

Forestry Outlook Studies in Africa (FOSA)



Ethiopia



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This paper has been minimally edited for clarity and style.

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Summary

Ethiopia is largely an agrarian country with over 90% of its population living in rural areas. Of the currently estimated population of 62 million, the subsistence agricultural sector engages nearly 85% of the work force. Agriculture is the cornerstone of the economy contributing about 53% of the GDP and accounts for more than 90% of all exports. The low level of productivity of the agricultural sector, coupled with the recurrent drought has made the country poor with a per capita income of US\$ 106 per annum. The annual growth rate of the GDP has been sluggish averaging about 4.9% in 1994/95 (CSA, 1995).

In an agrarian society like Ethiopia, forestry can play significant role in economic development. The forestry GDP as a proportion of the whole economy and in relation to agriculture has been very low. The share of forestry in the GDP varied between 2% and 2.6% from 1971 to 1985 and declined to 1.9% between 1986 and 1987. The share of forestry in the agricultural GDP varied between 3.8% and 4.8% during 1971-1985 and declined to 3.7% in 1986 and 1987. If direct consumption of commodities such as fuel wood and charcoal and the indirect contributions of forests to watershed management and soil conservation as well as that of forest products utilised in other manufacturing and construction activities are considered in the calculation, the contribution of forestry to the total GDP and agricultural GDP will be much higher amounting to about 10% and more (EARO, 1998).

Forestry's contribution to employment generation is not documented. Most forestry operations are undertaken in rural Ethiopia and a large number of labourers are required for forest nursery operations, afforestation and for the construction and maintenance of roads. This is a major source of income for the rural people. People also profit from forestry employment through firewood, charcoal collection and sales, incense and gum collection. Fuel wood production is by far the largest employment generator accounting for nearly 50% of the total forestry employment, followed by afforestation contributing for about 34%. Forest industry employment amounted to about 2.2% of the total work force in the country and contributed 2.8% to employment in the agricultural sector in 1988/1989 (EFAP, 1992).

The major cause of deforestation is rapid population growth, which leads to an increase in the demand for crop and grazing land, wood for fuel and construction. Lack of viable land use policy and corresponding law also aggravated the rate of deforestation. New settlements in forests are increasing from time to time and hence resulted in the conversion of forested land into agricultural and other land use systems. At present, the few remaining high forests are threatened by pressure from investors who are converting the moist evergreen montane forests into other land use systems such as coffee and tea plantations.

The average volume per hectare for closed high forests is estimated to range from 30-120 m³ per hectare and 5-50 m³ per hectare for open forests. The woodland is estimated to have an average volume of 10-50 m³ per hectare. On the other hand, the annual incremental yield from all available forest is estimated at 14.4 million m³ while the demand is 47.4 million m³ for the year 1992 (EFAP, 1994). Although precise figures are not available, it is estimated that about 24 million m³ of wood is produced annually of which some 10% is used for industrial and building purposes and the remainder for fuel wood and charcoal

There are a number of problems facing the forestry sub-sector. The forest resources have been declining both in size and quality. The high forests which used to cover 16% of the land area in the early 1950s were reduced to 3.6% in the early 1980s and further declined to 2.7% in the early 1990s. The information of MoA (1999) compiled for forest resources assessment 2000 indicated that forests available for wood supply are over 14 million hectares and those not available for wood supply are estimated to cover an area of over 20 million hectares. In general, underlining causes of deforestation are poverty, population growth, poor economic growth and the state of the environment.

The federal and regional governments of Ethiopia recognise the economic and social values of forests and support their conservation and management for sustainable use. However, there is no comprehensive federal policy that covers either land use or forest management. Proclamation No. 94/1994 that was issued to provide for the conservation, development and utilisation of forests is currently serving as the forest policy statement of the country. Despite the fact that the proclamation has been issued six years ago, it did not help much to relieve the pressure from the forests, probably due to the absence of enforcing mechanisms. A formal forest policy is lacking and the frequent restructuring of the sub-sector has led to the discontinuation of planned activities.

The Forestry sub-sector is also confronted by problems which are related to the macro-economic situations and other factors like the reorganisation of the forestry institutional systems. Over the past decades, there have been numerous restructuring of institutions related to forestry. There were separations and re-unification of the sector with agriculture several times. The natural resources sector has been at a level of ministry, vice ministry and at present a team.

Currently, the forestry sector at a federal level has a lower organisational profile in the Ministry of agriculture. Budget allocations and staff resources are often inadequate to monitor forest resources effectively and to ensure sustainable management. The trend towards decentralisation and devolution of forest management responsibilities to the local governments could not be effective due to low capacity of the sector at all levels.

The current capacity of the sector is constrained especially at the regional level due to the absence of an appropriate management structure, the inadequate allocation of budget and the high level of encroachment for expanding agricultural land and illegal settlements.

In order to abate the pace of deforestation and environmental degradation and establish a sustainable forest resource use and development, the Government of Ethiopia has planned to formulate a regional program on forest conservation and development. The program is expected to address the following development objectives:

- Increase the supply of forest products on a sustainable basis, including sawn timber, fuel wood, poles, fodder, and non-timber forest products.
- Increase agricultural production through reduced land degradation and increased soil fertility.
- Conserve forest ecosystems, including genetic and wildlife resources; and
- Improve the welfare of rural communities.

INTRODUCTION

Current status of the forestry sector

Ethiopia is largely an agrarian country with over 90 % of its population living in rural areas. Of the currently estimated population of 62 million, the subsistence agricultural sector engages nearly 85 % of the work force. Agriculture is the corner stone of the economy contributing about 53 % of the GDP and accounts for more than 90% of all exports. The low level of productivity of the agricultural sector, coupled with the recurrent drought has made the country poor with a per capita income of US \$ 106 per annum. The annual growth rate of the GDP has been sluggish averaging about 4.9 % in 1994/95 (CSA, 1995).

In an agrarian society like Ethiopia, forestry can play significant role in economic development. The forestry GDP as a proportion of the whole economy and in relation to agriculture has been very low. The share of forestry in the GDP varied between 2% and 2.6% from 1971 to 1985 and declined to 1.9 % between 1986 and 1987. The share of forestry in the agricultural GDP varied between 3.8% and 4.8% during 1971-1985 and declined to 3.7% in 1986 and 1987. If direct consumption of commodities such as fuel wood and charcoal and the indirect contributions of forests to watershed management and soil conservation as well as that of forest products utilised in other manufacturing and construction activities are considered in the calculation, the contribution of forestry to the total GDP and agricultural GDP will be much higher amounting to about 10% and more. (EARO, 1998)

Forestry's contribution to employment generation is undocumented. Most forestry operations are undertaken in rural Ethiopia and a large number of labourers are required for forest nursery operations, afforestations and for the construction and maintenance of roads. This is a major source of income for the rural people. People also profit from forestry employment through firewood, charcoal collection and sales, incense and gum collection. Fuel wood production is by far the largest employment generator accounting for nearly 50% of the total forestry employment, followed by afforestation contributing for about 34%. Forest industry employment amounted to about 2.2 % of the total work force in the country and contributed 2.8 % to employment in the agricultural sector in 1988/1989 (EFAP,1992)

The major cause of deforestation is the rapid population growth, which leads to an increase in the demand for crop and grazing land, wood for fuel and construction. Lack of viable land use policy and corresponding law also aggravated the rate of deforestation. New settlements in forests are increasing from time to time and hence resulted in the conversion of forested land into agricultural and other land use systems. At present, the few remaining high forests are threatened by pressure from investors who are converting the moist evergreen montane forests into other land use systems such as coffee and tea plantations.

The average volume per hectare for closed high forests is estimated to range from 30-120 m³ per hectare and 5-50 m³ per hectare for open forests. The woodland is estimated to have an average volume of 10-50 m³ per hectare. On the other hand, the annual incremental yield from all available forest is estimated at 14.4 million cubic meters while the demand is 47.4 million cubic meters for the year 1992 (EFAP, 1994)

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The Forestry sub-sector is also confronted by problems which are related to the macro-economic situations and other factors like the reorganization of the forestry institutional systems. Over the past decades, there have been numerous restructuring of institutions related to forestry. There were separations and re-unification of the sector with agriculture several times. The natural resources sector has been at a level of ministry, vice ministry and at present a team.

Currently, the forestry sector at a federal level has a lower organizational profile in the Ministry of agriculture. Budget allocations and staff resources are often inadequate to monitor forest resources effectively and to ensure sustainable management. The trend towards decentralization and devolution of forest management responsibilities to the local governments could not be effective due to low capacity of the sector at all levels.

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- Increase agricultural production through reduced land degradation and increased soil fertility
- Conserve forest ecosystems, including genetic and wildlife resources and
- Improve the welfare of rural communities

Objectives of the study

The objectives of the study are:

- To collect, review and interpret existing information on the status and trends of forestry sector and the factors affecting the development of the sector
- To present a possible path for future development of the forestry sector through the year 2020.
- To survey the demographic, economic and social features and trends in the country with a view to their likely impact on the forest sector.
- To envisage the future direction for the development of the sector

THE CHANGE DRIVERS

2.1 External factors

2.1.1 Population Growth

With a current population of 62 million and growing at a rate of 2.92 % per annum and a land area of 1.1 million square kilometres is characterised by subsistence agriculture and extremely high population growth in the face of declining agricultural productivity.

