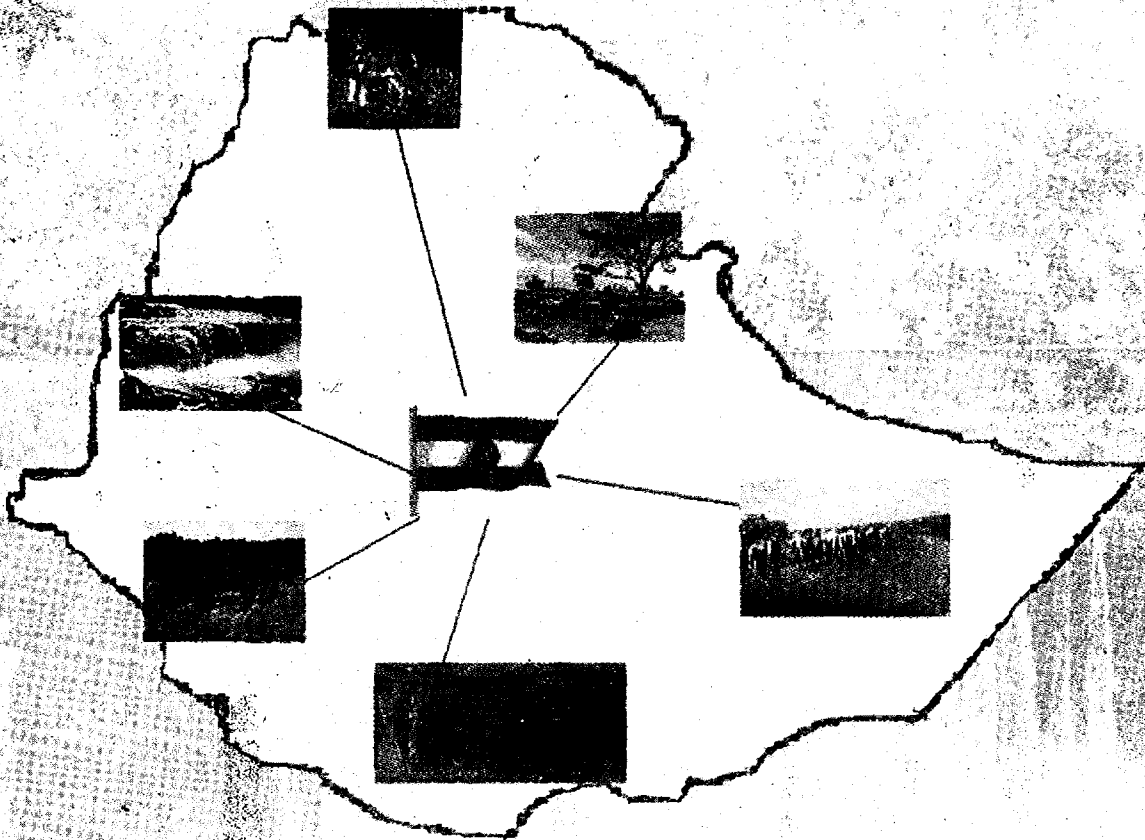


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**Environmental Protection Authority
Addis Ababa, Ethiopia**

August 2003

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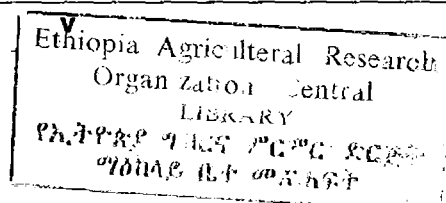
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FOREWORD

The Environmental Protection Authority (EPA), as stipulated in the Proclamation on the Establishment of Environmental Protection Organs, is required to prepare and avail to the government as well as the public a periodic state of the environment report of the country.

Accordingly, EPA has now produced the first State of the Environment Report of the Country. In this report, the factors exerting pressure on the environment, the resulting environmental conditions and the responses elicited have been summarized

The conclusions drawn are that Ethiopia's development initiatives and the demands for livelihoods by its people have introduced stresses on the renewable natural resources base which are manifested through the current environmental degradation arising from deforestation and, in general, degradation of vegetation cover, soil erosion and declining agricultural productivity are serious and require equally serious attempts to reverse the situation.

For these reasons, there is the need to continuously review development strategies and demands on the land to conform with the dictates of sustainable development. It is, therefore, hoped that this report will contribute towards focussing on examining the present condition and reshaping policies, strategies and laws to bring harmony between the present generation and its environment on the one hand, and between the satisfaction of the needs of the present generation and the future generations on the other.

Owing to the fact that it is only a first attempt, and also owing to the paucity of environmental information in Ethiopia, there is no doubt that this report will have serious limitations. However, every effort has been made to make it as comprehensive as possible, and it is hoped that it will help readers in obtaining an overall view of Ethiopia's environment and development.

As we strive to improve future editions, EPA welcomes comments and suggestions from all users of this report. I hope that you will all help us.

Tewolde Berhan Gebre Egziabher

Tewolde Berhan Gebre Egziabher
Director General
Environmental Protection Authority

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Numerous government organisations and institutions have contributed a great deal to the preparation of this State of the Environment Report. The regional governments as well as federal level sectoral organs have supported the process of preparation by providing data. The data acquired from them have contributed enormously to the preparation of this Report. Thanks are, therefore, due to the federal sector organisations, regional councils, the regional governments' sectoral organs and their professionals for cooperating in the provision of the data.

The Conservation Strategy Phase III Project provided the initial financial support, which helped to begin the preparation of this Report. The United States Agency for International Development (USAID) provided considerable financial and advisory support for most of the work.

The Environmental Protection Authority hereby expresses its thanks to all those who have collaborated in the provision of the required data as well as financial support and advice.

EXECUTIVE SUMMARY

Section One: Topography and Climate

Ethiopia is a country located between 33° and 48° East longitude, and 3° and 15° North latitude. It has a rugged and mountainous topography with the altitude ranging from a height of 4620 m above sea level (asl) at Mount Ras Dejen in North Gonder to a low of 110 m below sea level in the Dalol Depression of the Afar Region.

Ethiopia's mean annual rainfall distribution decreases from the southwestern areas of the country, which have the highest rainfall to the drier northern and eastern parts. The maximum mean annual rainfall reaches 2,000 mm in some of the southwestern parts of the country, while the lowest mean annual rainfall is below 250 mm in the north-eastern and south-eastern lowland areas.

Mean annual temperature in Ethiopia is estimated to range between 10°C on the mountains of the northwestern and southeastern highland areas and 35°C in the north-eastern lowlands. The highest mean maximum temperature of more than 47°C occurs between October and March in the lowlands. The higher parts of the highlands record nightly minimum mean temperatures of 0°C or below between November and February.

Section Two: Environment and Development

State of the Economy

Agriculture is the mainstay of Ethiopia's economy. In the year 1999/2000 agriculture's share of the GDP was 43.3 percent. Industry's share was 11.5 percent while distribution and services had a share of 22.2 and 29.0 percent respectively. Between 1988/89 and 1999/2000 GDP grew at an average annual rate of 5 per cent. When this is broken down into economic sectors, a growth of 2.5 percent in agriculture, 5.3 percent in industry, 6.3 percent in the distribution sector and 8.3 percent in other services is indicated.

There has been no year in Ethiopia in which excessive inflation has occurred. Relatively speaking, however, 1981/82, 1988/89 and 1992/93 were years with higher rates of inflation. In those years, inflation was 7.2, 9.8 and 10 percent respectively. Other than in those years, inflation has remained under 5 percent a year ever since 1980.

Over seven thousand investors with a combined capital of Birr 78.3 billion took investment licences between 1991/92 and 2001/2002 following the issuance of a government investment promotion policy. Out of the total of 7,122, the foreign investors were 176.

Export trade in Ethiopia is mainly based on agricultural products, which account for 90 percent of the total. Out of the agricultural products exported, coffee makes up 70 percent, and out of the total export, its share is 60 percent. Following coffee, leather and hides account for 12 percent and chat (*mirra* or *Catha edulis*) for 7 percent of export trade earnings.

The State of Poverty

Ethiopia is one of the least developed countries in the world. Between 1995/96 and 1999/2000, Gross National Domestic Product (GNP) per capita was between Birr 600 and 819. As indicated in the Africa Environmental Outlook published by the United Nations Environment Programme (UNEP) in 2002, Ethiopia holds the 171st position out of the world's 174 countries based on the UN human development index.

INTRODUCTION

According to a study carried out in 1999, an estimated 46 percent of the population is under the national poverty line, which is Birr 1,075 per annum. This means that 46 percent of Ethiopians meet their basic needs on an average income of Birr 3 per day.

Ethiopia has developed a poverty reduction strategy designed to bring about economic and social development. The poverty reduction strategy deals with agriculture, food security, expansion of educational and health services, controlling HIV/AIDS, expansion of roads, improving water resources utilization and gender equality. In addition, the strategy also addresses environment and population issues. Expansion of foreign trade, capacity building, including enhancement of good governance, is also part of the strategy.

Employment

In 1999-2000, Ethiopia had a labour force of 43.6 million, which was 68.8 percent of the total population of 63.5 million. According to the results of the 1994 census, 88 percent of all the labour force was employed in the agricultural sector and in the various governmental and non-governmental organisations as well as in the private sector.

A look at employment by economic sectors indicates that out of the total labour force, 79.8 percent is in agriculture, 5.9 percent in commercial activities, 4.4 per cent in other production activities and 3.5 per cent in hotel and restaurant businesses.

The economy of Ethiopia is based, directly and indirectly, on environmental resources. The economy of the country, particularly the dominant agricultural sector, can develop only if these environmental resources are protected, conserved and utilized appropriately and sustainably. Thus, it is important that every economic and social activity takes into account environmental concerns.

Section Three: Natural Resources Management and Utilization

Land Use

The size of Ethiopia is 111.5 million ha. Out of this, 74 million ha or 66 percent of the total area is suitable for agriculture. However, the actual size of land cultivated is estimated to be only 16.5 million ha or 14.8 percent of the total.

There are 10 major soil types that are estimated to cover 75.2 percent of the total area in Ethiopia. Some studies have indicated that these soil types are, in many cases, deficient in Nitrogen and Phosphorus.

A number of studies indicate that up to 400 tons of fertile soil per hectare is lost annually from land with no or little vegetation cover where no soil conservation work has been done. The soil thus lost annually is mostly from the farmlands, which make up 13 percent of the total area. This kind of erosion is common at altitudes between 1,700 and 2,600 m asl where land cultivation is extensively practiced. It is estimated that overall the country loses 1.5-1.9 billion tons of soil annually due to wind and water erosion.

To combat land degradation, particularly soil erosion and loss of soil fertility, activities including the construction of terraces, soil bunds, micro-basins and cut-off drains, tree planting on sloping land and in watersheds as well as the protection of vulnerable areas from free range grazing and tree cutting are being carried out.

However, in view of the great magnitude of the erosion and soil fertility loss that is occurring, far more both extensive and intensive efforts are required with respect to soil conservation and the protection of vegetation.

Biodiversity

As a result of its topography and diverse climatic conditions, Ethiopia is the home for various plant and animal species. There are no less than 7,000 different higher plant species out of which about 12 percent are endemic. Ethiopia is the centre of origin for various crop species, e.g. Arabica coffee, teff, noug or niger seed (*Guizotia abyssinica*),

enset (*Ensete ventricosum*). Ethiopia is also home to unique and useful genetic diversity of other crop species, e.g. sorghum, barley, wheat, horse beans, field peas, lentils and linseed.

Out of the total known wildlife resources, 30 mammals (12 %), 16 bird (2.5 %), 3 reptile (3.9 %), and 17 amphibian (31.5 %) species are endemic to Ethiopia.

In situ and *ex-situ* conservation are being carried out to protect and conserve biodiversity. The major areas where *in situ* crop conservation is being carried out are Bonga, Bale, East Shewa, South Wello and Tigray. In order to prevent the extinction of useful plants and crops, 56,558 samples of various species, mostly crops, are being conserved *ex-situ* in the Gene Bank at the Institute for Biodiversity Conservation and Research.

Settlement and investment activities that do not take into account biodiversity, the absence of a land use policy and land use plans as well as increasing amounts of toxic substances and pollutants can be mentioned as major factors leading to the depletion and disappearance of biodiversity in Ethiopia. The fact that forests, in particular, and vegetation cover, water and soil resources, in general, are exposed to enormous degradation due to low public awareness, the meagreness of the effort to protect and conserve biodiversity as well as the widespread poverty, are also major factors.

Forest Resources

Information and data on forest resources in Ethiopia are limited. As a result adequate information and data regarding their location, area, stock, annual incremental yield and deforestation rate is not available. According to data generated from field evaluations and observations carried out at different periods, the extent of natural forest cover in Ethiopia in the early 1990's was estimated to range from 2.5 to 3.0 million hectares.

Based on assumed per capita wood consumption, in 1992 the country's total demand for wood and wood products was 47.5 million m³, out of which 45 million m³ (94.7 %) was fuel wood. Although the actual consumption during the same period is not known, it is estimated to have been between 13.8 and 47.5 million m³. Taking into account the population growth rate, this demand is estimated to reach 95 million m³ by the year 2014.

As a major effort to curb the prevailing destruction of Ethiopia's forests and associated ecosystems and to prevent the likely consequent social and economic disruptions, countrywide tree planting activities and demarcation of forest reserve areas have been undertaken. With respect to the later, the demarcation and inventorying of 58 Natural Forest Priority Areas (NFPAs) totalling 4.78 million hectares can be mentioned. Many hillsides are also being closed off to animal grazing and the woody vegetation in these areas is naturally re-establishing, often quite rapidly.

Increases in population and consequent expansion of settlements result in the demand for farmlands near forest areas, and increase the demands for fuel, construction and industrial wood. The forest resources of the country are also being destroyed through forest fires, low public awareness, pervasive poverty and failure to demarcate and protect the boundaries of remaining forests.

Wildlife Resources

Among the 862 bird species recorded in Ethiopia 30.2 percent have been accorded international importance. In addition, about 31 of the species living in Ethiopia are among those recognized globally as threatened. More over, there are 5 critically endangered, 12 endangered and 14 vulnerable species.

To protect and conserve the country's wildlife resources, 9 national parks, 8 wild animal reserve areas, 3 wildlife sanctuaries, 18 game reserves and 51 important bird areas have been designated in different parts of the country. However, because of various pressures the size of these areas is continually shrinking. As a result their actual status at present is not well known. Settlement around wildlife habitats and the consequent expansion of farmlands, increases in the number of domestic animals, poaching, forest

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fires as well as the lack of a sense of ownership within concerned communities due to the absence of participation and benefit sharing arrangements in the development and protection of the wild animals, can be mentioned as major factors having a negative impact on wildlife resources throughout the country.

Water Resources

Ethiopia is known as the water tower of North East Africa. Surface water resources in Ethiopia flow in 12 major river basins. It is estimated that an average of 122.19 billion m³ of water is annually discharged from these basins. The country's total ground water resources are estimated to be around 2.6 billion m³. The waters of 11 of Ethiopia's rivers flow into neighbouring countries. The amount of discharge that remains in the country is not more than 9 percent.

The country is endowed with numerous lakes and wetlands. Among the major lakes 11 are fresh water, 9 are salty and many are crater lakes. In addition to natural surface water resources there are also a number of artificial lakes.

The wetlands in the various parts of the country cover a total of 18,587 km². This is estimated to be 1.5 percent of the country's area.

80 to 90 percent of the water resources of the country are found in the Abay, Tekeze, Baro and Omo-Gibe river basins. An estimated 30 to 40 percent of the country's population is estimated to live in these basins. On the other hand, while the population living in eastern and central Ethiopia is estimated to be 60 to 70 percent of the country's total, only 10 to 20 percent of the total volume of the country's water resources is estimated to be located there.

It is estimated that there are 3.5 million hectares of potentially irrigable land in the river basins of Ethiopia. When compared with 44 other African countries, this potential places Ethiopia fourth. However, because land developed for irrigation to date has not been more than 5 percent of the potential, Ethiopia comes down to eleventh position for actual utilization of water resources for irrigation.

Because of Ethiopia's topography the rivers have enormous hydropower generating capacity estimated at 650 Terra Watts. However, very little of this capacity is being actually used.

Ethiopia has water resources that can be used for various current and future economic purposes, but they are not being used to the desired extent at present. In addition, the water resources and related aquatic ecosystems are under great pressure. Major factors contributing to such pressure include siltation of water bodies, pollution caused by industrial and urban discharges, and disruption of the temporal and spatial rainfall distribution patterns.

Fish Resources

It is estimated that 32,962 tonnes of fish can be produced annually from the major lakes, rivers, reservoirs and ponds. Out of this around 59 percent (19,740 tonnes) is found in the major lakes.

There are 8 major fish species used for food in Ethiopia. Among them Tilapia and Nile Perch are being depleted rapidly. A major factor causing the depletion of these species is over fishing, which is prompted by a rising consumer demand for these species.

Rangelands and Livestock Resources

It is estimated that there is an area of 500,000 km² of rangelands in the lowland parts of the country and 57,000 km² in the middle and higher altitude areas. Fallow land is also used for grazing in the intensively cultivated areas of the middle and higher altitude areas. In total, the extent of rangelands in Ethiopia is estimated to be 51 percent of the total area.

Livestock production systems in the country can be categorized into three types. These are: modern dairy farms run by the private sector and governmental organisations; production based mostly on free-range grazing in the middle and higher altitude areas where mixed farming is practiced; and production by pastoralists in the lowlands. In 2000/01 Ethiopia's livestock was estimated to consist of 35.4 million cattle, 11.4 million sheep, 9.6 million goats, 4.9 million equines, 0.5 million camels, 38.0 million chicken.

In the arid and semi-arid areas, shortage of water caused by recurrent droughts and other factors is a major problem. This shortage of water is a serious constraint for the improved utilization and development of the rangelands for livestock production. In addition, degradation of rangelands due to various factors, widespread animal diseases and inadequate infrastructure are causing deterioration of rangelands and livestock.

Bee Keeping

It is roughly estimated that there are about 10 million bee colonies in Ethiopia. Due to the depletion of forest resources and other vegetation, the number of bee colonies as well as the products from them are decreasing. In addition, the fact that bee keeping is, in the majority of cases, traditional and the bees have to construct new honeycombs after every harvest has contributed to the low level of production and productivity in the sector.

Crop Resources

Due to the suitable natural conditions prevailing in Ethiopia, numerous crop species can be grown in the different climatic zones. An estimated 7 million smallholder farmers account for 97 percent of the crop production. Private entrepreneurs and state farms produce the remaining 3 percent. Available information indicates that before the late 1950s Ethiopia used to be a net exporter of cereals and pulses. However, since the late 1960s, domestic agricultural production has not been able to cover even the minimum basic per capita human food requirement. As a result, the deficit is being complemented through foreign purchase and food aid. Recurring drought and environmental degradation, among others, can be mentioned as factors that have led to this situation.

Agricultural Chemical Inputs

The chemical fertilizers that are in use in the country are DAP and Urea. In 1995/96, chemical fertilisers amounting to 253,152 tonnes were distributed and put to use. A comparison five years later indicated that distribution increased by 17.6 percent to 297,907 metric tons in 2000/2001. The total chemical fertilizer used over the five years was 1,343,107 tonnes.

In 1995/96 the country imported 927.7 tonnes of pesticides which increased by 16.6 percent to 1,081.9 tonnes in 2000.

A study carried out in 1998 by the Ministry of Agriculture (MoA) and FAO revealed that there was an accumulation of over 1,500 tonnes of obsolete pesticides as well as 1000 tons of contaminated equipment and soil in different parts of the country. By 2003, 1000 tonnes had been exported for safe incineration.

In general, the utilization of chemical agricultural inputs is showing an increase. Therefore, it is necessary to foresee the environmental impact that these chemical inputs may cause in both storage and utilization, and provide for adequate precautionary measures.

Mineral Resources

It has been ascertained that the country has 200 tonnes of gold, 12.5 tonnes of platinum, 17 million tonnes of nickel, 25,000 tonnes of tantalum and 58 million tonnes of iron ore. From 1998 to 2000 gold and tantalum amounting to 12,135 kg and 225.6 tonnes respectively, have been produced.

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The total number of workers in the mining sector is estimated to be more than one hundred thousand. However, the actual amount of mineral produced by this work force is not known exactly. The negative impacts that mining activities have caused on the environment include, among others, deforestation, disruption of ecosystems, erosion of fertile soils due to flooding, and water pollution.

Energy Resources

Energy supply in Ethiopia is mainly based on biomass resources. Out of the 698.84 Tera-joules of energy utilized in 1994, the share of biomass resources was 95.1 percent. The contribution of energy from petroleum and electricity was only 4.3 and 0.6 percent, respectively.

Studies made at various times indicate that the country has an estimated 30 to 50 billion m³ of natural gas, 1000 Megawatts of geothermal power and an unknown but substantial quantity of coal and other energy sources such as oil shale. As regards alternative sources of energy, the country has an estimated potential for generating 2.3 Terra Watt hours of solar energy and 4.8 million Terra Calories of wind energy per annum. However, except for a limited effort to apply solar energy for expanding telecommunication services in rural areas, no other significant action has been taken to utilize alternative sources of energy.

In 1996, total energy consumption in the country amounted to 723 Meta-joules. This is equivalent to 50 million tonnes of fuel wood, of which 94.5 percent was acquired from bio-mass sources including fuel wood, crop residues and animal dung.

Although it is believed that enormous amounts of energy can be generated from the various energy sources in the country, the sources that are most used (above 95 %) are wood and other biomass products. Due to poverty, the majority of the population cannot afford to buy and/or construct the equipment required for harnessing alternative sources of energy and the biomass resources are being increasingly depleted. As a result of the deforestation, the silting up of dams and the consequent reduction in reservoir capacity has undermined the generation of hydropower energy. Biomass resources such as dung, which should be utilized to enhance soil fertility, are not being ploughed back into the land since they are being utilized as sources of energy.

Section Four: The Human Environment

Demography

In 2002, the population of Ethiopia was estimated at over 67 million. Out of this 56 million (84.7 %) was rural and 10.3 million (15.3 %) was urban. Out of the rural population, 28.57 million (50.2 %) were males and 28.34 million (49.8 %) were females. For the urban population, the figures were 5.13 million (49.8 %) males and 5.17 million (50.2%) females.

The distribution of the population is 49 percent living at altitudes of 2,200 m or more above sea level, 11 percent at altitudes of less than 1,400 m above sea level, and 40 percent at altitudes of between 1,400 and 2,200 m above sea level.

Urban Conditions

A human settlement is considered to be a town when it has a population of at least 2000. Since most towns in Ethiopia do not have master plans and have been founded and administered in a haphazard manner, they are faced with very large social and environmental problems. After the enactment of the public health proclamations in 1950 and 1955, attempts to require the development of towns in accordance with plans were made.

Available information indicates that, at present, the preparation of town master plans is going on extensively. It is understood that these master plans more or less take into account environmental concerns. The environmental problems that urban areas are faced

with include shortage or non-existence of sewerage systems, unavailability/shortage or mismanagement of toilets, solid waste and industrial effluent disposal problems, and air pollution. Fulfilling the biomass demands of urban areas in terms of food and fuel obviously has negative impacts on the natural resources base of rural areas.

Environmental Health

Only 31 percent of the total population has access to clean water. The coverage in rural areas is 24 percent while the coverage in urban areas is 72 percent. Sources of drinking water include rivers and lakes (33.9%), developed springs and wells (11.1%), unprotected sources such as springs and wells (38.1%) and other sources (0.15%).

It is estimated that there are over three million people infected with the HIV/AIDS virus. From the time that the occurrence the HIV virus was discovered up to the year 2000, about 1.2 million people had died from HIV/AIDS.

The most widespread diseases in Ethiopia are related to or caused by the lack of environmental health and by malnutrition. Improving the sanitation of the human environment will greatly contribute to the reduction of the health problems.

Education

Education has an important role to play in a country's social and material development. According to the results of a study made in the year 2000, only 29.2 percent of the population above 10 years of age could read and write. The literacy rate for the rural population is 27.7 percent while it is 69.9 percent for the urban population.

Environmental education has been incorporated into the elementary education curriculum, grades 1 to 4, and efforts are being made to do the same in the curriculum of higher grades.

Gender and Environment

The female population is comparable in numbers to that of the male population. Women play an important role in the management and utilization of environmental resources and rural women in particular are responsible for providing fuel and water for household use.

As the livelihood of the majority of the population is directly dependent on natural resources the depletion and degradation of these resources threatens the security of each household. Since the chore of the management of the household falls mostly on women, the depletion of biomass resources, the degradation of water resources, land degradation and the expansion of desertification and low levels of environmental sanitation have particularly and directly exacerbated the problems for women.

Human-made and Natural Disasters

The increasing frequency of drought occurrences associated with global warming has exposed all local, but especially rural, communities to great amounts of misery. They do not have time to recover from past droughts and rebuild their assets before another dry period. The people living in the northern parts and the lowland areas of the country have suffered most from its impacts. Drought has also become a major factor causing natural resources degradation and the exacerbation of the poverty. The drought of 2002/2003 has exposed 15 million people to food shortages.

In addition to drought, the spread of desertification has become apparent in many parts of the country. Forest depletion, serious damage to soil resources, reduction in animal productivity and animal products, reduction in the amount of, and disruption in, the distribution pattern of rainfall are major causes for the expansion of drought and desertification.

Section Five: Laws, Policies, Guidelines and An Environmental Information System

Environmental Policy, Laws and Guidelines

Environment-related issues are not new to the Ethiopian legal system. However, since environment-related provisions of law were dispersed and lacked comprehensiveness, they were not adequate to ensure the wellbeing of the environment. In addition, since the existing laws were designed to protect specific natural resources they had created a situation where sectoral institutions could not give attention to environmental issues in their entirety because this would have taken them outside their specific sectors.

One of the objectives of the Constitution of the Federal Democratic Republic of Ethiopia (Proclamation 1/1995) is ensuring a clean and healthy environment. It states that every citizen has the right to live in a healthy environment. Based on the Constitution, the Environmental Protection Authority (EPA), established to cater for environmental matters, now has three different enabling proclamations, which were enacted by the Federal Council of Peoples Representatives towards the end of 2002. The environmental guidelines seen as needed to implement these laws have been prepared or are under preparation by the EPA. Examples include guidelines designed to help in the implementation of environmental impact assessment in the agricultural, transport and industrial sectors as well as for the leather processing plants and rapidly developing construction industry. Standards have also been developed to enable pollution control.

The recently enacted proclamations, which pertain to environmental impact assessment, pollution control and the establishment of environmental protection organs, have also given adequate attention to environmental auditing. The laws require that developers establish their own internal environmental audit procedures and that government organs with environmental mandates use environmental auditing as a tool for the enforcement of the laws.

Institutions

The Ministry of Natural Resources Development and Environmental Protection was abolished in 1995, and its three major functions were given to three different organisations, one of which was the Environmental Protection Authority. The Authority was established in 1995 by Proclamation No. 9/95.

The Authority functioned until 2002 in accordance with the powers and duties entrusted to it by Proclamation 9/95. This was recently repealed and the Proclamation on the Establishment of Environmental Organs, enacted in 2002, has replaced it.

This new proclamation includes provisions for the establishment of sectoral environmental units as well as regional environmental organs and describes the general area of their duties and responsibilities.

Environmental Information System

An environmental information system is an important tool for environmental decision making as well as enhancing the awareness of and drawing the attention of the public and government agencies to environmental matters.

The environmental information generated by various bodies at different levels has not been kept under either one centralized or several decentralized systems. Hence, it is difficult to assert that any meaningful information service is being provided despite the level of resources that have been spent on the collection of the information. The Ministry of Water Resources is now developing a metadatabase (MDB) that will include environmental information. The Environmental Protection Authority is now carrying out some preliminary activities aimed at establishing an effective environmental information system for the country, which will be compatible with the metadatabase of the Ministry of Water Resources.

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'State of the Environment' Reports are produced in many countries. These documents contain accounts of the state of environmental resources, the impact of economic and social activities on these resources, and the measures taken by various bodies to minimize their negative impacts.

Although isolated sectoral attempts have been made to describe the state of Ethiopia's environmental resources as well as the impacts of human activity on these resources and the measures that have been taken to minimize these impacts, a comprehensive and holistic environmental report has not been produced to date.

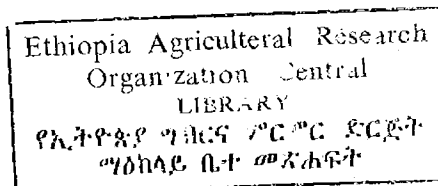
The Objectives of the Ethiopian State of the Environment Report are to:

- ❖ Promote informed decision making at all levels;
- ❖ Provide useful information relevant to economic and social activities based on natural resources;
- ❖ Create awareness about the conditions of environmental resources and the trends in their utilization and management; and
- ❖ Lay the foundation for, and develop the experience required to produce State of the Environment Reports in the future;

This report was prepared by a team of professionals drawn from the various sections of the Environmental Protection Authority (Annex 14). The Planning and Programming Service led the process.

Ethiopia has not yet established an environmental information system that can assist in the preparation of State of the Environment Reports. Therefore, information acquired from 26 federal organs and all the eleven regional states has been used as the basis for the preparation of this Report (Annex 13). In each region, completed questionnaires were collected from between 9 and 12 institutions. Reports produced by various domestic and international organisations have also been reviewed. To the extent that the availability of information permitted, an attempt has been made to indicate in this Report the environmental situation between 1996 and 2002.

This Report is divided into five sections. Section One deals with topography and climate; Sections Two and Three deal with economic conditions and the management and utilization of natural resources, respectively; Section Four deals with the human environment; and Section Five deals with environmental policies, laws, guidelines as well as information systems. In addition, annexes containing detailed information are given at the end of this document.



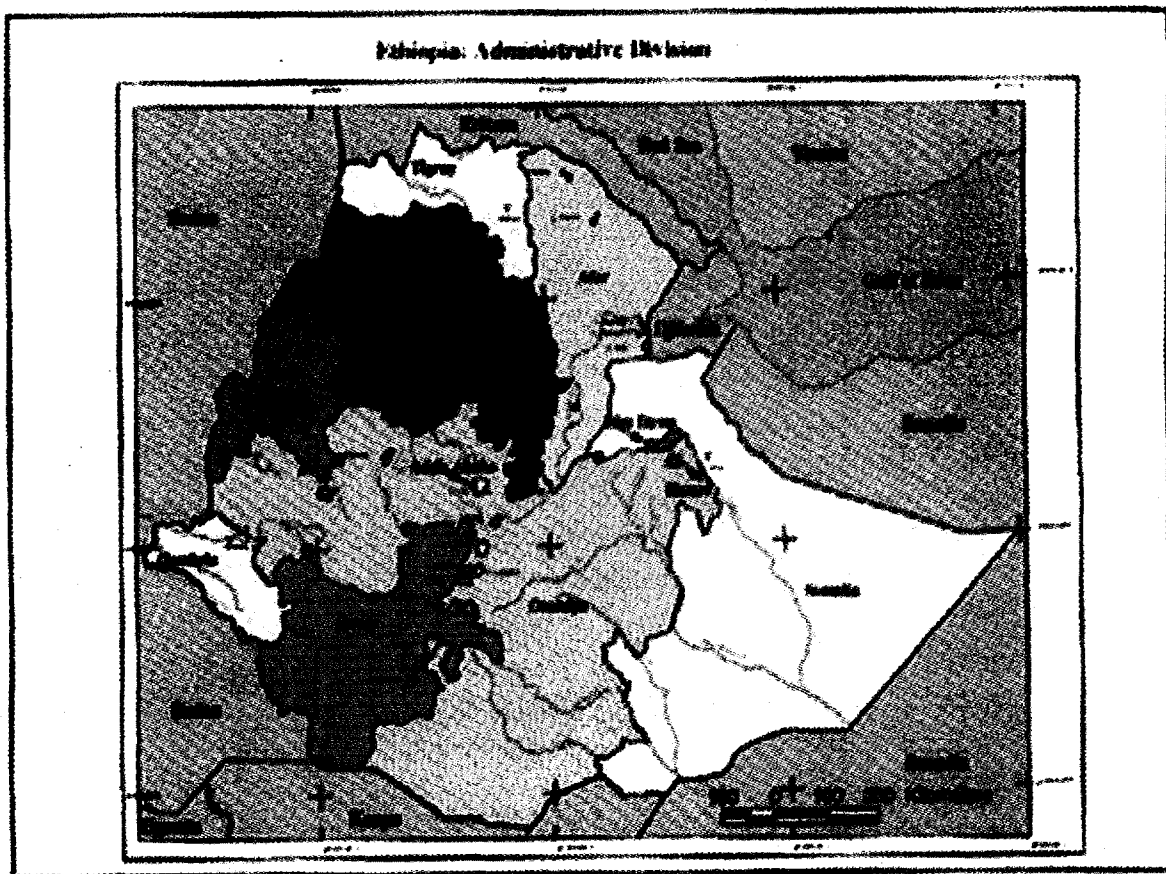
SECTION ONE: TOPOGRAPHY AND CLIMATE

1.1 TOPOGRAPHY

Ethiopia is located between 33° and 48° East longitudes and 3° and 15° North latitudes. Somalia and Djibouti in the East, Kenya in the South, Sudan in the West and Eritrea in the North bound it. It has an area of 1.130 million km². Since 1993 it has been divided into nine regional states and two city administrations (Map 1).

Ethiopia has a rugged and mountainous topography with an altitudinal range of between 4620 m above sea level at Ras Dejen Mountain in North Gonder and 110 m below sea level in the Dalol Depression in the Afar region. The Great Rift Valley separates the Western and Northern Highlands from the South Eastern and Eastern highlands. According to some studies, 55 percent of the country can be categorized as constituting lowlands below 1500 m asl. It is estimated that 15 percent of the population live in these lowlands while 85 percent live in the mostly mountainous highlands above 1500 m asl. The highlands make up 45 percent of the total area. Streams with deep valleys flow down from these mountains to join the rivers Abay, Tekeze, Mereb, Awash, Omo, Wabi Shebelle and Baro-Akobo.

Map 1: Administrative Regions of Ethiopia



Note: The boundary lines on the map cannot be taken as official

1.2 CLIMATE

Although Ethiopia is located in the tropical zone, it is endowed with a variety of climatic conditions resulting from its topography. The traditional classification of climate based on altitude and temperature gives five zones, namely: 'wurch' (cold climate at more than 3,000 m asl altitude), 'dega' (temperate highlands with altitudes of 2,500-3,000 m asl), 'weina dega' (warm highlands with altitudes of between 1,500-2,500 m asl), 'kola' (hot and in most places lowlands with altitudes of less than 1,500 m asl), and 'bereha' (hot and dry semi-desert lowlands).

According to the Köppen classification system, the climate of Ethiopia is divided into three major climatic regions. These are dry climate, tropical rainy climate and temperate rainy climate. These major categories are in turn divided into the following sub-climatic zones.

1) Dry Climate

- a) Hot Arid Climate: Mean annual temperature higher than 27°C mean rainfall less than 450 mm; low relative humidity; little cloud; evaporation twenty or more times in excess of rainfall in some places.
- b) Hot Semi-Arid Climate: Mean annual temperature 18°C-27°C; mean rainfall 410-820 mm; evaporation exceeds rainfall.
- c) Cool Semi-Arid Climate: Mean annual temperature below 18°C; mean annual rainfall 410-820 mm; evapotranspiration reduced owing to low temperature.

2) Tropical Rainy Climate

- a) Tropical Climate I: Has some dry months in winter (i.e. 'bega' or dry season); Mean annual rainfall 680-2000 mm.
- b) Tropical Climate II: Temperature of coldest month above 18°C; mean annual rainfall between 1200-2800 mm.

3) Temperate Rainy Climate

- a) Warm Temperate Climate I: Distinct dry months in winter; coldest month with mean temperature above 10°C, and mean temperature above 18°C for more than four months; Annual rainfall greater than twenty times the annual mean temperature plus fourteen [$120 \times (t+14)$].
- b) Warm Temperate Climate II: Dry months in winter; mean temperature less than 18°C; rainfall of driest month greater than one third of that of wettest winter month and also greater than one tenth of that of the wettest summer month.
- c) Cool Highland Climate III: Dry months in winter; mean temperature of the warmest month 10°C or less; annual rainfall between 800 and 2000 mm; dry climate.

1.2.1 Rainfall

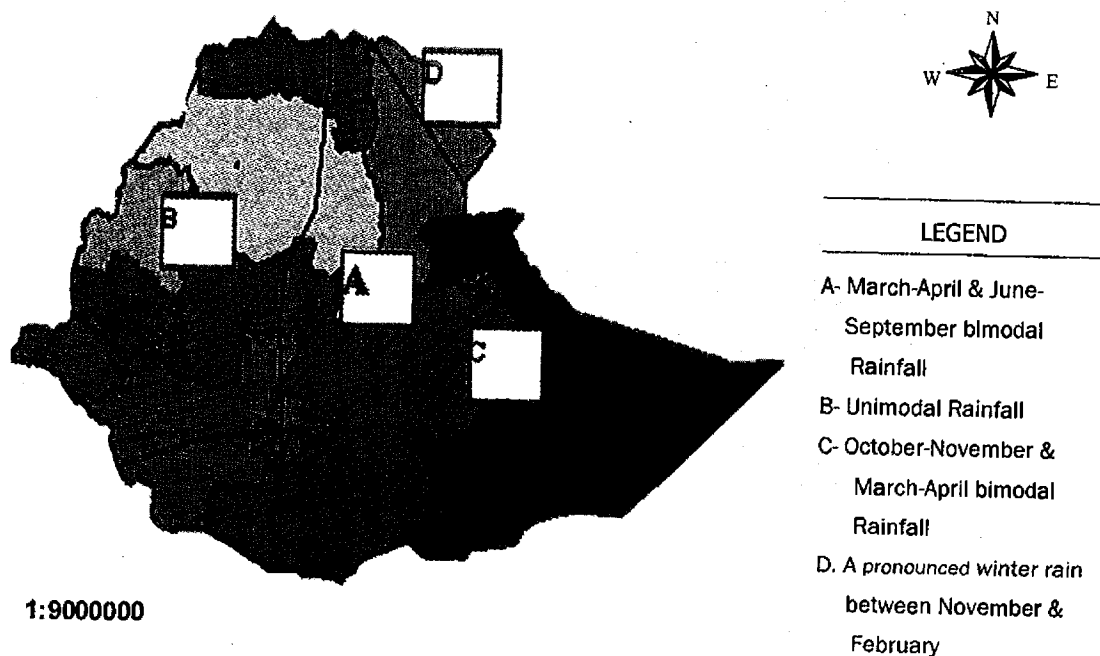
The three prevailing moisture bearing wind systems affecting the country are the south westerly from the South Atlantic, the south easterly from the Indian Ocean, and the easterly from the Arabian Sea. The highest amount of moisture comes through the south-

westerly winds during the summer season (June, July, August and September). The highest mean annual rainfall occurs in the southwestern highlands (over 2,700 mm) and gradually decreases to the southeastern lowlands (to less than 200 mm) and to the northeastern lowlands (to less than 100 mm).

