned natural and plantation forests in the form of stumpage fees, which vary by tree species, tree diameter at breast height (dbh) and the location of the sale (standing in the forest or at the road side). The charges also varied according to the distance of the forests from the capital Addis Ababa. For example, in the 1990s, a *Podocarpus* tree with a dbh of 40 cm situated 200 km from Addis Ababa had a stumpage charge of USD 5 per m^3 standing in the forest and USD 8 per m^3 delivered by roadside. The stumpage charges for the same tree 470 km from Addis Ababa were USD 4.60 standing and USD 7.60 by the road.

Stumpage charges for different species prior to 1990 are shown in Table 30 and trends in stumpage charges after 1990 for different species are shown in Table 31.

Table 30. Stumpage charges for 1979-1990. Source: Country Report FAO (2001).

Tree species	Stumpage charges (USD per m³)	
	Standing trees	Cut by roadside
Podocarpus falcatus	3.80	6.80
Juniperus excelsa	5.40	8.40
Hagenia abyssinica	7.60	10.60
Olea africana	5.40	8.40
Croton machrostachys	1.20	4.20
Pinus patula	1.00	1.20

There has been a change in the charges, especially after the evaluation of forest product pricing which reviewed the different charges paid. Stumpage charges applied from 1990-1993, from 1993-1995 and from 1995-2000 show different charges for different species.

Table 31. Trends in stumpage charge. Source: Country Report FAO (2001).

Tree species	Stumpage charges (USD per m³)			
	1990-1993	1993-1995	1995-2000	2001-2010
Cupressus lusitanica	-	-	17	70
Podocarpus falcatus	6	20	75	-
Juniperus excelsa	5	17	73	-
Hagenia abyssinica	6	20	80	85

Table 32. Forest royalties/licences/penalties amounts (for plantations and natural forests) during the last five years (USD/m3). Source: Regional Bureaus of Agriculture (2010), Oromia Forest & Wildlife Enterprise (2010).

Type of wood, NWFP and service	2006	2007	2008	2009	2010
Forest plantations					
Lumber	192	218	148	178	195
Transmission poles	7	8	18	17	21
Fuel wood	9	7	10	7	6
Log	11	12	13	9	9
Natural forests					
Incense /gums per quintal	151	142	163	271	289
Licences fees	82	82	82	82	82
Penalties depending on the nature of illegal activity	200	600 1200 1800	600 1200 1800	600 1200 1800	600 1200 1800

In previous years, collection of stumpage fees was the responsibility of the central government and fees used to be collected and deposited in the central treasury. Currently stumpage fees are collected by the existing forest enterprises and deposited in the account opened for this purpose.

Different regional governments have different stumpage fee estimates. There is no uniform stumpage to be paid. It is done through bidding. Forest charges were revised in 1993. Since 1995, each regional state is responsible for setting forest charges and providing permits to use forest products.

For those who are allowed to operate within state forests, permits are required from MoA or the appropriate regional bureau to harvest and transport forest products as well as settle within the forest boundary, graze livestock, hunt, carry tools for tree cutting or keep beehives.

Harvest of forest products from state forests without the necessary permit from the appropriate regional office of agriculture is not allowed. A forest product movement permit is required to transport any forest product within and outside the country. Approval of the ministry or the

regional office of agriculture in the form of a license is needed for any investment activity within a state forest. Fines and penalties can be levied if such forest laws and regulations are not followed. Forest products that are produced illegally are confiscated and sold by the government which is usually by auction.

The forestry officials used to check for licenses and permits and impose charges at check points. Nowadays, the movement of round wood, sawn wood and wood-based panels is not strictly controlled and these checkpoints have been discontinued except in few places in the country. Thus, there is a free movement of forest products and these charges are no longer collected.

It is prohibited for private individuals to cut *Cordia africana*, *Hagenia abyssinica*, *Juniperus procera* and *Podocarpus falcatus* in both state and private forests, as they are considered as endangered indigenous species. Utilising products from within a state forest without a permit is punishable by between one and five year's imprisonment as well as a fine of USD 1000.

Most forestry activities, such as charcoal production and wood fuel cutting and sale, are conducted informally without any license. Instead of obtaining licenses, or pay the required fee, the majority evade payment. Charcoal trade is characterised by weak law enforcement. There is a low capacity to enforce regulations and effectively collect revenue. Most charcoal is harvested without any payment made for the wood raw material and licenses and levies are largely evaded. About 2.3 million quintals (one quintal is estimated at 100 kg) of charcoal is used every year in Ethiopia with an estimated value of USD 20.9 million that the forestry sector lost as revenue.