According to the census of 1984, the population of Ethiopia was 42.2 millions which was growing at 2.95 % per annum (CSA, 1985). By mid 1990, the population was estimated at 50.6 million of which about 89 % lived in rural areas (CSA, 1990). The population in 1994 was 53.5 million which grew to 61.7 million in 1999 of which 85% are rural and 15% are urban(CSA,1999). Based on the projection made by Anders et, al. 2000, the population is expected to increase to 102 million by year 2020. The high population growth is driven by a high fertility rate of about 6 children per year.

The same report indicated that there has been a change in the annual population growth rate from 2.18 % between 1955 and 1960 which increased to 2.43 % between 1975 and 1980. The growth rate then changed to 2.45 % between 1995 and 2000. It is expected to grow to 2.49 % between 2015 and 2020.

In addition, the current population density of 57 persons per square kilometre is expected to increase to 93 persons per square kilometre by the year 2020. The rural population alone is expected to reach over 84 million from the current 54 million. Similarly, the urban population is expected to increase to 34.4 million from the current population of 11.6 million. The structure reflects a high dependency ratio with about 45.4 percent of the total population under the age of 15 years and 3.2 % aged 65 and above (NMSA, 2000).

Ethiopia today has approximately 10.2 million households with about 5.2 persons per households. Urban households are smaller than rural households with a high dependency on agriculture. If all other factors remain unchanged, the remaining forest land are likely to be converted to agricultural land.

The increase in both human and livestock population has led to decreased holdings of arable land. Arable land per capita declined significantly. In 1994/95, about 61 % of farming households cultivated less than one hectare of land. Only 1 % of the farmers own holdings greater than 5 hectares and these are likely to be concentrated in the sparsely populated areas with low agricultural potential.

The increase both in the rural and urban population means that there will be more pressure both on forest and agricultural lands. This also means an increase in the demand for forest products. As a result, deforestation will continue and all the positive functions of forests will disappear. The increase in urbanization also calls for more wood for construction. Unless appropriate forest policy and existing environmental policy are in place and effective, these trend will continue unabated.

If all other factors remain unchanged, the remaining forest land is likely to be converted to agricultural land.

The forest area per capita is decreasing which will reduce the services rendered by the forests. Unless the technologies used result in increasing agricultural productivity, the pressure on forests will steadily increase. There will be a decreasing forest-population ratio in the years to come.

2.1.2 Economic Growth

Ethiopia is one of the least developed countries in the world. The gross domestic product (GDP) in 1997 was USD 6,181 million at market prices and exchange rate. GDP with baseline scenario, at high growth scenario and low growth scenario is as shown in Table 1 (NMSA, 2000).

Table 1. GDP for baseline, high growth and low growth scenarios

Year	GDP US Mil. Dollars (A.)	GDP US Mil. Dollars (B)	GDP US Mil. Dollars (C).
1997	6,381	6,381	6,387
2000	6,211	6,713	6,245
2005	5,937	7,304	6,024
2010	5,676	7,948	5,811
2015	5,426	8,648	5,606
2020	5,187	9,411	5,407

The country's economy is heavily dependent on agriculture for generating employment, income and foreign exchange. The dominant sectors and their contribution to GDP in 1994 were 49.7% for agriculture 11.2% for industry and 39.1% for services (NMSA, 2000).

Ethiopia has been restructured from a unitary and highly centralized state into a federal one whereby the regional administrations are entitled to plan and execute their own development activities. The economic aspects of these policies stress the liberalization of the economy to become market-oriented. The previous centralized economic planning and decision making, which gave total authority on the economy to the state has been abolished.

The decentralization and devolution process that Ethiopia has undergone in the last few years has resulted in new political and administrative institutions. The introduction of a federal system has changed the balance of power in favour of the regional states, which have the legislative, executive and judicial powers

The poor performance of the economy over the last two decades demonstrated itself through declining rates of economic growth. The annual average GDP growth rate ranged from -5.2 in 1992 to 4.9 in 1993. The average growth rate in GDP from 1990 to 1997 is - 0.9. The annual growth rate for GDP per capita is estimated at -2.6 % and the average GDP per capita is estimated at \$ 106 (Anders et al, 2000).

Economic growth and agricultural growth are constrained by the deteriorating forest resource base in particular and the environment in general. In addition to the degradation of forests, the most pressing environmental problems are land degradation, including soil erosion as well as the loss of soil fertility and bio-diversity.

The availability of foreign exchange is one of the major requirements for an increase in GDP which is limited by the decline in productivity of the agriculture sector and a high rate of population growth. The low rate of growth in the agriculture sector is aggravated by inappropriate land use practices, which focus on extensive land use. In Ethiopia, the major export commodity is coffee, which on average accounts for 65% of the foreign currency earnings. In an attempt to increase foreign exchange earnings, the government opted to increase the area under coffee through clearing of forests in the south-western part of the country.

The industrial sector is not much better than the agriculture sector. It did not show growth and less labour is absorbed by the sector. The shift of labour employment from the agriculture to the industrial sector is not substantial showing the poor performance of the economy.

An estimated 50 % of the population lives below the absolute poverty line. More than 13 million people living in the rural areas are classified as food insecure who are unable to meet their subsistence requirements even in years of normal rainfall. The economically active rural population was estimated to have grown by more than 3 percent per annum between 1985 and 1995. Around 550,000 persons were added to the labour force each year. The absorption of such a large labour force into productive employment has remained one of the major challenges for the government.

The central concern is the widespread poverty which is mainly determined by poor performance of the economy. Declining standard of livelihood of the farming communities and their close dependence on forests and woodlands have led to clearing for subsistence farming, cutting of trees for fuel wood and charcoal production both for consumption and sale, construction

material and over-grazing. High population growth is a reflection of the incidence of poverty and is, at the same time, a key factor in the accelerating deterioration of the natural resource base particularly, forests. Environmental degradation, in turn, severely constrains production and productivity of the agricultural sector and, therefore, the growth of the overall economy.

With population increasing faster than the economy, the per capita income declined, and this, in turn has adverse effect on forests.

This means that the population growth in the agricultural sector is high which led to an increase in the ratio of population to land, causing overgrazing, deforestation, environmental degradation and reduction in agricultural productivity.

2.1.3 Development in the Agriculture Sector

Socio-economically, agriculture at subsistence level is the mainstay of the economy and contributes 53 % of the GDP, 90% of the export earning and 85% of the employment and livelihood. Because of the importance of agriculture for the overall economy of the country, and its particular importance to the livelihoods of the bulk of the rural poor, the government has based its long term development strategy on Agriculture Development Led Industrialisation (ADLI). This strategy views agriculture as the primary stimulus to generate employment and income for the poor.

The strategy relies on promoting small scale crop and livestock production, intensification and diversification of farm enterprises, strengthening rural institutions, enhancing the availability of rural credit, grass root participation and creating community awareness in development.

Over the past many years the agricultural sector of Ethiopia showed a very low growth rate. Total food production ranged between 5.05 million metric tons (1985) and 10 million metric tons (1996). The overall food production showed a trend of steady increase followed by a trend of decrease (1991-1994) (FDRE, 1996).

According to the Land Use Planning and Regulatory Team of the MoA, about 66 % of the land area is potentially arable. Despite the big potential, only less than 20 % or an estimated 16 million hectares is presently under crops. About 20,000 to 30,000 hectares of crop land is abandoned annually because cropping can no longer be supported on the highly degraded areas.

The highlands (above 1500m above sea level) which amount to about 44% of the highland mass. are the greatest economic asset of the country. They shelter about 88 % of the total population and account for over 90% of the economic activity, including about 95% of the cultivated lands and 67% of the livestock population. Close to 60% of the highlands exhibits slopes in excess of 30%.

The country has a significant potential for irrigation. An estimated 3.6 million hectares of land area is irrigable from surface water alone. Agriculture which is dominated by smallholder peasant agriculture accounts for more than 95% of the total food production. These sector is dependent on natural rainfall and traditional farming methods with a very limited use of improved technologies. The food production trend is very much correlated with the rainfall pattern. Land degradation is a constraint affecting improvements in agricultural production and

hence food security for the population. Total crop production on private peasant holdings was 25% below the 1996/97 and 10% below the 1994/95 levels (CSA, 1997/98).

The performance of the agricultural sector has been poor. Its annual growth rate for the past 20 years has never exceeded 2% while the population growth rate is now about 2.9 % per year. Agriculture registered negative growth rates in 1991/92 (-2.7%), 1993/94 (-3.6%), and 1997/98 (-11.4%) while during the same period population grew at an annual rate of 3 % (DPPC, 2000).

According to the current estimate of the Federal Democratic Republic of Ethiopia, 52% of the total population is thought to be food insecure or below the poverty line (FDRE, 1996).