Based on annual rainfall distribution patterns, the four major rainfall regions given in Map 2 have been delineated as follows:

- A. The central, eastern and northeastern areas experience a nearly bimodal (two peak) rainfall distribution. The moisture for the small (spring) rains (February-May) comes from the Arabian Sea and the big (summer) rains (June-September) mainly from the South Atlantic but also from the South Indian Ocean. A long dry period (October-January), and usually a short dry spell (mid-May to mid-June) occur between the two rainfall periods.
- B. The southwestern and western areas of the country are characterised by a mono-modal (single peak) rainfall pattern. Moisture is brought by the wind system coming from the South Atlantic Ocean and the Indian Ocean with the length of the wet season decreasing northwards.
- C. The southern and southeastern areas of the country are dominated by a distinctly bimodal (two peaks) rainfall pattern. Rain falls during September to November and March to May with two distinct dry periods of approximately the same duration separating the two wet seasons.
- D. In the northern part of the Rift Valley and adjacent escarpment the major source of moisture is easterly winds that come from the Indian Ocean. The rainfall is scanty and the distribution pattern is rather diffuse but with a pronounced winter rain peaking between November and February.

Map 2: Distribution of major rainfall regimes in Ethiopia



Source: Conservation Strategy of Ethiopia, Volume 1, 1997

1.2.2 Temperature

The temperatures are determined by altitude, with the highest parts being the coldest and the lowest being the hottest.

According to information from the National Meteorological Services Agency, the average temperature in Ethiopia is estimated to range between 10°C in the northwestern, central and southeastern highland areas of the country and 35°C in the northeastern parts of the country (Map 3).

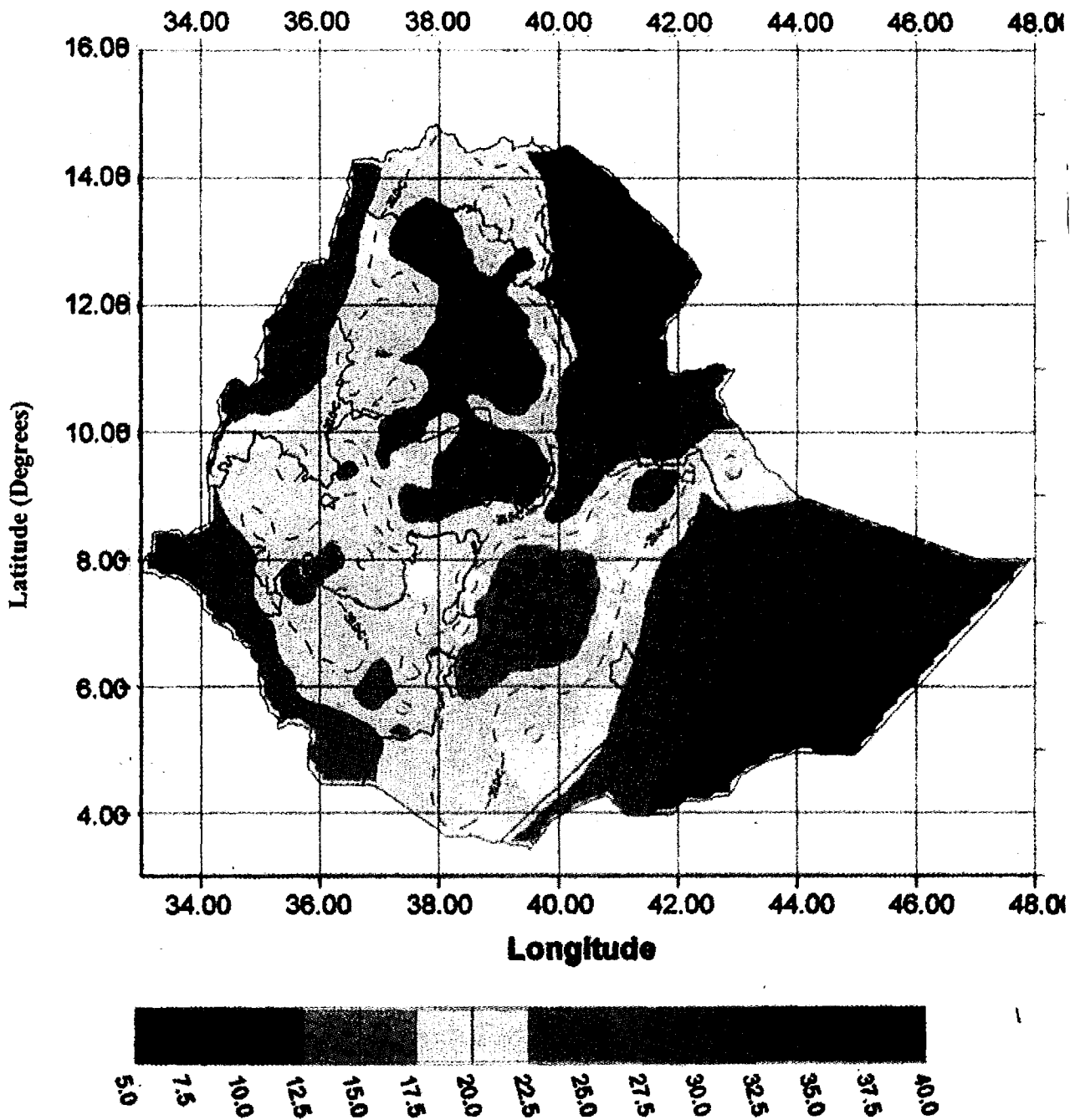
The highest maximum mean temperature occurs in the Afar Depression, reaching as high as 45°C between April and September and 40°C between October and March. In July the northwestern lowlands have an average maximum temperature of 41°C. In April, the Western and southeastern lowlands record temperatures of 35 to 41°C.

On the other hand, the highlands have a mean minimum temperature of 0° C or below between November and February at night (Environmental Protection Authority, 1997).

Daily mean maximum temperature varies from more than 37°C over the lowlands of the northeast (Afar Triangle) and southeast (Ogaden) to about 15°C over the highlands of Central and northern Ethiopia. The months of March to May are the hottest during the year.

Lowest annual minimum temperatures occur over the highlands particularly between November and January. Minimum temperatures that reach frost point during the Bega season are not uncommon over the highlands. Also temperatures lower than 5°C occur during high rainfall months (July and August) over the higher parts of the plateau in Northwest, Central and Southeast due to high cloud cover.

Map 3: Annual Daily Mean Temperatures



Source: National Meteorological Services Agency, 2001

SECTION TWO: ENVIRONMENT AND DEVELOPMENT

2.1 STATE OF THE ECONOMY

Gross Domestic Product (GDP) is one of the indicators of a country's state of the economy. However, this indicator does not take into account major environmental factors such as environmental quality, degradation, depletion of natural resources and expenditure for the protection of the environment. As a result, GDP calculations used so far have disregarded environmental aspects.

Despite that, however, there is no doubt that GDP provides some useful information about a country's economic situation. Between 1988/89 and 1999/2000 GDP in Ethiopia grew by an average of 5 percent. When measured by economic sectors, there has been a growth of 2.5 percent in agriculture, 5.3 percent in industry, 6.3 percent in distribution (transport, communication, trade and tourism), and 8.3 percent in other service areas. From 1995/96 to 2001/2002, the average per capita GDP growth rate was 2.4 percent.

An overall review of the GDP in the past few years gives us a picture of a healthy economic performance. For example, in 1995/96 GDP grew by 10.6 percent. The main factor for this growth in GDP was the bumper crop harvested as a result of the good weather conditions in that year. An additional factor was the growth in the share of GDP of the industrial and distribution sectors as well as of other services.

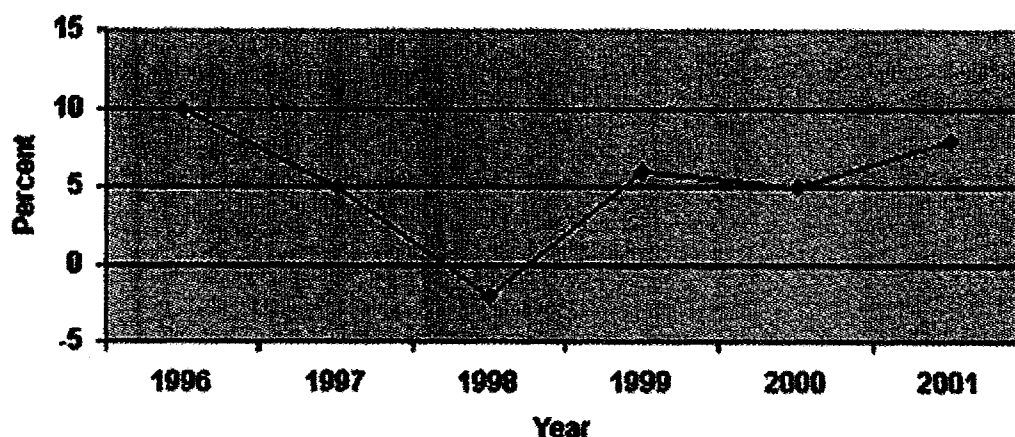
Although the economic growth rates between 1996/97 and 1998/99 were encouraging, they were lower when compared to the growth rate in 1995/96. The GDP growth in 1997/98, which was 1.2 percent, was particularly low. The reason for this was the weak performance of the agricultural sector in that year. Nevertheless, conditions have improved and growth rates of 5.0 percent to 7.7 percent have been recorded since then. (Refer to Table 1 and Figure 1)

Table 1: Annual GDP, GDP Per Capita and Growth Rate at Factor Cost

| Description | 1995/96 | 1996/97 | 1997/98 | 1998/99 | 1999/00 | 2000/01 | 2001/02 |
|---|---------|---------|---------|---------|---------|---------|---------|
| Gross Domestic Product (GDP) at Current Factor Cost (in billion Birr) | 35.1 | 38.2 | 41.4 | 44.8 | 47.6 | 52.0 | 57.1 |
| GDP Growth Rate with previous year as 100 % (in 1980/81 prices) | 10.6 | 5.2 | -1.2 | 6.3 | 5.4 | 7.7 | 5.0 |
| GNP at factor cost (in billion Birr) | 34.8 | 38.0 | 41.1 | 44.4 | 47.1 | n.a | n.a |
| GNP per capita at market price (in Birr) | 600.0 | 650.0 | 708.0 | 791.7 | 818.8 | n.a | n.a |
| GNP growth rate (per capita) | 7.1 | 2.1 | -4.1 | 3.2 | 3.8 | 5.8 | 4.0 |

n.a = information not available

Sources: Central Statistical Authority, 2002 and Ministry of Finance and Economic Development, 2002

Figure 1: Annual Growth of GDP at 1980/81 Prices (with previous year as 100)

Source: Ministry of Finance and Economic Development, 2002

2.1.1 Agriculture

Agriculture is the mainstay of Ethiopia's economy. Consequently the agricultural sector's share of the GDP is about 50 percent. It is estimated that agriculture's share of total foreign exchange earnings amounts to 90 percent. Agriculture is also a sector on which the country's food security depends while it also serves as a source of raw materials for agro-industries. An estimated 70 percent of the raw materials required by large, medium and small agro-industries are acquired from this sector. About 85 percent of the labour force is employed by this sector.

Of the total contribution of the agricultural sector to the economy, the share of crops, livestock and forest and other related products is 60, 27, and 13 percent respectively.

Agriculture in Ethiopia is mainly characterised by a rain-fed mixed farming system carried out by smallholder farmers using traditional agricultural methods and practices. These smallholder farmers utilize 95 percent of all cultivated land and produce 90 percent of the total agricultural production without considering coffee, which is primarily produced by smallholder farmers.

2.1.2 Structure of the Gross Domestic Product

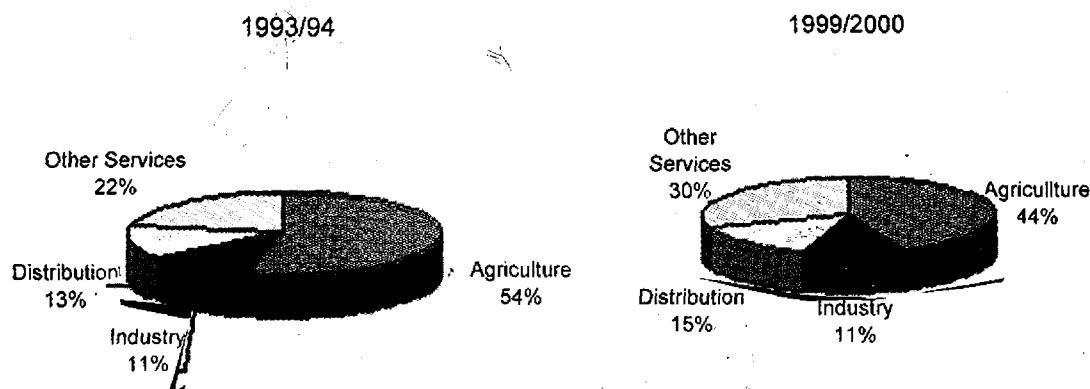
The various economic sectors make their own contribution to the GDP, and this varies from year to year. For example, the agricultural sector, which is natural resources based, had a share of 53 percent of GDP in 1993/94 and 43.3 percent in 1999/2000. During those same years, the share of industry was 10.6 and 11.5 percent respectively. The respective shares of the distribution sector and other services were 13.3 and 22.2 percent in 1993/94 and 14.5 and 29.0 percent in 1999/2000 (Table 2).

Table 2: GDP by Sectoral Origin at 1980/81 Constant Factor Cost

| Economic Sector | 1993/94 | % | 1999/00 | % |
|--|-----------------|-------------|-----------------|-------------|
| 1. Agriculture | 14,159.0 | 53.9 | 7,052.8 | 43.3 |
| Farming | 12,488.0 | 47.5 | | |
| Forestry | 1,661.3 | 6.3 | | |
| Fishery | 12.2 | - | | |
| 2. Industry | 2,790.0 | 10.6 | 1870.8 | 11.5 |
| Mining and quarrying | 85.3 | 0.3 | 82.6 | 0.5 |
| Factories | 1,081.1 | 4.1 | 782.2 | 4.8 |
| Handicrafts and small-scale industries | 697.0 | 2.7 | 326.4 | 2.0 |
| Building and road construction | 672.9 | 2.6 | 243.3 | 1.5 |
| Light, electric power and water | 253.7 | 1.0 | 436.4 | 2.7 |
| 3. Distribution | 3,506.0 | 13.3 | 2,231.1 | 14.9 |
| Trade, hotels and restaurants | 2,360.9 | 9.0 | 1,396.6 | 8.6 |
| Transport and recreation | 1,145.1 | 4.4 | 1,026.5 | 6.3 |
| 4. Various other services | 5,827.7 | 22.2 | 4,955.0 | 30.4 |
| Total | 26,282.7 | 100 | 16,301.7 | 100 |

Source: Central Statistical Authority, 2002

Figure 2: GDP by Industrial Origin at 1981 Constant Factor Cost (1993/94 and 1999/00)



Source: Drawn from data taken from Central Statistical Authority 2002.

2.1.3 The Economic System

Ethiopia is a country in the process of building a free market economic system. The progress that the country is making in this direction is encouraging. Among the factors that indicate this progress is the continuous growth of GDP. Other indications are the measures taken to have domestic and foreign investors participating significantly in economic and social development activities. This participation has contributed to the creation of employment opportunities, to the diversification of the economy as well as to the increase in government revenue and growth in GDP.

However, since the majority of the investment activities are based on the exploitation of natural resources, it is essential to take precautionary measures to prevent negative environmental impacts from such investment activities. It is, therefore, important that a major effort is made to ensure that the relevant organisations and the public comply with the environmental policies and laws that have been issued by Government.

2.1.3.1 Gross National Product (GNP)

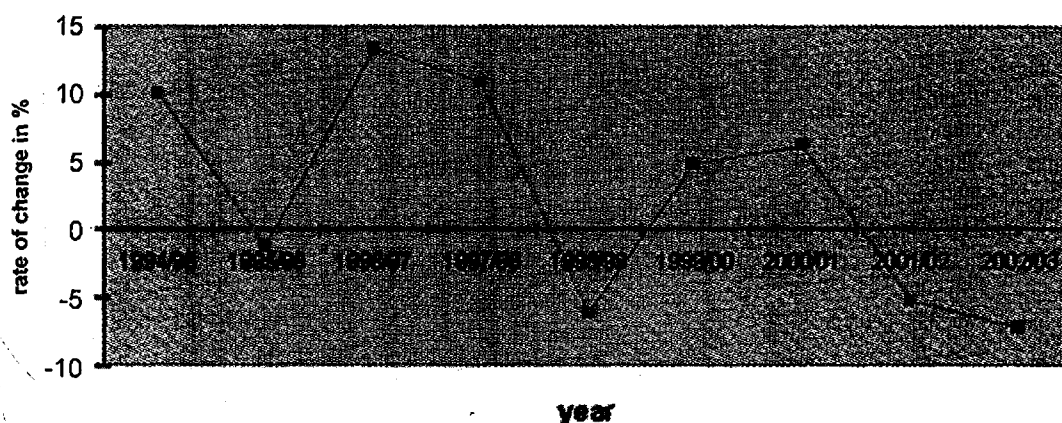
GNP, which combines GDP and foreign trade earnings, is an indicator of economic and social development. In 1975/76, per capita GNP at market prices was Birr 600 and in 1999/2000 Birr 818.8. (Refer to Table 1)

2.1.3.2 Annual Inflation Rate

In the performance of a country's economy, increases in the average inflation rate reduces the purchasing power of the people and results in the decline of their standard of living.

There has not been a single year in Ethiopia where a very high inflation rate has occurred. However, during the last two years of the Derg's downfall, i.e. 1990/91 and 1991/92, inflation rates of 20.5 and 20.0 respectively were recorded. In 1984/85, a year when a drought occurred, inflation reached 18.5 percent. The years 1994/95, 1996/97, 1997/98 and 1999/00 were also years when inflation rates of 10, 13.4, 10.9 and 6.2 percent respectively were recorded. Outside these years, inflation since the year 1994/95 has remained below 5 percent because instability in price levels was gradually reduced as a result of the economic rehabilitation measures taken by the Government. (Figure 3).

Figure 3: Trends in Inflation based on Addis Ababa Retail Price Index (%)



Source: Drawn from data taken from Ministry of Economic Development (1999) and Congregation and National Bank of Ethiopia (2003).

2.1.3.3 Savings and Investment

Savings and investment play key roles in speeding up economic growth, expanding employment opportunities and improving the people's standard of living. According to available data, the rate of domestic savings and general capital formation has improved. The GDP share of general domestic capital formation was 10.6 percent in 1990/91 and 20.2 percent in 1998/99. During this period domestic savings had a share of 3.5 percent and 7.0 percent respectively.

In spite of that, the contribution of domestic savings to general domestic capital formation remains low. For example, in 1997/98, the contribution of domestic savings to general domestic capital formation was only 34 percent. As a result of this low rate of savings, capital formation in the country is dependent on the flow of financial resources from external sources. This has a negative effect on the country's external debt and balance of payment. Thus, improving the rates of domestic savings and investment is indispensable for sustainable development and growth.

The Government has been putting a lot of effort into encouraging investment. In this respect the establishment of the Ethiopian Investment Authority at the federal level and

corresponding offices at the regional level, the issuance of the Investment Policy and the measures taken to reform the tax regime can be mentioned as examples.

Following the policy that was issued by the Government to encourage investment, domestic and foreign investors are undertaking encouraging investment activities. Between June 1992 and October 2002, investment licences were issued to 7,122 investors with a total capital of Birr 78.3 billion. Of these, 307 are foreign investors. Of the total number of investors 2,075 have already started operation and 1,257 have their enterprises still under construction. The remaining enterprises have either not started construction or have abandoned their planned investment. Information from the Ethiopian Investment Authority shows that in 1996/97, investment licences were granted to 794 projects with a total capital of Birr 6.7 billion, in 2001/2002 investment licences were issued to 791 projects with a total capital of Birr 7.6 billion (Table 3).

Table 3: Number of Projects Issued with Investment Licenses in Various Investment Sectors and Related Amounts of Capital in 1995/96 and 1999/00 (in million Birr)

| Investment Sector | 1995/96 | | 1999/2000 | |
|-------------------|---------|---------|-----------|---------|
| | Project | Capital | Project | Capital |
| Agriculture | 181 | 2387.50 | 74 | 763.77 |
| Manufacturing | 376 | 1935.26 | 200 | 1666.61 |
| Services | 237 | 2392.00 | 517 | 5163.41 |
| Total | 794 | 6714.61 | 791 | 7593.79 |

Source: Ethiopian Investment Authority, 2002

Overall, in the period between 1991/92 and 2001/2002 investment licences were issued in 33 sub-sectors within the 3 major investment sectors. Among these 1527 (21 %) were in agriculture and 2,992 (41.2 %) in the manufacturing industries. The remaining 2,736 (37.8%) were in other areas such as mining, construction and social services. With respect to the share of investment capital, agriculture has a share of 10.7 percent while manufacturing and services have a share of 31.1 and 57.3 percent, respectively.

2.1.3.4 Employment

The size of the labour force and the manner in which it is employed within an economy determines the rate of economic and social development of a country. According to the Central Statistical Authority, the labour force of Ethiopia consists of all persons 10 years old and above. People within this age category are either already employed or are potentially employable.

In 1999/2000, Ethiopia had a labour force of 43.6 million, which was 68.6 of the total population of 63.5 million. Of that labour force, 7.3 million (16.6 %) were urban and 36.4 million (83.4%) were rural. According to the results of the 1994 census, 88 percent of all the labour force was employed in the agricultural sector in various governmental and non-governmental organisations. Out of the employed labour force 14.1 million were male and 10.8 million were female.

Studies made by the Central Statistical Authority show that, in terms of employment by economic sectors, 79.8 percent of the labour force is employed in agriculture, 3.9 percent in trade, 4.4 percent in industrial production and 3.5 percent in the hotels and restaurants sectors.

2.2 TRADE

Activities in the trading sector are directly related to the productive sector of the economy. Export trade in Ethiopia is mainly based on agricultural products, which amount to 90 percent of the total, with coffee making up 70 percent and having a share of 60 percent of the total export trade earnings. Following coffee, leather and hides and chat have a share of 12 and 7 percent respectively (Table 4 shows the trade situation between 1993/94 and 1997/98).

Table 4: Value of Exports by Major Commodity Groups (in million Birr)

| Type of Commodity | 1992/93 | 1993/94 | 1994/95 | 1995/96 | 1996/97 |
|----------------------|----------|----------|----------|----------|----------|
| Coffee | 718.20 | 1,799.04 | 1,724.00 | 2,307.39 | 2,827.97 |
| Leather and Hides | 203.61 | 373.55 | 321.00 | 372.25 | 347.64 |
| Pulses and Oil Seeds | 71.89 | 153.42 | 119.18 | 161.28 | 417.79 |
| Pulses | 27.70 | 103.29 | 77.22 | 87.26 | 103.20 |
| Oil Seeds | 44.19 | 56.13 | 41.94 | 74.02 | 314.59 |
| Chat | 107.93 | 172.34 | 174.44 | 217.96 | 272.61 |
| Total Export Trade | 1,238.73 | 2,732.04 | 2,539.06 | 3,617.79 | 3,865.99 |

Source: Ministry of Economic Development and Cooperation. 1999

A look at the balance of payments that Ethiopia has with other countries indicates that in 1996 it was -4.3 billion Birr and further deteriorated to -6.4 billion Birr by the year 2000. Among the major factors to which the deterioration is being attributed is the continuous fall in world coffee prices (Table 5).

Table 5: Total Value of Imports, Domestic Exports and Re-Exports and Visible Balance of Trade

| Year | Imports | Domestic Export and Re-exports | Visible Balance of Trade |
|------|-----------|--------------------------------|--------------------------|
| 1996 | 7,103.10 | 2,782.30 | -4,320.80 |
| 1997 | 7,490.60 | 3,719.30 | -3,771.3 |
| 1998 | 10,387.00 | 3,966.00 | -6,421.00 |
| 1999 | 11,070.11 | 3,552.90 | -7,517.20 |
| 2000 | 10,366.50 | 3,959.00 | -6,407.50 |

Source: Central Statistical Authority, 2002

For example, while revenue earned from coffee in 1997/98 was Birr 2.9 billion, earnings from coffee in 2000/01 were only Birr 1.45 billion. On the other hand, earnings from the export of other commodities have been progressively increasing. Thus, while earnings from non-coffee commodity exports in 1997/98 amounted to Birr 1.25 billion, in 2000/01 it increased to 2.23 billion Birr showing a growth of 77 percent.

The value of goods that were imported in 1996 was Birr 7.1 billion while in 2000 it increased to Birr 10.4 billion. Although, as indicated above, the visible balance of trade has been deteriorating from one year to the next, import trade has increased to meet the country's basic requirements in fuel, medicine and spare parts. For example, in 1996 export earnings covered only 39 percent of the cost of imported goods requirements. Available data indicate that there has not been any significant change since then.

2.3 INDUSTRY

2.3.1 Types, Numbers and Distribution of Industries

Modern industries started being established in Ethiopia towards the end of the 19th Century.

The fact that many foreigners (especially Armenians, Greeks, Italians, and Indians) came into the country following the construction of the Ethio-Djibouti railway system is considered to have been a major factor for the expansion of industries. The establishment of the industries was stimulated by the demand for consumer goods and construction materials. The food, beverage, textiles, leather and shoe processing sub-sectors dominate industrial production in Ethiopia. (Table 6)

Table 6: Number of Industrial Establishments in Ethiopia (1998/99- 1999/00)

| Industry | 1998/99 | 1999/00 |
|---------------------------------|---------|---------|
| Food and Beverage | 228 | 235 |
| Tobacco | 1 | 1 |
| Textile | 36 | 36 |
| Clothing | 28 | 25 |
| Leather and Leather Products | 49 | 53 |
| Wood Works | 16 | 16 |
| Paper Products and Printing | 60 | 64 |
| Chemicals and Chemical Products | 43 | 40 |
| Rubber and Plastic Products | 32 | 29 |
| Non-Metallic Mineral Products | 88 | 85 |
| Metal and Metal Products | 46 | 59 |
| Machinery & Equipment | 20 | 15 |
| Motor Vehicles | 11 | 11 |
| Furniture | 121 | 119 |
| Total | 779 | 788 |

Source: Central Statistical Authority, 2002

According to studies carried out by the Central Statistical Authority, the number of industries that employ 10 or more people was 273 in 1992/93 and 642 in 1995/96. The number of industries has progressively increased reaching 788 by the year 2000. As indicated in Table 6, in 1998/99 and 1999/2000 the number of manufacturing industries was 779 and 788 respectively.

2.3.2 Industrial Environmental Problems

The majority of industries in Ethiopia are old and use outdated technology. Despite the fact that their number is small, their impact in terms of pollution is large. Moreover, a great majority of these industries discharge their waste in the form of liquid, dust particles and smoke, without any treatment. For example, a number of studies have indicated that among the industries located in Addis Ababa, 90 percent discharge their waste without any treatment into nearby water bodies and open spaces. This has exposed streams flowing across Addis Ababa into the Awash River to serious pollution. Although no studies to ascertain the impact on human health resulting from this pollution have been made, it can be assumed that there has been toxic impact on humans since many people drink water taken directly from the streams.

To find out the types and amounts of pollution generated, a study on water samples of 33 industrial plants and other establishments in and around Addis Ababa was made taken from water bodies where they discharge their waste. The result shows that all the

SECTION TWO: ENVIRONMENT AND DEVELOPMENT

factories studied generate wastes that carry pollutants in excess of internationally accepted pollution standard. The details are given in Annex 1. The same study shows that the textile and the leather factories are highly polluting. The extent of pollution also exceeds the level indicated in Article 18 of Regulation 5/ 1995¹ of the Addis Ababa Water and Sewerage Authority.

Table 7: Industrial Plants and Other Enterprises Sampled

| Factory/Plant | Type of Pollutant | | |
|------------------------------|-------------------|------|-------|
| | Air | Soil | Water |
| Leather and Leather Products | – | 5 | 5 |
| Chemical | 1 | 5 | 7 |
| Textile* | 2 | 4 | 7 |
| Metal* | 2 | 4 | 7 |
| Non Metal | 2 | – | – |
| Beverages | 1 | 1 | 4 |
| Food | 1 | 2 | 3 |
| Abattoirs | 1 | 1 | 1 |
| Hospital* | – | 1 | 1 |

* Factory/Health facility with one each having a treatment plant

Source: UNIDO, 2001

The study has also ascertained that the waters of the rivers and streams flowing across Addis Ababa are pollution free upstream of Addis Ababa and only become highly polluted in the course of crossing the city. As a result of this high degree of pollution, the oxygen content of these streams and rivers is so depleted that the aquatic ecosystems have become disrupted.

2.3.3 Measures taken to reduce the Impact of Industry on Environment

Since the overall development of industry is low, the countrywide impact that the sector causes cannot be considered serious. Nevertheless, the problem is significant in certain parts of the country. Efforts to ameliorate the problem have been made, although they are as yet inadequate compared to the degree of industrial pollution. These efforts are as follows:

- ❖ The implementation of the Ecologically Sustainable Industrial Development (ESID) Strategy and the Ethiopian Cleaner Production Programme, which have been launched to bring about sustainable industrial development.
- ❖ The establishment of a Cleaner Production Centre.
- ❖ The issuance of sectoral and cross-sectoral policies and strategies that help to prevent damage to the environment from industrial activities. Among these the policies in the area of health, water, energy as well as the proclamations issued in the area of health, labour, water and trade registration and licensing can be mentioned.
- ❖ Environmental auditing of state owned factories earmarked for privatisation has started with financial resources secured from the African Development Bank through the joint collaboration of the Privatisation Agency and the Environmental Protection Authority.

¹ Wastewater shall not exceed the following: 200 mg/l TDS, 2000 mg/l SS, 650 mg/l BOD and pH level of 5-10.

- ❖ The Proclamation of an Environmental Impact Assessment Law (Proclamation No. 299/2002), which is intended to predict and manage the environmental effects of design, sighting, construction and operation of a proposed industrial activity or modification and termination of an ongoing one.
- ❖ The proclamation of an Environmental Pollution Control Law (Proclamation No. 300/2002), which is intended to eliminate or at least minimize industrial pollution to an acceptable level.

2.4 POVERTY

2.4.1 The Poverty Situation

Poverty is a broad concept. It has economic, social and political dimensions. The economic dimension is not only limited to lack of basic necessities such as food, shelter and clothing but also relates to the lack of access to health and educational services as well as lack of employment opportunities, resources etc.

Ethiopia is one of the least developed countries in the world. Between 1995/96 and 1999/2000 GNP per capita was between Birr 600 and 819. As indicated in the Africa Environmental Outlook, published by the United Nations Environment Program (UNEP) in 2002, Ethiopia holds the 171st position out of 174 countries in the human development index.

According to a study carried out by the Central Statistical Authority in 1996 and published in 1999, an estimated 46 percent of the population is under the poverty line, which is Birr 1,075 per annum. This means that 46 percent of Ethiopians meet their basic requirements on an average income of Birr 3 per day.

This income level does not enable people to save and invest over and above meeting their subsistence requirements. Since people do not have a variety of choices in terms of products and are dependent only on limited types of natural resources for consumption, they are forced to deplete these natural resources in a situation where efforts to enhance the productivity of these natural resources is inadequate or even absent. This, in turn, exacerbates the process of environmental resources degradation.

2.4.2 The Poverty Reduction Programme

Ethiopia has developed a poverty reduction strategy designed to bring about economic and social development. Measures have been taken to ensure the participation of all sectors of the population in the process. The objective of the Poverty Reduction Strategy is to reduce and ultimately eradicate poverty by bringing about fast economic and social development and macro-economic stability.

The poverty reduction strategy deals with agriculture, food security, expansion of educational and health services, controlling HIV/AIDS, expansion of roads, improving water resources utilization, and gender issues. In addition, the strategy also addresses environment and population. Expansion of foreign trade, capacity building, including enhancement of good governance, is also part of the strategy.

SECTION THREE: NATURAL RESOURCES MANAGEMENT AND UTILIZATION

3.1 LAND USE AND LAND COVER

3.1.1 Land Use

It was not possible to acquire current, scientifically generated and credible information on land use in the country. Thus, there was no choice except to use the studies made in the early 1980s by the Ministry of Agriculture. Information from this period indicates that the size of Ethiopia is 113 million hectares. Out of this, 74 million hectares or 66 percent of total area is considered suitable for agriculture. However, the actual size of land under cultivation is estimated to be only 16.5 million hectares or 28 percent of the total.

Table 8: Land Use Area and Percentage

| Land Use | Area (in 000' Ha) | % of total |
|---------------------------------|--------------------|------------|
| Cultivated Land | 17,293,875 | 15.3 |
| Land Covered by Annual Crops | 15,336,828 | 13.6 |
| Land Covered by Perennial Crops | 1,957,047 | 1.7 |
| Rangelands | 57,747,935 | 50.8 |
| Forests and Bush land, etc | 13,881,815 | 12.3 |
| Forest | 4,420,379 | 4.0 |
| Bush land and others | 9,461,436 | 8.4 |
| Unproductive land | 4,488,849 | 4.0 |
| Currently unutilised Land | 19,587,526 | 17.3 |
| Total | 113,000,000 | 100.0 |

Source: Ministry of Agriculture, 1986

3.1.2 Soil Resources

The geomorphology and soils map produced by the Ministry of Agriculture in 1984 recognizes 18 dominant soil associations. One more has been described since then (Table 9 and Map 4). This diversity of soils is attributed to the diversified nature of the climate, topography, parent material, geological age and biological parameters including vegetation and land use.

Table 9: Distribution and location of the different types of soils in Ethiopia

| Dominant Soil | Area (km ²) | Area (%) | Agricultural Properties | Location |
|---------------|-------------------------|----------|---|---|
| Acrisol | 55,727 | 5.0 | 50% base saturation Very porous Reddish brown to red colour (leaching of bases down the profile to B horizon and Fe, Al, Mn remains) Chemically poor Low cation exchange capacity Low available phosphorus Moderately suited for agriculture | Moderate to steep slopes of high-rainfall areas (e.g. western Ethiopia) |

SECTION THREE: NATURAL RESOURCES MANAGEMENT AND UTILIZATION

| Dominant Soil | Area (km ²) | (%) | Agricultural Properties | Location |
|---------------|-------------------------|------|---|---|
| Andosol | 13,556 | 1.2 | Very low bulk density (0.85 g/cc) High organic matter Humification of organic matter and incorporation with Allophane-forming stable complex Mollic horizon | Northern highlands (western Tigray, north Gonder, and near Lake Abiyata, Lake Ziway, and Lake Koka) |
| Arenosol | 9,024 | 0.8 | Coarse texture Excessive drainage* Low water-holding capacity* Low cation exchange capacity* Poor fertility* | On steep gorges of south-eastern Welo, at the base of Mt Dejen in north Gondar and in north-eastern Bale |
| Cambisol | 124,038 | 11.0 | Chemically rich On steep slopes* | Central part of Ethiopia, and north-eastern escarpment |
| Chernozen | 814 | 0.07 | High organic matter content Deep Mollic A horizon Loamy texture Excellent structure Good nutrient status Some accumulation of CaCO ₃ at depth | Humid temperate climate with pronounced seasons found on the flat pyroclastic plateau of south Mt Chilalo in Arsi. |
| Regosol | 133,596 | 11.8 | Shallow Exceedingly stony Clay loam Very low organic matter Chemical characteristics ??? | North-eastern Welo, eastern Tigray, sandstone plains of eastern Ogaden Depend on the parent material on flatter landforms Where volcanic ash deposits are occasionally found on <u>largely blown slope</u> : debris materials on the flatter landforms throughout Denakii and in the eastern Ogaden |
| Rendzina | 16,348 | 1.4 | High organic matter content Exchange complex dominated by calcium Excellent structure Production for short periods | Moderate to steep-sided slopes of limestone. Landforms in the central, northern, and Chercher highlands |
| Solonchak | 47,217 | 4.2 | Very high salinity PH alkaline Low organic matter content | Found in arid areas on colluvial slopes or evaporate deposits (Ogaden); Awash River Valley: around Lake Shala, in Denakii and in the extreme southern Rift valley around Chew Bahr |
| Fluvisol | 88,262 | 7.8 | Have variable physical and chemical characteristics Have a range from non productive to highly productive Irregular change in organic matter with depth | Occur in recent alluvial deposits and on flat land scattered throughout Ethiopia |

| Dominant Soil | Area (km ²) | (%) | Agricultural Properties | Location |
|---------------|-------------------------|------|--|---|
| Gleysol | 5,273 | 0.5 | Seasonal presence of ground water table within 50cm of the surface* Presence of Histic Dominant neutral hues High in clay content Good fertility Waterlogged* Dominated with peasant and nomadic livestock grazing | Every where in Ethiopia where the ground water table is within 50cm of the surface, e.g. flood plain of Awash where flooding is extreme |
| Histosol | 4,720 | 0.4 | Developed in marshy area* | On permanent swamps and marshes (Asaita Delta at the mouth of Awash River near the Djibouti border and the Dabus River swamp in western Welega and Fincha) |
| Leptisols | 163,185 | 14.4 | Formed within 10 cm depth on continuous coherent Occurring on all parent | On steep and very steep slopes of the eastern part of the country, with largest extents in rock extents in Ogaden and Denakil |
| Luvisol | 64,064 | 5.7 | Disposition of clay Base saturation of 50% or more Intensively cultivated and among the best agricultural lands in the tropics flatter landforms of southern Sidamo, southern Rift Valley in the coarser-textured granite soils, further south of flood plain of Awash River | Occur throughout Ethiopia where climatic conditions are favourable for clay movement: central Ethiopia, east and west Chercher highlands, northern highlands, |
| Solonetz** | 495 | 0.04 | Characterized by high sodium accumulation within B horizon | Found in some arid and semi arid parts of Ethiopia |
| Nitosol | 150,089 | 13.3 | Clayey Reddish brown to red Deep Very porous High moisture storage capacity Stable angular blocky to sub-angular blocky structure Deep rooting volume Highly weathered | In the central highlands and the western lowlands; west, where Chercher highlands are wettest; north of Lake Tana: southern Rift Valley (moving upward out of the Rift) |
| Phaeozem | 32,551 | 2.9 | Dark coloured Rich basic topsoil Mollic A horizon Little or no CaCo ₃ Central (Blue Nile Goge) and Chercher highlands | Widely spread on the North-eastern Escarpment and northern highlands (Western Tigray, northern Gonder and Welo) |

SECTION THREE: NATURAL RESOURCES MANAGEMENT AND UTILIZATION

| Dominant Soil | Area (km ²) | (%) | Agricultural Properties | Location |
|---------------|-------------------------|------------|--|--|
| Vertisol | 116,785 | 10.3 | Dark in color Montmorillonitic clay soils Expanding and contracting with changes in moisture content Wide vertical cracks Slicken sides Gilgai microtopography concentrated largest extents found in central Ethiopia in basins with seasonal drainage deficiencies | Flat to undulating land throughout Ethiopia where fine-textured Colluvium collects except in the very driest areas and where the parent material evaporates on flood plains of major rivers where fine-textured alluvium has |
| Xerosol | 53,171 | 4.7 | PH neutral to alkaline Low organic matter Weak structure Medium to coarse textured | Extensive in the semiarid areas of Ethiopia |
| Yermosol | 34,950 | 3.1 | Medium to coarse textured Weak structure High BH Low organic matter Chemically more variable than Xerosols Very frequently saline | On vast plains of the arid and semiarid regions of Ethiopia (Ogaden) more representative for arid regions |
| Others | 16,135 | 1.4 | | |
| Total | 1,130,000 | 100 | | |

* Identified recently

* Agricultural potential severely limited by soil depth, frequent stoniness, and topographic position.