Stumpage received by wood growers was considered not to have constituted the true cost of production. Various studies indicated that if stumpage had followed true forest production cost, the selling prices of forest products such as lumber would have been double what it is today long ago. Some of the forest charges applied from 1979 to 1990 indicated the variation in charges based on the type of species and the location of the product.

Forests are owned by the Regional State Governments after the decentralisation of 1991. All regional governments collect revenues from production in public forests. Forest charges fixed by auction are levied during the production of raw material from the forest. Revenues are collected from charges and these charges are based on the volume or value of outputs.

Charges in the form of royalties are also paid on the movement of forest products to processing facilities and markets. Products levied through this process include firewood, industrial round wood, charcoal, sawn wood and bamboo.

Wood fuel charges in the form of royalties are usually based on volume and type of transport used. Industrial round wood charges in the form of royalties are based on the volume of production or number of trees cut with the level of charges varying according to species and quality of wood. Charges are also different based on the type of producer and the scale of production.

Harvesting forest products without written permission from the MoA or the appropriate regional body will result in payment of fines and penalties due to failing to abide to the laws and regulations. Forest products which are illegally harvested are confiscated and sold by the responsible institution.

Fines and penalties are charges paid for breaking forestry laws and regulations. When one is convicted of an offence under the forest laws and regulations, the person may be imprisoned for up to 2-5 years or fined up to USD 1000 depending on his conviction.

Licenses are issued by the Ministry of Trade (MoT) for any applicant for use of forest products. A statement of agreement from the forestry sector is required before the issuance of licenses. They are renewed annually with payment of tax to the MoT.

8.1.2 Suggestions for improvement of forest charges and licences

Forest charges are low and should be revised to reflect the realistic market prices for forest products. They should be set with reference to the existing economic situation so that real market values are charged. Stumpage fees still do not reflect the cost of growing trees and should be based on replacement costs plus an additional amount to cover future development expenditure,

cross-checked with market prices. The low stumpage fees on forest products and the very low penalties for illegal acts do little to discourage the over-exploitation of forest resources.

The fines are low and not high enough to discourage unlawful practices. Instead they encourage illegal activities. The fines should be high enough to make illegal operations unattractive. Weak governance and the failure of the legal system have been identified as one of the constraints to effective forest conservation and management. Capacity to enforce laws is a prerequisite for good governance and avoids poor implementation of policies and laws that have allowed illegal activities.

8.2 Forest concessions/permits

Concessions are given for the production of incense and gum where the resources are abundant. While ownership of the woodlands and shrublands remains with the government, the rights to tap and manage the resource usually are allocated to private companies and small cooperatives. They are allocated with woodland areas which are called concession areas to be harvested over a one year period and in return they pay 20% of the sale price for the incense harvested to the government. An agreement or contract is signed between the government and the concessionaires that will legally identify the relationship between the two parties over the duration of the contract.

The main purpose of the contract is to recognise and legalise the rights and responsibilities of the concession holder and the government in the management of the forest within the concession area. The content of the agreement is dealing with the rights and obligations of the concession holder, contract duration, and forest management planning. The rights and responsibilities of the concession holder are spelled out clearly so as to avoid future complications that may arise. Boundaries of the concession area are also demarcated, which are on average 20 ha.
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8.2.1 Current concessionaires/permit holders

Until 1986, the government-owned Ethiopian natural gum production and marketing enterprise was responsible for all production and marketing. However, gum production and export today involve both the government and private sectors.

Concession owners acquire the products from two sources: collected by hired tappers in the forest concession stands and/or through direct purchase of gum/resins collected by local collectors (farmers/nomads or producer cooperatives). The products are sorted and graded, and finally prepared for shipment. Major natural gum exporting private enterprises are shown in Table 33.

Table 33. Forest concessionaires/permit holders 2009. Source: Survey result (2010).

Name of concessionaire/ permit holder	Type of forest	Concession size, ha	Length of concession/ Permits	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	16 000	One year	20% of sale per quintal
NGPME	Woodland and shrub land	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 land	10 000	One year	20% of sale per quintal

Concessions are allocated through bidding processes. Concessionaires apply for the job through preparation of management plans and indicate their financial capacities to undertake the activities.

Based on the guidelines prepared for the selection of potential concession holders, and criteria set regarding utilization, selection is made and announced.

8.2.2 Monitoring of compliance

The site forest technicians are responsible for demarcating the compartments that are to be harvested from plantation forests. Harvesting will be carried out by the logging section of the enterprise unless the forests are sold to outsiders. The technicians also make follow-up visits to sites to see whether felling regulations and tapping intensities have been followed. The forest technician measures the volume of logs that will be harvested and calculates the charges that should be paid. This report includes information about the logging site, such as the types of logs harvested and the volume of wood removed. The total estimated charges that must be paid will also be reported. The forest administration and finance section of the enterprise check all these reports and then aggregate the information and confirm the payment.