The Government of Ethiopia has drafted a food security strategy for the country in November 1996 to increase food production through the diffusion of simple technology packages within small holder institution in areas of reliable rainfall. The extension package includes improved seeds, fertilizers and better crop husbandry methods. Livestock development is also a high priority of the Government through the intensification of small holder dairy farming.

Intensification of agricultural production through the use of fertilizer, improved seeds and chemicals can have a favourable impact on labour absorption.

In the future, the availability of agricultural land per capita is likely to decrease which will result a continued and increased pressure on rural resources including the remaining forests and woodlands unless improvement in agricultural productivity is made through intensification of agricultural lands. The anticipated growth in agriculture would come from opening up new lands for cultivation through expanded irrigation in low lying areas. Other strategies also include marketing infrastructure, promotion of irrigation etc. which all aim at increasing agricultural production.

2.1.4 Change in Energy Use and Their Implications on Forest Resources

The energy sector remains heavily dependent on wood for fuel. Despite the poor documentation on the production and consumption of wood fuel (EFAP, 1994) estimated that wood provided 78% while dung and crop residues providing 16% of the energy required. However, national figures conceal considerable regional and local variation in both supply and consumption patterns. This could be due to the varying fuel wood prices and costs of supplying alternative energy sources which also have large influence on the consumption pattern and the level of biomass consumption.

Even though per capita energy consumption is among the lowest in the world, the gap between sustainable fuelwood supply and demand is constantly widening. The current fuelwood deficit is estimated to be about 47 million m³. The demand of households for forest products in many areas exceeds by far the annual incremental yield from the existing forest resources.

The importance of woody biomass energy in the rural sector is unlikely to diminish in the foreseeable future, since it will be difficult to provide supplies of modern energy to most of the rural areas.

The fuel wood demand and supply projection made by EFAP (1994) indicates that the current demand for fuel wood is 58 million m³ whereas the supply is 11 million m³. The same projection

for fuel wood for the year 2008 indicated a supply of 9.8 million cubic meters against a demand of 74.9 million cubic meters showing a deficit of 65 million m³ of wood. The projection made for the year 2020 indicated that the demand will reach to 100 million m³ against a supply projection of 7.7 million m³ envisaging a deficit of 92.3 million m³.

The major user of energy is the household, accounting for 89% of the overall energy consumption of the country. The consumption in energy is directly correlated with the size of population and with the availability of bio-mass. There is a considerable variation in the consumption of modern energy which is a function of the degree of urbanization. In Ethiopia, energy expenditure constitutes a significant portion of the total expenditure of households. The estimated energy consumption is 2.1 kg of wood fuel equivalent per person per day.

Statistics show that both rural and urban demand for wood energy has increased and is expected to increase due to the growing populations and macro-economic changes. Use of fuel wood has increased as an indirect result of the removal of all subsidies since all alternative sources of energy are based on subsidized prices which reversed the progress made in reducing pressures on the natural forests. Today many people have been forced to revert to wood energy for their domestic needs. The recent tariff increase for electricity have a dramatic effects on the natural resources base where by many consumers of electricity have switched back from the use of electricity to biomass fuels to meet the cooking requirements, thereby contributing to the diminishing forest cover.

The shortfall between available supply and actual demand of wood fuel is usually met through the use of dung and agricultural residues, but at the cost of agricultural productivity. The subsequent use of these substitute fuels competes with their use as organic fertilizer, and consequently exerts pressure on the agricultural sector where sustainable agricultural production could be threatened.

Besides the long term measures to enhance the supply of fuel wood, the pressure on traditional energy supplies can only be alleviated in the near and medium term by measures that promote the end-use energy efficiency, increase the supply of woody biomass resources through the involvement of the individual farmers in planting trees in farm forestry.

2.1.5 Industrial Development and its Implications on Forestry

One of the major reasons for underemployment of labour in rural Ethiopia is the lack of employment opportunities in the non-agricultural sectors. Even though employment in the manufacturing sectors seems to be growing, industrial employment absorbs only a small fraction of the available labour force. The shift of employment from the agricultural to the industrial sector was not substantial which shows the poor performance of the economy. The population growth in the agricultural sector was high. This was not offset by a commensurate growth in the industrial sector. This led to an increase in the ratio of population to land, causing overgrazing, deforestation and reduction in agricultural productivity.

The manufacturing industry is small accounting for some 5 % of GDP and contributing only about fifteen % of export earnings in 1990/93. About 75 % of the value added income from industry came from medium and large scale state owned enterprises, with the remainder contributed by small scale private enterprises (CSE, 1997).

The industry sector strategy has a number of objectives which are related to the forestry sector development. The strategy for industrial development is expected to have a considerable impact in alleviating poverty and reducing pressure on forest resources through various incentives such as, building infrastructure, electric power generation and road network and off-farm employment in the rural sector through the creation of labour intensive technology. Since 1992, industrial production has been peaking up and a number of new factories are being constructed both by the private and public sectors. The opportunity for employment by the industrial sector seems promising in the future.

2.1.6 Development of Communications Infrastructure

Most of the statistical data/information required for forest resources planning, policy formulation, analysis and projection of future situations are either unavailable or partially available in fragmented form. Hence, there is a need to strengthen the existing data base through enhancing the data collection and processing capacity.

2.2 Developments within the forestry sector

2.2.1 Policy and Institutional Changes

Institutional Setup

There have been fundamental changes in the forestry sector as a result of change from centralized to a market economy, decentralization of decision making and regionalization. As a result of these, ministries both at national and regional levels have been restructured which affected forest management

Government forestry administration and management practices have been decentralized and the responsibilities to manage and administer forest resources have been devolved to the regional governments. They have little capacity to shoulder this challenging responsibilities and could not control deforestation.

Institutions which are involved in natural resources conservation and development have had weak interaction and integration, which are necessary for the formulation of effective plans and strategies. Priorities, plans and strategies are formulated independently within the different sectors and are often conflicting.

It is the absence of a common vision on the role of forests in rural development which inhibits the integration of different stakeholders.

There is a need to conduct the valuation of forests and its impacts on key policy issues such as poverty reduction, food security and income generation. In addition, the capacity of national and local level institutions be improved and strengthened.

Policy Environment

The forestry policy which is at a draft stage sets out the following objectives:

- Satisfying the demand for forest products

- Protecting and conserving genetic resources in general and forest resources in particular, and
- Reducing soil erosion and protecting soil fertility thereby increasing agricultural production.

The policy also encourages the development of forests by individuals, organizations and government and the designation of protected and productive forests. It also emphasises the security of ownership of forest products to the developers and the importance of protecting the forests both from man-made and natural causes.

Ethiopia is signatory to conventions on biological diversity, climate change and combating desertification that have direct relevance to the forest resources conservation and development. It has established the Environmental Protection Authority and enacted a national environmental policy and national biodiversity conservation strategies and policies and initiated the same at the regional levels. Environmental protection and biodiversity conservation are high in the development agendas of the country. In view of the progressive efforts underway towards the sustainable use and development of the biological resources, an urgent national action has been taken by the Government which was realized through the formulation and approval of a well defined National Policy on Bio-diversity Conservation and Research.

In addition, forestry operations are on the process of privatisation. The development of participatory management systems, in which local communities play an important role through joint forest management has gained acceptance. This is one of the new arrangements being tried by many stakeholders including the government through the Ministry of Agriculture. It is expected that the draft policy will be approved in due course.

The expected out puts of the policy include among others:

- Participatory forest management practices in selected forest priority areas in cooperation with foreign agencies.
- Privatisation, devolution and decentralization, and recognition of indigenous peoples rights to forest management which are expected to change the roles of forest administration and management

Understanding the problems of land degradation, and in view of future development perspectives of the country, the government of Ethiopia has developed related policies that encourage and attract private investors in the forestry sector. They encourage the private sector in forestry and related activities by leasing land outside the possession of farmers and give land to individual investors that contribute to the improvement of the environment and the people.

The forestry sector is affected by major international developments following UNCED (1992) which directly or indirectly link conservation, management and sustainable development of forests and trees to sustainable economic development. In line with this, the Ethiopian government has undertaken various initiatives to adapt the national forestry plans, policies to the growing societal need for the development of the protective, productive, environmental and socio-economic roles and functions of forest resources.

Ethiopia has also ratified the Convention on Climate Change and is committed to develop and submit a National Communication that contains an inventory of green house gas emissions for a base year and a strategy to mitigate climate change. The ratification of the Climate Convention clearly signifies the commitment of the government to stabilize the emission of GHGs.

The Government, being cognizant of both the importance of the forestry sub-sector to the national economy as well as the adverse ecological effects that emanate from the processes of deforestation, has taken a number of policy initiatives such as, Conservation Strategy of Ethiopia, Ethiopian Forestry Action Plan, National Action Plan to combat desertification, for the conservation, development and proper utilization of its forest resources. There are programs, plans and strategies that vary in form and content with the objective to ensure the sustainable use and development of forest resources. They all aim at alleviating the problem of forest resources degradation, which are subjected to various pressures such as shifting cultivation, forest fire, and exploitation for fuel wood and clearing for cash crop and farming.