Source: Ministry of Agriculture, Land use Planning & Regulatory Department, 1984

3.1.2.1 Areas of the major arable soils in Ethiopia

In terms of area coverage, Nitosols, Cambisols and Vertisols comprise nearly 60 percent of the arable land (Table 10).

Nitosols, the most intensively cultivated soils, are highly weathered, clayey, reddish brown to red, having an argillic B-horizon with abrupt textural changes. Chemically, they are acidic in reaction and have a low available phosphorus and chemical exchange capacity. The clay is mainly kaolinite but they also contain weatherable minerals. Physically they are well drained, deep and workable and have excellent structure and a high water holding capacity.

The second ranking soil class in terms of area coverage of arable soils are the Cambisols. These soils are shallow, stony and have low organic matter and phosphorus content. In these soils moisture is mostly the main limiting factor to crop production. Nitrogen and phosphorus are also low.

Vertisols, with a large acreage in central, north-western and western Ethiopia, are cracking black montmorillonite clay soils which expand and contract with changes in moisture content. They are low in permeability and occur on flat to undulating topography making them poorly drained and difficult to work. Despite their physical problems and their susceptibility to erosion, their nutrient retention and water holding capacity can make them productive. Most of the Vertisols in Ethiopia have moderate organic matter content and low levels of available phosphorus.

The low level of leaching to which arid soils (xerosol, solonchaks) have been subjected has resulted in many cases in the accumulation of ions including the important plant nutrients. These soils are therefore generally rich in calcium, potassium, sodium,

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phosphorus and sulphur. However, the shortage of precipitation, the high evapo-transpiration and the absence of leaching have also resulted in many cases in the accumulation of salts detrimental to plant growth, such as chlorides, carbonates, sodium, and magnesium.

Table 10: Area in km² of the major arable soils in Ethiopia

| Soil type | Rank | Actual area (km ²) | Area coverage % |
|------------|------|--------------------------------|-----------------|
| Nitisols | 1 | 143,796 | 23 |
| Cambisols | 2 | 119,960 | 19 |
| Vertisols | 3 | 118,746 | 18 |
| Luvissols | 4 | 59,448 | 9 |
| Fluvisols | 5 | 59,324 | 9 |
| Xerosols | 6 | 54,652 | 9 |
| Solonchaks | 7 | 37,903 | 6 |
| Acrisol | 8 | 18,173 | 3 |
| Subtotal | | 612,002 | 96 |
| Other | | 24,941 | 4 |
| Total | | 636,943 | 100 |

Source: Ethiopian Agricultural Research Organization, 1998

3.1.2.2 Soil Erosion and Land Degradation

In Ethiopia, up to 400 tons of fertile soil per hectare is lost annually from land with insufficient vegetation cover as well as from land where no effective soil conservation has been carried out. The soil thus lost annually is from the farmlands, which make up 15.3 percent of the total area. It is estimated that the amount of soil that the country loses annually due to water and wind erosion reaches 1.5 to 1.9 billion tonnes. Out of this, 45 percent occurs on crop farmlands and 21 percent occurs on overgrazed rangelands. The value of soil that was eroded in 1989/90 only was estimated to have a monetary value of Birr 59 million.

Photo 1: A gully resulting from soil erosion in Tigray Region, Enticho woreda, 45km on the Adewa - Adigrat road(Photo, EPA)



Soil erosion has caused several direct and indirect negative impacts. It has led to the degradation of agricultural land and consequent reduction in agricultural production thus exposing the population to food insecurity. The accumulation of silt in various water bodies has led to water resources degradation as well as the shortening of the life spans of dams.

3.1.2.3 Measures Taken to Conserve and Protect Soil Resources

To combat land degradation, particularly soil erosion and loss of soil fertility, traditional as well as modern soil conservation measures have been carried out in different parts of the country. For centuries communities in Ethiopia have been carrying out traditional soil conservation measures. The Konso and Hararge areas can be mentioned as examples of such traditional practices. Among the types of soil conservation measures taken, the construction of terraces, soil bunds, micro-basins and cut-off drains, area enclosure for the protection of regenerating natural vegetation as well as tree planting, especially on slopes and in watersheds of particular interest, can be mentioned. The type and extent of soil conservation between 1995/96 and 1999/00 is shown in Table 11. The extent of land protected by area enclosures to keep out animals from grazing it and to prevent humans from cutting down young trees is not included in this table, but it is being extensively practiced especially in Tigray, Amhara and Oromia regions.

Photo 2: Soil and Water conservation in Tigray Region 120km on the Mekele to Adigrat road(Photo, EPA)



As indicated in the Table 11, on-farm and off-farm terracing and maintenance related thereto have been carried out extensively. Since the direct victims of soil erosion are the communities they have been at the forefront of the effort to ameliorate the situation.

**Table 11: Countrywide Soil Conservation Activities in Hectares
(1995/96–1999/00)**

| Type of Work | 1995/96 | 1996/97 | 1997/98 | 1998/99 | 1999/00 |
|---------------------|---------|---------|---------|---------|---------|
| On Farm Terraces | 89,350 | 141,430 | 187,210 | 224,472 | 642,462 |
| Other Terraces | 170,393 | 257,435 | 178,993 | 22,732 | 629,553 |
| Terrace Maintenance | 36,558 | 26,291 | 44,886 | 56,809 | 164,544 |
| Soil Bund | 50,921 | 3,227 | 1,860 | 1,691 | 57,699 |
| Check-dam | 478 | 20,811 | 752 | 856 | 22,897 |
| Micro-basins | 1,150 | 1,416.5 | 1,799 | 1,828 | 6,193.5 |
| Cut-off drains | 445 | 704 | 866 | 808 | 2,823 |

Source: Ministry of Finance and Economic Development, 2000

3.2 BIODIVERSITY

3.2.1 Major Ecosystems

The Ecosystem zonation of Ethiopia is based on vegetation types. This is because there is far better data available as regards flora than fauna, and also because the distribution of fauna resources is closely related to that of flora.

The vegetation of Ethiopia can be divided into the following 9 broadly defined types:

- ❖ Desert and Semi-arid Scrublands;
- ❖ *Acacia-Commiphora* (Small-Leaved Deciduous) Woodlands;
- ❖ Lowland Semi-Evergreen Forests;
- ❖ *Combretum-Terminalia* (Broad-Leaved Deciduous) Woodlands;
- ❖ Moist Evergreen Forests;
- ❖ Evergreen Scrub;
- ❖ Dry Evergreen Montane Forests and Associated Montane Grasslands;
- ❖ Afroalpine and Subafroalpine Vegetation;
- ❖ Riparian and Swamp Vegetation.

3.2.2 State of Biodiversity

The topography and diverse climatic conditions of Ethiopia have led to the emergence of habitats that are suitable for the evolution and survival of various plant and animal species. As a result, the country is in one of the biodiversity rich parts of the world. Owing to the long history of agriculture coupled with the diversity of the environment, Ethiopia is one of the 12 Vavilov centres of crop genetic diversity.

The Ethiopian flora is estimated to contain nearly 7,000 species of higher plants, of which about 12 percent are endemic, but the pattern of endemism is far from random with certain families, for example Poaceae, Moringaceae, Fabaceae, Euphorbiaceae and Asteraceae having a far higher proportion of endemic species than 12 percent. The vegetations types with the highest proportion of endemics are the woodlands, followed by the Afroalpine and Subafroalpine.

Ethiopia is the centre of origin for various crop species including Arabica coffee, teff, niger seed or noug (*Guizotia abyssinica*), enset (*Ensete ventricosum*), and sorghum in part. Other crop species that have high genetic diversity in the country are barley, wheat, faba bean, field pea, lentil, linseed, and sesame. In addition, there are various wild plants that are used by communities for various purposes, including medicinal use.

SECTION THREE: NATURAL RESOURCES MANAGEMENT AND UTILIZATION

Photo 3: High forest cover in Belete Gera High forest, SNNPR, Jimma zone, Gera woreda, Bonche Kebele, 48km South West of Agaro Town (Photo, EPA)



The Flora of Ethiopia is in the process of being published in a seven-volume work. It is estimated that there are between 6,500 and 7,000 known species of higher plants in Ethiopia. About 800 species are used in traditional medicine. A number of these medicinal plant species are endemic to Ethiopia, including *Taverniera abyssinica*, *Enchinops kebericho*, *Boswellia pirottae*, and *Lobelia rhynchopetalum*. Some indigenous medicinal plants are highly endangered.

Photo 4 Hakim Abebech Shiferaw Medicinal Plants Centre, Oromia Region, East of Debre Zeit town(Photo, EPA)



There are also numerous wildlife and domestic animal resources in the country. Out of the total wildlife genetic resources, 30 mammal, 16 bird, 3 reptile, 17 amphibian and 3 fish species are known to be endemic to Ethiopia. However, knowledge of reptiles, amphibians, fish and all invertebrates is far from complete, and the number of endemic species could be higher than those so far recorded.

3.2.3 Environmental Problems Related to Biodiversity

3.2.3.1 Expansion of Alien Invasive Species

Alien invasive species are one of the major factors threatening biodiversity resources globally. Alien invasive species lead to ecosystem disruptions by destroying or displacing indigenous species through rapid reproduction and expansion. They cause severe damage by reducing crop yields, displacing indigenous species, obstructing irrigation infrastructures and aiding the spread of other crop pests.

Alien species are found in many parts of the country. Although no detailed studies about their quantitative impact have been carried out to date, these species are causing enormous problems for the ecosystems and the economy. The invasive alien species that are causing damage across the country are listed in Table 12.

Table 12: Exotic Invasive Species, Localities Invaded and Damage Occurring

| Species | Area of distribution | Damage Occurring |
|---------------------------------|---|--|
| <i>Parthenium hysterophorus</i> | Northern, eastern and western Ethiopia | Invading most of the country. |
| <i>Prosopis juliflora</i> | Middle and Lower Awash River Basin, Awash National Park, eastern Hararge, Raya and Azebo Plains | Invading eastern semi-arid areas, but likely to spread to other lowland semi-arid areas. |
| <i>Argemone mexicana</i> | 'Dega' and 'Woyna Dega' areas | Causing reduction in agricultural productivity in the highlands. |
| <i>Tagetes minuta</i> | 'Dega' and 'Woyna Dega' areas | Not evaluated |
| <i>Eichornia crassipes</i> | Oromia, SNNPR ² , Gambella | Invading relatively moist lowlands |
| <i>Lantana camara</i> | Hararge, Somali Region | Invading highland and upper lowland areas of autumn and spring rainfall |

Source: Institute of Biodiversity Conservation and Research, response to questionnaire, 2001, and Ethiopian Agricultural Research Organisation, 2002, modified.

In addition, the following major factors can be mentioned as endangering ecosystems:

- ❖ Uninformed government decisions that have been disregarding and often overriding local organizations and management systems;
- ❖ Settlement and investment activities that do not take into account environmental concerns;
- ❖ The inappropriate use of natural resources resulting from the lack of land use policy and land use planning;
- ❖ The continuous increase in the amount of toxic waste and other pollutants;

² Southern Nations, Nationalities and Peoples Region

SECTION THREE: NATURAL RESOURCES MANAGEMENT AND UTILIZATION

- ❖ The low awareness of some sectors of the public regarding the value of biodiversity;
- ❖ The high degradation of forests, vegetative cover, and water and soil resources;
- ❖ The relative insignificance of the effort made to conserve and protect biodiversity;
- ❖ The impact of widespread poverty in the country and the recurring drought and desertification.

3.2.4 Measures taken to Protect and Conserve Biodiversity

Two approaches are being used to protect and conserve biodiversity. These are the *in situ* and *ex situ* conservation approaches. The *in situ* approach conserves species within their natural habitat while the *ex situ* approach does so outside the habitats of the species by collecting and protecting them in gene banks.

3.2.4.1 *In Situ* Conservation

In situ conservation of crop species is being carried out in different parts of the country, namely Keffa, Bale, Eastern Shoa, Southern Wollo and Tigray. In these conservation sites various plants, mostly crops, are being protected individually as well as in groups. Among the plants which are being protected *in situ* can be found wheat, barley, sorghum, teff, maize, horse bean, field pea, enset, oil seeds, medicinal and cosmetic plants, coffee, spices, legumes and tubers.

In situ conservation of wild flora and fauna is carried out in protected areas by the Ethiopian Wildlife Conservation and Development Organization. Further detail on this is given in Section 3.4.

3.2.4.2 *Ex Situ* Conservation

The Institute for Biodiversity Conservation and Research is storing *ex situ* samples of crops of farmers' varieties from fields and markets in cold storage. These samples are to conserve the genetic diversity of these species and to make material available for research. To do this, 62,000 accessions of 104 crop species are being conserved in the gene bank. In addition, not less than 35,000 samples have undergone evaluation. The crop samples being conserved *ex situ* are listed in Table 13. Plants used in traditional medicine have also been identified and protected by the Institute. These are listed in Annex 2.

Table 13: Crop Samples of *Ex Situ* Conserved Seeds held in IBCR

| Type | No. of Samples | Crop | No. of Samples | Crop | No. of Samples |
|---------|----------------|---------------|----------------|--------------|----------------|
| Millet | 1,811 | Noug | 1,142 | Rape seed | 1,257 |
| Tef | 4,395 | Linseed | 1,164 | peas | 1,490 |
| Barley | 14,592 | Lentils | 948 | Horse beans | 1,612 |
| Sorghum | 8,021 | Chickpea | 574 | Castor beans | 505 |
| Wheat | 12,471 | Vetch | 506 | Fenugreek | 521 |
| Maize | 884 | Haricot beans | 326 | Coffee | 1,181 |
| | | | | Others | 3,158 |
| | | | | Total | 56,558 |

Source: Institute of Biodiversity Conservation and Research, response to questionnaire, 2001.

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Since its establishment, the Institute distributed around 40,000 samples of crop species to domestic and international users. At the domestic level, crop germplasm has been distributed to farmers, agricultural enterprises and researchers. The International Centre for Agricultural Research in Dry Areas (ICARDA), the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), and the International Livestock Research Institute (ILRI) are among the international recipients.

In addition to the measures described above other measures have also been taken to protect and conserve biodiversity. These include:

- ❖ The issuance of a biodiversity policy and the commencement of activities to develop a biosafety system;
- ❖ The ongoing countrywide demarcation of wildlife protected and controlled hunting areas;
- ❖ The issuance and implementation of a conservation strategy, an environmental policy, a biodiversity strategy and action plan, a genetic resources policy.

Nevertheless, there is a need for an increased effort to save the biodiversity for which Ethiopia is renowned.

3.3 FOREST RESOURCES

3.3.1 The Contribution of Forest Resources to the Economy

There are no current data that shows the contribution of forest resources to GDP. In the early 1990s, the contribution of forest resources to GDP was 2.5 percent of the total, while their contribution to that of the agricultural sector was 5.5 percent.

There are also no adequate current data regarding the contribution of the forestry sub-sector to the creation of employment opportunities. Data compiled from various government documents in 1989 indicate that 2.2 percent of the total labour force was employed by the forestry sub-sector and that 2.8 percent of the labour force employed in agriculture was in the forestry sub-sector.

However, forest resources are providing numerous direct and indirect economic benefits. Forest resources are particularly beneficial for the production of incense, gums, bamboo, honey and wild coffee. Furthermore, it is useful as a source of fuel wood and medicinal plants, as a sanctuary for wildlife as well as for the protection of the integrity of ecosystems and water regimes. Unfortunately, no forest resources valuation in monetary terms is currently available.

3.3.2 Status of Forest Resources

According to information from Woody Biomass Inventory and Strategic Planning Project, the extent of natural forest resource is about 3.9 million ha. This natural forest is distributed in the three regional states, namely in Oromia (2.6 million ha), Southern Nations, Nationalities And Peoples Regional State (SNNPRS) (0.8 million ha), and Gambella (0.5 million ha). This accounts for about 3.43 percent of the total land area of the country.

The land use/land cover of these three regions is given in Tables 14, 15, and 16.

SECTION THREE: NATURAL RESOURCES MANAGEMENT AND UTILIZATION

Table 14: Oromia Regional State, Area of Land Use/Land Cover

| Land use/Land cover | % | Area in ha. |
|---------------------|------------|-------------------|
| Cultivated land | 26.9 | 9,671,458 |
| Grassland | 12.0 | 4,320,639 |
| Natural forest | 7.1 | 2,562,587 |
| Plantation forest | 0.2 | 62,770 |
| Woodland | 27.3 | 9,824,305 |
| Shrubland | 21.6 | 7,750,425 |
| Afro-Alpine | 0.5 | 180,155 |
| Wetland | 1.1 | 396,715 |
| Others | 3.3 | 1,192,930 |
| Total | 100 | 35,961,984 |

Source: Woody Biomass Inventory and Strategic Planning, 2000.

Table 15: SNNPRS, Area of Land Use/Land Cover

| Land Use/Land Cover | % | Area in ha |
|---------------------|------------|-------------------|
| Cultivated land | 36.4 | 3,905,454 |
| Grassland | 15.7 | 1,689,925 |
| Shrubland | 22.8 | 2,451,255 |
| Woodland | 14.9 | 1,601,877 |
| Natural forest | 7.3 | 784,705 |
| Plantation forest | 0.1 | 15,401 |
| Wetland | 2.6 | 281,576 |
| Others | 0.04 | 4,116 |
| Total | 100 | 10,734,308 |

Source: Woody Biomass Inventory and Strategic Planning, 2000

Table 16: Gambella Regional State, Area of Land Use/Land Cover

| Land use/ Land use cover | % | Area in ha |
|-----------------------------|------------|------------------|
| Cultivated land | 3.4 | 107,325 |
| Grassland | 30.3 | 970,329 |
| Shrubland | 4.7 | 148,951 |
| Woodland | 36.4 | 1,167,192 |
| Natural forest | 16.7 | 534,600 |
| Wetland | 7.7 | 247,556 |
| Others | 0.9 | 27,271 |
| Total | 100 | 3,203,224 |

Source: Woody Biomass Inventory and Strategic Planning, 2000.

Although there are several reasons for the depletion of forest resources, the following are considered major:

- ❖ Increases in population and consequent increases in the demand for agricultural land, fuel wood as well as construction and industrial use;
- ❖ Settlements around forest areas and forest fires;
- ❖ The expansion of large commercial farms in forest areas;
- ❖ The absence of a forest protection and conservation policy;

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- ❖ The absence of a strong forest administration system capable of arresting the rapidly increasing rate of deforestation as well as controlling and preventing the disruption of the various ecosystems;
- ❖ Lack of effort to ensure the participation of communities in forest protection and conservation and the sharing of benefits;
- ❖ Failure to clearly demarcate and enforce the boundaries of natural forest reserves.

Photo 5: Forest destruction for fuelwood in SNNPR, Sheka zone, Masha woreda, Kanga kebele, 16km South West of Masha-Tepi road(Photo, EPA)



3.3.3 Measures taken to alleviate the Problems of Forest Management and Utilization

The effort to curb the prevailing destruction of Ethiopia's forests and associated ecosystems and reverse the consequent social and economic disruptions is not adequate when compared to the attention that the problem requires.

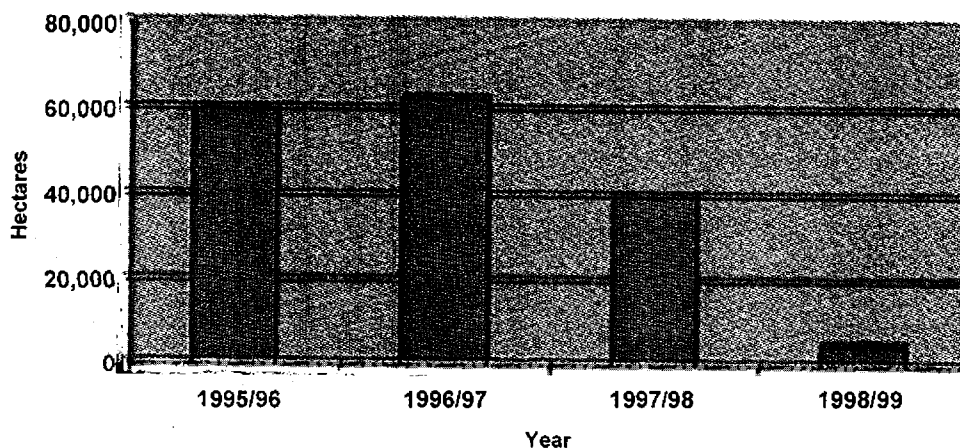
Nevertheless, frequent countrywide tree planting and afforestation campaigns have been carried out. Information from the Office of the Prime Minister (2000) indicates that in 1995/96, 59,085 ha of land was planted with trees. Seedlings produced during the same period were 380.83 million. In 1998/99, the tree planting and seedling production rate fell to 3,085 hectares and 25,851 seedlings, respectively. Forest demarcation and inventorying activities have increased to cover 8,264 hectares of natural forest in 1998/99. The details are given in Table 17.

Table 17: Seedlings Production and Planting, Forest Demarcation and Surveying Carried Out between 1995/96 and 1998/99

| Type of Work | Unit | 1995/96 | 1996/97 | 1997/98 | 1998/99 |
|---------------------------|------------|---------|---------|---------|---------|
| Seedling Production | In million | 380.83 | 46.650 | 299.38 | 27.85 |
| Tree Planting | Hectares | 59,085 | 61,299 | 37,471 | 3,085 |
| Demarcation and Surveying | Hectares | 6,316 | 9,159 | 4,601.5 | 8,204 |

Source: Office of the Prime Minister, 1999

Figure 4: Tree Seedling Planting Activities, 1995/96 to 1998/99



Source: Drawn from data taken from Table 16

Other major efforts to increase the improve the protection of natural forests and obtain up-to-date data on the existing forest resources include:

- ❖ The implementation of fuelwood development projects in some urban areas;
- ❖ Commencement of inventorying and demarcations of 58 Natural Forest Priority Areas (NFPAs) covering 4.78 million hectares (details given in Annex 4);
- ❖ The preparation of the National Forestry Action Programme at the federal level and the commencement of preparation for Regional Forestry Action Programmes in some of the regions;
- ❖ The recent development and application in different parts of the country of an extension package which takes into account forest resources;
- ❖ The establishment of forestry research and training institutions;
- ❖ The promotion of activities designed to popularise participatory forest management and conservation in some parts of the country (e.g. Adaba-Dodola, Bonga and Chelimo);
- ❖ The establishment of an institution designed to facilitate the utilization of forest genetic resources.

Although several measures to protect, conserve and utilize forest resources have been taken, more effort is still required to attain the sustainability that is required.

3.4 WILDLIFE RESOURCES

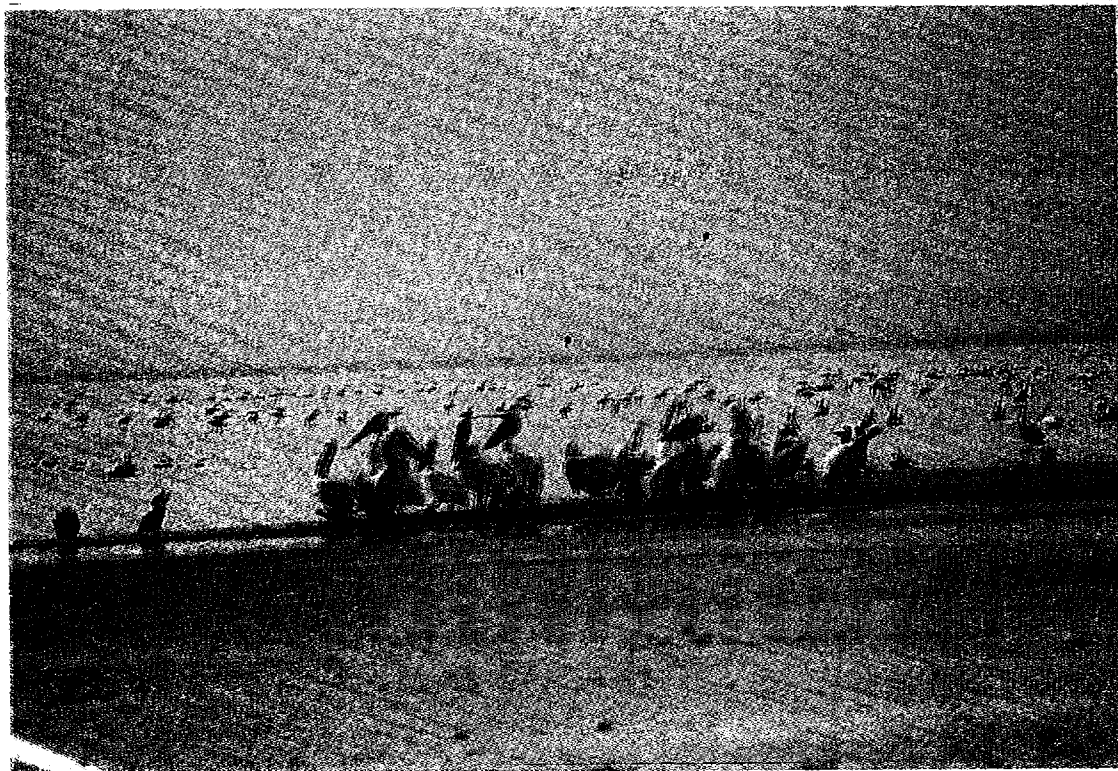
3.4.1 The State of Wildlife Resources

Wildlife, which is one of the important natural resources of Ethiopia, has a relatively low contribution to the country's economic development. In 1996/97 an income of 15.5 million Birr was earned from wildlife resources. This shows the possible importance of wildlife to the economy of the country. Wildlife resources are major tourist attractions in addition to being a source of protein in some parts of the country where they are used as food. Wildlife meat is of great importance particularly in the Southern and Southwestern parts of the country.

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Out of 277 mammals 31, out of 862 birds 16, out of 201 reptiles 10, and out of 63 amphibians 34 are endemic to Ethiopia. Out of the bird species, 31 are globally threatened. Among these 5 are critically endangered, 12 endangered and 14 vulnerable species. Various migratory birds considered endangered at the international level also visit about fifty sites in Ethiopia every year.

Photo 6: Lake Abijata – One of the Rift Valley Lakes best known for its bird population, Oromia region, 120km on the road from Addis Ababa to Awassa, (Photo, EPA)



Among the numerous wildlife in the country, the Walia Ibex, "Key Kebero" (Ethiopian wolf), and the Gelada Baboon found in the Semien National Park, the Menelik's Bush Buck and "Key Kebero" (Ethiopian wolf) found in Northern Shoa, the Mountain Nyala, "Key Kebero" (Ethiopian wolf) found in the Bale Mountains National Park, are the major ones. The various bird species in the different parts of the country also have special attraction. However, due to the pressure they are encountering, the numbers of wild animals are decreasing. There is evidence that the "Key Kebero" (Ethiopian wolf), is especially endangered due to cross breeding with the domestic dog and due to infection by a disease that the dogs acquire through human contact. In addition, information acquired from the Ethiopian Wildlife Organisation and the Ethiopian Wildlife and Natural History Society indicate that there are 7 mammals that are seriously endangered as well as 2 mammals and 8 birds that are vulnerable. (Table 18)

Photo 7: Walia Ibex and Ethiopian Wolf, two critically endangered endemic species of Ethiopia



Table 18: Conservation Status of Major Mammals and Birds

| Type and species | Critically Endangered | Endangered | Vulnerable | Near Threatened |
|-------------------------|-----------------------|------------|------------|-----------------|
| Mammals | | | | |
| Gelada Baboon | | | √ | √ |
| Grevys Zebra | | √ | | |
| Swaynes Hartebeest | | √ | | |
| Speake's Gazelle | | | √ | |
| Mountain Nyala | | √ | | |
| Walia Ibex | √ | | | |
| African Wild Ass | √ | | | |
| Ethiopian Wolf | √ | | | |
| Tora Hartebeest | | √ | | |
| Dibatag | | √ | | |
| Birds | | | | |
| Ankober Serin | | √ | | |
| White-winged Flufftail | | √ | | |
| Prince Ruspoli's Turaco | | | √ | |
| Sidamo Long-Clawed Lark | | | √ | |
| Yellow-throated Serin | | | √ | |
| Ferruginous Duck | | | √ | |
| Great Spotted Eagle | | | √ | |
| Imperial Eagle | | | √ | |
| Lesser Kestrel | | | | √ |
| Taita Falcon | | | | |
| Harwood's Francolin | | | √ | √ |
| Wattled Crane | | √ | | |
| Corn Crane | | | √ | |

Source: Wildlife Conservation and Development and Organization, 2001, response to questionnaire, and Ethiopian Wildlife and Natural History Society, 2002

3.4.2 Problems Encountered in the Management and Utilization of Wildlife Resources

The following major problems have been observed in the management and utilization of wildlife resources:

- ❖ Failure to ensure the participation of local communities in the protection and management of wildlife resources;
- ❖ The fact that human populations living around wildlife sanctuaries do not have alternative livelihoods and widespread poverty forces them to give priority to short term benefits;
- ❖ Human settlements, farming and grazing activities, deforestation to meet fuel wood and construction needs as well as forest fires in protected areas are becoming common phenomena and the resulting destruction of wildlife habitat, the spread of alien species and competition among wildlife for habitat;
- ❖ The non-existence of legally recognised boundaries for the protected areas and illegal hunting.

3.4.3 Efforts Made to Protect and Conserve Wildlife Resources

The following efforts have been made to protect and conserve the country's wildlife resources.

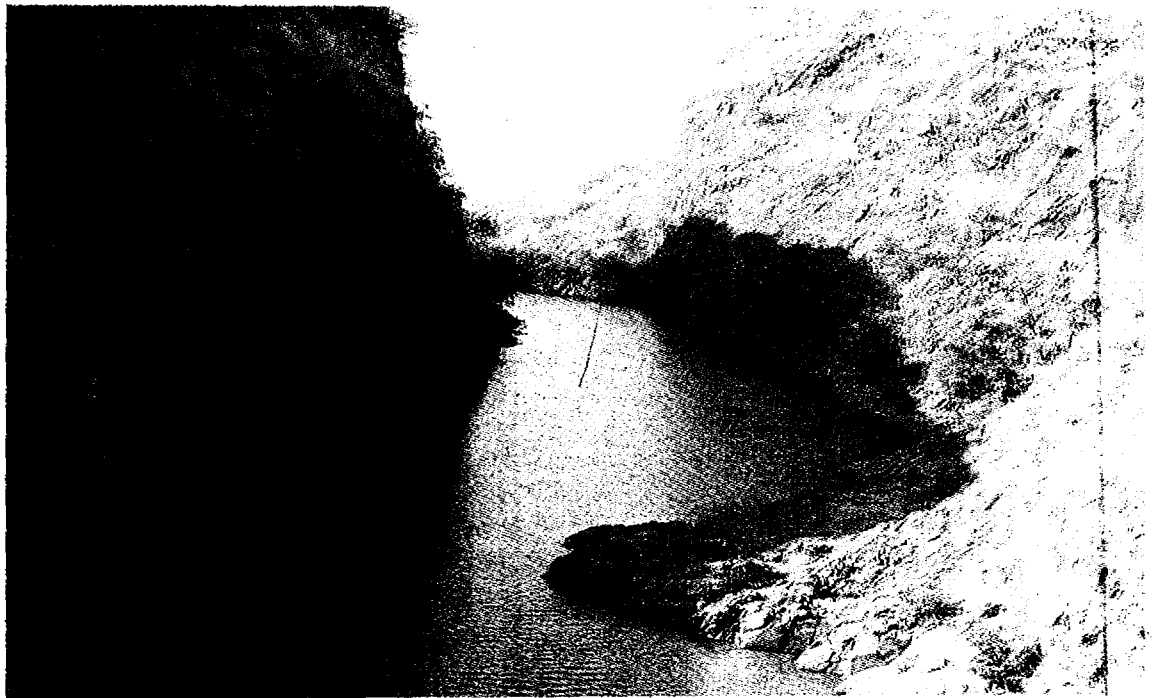
- ❖ 9 national parks, 8 wild life reserves, 3 wildlife sanctuaries, 18 hunting areas and 51 important bird areas have been designated in different parts of the country (Annex 5).
- ❖ Rehabilitation activities designed to bring a number of parks and sanctuaries that have suffered destruction and looting during the change of government in 1991 back to their former conditions have been carried out with assistance from UNDP.
- ❖ In accordance with the strategy designed to ensure that the local communities share from the benefits of national parks, 85 percent of income from legal wildlife hunting is going to the communities where the hunting is being carried out;
- ❖ Various projects designed to improve wildlife protection have been and are being undertaken.

These efforts cannot be considered adequate in view of the pressure that the sector is faced with. It is, therefore, essential that the federal and regional state governments, local communities, non-governmental organisations, civil society and the private sector take coordinated, sustainable and result oriented measures to improve the protection of wildlife resources throughout the country.

3.5 WATER RESOURCES

Ethiopia is known as the water tower of North East Africa. Surface water resources in Ethiopia flow in 12 major river basins. It is estimated that an average of 122.19 billion m³ of water is annually discharged from these basins. The country's total ground water resources are estimated to be around 2.6 billion m³. Much of the discharge of Ethiopia's rivers flows into neighbouring countries. The amount that remains in the country is not more than 9 percent.

Photo 8: The Omo River in SNNPR, Dawro zone(Photo, EPA)

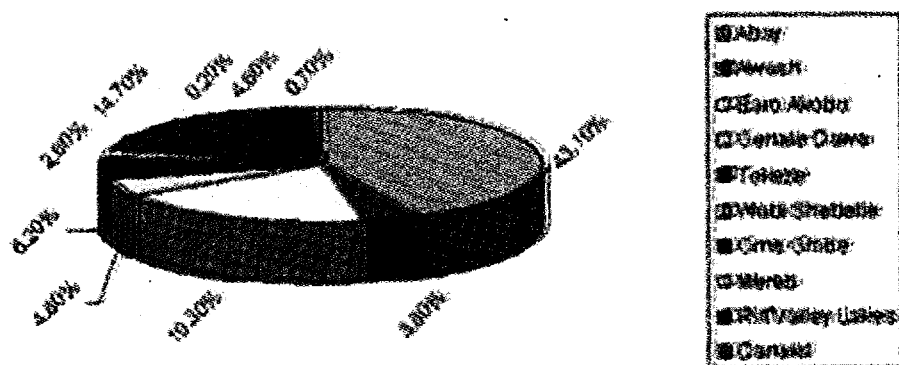


3.5.1 Surface Water Resources

3.5.1.1 Rivers and Catchments

The study of Ethiopia's surface waters started around the mid 1950s. The surface waters in Ethiopia flow in 12 major river basins (Table 19). Nine of these basins have perennial rivers while the remaining three have water only in the rainy season. The Wabi Shebelle River has the largest catchment area. While the river Abay, which contributes 70 percent of total, ranks first in terms of annual discharge. It is estimated that a total of 122.19 billion m³ of water is discharged from these river basins annually.

Figure 5: Percentage of Average Annual Discharge by Basins



Source: Drawn from data taken from Ministry of Water Resources 2002.

Table 19: Catchment Area and Average Annual Discharge

| Catchment | Catchment Area in km ² | Average Annual discharge (in billion m ³) |
|-------------------|--------------------------------------|--|
| Abay | 199,812 | 54.4 |
| Awash | 112,700 | 4.9 |
| Baro Akobo | 74,102 | 23.23 |
| Gneale Dawa | 171,050 | 6.1 |
| Tekeze | 90,000 | 8.2 |
| Wabi Shebelle | 200,214 | 3.16 |
| Omo Ghibe | 78,200 | 16.6 |
| Mereb | 5,900 | 0.72 |
| Rift Valley Lakes | 52,740 | 5.64 |
| Danakil | 74,002 | 0.86 |
| Ogaden | 77,100 | 0 |
| Aisha | 2,200 | 0 |
| Total | 1,138,016 | 122.19 |

0 Shows dry basin without any permanent water flow.

Source: - Ministry of Water Resource, 2002

3.5.1.2 Lakes

The country has numerous lakes and marshes. Out of the important lakes 11 are freshwater, 9 are saline and four are crater lakes. (Table 20)

Table 20: Ethiopian Lakes and their Characteristics

| Lake Characteristics | Lake Name |
|----------------------|--|
| Fresh Water Lakes | Abaya, Abijata, Alemaya, Ashenge, Awassa, Cahmo, Langano, Shalla, Tana, Zeway, Yardi, Esphari and Artede |
| Saline Lakes | Abe, Afambo, Afdera, Aseli, Beseka, Chew Bahir, Gargori and Turkana |

Source: Ministry of Water Resources Development, response to questionnaire, 2001.

Since no study has been made regarding the amount of water in these lakes and marshes, estimates vary. The Ministry of Water Resources has recently commenced such a study. In addition to the natural surface water resources, there are also man-made reservoirs. Among them, Koka, Melka Wakana, Fincha and Gilgel Gibe can be mentioned as the major ones. The man-made lakes in Ethiopia are listed in Annex 6.

3.5.1.3 Wetlands

If one takes the categorisation of wetlands under the Ramsar International Convention as a basis, Ethiopian wetlands would consist of fresh and brackish lakes, ponds, swamps/marshes, perennial and intermittent rivers and streams, riverine flood plains and manmade lakes.