There is a form developed showing the number of logs, their volume, the species/type, and the stumpage price. The form is filled and payment is made in advance. The person to carry out the log transport will take the form to the technician, who in turn checks and ensures they comply with the regulations. Then they transport the logs to the sawmills.

In the case of concessionaires, they are required to submit technical, economic and environmental plans. The technical requirements include the preparation of a forest management plan and annual exploitation plan. The economic requirements include building a processing unit and financial capacity to undertake the activity. They sign contracts and if they fail to comply with the contract, the concession may be withdrawn.

8.2.3. Suggestions for improvement of concessions/permits

The design and contents of the agreements and contracts signed between the government and the concessionaires are described in the introductory paragraph under 8.2 above. If followed, they work reasonably well. One possible improvement might be that forest management plans should predict and outline the manner in which the operations in the concession will influence the sustainability of the woodland resources, including their future productivity. In order to provide concessions, the preparation of management plans that incorporates an annual exploitation plan, and setting out economic and social requirements should be agreed between the two parties.

8.3 Administration of forestry revenue systems

In the current market structure, processed forest products markets are unregulated and the free markets gives rise to many different prices based on wood quality and species type. Forest product prices vary depending on the season, the availability and scarcity of the products, the distance to the market, the quality of the product and the demand for the product. Market prices of many forest products fail to reflect their full economic costs due to the open access to the forests and woodland resources. Setting royalties and taxes was the responsibility of the forestry sector in the past, but there is no more royalty paid nowadays. The process of setting forest charges starts with a survey of the local market prices of forest products. The results of the survey are compiled, analysed and discussed by the staff of the forestry sector. The proposed charges will be reviewed and sent to the board. The board approves the prices of forest products based on the technical guidelines and estimates of the products' value. The technical sector makes recommendations on what the level of forest charges should be. The ultimate responsibility for setting the charges rests with the board.

There has been a revision of forest charges in the last ten years. Some states use auctions to sell standing round wood and use the prices established in the forest charges schedule as reserve prices for these auction.

All forest revenues collected at various levels by the enterprise are deposited in the bank account opened for this purpose by the enterprise. The enterprise is allowed to use the revenue based on the annual plan and expenditures approved by the board. Depending on the amount of profit

gained by the enterprise, an amount will be given to the government which varies with the amount of net profits made.

The board has the overall responsibility for supervising the management of the revenue. The enterprise is responsible for the collection of statistics about the production and utilisation of forest products. This information is used by the Auditor General to compare the amount of revenue generated with the recorded production of forest products.

As noted above, revenue collection is totally decentralised to the forest enterprise and has the right to set and collect all forest charges. Every time forest revenue is collected on behalf of the enterprise, serially numbered official receipts are issued and used. The charges for the forest products are usually paid by cheque to the enterprise, where there is an account for forest revenues. All forest revenues are not used unless they get the approval from the board based on annual plans of branch offices of the enterprise.

In general, forest revenue is collected from the following activities:

- Stumpage prices;
- License fees for the movement of forest products;
- Seedling sales;
- Concession fees for harvesting non wood forest products;
- Sales of illegally cut timber; and,
- Penalties for illegal harvesting.

In order to ensure sustainable forest management, the forest revenue collection system should be revised to guarantee that the forest revenue is reinvested in forest conservation and development. Stumpage prices, and license fees and penalty charges should be raised to control illegal activities in forestry. The stumpage prices should be raised to a level that recovers the tree replacement costs. In addition, forest products pricing should be revised and conducted and monitoring of forest products pricing. In order to reduce corruption among forest guards and others involved, provisions are made that a share of the fines and revenues collected go to the guards as an incentive.

Table 34. Government revenue (USD; rounded to nearest 100 USD) collected from royalties/licences/penalties on wood products and NWFPs and services 1998-2010.
Sources: Regional Bureaus of Agriculture (2010), Oromia Forest & Wildlife Enterprise (2010)

Year	Timber	Poles	NWFPs	Woodfuel	Total
1998	1 475 200		2 339 600	86 300	3 901 100
1999	1 012 200	4 800	2 728 500	78 400	3 823 900
2000	739 600	52 600	3 416 400	25 000	4 233 600
2001	462 500	31 400	3 164 800	13 400	3 672 100
2002	559 300	50 400	2 509 800	17 700	3 137 200
2003	754 200	12 700	4 607 900	20 800	5 395 600
2004	814 300	375 100	5 078 700	48 900	6 317 000
2005	6 132 300	41 700	5 910 600	94 500	12 179 100
2006	1 126 000	47 000	5 661 400	131 800	6 966 200
2007	1 677 700	59 300	5 650 000	196 800	7 583 800
2008	3 770 800	390 200	6 900 000	203 900	11 264 900
2009	4 021 000	1 082 900	9 600 000	448 300	15 152 200
2010	3 135 300	17 300	12 700 000	280 400	16 133 000