1.2.2 Current Status of Forest Management in Ethiopia

Forestry still suffers from lack of proper management systems for the natural and plantation forests. Cutting permits are issued despite a lack of information about standing volumes within the specific forest.

The general objectives of forest management is to promote the conservation and sustainable use of forest resources to meet local and national needs through encouraging local communities, investors and NGOs to manage, protect and restore forest resources and land, for the benefits of present and future generations

The main objectives of management are to protect and develop the remaining natural forests and woodlands of the country so that they make maximum contributions to soil and watershed protection and conservation of existing ecosystems. At the same time, the forests are managed so that they produce increased volumes of industrial wood, fuel wood, fodder and non-timber forest products to meet the needs of people on a sustained basis. The management objectives also include the increase in the involvement of local people and communities in forest resource management.

Various attempts were made to map the vegetation of the country through the use of remote sensing techniques and estimate the area cover. External factors which contribute to the non-materialization of the efforts were lack of international support and weak political commitment. In addition, involvement of the private sector in forest management planning and implementation is still far from being significant.

a. Management of natural forests

The high forests are managed primarily for protection and conservation while commercial utilization is a secondary objective. In light of the status of the remaining natural high forests and the national overall objectives, the forestry administration at the federal level has classified 58 of the most important high forest areas totalling an estimated area of 2 million hectares as National Forest Priority Areas. Management plans for NFPAs have been under preparation since 1985. Eight such plans have been prepared, and two are being implemented. About half of the

58 identified NFPAs have been delineated and mapped. Demarcation of boundaries has been partly done on some NFPAs. However, they have not been gazetted and this has contributed to the uncontrolled illegal cutting and the encroachment and clearing of forest land for crop production and grazing. Hence, present forest management fails to achieve the protection and conservation objectives of the state.

Over two-third of the high forests are currently classified as heavily disturbed while the balance is classified as slightly disturbed. The estimated annual incremental yields are well below the optimum. Generally, they are under stocked and producing well below capacity. Many NFPAs include forests on steep slopes which should be retained to control soil erosion and /or preserve the natural flora and fauna and should not be exploited. Although the ratio of production to protection /conservation land under the high forest varies significantly from NFPAs to NFPAs, it was decided that 60% of the natural high forests in NFPAs should be dedicated to conservation and protection while the rest for production forests. The growing stock of the natural high forests is being depleted rapidly. Further depletion will be unavoidable as conflicts between the state's conservation objectives and the immediate needs of local people mount.

In the face of the nation's need for wood products and the ultimate loss of its remaining habitats for wildlife and endemic species, the forestry administration both at federal and regional levels are trying to find a system of management that will minimize further destruction of natural forests, balancing protection objectives with production interests of the State and local communities while at the same time preserving ecosystems and genetic resources.

In order to resolve these conflicts of interests over the use of high forests, the forestry administration is now trying to:

- Prepare and implement realistic forest management plans that involve local communities in all process of forest management
- Facilitate private sector development and
- Adopt an integrated approach to forestry sub-sector development.

b. Management of woodlands and bushlands

Wood land and bush lands mainly occur in the pastoral and agro-pastoral zones and are important sources of fuel wood, and construction material for the local communities, production of charcoal for the urban markets and for the collection of non-timber forest products such as gums, incense, myrrh and honey.

The woody biomass of the woodlands and bushlands is being depleted by the spread of sedentary farming, the growth of pastoralist and livestock populations. Open access is the main factor for the decline of the woody biomass in woodlands and bushlands.

c. Management of plantations

Plantations include industrial and peri-urban plantations established and operated by the government as well as community woodlots and catchment/ protection plantations. Peri-urban plantations are treated to supply urban centres with poles and woodfuel while community

woodlots are established and managed by groups of farmers or a community for either protection or production of fuel wood. Catchment and protection plantations are designed to prevent land degradations such as, area closures, planting of steep slopes and areas of badly degraded land. Poor management, encroachment and illegal cutting have reduced the growing stock below the desirable level. These shortcomings are rooted in weakness in the organization and staffing of the forest administration at all levels, and in the lack of funds to support the maintenance of plantations since all royalties are reverted to the central treasury.

The area of forest plantations established for industrial wood supply can not help to compensate for the reduction in production from natural forests mainly due to the nature of the trees planted and poor past management practices

d. Status of minor forest products

The Ethiopian forests provide a wide variety of non-wood products such as gum Arabic, incense, medicinal plants, bamboo, foodstuffs, honey etc., They are socially and commercially significant for the rural poor. They also provide employment opportunities since all activities from tapping to collection and packing and marketing of the natural gum demand high labour inputs. Most rural people in the lowlands use them for health and nutritional needs.

Gums and incense are used to be an important export products but Ethiopia has not performed very well as a supplier because of a dwindling raw material supply. Average annual production between 1978 and 1991 was about 1,500 tons with peaks of over 4,200 tons. About 1,500 tons of gums and incense is sold annually through official trading channels of which 50% is exported. Domestic demand for incense is still great for fumigation and church rituals. The demand for incense at a national level is estimated at 6,000 quintals per annum. The supply was estimated at 15% of this (MoA, 1998).

There is also an ancient tradition for bee keeping with an estimated amount of 4-10 million traditional beehives and some 10,000 modern box hives are believed to exist in the country.

Each traditional beehive is estimated to yield about 8kg of honey annually. This translates to 32-80 million kg of honey per year. The honey is almost exclusively used for local consumption while a considerable proportion of the wax is exported.

Traditionally, the most important roles played by NWFPs are health care, food security and nutrition. They also support agricultural and livestock production, construction materials, household items and cultural values. They range from products used for local consumption to products which are traded in the international markets. The majority are used for subsistence and in support of small scale household based enterprises which provide income and employment for rural people.

The potential economic value of medicinal plants is not yet recognized. The indigenous population has been using these plants extensively.

There is no inventory information for NWFPs to estimate the potential and plan its development. The biological, silvicultural and technical methods applicable to their management and utilization have not been developed and needs urgent attention. Every management program for these resources must address these constraints effectively.

Information on the management of natural stands of these crops is not readily available particularly information on the growth and factors influencing natural regeneration.

The future program in NWFPs need to focus on:

- Commercialisation of some of the selected NWFPs through private sector involvement
- Investment in research and development to improve the management of these resources
- Large scale development of industries which use these resources as raw materials
- Improve the marketing conditions for these products
- Inventory of the resources
- Avoid the unsustainable and wasteful harvesting of these resources and estimate their monetary value to the national economy

e. Management of bio-diversity resources

Ethiopia is an important centre of biodiversity and endemism on the African continent which is related to its eco-geography-physical diversity. The centres of endemism and bio-diversity are found principally in the highlands and the Ogaden and it is worth to note that over 80% of the land above 3000 m in Africa occurs in Ethiopia. The Simien and Bale mountains have been identified as areas of plant endemism of continental importance and provide the best examples of high altitude vegetation in Ethiopia. High endemic areas that require attention for conservation include the Ogaden-Somali region, the Afro-alpine and sub-afro-alpine regions and the wet evergreen forests of the South-western part of the country.

The size of the flora is estimated to be more than 7,000 species of higher plants of which 12 % is probably endemic (CSE, 1997). Though it is believed that the country has one of the largest floras, rich both in species diversity and endemics, information on species abundance and diversity is lacking. The diversity is not yet properly conserved and sustainably used. They are faced with a serious threat of genetic erosion and irreplaceable loss. The threat on forest coffee ecosystems which is found only in Ethiopia due to human impact, particularly investment could be the best example.

Some of the major factors that contribute to the acceleration of decline of the resources are the absence of land use policy and forest policy to ensure the conservation and development of genetic resources, impact of other policies that invite over-exploitation of species and natural habitats, inadequate technical knowledge for conservation of bio-diversity, lack of appropriate institutional set up and linkage that assists to coordinate efforts in the area of bio-diversity conservation and development, frequent organizational restructuring of institutions and lack of national coordination and conflicting sectoral interests, as well as size and the pattern of distribution of human and animal population.

f. Management of wildlife resources

The Ethiopian wildlife conservation organization in its efforts to save the wildlife resources of the country has established 38 protected areas under four categories (EWCO, 1990).

There are nine National parks, three wildlife sanctuaries, eight wildlife reserves and eighteen controlled hunting areas in the country with different levels of degree of management. Only two of the national parks are legally gazetted. The total area of all protected areas is about 192,000 km².

The distribution and extent of the wildlife conservation areas was very much determined by the occurrence and abundance of wildlife and hence, most of these areas are located in the lowlands while few are in alpine highlands. The highland montane forests are under represented and the broad leaved forests of the southwest are left out completely.

The inventory of the species in the country indicates that there are 277 species of terrestrial mammals, 862 species of birds, 201 species of reptiles, 63 species of amphibians, 150 species of fish and over 7,000 species of plants. Among these, 11% of mammals, 3.3% species of birds, 4.5% species of reptiles, 38% species of amphibians, and 12% of vascular plants are endemic (EFAP,1994).