Wetlands in Ethiopia cover an estimated area of 18,587 km² amounting to 1.5 percent of the country's total area (Table 21).

Table 21: Area in km² of Major Wetlands in Ethiopia

| Types of Wetlands | Area (km ²) | Percent |
|-------------------------------|-------------------------|---------|
| Fresh water lakes | 5,766.6 | 30.6 |
| Saline lakes | 1770.0 | 9.6 |
| Marshlands | 2330.0 | 12.6 |
| Seasonally inundated wetlands | 8720.0 | 47.2 |
| Total | 18587.0 | 100 |

Source: Environmental Protection Authority, 2003

Wetlands provide a wide range of ecological services. Such services include soil erosion and flood control, water purification and pollutant and nutrient retention as well as groundwater discharge and recharge.

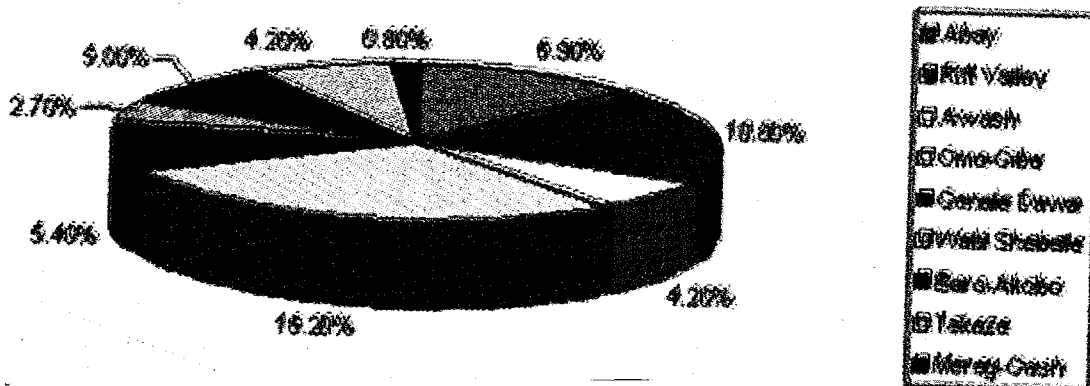
Although wetlands provide the ecosystem services mentioned above, they are under severe pressure from water and land based human activities, which are jeopardizing the natural services that they provide. In fact, some wetlands are drying up. Draining for agricultural purposes, spreading of alien invasive species, pollution and siltation as well as deforestation and overgrazing are among the human activities that are adversely affecting wetlands.

Shortage of agricultural land in relation to increases in population, the low awareness of communities regarding the ecosystem benefits of wetlands and the lack of technical and financial support for wetland conservation are among the major factors leading to the pressure that the wetlands are facing currently.

3.5.2 Ground Water Resources

There are no detailed studies regarding Ethiopia's groundwater resources. However, based on preliminary and indicative studies carried out at various times, the amount of groundwater can be estimated at 2.6 billion m³. The share that the major basins of the country have out of the total ground water resources of the country is indicated in Figure 6.

Figure 6: Percentage of Groundwater Potential of Ethiopia by Major Basins



Source: Drawn from data taken from Ministry of Water Resources, 2002

Ground water is the major source of rural water supply. Although, generally, groundwater is cleaner than surface water, high groundwater fluoride content in some areas, particularly within the Rift Valley, reduces its quality and its appropriateness for use as a source for drinking water. It is recorded that 5,777 boreholes and hand-dug wells have been constructed at various times for purposes of rural water supply.

Reliable hydro-meteorological data is indispensable in the planning and proper utilization of water resources. Recording hydro-meteorological data in Ethiopia commenced in 1936, the year of the Italian Invasion of Ethiopia. Ever since then, steps have been being taken to broaden the hydro-meteorological database through the continuing establishment of new data recording stations and the strengthening of existing ones. According to information from the Ministry of Water Resources, in 1999/2000 there were 407 staff gauges, 165 cables and 100 automatic stations in Ethiopia. These meet less than one third of the country's requirements for hydro-meteorological stations.

3.5.3 Water Resources Utilization

3.5.3.1 Drinking Water

80 to 90 percent of the water resources of the country are found in four basins located in the northwestern and southwestern parts of the country, i.e. the Abay, Tekeze, Baro and Omo-Gibe basins. The population in these basins is estimated to be 30 to 40 percent of the total. On the other hand, the water resources in the basins located in Eastern and Central Ethiopia are estimated to be 10-20 percent of total and the population within these basins is estimated to be 60-70 percent of total (Ministry of Water Resources Development, 2001).

The temporal and spatial distribution of water resources in Ethiopia is unbalanced. Thus, the supply of water available for drinking and other economic and social purposes is low. As a result, people living in the various parts of the country are frequently exposed to health risks.

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The majority of Ethiopians get their drinking water from natural rivers, lakes and springs, which are usually polluted with human and animal waste and are thus unhealthy. The portion of the population with access to clean drinking water is not more than 30 percent. At present 797 deep wells, 1,621 hand-dug wells, 1,717 springs, 1,642 medium depth wells and 283 ponds have been constructed and are providing clean drinking water.

3.5.3.2 Irrigation

It is estimated that there are 3.5 million ha of potentially irrigable land in the river basins of Ethiopia (Table 22). When compared with 44 other African countries, this potential places Ethiopia at fourth position. However, because land developed for irrigation to date is not more than 5 percent of the potential, Ethiopia comes down to eleventh position in the actual utilization of its water resources for irrigation.

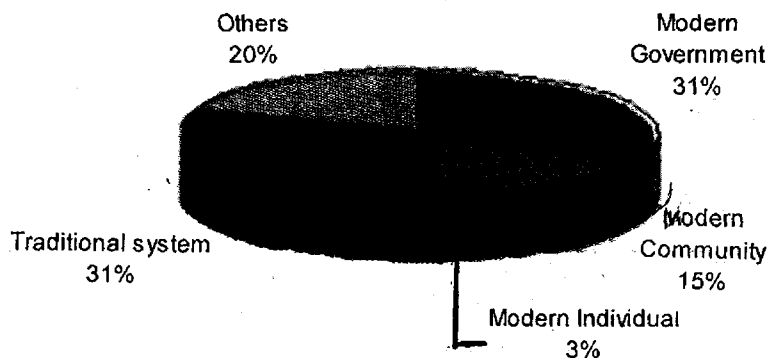
Table 22: Ethiopia's Irrigation Potential by Major Catchments

| Catchment | Total Irrigable Land (in hectares) |
|---------------|------------------------------------|
| Abay | 977,915 |
| Rift Valley | 122,300 |
| Awash | 204,400 |
| Omo Ghibe | 450,120 |
| Genale | 435,300 |
| Wabi Shebelle | 204,000 |
| Baro | 748,500 |
| Tekezze | 312,700 |
| Mereb | 37,560 |
| Ogaden | - |
| Afar | 3,000 |
| Aisha | - |
| Total | 3,495,795 |

- Shows that there is no irrigable land since there is flood only when it rains upstream.

Source: Ministry of Water Resources, 2002.

Figure 7: Percentage of Land Under Irrigation



Source: Drawn from data taken from Ministry of Water Resources, 2002.

3.5.3.3 Water Resources put to Other Uses

Energy: Due to their suitable topography, the rivers of Ethiopia have a potential generating capacity of 650 Terra Watts of hydroelectricity. However, only very little of this potential has been used to date. Awash, Abay, Wabi Shebelle, Gilgel Gibe and Fincha are among the rivers currently being used for the generation of power or on which additional power stations are being constructed. In addition, projects have been developed and studies are being carried out to generate hydropower from many other water bodies.

Tourism: Ethiopia has numerous water-based tourist attractions. Major among these are the rift valley lakes, the Tis Isat and other waterfalls. Lake Tana, Lakes Awassa, Zeway and Chamo, the hot springs of Sodere and Wondo Genet are other tourist attractions currently being used.

Transport: Although Ethiopia has numerous water bodies they are not convenient for navigational purposes because of the rugged topography. Rivers Baro and Lake Tana are currently providing limited water transport services.

Fishery: Detail on fishery resources is given in Section 3.6.

3.5.4 Pressure on Water Resources

Ethiopia has water resources that can be used for various current and future economic purposes. However, due to various reasons, including limited capacity, the resource is not presently being used to the desired extent. Further, the water resource and the related aquatic ecosystems are facing a great deal of pressure. Siltation and in some areas also pollution of water resources are among the major problems.

Siltation: Ethiopian rivers have their headwaters in the highlands. Water bodies are silting up due to deforestation and devegetation along with the nature of the farming system, and the nature of the topography, and the consequent erosion caused by the torrential rains in these areas. Since the rivers flow from large highland areas, their silt carrying capacity is high. The number of rivers exposed to siltation and the depth and amount of the silt in each of them is not exactly known as no detailed study has been made to date. However, some preliminary studies indicate that the levels of Koka and Aba Samuel dams as well as of lakes Awasa, Abaya, Alemaya, Langano, Turkana, Chew Bahir, etc. have decreased and that some of them are showing signs of drying up.

Since a number of rivers, including the economically most used Awash River, have large amounts of recently accumulated silt in their beds in the lowland planes, they often change their courses, particularly during the rainy season. The floods resulting from such changes have led to the inundation of the areas near the riverbanks resulting in high economic and social harm. The Afar Draft State of the Environment Report 2003 indicates that frequent changes in the course of the Awash resulting from siltation has led to flooding in parts of Dubti, Asaita, Bure, Medaitu and Dolecha woredas. In addition, the changes in the river's course have led to shortages of water for the irrigation farms in the surrounding areas and the consequent drying up of crops. In the last 23 years only, 2,300 tonnes/km² or 2.5 million m³ of silt have accumulated in the Koka dam while the Aba Samuel Dam managed to accumulate 445 tons of silt/km² in the fifty years between 1941 and 1991.

Pollution of Water Bodies: Chemical pollutants discharged from farms, industries, mining operations and urban sewers harm water bodies. Although one cannot say that the pollution of water bodies has become really serious in Ethiopia, there is a great deal of pollution in the major cities of the country, in areas where mining is carried out as well as in areas of industrial concentration. For example, the tributaries to the Awash River that go through Addis Ababa and Akaki are polluted as a result of urban waste mismanagement and industrial discharge.

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A study carried out by the Environmental Protection Authority in and around Addis Ababa shows that 80 percent of the factories discharge their waste without any treatment directly into nearby water bodies. The details are given in Annexes 1 and 7.

What has been attempted above is to indicate the pressure that the water resources of the country are faced with. The following are some of the other problems:

- ❖ The limited capacity of human resources in the water resources sector;
- ❖ The low level of research and development in the water sector;
- ❖ The transboundary nature of many of the rivers in the country;
- ❖ The lack of reliable, standardized and continuously available water resources data;
- ❖ Weakness in the maintenance and operation of water resources infrastructure;
- ❖ The low level of harmonization of activities in the water sector with other development sectors;
- ❖ The weakness of project assessment and evaluation within the water sector;
- ❖ The low level of public participation.

3.5.5 Measures Taken to Ameliorate the Pressure on Water Resources

The pressure on the water resources of the country is big and the factors causing the pressure have sectoral and cross-sectoral nature. Any effort to find solution to the problems requires the participation of various organisations and a coordinated approach. The effort to achieve this to date cannot be said to be adequate even though water resources conservation and protection programmes have been being implemented by the various sectors. The activities are as follows:

Environment: In terms of environmental protection the following efforts can be mentioned:

- ❖ Enactment of the Environmental Pollution Control Proclamation;
- ❖ Enactment of the Environmental Impact Assessment Proclamation;
- ❖ The preparation of water resources related standards.

Water Resources: The following are some of the major efforts made in the water resources sector:

- ❖ The issuance of the Ethiopian Water Resources Development and Protection Policy;
- ❖ The development of a Water Sector Strategy;
- ❖ The preparation of a water sector development programme;
- ❖ The preparation of master plans for a number of rivers;
- ❖ The enactment of the Water Resources Proclamation;
- ❖ The commencement of the implementation of the Nile Countries Shared Vision Programme for the purpose of ensuring the equitable sharing of the water resources of the Nile Basin and promoting sustainable social and economic development;
- ❖ The establishment of the Arba Minch Water Technology Institute to tackle the shortage of trained human resources in the water sector;
- ❖ The preparation of a drinking water and sanitation master plan;
- ❖ The preparation of water resources regulations; and
- ❖ The establishment of a Water Fund.

3.6 FISH RESOURCES

3.6.1 State of Fishery Resources

It is estimated that 32,962 tonnes of fish can be produced annually from the major lakes, rivers and reservoirs. Out of this around 59 percent (19,740 tons) is found in the major lakes. As regards regional fish resources distribution, Amhara, Oromia and SNNPR, respectively, have large amounts of fish. (Table 23)

It is not possible to compare fish resources estimates for various years due to lack of adequate data. Nevertheless, various information sources indicate that there is a greater amount of fish resource in the country than indicated in the figures cited in this report.

Table 23: Regional Distribution of Fish Resources in Various Water Bodies

| Type of water body | Fish Resources (in tonnes) | | | | | | | | |
|--------------------|----------------------------|------------|---------------|--------------|--------------|--------------|------------|------------|--------------|
| | Country-wide | Tigray | Amhara | Oromia | SNNPR | B-Gumuz | Afar | Somali | Gambella |
| Lakes | 19,740 | na | 10,400 | 3,740 | 5,600 | - | na | - | - |
| Rivers | 4,710 | 69 | 279 | 408 | 650 | 1,040 | 79 | 289 | 1,896 |
| Dams and ponds | 8,512 | 118 | 43 | 4,968 | 1,500 | 68 | 35 | 88 | 1,692 |
| Total | 32,962 | 187 | 10,772 | 9,116 | 7,750 | 1,108 | 114 | 377 | 3,588 |

na - data not available; - no lakes in the region

Source: Ministry of Water Resources, 2001

Eight fish species are known to be important for fishing (Table 24). Among these, Tilapia is being depleted fast. However this species is found in large numbers in lake Chamo. The Nile Perch, found in lakes Abaya and Chamo, has also been overfished.

The main reason for the depletion of the Tilapia is the overfishing carried out to meet the high demand for it. For example, as indicated in Table 24, the amount of Tilapia caught in 1998 is greater by 54 percent than the amount caught in 1996. Among the major reasons for the depletion of fish resources are substandard fishing gear and the consequent catching of small fish not yet ready for consumption. The situation is affecting the sustainability of fish resources.

Table 24: Fish Catch in tonnes and Status of the Fish Species

| Type of Fish | 1996 | 1997 | 1998 |
|-----------------|--------------|---------------|---------------|
| Tilapia | 5,146 | 6,076 | 7,913 |
| Catfish | 812 | 1,200 | 1,677 |
| Ciprinus Carpio | 191 | 90 | 62 |
| Nile Perch | 270 | 230 | 191 |
| Barbus | 390 | 639 | 768 |
| Bagrus Doemak | | | 94 |
| Labeo Horie | 1,994 | 2,007 | 3,168 |
| Karassius | na | na | 88 |
| Others | 86 | 26 | 3 |
| Total | 8,889 | 10,268 | 13,964 |

Source: Ministry of Agriculture, 2001, response to questionnaire.

Photo 9: Fish Market by Lake Awassa(Photo, EPA)



3.6.2 Pressure on Fish Resources

Following are the major factors that are considered as contributing to the depletion of fish resources:

- ❖ Failure to practice sustainable fishing methods;
- ❖ Using sub-standard fishing gear;
- ❖ Failure to select appropriate fishing spots;
- ❖ Lack of control and protection system;
- ❖ Siltation of water bodies due to inadequacy of soil and water conservation measures; and
- ❖ The difficulty of ensuring sustainable fishing practices in a situation where unlicensed fishermen far outnumber those licensed.

3.6.3 Efforts Made to Reduce the Pressure on Fish Resources

- ❖ The enactment of a fishery resources utilization proclamation;
- ❖ The undertaking of research activities focussing on a number of fish species by various institutions; and
- ❖ The existence of programmes for organising and training of fishermen.

3.7 RANGELANDS AND LIVESTOCK RESOURCES

3.7.1 State of Rangelands

There are extensive rangelands in the northeastern, southern, southeastern, southern and southwestern parts of the country. These rangelands, which are situated below 1,700 m above sea level, have a rainfall that is below 600 mm. It is estimated that there is 500,000 km² of rangelands in the lowland parts of the country and 57,000 km² in the 'dega' and 'woyna dega' parts of the country. In addition, in the 'dega' and 'woyna dega' parts, fallow land is also used for grazing. In total, the extent of rangelands in Ethiopia is estimated to be 51 percent of the total area.

3.7.2 State of Livestock

Livestock is one of Ethiopia's important resources. The exact number of the livestock is not known due to the fact that livestock censuses have never taken place in Ethiopia. According to sample studies carried out by the Central Statistical Authority in 2000/01 Ethiopia's livestock was estimated to consist of 35.4 million cattle, 11.4 million sheep, 9.6 million goats, 4.9 million equines, 0.5 million camels, and 38.0 million chickens. The numbers of livestock that, according to the Central Statistical Authority's study, existed from 1997/98 up to 2000/01 is indicated in Table 25 below.

Table 25: Types and Numbers (in '000s) of Domestic Animals in Ethiopia

| Type | Number in '000s | | | |
|---------|-----------------|-----------|-----------|-----------|
| | 1997/98 | 1998/99 | 1999/2000 | 2000/01 |
| Cattle | 35,371.77 | 35,095.23 | 33,075.33 | 35,383.31 |
| Sheep | 13,428.48 | 12,235.94 | 10,950.68 | 11,438.20 |
| Goats | 10,460.39 | 9,544.32 | 8,597.77 | 9,620.89 |
| Equines | 4,663.18 | 4,542.46 | 4,428.00 | 4,925.14 |
| Chicken | 32,978.65 | 30,157.32 | 28,542.89 | 37,763.99 |
| Camels | 479.36 | 527.34 | 262.41 | 326.47 |

Source: Central Statistical Authority, 2001

Livestock production plays a great role in the lives of 85 percent of the country's population. Livestock are sources for traction power, transport, milk, meat, eggs as well as other animal products. In addition, they are sources of income needed by farmers and pastoralists to meet their basic consumer goods requirements.

Livestock production in the country can be categorized into three types. These are the modern dairy farms run by the private sector and governmental organisations, the production in the 'dega' and 'woyna dega' areas where mixed farming is practiced, and the sole production of livestock by the pastoralists in the lowlands. An estimate of the amount of livestock products produced in the country between 1995/96 and 1999/2000 is given in Table 26.

Table 26: Milk, Meat and other Animal Products

| Year | Meat (in thousand tonnes) | Milk (in mil. litres) | Eggs (number in mil.) | Hides (number in mil.) | Leather (number in thousand) |
|---------|---------------------------|-----------------------|-----------------------|------------------------|------------------------------|
| 1995/96 | 405.75 | 1194.8 | 680.6 | 2283.7 | 15154.4 |
| 1996/97 | 414.51 | 1219 | 688.4 | 2330.5 | 15510.6 |
| 1997/98 | 425.55 | 963.67 | 438.4 | 2667.9 | 9342.5 |
| 1998/99 | 391.7 | 956.71 | 417.8 | 2456.7 | 11605.3 |
| 1999/00 | 381.24 | 1418.19 | 396.7 | 2480.6 | 7646 |

Source: Central Statistical Authority, 2002

3.7.3 Problems in the Management and Utilization of Rangelands and Livestock

In the arid and semi-arid areas moisture deficiency is a great problem. Therefore, water shortage is the major constraint for the appropriate development and utilization of the rangelands. Recurring drought is exacerbating the situation.

In some of the arid areas the encroachment of irrigation into the rangelands has reduced the land area used for grazing by the pastoralist communities. It is in this manner that Afar and Kereyu pastoralists have lost 35,400 and 22,000 hectares of pasture land respectively. In addition, 19,767 km² for parks, 28,100 km² for wildlife protected areas, 9,536 km² for bird and wildlife sanctuaries had been taken away earlier from the rangelands. The encroachment has forced the pastoralists communities to overgraze by confining their movement to marginal lands, thus exposing their areas to degradation. (CSE 1989)

Because large parts of the rangelands in the arid and semi-arid areas of the country are infested with tsetse fly and malaria, it is difficult to utilize them. Moreover, progressive reduction in the availability of grazing land and depletion of fodder grass resulting from the spread of alien invasive species is becoming a common problem.

Highland areas with altitude of over 1500 m above sea level have also become extremely overgrazed. The fact that over 75 percent of the livestock of the country are in these areas as well as the ploughing up of pastureland to meet requirements for additional farmlands has, among others, contributed to this situation.

Furthermore, the inadequacy of the extension service in the livestock sector has constrained the development of a sustainable rangelands management system.

3.7.4 Measures Taken to Improve the Management and Utilization of Rangelands and Livestock

The free grazing of livestock, as practiced in the traditional livestock system, has resulted in excessive trampling and overgrazing. Among the measures taken at different times to minimize the problem and increase productivity are the following:

- ❖ Development of improved fodder for livestock;
- ❖ Selection of improved livestock breeds and artificial insemination services for cross breeding;
- ❖ The establishment of the Veterinary Institute to meet the need for livestock professionals;
- ❖ The preparation of a national livestock strategy;
- ❖ The production within the country of vaccines against livestock diseases and the expansion of the livestock extension package;
- ❖ The increase in the supply of livestock medicines both by government and the private sector;
- ❖ The establishment of offices for pastoral affairs in the predominantly pastoralist areas;
- ❖ The establishment at the federal level within the Ministry of Water Resources an office to follow up pastoral issues; and
- ❖ The implementation of tsetse fly control.

Although, as indicated above, efforts have been made at all levels to improve the situation, increased effort is still required.

3.8 BEE KEEPING

Bee keeping is widespread in Ethiopia and is carried out to varying extents in all the regions of the country. According to information from the Ministry of Agriculture, there are about 10 million colonies of bees. Among these, about 24 percent are wild colonies. According to a study by the Central Statistical Authority, however, the number of beehives in Ethiopia is estimated to be about 3.4 million (Table 27). This estimate is based on the agricultural sample survey, which excludes wild colonies and beehives kept by forest dwelling as well as pastoralist communities. Neither does it include beehives in urban and peri-urban areas.

Table 27: Number of Hives (in'000) and Production ('000 kg)

| Region | 1998/99 | | | | 1999/00 | | | |
|-------------------|-------------|------------------|-------------|------------------|-------------|------------------|-------------|------------------|
| | Traditional | | Modern | | Traditional | | Modern | |
| | No of hives | Total production | No of hives | Total production | No of hives | Total production | No of hives | Total production |
| Tigray | 168 | 893.50 | 2.8 | 15.8 | 148 | 840.30 | - | 1.7 |
| Afar | 2.2 | 6.0 | - | - | 1.3 | 2.8 | - | - |
| Amhara | 624.6 | 3,229.10 | 2.4 | 35.6 | 605.5 | 2,754.90 | - | 96.7 |
| Oromia | 1,641.30 | 4,116.10 | 7.7 | 10.0 | 1,526.10 | 3,609.40 | 6.3 | 25.3 |
| Somali | 1.4 | 5.3 | 0.06 | 0.1 | 1.2 | 3.7 | - | - |
| Benishangul Gumuz | 231.90 | 664.20 | 2.1 | 31.3 | 204.60 | 472.50 | 3.1 | 2.96 |
| Southern | 568.70 | 3,435 | 1.3 | 2.7 | 602.90 | 2,895.70 | 4.6 | 11.3 |
| Gambella | 131.20 | 683.40 | - | - | 112.60 | 444.30 | - | - |
| Harari | 0.6 | 106 | - | - | 0.9 | 2.7 | - | - |
| Addis Ababa | 0.3 | 0.8 | 0.1 | 0.1 | 0.3 | 0.7 | - | 0.1 |
| Dire Dawa | 0.7 | 2.9 | - | - | 0.7 | 3.1 | - | - |
| Total | 3,370.60 | 12,977.70 | 16.4 | 95.6 | 3,204 | 11,030.1 | 16.5 | 164.70 |

Source: Central Statistical authority, 2002

According to this study, 11.19 thousand metric ton of honey were produced in 1999/2000. Considering the exclusion of the bee colonies indicated above, this is an underestimate. The regions which are the major honey producers are Oromia 32.4 percent, SNNPR 26.0 percent, Amhara 25.5 percent and Tigray 7.5 percent.

Although it is difficult to present researched data, one can assume that traditional honey production has an impact on natural resources. This is because the activity involves the use of smoke by burning wood for processing out the honey from the hive. This method has frequently led to the occurrence of forest fires. In order to reduce the frequency of such practices and increase productivity it is necessary to popularise modern hives. Thus, increased effect to expand modern honey production by organising and training honey producer communities is required.

3.9 CROP RESOURCES

3.9.1 Crop Resources Development

As a result of its suitable natural conditions and the long history of its agriculture, Ethiopia grows various crops in its different climatic zones. Among the major types of crops grown are:

- ❖ Cereals (e.g. teff, barley, maize, wheat, sorghum, oats, finger millet, pearl millet)

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- ❖ Pulses (e.g. horse bean, field pea, chickpea, lentil, grass pea, cowpea, haricot bean);
- ❖ Oil seeds (e.g. niger seed or noog, linseed, sesame, safflower or suf, groundnut);
- ❖ Tubers (e.g. enset, potato, yam, sweet potato);
- ❖ Vegetables (e.g. cabbage, kale, tomato, pepper, pumpkin, shallot, onion and garlic);
- ❖ Fruits (e.g. lime, orange, banana, papaya, peach, plum, 'trungo');
- ❖ Stimulants (e.g. 'chat' or mirra, coffee, tea);
- ❖ Various spices (e.g. basil, rue, cumin, coriander, cardamom, black and long pepper);
- ❖ Fiber crops (e.g. sisal, cotton)

Cash and industrial crops such as coffee, tea, papaya, bananas, avocado, mango, cotton, sisal, tobacco, spices, sugarcane and chat are grown.

An estimated 7 million smallholder farmers produce 97 percent of the crops including coffee. The private sector and the state farms produce the remaining 3 percent. Crop resources play the major role in food security, income generation, and provision of industrial raw materials as well as the creation of employment opportunities.

Available information indicates that before the early 1960s, Ethiopia used to be a net exporter of food crops. However, since the early 1970s, domestic production of food crops has not been able to cover the minimum basic per capita human food requirement of the population. As a result, the deficit is being complemented through foreign purchase and food aid. Recurring drought and environmental degradation, among others, can be mentioned as factors that have led to this situation.

According to the Central Statistical Authority, the area under cultivation in 1997/98 was estimated to be 6.85 million ha and the amount of crop produced during the same period was 73.63 million quintals. Information acquired from the Central Agricultural Census Commission also indicates that the area of land covered by the major crop types in 2001/02 was 8.0 million hectares while the amount of crop produced during the same period was 113.6 million quintals.

Table 28: Area of Cultivated Land and Major Crop Types in Ethiopia

| Crop group | 1997/98 | | 2001/02 | |
|------------|---------------------------|----------------------------------|---------------------------|----------------------------------|
| | Cultivated land (mil. ha) | Total Production (mil. quintals) | Cultivated land ('000 ha) | Total Production ('000 quintals) |
| Cereals | 5.60 | 64.99 | 6,370.11 | 87,068.28 |
| Oil Seeds | - | - | 426.13 | 2,001.30 |
| Pulses | 0.84 | 6.80 | 1,016.79 | 10,212.15 |
| Others | 0.41 | 1.84 | 185.60 | 14247.30 |
| Total | 6.85 | 73.63 | 7,998.60 | 113,609.20 |

- = data not available

Source: - Central Statistical Authority, 1998 and Central Agricultural Census Commission, 2002.

3.9.2 Agricultural Chemical Inputs

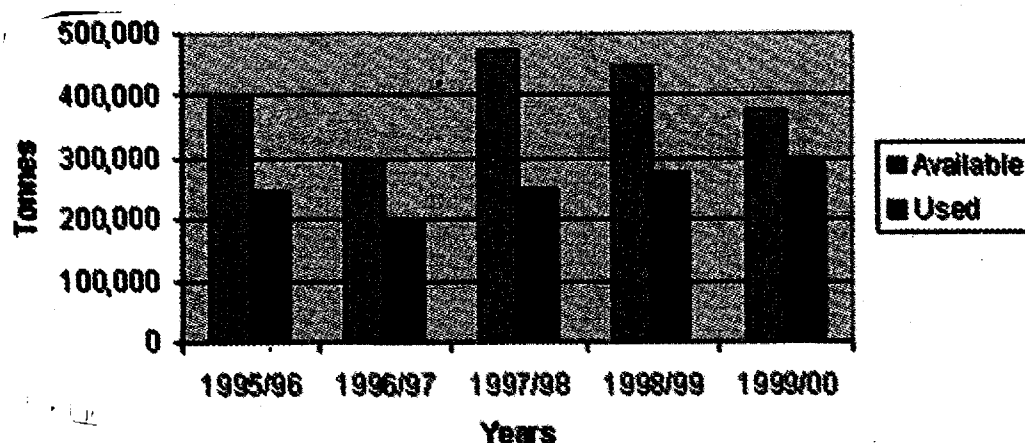
The chemical inputs that are used in Ethiopia to increase production are fertilizers, pesticides and herbicides.

3.9.2.1 Chemical Fertilizers

The use of chemical fertilizers in Ethiopia commenced in the late 1960s along with the launching of integrated agricultural programmes and projects. Ever since then, chemical fertilizers have been promoted and the expansion of their use promoted through the Agricultural Extension Programme. But the overall use of chemical fertilizers throughout the country remained very low. The chemical fertilizers that are in use in the country are DAP and Urea.

According to information made available from the National Fertilizer Agency, 253,152 metric tonnes of chemical fertilizers were distributed and put to use in 1995/96. Five years later, comparison with the 1995/96 amounts indicates that the distribution increased by 17.6 percent to 297,907 metric tonnes (Figure 8).

Figure 8: National Fertilizer Supply and Consumption (tonnes)



Source: National Fertilizer Agency, 2001, drawn from data that came in response to questionnaire.

3.9.2.2 Pesticides and Herbicides

The amount of pesticides and herbicides that were imported by the Ministry of Agriculture for application in the agricultural sector is indicated in Table 29. It was not possible to get information regarding the amount imported and distributed by the private importers. Table 29 shows that 927.7 tonnes of pesticide and herbicide chemicals were imported in 1995/96 while in 1999/00, the amount increased to 1,081.9 tons. This is a 16.6 percent increase over the 5 years.

Table 29: Imported Herbicides and Pesticides (tonnes)

| Type of Chemical | 1995/96 | 1996/97 | 1997/98 | 1998/99 | 1999/00 |
|-------------------------|---------|---------|---------|---------|----------|
| Insecticides | 327.21 | 517.657 | 505.019 | 303.34 | 207.64 |
| Herbicides | 554.00 | 467.45 | 328.15 | 794.22 | 826.76 |
| Fungicides | 45.79 | 16.06 | 7.89 | 117.30 | 41.61 |
| Rodenticides | - | - | - | 2.00 | 2.00 |
| Avicides | - | 5 | 10 | - | - |
| Plant Growth Regulators | - | - | 20 | - | 4 |
| Total | 926.90 | 1028.94 | 998.88 | 1230.86 | 1081.939 |

Source: Ministry of Agriculture, 2001, response to questionnaire

3.9.3 Problems Encountered in Crop Resources Development

Two interrelated problems arising from attempts to improve agricultural production have important environmental dimensions.

- ❖ Traditional agriculture in the country has low productivity. A large area of land has been put under cultivation to meet the food requirements of the increasing population. This has resulted in the destruction of forests, the cultivation of marginal lands, the repeated ploughing of farmland, the erosion of fertile soils by flooding and other similar environmental problems.
- ❖ There has been a serious problem in the accumulation in various places of unused and expired imported pesticides. The biodiversity rich agricultural systems are robust and do not suffer much from pest infestation. Therefore, these chemicals have not been used. The probability of damage to human health and the environment due to leakage of such chemicals from aging containers is high. For example according to a study made by the Ministry of Agriculture and FAO in 1998, there were 1,500 tons of expired toxic pesticides as well as an accumulation of 1000 tons of contaminated equipment and soil in various parts of the country.

3.9.4 Measures Taken to Minimize Environmental Problems Associated With Crop Production Activities

Several attempts have been made to contain the adverse environmental impacts emanating from crop production activities. The following are some of the major ones:

- ❖ The issuing of a rural development policy that recognizes that ecological principles are the basis for building up soil fertility, with the application of fertilizer to help, not to substitute, ecologically sound fertility management.
- ❖ The incorporation of natural resources conservation into the extension services along with that of crop production.
- ❖ The inventorying, packaging and export for disposal by incineration of expired pesticides.
- ❖ The establishment laboratories for the analysis of soils to determine their conditions and fertilizer requirements (Annex 8).
- ❖ The fostering of and materially support to research on soil biology, microbiology and organic fertilizers.

3.10 MINERAL RESOURCES

3.10.1 Mineral Resources Potential and Exploration in Ethiopia

Ethiopia has an area of 1.130 million km² of land underlain by rocks of varying geological ages. Metamorphic rocks cover more than one third of this area. Volcanic rocks of the Quaternary and Tertiary period and sedimentary rocks of the Mesozoic era cover the remaining area. The geological characteristics of the rock formations found in various parts are favourable for the formation of diverse types of mineral deposits, including multi-element associations.

Precambrian metamorphic rocks with potential for mineral exploration are found in southern, south-western, western, north and eastern Ethiopia. Some of the Precambrian areas explored for mineral deposits are:

- ❖ Southern Ethiopia - Adola, Arero, and Hageremariam Greenstone belt;
- ❖ Western Ethiopia - Akobo and Western Greenstone belt; and
- ❖ Northern Ethiopia - Tigray Greenstone belt.

3.10.1.1 Exploration and Production of Minerals

Among the mineral occurrences identified in Ethiopia only a few have been properly evaluated. The remaining require further exploration before they can be evaluated. The known mineral resources occurrence by type, location and volume is given in Annex 9.

Precious Metals: Precious metals include minerals such as gold, platinum, and silver. Studies carried out to date indicate the occurrences of these minerals in Oromia, Tigray, Gambella, Benishangul Gumuz and SNNPR. To date the occurrence of platinum is known only in Yubdo, Oromia.

The production of alluvial gold in various parts of Ethiopia has been known since ancient times. Currently, at least one hundred thousand artisan miners are engaged in alluvial gold mining. Their annual production is estimated to reach up to 3000 kg. For a long time Adola and its surroundings have been known for traditional gold mining. The alluvial mining in Adola is continuing using partially modern mining methods.

The production of gold from primary ore at Legedembi has been going on for the last two decades. In recent years gold amounting to 3000 kg as a primary and silver as a minor and secondary mineral are being mined from the primary gold ore at Legedembi. The gold produced from Legedembi is thus contributing substantially to the country's foreign exchange earnings. Furthermore, detailed exploration and feasibility studies are being carried out on some gold deposits recently discovered in the western and southern parts of the country. Platinum production presently takes place only in Yubdo on a small scale. At this place the total deposit of platinum is estimated to be 12.5 tonnes.

Since 1990, tantalum has ranked second to gold in terms of foreign exchange earnings. Tantalum is believed to exist in other parts of the country as well. However, at present it is being exploited only in Kenticha, Oromia region. Studies carried out at this place indicate the existence of 25,000 tonnes of Colombo Tantalite deposits. Further exploration for tantalum is taking place.

The contribution of gold and tantalum to the country's foreign exchange earning capacity has been growing. For example, the following table shows the 1997/98 to 2000/01 production and sales figures of these minerals.

Table 30: Gold and Tantalum Production and Sales (1997/98 to 2000/01)

| Year | Production | | Sales | |
|---------|------------|-------------------|--------------|--------------------|
| | Gold (kg) | Tantalum (tonnes) | Gold (in \$) | Tantalum (in Birr) |
| 1997/98 | 840 | 63 | 6,422,059 | 38,770,000 |
| 1998/99 | 2809 | 50 | 20,010,378 | 24,620,000 |
| 1999/00 | 4365 | 65.7 | 30,435,035 | 47,003,000 |
| 2000/01 | 4121 | 46.9 | *12,904,770 | n.a |

* Sales value of 1950 kg only.

Source: Ministry of Mines and Energy, response to questionnaire, 2003

Base Metallic Minerals and Other Metals: Base metals such as copper, zinc, lead, nickel, and other metals including iron and manganese occur in Ethiopia. A feasibility study on the iron deposit at Bikilal has been completed and its economic value has been found to be marginal. The quantity of the iron deposit at Bikilal is 57 million tons while that of the nickel deposit in Adola is 17 million tons. Preliminary studies have shown that there are various metallic minerals in many parts of the country. The exact volume and area extent of the occurrences of the metallic deposits in other regions have not well studied.

Industrial minerals including kaolin, feldspar, quartz and soda ash are currently being produced to serve as raw materials in various industrial processes.

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Soda ash is being produced from Lake Abijata, which is located in the Rift Valley. It is serving as a raw material in the production of caustic soda. This mineral is expected to benefit many other industries in the future.

Silica Sand is currently serving as an important raw material in the production of glass. There are large deposits of silica sand in many parts of the country.

Phosphates are minerals that have enormous potential contribution to the productivity of agriculture. Occurrences of phosphates are known in Bale (Melka Arba) and Western Wollega (Bikilal), in the Oromia Region. The exploration and feasibility studies made on Bikilal have proved the existence of phosphate, iron and titanium associated ores estimated to be 435 million tonnes. Out of these, 181 million tonnes consist of phosphates with an average concentration of 3.5 percent. This amount of ore has been found to be economically marginal, but subsurface exploration is continuing to investigate the continuity of the ore in the vicinity.

Potash is found in the Dalol area of the Afar region. The existence of 160 million tons of potash has been confirmed. It has been proved to be economically feasible to exploit.

Sulphur is an important industrial mineral. The occurrence of sulphur deposits is known in the Dallol Depression.

Coal is used as an industrial mineral for the production of fertilizers, such as urea. It can also be used for electric power generation, acetylene gas production and other industrial and domestic uses. The occurrences of coal deposits have been reported in the Amhara region (Chilga, Mush Valley and Wuchale), Oromia region (Yayu, Delbi, and Meye) and SNNPR (Waka and Moda). A detailed exploration and feasibility study on the coal deposits at Yayu to be used as raw material for an anticipated fertilizers plant was undertaken. It was found to be economically marginal. Further explorations in the vicinity are taking place to appraise its economic value in the future.