9. Processing of produce

9.1 Ownership and types of industries

Sawmilling is the main forest industry in Ethiopia, and the three principal types of primary industrial wood products are sawn-wood, wood-based panels (including plywood, fibreboard, chip board) and paper products. The main product from saw mills is the sawn timber which is used in carpentry, joinery and construction. Sawn wood, both from saw mills and from pit sawing, is by far

the most important industrial wood product in the country. Forest industries are dominated by primary production, with little value adding.

Sawmills are normally characterised by low utilisation capacity and obsolete equipment resulting in low recovery rates and generate large amount of wastes. Most of the mills are old and designed to convert large saw logs of indigenous species. Larger mills dominate the formal timber processing from softwood plantations and are now operating predominantly under the state-owned Oromia Forest and Wildlife Enterprise (OFWE) since 2007. The enterprise manages 22 sawmills including both stationary and mobile sawmills. Few sawmills combine production of sawn timber with the manufacture of furniture and other joinery products.

The total capacity of the sawmills is very low and decreasing, partly due to the depleting raw material base and partly to old and poorly maintained machinery causing frequent breakdowns. The mills can be inactive for months. Most industries use modified tools and equipment, and they mainly produce for the local market.

Products are sold directly to end users such as Government organisations and private contractors, as well as to industries that use sawn wood. Currently, the Enterprise working in plantation forests are progressive since most mobile sawmills are new and in better condition, with an average total annual capacity to produce 45 000 m^3 of timber.

The development of new processing technologies now allows commercial use of small diameter logs with lower quality wood for many higher value products. Despite the ban on timber, many small private mills are operating with portable Chinese sawmills, which can only handle small sized logs. These small and medium forest-based enterprises constitute one of the largest sources of income and employment for the rural poor and account for a large part of the total harvest from forests. According to the CSA (2004), the 169 public and private forest enterprises currently employ 6% of the industrial work force of Ethiopia.

The second category of forest industries is the ***wood based panel*** sector that consists of veneer and plywood, chip boards, and fibreboard industries.

There are seven chip board factories, one in Awassa, two in Addis Alem three around Addis Ababa and one in the Tigray region. All are big with an average capacity of 150 m^3 per day. The chip board factory of Addis Ababa has the capacity to produce up to 7 000 m^3 per year. The Awassa chip board has a capacity of 140 m^3 per day, and the chip board factory in Mychew has a capacity of 70 000 m^3 per year. The capacity for each is indicated in Table 35.

There are three paper producing industries which use imported pulp and waste paper as raw material. The average production has been 17,000 metric tonnes per annum. The main products produced include writing, printing and stationary papers; sanitary tissues, packaging and wrapping paper and paper boards. There is a plan to establish three paper mills in Ethiopia by Land and Sea Development private limited company.

Table 35. Current and potential capacity of forest industries in m^3. Source: Survey result of 2010 and Oromia Forest & Wildlife Enterprise (2010).

No	Owner	Forest industry	Current capacity (m^3)	Potential capacity (m^3)	Integration with forest plantations
1	OFWE	Dolo Mena sawmill	1 500	3 500	Yes
2	OFWE	Tiro Boter Becho sawmill	1 500	3 000	Yes
3	OFWE	Gilgel Gibe sawmill	1 500	1 500	Yes
4	OFWE	Sole sawmill	1 500	1 500	Yes
5	Private	Wanza sawmill	2 000	3 000	No
6	OFWE	Jigessa sawmill	1 500	2 000	Yes
7	OFWE	Ambo sawmill	1 200	2 000	Yes
8	OFWE	Gefere sawmill	1 500	1 500	Yes
9	OFWE	Etero sawmill	1 500	1 500	Yes
10	OFWE	Elubabor Becho sawmill	1 500	1 500	Yes
11	OFWE	Guji sawmills	1 500	1 500	Yes

12	OFWE	Din Din sawmill	1 500	2 000	Yes
13	OFWE	Kibre Mengist sawmill	1 500	1 500	Yes
14	OFWE	Wadera sawmill	1 500	1 500	Yes
15	OFWE	Sheger Sawmill (2)	1 300	1 500	Yes
16	Private	Seyoum Biadigilign	1 500	1 500	No
17	Private	Asfaw Getahun sawmill	1 500	1 500	No
18	Private	Abdul Kadir mobile sawmill	1 500	2 000	No
19	Private	Yekatit Paper mill (1)	1 300	4 000	No
20	Private	Ply wood factory	2 000	2 000	No
21	Private	Mychew Chip board factory	70 000	80 000	Yes
22	OFWE	Chip Board factory	7 000	7 000	No
23	OFWE	Mobile Sawmills (eleven)	19 000	30 000	Yes