Despite all these potentials, little has been achieved compared to other African countries. The revenue collected in the past ten years (1980-1990) is only about 188,591 US Dollars and from that of sport hunting is 856,182 US Dollars (EWCO, 1994).

There was no institution established to conserve and manage the wildlife resources of the country until 1964. Since 1908, 13 different wildlife laws and regulations were declared on different wildlife issues of which 6 are still working. The country is committed to implement and work as a partner institution with respect to CITES, African Convention on the Conservation of Nature and Natural Resources, Water Birds Agreement, World Heritage Convention, Convention on the Conservation of Migratory Species of Wild Animals and Convention on Biological Diversity.

A number of factors have contributed to the decline of wild life management in Ethiopia. The key problems facing conservation efforts in protected areas are land use conflicts, lack of clear policies for the conservation and development of the sector. The crucial problem remains to be the problem of implementing conservation objectives against the interests of the local communities. The involvement of the local people in the planning process for the conservation and development was ignored. The people were not benefited from this sector and started to develop negative attitudes towards wildlife resources. This was confirmed in 1993 where most of the infrastructure of national parks was destroyed, properties looted and wildlife animals killed. The violation against protected areas regulations come through a variety of activities such as deforestation, permanent settlement, overgrazing, agriculture and other activities inside the protected areas. These problems resulted in the decline and disappearance of species and loss of habitat.

The consequences are:

- Loss of bio-diversity such as the extinction of Grevy's Zebra from Awash National Park
- Hybridisation of domestic dog with the critically endangered and endemic species, Simien Fox (*Canis simensis*)
- Transfer of disease from domestic stocks to the wild animals such as Rabies and anthrax outbreak

- Uncontrolled fire which leads to shrubs encroachment and thus loss of wildlife habitat, etc.

1.2.3 Changes in Forest Technology

Although useful results have been generated from forestry research, the major problems facing the forestry sub-sector remained unresolved. The main reasons often cited include narrow scope, few published results, weak link with stakeholders, fragmentation of the research among different institutions often with very little or no communication, poor and variable funding, critical shortage of skilled human and physical resources, poor research data base, poor or no extension linkages, etc. This is exacerbated by the absence of forestry research policy, tradition of strategic planning and mechanisms of priority setting of research programs, projects and activities.

Cognizant of the importance of research and the various problems encountered in the agricultural research system (including forestry research), and the need to modernize and make agricultural research efficient and effective, the Ethiopian government has taken a commendable action by publishing a proclamation to provide for the establishment of the Ethiopian Agricultural Research Organization (EARO) in 1997. The proclamation brought crops, livestock, soil and water as well as Dryland Agricultural research under the same umbrella of EARO. Following this re-structuring, the National Forestry Research Strategic Plan has been developed with the active participation of key stakeholders. To translate the strategic plan into action, prioritisation of the research agenda has also been made in which major stakeholders took an active part.

After careful consideration of the scope of and opportunities in forestry research in the country, seven national research programs have been identified, namely plantation forests, farm forestry, dryland forestry, natural forests, bio-mass based and alternative energy, non-timber forest products as well as timber and panel products.

The general objective of plantation forests research program is to generate technologies that enhance sustainable plantation development and management to alleviate wood shortage, rehabilitate degraded lands, and provide other social, economic and ecological benefits.

The farm forestry research program aims at developing biologically, economically and ecologically viable technologies that increase productivity, sustainability and economic diversity of rural land and alleviate rural poverty.

The general objective of dryland forestry research program is to generate knowledge and technologies that can assist in the development, sustainable utilization and conservation of trees /shrubs and woodland resources of the drylands as well as combating land degradation and desertification.

Research will be undertaken on identification of bio-mass materials for energy production, developing appropriate techniques for energy generation, conservation and efficient utilization.

The bio-mass based energy research program aims to develop technologies that can help to generate energy from forest and non-forest biological products. The production and dissemination of knowledge and appropriate technologies for the development and sustainable

utilization and conservation of trees on farm will be better promoted. In addition, appropriate technologies that can help to rehabilitate degraded lands will be developed.

The natural forest research program will create a favourable opportunity to explore and characterize natural forests and their components so as to generate technologies that will allow their development and sustainable utilization. Knowledge and appropriate technologies that will help to reduce environmental degradation will be generated.

Environment considerations are expected to become more important and technologies which are environmentally friendly are expected to emerge.

Bio-mass based and alternative energy research programme aims at screening short rotation and high yielding species with high calorific value for energy use. In addition, technology for generating energy from agricultural and industrial residues and technology that can improve the efficiency of energy use will be available. The use of recovered paper is also expected to increase.

Improved wood utilization technologies such as the efficiency of wood stoves, the use of wastes from timber and agricultural residues as raw material for manufacturing of panel products is likely to get acceptance and be widely distributed.

Access to information is poor and research work tends to be fragmented and narrowly focused. There has been limited success in extending technologies generated from forestry research to end-users. No formal system exists that links forestry researchers with end-users which has been a constraint not only to forestry but also other sub-sectors of agriculture. As a result, extending research outputs to end-users and receiving feedback from them have been very difficult so far, which indicates the need for establishing a proper linkage.

Technology generation has been confined to the fast growing exotic tree species with little attention to the indigenous tree species. The natural forests in Ethiopia benefited little from technology driven productivity gains. They have not been managed for sustainable production of timber. Most of the plantations in the country are managed by conventional methods and trees are grown mostly from seeds of poor quality. High yielding plantations as a means to offset pressure on natural forests have not been established due to lack of appropriate technologies.

On the other hand, technologies to rehabilitate natural forests are in practice. Improvement in agro-forestry practices is expected to benefit from technology development. The future trend will be in a better condition with the current effort in the area of networking.

The use of remote sensing technologies in forest resources monitoring shall be widely used.

The formation of a regional forestry research network which is established in 1999 is aiming at strengthening forestry research and its impact on development in East Africa. In the future, quality in forestry research shall be improved and linkage shall be created between forestry research institutions.

THE FORESTRY SECTOR IN 2020

This part of the study provides an outlook for forest resources in Ethiopia, and the likely demands that will be placed on forests in the future. It also provides a foundation for subsequent analysis related to future policy choices that could be made to ensure better forestry contribution to the economic, environmental and social objectives. Scenarios are used to display possible future development in the forestry sector.

3.1 State of Natural Forests and plantations

3.1.1 Natural Forests

The major parts of the remaining natural forests are located on steep slopes at high altitude which are logged by selective cutting leaving behind the commercially less important broad-leaved species. The total area of natural forest is expected to decline at a rate of 62,000 hectares per year (FAO, 1990).

The natural forest quality, species composition and the stocking density of the natural forests will be reduced to less than 150 timber quality tree (Tesfaye et al, 1997) per hectare. They are characterized by a low stocking of mature, deformed and over-aged trees. Natural regeneration is scarce due to the high impact of livestock.

At present, the natural forest and other woody vegetation area available for wood supply is estimated at 14 million hectares and the remaining 20 million hectares do not supply wood (FRA, 2000). As long as the constraints impeding management under the natural forests are not effectively addressed, the volume harvested will exceed incremental yields causing future incremental yield to fall. This will result from the continued encroachment of local communities in the high forest areas. The projected industrial wood, construction wood and fuel wood supply is expected to decline.

According to FAO (1999), the total area of natural forests in 1990 was estimated at 13.9 million hectares and later reduced to 13.6 million hectares in 1995 with an annual rate of depletion of 62,000 hectares. This is due to conversion of the forest land to other land uses and due to the degradation of forests to wooded land. Within this overall change framework, it is also expected that there will be changes in the area of forests available for supplying commercial timber. The area of disturbed natural forest is expected to increase as some of the currently undisturbed areas are harvested and those, which are not accessible are opened up by new roads.

If the trends continues with no change, the forest area will be reduced to less than 7 million hectares by 2020. This means that the area available for timber production will be reduced. It is expected that past deforestation rates will continue and that about 1.2 million hectares of forests and other secondary forests will be converted to other land uses mainly arable land and perennial crops by 2020. Most of these conversions will take place in the South and Southwestern part of the country. Natural forests are likely to continue to be converted to other land uses and protection of these areas will become increasingly difficult. Despite the emphasis by the National policy to conserve forests for bio-diversity and to promote the environmental and bio-diversity functions of forests.

The forest area per capita is expected to be 0.1 ha. in the year 2025 from 0.25 ha in 1995 and 0.4 in 1980. Forest area as a percent of total land area was 13.58% in 1995 and is expected to decline to 11.85% in the year 2025 (Anders et al, 2000).

3.1.2 Plantation Forests

The current total area estimate of plantations is 255,214 hectares, which comprise around 76,050 ha of industrial plantation and 179,164 ha of plantations for the production of fuel wood and poles (FRA, 2000). Of this, 79,500 ha represent plantations established by farmers and communities and 99,664 ha represent public sector plantations for fuel wood and pole production. *Eucalyptus* and *Cupressus* are the main species in industrial plantations (58 % and 29%, respectively), followed by *Juniperus procera* (4%), *Pinus* (2%) and other species (7%).