Common Salt: At present common salt is being produced in Ethiopia in two ways. The first method of production is in the form of rock salt or 'amole' from bedded sedimentary rocks. This method is widely practiced in the Afar region (Dallol/Berahle) as well as the Somali Region and Sidamo. The second method of production of salt is in the granular form from brine lakes. The second method involves the pumping of brine into manmade ponds from Lake Afdera and precipitating the salt from the brine through an evaporation process. Aside from Afdera, salt brines are found in various other lakes, including Lake Abijata, where salt is produced in conjunction with soda ash.

Limestone, gypsum and dolomite: Extensive deposits of limestone, gypsum and dolomite are found in the country. They have not been used much except in the production of cement, some lime, as input in caustic soda, glass, paper and sugar factories, and some stucco for plastering buildings and chalk for teaching at schools. Very limited amounts of dolomite are also being used in soap and paint factories. These minerals are found in the Blue Nile Valley (Muger and Jema), Tigray, Afar, Oromya (Harer) and Somali (Ogaden Basin).

Minerals such as diatomite and bentonite are also being used in borehole drilling and in tyre factories. Studies have confirmed the existence of an estimated 70 million tonnes of bentonite in Gewane and Lile as well as 40 million tonnes of diatomite in the lakes of the Rift Valley.

Gemstones: Other than the current small-scale production of opal in Northern Shewa, and traditional gemstone mining, such as olivine around Megado and Megadi, there is no production of gemstones in the country. The occurrences of opal and agate in Gonder and sapphire in Yabello have been confirmed recently.

Construction Minerals: Construction minerals include sand, clay soil, various building stones as well as dimension stones such as granite, marble and limestone. Construction minerals are extensively used in Ethiopia since they are important for the development of infrastructure.

Even though different types of dimension stones are found in many places in the country, only marble, granite and slate are being produced at a few places in small quantities.

Geothermal and Mineral Water Resources: Studies indicate that geothermal and mineral water deposits have been accessed through drilling and are being used for drinking water supply, agriculture, and power generation.

Geothermal deposits are found in various parts of the Rift Valley area (from Northern Danakil Depression to the southern parts of Lake Chamo). Geothermal power production at a pilot level has commenced at Aluto near Lake Langano.

Mineral Water: At present mineral water production is taking place from Ambo, Babile, Tossa, and several other localities.

Petroleum and Natural Gas Deposits: Studies made to date on the sedimentary rocks of the country indicate the presence of condensate petroleum and industrial minerals. Sedimentary basins are found in the following areas:

- ❖ Ogaden Basin (eastern and south-eastern Ethiopia)
- ❖ Gambella Basin (western and south-western Ethiopia)
- ❖ Mekelle Basin (Tigray Region)
- ❖ Abay Basin (Central Ethiopia)

There are some young localized sedimentary basins associated with the Tertiary updoming and volcanism process. These basins include:

- ❖ Omo Valley (southern Ethiopia in the Rift Valley),
- ❖ Danakil Depression (northern Ethiopia, Afar Region), and
- ❖ The Coal bearing basins in western Ethiopia (Yayu and Delbi Moye), north Ethiopia (Chilga, Hayk, and Wichale) and others.

Of these sedimentary basins, the largest sedimentary rock deposit is found in the Ogaden Basin with an estimated maximum thickness of about 5,000 metres and an area covering up to 350,000 km².

3.10.2 Mining and the Environment

3.10.2.1 Impact of Mining

The mineral explorations and operations being undertaken at present are generally causing adverse impacts on the environment. Among the factors causing such adverse impacts, the following can be mentioned:

- ❖ Failure by some government organisations and enterprises to take into account the need for environmental protection and rehabilitation works.
- ❖ Failure to organise and provide training to the artisan miners who are carrying out their activities haphazardly.
- ❖ Failure to issue standards regarding the discharge into the environment of both solid and liquid waste emanating from the mining industry.
- ❖ The inadequate knowledge that those responsible for the implementation of the mining laws at both federal and regional level have regarding environmental protection and their failure to give attention to the issue.
- ❖ Failure to provide adequate and up-to-date training to those producers and professionals involved in mineral development.
- ❖ The lack of a regulatory system and of skilled human power in the mining sector, particularly at the regional level.
- ❖ Severe ecosystem disruptions caused by excavations made by artisan and illegal miners. The excavations are also serving as ideal hatching grounds for

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vector borne diseases (malaria and other waterborne diseases) because no rehabilitation of the excavated land is made to restore it to its pre-mining condition.

- ❖ Soil erosion due to loss of vegetation cover.
- ❖ The emergence of small settlements stimulated by the proliferation of illegal mining activities in some areas and the consequent pressure on the natural resources in such areas.
- ❖ The risk to the environment and the communities near mining undertakings created by inappropriate handling of chemicals used for mining purposes.

3.10.2.2 Efforts Made to Ameliorate the Pressure on the Environment Resulting from Mining Activities

The pressure on the environment resulting from mining has been locally serious in some areas. Although tackling the problems requires coordination among several organisations, efforts in this regard are inadequate. Nonetheless, the following are among the regulatory instruments that have been issued and efforts that have been made by the government:

- ❖ Mining Proclamation No. 52 of 1993;
- ❖ Mining Regulation No. 18 of 1994;
- ❖ Environmental Pollution Control Proclamation No. 300 of 2003;
- ❖ Environmental Impact Assessment Proclamation No. 299 of 2003;
- ❖ Some studies carried out to determine the environment impact resulting from mining activities; and
- ❖ Regulatory activities carried out at least once a year in places for which mining licences have been issued.

3.11 ENERGY RESOURCES

3.11.1 State of Energy Resources:

Sources of Energy can be categorized as renewable and non-renewable. Sources of energy that are renewable include solar, biomass, hydropower and wind energies. Energy sources such as petroleum, coal, natural gas and the like, are categorized as non-renewable. Most of the domestic energy needs in Ethiopia are met from renewable bio-fuels. In 1994, the total amount of energy consumed in the country was 698.84 Tera Joules, out of which 95.1 percent was covered by bio-fuels. The share of energy generated from petroleum and electricity was only 4.3 percent and 0.6 percent, respectively.

The total annual hydropower potential of Ethiopia is estimated at 550 TW, of which 25 percent can be directly used for energy supply (Table 31).

Ethiopia is also endowed with deposits of natural gas in the order of 30–50 billion m³, geothermal resources of 1000 MW, as well as other sources of energy such as coal and oil shale estimated at several millions tonnes, all of which could be used for power generation. In the area of alternative renewable energy resources, the country is noted to have a huge potential of about 2.3 TWH of solar and 4.8 million terra calories of wind power per annum.

Table 31: Hydropower Potential in GWH of Ethiopia by Basins and Generation Type

| Name of Basin | Generation type | | | Total |
|------------------------|----------------------|--------------------|--------------------|----------------|
| | With Flow Regulation | Small Slope Plants | River Plain Plants | |
| Awash | 16,770 | 1,574 | 4,010 | 22,354 |
| Tekezze | 23,150 | - | 12,720 | 35,870 |
| Blue Nile | 221,930 | 8,197 | 51,017 | 280,144 |
| Baro | 58,700 | 2,553 | 18,050 | 79,303 |
| Chamo | 73,850 | 2,961 | 27,430 | 104,241 |
| Bilate, Segen and Dawa | 47,050 | 1,910 | - | 48,960 |
| Genalle | 31,500 | 2,641 | 11,360 | 45,501 |
| Gistro | 4,400 | 133 | - | 4,533 |
| Wabi Shebelle | 14,500 | 1,490 | 8,78 | 24,770 |
| Total | 491,850 | 20,459 | 133,367 | 645,676 |

Source: Ministry of Miner and Energy, 1986.

Regarding sources of biomass energy, the potential of the country is reckoned at about 14 million terra calories, out of which one million terra calorie of energy can be produced annually. Out of this, the share of forest products, animal dung and crop residue is 79 percent, 13 percent and 8 percent, respectively.

3.11.2 Energy Resources Utilization

Much of the energy needs of the country (77%) is met from fuelwood, while animal dung, crop residues, liquid petroleum gas (LPG), coal, hydropower, petroleum and oil cover 7.7 percent, 8.7 percent, 0.06 percent, 1.55 percent, 1 percent, 0.05 percent and 4.8 percent of the energy requirements of the country, respectively. This shows that 95 percent of the energy consumed in the country originates from biomass energy sources. The type of energy consumed by sectors in 1996 is given in Table 32.

Table 32: Energy Utilization by Energy Types and Sectors (1996).

| Sector | Total | | Biomass | | Petroleum | | Electricity | |
|---------------------|--------------|------------|--------------|-------------|-------------|------------|-------------|-------------|
| | Pita Jule | % | Pita Jule | % | Pita Jule | % | Pite Jule | % |
| Household | 644.7 | 89.2 | 635.7 | 93 | 7 | 2 | 2 | 43.9 |
| Urban | 42.6 | 5.9 | 34.0 | 5.4 | 6.5 | 18.7 | 2 | 43.9 |
| Rural | 602.1 | 83.3 | 601.7 | 88.4 | 0.5 | 1.5 | - | - |
| Agriculture | 0.8 | 0.1 | - | - | 0.8 | 2.3 | - | - |
| Industry | 33.4 | 4.6 | 24.1 | 3.5 | 7.3 | 20.9 | 2.0 | 42.9 |
| Transport | 17.9 | 2.5 | - | - | 17.9 | 51.4 | - | - |
| Services | 26.1 | 3.6 | 23.7 | 3.5 | 1.8 | 5.2 | 0.6 | 13.2 |
| Total | 722.9 | 100 | 683.5 | 100 | 34.8 | 100 | 4.6 | 100 |
| Coverage (%) | | | | 94.5 | | 4.8 | | 0.06 |

Source: Sultan Tilimo and Mekonnen Kassa, 2001

Based on this energy consumption pattern, forecasts of energy demands by sources in 2005 and 2010 are presented in Table 33.

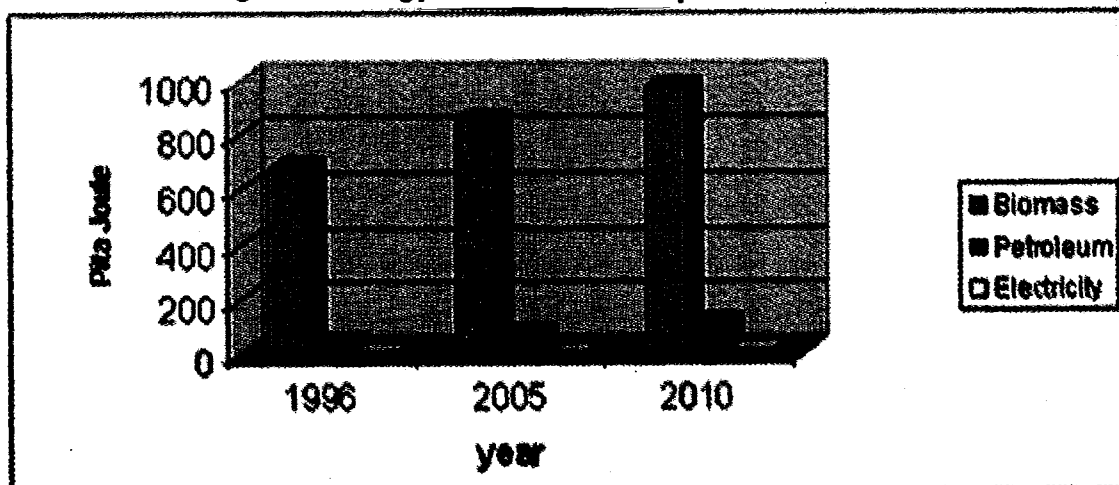
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Table 33: Predicted Energy Demands by Sources (2005 and 2010)

| Energy Source | 2005 | | 2010 | | Annual Average Growth (%) |
|---------------|----------------|------------|------------------|------------|---------------------------|
| | Tera-joule | % | Tera-joule | % | |
| Bio-mass | 862,552 | 91.0 | 974,464 | 88.5 | 2.6 |
| Fuel wood | 47,986 | | 53,932 | | 2.5 |
| Coal | 805 | | 1,113 | | 6.4 |
| Crop residue | 4,755 | | 5,316 | | 2.4 |
| Dung | 5,340 | | 5,988 | | 2.4 |
| Petroleum | 76,514 | 8.1 | 113,859 | 10.3 | 8.7 |
| Electricity | 9,132 | 1.0 | 13,365 | 1.2 | 7.9 |
| Total | 948,198 | 100 | 1,101,688 | 100 | 3.0 |

Source: Sultan Tilimo and Mekonnen Kassa, 2001.

Figure 9: Energy resources consumption and demand



Source: Drawn from data taken from Table 32 & 33

The above figures suggest that energy derived from biomass may be expected to fall slightly, while energy consumption from electricity and petroleum may increase.

3.11.2.1 Hydropower:

In spite of the large hydropower and geothermal power potential, the use of electricity in Ethiopia is low (Tables 32, 33 and 35).

Table 34: Total Installed Electricity Generation Capacity in 2002

| ICS (Inter Connected System) | | | SCS (Self Contained Systems) | | |
|-------------------------------|--------------|------------|------------------------------|-----------|----|
| Generation | MW | % | Generation | MW | % |
| Hydro | 444.6 | 94 | Hydro | 6.2 | 31 |
| Diesel | 22.5 | 5 | Diesel | 13.8 | 69 |
| Geothermal | 7.3 | 2 | Geothermal | 0 | |
| Total | 474.4 | 100 | Total | 20 | |

Source: Ministry of Infrastructure, 2003

Table 35: Electricity Generation and Distribution in 2000-2002

| Capacity | Unit | 1999/00 | 2000/01 | 2001/02 |
|--|---------|---------|---------|---------|
| Reliable electric power capacity of the interconnected system | MW | 327.7 | 352.3 | 474.4 |
| Reliable electric energy capacity of the interconnected system | GWH | 1367 | 1856 | 1976 |
| Electric power production per capita | KW/head | 27.4 | 28.7 | 31 |
| Electric energy consumption per capita | KW/head | 24 | 25 | 25 |
| Part of the Population which has access to electricity | % | 13.2 | 13.5 | 13.99 |

Source: Ministry of Infrastructure, 2003

At present, there are 7 major and 3 small-scale hydropower generation plants in Ethiopia. The combined electric energy generated from these plants is in the order of 451.35 Mega Watts. When compared to the country's hydropower potential of about 650 TWH/year, the amount generated so far is only 0.006 percent. Considering the yearly amount of power generated from the plants that are currently operational, we find that 1,497.5, 1,566.38, 1,575.48 and 1,617.4 million KW/h were generated in 1995/96, 1996/97, and 1997/98 and 1998/99 respectively.

Table 36: Electric Power Potential and Actual Production of the Hydropower Generation Plants.

| Power Station | Production potential (MW) | Actual Production in Billion KW/H | | | |
|---------------|---------------------------|-----------------------------------|----------------|----------------|----------------|
| | | 1995/96 | 1996/97 | 1997/98 | 1998/99 |
| Koka | 43.20 | 84.80 | 129.30 | 59.30 | 120.10 |
| Soar | 5.00 | 10.50 | 11.50 | 11.99 | 11.30 |
| Awash 2 | 32.00 | 106.60 | 159.10 | 97.80 | 114.80 |
| Awash 3 | 32.00 | 106.80 | 183.50 | 113.40 | 175.50 |
| Denbi | 0.80 | 1.00 | 1.80 | 2.10 | 1.86 |
| Fincha | 100.00 | 777.10 | 624.40 | 843.30 | 671.50 |
| Yadot | 0.35 | 0.84 | 0.88 | 0.79 | 0.95 |
| Melka Wakena | 153.00 | 381.60 | 436.30 | 438.90 | 510.10 |
| Tis Abay 1 | 12.00 | 28.30 | 19.60 | 11.90 | 11.30 |
| Tis Abay 2 | 73.00 | - | - | - | - |
| Total | 451.35 | 1497.54 | 1566.38 | 1575.48 | 1617.41 |

Source: Ethiopian Electric Power Corporation, 2001

In addition to the hydropower plants given in Table 36, the Gilgel Gibe hydropower station, which is under construction at present, has a planned power generation capacity of about 184 Mega Watts when completed, and is expected to push the country's actual power production capacity to 629 Mega Watts.

3.11.2.2 Biomass Energy

The country's total power consumption in 1996 was 723 Peta Joule. This is equivalent to 50 million tonnes of firewood. Out of the total consumption, 94.5 percent was covered by biomass energy sources, including firewood and charcoal, crop residues and animal dung. (Table 33)

Photo 10: Charcoal for Sale (produced from depleted Acacia forests) Oromia Region, Awash Park, on the Awash park- Addis Ababa road(Photo, EPA)



3.11.2.3 Other Energy Sources:

Solar Energy: Studies indicate that the country's average annual solar energy is in the order of 5.26 KWH/m². This figure, however, varies seasonally from a high of 5.26 KWH/m² to a low of 4.55 KW/M². Apart from some ongoing initiatives to exploit solar energy for rural telecommunication services, nothing substantial has been done to date in this area.

Wind Energy is an important renewable energy sources. In Ethiopia, though wind energy resources vary from place to place, on the average the wind speed is about 4.7 m/sec. Generally, because of the limited data available, it is difficult to state the exact extent of the country's wind energy potential.

Geothermal Energy: Although the country's geothermal energy resources are estimated to be in the order of 700 MW, the amount put to beneficial use is only 6.77 WM. The geothermal reserves in the Rift Valley of Oromia, Afar and SNNPR, is known to be particularly large.

Coal and Fuel Oil Energy: Coal reserves of varying magnitude are found in many parts of the country, though not yet put to economic use. However, preliminary studies have been conducted recently and it is hoped that the private sector could be attracted into their development and utilization.

With regard to petroleum and natural gas, the potential reserve in the Ogaden, Gambella, Tigray, Blue Nile Valley and Omo Valley areas is reckoned to be substantial, though there has not been sufficient study to show the extent and distribution. In spite of the promising prospects to become an oil and natural gas self-sufficient country, 626,993.8 MT of petroleum products were imported between 1996 and 2000 alone, growing by 94.3 percent in that period. Data from the Ethiopian Energy Agency show this increase (Table 37).

Table 37: Fuel Oil Consumption in MT (1988 to 92)

| Fuel Type | 1995/96 | 1996/97 | 1997/98 | 1998/99 | 1999/00 |
|--------------------|---------|---------|---------|---------|---------|
| Amount Imported | | | | | |
| Petrol | 75,381 | 67,352 | 111,520 | 134,763 | 142,019 |
| Diesel Oil | - | - | 99,489 | 96,021 | 109,268 |
| Gas Oil | 336,448 | 413,118 | 454,024 | 541,364 | 548,013 |
| LPG | 189 | - | 3,483 | 1,288 | 1,229 |
| Annual Consumption | | | | | |
| Petrol | 184,378 | 182,757 | 180,355 | 181,724 | 185,368 |
| Diesel Oil | 97,939 | 105,746 | 109,204 | 109,148 | 17,541 |
| Gas Oil | 460,584 | 495,141 | 539,998 | 561,309 | 631,133 |
| LPG | 8,227 | 7,951 | 4,558 | 1,150 | 1,153 |

Source: Ethiopian Energy Agency, 2001, response to questionnaire.

3.11.3 Energy Resources Utilization and Environmental Problems

Although the country is known to have the potential to produce substantial amounts of energy from its various sources, as things stand now, most of the energy consumed comes from biomass. As a result:

- ❖ The water holding capacity of dams is decreasing rapidly due to increased siltation and consequently there is a pressure on hydropower energy utilization;
- ❖ The heavy dependence on biomass resources such as animal dung for energy supplies is leading to a situation where soils are being deprived of natural soil conditioners essential for maintaining soil fertility.

The fact that the income of the majority of the population is too low to use alternative energy sources has led to heavy dependence on biomass resources, which are, as a result, being depleted fast.

Apart from the environmental problems mentioned above, there are other factors that directly affect the energy resources utilization in the country. These are:

- ❖ Inefficiency in energy utilization which results in a high degree of energy resources wastage in the country;
- ❖ Lack of capacity to effectively develop the country's energy resources such as hydropower, solar and other renewable energy sources;
- ❖ The fact that climate change is causing erratic rainfall, both in amount and distribution and consequent fluctuations in the hydropower energy supply in the country.

3.11.4 Efforts Made to Tackle the Problems Associated with Energy Resources Development and Utilization

The following are the major efforts that have been made to tackle the problems associated with the poor development of the energy resources of the country.

- ❖ A national energy policy has been issued;
- ❖ Even though insignificant compared to the vast potential, some attempts to utilize renewable energy resources have been made;
- ❖ Some steps to promote charcoal and other biomass energy efficient cooking stoves have been taken;
- ❖ An investment code that encourages the involvement of the private sector in energy generation has been promulgated;
- ❖ Survey, design and construction are being done to develop the country's enormous hydropower potential;

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- ❖ There are ongoing initiatives in the agricultural sector designed to encourage the participation of rural communities in the development of forests for firewood;
- ❖ In order to enhance energy development for rural areas, a Rural Energy Development Promotion Centre has been established as an independent entity by the Federal Government and by some Regional States; and
- ❖ A Rural Electrification Fund has been established.

Though the efforts made to tackle the problems related to energy resources utilization so far are commendable, there is need to do much more in view of the magnitude of the pressures exerted on the environment generally and on forest and other biomass resources in particular.

3.12 CLIMATE CHANGE

3.12.1 Causes of Climate change:

The atmosphere has an important role in the circulation of heat, sunlight as well as other forms of radiation between the sun and the earth. The atmosphere ensures that the average temperature on planet earth remains constantly at 15°C. It is because of this ideal temperature that life exists on mother earth.

The natural capacity of the atmosphere to absorb heat is indispensable. Unfortunately, now the concentration of man-made gases with marked propensity for trapping heat is increasing in the atmosphere so rapidly that there is fear that changes in climate of a magnitude never seen before is taking place on earth. Since climate change is linked to gases that emanate by and large from industrial growth and energy consumption, developed countries are the major contributors to the problem. Among the various greenhouse gases that are behind the adverse climatic change threatening life on earth, CO₂ is in the forefront. CO₂ is injected into the atmosphere through the burning of fossil fuels.

The International Panel on Climate Change forecasts that up to the end of the 21st century, the temperature in our planet would rise on average between 1.5°C and 3.5°C. This global warming is expected to cause unprecedented flooding, drought and inundation of coastal areas. (National Meteorological Services Agency, 2001)

The major victims of global warming are poor countries in the tropics, including Ethiopia. This phenomenon is expected to exacerbate the economic and social problems that these countries are faced with currently.

3.12.2 Status of Greenhouse Gas Emissions in Ethiopia

Greenhouse gases are the single most important causes for global warming. The industrialized countries are the major sources for the emission of such gases. The contribution of developing countries, in terms of the emission of such gases, is negligible. For example, the carbon dioxide emission in the East African Countries (Ethiopia, Djibouti, Uganda, Kenya, Eritrea, Rwanda and Burundi) is not more than 2 percent of the total global carbon dioxide emission. Thus, the impact of the greenhouse gas emission from Ethiopia is insignificant. In any event, since most of the carbon dioxide produced comes from biomass, it goes back to create the next year's biomass production and the net result is that Ethiopia's impact is proportional only to the small amount of petroleum product it burns.

Ethiopia is a developing country whose economy is predominantly agriculture-based with a very low level of industrialization and urbanization. There is hardly any source of greenhouse gases other than that which comes from the agricultural sector. According to

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data from the National Meteorological Services Agency, out of the total greenhouse gases generated in the country, the share of agriculture is estimated to be 80 percent.

Table 38 shows that, without including emissions from land use and the sequestration by forests, the total amount of the three gases (CO₂, CH₄ and N₂O) generated from all the sectors in 1994 was estimated at about 48,000 giga gramme of carbon dioxide equivalent. Of this CO₂, CH₄ and N₂O account for 5 percent, 79 percent and 15 percent respectively.

Table 38: 1994 Emissions and Removals in Absolute Values (Gg) and Aggregated Emissions in terms of CO₂-Equivalent Emissions (Gg) Using the 1995 IPCC GWP Factors over a 100 Year's Time Horizon.

| Greenhouse Gas Source and Sink Categories | Emissions & Removal In absolute values (Gg) | | | | CO ₂ Equivalent Emissions (Gg) | | | | |
|---|--|-----------------------------|-----------------|------------------|---|-----------------|------------------|------------|-----|
| | CO ₂ Emissions | CO ₂ Removals | CH ₄ | N ₂ O | CO ₂ | CH ₄ | N ₂ O | Aggregated | % |
| Energy (Fuel Combustion) | 2,285 | | 194 | 3.0 | 2,285 | 4,074 | 930 | 7,289 | 15 |
| Industrial processes | 310 | | | 0 | 310 | 0 | 0 | 310 | 1 |
| Agriculture | | | 1,540 | 19.7 | | 32,340 | 6,116 | 38,455 | 80 |
| Land use change and forestry | | -15,063* | 28 | 0.2 | | 594 | 60 | 654 | 1 |
| Waste | | | | | | | | | |
| Total National Emission and Removals | 2,595 | -15,063* | 1,808 | 24 | 2,595** | 37,968 | 7,440 | 48,003 | 100 |
| % | | | | | 5 | 79 | 15 | 100 | |

* represents 'net' emissions of CO₂ in the LUCF sector. Please note that for the purposes of reporting, the signs for uptake are always (-) and for emissions (+)

** carbon emissions/ sinks from the LUCF sector are not included in total CO₂ emissions

Source: National Meteorological Services Agency, 2001

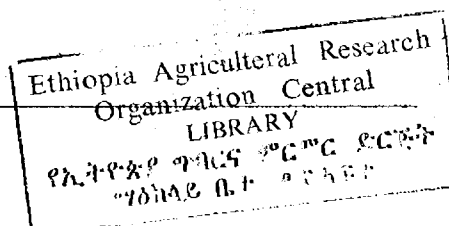
As indicated in the table above, the per capita emission in the country in 1994 is estimated to be about 0.8976 tonnes of carbon dioxide equivalent.

There was a general increasing trend of greenhouse gas emissions in Ethiopia in the period 1990-1995. A comparison of greenhouse gas emissions for the years 1990 and 1995 shows that total (gross) CO₂ emissions (i.e. emissions from the Energy and Industrial Process Sectors) increased by about 24 percent while emissions of CH₄ and N₂O increased by 1 percent and 119 percent respectively. Aggregate emissions of greenhouse gases in terms of CO₂ equivalents, increased by 12 percent (Table 39)

Table 39: Emissions for the Period 1990 to 1995 in terms of Carbon Dioxide Equivalent (Gg)

| Greenhouse gas | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | % Change Between 1990 & 1995 |
|-----------------|--------|--------|--------|--------|--------|--------|------------------------------------|
| CO ₂ | 2,308 | 1,897 | 2,073 | 2,402 | 2,595 | 2,862 | 24 |
| CH ₄ | 37,800 | 38,661 | 37,320 | 37,498 | 37,968 | 38,235 | 1 |
| NO ₂ | 3,430 | 4,579 | 4,705 | 4,818 | 7,440 | 7,498 | 119 |
| Total | 43,537 | 45,119 | 44,098 | 44,718 | 48,003 | 48,595 | 12 |

Source: National Meteorological Services Agency, 2001



3.12.3 Climate Change and Environmental Problems in Ethiopia

Climate change is the major cause for the occurrence of a considerable number of environmental problems of which drought, desertification, floods and the expansion of vector-borne diseases are in the forefront.

The backbone of Ethiopia's economy, agriculture, is vulnerable to climate change. Most of the country being arid and semi-arid, it is threatened by desertification and recurrent drought. The highland ecosystem of Ethiopia is also exposed to severe disruptions due to the heavy burden it has to carry in supporting an ever-growing population driven upwards by desertification from the lower areas. Forests, water and biodiversity are all liable to destabilization by climate change. Vector-borne diseases such as malaria and trypanosomiasis are widespread in Ethiopia, and climate change will create a favourable environment for their further expansion. There already are indications that malaria is occurring higher up in altitude than in the past.

Though comprehensive research has not been conducted, whatever little research there is in the country reveals the occurrence of quite a number of problems associated with climate change.

Preliminary studies coordinated by the National Meteorological Services Agency indicate that the average annual rainfall remains more or less constant. However, these studies also indicate that there would be a likelihood of shortfalls in rainfall amounts in the northern and south-western parts of the country and a likelihood of increases in rainfall amounts in the central parts of the country.

Temperature in the country has been rising in the last 50 years. In the last ten years the minimum mean annual temperature has increased by 0.5°C and the maximum mean annual temperature has increase by 0.1°C at ten-year intervals. This shows that the minimum mean annual temperature rise has been greater than the maximum mean annual temperature.

Studies conducted to determine the impact of climate change on the country's agricultural sector disclose, for instance, that the production of wheat may reduce.

The north eastern, south eastern, eastern, southern and south western parts of the country are mostly lowlands below 1500 meters and are estimated to cover from 55 to 60 percent of the total land area. An estimated 93 percent of the population inhabiting the lowlands consists of pastoralists or semi-pastoralists. These low-lying areas are affected, in most cases, by recurrent droughts and shortage of grazing lands. They are also exposed to a multitude of problems that are generally exacerbated by climate change such as scarcity of drinking water for humans and cattle. The major problems emanating from climate change are declining productivity of grazing land both in quantity and quality, decreasing productivity of livestock resources as well as expansion and prevalence of human and animal diseases. Rising temperatures and fluctuations in the amount and distribution of rainfall are considered the root causes for these adverse impacts.

In the forestry sector, climate change brings about changes in forest types and in the environment surrounding them as well as the fragmentation and thinning of the forest cover. As a result it is expected that some forest types would become extinct.

Similarly, studies conducted in the water resources sector indicate that if the Awash and Nile basins become warmer by 2°C, their run-off would diminish even if there were no decrease in the amount of rainfall.

3.12.4 Attempts Made to Control Possible Problems Caused by Climate Change

As stated earlier, the geographic location of Ethiopia in the tropical climatic zone makes it one of the countries to be severely affected by climatic changes. In this regard, the agriculture sector becomes the primary victim with damaging repercussions on the overall economy of the country. Therefore, it is necessary to take timely and comprehensive measures to combat the problems expected to emerge with climate change.

The following are some of the most significant initiatives taken in Ethiopia concerning this crucial issue:

- ❖ Ratification of international agreements on climate change;
- ❖ Ratification of international agreements for the control of desertification and the development of a National Action Programme for combating desertification;
- ❖ Developing the National Disaster Prevention and Preparedness Policy and strategy as well as an early warning system;
- ❖ The building up of capacity in the National Meteorological Services Agency in the area of monitoring climatic change, and collecting and disseminating timely data;
- ❖ Issuing other policies and strategies related to climate change including policies on population, Science and Technology, Energy, Water Resources as well as a Forestry Development Action Plan and Health and Solid Waste Management and Disposal Action Plan for Addis Ababa.

However, in addition to the above initiatives, other measures are deemed necessary to combat problems associated with climate change.

SECTION FOUR: HUMAN ENVIRONMENT

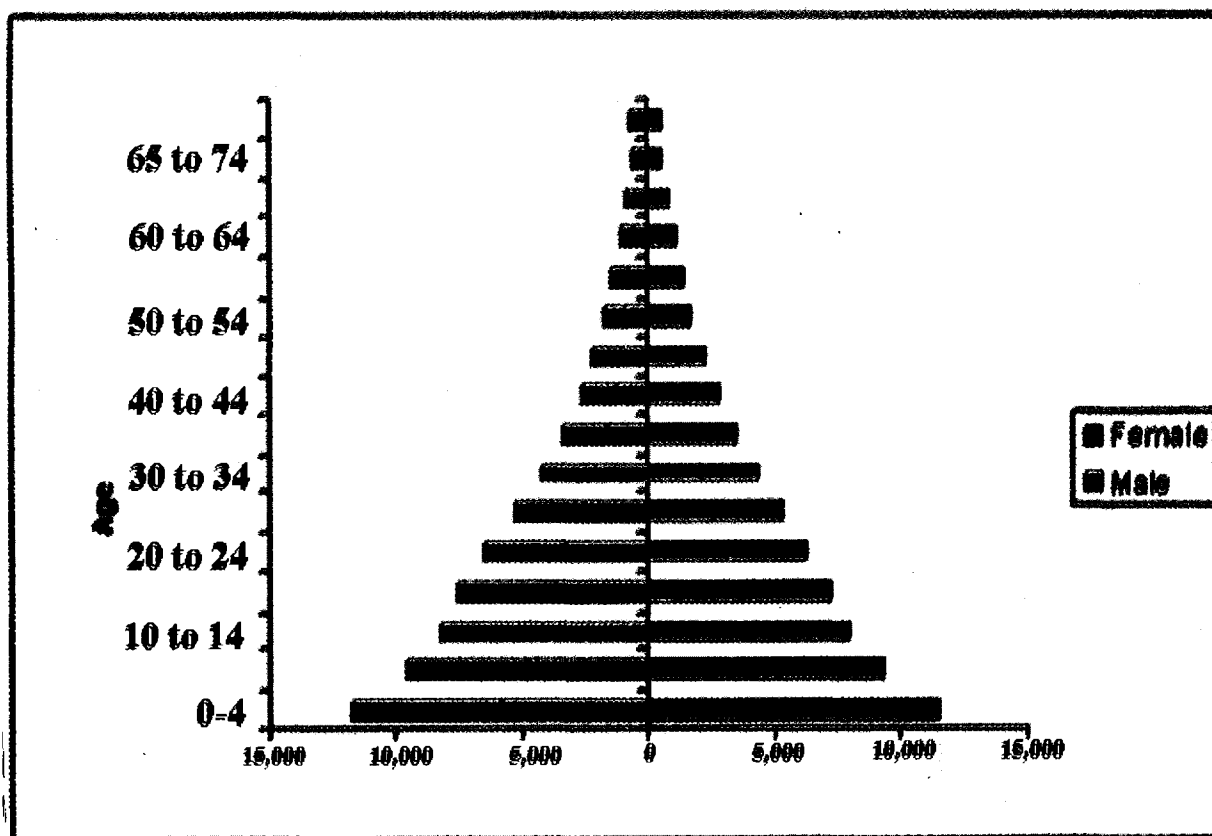
4.1 POPULATION

4.1.1 Population Growth

According to the forecast based on the 1994 population and housing census, the total population of Ethiopia in the year 2002 was 67.22 million, of which 56.9 million (84.7%) were rural and 10.3 million (15.3%) were urban dwellers. Out of the rural population, 28.57 million (50.2%) are males while 28.34 million (49.8%) are females. Out of the total urban population, 5.13 million (49.8%) are males and 5.17 million (50.2%) are females.

In terms of age groups, most of the population of Ethiopia, as in many other developing countries, falls within the young age bracket. According to projections made based on the results of the 1994 population and housing census, the number of people below the age of 19 years is expected to reach 56.4 percent of the total by the year 2002. The total population of the country by age groups is presented in Figure 10.

Figure 10: Total Estimated Population of Ethiopia by Age and Sex in 2002



Source: Drawn from data taken from Central Statistical Authority, 2001

The Figure shows that 31.4 percent of the total population of Ethiopia is below 10 years old. This indicates that the birth rate in the country is high. On the other hand, only 3.4 percent of the country's population is above 64 years old. Since the mainstay of the livelihood of 85 percent of the population is agriculture, having so many young people relying on the productive segment of the population for their survival exacerbates poverty and the pressure on the environmental resources.

4.1.2 Population Distribution and Density

The majority of the Ethiopian population lives in the highlands. Several studies indicate that more than 49 percent of the country's population live above 2,200 m asl, 11 percent live below 1,400 m asl and 40 percent between 1,400 and 2,200 m asl.

Therefore, there is a difference in population density between the highland and lowland areas. Population density is very high in areas that are located between 2,200 and 2,600 m asl. In these areas the population density is about 170/km². By contrast, the population density in areas that are below 1,000 m asl it is, on average, 8/km². Table 40 presents the population distribution and density in the various areas of Ethiopia.

Table 40: Population Distribution and Density by Altitude (1998-2002)

| Altitude (in metres) | % of total area | Population (in '000) and population density (per km ²) | | | | |
|-------------------------|--------------------|--|--------------------------|-----------------------|------------|-----------------------|
| | | 1998 | | 2002 | | |
| | | Population | % of total population | Population Density | Population | Population Density |
| above 2600 | 5.8 | 6,228 | 10.4 | 99 | 6,991 | 111 |
| 2200-2600 | 11.8 | 29,474 | 39.2 | 183 | 26,350 | 205 |
| 1800-2200 | 19.4 | 16,707 | 27.9 | 79 | 1,754 | 89 |
| 1400-1800 | 28.1 | 6,886 | 11.5 | 23 | 7,730 | 25 |
| 1000-1400 | 13.4 | 4,910 | 8.2 | 34 | 5,512 | 38 |
| below 1000 | 21.15 | 1,677 | 2.8 | 7 | 1,883 | 8 |
| Total | 100 | 59,882 | 100 | 55 | 67,220 | 62 |

Sources: Ministry of Economic Development and Cooperation, 1999, and Central Statistical Authority, 1999.

Similarly, regional population densities vary depending on the land area and the size of population. As indicated in the 2001 Yearly Statistical Bulletin of the Central Statistical Authority, there is a heavy population density in urban areas. Thus, Addis Ababa, with 4,991 people/km² stands first. The Harari Region with 553 people/km² stands second and Dire Dawa with 282 people/km² takes the third place.

Region wise, the heaviest population density is found in the Southern Nations, Nationalities and Peoples Region, where an average of 118 people/km² are estimated to live. This is followed by Amhara, Tigray and Oromia Regions, with population densities of 108, 78 and 67 people/km², respectively. Available information also indicates that Gambella, with 8.6 people/km² and Benishangul with 11.5 people/km² respectively, are among the regions with the lowest population densities.

4.2 SOCIAL DEVELOPMENT

4.2.1 Urban Environment

4.2.1.1 Urbanization

Before the present urban centres came into being, local communities had been living in small villages for centuries. The history of Ethiopia indicates that only Axum, Lalibella and Gondar existed for quite long spans of time as large cities.

Modern cities only started in the 20th century. Urbanization in Ethiopia is still rather slow and lacks proper planning.

As shown by data from the Central Statistical Authority, the total number of inhabitants in the cities in Ethiopia is 10.3 million, of which 50.2 percent are females and 49.8 percent are males. The average yearly growth rate of the urban population is 5.0 percent. This growth rate, however, varies from region to region.

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According to the Central Statistical Authority, any settlement over a population of 2000 is identified as a town. The 1994 Population and Housing Census, carried out by the Central Statistical Authority, classifies the number of Ethiopian towns into 5 categories in terms of the size of their populations. The information is presented in Table 41.