Note: OSFWE is the state-owned Oromia Forest and Wildlife Enterprise

9.2 Raw material supply and quality

Raw material supply has not been a problem for the forest enterprise since 2007 after the integration of saw mills with plantation forests. Most logs from plantation forests are sawn by mobile sawmills. Despite this, the quality of plantation logs is very low mainly due to past management practices which constrained financial resources since the sector was not allowed to utilise revenue for forest management.

An open tendering system is used in the process of raw material supply to private saw mills. The private small and medium forestry enterprises (SMFEs) purchase timber through legal channels, partly as they have to rely on these woodlots and logs from private farmland. Much of the timber trade originating from natural forests is illegal.

There is also a growing volume of imported timber on the market, which the government has identified as a means to offset the pressure on domestic forests. Due to trade liberalisation, wood products are now imported into the country, mainly from Australia, to be further value added by the existing mills.

9.3 Constraints facing the sub-sector

The main constraint facing the sub-sector is poor technology of the old and out-dated industries. Very few forest industries have secondary processing units. Most forest industries require rehabilitation, and a systematic study of the rehabilitation needs is urgently required. This would help to evaluate the processing units in the areas of performance and technical capacity, and would also help to decide which wood processing units will be closed and which are ready for rehabilitation.

Currently, the planning, administration and management of industrial forest development and wood processing plants are dealt with separately, except in the new established Oromia Forest & Wildlife Enterprise. This separation of management and administration has affected both the industry and the forest development sectors.

9.4 Potential for future investment

Currently, there are two enterprises, one in the Oromia and one in the Amhara regional states, which will positively impact forest industry developments in the country. This will create conducive environments for the integration of plantations with wood processing plants. The institutional changes involving the establishment of forest enterprises that integrate forest development and utilisation, and with financial autonomy given to the enterprises, will, hopefully, improve the future potential for investment in forest industries.

There is also the opportunity to improve technology used and replace outdated old mills by new ones. There is a potential to improve the existing small and medium forest enterprises regarding their access to raw materials and capital, and building the capacity of the unskilled labour in the enterprises. The existing forest enterprises have plans to establish three new sawmills - one each

in Illubabor, Jimma and Wolega. In the new enterprise to be established in the Amhara Regional State, two new sawmills are planned to be established, one in Debre Markos and another in Kombolcha. There is enough raw material supply for these newly established, or planned, sawmills.

The future plan is to integrate sawmill industries with plantation forests and there are already new nurseries established to produce seedlings and plants so that raw material supply will not be a problem. The basis for computing the potential capacity has taken into consideration the issue of expansion of forest plantations to provide raw material supply, the decline in natural forests and the current status of the old forest based industries, which lack spare parts.

The tentative result of the survey and information from the Oromia Forest & Wildlife Enterprise Office, indicates that the total sawmill capacity will decline marginally from c. 45 000 m³ per year currently to c. 35 000 m³ in 2015, and raise again to c. 41 000 m³ in 2025. Likewise, the current capacity of chip board and plywood production of c. 107 000 m³ will go down to c. 90 000 m³ in 2025. These are naturally very uncertain figures and with determined investments in better machinery they can be significantly improved.

10. Socio-economic and environmental contributions of forests

10.1 Income generation

GDP calculations do not take into account the value of forest products that are traded informally. Neither do they take into account the positive influence of forests on agricultural production. The official GDP figures used therefore do not reflect the true economic importance of the forest sector in the national economy.

Forests provide a wide range of economic and social benefits. These include contributions to the overall economy such as employment, trade of forest products, watershed management and climate change. Economic benefits include income from employment in the sector, the value of the production of goods and services from forests, energy supplies and trade.

The contribution of forests and woodlands to national economies through the production of gums and incense, medicinal plants, honey and beeswax is quite considerable (Table 36). They are also central to the livelihood systems of millions of rural poor providing them with a wide range of goods and services, including wood fuel and charcoal, NTFPs, medicines, and timber resources.

Table 36. Income from industrial forest plantations, natural forest management, processing industries and services for 2009. Source: Regional Bureaus of Agriculture (2010), OFWE (2010)

Sub-sector	Income in 1000 USD
Forest plantations	6 078
Natural forest management	
Gums and incense	9 600
Honey	66 700
Beeswax	19 840
Bamboo	5 500
Spices	2 700
Forest industries	3 000
Environmental services	
Climate regulation from 4 million ha of natural forests	892 000
Water regulation	24 000

10.1.1 Current income

Income is generated from the sale of wood products from plantation forests, natural forests, forest industries and sale of NTFPs. Incomes are summarised for 1999-2009 in Table 37. If proper monitoring and management had been in place, more income could have been generated.