As a response to the decline of the natural forest area, a plantation programme has been initiated on large scale to rehabilitate formerly forested areas, for construction and fuel wood production. Plantations are mainly of exotic tree species with few indigenous trees in few of the NFPAs. *Eucalyptus* comprises the largest area of hardwood plantations mainly for construction and fuelwood. The emphasis is on short rotation plantations and little in growing valuable indigenous trees due to slow growth rate and low economic return.

The current rate of plantation forest development is not encouraging and their management is also poor. They are fragmented and mixed with many tree species with little or no commercial value. The average area of planting is about 12,000 hectares per year which is far below the required area for ensuring a sustainable supply of forest products (FAO, 1990). They are not expected to provide the multiple uses and services which use to be available from the natural forests. The supply of industrial wood from the plantations would be of poor quality due to the current low management practices.

Assuming that the establishment continues at this rate throughout the period to 2020, the area of industrial forest plantations is expected to increase to about 500,000 hectares in 2020. Most of this increase is likely to be in fast growing and short rotation plantations.

Projections of the future contribution of the forest plantation to industrial wood supply have been made by EFAP (1994). The projection indicated that the incremental yields would reach 1.1 million m³. Gains in productivity of forest plantations through improved management and tree improvement program are expected to materialize until 2020. The projected sustainable fuel wood supply from all forest types is 8.8 million m³ without any intervention but the projected supply would reach 21.8 million with intervention scenario by 2014 (EFAP, 1994).

3.1.3 Trees outside forests

Trees outside forests are important sources of wood and other benefits. Such trees include roadside scattered trees, trees planted in and around fields, trees around homestead and windbreaks around agricultural fields, etc. There is no reliable data on tree resources outside forests.

The wood supply from non-forest areas is mainly derived from two major sources namely, farm forestry and the woody vegetation patches. The stock per hectare in tons varies from 1 ton per hectare to up to 60 tons per hectare in the south western part of the country (WBISPP, 1995). The wood supply from trees outside forests is mainly fuelwood for the rural population, and wood for fencing and construction. The supply of fuel wood from farm homesteads is estimated at 80,000 tons per year based on an estimate of five mature trees per rural household. There are nearly 10.2 million rural households in the country with 51 million trees with an estimated yield of 15 cubic meters per hectare per year.

Trees outside forests have the potential to contribute as sources of wood especially for construction and fuel. The future policy should support the individual efforts made in the establishment of trees around farm lands and households. Trees outside forests will be increasingly recognized as important sources of wood.

3.1.4 Development of Non-wood Forest Products

In the future rural use of non-wood forest products will increase and attention will be given to the possibilities of expanding small scale industries and promote the potential use of these resources in selected areas in the country.

Non-wood forest products are expected to receive attention in trade mainly bamboo and resins. The most important non-wood forest products are natural gum and incense. They are capable of supporting the rural communities in income generation.

The management of these resources is expected to improve in the near future. Possible improvements in the use of the resources for medicinal use may be made through research.

Policy to protect the traditional and indigenous knowledge of the local people with regard to medicinal values of trees and shrubs will be given considerable attention.

The collection, processing and marketing of non-wood forest products shall be promoted to provide income to rural populations which is locally important.

Information shall be generated for production techniques, marketing and harvesting of non-timber forest products. Appropriate technology for production, processing and utilization are expected to develop through research.

1.3 Outlook for the conservation and management of bio-diversity and protected areas

The future prospect of wildlife conservation, management and thus sustainable utilization lies on the critical realization and materialization of the drafted land use and wildlife resources policies and legislation.

On condition that both the land use and wildlife policies are in place, all the protected areas will have a legal status and better developed to provide investment opportunities which will lead to the improved management situation of the parks and conservation areas.

New approaches to wild life management through benefit sharing mechanism with the local people have been part of the current management proposal. The benefit includes, the provision of veterinary services, schools and medical centres. This has helped to bring change to the local people's attitude towards conservation. There is a proposal to share the revenue obtained from non-consumptive and consumptive utilization of wildlife in protected areas. Employment of local communities in protected areas has been attractive and has helped to lessen the conflict due to the linkage which is created between the local people and the protected area management.

The new investment policy encourages private investors to involve in the wildlife sectors which increased the demand to establish ranches, wildlife farm (Ostrich and Civet Farms) and tourism facility development including building of tourist lodges national parks and other protected areas.

Establishment of a biosphere reserve is being promoted to provide direct benefits to the people so that they support and encourage the very existence of the conservation area in the long term.

In addition, the integration of conservation and development program is in place which considers the impact of human population and secure the survival and well being of the people and the resources on which they depend.

1.4 Future Services of Forests

The EHRS has estimated that in the Ethiopian Highlands over 1.5 million tones of soil are lost every year which is equivalent to 35 t/ha/year. However, rates of soil loss vary from almost zero on grassland to over 300 t/ha/year on steep slopes. The extent of erosion is massive affecting about half the area of the highlands, some 27 million hectare is significantly eroded and over 25% (14 million hectares) is seriously eroded. Over 2 million hectares of farmlands have reached a point where economic crop production could not be sustained. It was forecasted that, in addition to the 2 million hectare farm land with irreversible degradation, 7.6 million hectare will deteriorate to the same status by the year 2000. Only 20% of the area (10 million hectare) can be said to be free from serious erosion risks.

This alarming situation can be eased through protection of existing vegetation and more importantly through intervention by way of afforestation.

Change in land use often results in changes in the quantity of bio-mass on the land and produce a net exchange of green house gases. Since bio-mass is about 45% carbon by weight, forest clearing leads to release of carbon dioxide, methane, carbon monoxide, nitrous oxide and oxides of nitrogen. Forest conversion into pasture or cropland results in release of soil carbon through oxidation of organic matter contained in the soil. Forest protection conserve carbon both in the vegetation and soil.

Currently, a variety of schemes are being developed to mitigate the effects of climate change. In line with this, inventory of greenhouse gases and different mitigation options have been developed for the country.

Due to the increasing demand by human population for more land for agriculture and wood products mainly fuelwood, it is likely to have a major effect on land availability for projects related to carbon storage.

The country has established strategies and priorities within the framework of sustainable development plans and policies to combat desertification and mitigate the effects of drought. The regional governments are also on a process of developing their specific programme taking into account the national programme as a framework.

Ethiopia has made a significant progress in many areas in implementing the convention resulting in substantial achievements. The major achievement is the finalization of the NAP itself with the participation of as many stakeholder groups as possible. The next step is to give emphasis to activities that lead to smooth transition from the formulation of national action programmes to its implementation. Thus, by designing the necessary policies and strategies, strengthening the necessary institutions at all levels and carefully designing the kinds of projects appropriate to combat desertification and mitigate the effects of drought, Ethiopia is expected to benefit much in the coming 15-20 years.

1.5 State of forest industries

saw milling started in the 1920s with 46 operational sawmills in 1972 (FAO, 1990). There are now about 38 sawmills of which 24 are nationalized and are run by the ministry of Industry and sawmills and joinery enterprise. There are also 14 privately owned mills which are closed due to lack of spare parts and raw materials. Most of the mills are old and designed to convert large saw logs of indigenous species. Vertical band saws of diameter 110 - 140 cm were used for the initial breakdown with either frame or circular saw for the subsequent re-sawing into timber of 25, 40, or 50 mm thickness. The most common timber size is 50 mm thick. Recovery rate is said to average 55%. There are also five mobile sawmills which operate on the thinnings from plantations of *Cupressus lusitanica* and *Pinus patula*.

There are two state owned plywood mills with an average annual output of 2,500 cubic meters which are old and were established in the mid 1960s. They have a recovery rate of 35-40%. There is also one fibre board mill with a capacity of 1,500 cubic meters per annum and two particle board mills with annual output of 4,500 cubic meters and mainly use Eucalyptus trees.

There is one paper producing factory which uses imported pulp and waste paper as its raw material. Its average production has been 9,500 metric tons per annum.

The existing sawmills are not equipped to handle logs from plantations. Furthermore, prospects for developing new industries will be limited on account of shortage of plantation based forest resources. The capacity of the forest industry is very small and annually decreasing, partly due to the depleting raw material base and partly to old and poorly maintained machinery with frequent breakdowns. Efficiency in processing of logs will be limited and require re-investment in the sector. Better mill recovery is not envisaged unless the sawmills are renovated.

It is a common feature of the entire forest industry that reinvestment is urgently required. Without renovation of the existing equipment, the supply prediction will most probably not be achieved. Without the procurement of material inputs and spare parts, both production and quality of products will inevitably decline in the future.

Demand for all forest products will increase significantly due to population growth. Large sized logs will be in short supply and shift will be made to soft wood logs. Dependency on imported industrial wood products and stagnation in sawn wood production is likely to persist due to the declining availability of large diameter logs for the existing forest based industries.