Table 41: Categorization of Towns by Population Size

| Division | Population Size | Number of Cities | Coverage of Total Urban Population (%) |
|----------|-----------------|------------------|--|
| 1 | 2000-4,999 | 297 | 59 |
| 2 | 5000-19,999 | 166 | 33 |
| 3 | 20,000-59,999 | 32 | 6.4 |
| 4 | 60,000-249,999 | 7 | 1.4 |
| 5 | Above 250,000 | 1 | 0.2 |

Source: Environmental Protection Authority 2001

Most towns in Ethiopia do not have master plans and are established and managed haphazardly. As a result they are all characterized by chronic social and environmental problems. The Public Health Proclamations of 1942 and 1947 are indicative of the fact that the first attempts to issue legislation for the planned development and management of towns in Ethiopia commenced many years back. However, the main preoccupation of these laws was urban land use control and not a planned approach to the whole urbanization process. The next attempt was the inclusion of a number of relevant provisions in the Civil Code of 1960. These Civil Code provisions remained as the only binding urban development directives until 1975.

Urban planning, as an integral part of national socio-economic development planning, was included for the first time in the second five-year development plan that was implemented from 1963-1967. After that, urban plans of various types have been developed and passed through diverse phases of implementation.

At present, urban master planning, which more or less takes environmental problems into account, is intensifying. Planned development will ensure that towns are provided with appropriate land use plans, proper infrastructures and urban industrial waste management systems as well as the necessary legal basis for the management of their growth.

4.2.1.2 Urban Environmental Problems

Characteristically, urban areas alter the natural environment. Towns are places where ecosystem changes take place and natural resources are exposed to diverse pollutants emanating from all sorts of development activities. In the Ethiopian context, most of the towns are affected by the following major environmental problems:

Inadequacy or absence of sewerage services: Large amounts of raw sewage are released, particularly in major cities, from households and private and government organizations. Adequate sewers are not available for the safe disposal of such sewage. Only Addis Ababa has a sewerage system, and that covers only a small part of the city. Thus, urban environments are exposed to pollution.

Shortage or Lack and Poor Management of Latrines: Shortage of latrines in Ethiopia is one of the causes for the unsightly situation in the cities and towns. According to data from the Welfare Monitoring Survey of Ethiopia (2001), about 26.9 percent of urban dwellers, not having latrines in their homes, defecate in the open spaces of the cities and towns.

Solid Waste Disposal: Lack of a proper waste disposal and management system is one of the leading factors for the deterioration of environmental cleanliness, the increase in

pollution, the spread of pathogenic organisms and the degeneration of scenic beauty. This problem is common in almost every major city in the country and is caused by poverty and lack of capacity to put in place effective waste management systems.

Only a few towns, including Addis Ababa, Dire Dawa, Bahir Dar, Gondar, Nazareth, Harar, Jimma, Dessie and Mekele, have vehicles for the disposal of solid waste. Information in the Welfare Monitoring Survey (2001) indicates that the amount of waste collected and disposed using disposal trucks is only 17.7 percent. An additional 15.4 percent and 12.4 percent is, respectively, disposed of by burning and burying in pits

Waste Disposal from Small and Large Industries: Industries in Ethiopia are small in number and most of them are located in the cities. The wastes from these industries are released into the environment in diverse forms. Liquid industrial waste is usually discharged into streams via ditches. The bulk of the solid waste, however, is mostly dumped in factory premises or any nearby open area. Gaseous emissions are simply released into the air without any treatment.

Urban Environment Air Pollution: Compared to the overall environmental problems in Ethiopia, air pollution is not significant. However, it is growing fast in the major towns of the country. The major sources of air pollution are toxic gases released from the exhaust pipes of vehicles.

Urban Social Problems: The number of Ethiopian towns overcrowded beyond the carrying capacity of existing infrastructure and basic services are increasing progressively. Numerous economic and social problems have begun emerging in these towns.

Widespread unemployment and increasing rates of rural-urban migration are among the major problems. The increases in the number of prostitutes, street children and the homeless as well as victims of HIV/AIDS as a result of poverty and unemployment are serious social problems.

4.2.1.3 Efforts Made to Improve the Urban Environment

Among the measures taken to ensure sustainable urban development and to ameliorate the environmental problems in the urban areas, the following major attempts are worth mentioning:

Development of master plans, which take into account urban environmental problems;

- ❖ Enactment of environmental impact assessment and pollution control proclamations; and
- ❖ Enhancing community and individual participation in the protection of the urban environment.

4.2.2 Health

Public health status is one of the factors that play a pivotal role in the development process of a country. The state of health services in Ethiopia is low even when compared to Sub-Saharan African countries. Communicable diseases as well as nutrition related diseases are the main health problems. Poor housing conditions and lack of sanitation services in both urban and rural settings further aggravate the health problems. Health service institutions and medical equipment and supplies in the institutions are inadequate and have to serve large areas making it difficult for local communities to get to them easily. The low level of income and the pervasive poverty in the country are responsible for the poor state of the health of the people.

Available information indicates that the Federal Democratic Government of Ethiopia has issued a national preventive health policy. Health sector programmes are now based on this policy. In addition, there is an ongoing effort to increase the number of health institutions and enhance their capacity to provide the required services.

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Even though the population as a whole is affected by the inadequacy of the health infrastructure, mothers and children are particularly affected, and the infant mortality rate is 96.8 per 1000, while the mortality rate of children of below 5 years of age is 140.1 per 1000, and maternal mortality rate is 871 per 100,000.

4.2.2.1 Health Institutions

At present, health services are provided by hospitals, clinics, health centres, health posts and pharmacies established by the government, as well as some established by non-governmental organizations and the private sector.

Data released by the Ministry of Health in 2001 show that there were 110 hospitals, 382 health centres, 2,393 clinics and 1,023 health posts throughout the country (Table 42)

Table 42: Distribution of Health Institutions and Potential Health Services by Region in 2001

| Region | Hospitals | Health Centres | Clinics | Health Post | Health Services coverage (%) |
|--------------------|------------|----------------|--------------|--------------|------------------------------|
| Tigray | 13 | 29 | 179 | 103 | 66.24 |
| Afar | 2 | 5 | 53 | 36 | 52.70 |
| Amhara | 16 | 77 | 536 | 361 | 43.50 |
| Oromia | 28 | 114 | 795 | 145 | 46.91 |
| Somali | 6 | 10 | 91 | 0 | 30.55 |
| Benishangul-Gumuz | 2 | 7 | 71 | 24 | 86.21 |
| SNNPR | 12 | 107 | 443 | 290 | 55.06 |
| Gambella | 1 | 5 | 38 | 0 | 87.96 |
| Harari | 5 | 2 | 19 | 7 | 114.46 |
| Addis Ababa | 18 | 24 | 161 | 47 | 93.39 |
| Dire Dawa | 2 | 2 | 7 | 10 | 51.52 |
| Referral Hospitals | 5 | — | — | — | — |
| Total | 110 | 382 | 2,393 | 1,023 | 51.24 |

-- = Not applicable

Source: Ministry of Health, 2001

4.2.2.2 Potential Health Services

The potential health service coverage is based on the assumption that one health centre serves 25,000 people and one health station serves 10,000 people. Hospitals are not included as they are expected to take what health centres and stations find difficult to treat.

Only 51.24 percent of the population has the potential to have access to health services. In terms of regional coverage, the lowest is in the Somali Region (30.55%) and the highest in the Harari Region (114.96%). Compared with the countrywide coverage of health services, 6 regions and 2 chartered cities are above the national average while the remaining are below the average. (Table 42)

Various programmes primarily aimed at preventing diseases and providing appropriate treatment for mothers and infants have been going on in the country for some time. Particular effort is being made to address maternal and child health problems by way of providing vaccination and birth control services. The coverage between 1997 and 2001 is presented in Table 43.

Table 43: Coverage of Health Services (1996–2001) by percent of population

| Types of Health Services | 1996/97 | 1997/98 | 1998/99 | 1999/2000 | 2000/01 |
|------------------------------|---------|---------|---------|-----------|---------|
| General Health Services | 53.2 | 50.7 | 49.1 | 50.7 | 51.2 |
| Various Vaccination Services | 59.3 | 42.7 | 38.4 | 41.9 | 41.9 |
| Birth Control Services | 9.8 | 6.0 | 7.9 | 13.3 | 18.7 |

Source: Ministry of Health, 2001

In addition, close attention is being given to strengthening the capacity of health institutions through training health professionals. The total number of health professionals that graduated from the educational institutions in the country between 1998 and 2001 is presented in Table 44.

Table 44: Total Number of Health Professionals Graduated from Educational Institutions in the Country (1998–2001)

| Qualification | Year of Graduation | | | |
|-----------------|--------------------|---------|---------|---------|
| | 1997/98 | 1998/99 | 1999/00 | 2000/01 |
| Medical Doctors | 140 | 136 | 152 | 128 |
| Health Officers | 83 | 79 | 157 | 181 |
| Pharmacists | 31 | 34 | 31 | 54 |
| Nurses | 15 | 27 | 25 | 13 |

Source: Ministry of Health, 2001

4.2.2.3 Prevalent Diseases

While the major causes for diseases in the country are more or less the same in all the regions, there is some variation in the degree of their prevalence. Data from the Ministry of Health and Central Statistical Authority reveal that the major diseases in the country are upper respiratory tract diseases, infections of the respiratory tracts, malaria, ophthalmic diseases, intestinal parasites, skin infections, tuberculosis, gastritis and other abdominal diseases, dysentery and other communicable diseases as well as HIV/AIDS.

In the past five years, malaria and HIV/AIDS have emerged as the leading killer diseases in most of the areas in the country. It is clear that these diseases are undermining economic growth and development by affecting the productive segment of the society. Of the total patients examined in the health institutions in the country from 1996 to 1999, 43.1 percent, 46.2 percent, 46.3 percent and 47 percent had contracted malaria. This shows that the prevalence of malaria is increasing every year.

Food deficiency is another serious problem in Ethiopia. Children are the most vulnerable to the problems related to food deficiency. A sample survey conducted in 2000 drives home the reality that children ranging from 5 months to 3 years of age are more affected by various disease associated with food deficiency. The health status of a child is measured by comparing the correlation between the weight and height, the weight and age as well as the height and age of the child with standard criteria set for healthy children. The percentage of children suffering from wasting, stunting and underweight conditions is shown in Table 45.

Table 45: Types of Food Deficiency Diseases and Percentage of Children Affected in Rural and Urban Areas (1996–2000)

| Area of sample survey and year | Wasting | Stunted growth | Under weight |
|--------------------------------|---------|----------------|--------------|
| Nation wide | | | |
| 1996 | 7.3 | 65.7 | 45.4 |
| 1998 | 9.6 | 54.7 | 44.9 |
| 2000 | 9.6 | 56.7 | 45.0 |
| Rural | | | |
| 1996 | 7.6 | 66.6 | 46.7 |
| 1998 | 9.7 | 56.2 | 46.3 |
| 2000 | 9.8 | 57.9 | 46.7 |
| Urban | | | |
| 1996 | 5.3 | 58.4 | 34.4 |
| 1998 | 8.5 | 40.5 | 30.7 |
| 2000 | 6.4 | 44.4 | 27.0 |

Source: Central Statistical Authority, 2001

4.2.2.4 HIV/AIDS

Some studies show that the spread of HIV/AIDS in Ethiopia started in the first half of the 1980s. The first case of HIV/AIDS in Ethiopia was identified in 1984. The rate of expansion of HIV/AIDS in the early 1980s was very slow. But, at present the HIV/AIDS pandemic is expanding very fast and is putting pressure on all socio-economic initiatives of the country.

Data from the Ministry of Health reveal that in 1999 alone over 3 million people were infected with HIV/AIDS. From the moment the case was first identified up to year 2000, about 1.2 million people had lost their lives because of the disease. It was projected that this figure could rise to 1.7 million in the year 2002.

According to a paper presented by NGOs at the consultative conference on the Poverty Reduction Strategy, the number of children orphaned by HIV/AIDS at present is estimated at 750,000. It is also projected that this number will increase to 2.1 million by the year 2014 and that the current average life expectancy will decline by 10 years by the same year.

According to data released by the Ministry of Health in 2001, of the adults between the ages of 15 and 49, about 2.9 million are estimated to have contracted HIV/AIDS. Out of this 1.6 million (55.2%) are females. The same source shows that, in the same year, the total HIV/AIDS positive children below the age of 15 years was in the range of 150,000.

The group that is hardest hit by the pandemic is the young adult population. This will result in drastic reduction in productive human resources. The prohibitively high medical expenditure and the time required for caring for the victims of the pandemic compete for time and resources with the development needs of the country. All in all, the pandemic becomes an obstacle to economic growth and development by severely reducing production and productivity.

4.2.2.5 Potable Water Supply and Environmental Sanitation

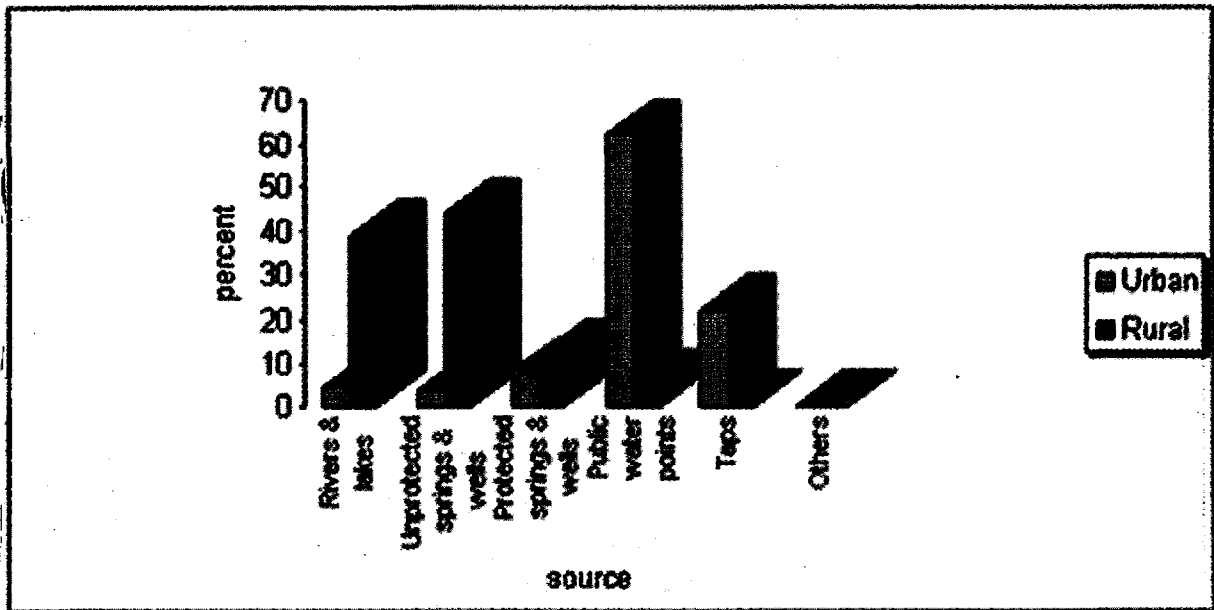
The extent of potable water supply coverage in Ethiopia is very low. A survey conducted in the year 2000 shows that most people get their water from streams and lakes (33.9%), developed springs and wells (11.1%), unprotected springs and wells (38.1%), public taps, (13.5%), home taps (3.3%) and other sources (0.1%), see Figure 11. The number of people in the regions using water from diverse sources is presented Annex 10.

Photo 11: The Supply and Demand for Drinking Water



Source: Ministry of Water Resources Development, 2003

Figure 11: Number of People Using Water From Different Sources by Percentage in 2000



Source: Drawn from data taken from Central Statistical Authority, 2001

Information from the Ministry of Water Resources shows that the clean potable water supply coverage is 24 percent in the rural areas, 72 percent in the urban areas and 31 percent nationwide.

In Regional terms the coverage in the Afar Region is relatively low, while coverage in the rest of the regions is between 22 percent and 34 percent (Table 46)

Table 46: Potable Water Supply Coverage by Region

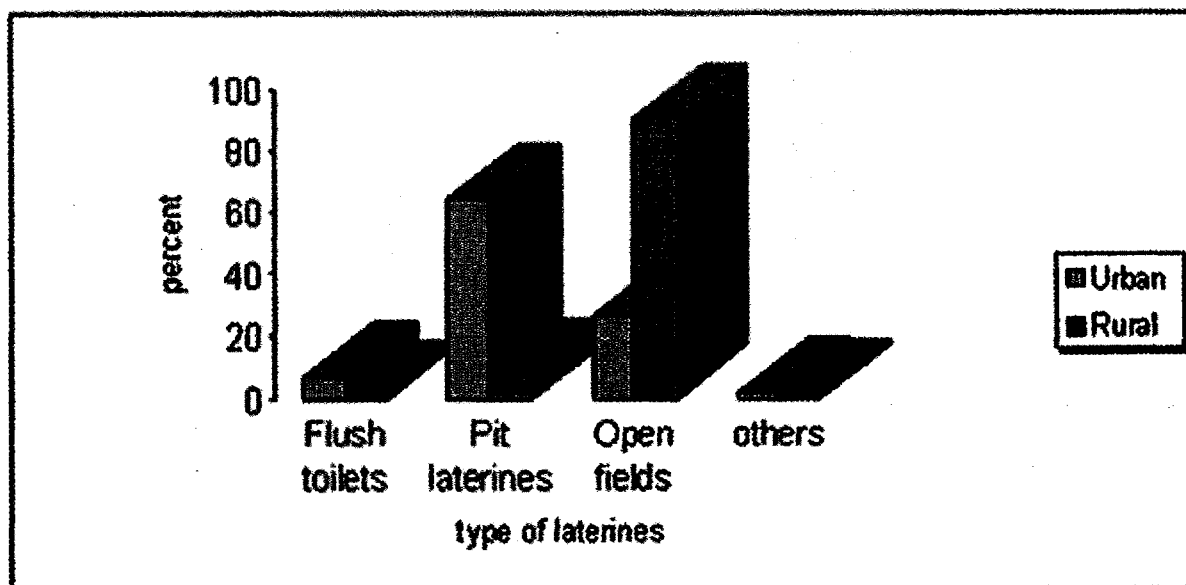
| Region | Potable Water Supply Beneficiaries (%) | | |
|-------------------|--|-------|---------|
| | Rural | Urban | Overall |
| Tigray | 29 | 59 | 34 |
| Afar | 14 | 44 | 16 |
| Amhara | 23 | 96 | 29 |
| Oromia | 24 | 96 | 30 |
| Somali | 20 | 7 | 28 |
| Benishangul-Gumuz | 21 | 7 | 27 |
| SNNPR | 24 | 83 | 28 |
| Gambella | 14 | 35 | 22 |
| Harari | 17 | 2 | 22 |
| Addis Ababa | 0 | 71 | 71 |
| Dire Dawa | 50 | 95 | 82 |
| Total | 24 | 72 | 31 |

Source: Ministry of Water Resources, 2002

Like potable water supply, sanitary service in Ethiopia is exceptionally low. Various information sources indicate that sanitary service coverage in Ethiopia does not exceed 10 percent.

Reports of the Central Statistical Authority show that people that have access to modern sanitation facilities in Ethiopia are not more than 18 percent, and that 82 percent of the population defecate in the fields, forests and other places making the environment conducive for the occurrence of diseases. The details are presented in Figure 12.

Figure 12: Types of Sanitation Facilities and Percentage of Users in Rural and Urban Areas (2000)



Source: Drawn from data taken from Central Statistical Authority, 2001

4.2.2.6 Initiatives to Control Problems Related to Environmental Sanitation

The health problems that are prevalent in Ethiopia are closely associated with poor environmental sanitation services and low level of nutritional standards. Therefore, action taken in the health sector should be compatible with and take into account the causes of these diseases.

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To improve the standard of health services in the country attempts are being made by the government, non-governmental organizations and the communities in general. The efforts related to environmental health are the following:

- ❖ Promulgation of a preventive health policy and its Implementation;
- ❖ Relative progress in initiatives designed to strengthen capacity building in the health sector (training of manpower and establishment of training and health services institutions, etc.);
- ❖ Putting in place attractive investment incentives to fully exploit the entrepreneurial capacity of the private sector in health service development activities. The progress registered in this field is encouraging;
- ❖ Issuance of policies, strategies and proclamations related to the health sector (pollution control proclamation, environmental impact assessment proclamation, water policy, water resources environment and protection proclamation, labour law, etc);
- ❖ The development and the efforts at implementing the health sector policies, health sector development strategy and programmes, water supply and sanitation programmes, and water resources development programmes;
- ❖ The issuing of a national policy to combat the spread of HIV/AIDS and the establishment of federal and regional offices for its implementation. At the moment, various activities are going on in almost all parts of the country;
- ❖ The establishment of a National Radiation Protection Authority and ongoing activities in this area; and
- ❖ Measures taken to enhance the participation of non-governmental organizations and civil society in the health sector.

Although all these initiatives are widely believed to have a significant impact in ameliorating the problems in the health sector, taking the country's very poor environmental sanitation standards and the magnitude of health problems associated with food deficiency and HIV/AIDS, much work still remains to be carried out. Much more effort is also required to implement the policy elements of these initiatives in full in order to bring about concrete changes.

4.2.3 Education

Education plays a critical role in the social and material progress of a country, including in the development and appropriate use of environmental resources.

There is inadequate appreciation of environmental problems, especially for some of the complex environmental issues on the part of the general public, and often among decision makers. Therefore, strengthening environmental education and raising the awareness of the society is one of the strategies required for the effective realization of environmental objectives and goals.

A study conducted in the year 2000 indicates that the number of literate people above 10 years of age is only 29.2 percent of the total population, out of which 27.7 percent are rural and 69.9 percent urban. It must be pointed out, however, that even the mostly illiterate rural people are aware of the main problems related to land degradation, which is Ethiopia's biggest environmental problem.

4.2.3.1 Educational Institutions and Number of Students.

In terms of the number and distribution of schools, Ethiopia is still trailing behind many other developing countries. To reverse this intolerable situation, enormous efforts are currently being made. As a result, in the five year period stretching from 1997 to 2001, the number of elementary and secondary schools increased from 10,033 to 11,600. The increase in the number of high schools rose from 368 in 1997 to 424 in 2001, an increase

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of 15 percent (Ministry of Finance and Economic Development, 2002). Kindergartens have registered a growth rate of 28 percent from 751 in 1979 to 964 in 2001.

Along with the increase in the number and distribution of schools, the student population is also growing fast every year. This growth for the period 1997–2000 can be seen in Table 47. From this table it can be noted that, in the period between 1997 and 2000, the number of students overall increased by 43.6 percent, with the growth in the number of elementary school students being 44.6 percent, and those in higher education being 76.7 percent.

Table 47: Number of Students at Various Levels, 1997–2000

| School Levels | 1996/97 | 1997/98 | 1998/99 | 1999/00 | Growth 1997-2000 (%) |
|--|------------------|------------------|------------------|------------------|----------------------------|
| Pre-Formal Schools | 80,835 | 86,104 | 90,321 | 99,710 | 23.3 |
| Elementary Schools (1-8) | 4,468,294 | 5,090,670 | 5,702,223 | 6,462,503 | 44.6 |
| Comprehensive Secondary High Schools | 426,495 | 467,669 | 521,728 | 571,719 | 34.0 |
| Colleges & Universities | 21,051 | 23,603 | 27,345 | 37,195 | 76.7 |
| Teacher Training Institutions | – | 4,156 | 5,443 | 4,813 | |
| Total | 4,996,675 | 5,672,202 | 6,347,060 | 7,175,940 | 43.6 |

Source: Ministry of Education, 2001, response to questionnaire

4.2.3.2 Educational Coverage

In 2001, 57.4 percent of the children of school age enrolled in the elementary schools (grade 1–8) and 12.9 percent in the high schools (Grade 9–12). Of this, the share of female students was 47 percent in the elementary schools and 10.9 percent in the high schools. The growth in the elementary education was up by 23 percent from the 34.7 percent in 1997. High school educational coverage increased from 8.4 percent in 1997 to 12.9 percent in 2001.

4.2.3.3 Environmental Education

One of the causes for the deep-rooted environmental problems in the country has been the lack of environmental awareness especially at the level of decision makers. This lack of awareness is at the very heart of the inappropriate management and utilization of environmental resources. The recurrent and disastrous droughts that have affected the country are considered to have compelled various members of the society and the government to give attention to environmental issues. There is evidence indicating that, during the reign of Emperor Menelik II, afforestation and wildlife protection was highly encouraged. During the catastrophic drought and famine of the early 1970s, massive afforestation programmes were launched throughout the country.

In addition to the awareness created following these early initiatives, activities related to the strengthening of environmental education and awareness creation have also been taken. The Ministries of Education and Agriculture have jointly been conducting an environmental education programme. Some 68,593 students, teachers and farmers had the opportunity to participate in this programme. This training was also instrumental in the establishment of hundreds of school environmental clubs.

After 1995, however, in cognisance of the need to include environmental issues in the formal school curricula, the Ministry of Education incorporated such issues at the

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elementary school level. On top of this, attempts are being made to commence postgraduate programmes in the fields of environmental science and dry land biodiversity conservation at the Addis Ababa University. This is in addition to efforts being made to expand and strengthen the soil and water protection, forestry, sanitary engineering and other natural and social science educational streams. However, there is no conclusive evidence to date as to whether environmental education has been included in the curricula of other educational streams.

Apart from the activities in the formal education sector, some work is also being done in the informal education sector. The existence of regular environmental awareness raising programmes in the mass media, the frequency of training workshops and seminars on environmental issues and the activities of the environment clubs throughout the country are some of the endeavours with significant contribution in enhancing environmental awareness. NGOs are also engaged in various capacities in the area of environmental awareness creation.

Even though the activities undertaken so far are positive, the work done to date in the area is inadequate compared to the level of environmental degradation, the grinding poverty, droughts and other similar problems pervading in the country.

4.3 TRANSPORT AND COMMUNICATION

4.3.1 The Road System

According to an Ethiopian Road Authority report, in 1996 the total length of all-weather roads in the country was 23,442 km, and in the year 2000 the length extended to 28,652 km. The types and the length of roads constructed in these five-year periods are shown in Table 48. Out of the total length of all-weather roads in the country, asphalt covers 13.3 percent while the remaining consists of gravel and earth rural roads.

Table 48: Type of Roads and Their Lengths

| No. | Type of Road | Length in km | | | | |
|-----|-----------------|--------------|--------|--------|--------|--------|
| | | 1996 | 1997 | 1998 | 1999 | 2000 |
| 1. | Asphalt | 3,630 | 3,656 | 3,656 | 3,656 | 3,812 |
| 2. | Gravel | 12,000 | 12,133 | 12,133 | 12,240 | 12,240 |
| 3. | Motorable track | 7,812 | 8,043 | 8,043 | 10,157 | 12,600 |
| 4. | Total | 23,832 | 23,832 | 23,832 | 26,053 | 28,652 |

Source: Ethiopian Road Transport Authority, 2002

According to data presented at the Ethiopian Poverty Reduction Consultative Conference of 2002, road density in Ethiopia had increased to 0.45 km/1000 people and 28 km/1000 km² while overall road quality had improved by 30 percent, when compared to the 1998 road density, which was 0.43 km/1000 people and 21 km/1000 km² as well as a road quality of only 18 percent. Road construction has shown a relatively marked progress. This shows the special emphasis given to road construction in the country.

4.3.2 State of the Transportation System

In most parts of the country, pack animal and human portage are the dominant forms of transport. Compared to urban areas, use of modern transport in rural areas is very low. Even in the urban areas motor vehicle ownership is small. However, transportation infrastructure to link urban and rural populations to markets and other amenities is crucial for development.

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The modern transport system in Ethiopia consists of a 23,312 km road network, a 781 km railway which links Addis Ababa to the Port of Djibouti as well as two international and sixty (60) local (domestic) airports. In addition, Ethiopia has eleven (11) freight and passenger ships sailing to Western Europe as well as to the Middle and Far East countries.

The transport and communication sector accounts to 6.3 percent of the country's GDP. Although the contribution of transport to the country's GDP is low, it provides significant support to other sectors. Currently, modern road transport users do not exceed 30 percent of the total population of the country.

4.3.2.1 Land Transport

According to the Ethiopian Road Authority, in 1997, there were 102,880 registered motor vehicles operating in the country. Out of these, automobiles accounted for 50.6 percent, light goods trucks 13.5 percent and heavy goods trucks 34.4 percent, see Table 49.

Table 49: Registered Vehicles Operating in the Country (1993-97)

| Type of vehicle | 1993 | 1994 | 1995 | 1996 | 1997 |
|------------------------------|--------|--------|--------|--------|---------|
| Automobile/car | 35,771 | 41,991 | 41,814 | 44,428 | 52,131 |
| Light goods truck | 12,878 | 10,154 | 14,331 | 15,157 | 13,921 |
| Heavy goods truck | 19,605 | 24,633 | 33,060 | 35,448 | 35,396 |
| Motorcycle | 963 | 977 | 1,709 | 1,151 | 1,172 |
| Non-motorized vehicle/others | 502 | 524 | 547 | 318 | 260 |
| Total | 69,719 | 83,279 | 91,457 | 96,502 | 102,880 |

Source: Road Transport Authority, 2001, response to questionnaire.

4.3.2.2 Air Transport

The Ethiopian Civil Aviation Authority manages the country's domestic and international airports. The two airports serving international flights are in Addis Ababa and Dire Dawa. There are 12 major airports that serve domestic flights. They are located in Arba Minch, Asosa, Axum, Bahir Dar, Gambella, Gode, Gondar, Jijiga, Jima, Lalibella, Mekele and Robe-Goba. There are also 48 smaller airports in different parts of the country capable of landing light aircraft. The number of Ethiopian Airlines domestic and international flight routes is shown in Tables 50 and 51.

Table 50: Number of Airports Served by Domestic and International Flight Routes

| Year | Airports | Domestic flight routes | International flight routes |
|------|----------|------------------------|-----------------------------|
| 1996 | 34 | 29 | 45 |
| 1997 | 32 | 28 | 42 |
| 1998 | 33 | 28 | 44 |
| 1999 | 32 | 32 | 39 |
| 2000 | 29 | 27 | 48 |

Source: Ethiopian Civil Aviation Authority, 2001

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Table 51: Domestic and International Services Rendered in Addis Ababa and Dire Dawa Airports

| Type and place of operation | 1997/98 | 1998/99 | 1999/00 | 2000/01 | 2001/02 |
|-----------------------------|---------|---------|---------|---------|---------|
| Addis Ababa | | | | | |
| Number of passengers | | | | | |
| Domestic | 299,169 | 231,673 | 262,536 | 222,696 | 244,723 |
| International | 671,534 | 607,967 | 669,553 | 805,210 | 920,815 |
| Freight in tonnes | | | | | |
| domestic | 762 | 626 | 975 | 304 | 292 |
| International | 35,904 | 29,635 | 29,667 | 26,113 | 25,066 |
| Dire Dawa | | | | | |
| Number of passengers | | | | | |
| Domestic | 85,288 | 73,705 | 71,733 | 58,753 | 59,909 |
| International | 9,049 | 6,494 | 8,093 | 7,103 | 8,872 |
| Freight in tones | | | | | |
| domestic | 469 | 386 | 333 | 292 | 46 |
| International | 3,810 | 3,620 | 5,344 | 5,639 | 6,157 |

Source: Ministry of Infrastructure, 2003.

4.3.3 Communications

In recognition of the immense contribution of communications to the country's development, considerable attention has been given to the improvement and development of the sector. This sector consists of telecommunications, postal services and the mass media, i.e. radio, television, press, etc.

According to Central Statistical Authority reports, there were 283,683 telephone subscribers in the country in mid-2001. There was a growth of 45.8 percent compared to the 194,493 telephone subscribers in 1999. The extent of the telecommunications services in 1998-2002 and the postal services in 2002 are given in Tables 52 and 53 respectively.

In 2002, there were 131 newspapers in the country. They were published by both the state and the private sector. Out of these, 76 concentrated on political, economic and social issues, 21 on religious issues and the rest on entertainment and advertisement. There were also 37 magazines.

Table 52: Number of Telephone and Internet Subscribers and Mobile Phones, 1997/98 to 2001/02

| Description | 1997/98 | 1998/99 | 1999/00 | 2000/01 | 2001/02 |
|-------------------------------------|---------|---------|---------|---------|---------|
| 1. Subscribers | | | | | |
| 1.1. Telephone Subscribers | 164,140 | 194,494 | 231,945 | 283,683 | 353,816 |
| 1.2 PBxs | 1,544 | 1,615 | 1,241 | 1,419 | 1,426 |
| 1.3. Telex Subscribers | 487 | 373 | 336 | 318 | 300 |
| 1.4. Coin Box | 1,014 | 1,016 | 957 | 935 | 1,610 |
| 2. Internet and mobile phone | | | | | |
| 2.1. internet subscriber | | 2,163 | 2,461 | 4,073 | 6,740 |
| 2.2. mobile phone disseminated | | 6,740 | 17,727 | 27,532 | 42,910 |

Source: Ministry of Infrastructure, 2003.

Table 53: Numbers of Post Boxes, Post Offices and Sub-Post Offices Distribution by Region in 2002

| Region | Post box | Post office | Sub post office |
|-------------------|----------|-------------|-----------------|
| Tigray | 4773 | 9 | 36 |
| Afar | 250 | 2 | 4 |
| Amhara | 8411 | 19 | 109 |
| Oromia | 17953 | 48 | 189 |
| Somali | 797 | 4 | 8 |
| Benishangul-Gumuz | 450 | 1 | 3 |
| SNNPR | 6395 | 15 | 60 |
| Gambela | 350 | 1 | 4 |
| Harari | 1250 | 1 | 1 |
| Addis Ababa | 72013 | 24 | 9 |
| Dire Dawa | 2900 | 1 | 1 |

Source: Ministry of Infrastructure, 2003

4.3.4 The Impact of Transport on the Environment

Although no research has been undertaken to ascertain the impact of the transportation sector on the environment, it is widely assumed that emissions from motor vehicles are contributing to adverse impacts on health. Environmental pollution has increased over time as motor vehicle ownership expands in Addis Ababa and the other major urban centres of the country. The situation is exacerbated by the use of old and poorly maintained vehicles that use leaded fuel.

As indicated in Annex 11, about 50 percent of the motor vehicles in the country have over 20 years of service. Old vehicles emit hydrocarbons and smoke to the atmosphere at up to five times the rate of emissions from new vehicles. This happens because the engines of old vehicles cannot burn fuel efficiently. Motor vehicles emit carbon monoxide, carbon dioxide, nitrogen-oxide, volatile organic compounds, methane and sulphur-dioxide (Table 54).

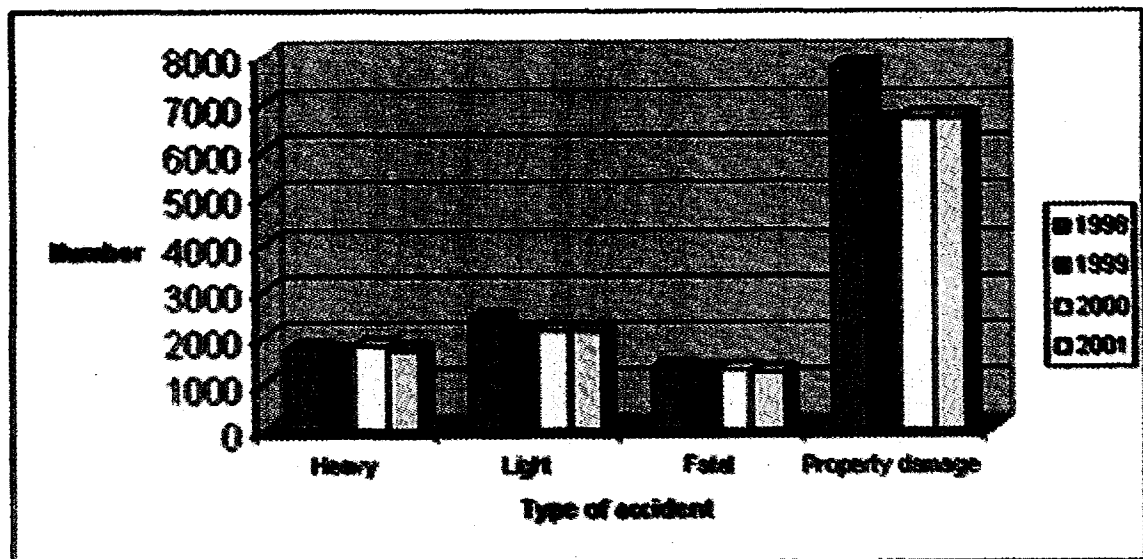
Traffic safety is one of the environment-related issues that calls for special attention. In Ethiopia, many lives are lost and much property damaged annually due to traffic accidents. For example, in 2001 a total of 11,776 traffic accidents occurred in the country. These resulted in 1,697 heavy injuries, 2,134 light injuries and 1,261 fatalities. The number of items of property damaged during the same was 6,684, see Figure 13.

Table 54: Pollutants Emanating from Transport in Ethiopia in 1994

| No | Pollutant | Amount in Giga grammes |
|----|------------------------------------|------------------------|
| 1. | Carbon-dioxide (CO ₂) | 1001 |
| 2. | Methane (CH ₄) | 0.1 |
| 3. | Nitrogen-oxide (N ₂ O) | 0.0 |
| 4. | Nitrogen compounds | 10.1 |
| 5. | Carbon-monoxide (CO) | 49.5 |
| 6. | Volatile Organic Compounds (VOC) | 4.9 |
| 7. | Sulphur dioxide (S ₂ O) | 4.3 |

Source: National Meteorological Service Agency, 2001

Figure 13: The State of Traffic Safety in Ethiopia (1998-2001)



Source: Drawn from data taken from Central Statistical Authority, 2002

Another problem to be mentioned is the adverse environmental impact induced by road construction. Because environmental impact assessment has not been being carried out before projects were implemented, road construction has been adversely contributing to the depletion of biological diversity, land degradation, as well as disruption in the behavioural pattern of surface water. Lack of regular inspection during road construction, and lack of regular maintenance of roads has affected drainage canals and other infrastructures.

4.3.5 Measures Undertaken to Mitigate the Negative Impacts of Transport Infrastructure on the Environment

Following are the main efforts being made to mitigate the negative impacts of the transport infrastructure on the environment:

- ❖ The Ethiopian Road Authority has issued guidelines (a manual) to assess and monitor the impact of road construction on the environment and a department responsible for following up the effective implementation of the guidelines has been established.
- ❖ Environment related policies and strategies have been formulated and proclamations on Environmental Impact Assessment and Pollution Control have been enacted for implementing such policies and strategies.
- ❖ The transport and communication bureaux are carrying out annual motor vehicle inspections.
- ❖ A Rural Transport Sub-Programme has been formulated.
- ❖ A Road Sector Development program has been formulated.