Table 37. Income in 1000 USD from industrial forest plantations, natural forest management (no logging in natural forests after 2001), processing industries and NTFPs 1999-2009 (only uneven years shown). Source: OFWE (2010). MoT (2010)

Year	Plantation forests	Natural forests	Forest industries *	NWFPs
1999	1 095	735	3 780	2 728
2001	507		3 466	3 165
2003	788		2 466	4 608
2005	6 269		2 881	5 911
2007	1 934		2 968	5 650
2009	5 552		3 000	9 600

**Income from sale of paper, fiber board, particleboard and sawn wood*

10.1.2 Potential for income generation

Based on the supply projections from plantation forests made in chapter 7, potential income is projected with estimated prices for wood fuel and industrial wood products. For natural forests, incomes from NTFPs sale is taken from the supply projection made in chapter 7. The estimated potential income is shown in Table 38.

Table 38. Potential income from industrial forest plantations, natural forest management and processing industries (2015, 2020, 2025, and 2030). Expert estimation.

Sub-sector	Potential income in 1000 USD			
	2015	2020	2025	2030
Forest plantations	14 092	15 345	16 811	18 080
Natural forest management	13 200	26 400	52 800	105 600
Forest industries	4 000	4 200	4 400	4 600

10.2 Employment

10.2.1 Current employment

Most forestry operations are undertaken in rural areas, and a large number of labourers are required for operations in forest nurseries, afforestation and plantation silvicultural and logging work, as well as construction and maintenance of roads.

Fuelwood and charcoal production contribute the largest share of employment in the forest sector, estimated at 50 % of the total. Afforestation work, on the other hand, contributes c. 34 % and forest industries a mere 1 % of total employment (EFAP, 1994).

Rural poor profit from forestry through employment in the collection, production, transport and sale of firewood and charcoal. A wood energy survey conducted in 1996/97 indicated that over 230 000 tones of charcoal are used every year in Ethiopia, of which 70% is in towns. From this, it is possible to estimate the number of people employed in the production, transportation and selling of these resources. It is also projected that charcoal consumption and firewood will increase indicating more informal employment in the production and selling of these resources. Employment is also provided in the wood based industries, with c. 10 000 people employed (Table 39).

Table 39. Employment in industrial forest plantations, natural forest management, processing industries and services for 2009. Expert estimation.

Sub-sector	No. of people employed
Forest plantations	187 900
Natural forest management	
Charcoal and fuelwood production	276 300
Traditional healers	80 000
Incense and natural gum	25 000
Forest industries	5 500
Forest training institutions	1 000
Government forestry employment	8 000
Total	**552 600**

The number of people employed as causal labourers for plantation establishment, assuming an average annual plantation establishment of 3 700 ha, is estimated at c. 187 900 per year. About 8 000 people earn their living from formal sector forest-based employment. Small scale forest product processing is also one of the largest sources of rural non-farm employment and, unlike formal sector employment, appears to be increasing. Most of these jobs provide seasonal supplemental income. Large scale forest plantations often generate high employment during the tree establishment season.

Employment opportunities have been generated throughout the year by the *Boswellia* products sector that include tapping and collection, transportation, processing (cleaning, sorting and grading), and marketing of frankincense and guarding of storage facilities (Wubalem *et al.,* 2002). At household level, studies carried out in one region of Ethiopia have shown that the gum resins business provides employment and incomes which are about three times higher than the contribution of crop farming (Kindeya, 2003; Mulugeta *et. al.,* 2003). Incense collection offers off-farm employment for many farmers. In Western Tigray alone, annually about 7 000 seasonal labourers are employed.

According to the CSA (2004), the 169 public and private forest enterprises currently employ 6% of the industrial work force of Ethiopia. There are also thousands of construction pole and charcoal sellers in the city of Addis Ababa alone. On average, 26 people are employed for one mobile sawmill, the total employment generated by the existing mobile sawmills in Ethiopia is 500 people per annum without considering the labour involved in logging operation.

Fuelwood collection and sale constitute the single largest source of forestry employment. A minimum of 50 000 women and children are engaged in fuelwood collection around Addis Ababa only. Fuelwood and charcoal collection is estimated to employ 175 000 people per annum. The gum and incense sub-sector is reported to use 20 000-30 000 seasonal workers engaged in tapping and grading per year, while as many as 80 000 traditional healers are assumed to exist in the country.