Alternative raw material for forest industries, technologies that can utilize wastes from forest and non-forest products shall be investigated. Residues could be used more effectively.

1.6 Wood demand and supply situation

1.6.1 Fuel wood

At present more than 90% of the domestic supplies of industrial wood and firewood comes from the natural forests which are the main sources of wood products. Fuel wood accounts for the bulk of the wood used, and is the predominantly preferred domestic fuel in both rural and urban areas.

The projected demand for fuel wood and building poles based on assumed per capita requirement is on the increase and is expected to be over 100 million m³ by 2020. On the other hand, the projected supply from all sources is expected to be only 9 million m³ which is far below the demand.

Ethiopia is one of the lowest electricity per capita consumer and from the current trend in the prices of electricity and other commercial fuels, Ethiopia will remain highly dependent on woodfuel for the foreseeable future. The rural people will remain to be the main users of wood fuel in the future. The urban poor also continue to depend heavily on wood fuels. The urban populations have options to mix their energy use mainly depending on income level. The rural population on the other hand, collect woodfuel free and mainly depend on wood fuel as the main source of energy. Non-wood bio-mass are also important sources of fuel for the rural population.

The increasing scarcity and cost of household fuels, particularly fire wood threatens the ability of the people even to maintain the already low incomes and quality of life, particularly in the rural areas. To compensate for the worsening fire wood scarcity, dung and crop residues are being diverted to household fireplaces, reducing crop yields. While there is a continued need to explore other alternative sources of energy, large scale tree planting appears to be the only realistic option for resolving the wood fuel supply problem. The rural woodlots and agro-forestry on a massive scale are essential to allowing a sustainable energy supply to meet demand in the rural areas. In addition, the introduction of efficient cooking stoves for improved use of wood fuel, efficient charcoal making technology, and an appropriate woodfuel marketing and pricing practices may improve the energy problem, thereby relieving the pressure on the few remaining natural forests.

With the contribution of traditional fuels to domestic energy use being so overwhelming and the supply of woody bio-mass deteriorating as a result of deforestation, the following changes are expected to take place:

- Dung and crop residues are replacing woody biomass in rural areas

- The commercialisation of woody bio-mass around urban centres is expanding and less preferred fuels are used by low income households in urban centres
- Kerosene is replacing woody bio-mass for cooking in urban areas
- More and more fuel saving measures are being adopted by urban households including buying of improved stoves. There will be a shift in household energy from firewood to charcoal.

It is therefore, essential to initiate research and development of new cooking fuels and improvement of energy conversion technologies.

1.6.2 Industrial round wood and other wood products:

Industrial round wood production and consumption is one of the lowest in the world. This low level of production and consumption reflects the fact that the country has limited forest resource base which has been and continue to be primarily exploited for fuel wood.

Industrial round wood is mainly produced from non-conifers and there has been a decline in the production of logs from 130,000 m³ in 1980s to 6,000 in m³ in 1999 (MoA, 2000).

The projected demand for construction and industrial wood which include sawlogs, plylogs, telecommunication poles and construction wood is on the increase. The projected demand for the year 2020 is 1.5 million for saw logs, 47,000 m³ for ply logs, 4.5 million m³ for construction wood and over 61,000 m³ for telecommunication poles. On the other hand, projected industrial wood supply both from the natural and man made forests is only 338,000 m³ without any intervention scenarios and could only reach 1.2 million m³ with intervention. The projected supply of construction wood will decline from the current one million m³ to 936,000 m³ in 2014. There has been a major shift in consumption from hardwood logs to logs of soft woods. This will continue to increase in the future. Most logs from natural forests are inadequate and import of soft wood timbers and production of timber from soft woods 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.

Sawn wood production is on the decline when one looks at the trend in production from 1979 to 1989. The average production from 1980 to 1990 has been about 23,000 m³ per year. Based on the projection made by EFAP (1994), per capita demand for sawn timber will increase in urban areas and remain constant in rural areas. The same study showed the projected incremental yields from industrial plantations to be 1.1 million m³ in 2014.

The production of wood based panels is estimated at 12,000 m³ with an average import of 1,000 m³ per annum. There has been a decline in the production of veneer sheets from 1986 to 1996 which declined from 156,000 m³ to 82,000 m³. The production of paper and paper board has been in the range of 7,000 to 9,000 metric tons from the period 1993 to 1999. In addition, importation of pulp has been increasing and reached 6,528 metric tons per year.

The average annual production for plywood is 3,000 cubic meters while the production of particle board is increasing from 5,000 m³ in 1993 to 7,466 m³ in 1997. The projected capacity of paper production for ten years is estimated at 10,000 metric tons.

Overall assessment of the implications

4.1 Social and economic implications

Irrespective of its potential to contribute to the national economy, the performance of the sector remain negligible over the years. Mechanisms should be developed to properly account for the contribution of forestry to the national economy and the environment. The Government and the public should become increasingly aware of the fundamental role forestry can play in the national economy, its role in providing productive employment, stabilizing the environment and thereby enhancing agricultural production and productivity, and alleviating shortages in the supply of essential forest products. Forest management should take account of the diversified functions of forests.

The social aspects of forestry development is better understood and has received more attention from the professionals in the field of forestry. There is a general recognition of the roles of forests in local peoples livelihoods and the importance of involving local people in developing successful forest management strategies.

New management modalities have been developed to ensure the needs of the rural poor who place intense pressure on forest lands. The future management practices of forests will take into account the social implication of the distribution of benefits from forests. There is an increasing concern as how to meet the needs and respect the rights of indigenous people who are forest dependent.

NGOs, both local and international are advocating different participatory forest management strategies. Access rights have been recognized for the local communities and is supported by the current draft forest policy.

In the future, demand for social equity will continue and increase and new roles for the private sector to develop forests will increase. Balance between economic, social and environmental benefits will be maintained.

The prospects for agro-forestry on farmers plots are promising and it is likely that perennial species will feature in the farming system. This system combines farming with tree planting without disrupting the main functions of the forest. This will help to promote the role of forestry in land use and land husbandry.

The employment effects of forest based activities such as, fuelwood and charcoal production, plantation establishment and management, harvesting and the use and collection of non-wood forest products will continue to persist. This will increase the relative contribution of the forestry sector to GDP in comparison with other sectors.

1.7 Environmental values

Out of the total 58 important forest areas, 13 of them are accessible for commercial exploitation while the remaining forests covering 60% of the total area proposed are to be managed for

rehabilitation, protection and genetic conservation. Since none of these forests are gazetted, it is assumed that a substantial portion of these forests will continue to be deforested or degraded until proper protection can be afforded to them.

National forest proclamations and the environmental policy of Ethiopia reflects the environmental importance of forests and local non-governmental organizations are emerging with concern about carbon sink, soil conservation, watershed protection, and overall reduction of land degradation. Despite this, forests are not protected and the environmental functions are not realized. In the management plans which have been prepared, environmental issues are addressed but no management plans have been effectively implemented.

The Forest Plant Genetic Resources Conservation Project will have several projects of various kinds and is anticipated to yield the following major results:

- To establish a data base containing the distribution and conservation status of the forest plant genetic resources
- To establish Ex-situ conservation stands in representative ecological zones
- To increase the number of protected forest areas through the demarcation and protection of in-situ conservation sites.

The future activities will focus on inventory and collection, characterization, evaluation and research and conservation activities. In the long term until year 2020, it is expected to enhance the sustainable utilization of forest plant genetic resources at national level and promote the contribution of forest plant genetic resources to the national economy.

1.8 Institutional Framework for Forestry

Changes in national economic policies have direct impacts on the management and administration of forests. Currently, all forests are managed and administered by regions and the federal MoA is responsible for policy and strategy development. Forestry research has been organized under the Ethiopian Agricultural Research Organization and forestry training is organized under the Ministry of Education where as Forest Genetic Resources Conservation is the mandate of Institute of Bio-diversity Conservation and Research.

The organization responsible for the forestry sector is known to have existed within the Ministry of Agriculture, since about the mid 1940s under various capacities, as a Section; an Agency; a Department and an Authority. Currently, the responsibility for the conservation, development, management and rational utilization of the forest resources rests within the Ministry of Agriculture. In reference to the mandate given to the regional administration, responsibilities for forest management and conservation have been transferred to the Regional Bureau of Agriculture. There are two main departments with extension and regulatory functions. The forest conservation aspect is treated by the regulatory section of the Bureau and the development aspect is addressed by the extension wing of the same.

The government of Ethiopia has found it essential to undertake research in a systematic and coordinated manner. The duties of forestry research and wood utilization research centres which

were used to be administered by MoA had been transferred to EURO and forestry research is organized as one of the directorates in EURO.

AFREA which is the Association for Forestry Research Institutions in Eastern Africa has been established. In the future forestry research shall be strengthened so that it will have a greater impact on management and conservation of forests and tree resources. The capacity is envisaged to be strengthened. Exchange of technical forest related information will be practical and collaborative forestry research will be possible. Networking efforts have been initiated with a view towards improving the efficiency and Impact of research.