4.4 TOURISM ACTIVITIES

4.4.1 Tourist Attractions

Ethiopia has natural, cultural and historical attractions that have the potential for attracting tourists, for details, see Annex 12. Although these are the tourist attractions that are registered by the Ethiopian Tourism Commission, it is probable that there are other

tourist sites that are not yet registered. The known attractions can be categorized as follows:

- A. Fully developed and utilized as tourist attractions
- B. Partially developed tourist attractions; and
- C. Attractions that have the potential for future development as tourist centres.

Out of the natural, human-made and cultural resources listed in Annex 12, those declared (designated) as world heritage sites by UNESCO are: The Semien Mountains National Park, The Historical and Archaeological Sites of Axum, the Rock-Hewn Churches of Lalibela, the Medieval Castles of Gondar, the Tiya Monolithic Stone Stelae, the Lower Awash Valley Palaeontology and Pre-historic Sites, and the Omo Valley Palaeontology and Pre-historic Sites.

The tourism industry is developing and expanding in many countries of the world. Given the country's potential, tourism can contribute a lot to the economic development of Ethiopia.

Out of the total revenue generated from tourism activities in Africa, Ethiopia earns less than 0.5 percent. For example, in 1995, Kenya earned USD 411 million from tourism, while Ethiopia's earnings in the same year were not more than USD 36 million. This shows that, compared to other African countries with tourist attractions, the Ethiopian tourism industry is yet in its infancy.

4.4.2 Tourism Activities

As indicated above, compared to other countries, tourism activity in Ethiopia, and the revenue generated from the tourism industry is very low. According to the Ethiopian Tourism Commission, the number of foreign tourists that visited Ethiopia annually from 1987 to 1999 was, on the average, 90,024. The number of tourists from 1987 to 1997 increased by 56.8 percent. However, the number of foreign tourists that came to the country in 1998 and 1999 decreased when compared to that of 1997 (Table 55).

So far Ethiopia has not benefited as much as it could from the tourism industry. There are a number of problems that have hindered the development of tourism, among which the major ones are the following:

- ❖ Lack of a national tourism policy and strategy;
- ❖ Limited participation of the private sector in tourism development;
- ❖ Poor state of infrastructure;
- ❖ Limited participation of local communities in the development of tourism industry;
- ❖ Lack of a legally mandated body as regards the demarcation and conservation of tourist attractions;
- ❖ Recurrent manmade and natural disasters;
- ❖ Lack of coordination among stakeholders in the tourism sector; and
- ❖ The fact that tour-operators, hotels, restaurants, souvenirs and handicrafts shops, and the Ethiopian Airlines benefit most from the revenue generated from tourism because mechanisms are not in place to enable local communities to share benefits from this sector.

Table 55: Tourism Activities in Ethiopia and Revenue Generated in Foreign Currency

| Year | Number of Foreign Tourists | Revenue in US\$ |
|------|----------------------------|-----------------|
| 1987 | 73,144 | 29,500 |
| 1988 | 76,450 | 39,271 |
| 1989 | 76,844 | 42,901 |
| 1990 | 79,346 | 52,282 |
| 1991 | 81,581 | 38,824 |
| 1992 | 83,213 | 57,763 |
| 1993 | 93,072 | 107,822 |
| 1994 | 98,070 | 144,315 |
| 1995 | 103,336 | 144,972 |
| 1996 | 108,885 | 182,665 |
| 1997 | 90,847 | 230,158 |
| 1998 | 114,732 | 129,057 |
| 1999 | 91,859 | 130,000 |

Source: Ethiopian Tourism Commission, 2001, response to questionnaire

4.4.3 Tourism and the Environment

Available information indicates that tourism is a big and internationally growing industry. Many countries around the world have already become beneficiaries of tourism industry. In relative terms, many African countries are also benefiting from this sector. Although in Ethiopia the role of tourism as an economic sector has been negligible in the past, its contribution to the economic development of the country is now well recognized.

Like any other economic sector, tourism has also adverse environmental impacts. These problems emanate from the personal behaviour of individual tourists, the level of care for tourist facilities as well as the manner in which the tourism industry is managed overall. However, since tourism in Ethiopia is yet in its infancy, no serious environmental problem has been observed so far. However, in some of the tourist centres problems of solid waste management, population increase and other social problems have been observed. Taking its imminent ecological, social and economic impacts into consideration, there is a need to design a strategy for the sustainable development of tourism in the country.

Eco-tourism is a relatively new venture in Ethiopia. Because of lack of awareness about its concept, the idea of eco-tourism is not yet well understood by either the government or the public at large. However, the integration of eco-tourism development in the second-five year development plan of the country indicates that an enabling investment climate has been created to attract investors. At present, there are two investors who are engaged in the development of eco-tourism sites in two regions of the county. The first is in Oromia Region in a place called Bishangari, and the second is in the Afar Region in a place called Bilen.

The development of eco-tourism can have a wide range of social and economic benefits to the country including contributing to the sustainable economic development of Ethiopia. It must be noted, however, that if not well managed, eco-tourism also can cause environmental damage.

4.4.4 The Impact of Tourism on Tourist Attraction Sites

Ethiopia has enormous natural, cultural and man-made tourist attractions. However, some of these resources are being diminished because of various reasons. Some of these are:

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- ❖ Various tourist attraction sites have been damaged because of lack of conservation and preservation. The rock-hewn churches of Lalibela and the medieval castles of Gondar can be cited as good examples.
- ❖ Human settlement, expansion of agriculture and livestock grazing has contributed to the depletion and elimination of flora and fauna within some of the natural tourist resources areas. For example, in the Netch Sar National Park, over 6,000 people and over 35,000 domestic animals have severely disturbed the habitat of the zebras, hartebeest and other animals.
- ❖ Illegal trade and looting of moveable objects/items of historical and cultural significance.

4.4.5 Measures Taken to Mitigate the Impact of Tourism on the Environment

Following are some of the measures being taken to mitigate the adverse effects of tourism on the environment.

- ❖ A Heritage Conservation Research Institute has been established and it has become fully operational;
- ❖ Proclamations for Environmental Impact Assessment and Pollution Control have been enacted;
- ❖ The government has taken positive measures to encourage the involvement of private investors in the development of eco-tourism; and
- ❖ Projects designed to rehabilitate and strengthen the national parks are being implemented, and management plans have been prepared to better manage and administer the parks.

4.5 GENDER AND ENVIRONMENT

In the conservation, development and utilization of environmental resources, women and men have their own specific roles. Their roles are determined mostly by the cultural, social and economic conditions in their communities. Women play an important role in the conservation and management of environmental resources. Rural women have total responsibility for water and fuel wood collection. The availability or non-availability of these resources within a reasonable walking distance is of particular interest to them. Therefore, the depletion or total degradation of natural resources has adverse effects on women's status. Ecological disturbance, degradation of rangelands, soil erosion and diminution or drying-up of utilizable water supplies and other related environmental damage expose women, particularly the rural poor women, to excessive hard work and destitution. This situation has been observed in different parts of the country at different periods of time. Poverty among men and women is manifested in different ways. Women have had limited access to land, credit and most of the essential resources for production.

Compared to the status of men, women have relatively poor access to education. They are overworked, and often in poor health. Women's literacy in 1996 and in 2000 was 25.8 percent and 29.2 percent respectively. In 2000, out of the literate people in the country only 19.4 percent were female while 39.2 percent were male.

The Government and the people of Ethiopia have taken positive initiatives to achieve equal participation of men and women in the economic, social and political activities of the country.

The major measures taken to achieve this are the following:

- ❖ The particular attention given to women's issues in the country's Poverty Reduction Strategy;

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- ❖ Adoption of the Policy on Ethiopian Women to promote the equal participation of women and men in all aspects of economic, social and political activities;
- ❖ The establishment of Women's Affairs Offices at the Prime Minister's Office and at the departmental level within federal government agencies and at regional bureau level in all regions of the country, to ensure effective implementation of the Policy and to give emphasis to women's issues;
- ❖ The establishment and expansion of professional associations and non-government organizations in order to create an enabling environment and provide women the legal support required for ensuring their rights of access to, control of and decision making over economic and environmental resources; and
- ❖ The reviewing of existing laws that hinder women from improving their status.

Besides helping in their emancipation, these measures are expected to facilitate the participation of women in the protection, conservation and development of environmental resources.

4.6 MAN-MADE AND NATURAL DISASTERS

4.6.1 The Nature of Man-made and Natural Disasters in Ethiopia

Drought and famine have a long history in Ethiopia as in all other agrarian societies and thousands of people and animals have died as a result of their recurrence.

With global warming the drought cycle is shortened, and the victims are caught by surprise before they even get time to recover from past droughts and rebuild their assets to be able to lead a normal life. The pastoralists living in the semi-arid lowlands are particularly the most vulnerable to the threat of droughts. In these areas, droughts are the primary causes for natural resources degradation and the aggravation of poverty. Data from the Disaster Prevention and Preparedness Commission reveal that drought has occurred in 43 areas between 1996 and 2000 alone (Table 56).

For instance, due to the drought that hit the country from 1972 until 1974, the pastoralists in the Afar region lost about 72 percent of their livestock by drought and drought induced slaughtering and sale. As some studies indicate, the Borena areas lost 60 percent of their livestock by the drought of 1976 and both the Somali and Borena areas lost 78 percent of their livestock by the drought of 1988 (as quoted by PANOS, 2002). Similar sources point out that the per capita of 4.1 TLU (Tropical Livestock Unit) for Borena area livestock production in 1998 went down to 2.25 in 1999. It takes many years for pastoral people to recover from losses caused by drought. The stock recovery period for goats, sheep, cattle and camels is, respectively, 6, 10, 24 and 28 years. As a result of the impact of the recurring drought the dependence of the pastoralists on relief aid is increasing. As a result of the droughts that have occurred during the same period in the northern parts of the country, livestock have died or have been forced to migrate causing inestimable damage to social and economic activities.

The discharge of Ethiopian rivers varies seasonally. During heavy rainfall in the highlands of Ethiopia, the Awash, Wabi Shebelle, Omo and Baro rivers ravage the areas around their banks with floods. This particularly occurs in flat areas found in the lower river valleys where the pastoralists and semi-pastoralists live. These people suffer loss of life and property. The flooding affects communities by blocking access to health and educational establishments, inundating close-by farmlands, and aggravating the prevalence of water-borne and other diseases.

Photo 12: People struggling through floods from the Awash River, Middle Awash, Amibara



(Photo, Disaster Prevention and Preparedness Commission)

As far as man-made causes are concerned, 23 incidents have occurred in just 5 years, i.e. between 1996 and 2000, see Table 56. Man-made causes in 2000 are far higher than the other years because the data takes into account displacements of people that resulted from Ethio-Eritrean border conflict.

Table 56: Recurrences of Droughts and other Disasters

| Type of Disaster | 1996 | 1997 | 1998 | 1999 | 2000 |
|------------------|------|------|------|------|------|
| Drought | 11 | 9 | 10 | 8 | 5 |
| Man-made causes | 3 | 5 | 3 | 1 | 11 |

Source: Federal Disaster Prevention and Preparedness Commission, 2001, response to questionnaire

Although massive migrations occur as a result of natural disasters, there are no data available to make accurate statements regarding the exact numbers of displaced people.

Almost all the regions in the country have undergone periods of drought and other man-made disasters. However, as a result of differences in land area, size of population and climatic variability, there seem to be differences in the frequency of droughts. Between the year 1996 and 2000, the regions most affected by recurrent natural disasters, were Tigray, Amhara and Oromia. Although the recurrence was not frequent, the other regions also experienced drought during the same period (Table 57).

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Table 57: Regional Distribution of Drought and Man-Made Disasters

| Type of Disaster | Frequency of Occurrence | | | | | | | | | | |
|------------------|-------------------------|------|------|------|------|-------|------|------|-----|-----|-----|
| | Tig. | Amh. | Oro. | SNNP | Afar | Beni. | Som. | Gamb | Har | D.D | A.A |
| Drought | 5 | 5 | 5 | 3 | 3 | 2 | 5 | 4 | 4 | 3 | 4 |
| Man-made | 3 | 5 | 4 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 1 |

Source: Federal Disaster Prevention and Preparedness Commission, 2001, response to questionnaire

The number of victims of drought and man-made disasters is high, and the number of people on relief aid is substantial. During the five years (1996-2000), 5.95 million people were exposed to natural and man-made disasters, see details in Tables 58 and 59.

Table 58: Number of Victims in '000 affected by Various Disasters in the Country

| Type of disasters | 1996 | 1997 | 1998 | 1999 | 2000 | | | |
|--------------------|------------|------------|------------|---------------|------------|---------------|------------|---------------|
| | Given free | Given free | Given free | Food for work | Given free | Food for work | Given free | Food for work |
| Drought & man-made | 4000 | 2,784 | 1,519 | 1,881 | 1,707 | 2,333 | 3,934 | 3,259 |

Source: Federal Disaster Prevention and Preparedness Commission, 2001, response to questionnaire

Table 59: Food Aid in '000 tonnes (1996-2000)

| Type of disasters | 1996 | 1997 | 1998 | 1999 | 2000 | | | |
|--------------------|------------|------------|------------|---------------|------------|---------------|------------|---------------|
| | Given free | Given free | Given free | Food for work | Given free | Food for work | Given free | Food for work |
| Drought & man-made | 347 | 265 | 152 | 201 | 120 | 187 | 219 | 227 |

Source: Federal Disaster Prevention and Preparedness Commission, 2001, response to questionnaire

There are many factors that contributed to the occurrence of the disasters as well as to their severity. The major ones are the following:

- ❖ Rapid population growth – the majority of the people living in the highlands of the country inflicting heavy damage on the agricultural resource-base;
- ❖ Accelerated depletion of forest resources due to additional needs for farmland, fuel wood and construction, as well as the occurrence of wild forest fires;
- ❖ Disruption in the amount and distribution of rainfall as a result of global climate change;
- ❖ The spread of drought induced animal diseases;
- ❖ Low production and productivity in the rain-fed agricultural sector;
- ❖ The sole dependence of the majority of the population on agriculture as a means of survival without any alternative source of income or employment; and
- ❖ The consequent grinding poverty endured by the population.

4.6.2 Initiatives to Combat Natural and Man-made Disasters

The following initiatives have been taken to combat natural and man-made disasters.

Conservation Measures Taken to Control Natural and Man-made Disasters: Through food-for-work programmes using relief grain and edible oil aid, extensive work has been carried out in a number of regions in the area of soil and water conservation. The aim has been to liberate the society from total reliance on aid. As stipulated in the National Policy for Disaster Prevention and Management, efforts are currently being made to combat food aid dependency in the society and minimize disaster vulnerability by undertaking development projects and environmental conservation activities. Most of the food aid destined for the regions is used for this purpose. In this regard encouraging work is being done in Tigray, Amhara and Oromia regions.

Disaster Preparedness and Early Warning: The Disaster Prevention and Preparedness Commission (DPPC), in cooperation with other governmental organizations and NGOs, regularly conducts crop assessments necessary for forecasting and preparing for disasters. Based on information collected from the woredas, the Commission carries out studies pertaining to the condition of food crops and livestock as well as market trends and prices, provides periodic information about the occurrence, the scale and the impact of disasters and appeals for aid. Based on meteorological data, the Commission gives warning to the farmers over the mass media before disasters occur so that they can take precautionary measures to safeguard their crops and animals. In addition, a research project designed to identify the root causes of disaster vulnerability is going on.

Much work has been done after the issuance of the National Policy for Disaster Prevention and Management. The major ones are:

- ❖ Capacity has been developed to forecast and respond to disasters before problems get out of hand in order to save the lives of a lot of people;
- ❖ Attention has been given to development activities designed to minimize disaster vulnerability throughout the country;
- ❖ A Desertification Action Plan has been prepared to combat the problem; and
- ❖ The public has been actively participating in combating disasters.

4.6.3 Refugees and the Environment

4.6.3.1 Number of Refugees

Ethiopia has for long been receiving and hosting large numbers of refugees from other countries. In the late 1980s, there were 600,000 refugees and about 1 million returnees (i.e. Ethiopians who had been refugees in other countries and who had just returned) residing in the Somali National Regional State alone. Currently, large numbers of refugees from the Sudan, Djibouti and Kenya are residing in different parts of the country (Table 60). As shown in the table, from 1996 to 2000, the number of refugees in refugee camps decreased from 385,328 to 198,534. This is because most of them have been repatriated to their home countries.

SECTION FOUR: HUMAN ENVIRONMENT

Table 60: Refugee Camps in Ethiopia and Number of Refugees, 1996–2000

| Camp | Region | 1996 | 1997 | 1998 | 1999 | 2000 |
|-------------|----------------|---------|---------|---------|---------|---------|
| Bonga | Gambella | 16,101 | 16,933 | 11,946 | 12,570 | 14,390 |
| Dima | " | 10,300 | 12,034 | 7,691 | 7,905 | 12,290 |
| Pupido | " | 34,584 | 42,523 | 18,392 | 24,231 | 24,715 |
| Sherkole | Benishangul G. | – | 3,081 | 18,638 | 13,874 | 15,615 |
| Yarenja | " | – | – | – | – | 4,254 |
| Hartisheik | Somali | 58,710 | 51,317 | 31,432 | 17,480 | 11,488 |
| Terferi Ber | " | 46,379 | 45,667 | 30,435 | 29,101 | 12,819 |
| Darwonaji | " | 43,006 | 39,762 | 27,006 | 25,136 | 8,700 |
| Kebribeyah | " | 10,311 | 11,097 | 11,621 | 11,622 | 11,645 |
| Aisha | " | 15,282 | 15,282 | 15,290 | 13,944 | 13,944 |
| Daror | " | 49,391 | 34,150 | 33,985 | 33,950 | 28,150 |
| Kamabuker | " | 36,110 | 28,065 | 28,590 | 26,590 | 22,349 |
| Rabasso | " | 28,484 | 16,818 | 16,814 | 14,811 | 11,811 |
| Moyale | SNNPR | 8,670 | 8,670 | 8,670 | 4,700 | 4,855 |
| Afar | Afar | 28,000 | 1,800 | 3,000 | 1,503 | 1,500 |
| | Total | 385,328 | 327,199 | 263,510 | 237,417 | 198,534 |

– = No refugees

Source: United Nations High Commission for Refugees Branch Office in Addis Ababa, 2000

Under the tripartite agreement reached among the home countries of the refugees, the Ethiopian government and United Nations High Commissioner for Refugees (UNHCR) have repatriated 138,222 refugees to their home countries, mostly to Somalia, during the five-year period between 1996 and 2000.

4.6.3.2 The Impact of Refugees on the Environment

Due to man-made and natural disasters, repeated influxes of refugees have been taking place from neighbouring countries to different parts of Ethiopia.

The refugees settle in areas where the human and animal population is large. This large concentration of people by itself brings more stress on the already stressed environment, inducing further ecological imbalances. Some survey findings have indicated the major environmental impacts to be the following:

- ❖ The demand for fuel wood has induced the depletion of natural forests and woodlands at and around the refugee camps;
- ❖ The natural environment has been exposed to degradation as the ecosystem is burdened beyond its carrying capacity. (This has resulted in loss of biodiversity, particularly depletion of vegetation cover, elimination of wildlife, and water and soil degradation);
- ❖ The massive amounts of garbage around the refugee camps have contributed to serious problems in the area of human health and environmental sanitation;
- ❖ To generate money or to supplement their rations and other basic needs, a sizeable number of refugees are engaged in illegal charcoal making and selling. Charcoal has become an important cash commodity in many refugee camps;
- ❖ Local inhabitants who had never been in the business of charcoal making have now adopted this practice following the refugees. This in itself has induced more vegetation clearing;

- ❖ Trucks driving in haphazard directions on the plains of these regions have created a number of random transport routes that have contributed to soil erosion and the degradation of environmental resources;
- ❖ The spread of contraband activities has led to the import of environmentally damaging products into the country;
- ❖ The growth of prostitution and the spread of HIV/AIDS; and
- ❖ Hunting activities carried out by people in some refugee camps has been the cause of destruction of wild animals.

4.6.3.3 Efforts Made to Mitigate and Control the Impact of Refugees on the Environment

In most cases measures have never been taken to prevent environmental problems in refugee camps. However, in order to mitigate some of these refugee induced problems the following measures are now being taken by the UNHCR in collaboration with relevant Ethiopian government agencies.

- ❖ UNHCR has introduced reforestation programmes in different refugee camps in order to restore vegetation cover;
- ❖ Efforts have been made to give environmental education to refugees and local community members;
- ❖ Fuel-saving stoves have been produced and distributed to households in order to minimize individual fuel consumption and reduce the pressure on forests and woodlands;
- ❖ Soil and water conservation activities have been undertaken to prevent man-made soil erosion; and
- ❖ A number of water supply projects have been implemented to meet the demand created by the growing numbers of human and animal populations in refugee camps.

However, additional efforts are required to prevent further adverse environmental impacts and to reinstate the degraded environment to its natural state.

SECTION FIVE: ENVIRONMENTAL LAW, POLICIES, INSTITUTIONS AND ENVIRONMENTAL INFORMATION

5.1 ENVIRONMENTAL LAW, GUIDELINES AND STANDARDS

5.1.1 Environmental Law

In Ethiopia, the laws written since the 15th century have had provisions with environmental implications. For example, the Fetha Negest (The Law of Kings) prohibited the emission of smoke from a lower place to a higher place.

However, since such environment related provisions of law were dispersed and lacked comprehensiveness, they were not adequate enough to ensure the well being of the environment. Moreover, these laws were enacted only for the purpose of protecting neighbours and specific natural resources. As a result, sectoral organisations did not give much attention to environmental issues outside those natural resources for which they were specifically mandated.

One of the objectives of the Ethiopian Federal Democratic Republic's Constitution (Proclamation No. 1/1995) is to ensure the existence of a clean and healthy environment. It provides that all persons have the right to a clean and healthy environment. Based on the Constitution, three different proclamations have been drafted by the Environmental Protection Authority and enacted by the Council of Representatives.

These Proclamations are the following:

5.1.1.1 Proclamation for the Establishment of Environmental Protection Organs

The main objective of this Proclamation is assigning responsibilities to separate organizations for environmental development on the one hand, and environmental protection, regulation and monitoring on the other, avoiding possible conflicts of interests and duplication of efforts. The Proclamation was enacted as Proclamation No. 295/2002 on 29th of October 2002.

This new proclamation repeals the Environmental Protection Authority Establishment Proclamation No. 9/95. It provides for the Environmental Protection Authority to be accountable to the Prime Minister, establishes the Environmental Protection Council to oversee its activities, as well as sectoral agencies and environmental units to define institutional responsibility while ensuring coordination among sectoral ministries and agencies on environmental matters.

Pursuant to this proclamation each relevant government organisation shall establish under it environmental units with the responsibility to ensure that its activities are being carried out in a manner which is compatible with the environmental law and obligations emanating there from. In addition, the proclamation entrusts environmental organs to be established by the regions with mandates that enable them to coordinate environmental activities, avoid duplication of efforts and improve the dissemination of environmental information.

5.1.1.2 Environmental Pollution Control Proclamation

This Proclamation was enacted as Proclamation No. 300/2002 on 2nd of December 2002. It was enacted to help realize the effective implementation of the environmental objectives and goals incorporated in the Environmental Policy. In addition, the Proclamation was enacted because:

- ❖ Some of the social and economic development endeavours may be capable of causing environmental impacts that might be detrimental to the development process itself;

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- ❖ The protection of the environment in general and the safeguarding of human health and wellbeing, and the preserving of biota is the duty and responsibility of all; and
- ❖ It is essential to prevent or at least minimize to acceptable levels pollution resulting from economic development through appropriate measures.

The Proclamation consists of a number of articles on different issues such as pollution control, management of hazardous wastes, chemicals and radioactive substances, environmental standards, the rights and duties of environmental inspectors and penalties etc.

5.1.1.3 Environmental Impact Assessment Proclamation

The Proclamation was enacted as Proclamation No. 299/2002 on 2nd of December 2002. The main reasons for enacting this proclamation are the following:

- ❖ Environmental Impact Assessment serves to bring about thoughtful development by predicting and mitigating the adverse environmental impacts that a proposed development activity is likely to cause as a result of its design, location, construction, operation, modification and cessation.
- ❖ A careful assessment and consideration of the likely environmental impacts of public documents prior to their approval provides an effective means of harmonizing and integrating environmental, economic, social and cultural considerations and aspirations into the decision-making process in a manner that promotes sustainable development.
- ❖ Implementation of the environmental rights and objectives enshrined in the Constitution requires the prediction and management of likely adverse environmental impacts, ways in which the benefits might be maximized, and the balancing of socio-economic benefits with environmental costs.
- ❖ Environmental impact assessment serves to bring about administrative transparency and accountability, as well as involve the public and, in particular, communities in development planning decisions which may affect them and their environment.

Now that these laws have been enacted, the Environmental Protection Authority is preparing procedures, regulations, guidelines and standards to effectively implement and enforce them.

Environmental guidelines are among the tools for facilitating the inclusion of environmental issues and principles of sustainable development into development proposals. There were no such environmental guidelines in the past. However, following the establishment of the Environmental Protection Authority by virtue of Proclamation No. 9/95, sectoral Environmental Impact Assessment guidelines focusing on agriculture, transport, industry, tannery and settlements have been prepared.

In addition to these, a general guideline for facilitating EIA in all sectors has been prepared. The fundamental purpose of this guideline is to ensure that proponents, the government and all other interested and affected parties have the opportunity to participate meaningfully in the EIA process. Since the guideline explicitly states the responsibilities of each party, it helps to eliminate problems that may arise from lack of understanding of the process, from acting beyond ones mandates and responsibilities as well as from negligence.

The guidelines show that EIA, strategic environmental assessment, social impact assessment, and project environmental assessment are complementary with one another. They have specific criteria for the identification of matters that should and need not be subjected to EIA.

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In addition, EPA is preparing guidelines for the preparation of projects for the follow-up and supervision of environmental matters to be submitted to the Global Environmental Facility as well as for waste disposal, for environmental education and gender and social impact assessment.

National institutions including the former Ethiopian Valleys Development Study Authority (EVDSA) and the Water Resources Commission had been undertaking environmental impact assessments of projects to varying degrees of rigour. However, there was no law requiring environmental impact assessments on projects, programmes and policies likely to result in adverse environmental impacts. Therefore, until the law of 2002, voluntary EIA was being undertaken only to comply with Article 4 of the Investment Proclamation No. 37/1996. In addition, in line with the conditionalities and policy requirements of funding agencies, EIA has been undertaken on projects financed by loans and grants.

However, since there was no law to ensure that standardized procedures are applied and adequate quality is maintained, environmental impact studies did not conform to essential parameters and were not adequate as bases for monitoring and evaluation.

The Environmental Impact Assessment Proclamation of 2002 incorporates Project, Strategic and Social Impact Assessment. Therefore, the implementation of projects, programmes or policies likely to have environmental impact shall not be allowed unless they include impact mitigation and contingency plans.

The Environmental Impact Assessment Guidelines focus on the implementation of the following principles:

- ❖ The application of the EIA process at an early stage during the investment planning;
- ❖ The participation of all stakeholders in the process;
- ❖ The consideration of all feasible alternatives for the project, for example alternative sites or sources of raw materials or even disallowing implementation altogether; and
- ❖ The application of an operational system that ensures transparency and accountability.

The EIA process includes the following steps:

- ❖ Identification
- ❖ Defining the scope of the study
- ❖ Impact assessment
- ❖ Evaluation

The participation of stakeholders at all the critical stages of the EIA process is stated as a prerequisite.

The federal Environmental Protection Authority is mandated to review the EIAs of projects that may have an environmental impact of a transboundary nature, whether regional or international as well as of Federal Investment Authority licensed projects. Moreover the Environmental Protection Authority shall also be involved in the review of EIAs where it is requested to do so by the regions in situations where the scale or the level and complexity of the impact of a project requires such involvement. In all other cases regional bodies with environmental mandates shall review project environmental impact studies.

5.1.1.4 Strategic Environmental Assessment

Strategic environmental impact assessment has not been being fully undertaken in Ethiopia. However, the River Basin Master Plan Projects and assessments carried out by the Ministry of Economic Development and Cooperation had incorporated some strategic

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environmental assessments. The Environmental Impact Assessment Proclamation of 2002 now provides a framework for strategic environmental impact assessment.

The law requires that environmental impact assessment be carried out on any policies, programs and international agreements. It is expected that carrying out such assessments will help decision makers at all levels in their effort to bring about sustainable development.

5.1.1.5 Environmental Audit

Environmental Audit is one of the tools for facilitating environmental protection and conservation. As is the case with regard to the other tools, in the past there was no law to promote or enforce the application of environmental audit. However, the occupational safety inspections undertaken by the Ministry of Labour and Social Affairs as well as the environmental health inspections undertaken by the Ministry of Health provide useful experiences.

In addition to these experiences, a number of training and demonstration programmes have been conducted in collaboration with the National Cleaner Industrial Production Project. The Environmentally Sustainable Industrial Development Project has prepared a checklists and procedures for facilitating environmental audit. Training on environmental audit has also been provided to the professionals and experts of the Environmental Protection Authority as well as to staff of some of the regional environmental protection offices in order to build capacity.

Environmental auditing has commenced on state owned factories to prepare for their privatisation, thus providing additional experience.

Environmental audit has been given an emphasis in the recently enacted Environmental Impact Assessment Proclamation, Pollution Control Proclamation and in the Proclamation for the Establishment of Environmental Protection Organs. The Proclamations require investors to have their own internal audit systems, and organisations with environmental mandates to use environmental auditing as tool for enforcing government laws.

However, since, there is a shortage of qualified and skilled workforce and equipment and since the environmental quality standards are only under preparation, the full application of environmental audit will be a slow process to take off.

5.1.1.6 Environmental Standards

There are no formally adopted environmental quality standards for ensuring environmental wellbeing. However, the Ethiopian Environmental Policy underlines that environmental quality standards are indispensable instruments to ensure the wellbeing of human beings as well as other living things. In principle, it is considered essential that such standards be based on the concrete conditions in the country and have a national character.

The Environmental Protection Authority, in recognition of the seriousness of the problem, is taking appropriate measures intended to improve the situation and it has prepared provisional environmental quality standards which are now under discussion prior to adoption.

The provisional environmental quality standards require industries to monitor and inspect the wastes that they discharge to ensure that they are within the allowable levels.

5.1.1.7 Other Laws

In addition to the above-mentioned proclamations, other environment related proclamations and regulations prepared by sectoral agencies are being implemented. These are

- ❖ Forestry Proclamation No. 94/02

- ❖ Mining Operation Council of Ministers' Regulation No. 182/94;
- ❖ Labour Proclamation No, 45/95;
- ❖ Investment Proclamation No 37/96;
- ❖ Commercial Registration and Business License Proclamation No. 67/97;
- ❖ Water Resources Management and Administration Proclamation No. 197/2000;
- ❖ Environmental Health Proclamation No. 200/2000;
- ❖ Mining Proclamation No. 52/1993;
- ❖ Radiation Protection Authority Establishment Proclamation No. 79/1993; and
- ❖ Urban Zoning and Building Permit Proclamation No. 316/1987

5.2 ENVIRONMENTAL POLICIES AND STRATEGIES

The framework economic development strategy in Ethiopia is the Agricultural Development-Led Industrialization (ADLI) strategy. In line with this strategy, the government is taking various economic reform measures including price deregulation, market liberalization, withdrawal of subsidies, deregulation, tariff reduction, etc. At the same time, the government is focussing its efforts on rural development and taking measures to improve productivity in smallholder peasant agriculture. In this respect, extensive activities are being undertaken with regard to agricultural extension packages as well as rural credit services, primary education, health care, drinking water supply and road construction.

In addition, sectoral and cross-sectoral policies and strategies that incorporate, directly or indirectly, environmental concerns have been formulated and are being implemented. The following are the major ones:

Cross-sectoral Policies and Strategies: These include policies and strategies on rural development, capacity building, disaster preparedness and prevention management, environmental conservation, science and technology, population, women, biotechnology, poverty reduction, food security etc. Programmes to implement policies, e.g. poverty reduction, food security, rural development are in place.

Sectoral Policies and Strategies: These include, policies and strategies on energy, water resources development and management, fertilizers, bio-diversity conservation and research, agricultural research, health, education and training etc.

The Conservation Strategy of Ethiopia and the Environmental Policy of Ethiopia: The Conservation Strategy of Ethiopia consists of 10 cross-sectoral and 10 sectoral issues pointing out the strategies for the sustainable development of the country. The preparation of the document took more than seven years. It was prepared through Federal and regional level joint consultations. The preparation of this document has been a major factor leading to the establishment of the Ethiopian Environmental Protection Authority and the formulation of the Environmental Policy of Ethiopia. The regions have prepared region specific conservation strategies expected to promote regional conservation efforts.

The Council of Ministers approved the Ethiopian Environmental Policy in 1997. The following sectoral and cross-sectoral issues are included in the Environmental Policy:

Sectoral Environmental Policies

- ❖ Soil husbandry and sustainable agriculture,
- ❖ Forest, woodland and tree resources,
- ❖ Genetic, species and ecosystem biodiversity,
- ❖ Water resources,
- ❖ Energy resources,
- ❖ Mineral resources,

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- ❖ Urban Environment and environmental health,
- ❖ Control of hazardous materials and pollution from industrial waste,
- ❖ Atmospheric pollution and climate change,
- ❖ Cultural and Natural heritage,

Cross-sectoral policies

- ❖ Population and the environment,
- ❖ Community participation and the environment,
- ❖ Tenure and access rights to land and natural resources,
- ❖ Land use plan,
- ❖ Social, and gender issues,
- ❖ Environmental economics,
- ❖ Environmental information system,
- ❖ Environmental research,
- ❖ Environmental impact assessment,
- ❖ Environmental education and awareness,

The following major activities have been undertaken to implement the environmental policy:

- ❖ The Environmental Protection Authority has been established at the federal level;
- ❖ Three regional states have established their own environmental organs;
- ❖ Proclamations for pollution control, environmental impact assessment, and the establishment of environmental protection organs have been enacted;
- ❖ The National Plan of Action to Combat Desertification has been prepared; and
- ❖ The Environmentally Sustainable Industrial Development Strategy has been prepared.

5.3 INTERNATIONAL AGREEMENTS AND THEIR IMPLEMENTATION IN ETHIOPIA

Ethiopia has adopted and ratified several international conventions and agreements related to the environment. The major ones are:

5.3.1 Convention on Biological Diversity

The Convention on Biological Diversity has three goals. These are: the conservation of biodiversity; the sustainable use of the components of biodiversity; and the fair and equitable sharing of the benefits arising from the use of genetic resources. The Convention was ratified by Ethiopia by Proclamation 98/94, on May 31, 1994.

By Proclamation No. 362/2003, Ethiopia has ratified the Cartagena Protocol on Biosafety to the Convention on Biological Diversity.

Various activities are being carried out towards the implementation of this convention. The following are some of them:

- ❖ Through supporting farming communities, *in situ* conservation of crop genetic resources diversity is being undertaken by the Institute of Biodiversity Conservation and Research. The Institute has now accumulated a lot of experience in this novel field;
- ❖ A National Biodiversity Protection and Research Policy has been prepared;

- ❖ Prior to 1998, the Institute of Biodiversity Conservation and Research had been given the responsibility to conserve and carry out research on the country's plant, animal and micro-organism genetic resources, and it is active in fulfilling its mandate. It has a good gene bank for *ex situ* conservation and is undertaking *in situ* conservation of coffee in various parts of the country;
- ❖ Efforts are being made to conserve forest genetic resources including the development of a national forest genetic resources research strategy, registration of woody biomass, conducting socio-economic surveys in natural forest areas, establishing forest gene banks, compiling data on indigenous trees and shrubs, awareness creation and institutional capacity building.
- ❖ Efforts are also being made to conserve and sustainably use medicinal plants.
- ❖ A National Biodiversity Strategy and Programme is being developed by the Institute of Biodiversity Conservation and Research in collaboration with the relevant federal and regional institutions.
- ❖ A national report on the implementation of the Convention on Biological Diversity has been submitted to the Secretariat of the Convention.
- ❖ A Wildlife Protection Support Programme is being implemented to carry out the following activities:
 - Establishment of an endowment fund, rehabilitation of infrastructure, undertaking community and tourism development in 6 national parks as well as rehabilitating and enhancing the management of protected areas of prime importance. The Ethiopian Wildlife Conservation and Development Organization is following up this issue.
 - Rehabilitation of three national parks (Omo, Mago and Nech Sar) is underway.
 - Effort is being made to improve household security for pastoralists and undertake conservation and protection activities in the Awash National Park.
- ❖ A Programme for the conservation of priority forests is being undertaken.
- ❖ A Biodiversity Protection and Conservation Support Project in important bird areas is being implemented since 1999 by the Ethiopian Wildlife Conservation and Development Organization.
- ❖ A Biosafety framework, with the law being based on the Biosafety Model Law issued by the African Union, is being developed by the Environmental Protection Authority.

5.3.2 The United Nations Convention to Combat Desertification (CCD)

The objective of the Convention is to combat desertification and mitigate the effects of droughts in countries experiencing serious drought and/or desertification, particularly in Africa. Ethiopia has ratified the Convention through its Proclamation No. 80/1997.

To implement the Convention, the following activities are being carried out with the coordination of the Environmental Protection Authority. The following are some of the activities that have been and are being carried out:

- ❖ Completion of the drafting of a national programme for combating desertification;
- ❖ Providing some capacity building support and implementing awareness raising programmes in the regions;
- ❖ Preparation by some of the regions of regional programmes for combating desertification;

- ❖ Demonstration to local communities on how degraded land can be rehabilitated using participatory approaches are underway in four regions;
- ❖ The drafting of a gender strategy designed to facilitate the incorporation of gender issues into the programme for combating desertification is in the process of preparation; and
- ❖ A draft document with respect to the establishment of a fund for combating desertification has been finalized.

5.3.3. The Vienna Convention for the Protection of the Ozone Layer

The basic objective of the Convention is to combat the negative impact on the environment and human beings resulting from ozone depleting substances by reducing the amounts released and eventually banning their commercial use through internationally agreed measures. The Montreal Protocol entered into force in 1989 to facilitate the implementation of the Convention.