PFM as one form of forest management is reported to benefit many local people. For example, direct beneficiaries through employment in the Bonga forest are estimated at 110 000 and 14 000 in the Chilimo forest.

10.2.2 Potential for employment creation

Forestry has a high potential for employment generation in Africa since it has a low capital requirement. Labour and land, which are not limiting in Ethiopia, are the key inputs for the production of wood and NTFPs. There is both formal and informal employment, with the informal sector dominating. The employment in the informal sector is expected to grow, which will result in resource depletion. Based on the assumption by EFAP (1994), 1.8% of the total employment in Ethiopia was estimated to be in the forestry sector, whereas the estimation made for the national work force estimated that 1.5% of the employment is in the forestry sector. The potential employment of forestry until 2030 is estimated as shown in Table 40.

Table 40. Potential employment in industrial forest plantations, natural forest management and processing industries (2015, 2020, 2025, and 2030).

Sub-sector	Potential employment (rounded to nearest 100)			
	2015	2020	2025	2030
Forest plantation work	214 400	209 500	298 500	353 600
Forest industries	5 900	6 800	7 700	8 900
Charcoal, fire wood and NWFPs	295 400	338 200	387 300	443 400
Traditional healers	80 000	80 000	80 000	80 000
Formal employment	1 000	1 000	1 000	1 000
Total	**590 800**	**676 500**	**774 600**	**886 900**

NTFPs have a major role in rural employment mostly in the informal sector. In densely forested areas, 10% of the rural population is involved in such employment.

10.3 Plantations in forest conservation

In Ethiopia, forest plantations mainly consist of different species of *Eucalyptus,* which cover over 50% of the total forest plantation area. Most plantation forests are monocultures and are, thus, not very rich in bio-diversity. However, investigations that have been made on the ecology of plantations and their management by Teketay and Feyera (2001), indicated that forest plantations could foster the regeneration of secondary natural vegetation. In other words, with growing age, many species of the natural vegetation re-invades the plantations, and when a plantation is cleared and not replaced by a new plantation, the natural vegetation will re-establish itself quite quickly.

There is a perceived notion regarding eucalypts that they dry up streams and wetlands and reduce crop productivity when planted close to agricultural crops. Despite these relations, farmers and the government plantations seem less concerned about the ecological and environmental impacts of the dominant tree species. Based on research results it appears as if eucalypts are efficient water users. For example, it was reported that in the Oromia region, eucalyptus plantations could produce 46.6 m^3/ha/year without depleting water reserves compared to 16.4, 16 and 12.4 m^3/ha/year biomass production for the conifers, acacias and other broadleaved species, respectively. This shows that for the same amount of water consumed, eucalyptus produce more biomass, which is economically profitable (Tesfaye, 2006).

The contributions of forests to addressing climate change, as well as the impact of climate change on forests, have been well recognised. There is also research underway to show the carbon sequestration values of plantation forests in Ethiopia. In an attempt to provide a better insight into the opportunities emerging from carbon financing, Tesfaye (2007) calculated the value of carbon sequestration for the Arsi forest to be USD 8.5 million per year, and argued that this value was higher than that of any other land use systems.

11. Conclusions and way forward

11.1 Conclusions

There is no reliable and up to date information on forest and tree resources regarding their areas, locations, species, wood volumes and growth. The status and trends of forest industries is not well documented.

Despite the increase in the area of forest plantations, there is no silvicultural operations that have followed the original plans and many plantations are now over-mature and of poor quality, mainly due to financial problems to undertake maintenance operation. They are fragmented, except in the current forest enterprises, mainly due to the competition for land with other uses.

In spite of these constraints, future forest industry developments and supply of wood will depend to a significant degree on plantation forests and on trees outside forests. Industries produce a wide range of forest products that include round wood, wood fuel and wood-based panels.

There is an expanding domestic market for poles, fuelwood, paper and wood based panel products. There is, therefore, a comparative advantage for developing short rotation fast-growing plantations on farm and in small woodlots.

The continued deforestation and forest degradation indicate that conventional approaches to managing the forests of Ethiopia have not been able to guarantee the conservation of these resources. All natural forests and the extensive industrial forest plantations remain under the overall control of the government. The existing PFM practice can only be effective if supported by an effective and enforced legal framework, and tangible benefits to, and capacity building of, stakeholders. Ownership rights must be legally recognised and assisted by building capacity of the beneficiaries to plan and implement forest management plans, to assess available resources, and to develop marketing information and strategies.

Incomes generated from forest use fees and harvesting activities are not reinvested into forest management except in one enterprise. In all regions, the money generated does not go directly to the forest sector but first becomes part of the national income and then allocated to the forestry sector as part of annual budgetary process.