CHANGE FACILITATION

Effective implementation of strategies and programs require a framework of supporting policies and institutions in the areas of forestry policy, administrative infrastructure, human resources development, research capabilities and peoples participation. Since management was unable in the past to control deforestation, develop and utilize the forest resources, an efficient management and planning system has to be built. Further more, policies and legislation must support the management and planning objectives and reflect the inter-sectoral linkages and harmonization with overall resource use policies.

1.1 Changes within the forestry sector

1.1.1 Policy and institutional changes

Establish an appropriate institutional structure for the forestry sector and a clearly defined forest policy and land use policy with the objective to ensure a sustainable allocation of land between sectors. Strategic land use planning agency at a federal level which will provide the necessary guidance on land use conflicts need to be established. The same agency will also need to be established at the regional level. The unit will need to establish a national natural resources data for making decisions on land use issues.

Community based forest conservation strategies must be developed and launched in order to address the problems of forest degradation.

Consolidate the implementation of collaborative forest management and social forestry and devolve responsibility for forest management to local communities. Responsibility will increasingly be decentralized and devolved to local communities with government playing more supportive roles

The forest sector is weak with low hierarchical profile and staff resources for forestry which are inadequate or even not existent to monitor forestry resources and ensure sustainable management, poor enforcement of laws and regulations, and increase the significance of forestry in the economy and value the forests

1.1.2 Investment

Private sector forest development should be encouraged through research and extension and the provision of appropriate policy in the area of pricing, increase sense of security of land and tree tenure. The government should create an enabling environment for their participation.

5.1.3 Technology change

- Identify the location, demarcate the area and map the main natural forests of the country with the view to preparing management plan for their use and management
- Prepare a management plan for the remaining forests with the full involvement of the surrounding and included communities
- Establish a capability to monitor physical changes in land use, especially with respect to the area of forests. This would pave the way for more detailed forest resource inventories required for the preparation of management plans.
- Improve the efficiency of the existing forest industries and encourage the forest industries to be plantation based.
- Trees growing outside the forest such as agricultural tree crops which are important sources of fuelwood and construction material should be promoted and make this activity to be commercially attractive
- Development in the agriculture sector should bring change to the rate at which farm productivity grows and higher yield on land already engaged for agriculture
- Technologies to monitor forest cover degradation and damage should be widely applied. Improvement in remote sensing techniques and communication and information processing should be better facilitated.

1.2 Change outside the forestry sector

1.2.1 Policies of other sectors

Forestry development objectives will be more fully achieved and sustained at much lower cost if they are integrated in the national development objectives. There has to be a clearer overview of the interests, relationships and different perspectives of the institutions involved in resource conservation and development. The activities of the concerned sectors have to be integrated. The policies and strategies of other sectors will also need to be critically examined, especially their relations to and influence on resources conservation and development.

Population Policy

Implementation of the existing population policy which are relevant to the sustainable utilization of the forest resources. Education programs which address small family size, ensuring a spatially balanced population distribution patterns in order to maintain environmental security.

Development of the industry sector

There is a need to promote a balanced industrial development in order to secure an impact on alleviating poverty and reducing pressure on natural resources generating an alternative means of income and employment opportunity.

Revenue generation

In order to enable the forestry sector to play a more active role in the development of the country's forest resources, stumpage and royalties should be directly realized and should be kept in a revolving fund rather than deposited in the central treasury to enable the sector to invest in further forest resources development. Revise values on an annual basis and monitor forest products prices on a continuous basis.

Annexes

Table 1. Forest resources of Ethiopia

Natural Forest Types	Forest available for wood supply (000) hectares	Forest not available for wood supply (000) hectares
Closed high forest	1,761.261	2,641.903
Wood land	2,000	3,000
Shrub land	5,062.610	7,593.915
Bush land	4,889.866	7,334.799
Bamboo	187.866	281.798
Riverine/Riparian forest	194.866	292.328
Plantation	255.214	
All forest types	14,182.835	20,891.431

Source: *Ethiopian Forestry Action Program, EFAP, 1994*

Table 2. GDP by sector (in Million Birr)

Period	Agriculture	Industry
1981/82	3,807.7	1,312.5
1984/85	3,125.3	1,473.5

1987/88	3,923.7	1,604.9
1990/91	4,342.9	1,289.1
1991/92	4,169.2	1,226.4
1992/93	4,375.3	1,379.4
1993/94	4,546.3	1,524.3

Source: MEDAC, 1994

Table 3. GDP and Growth rates for main sectors (1980/81 prices)

Year	GDP %	Agriculture%	Industry %	Services %
1987/88	2.1	2.6	3.4	3.7
1988/89	1.6	-1.3	3.1	4.0
1989/90	5.1	4.7	5.2	6.3
1990/91	-2.2	-9.9	5.3	1.0
1991/92	-7.0	-16.3	0.7	0.9
1992/93	6.6	9.6	4.8	4.3
1993/94	9.5	15.2	4.8	5.7
1994/95	1.9	-2.1	1.0	6.9
1995/96	1.6	2.2	0.4	1.5
1996/97	-1.5	0.2	-4.6	-2.0
1997/98	-0.3	7.9	-16.1	2.8

Table 4. GDP in USD (million) Current prices

Year	1.2 GDP in USD
1990	6,874
1991	5,356
1992	5,568

1993	6,253
1994	4,899
1995	5,779
1996	6,010
1997	6,381

Table 5. GDP per capita

Year	GDP per capita
1990	134
1991	101
1992	102
1993	117
1994	89
1995	102
1996	103
1997	106

Table 6. Export as percent of GDP

Year	Export as percent of GDP
1990	7.8
1991	5.7
1992	4.5
1993	8.3
1994	11.5
1995	14.5
1996	13.1

1997	15.9
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Table 7. Import as percent of Export

<u>Year</u>	Import as percent of export
1990	62.9
1991	44.3
1992	42.2
1993	49.2
1994	52.9
1995	61.6
1996	47.5
1997	60.4

Table 8. Share of agriculture (Percent of GDP)

Year	Inflation (annual change of inflation)
1990	2.4
1991	18.8
1992	9.0
1993	14.6
1994	4.6
1995	12.5
1996	1.3
1997	3.5

Table 9. Fuel wood demand and supply projections

Year	Projected demand for fuel wood (000)	Projected sustainable supply (000)	Deficit in m ³
2000	58,403	11,225	47,180
2004	66,250	10,593	55,657
2008	74,967	9,895	65,072
2011	81,812	9,378	72,434
2014	88,899	8,844	80,055
2020	100.0	7,744	92.3

Source : EFAP(1994)

Table 10. Projected Demand for fuelwood (1000 m³)

Year	Without Intervention Demand (000)
2000	58,403
2001	60,310
2002	62,269
2003	64,283
2004	66,350
2005	68,473
2006	70,583
2007	72,745
2008	74,967
2009	77,222
2010	79,539
2011	81,812
2012	84,130

2013	86,493
2014	88,899
2020	100.00

Table 11: Projected Industrial wood supply in 1000 cubic meters

Year	Supply
2000	306
2005	632
2010	959
2014	---

Table 12: Current and projected demand for wood products (in millions of cubic meters)

Year	Industrial wood	Construction wood
2000	0.7	2.7
2005	0.9	3.2
2010	1.3	3.8
2014	1.6	4.3
2020	1.8	4.9

Table 13. Projected supply of construction wood

Year	Projected supply of construction wood in 1000 cubic meters
2000	1,080
2005	1,038
2010	982
2014	936

Table 14. Projected supply of fuel wood in 1000 cubic meters

Year	Projected supply
2000	11,225
2005	10,423
2010	9,593
2014	8,844

Table 15. Industrial round wood production

Year	Industrial round wood production in 000 cubic meters
1986	66.9
1987	80.3
1988	62.7
1990	60.9
1995	28.2
1996	20.7
1997	9.713
1998	4.815
1999	5.438

Table 16. Projected Demand for Industrial and Construction wood in (1000 cubic meters)

Year	Sawlogs	Plylogs	Tel. Poles	Construction wood	Total
2000	578	30	47	2,741	3,396
2001	620	31	48	2,836	3,535
2002	665	32	48	2,932	3,677
2003	713	33	49	3,032	3,827
2004	765	34	50	3,135	3,984
2005	821	35	51	3,243	4,150
2006	880	37	52	3,350	4,319
2007	943	38	53	3,461	4,495
2008	1,011	39	55	3,576	4,681
2009	1,084	40	56	3,695	4,875
2010	1,162	42	57	3,818	5,079
2011	1,245	43	58	3,940	5,286
2012	1,333	44	59	4,067	5,503
2013	1,428	46	60	4,197	5,731

2014	1,529	47	61	4,331	5,968
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Table 17. Estimates of household energy by source (1992) in percent

Source of energy	URBAN		RURAL	
	1992	2014	1992	2014
Wood /charcoal	62	42	66	68
Dung	16	8	20	13
Crop residue	11	5	14	7
Electricity	3	15		5
Kerosene	8	20		2