The financial resources from public domestic financing remain inadequate for supporting forest development and conservation.

Most forestry activities continue to depend on external financial assistance instead of developing economically self sustaining entities. Domestic public financing is the major source of financing for forestry activities with ODA gradually declining in importance. A shortage of financial resources is one of the main factors limiting forest plantation development. The country has not yet benefited from the new market CDM and voluntary carbon markets.

Private sector investment in forestry has been limited to extractive industries and export of NTFPs. Most forestry activities are undertaken in the informal sector. Charcoal production, collection of fuel wood and trade of NTFPs are informally done and have aggravated resource degradation.

Demand for wood will continue to increase for the foreseeable future, due to continued increases in population and income. Natural forest resources have declined and this trend is expected to continue in the future. Forest plantations will alleviate potential future wood supply.

Sustainable NTFP harvesting and commercialisation contribute to poverty alleviation and livelihoods for people living in and around forests. There are also high export opportunities and potentials for the NTFPs. There is an increased pressure on the NTFP resource base due to higher demands and unsustainable harvesting methods.

Natural forests are coming to be valued less for their potential production of industrial round wood and more for their ecosystem services such as watershed protection and bio-diversity conservation. It is agreed to protect forests from logging and commercial exploitation. Due to the increasing emphasis on forest conservation, the production of industrial wood from natural forests has gradually declined over the last two decades. On the other hand, production of industrial wood from trees outside forests and industrial plantations has increased.

Small scale forest product processing is one of the largest sources of rural non-farm employment and contributes to poverty alleviation and sustainable livelihoods.

Currently, the planning, administration and management of industrial forest plantations and wood processing plants are dealt with separately, except in the newly established Oromia Forest & Wildlife Enterprise. The separation of management and administration has affected both the industry and the forest plantation sectors. The sector has financial problems which lead to inefficiency in management.

The wood based industries are dominated by a low level of technology, obsolete equipment and inefficiency. They are of low productivity and wasteful. They use modified tools and equipment and have difficulties obtaining spare parts. However, there are more mobile sawmills dominating the forest enterprise which is encouraging and has increased the supply from plantation forests. The

establishment of the forest enterprise has created opportunities to link plantation forests to forest industries, links which need scaling-up.

11.2 Way forward

Organising and documenting reliable information on forest resources of the country through data base establishment is helpful for improving and planning the management of forest resources and monitoring changes.

Limit the involvement of the public sector in forestry and enhance the involvement of the private sector in forest plantations. There is a need to avail land for the private sector to involve in industrial forest plantations and implement a land use policy to settle the competing claims on land for alternative uses. Identification of areas for expanded industrial forest plantation establishment is crucial, as is finding ways of privatising public sector plantations and developing partnership between public and private sector on forest development in the country.

Effective forest revenue systems should be in place, and revenues generated from all marketed forest goods and services should be reinvested in the sector for the sustainable production of forest goods and services. There is a need to develop systems that allow the reuse of revenues generated from the conservation and development of forests into further development of the forest resources and to create local fund raising mechanisms to establish forestry assets.

Planning and implementing out-grower schemes to encourage farmers to plant trees will entail provision of financial and technical support to the local farmers. Establishment of private large scale forest plantations is necessary for the implementation of out-grower schemes.

The importance of NTFPs to the economy of rural households should be highlighted and integrated in all food security programmes. There is a need to emphasise the importance of NTFPs and their commercialisation at the household and community levels for income generation and food security. Challenges that need to be resolved to enable rural communities to take advantage of NTFPs development are, among others, i) up-grading of local processing of gum and other NTFPs through importation of technology; ii) value addition and improved marketing strategies to improve the revenue of the local producers; iii) reduce post harvest loss through better storage; and, iv) create production, processing and marketing groups. Develop an enabling environment that ensures market access and sustainable use as well as household capacity for both product development and marketing.

Most forest industries require rehabilitation. There is a need for a wood industries rehabilitation study. This would help to evaluate the processing units in the area of performance and technical capacity, and also help to decide which wood processing units ought to be closed and which are ready for rehabilitation.

Institutional changes that involve the establishment of forest enterprises incorporating forest development and wood utilisation, and which are given financial autonomy, are commendable. It will create a linkage of plantations to the wood processing industries. It should be promoted also in other regional states in the country.

There are opportunities to improve technology and replace outdated old mills by new ones. There is also the potential to improve existing small and medium forest enterprises regarding their access to raw materials and capital, and to build the capacity of their unskilled labour forces.

There is enough raw material supply for the newly established sawmills. The future plan is to integrate sawmill industries with plantation forests and there are already new nurseries established to produce seedlings and plants so that raw material supply will not be a problem.

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