Ethiopia ratified and became party to the Vienna Convention and the Montreal Protocol in January 1996. The National Meteorological Services Agency has been mandated for the coordination and supervision of implementation of this convention. The following activities have so far been carried out towards implementing this convention:

- ❖ A programme for controlling ozone-depleting substances in Ethiopia is in place.
- ❖ A National Ozone Team has been established.
- ❖ A draft legislation for the control of substances that deplete the ozone layer has been prepared; and
- ❖ Training on awareness creation has been conducted.

5.3.4 Framework Convention on Climate Change (FCCC)

Ethiopia ratified this convention through Proclamation No. 97/1994 on May 2/1994. This convention takes into account the fact that climate change has transboundary impacts. The basic objective of this convention is to provide for agreed limits on the release of greenhouse gases into the atmosphere so as to prevent the occurrence of climate change. It also aims to prepare countries to minimize the impact of climate change should it occur.

The following major activities have been undertaken to implement the convention:

- ❖ Within the National Meteorological Services Agency, a Climate Change and Air Pollution Research Team has been established;
- ❖ Major sources of greenhouse gases in the country have been registered. Preliminary research has also been conducted to verify the effect of climatic change on the water flow of the Awash River as well as on wheat production and forest resources;
- ❖ Research has been undertaken on the best possible measures to minimize greenhouse gas emissions associated with energy utilization as well as from grazing and livestock production.
- ❖ A national report on the implementation of the UN Framework Convention on Climate Change has been submitted to the secretariat of the convention.

5.3.5 The Basel Convention

The objective of the Basel Convention is to control and regulate the transboundary movement of hazardous wastes. The Bamako Convention of 1991 plays a similar role at the level of the African continent.

Ethiopia ratified the Basel Convention through its Proclamation No. 357/2002. Its amendment was ratified through Proclamation No. 356/2002. The country has also ratified the Bamako Convention through Proclamation no 355/2002

5.3.6 The Stockholm Convention

In the year 2002, Ethiopia fully accepted and ratified the Stockholm Convention on Persistent Organic Pollutants by proclamation No. 279/2002 designed to ban the use of Persistent Organic Pollutants (POPS). The Environmental Protection Authority has the full mandate to implement the Convention at the national level. A project to develop an appropriate system for the realization of the objectives of the Convention in Ethiopia is in progress.

5.3.7 The Rotterdam Convention

This Rotterdam Convention on Prior Informed Consent (PIC), ratified by proclamation No. 278/2002, relates to prior informed consent in the context of international trade in specific hazardous chemicals and pesticides. The Environmental Protection Authority is the organ responsible for the domestic implementation of this convention, which has been ratified by Ethiopia in 2003. The Environmental Protection Authority is preparing a framework for its implementation.

5.3.8 Convention on International Trade in Endangered Species of Fauna and Flora (CITES)

The objectives of the Convention are:

- ❖ To control international trade in endangered species; and
- ❖ To ensure that international trade in non-endangered species is carried out in a manner which ensures stable markets and economic benefits for the exporting countries as well as to control and regulate illegal trade in such non-endangered species, fossils and/or their derivatives.

Ethiopia ratified the Convention through Proclamation 14/1970. The mandate to implement the Convention at the federal level is the responsibility of the Ethiopian Wildlife Protection and Development Organization.

5.4 INSTITUTIONS

In earlier days, natural resources development and environmental protection activities were carried out in a disparate manner by sectoral institutions. In 1985, natural resources protection and development was attached to the Ministry of Agriculture as a distinct sector led by a vice minister. This lasted until 1993.

In 1993, the Ministry of Natural Resources Development and Environmental Protection was established. This new institution functioned until 1995, when the environmental components of its mandate were given to the Environmental Protection Authority through Proclamation No. 9/95.

In accordance with the duties and responsibilities entrusted upon it, the Environmental Protection Authority has been undertaking various activities to fulfil its mandate of environmental protection. However it found this earlier proclamation to be too general to enable effective action. Therefore, it was repealed and replaced by the new more detailed proclamation which provides for the establishment of environmental organs. This new law which was issued as Proclamation no. 295/2002 is 2002, aims to:

- ❖ Facilitate the sustainable use of environmental resources by eliminating conflicts in mandates and duplication of work by allocating to separate institutions activities related to environmental development and management

on the one hand and environmental regulation and supervision on the other hand; and

- ❖ Establish a mechanism which will strengthen the carrying out of the distinct responsibilities of federal and regional environmental organs in a coordinated manner.

According to this new proclamation the objectives of the Authority are to ensure that all matters pertaining to the country's social and economic development activities are carried out in a manner that will protect the welfare of human beings as well as sustainably protect, develop and utilize the resource bases on which they depend for survival. The particulars of the Authority's power and responsibilities are incorporated in the Proclamation.

The Proclamation has also provisions that treat the conditions under which sectoral environmental units and regional environmental offices are to be established with detail of their duties and responsibilities.

It is believed that this institutional set up will facilitate the integration of environmental activities and information exchange hitherto scattered among diverse organizations.

At the Federal and Regional levels there are several institutions engaged in natural resources protection, development and research. The following are the major ones:

- ❖ Ministry of Rural Development and the corresponding regional bureaux;
- ❖ Ministry of Agriculture and the corresponding regional bureaux;
- ❖ Ethiopian Wildlife Development and Protection Organization;
- ❖ Ethiopian Agricultural Research Organization and the agricultural research institution in some regions;
- ❖ Ministry of Water Resources and the corresponding regional bureaux;
- ❖ Institute of Biodiversity Conservation and Research;
- ❖ Ministry of Mines and its corresponding regional bureaux;
- ❖ Ethiopian Science and Technology Commission;
- ❖ Ministry of Labour and Social Affairs and corresponding regional bureaux;
- ❖ Disaster Prevention and Preparedness Commission and corresponding regional bureaux; and
- ❖ Rural Energy Development Promotion Centre.

In addition, there are a number of non-governmental organizations, civil society institutions and trade associations that are involved in environmental protection, conservation and related activities.

5.5 ENVIRONMENTAL INFORMATION SYSTEM

Environmental information is crucial for decision making on environmental issues and for the creation of awareness. In view of the pivotal role that information plays, the Ethiopian Environmental Policy has incorporated it as one of the cross-sectoral policy issues.

At present, it is difficult to say that there is an efficient and consistent environmental information system in the country. In the past, since different institutions collected environmental data from diverse sources at different times and for various purposes, they were not compatible and lacked consistency in time and space. Data captured earlier are scattered all over the place and there is fear that no one could locate where exactly they are. As a result, one could say that environmental control and monitoring activities are not supported by adequate information.

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Much effort is being made, at present in the area of the collection and storage of environmental data. A meta-database on environmental and natural resources is being developed under the auspices of the Ministry of Water Resources to create one central national meta-database in order to ensure consistency of data and avoid duplication of work.

The Environmental Protection Authority has also started some initiatives in this area by setting up an environmental information system compatible with the meta-database of the Ministry of Water Resources.

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ANNEXES

ANNEXES

Annex 1:

POLLUTION LOADS OF INDUSTRIAL EFFLUENTS FROM SAMPLE INDUSTRIES IN ADDIS ABABA AND SURROUNDING

| No. | Name of Industries | pH | SS | DS | BODs | Nitrate | Sulphur | Chloride |
|-----|-----------------------------|------|---------|---------|----------|---------|----------|----------|
| 1 | Addis Soft Drinks | 11.7 | 94 | 2,880 | 581.5 | 0 | 40.65 | 0 |
| 2 | Awash Winery | 7.46 | 3,249 | 2,923 | 112,768 | 9 | 40.5 | 25 |
| 3 | Meta Abo Brewery | 5.27 | 429.3 | 211 | 12,169.5 | 3.75 | 0 | 20 |
| 4 | Moha Soft Drinks | 12.3 | 157.5 | 4,393 | 407.5 | 13.5 | 277.5 | 32.5 |
| 5 | National Alcohol and Liquor | 7.91 | 2,345 | 1,383.5 | 13,550 | 0.2 | 2.5 | 4 |
| 6 | St. Georgis Brewery | 6.64 | 36 | 62 | 55 | 1.05 | 5.95 | 5 |
| 7 | Addis Gas and Plastic | 8.27 | 13 | 9,087.5 | 13.5 | 1.6 | 12.95 | 785.23 |
| 8 | Addis Tyre | 8.89 | 272.5 | 895.5 | 24.65 | 2.7 | 2,646.25 | 675 |
| 9 | Chora Gas and Chemicals | 10.1 | 27,670 | 3,720 | 85 | 0 | 8.86 | 16 |
| 10 | Equatorial Paint | 8.3 | 3,616 | 41.5 | 575.5 | 0 | 312.5 | 52.5 |
| 11 | Gulele Paint | 13.5 | 205.5 | 89,650 | 57,231.5 | 200 | 80 | 3.5 |
| 12 | Nefas Silk Paint | 6.58 | 3,612.5 | 165.5 | 228.5 | 23.75 | 350 | 7.5 |
| 12 | Repi Soap | 9.0 | 321.5 | 1,990 | 1,034 | 7 | 25 | 52 |
| 14 | Addis Machine Tools | 8.24 | 31.5 | 645.5 | 16.6 | 6.7 | 213 | 70 |
| 15 | Akaki Spare Parts | 6.74 | 262 | 411.5 | 11 | 7.65 | 25.95 | 57.5 |
| 16 | Akaki Metal Products | 2.75 | 93.5 | 3,540 | 73 | 11 | 20.3 | 1,220 |
| 17 | Ethiopia Metal Foundry | 7.51 | 40.5 | 292 | 13 | 11.12 | 24.2 | 12.5 |
| 18 | Kaliti Metal Products | 8.64 | 157 | 304.5 | 165 | 7.0 | 87.8 | 27.6 |
| 19 | Addis Tannery | 9.45 | 1,350.5 | 4,089.5 | 2,428.5 | 113.75 | 1,520 | 150 |
| 20 | Awash Tannery | 3.80 | 664.5 | 17,425 | 914 | 6.25 | 1,576.25 | 11,500 |
| 21 | Tikur Abay Tannery | 8.27 | 1,365 | 12,850 | 1,673.5 | 14.4 | 959.5 | 200 |
| 22 | Dire Tannery | 5.96 | 1,615 | 11,950 | 2,782 | 375 | 3,276.5 | 18,750 |
| 23 | Hafeda Tannery | 7.73 | 709.5 | 13,400 | 985.5 | 6.85 | 250.87 | 60 |
| 24 | Walia Tannery | 10.5 | 997 | 5,250 | 1,648 | 17.64 | 144.7 | 175 |
| 25 | Akaki Textile | 9.07 | 159.5 | 966 | 259.5 | 50 | 57.85 | 116.5 |
| 26 | Edget Yarn | 10.3 | 54.5 | 251.5 | 81.5 | 5.0 | 29.8 | 9 |
| 27 | Nefs Silk Thread | 8.01 | 86 | 303 | 10 | 3.1 | 17.55 | 24 |

Source: UNIDO, 2001, P.11

Annex 2:

LIST OF MEDICINAL PLANTS IDENTIFIED AND PLANTED IN BONGA BY THE INSTITUTE OF BIODIVERSITY CONSERVATION AND RESEARCH

| No. | Plant Species | Plant Part Used for Medicinal Purpose |
|-----|--------------------------------|---------------------------------------|
| 1 | <i>Aolanthus</i> sp. | Leaf |
| 2 | <i>Celosia trigyna</i> | Leaf |
| 3 | <i>Ranuculus multifidus</i> | Leaf |
| 4 | <i>Clerodendron myricoides</i> | Seed |
| 5 | <i>Embelia schimperi</i> | Root |
| 6 | <i>Thalictrum rhyngocarpum</i> | Leaf and Seed |
| 7 | <i>Ruta chalepensis</i> | Leaf |
| 8 | <i>Persicaria senegalensis</i> | Flower and Seed |
| 9 | <i>Foeniculum vulgare</i> | Seed |
| 10 | <i>Aframomum cororima</i> | Liquid |
| 11 | <i>Euphorbia schimperiana</i> | Leaf |
| 12 | <i>Tagetes minuta</i> | Leaf |

Source: Institute of Biodiversity Conservation and Research, response to questionnaire.

Annex 3:

WOOD DEMAND AND SUPPLY IN 000 M³

| Year | Demand | | | Projected incremental yields | Difference between demand and supply |
|------|---|----------|--------|------------------------------------|---|
| | For industrial use and Construction | For fuel | Total | | |
| 1 | 2 | 3 | 4= 3+2 | 5 | 6= 4-5 |
| 1992 | 2,500 | 44,953 | 47,453 | 14,339 | 33,114 |
| 1993 | 2,586 | 46,450 | 49,036 | 14,193 | 34,843 |
| 1994 | 2,683 | 47,958 | 50,641 | 14,045 | 36,596 |
| 1995 | 2,785 | 49,518 | 52,303 | 13,857 | 38,446 |
| 1996 | 2,895 | 51,192 | 54,087 | 13,717 | 40,370 |
| 1997 | 3,015 | 52,917 | 55,932 | 13,550 | 42,382 |
| 1998 | 3,135 | 54,693 | 57,828 | 13,503 | 44,325 |
| 1999 | 3,263 | 56,521 | 59,784 | 13,314 | 46,470 |
| 2000 | 3,396 | 58,403 | 61,799 | 13,136 | 48,663 |
| 2001 | 3,535 | 60,310 | 63,845 | 12,932 | 50,913 |
| 2002 | 3,677 | 62,269 | 65,946 | 12,798 | 53,148 |
| 2003 | 3,827 | 64,283 | 68,110 | 12,681 | 55,429 |
| 2004 | 3,984 | 66,350 | 70,334 | 12,738 | 57,596 |
| 2005 | 4,150 | 68,473 | 72,623 | 12,617 | 60,006 |
| 2006 | 4,319 | 70,583 | 74,902 | 12,452 | 62,450 |
| 2007 | 4,495 | 72,745 | 77,240 | 12,108 | 65,132 |
| 2008 | 4,681 | 74,967 | 79,648 | 12,093 | 67,555 |
| 2009 | 4,875 | 77,222 | 82,097 | 11,852 | 70,245 |
| 2010 | 5,079 | 79,539 | 84,618 | 12,059 | 72,559 |
| 2011 | 5,286 | 81,812 | 87,098 | 11,559 | 75,539 |
| 2012 | 5,503 | 84,130 | 89,633 | 11,260 | 78,373 |
| 2013 | 5,731 | 86,439 | 92,170 | 11,054 | 81,116 |
| 2014 | 5,968 | 88,899 | 94,867 | 10,643 | 84,224 |

Source; Ministry of Natural Resources and Environmental Protection, 1993

Annex 4:

PRIORITY FOREST AREAS BY TYPE AND AREA COVERAGE (HECTARES)

| | Name of area | High Forest (ha) | | Man-made forest (ha) | Other forest areas (ha) | Total area (ha) |
|----|-------------------------|--------------------|-------------------|----------------------|-------------------------|-----------------|
| | | Slightly Disturbed | Heavily Disturbed | | | |
| 1 | Arbagugu | n.a | 6,300 | 1,600 | 13,500 | 21,400 |
| 2 | Chilalo Galema | n.a | n.a | 1,400 | 20,600 | 22,000 |
| 3 | Munesa Shashemne | 7,000 | 10,200 | 6,800 | 74,200 | 98,200 |
| 4 | Nashe-Batu Adaba Dodola | n.a | 10,000 | 1,700 | 28,300 | 40,000 |
| 5 | Logo | 5,000 | 16,400 | 900 | 36,700 | 59,000 |
| 6 | Goro Bele | 9,800 | 50,000 | 200 | 40,000 | 100,000 |
| 7 | Harena Kokosa | 20,000 | 70,000 | n.a | 92,000 | 182,000 |
| 8 | Kubayo | 5,000 | 17,900 | 300 | 55,200 | 78,400 |
| 9 | Mena-Anyetu | 20,000 | 50,000 | 200 | 119,800 | 190,000 |
| 10 | Bulki Malokoza | n.a | n.a | 500 | 10,500 | 11,000 |
| 11 | Gidola Gamba | 15,000 | 5,000 | n.a | 10,000 | 30,000 |
| 12 | Gidole Gamba | n.a | n.a | 1,200 | 14,800 | 16,000 |
| 13 | Guwanga Kahitas | n.a | 32,000 | 2,800 | 21,700 | 56,500 |
| 14 | Sekela Mariam | n.a | n.a | 2,000 | 8,000 | 10,000 |
| 15 | Butiji Melkajebdu | n.a | n.a | 3,800 | 41,400 | 45,200 |
| 16 | Dindin Arbagugu | n.a | n.a | 5,900 | 57,600 | 66,800 |
| 17 | Gara Muleta | n.a | 2,600 | 2,000 | 2,400 | 7,000 |
| 18 | Jalo Muktare | n.a | 2,500 | 4,100 | 14,700 | 21,300 |
| 19 | Iaro Gursum | n.a | 1,500 | 4,500 | 46,300 | 52,300 |
| 20 | Abobo Gog | 150,000 | 45,000 | 100 | 22,900 | 218,000 |
| 21 | Gebre Dima | 50,000 | 82,000 | n.a | 33,000 | 165,000 |
| 22 | Godere | 40,000 | 100,000 | 500 | 19,500 | 160,000 |

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| | Name of area | High Forest (ha) | | Man-made forest (ha) | Other forest areas (ha) | Total area (ha) |
|----|---------------------------|-----------------------|----------------------|-------------------------|-------------------------------|--------------------|
| | | Slightly Disturbed | Heavily Disturbed | | | |
| 23 | Sele Anderacha | 100,000 | 115,000 | 700 | 9,300 | 225,000 |
| 24 | Sibo Tale Kobo | 28,000 | 50,000 | 1,900 | 20,100 | 100,000 |
| 25 | Sigemo Geba | 67,700 | 190,000 | 2,300 | 20,000 | 280,000 |
| 26 | Yayu | 20,000 | 100,000 | 300 | 29,700 | 150,000 |
| 27 | Yeki | 10,000 | 100,000 | 500 | 11,500 | 122,000 |
| 28 | Wangus | 329,900 | n.a | n.a | 85,100 | 415,000 |
| 29 | Mesenigo | 292,350 | n.a | 650 | 32,000 | 325,000 |
| 30 | Abelti Gibe | n.a | 4,700 | 1,300 | 4,000 | 10,000 |
| 31 | Babiya Fola | n.a | 45,000 | 900 | 28,400 | 74,300 |
| 32 | Belate Gera | 76,500 | 35,200 | 1,100 | 35,700 | 148,500 |
| 33 | Bonga | 7,000 | 10,000 | 2,100 | 142,300 | 161,400 |
| 34 | Gura Ferda | 80,000 | 35,100 | 800 | 224,100 | 340,000 |
| 35 | Tiro Boter Becho | 16,000 | 23,300 | 2,300 | 44,200 | 85,800 |
| 36 | Butajira | n.a | n.a | 1,600 | 13,400 | 15,000 |
| 37 | Chilimo Gaji | n.a | 2,000 | 800 | 23,200 | 26,000 |
| 38 | Gedo | 2,000 | 3,000 | n.a | 5,000 | 10,000 |
| 39 | Jibate Muti Jegenfo | n.a | 5,000 | n.a | 33,500 | 38,500 |
| 40 | Menagesha Suba | n.a | 3,600 | 1,300 | 4,900 | 9,800 |
| 41 | Wof Washa | n.a | 2,000 | 4,200 | 2,700 | 8,900 |
| 42 | Yerer Diregebrecha Zukala | 300 | 3,800 | 1,700 | 3,800 | 9,600 |
| 43 | Anderara Wadera | n.a | 13,000 | 3,700 | 89,900 | 106,600 |
| 44 | Bore Asferara | n.a | 33,000 | 1,400 | 182,900 | 217,300 |
| 45 | Megada | 5,000 | 10,000 | 1,300 | 4,500 | 20,800 |
| 46 | Negele | n.a | 1,200 | 300 | 16,300 | 17,800 |
| 47 | Yabelo Arero | n.a | 8,000 | 150 | 41,750 | 49,900 |
| 48 | Desa | n.a | n.a | n.a | 20,000 | 20,000 |
| 49 | Chato Sengi Dengeb | n.a | 5,000 | 60 | 39,800 | 44,860 |
| 50 | Gergedra | 20,000 | 20,000 | 1,000 | 96,400 | 137,400 |

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| | Name of area | High Forest (ha) | | Man-made forest (ha) | Other forest areas (ha) | Total area (ha) |
|----|--------------------|--------------------|-------------------|----------------------|-------------------------|-----------------|
| | | Slightly Disturbed | Heavily Disturbed | | | |
| 51 | Gidame | n.a | 10,000 | n.a | 7,000 | 17,000 |
| 52 | Jurgo Wato | n.a | 15,000 | 200 | 4,700 | 19,900 |
| 53 | Komto Waja Tsega | n.a | 1,000 | 1,200 | 6,900 | 9,100 |
| 54 | Konchi | 10,000 | 5,000 | n.a | 8,000 | 23,000 |
| 55 | Linche Dali Gewe | n.a | 15,000 | n.a | 25,000 | 40,000 |
| 56 | Denkore | n.a | 2,300 | n.a | 3,000 | 5,300 |
| 57 | Guwobirda Girakaso | n.a | 11,500 | 2,200 | 12,300 | 26,000 |
| 58 | Yegof Erike | n.a | 2,800 | 8,400 | 6,800 | 18,000 |
| | Total | 1,386,550 | 1,385,200 | 84,860 | 1,921,250 | 4,777,860 |

Source: Ministry of Agriculture, 2003.

* Other forest areas include pasture areas, agricultural land etc.

Annex 5:
PROTECTED AREAS, LOCATION AND EXTENT (HECTARES) IN 1994

| No. | Protected area | Location | Area in hectares |
|----------|------------------------------|-------------------|------------------|
| 1 | NATIONAL PARKS | | |
| 1.1 | Abijata Shala Lakes | Oromia | 887 |
| 1.2 | Awash | Oromia | 756 |
| 1.3 | Yebale Mountains | Oromia | 2,471 |
| 1.4 | Gambella | Gambella | 5,061 |
| 1.5 | Mago | Gambella | 2,162 |
| 1.6 | Nechsar | SNNPR | 514 |
| 1.7 | Omo | SNNPR | 4,068 |
| 1.8 | Semien Mountains | Amhara | 179 |
| 1.9 | Yangudi Rasa | Afar | 4,731 |
| 2 | WILDLIFE RESERVES | | |
| 2.1 | Babile | Somalia/ Oromia | 6,982 |
| 2.2 | Senkele | Oromia and SNNPR | 54 |
| 2.3 | Yabelo | Oromia | 2,537 |
| 3 | PROTECTED AREAS | | |
| 3.1 | Alidege | Afar | 1,832 |
| 3.2 | Wast Shewa | Afar | 1,781 |
| 3.3 | Bale | Oromia | 1,766 |
| 3.4 | Chelbi | SNNPR | 4,212 |
| 3.5 | Shire | Tigray | 753 |
| 3.6 | Gewane | Afar | 2,439 |
| 3.7 | Mile Serdo | Afar | 8,766 |
| 3.8 | Tama | SNNPR | 3,269 |
| 4 | GAME RESERVES | | |
| 4.1 | Afdem Gewane | Afar | 5,932 |
| 4.2 | Abobo | Gambella | 5,049 |
| 4.3 | Arsi | Oromia | 10,876 |
| 4.4 | West Shewa | Afar | 9,136 |
| 4.5 | Bale | Oromia | 9,663 |
| 4.6 | Borena | Oromia | 45,366 |
| 4.7 | Boyu | SNNPR | n.a. |
| 4.8 | Chercherna Arbagugu | Oromia | 3,045 |
| 4.9 | Dabus Valley | Benishangul Gumuz | 1,227 |
| 4.10 | East Hararge | Somilia | 23,788 |
| 4.11 | Erer Gota | Afar | 2,386 |
| 4.12 | Jikawa | Gambella | 3375 |
| 4.13 | Mizan Teferi | SNNPR | n.a. |
| 4.14 | Mursi | SNNPR | 4,172 |
| 4.15 | Maze | SNNPR | n.a. |
| 4.16 | West Omo | SNNPR | 4,561 |
| 4.17 | Segene Valley | SNNPR | n.a. |
| 4.18 | Teyu | Gambella | 347 |
| 5 | MAIN BIRD SANCTUARIES | | |
| 5.1 | Entoto Park | Addis Ababa | n.a. |
| 5.2 | Gefersa Dam | Addis Ababa | " |
| 5.3 | Abie Lake | Afar | " |
| 5.4 | Aliyu Amha Dulecha | Afar | " |

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| No. | Protected area | Location | Area in hectares |
|------|--------------------------------|-------------------|------------------|
| 5.5 | Awash River Lake | Amhara | n.a. |
| 5.6 | Lake Tana | Amhara | " |
| 5.7 | Ankober Debresina Mountain | Amhara | " |
| 5.8 | Awi Zone | Amhara | " |
| 5.9 | Choka Mountains | Amhara | " |
| 5.10 | Fogera | Amhara | " |
| 5.11 | Guasa/ Menze/ | Amhara | " |
| 5.12 | Jama and Jara valley | Amhara | " |
| 5.13 | Middle Abay Valley | Amhara | " |
| 5.14 | Gofa Forest | Amhara | " |
| 5.15 | Dabuse Valley | Benishangul Gumuz | " |
| 5.16 | Baro River | Gambella | " |
| 5.17 | Aba Samuel wetlands | Oromia | " |
| 5.18 | Alemaya Adele Lakes | Oromia | " |
| 5.19 | Anfrera Forest | Oromia | " |
| 5.20 | Arere Forest | Oromia | " |
| 5.21 | Bisheftu Lakes | Oromia | " |
| 5.22 | Bisidimo | Oromia | " |
| 5.23 | Cheleleka Wetlands | Oromia | " |
| 5.24 | Dawa Wachile | Oromia | " |
| 5.25 | Fincha Chomen wetlands | Oromia | " |
| 5.26 | Genale River | Oromia | " |
| 5.27 | Arenguade Lake | Oromia | " |
| 5.28 | Kore wetlands | Oromia | " |
| 5.29 | Langano Lake | Oromia | " |
| 5.30 | Liben plains | Oromia | " |
| 5.31 | Mankubsa Welansa Forest | Oromia | " |
| 5.32 | Menagesha Suba Forest | Oromia | " |
| 5.33 | Metu, Gore and Tepi Forest | Oromia | " |
| 5.34 | Sof Omar | Oromia | " |
| 5.35 | Shiek Husein | Oromia | " |
| 5.36 | Sululta Plains | Oromia | " |
| 5.37 | Tiro Boter Becho Forest | Oromia | " |
| 5.38 | Lake Zeway | Oromia | " |
| 5.39 | Ziquala Mountain | Oromia | " |
| 5.40 | Begole Maniye Dolo | Somali | " |
| 5.41 | Lower Wabi Shebele River Basin | Somali | " |
| 5.42 | Bonga Forest | SNNPR | " |
| 5.43 | Boyu wetlands | SNNPR | " |
| 5.44 | Chew Bahir | SNNPR | " |
| 5.45 | Konso Segen | SNNPR | " |
| 5.46 | Mugo Highlands | SNNPR | " |
| 5.47 | Lake Turkana & Omo river | SNNPR | " |
| 5.48 | Lake Awasa | SNNPR | " |
| 5.49 | Lake Ashenege | Tigray | " |
| 5.50 | Desa forest | Tigray | " |
| 5.51 | Hugum Berdo/ Tekeze Valley/ | Tigray | " |

* n.a. = information not available

Source: Ministry of Agriculture/1993 E.C./

Annex 6:

MAJOR NATIONAL AND ARTIFICIAL LAKES IN ETHIOPIA

| Name | Altitude (m asl) | Area in km ² | Maximum depth (m) |
|---------------------|------------------|-------------------------|-------------------|
| Tana | 1,788 | 3,000 | 14 |
| Ziway | 1,636 | 485 | 9 |
| Langano | 1,582 | 225 | 46 |
| Abijata | 1,577 | 200 | 13 |
| Shala | 1,570 | 315 | 266 |
| Awasa | 1,680 | 92 | 22 |
| Abaya | 1,285 | 1,070 | 13 |
| Chamo | 1,230 | 350 | 13 |
| Chew Bahir | 500 | 308 | n.a. |
| Haiq | 1,960 | 35 | 23 |
| Ashenge | 2,440 | 20 | 25 |
| Koka (Artificial) | 1,590 | 236 | 13 |
| Fincha (Artificial) | 2,219 | 345 | 7 |
| Beseka | 1,900 | 30 | 7 |
| Turkana | 375 | n.a. | n.a. |
| Abe | 243 | 320 | n.a. |
| Gamari | 339 | 63 | n.a. |
| Afambo | 339 | 26 | n.a. |

n.a. = information not available

Source:- Environmental Protection Authority, 1997, modified

Annex 7:

POLLUTION IN STREAMS THAT FLOW THROUGH ADDIS ABABA, 2001

| No. | Rivers and Sampling locations | BOD ₅ | DO | NH ₃ | CI |
|-----|--|------------------|------|-----------------|-----|
| 1 | Tinishu Akaki River and Tributaries | | | | |
| 1.1 | Before Gulele Soap Factory | 3.5 | 7.0 | 0.53 | 5 |
| 1.2 | Near Building College | 339 | 0.8 | 32.3 | 110 |
| 1.3 | Zenebework area | 40 | 0.6 | 8.8 | 50 |
| 1.4 | Fifth Police station bridge | 535 | 0 | 63 | 83 |
| 1.5 | Abatoir area | 444 | 0 | 71 | 85 |
| 1.6 | Near Bihere Tsige Park | 252 | 0 | 52.5 | 65 |
| 1.7 | Down stream Kaliti waste water treatment plant | 105 | 0 | 80.6 | 235 |
| 2 | Kebena, Kurtume and other streams | | | | |
| 2.1 | Kurtume Near Habte Giorgis Bridge | 93 | 0.6 | 51.6 | 63 |
| 2.2 | Kurtume Main Post office area | 134 | 2 | 55.5 | 64 |
| 2.3 | Near Zewditu Hospit area | 144 | 2 | 58.1 | 15 |
| 2.4 | Near Kechene Bridge | 36 | 4.8 | 13.2 | 70 |
| 2.5 | North of French Embassy | 11.0 | 6.6 | 0.6 | 57 |
| 2.6 | Misrak high School area | 63 | 3.7 | 38.7 | 45 |
| 2.7 | Urael bridge | 24 | 0.80 | 30.7 | 48 |
| 2.8 | Bole Bridge | 60 | 0.60 | 32.3 | 47 |
| 3 | Tlliku Akaki river | | | | |
| 3.1 | Near Legedadi Dam | 5 | 7.7 | 0.6 | 2 |
| 3.2 | End of Bole area | 32 | 1.0 | 21.3 | 35 |
| 3.3 | Near Akaki Bridge | 10 | 4.7 | 0.9 | 22 |

Source: UNIDO, 2001

Annex 8:

LOCATION AND PRESENT STATUS OF SOIL LABORATORIES

| Location | Present status | Region to be served |
|------------------|----------------|---------------------|
| Bahir Dar | completed | Amhara |
| Mekele | completed | Tigray |
| Awasa | completed | SNNPR |
| Gambella | completed | Gambella |
| Dessie | completed | Amhara |
| Ziway | completed | Oromia |
| Bedele | completed | Oromia |
| Welkite | completed | SNNPR |
| Gonder | 21% | Amhara |
| Debre Markos | 43% | Amhara |
| Shire | 62% | Tigray |
| Nekemte | 47% | Oromia |
| Fiche | 11.8% | Oromia |
| Sodo / Weliyita/ | 46% | SNNPR |
| Tepi | n.a. | SNNPR |
| Jijiga | 62.4% | Somalia |
| Assosa | 52% | Benishangul Gumuz |

Source: Ethiopian Fertilizer Agency, 2001, response to questionnaire.

Annex 9:

MINERAL RESOURCES POTENTIAL BY TYPE AND LOCATION

| No. | Mineral type | Location | Potential in Tonnes |
|---|----------------------|--|-----------------------|
| A. Precious and rare metals(gold & platinum) | | | |
| 1 | Gold/Placer/ | Benishangul/serkole/ | 0.1-0.7 |
| 2 | Gold/Placer/ | Oromia/Degero/ | 0.07 |
| 3 | Gold | Benishangul Gumuz/ Dul-Kurmuk/ | 0.6 |
| 4 | Gold/Placer/ | SNNPR & Gambella/Akobo/ | 3.62 |
| 5 | Platinum | Oromia/Yubdo/ | 12.5 |
| 6 | Gold | SNNPR/ Dila/ | n.a |
| 7 | Gold | Tigray/ Shire, Hawzene, Wereina & Adigrat/ | n.a |
| 8 | Gold | Afar/Tendaho/ | n.a |
| 9 | Gold | Oromia/Gimbi Wolelga/ | n.a |
| B. Iron, Nickel & Base metal | | | |
| 10 | Iron | Oromia/ Bikilale/ | 57,800,000 |
| 11 | Nickel | Oromia/ Adolla/ | 17,000,000 |
| 12 | Iron | Oromia/ Melka Arba/ | 10,145,107 |
| 13 | Copper, Zink & Lead | Tigray/ Shire & Werei/ | n.a |
| 14 | Arsenic | Oromia/ Goha Tsion/ | n.a |
| C. Industial Minerals | | | |
| 15 | Potash | Afar/ Dalole/ | 185,000,000 |
| 16 | Bentonite | Afar/ Gewane & Mile/ | 70,000,000 |
| 17 | Diatomite | Oromia/ Shala Lake/ | 40,000,000 |
| 18 | Feldspar | Oromia/ Kenticha/ | 300,000 |
| 19 | Dolomite | Oromia/Daleti, Asebe Teferi, Kenticha/ | 1,434,000 |
| 20 | Limestone | Dire Dawa | 6,000,000 |
| 21 | Diatomite | Oromia/ Wenji/ | 426,525 |
| 22 | Phosphate | Oromia/ Bikilale, Arba Melka/ | 120,000,000 |
| 23 | Limestone | Oromia/ Muger/ | 120,000,000 |
| 24 | Silika Sand | Amhara & Oromia/ Jima, Muger/ | 5,000,000 |
| 25 | Gypsum | Amhara/ Abay Valley/ | In Millions |
| 26 | Kaolin | Oromia/Kombolcha/, Tigray, Harar, Sidamo | 300,000 |
| 27 | Quartz | Oromia/ Kenticha/ | 300,000 |
| 28 | Kianite | Oromia/ Chembi/ | 3,440,000 |
| 29 | Raw cement minerals | Tigray/ Mekele/ | In Millions |
| 30 | Raw Cement materials | Dire Dawa | 46,000,000 |
| 31 | Feldspar | Oromia/ Babile & Bomas/ | 150,000 |
| 32 | Limestone& Gypsum | Somali(Ogaden), Amhara(Abay Valley, North Shewa), Oromia(Muger), Tigray | In Millions |
| 33 | Coal, Oil shell | Oromia/Metu area/ | More than 100,000,000 |

ANNEXES

| No. | Mineral type | Location | Potential in Tonnes |
|-------------------------------|---------------------------|-------------------------|---------------------|
| 34 | Graphite | Somali, Oromia(Moyale) | 460,000 |
| 35 | Talk | Oromia/ Ano/ | 100,000 |
| D. Ornamental Minerals | | | |
| 36 | Opal | North Shewa, Gonder | n.a |
| 37 | Peridot | Yabelo, Megado | n.a |
| 38 | Safayer | Yabello | n.a |
| 39 | Garnet | Jinka | n.a |
| 40 | Emirald | Borena | n.a |
| 41 | Diamond | Kefa | n.a |
| E. Salt | | | |
| 42 | Salt extracted from Brine | Afar/ Afder lake/ | In Millions |
| 43 | Rock Salt | Somali/ Elkere/ | In Millions |
| 44 | Rock salt | Afar/ Berhale/ | In Millions |

n.a. = information not available

Source: Ministry of Mines and Energy 2003, response to questionnaire.

Annex 10:

PERCENTAGE OF PEOPLE WITH ACCESS TO SAFE DRINKING WATER BY SOURCE AND REGION

| | Rivers & Lakes | Protected springs and wells | Unprotected springs and wells | Public taps | Private taps | Other sources |
|--------------------------|----------------|-----------------------------|-------------------------------|-------------|--------------|---------------|
| Amhara | 31.2 | 9.1 | 49.0 | 9.2 | 1.5 | 0.1 |
| Rural | 34.5 | 9.3 | 54.2 | 1.9 | 0.1 | 0.1 |
| Urban | 4.0 | 7.6 | 5.7 | 69.9 | 12.8 | 0 |
| Tigray | 29.3 | 15.2 | 33.4 | 19.3 | 2.5 | 0.4 |
| Rural | 34.5 | 17.9 | 39.6 | 7.7 | 0 | 0.3 |
| Urban | 2.8 | 1.7 | 2.2 | 77.7 | 14.9 | 0.6 |
| Afar | 60.2 | 1.8 | 14.7 | 18.6 | 4.7 | 0 |
| Rural | 77.8 | 2.0 | 14.5 | 5.4 | 0.3 | 0.2 |
| Urban | 3.7 | 0.9 | M | 60.9 | 18.9 | 0 |
| Oromia | 35.6 | 10.9 | 38.9 | 11.5 | 2.9 | 0.2 |
| Rural | 39.1 | 11.0 | 43.4 | 6.2 | 0.2 | 0.2 |
| Urban | 8.5 | 10.1 | 3.2 | 53.8 | 24.1 | 0.2 |
| Somali | 32.6 | 21.4 | 16.8 | 27.1 | 2.0 | 0.2 |
| Rural | 41.2 | 7.8 | 23.8 | 27.1 | 0 | 0.3 |
| Urban | 15.7 | 48.2 | 3.3 | 27.0 | 5.8 | 0 |
| Benishangul Gumuz | 49.5 | 20.3 | 25.6 | 4.4 | 0.2 | 0 |
| Rural | 52.4 | 19.9 | 25.4 | 2.2 | 0 | 0 |
| Urban | 16.3 | 24.6 | 27.3 | 29.8 | 2.1 | 0 |
| SNNPR | 41.0 | 13.6 | 33.6 | 10.5 | 1.2 | 0 |
| Rural | 44.0 | 13.4 | 35.6 | 6.8 | 0.2 | 0 |
| Urban | 3.1 | 16.6 | 8.1 | 57.4 | 14.9 | 0 |
| Gambella | 39.4 | 20.5 | 22.9 | 14.5 | 1.9 | 0.9 |
| Rural | 46.1 | 22.2 | 28.2 | 2.4 | 0 | 1.1 |

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| | Rivers & Lakes | Protected springs and wells | Unprotected springs and wells | Public taps | Private taps | Other sources |
|--------------------|----------------|--------------------------------|----------------------------------|-------------|--------------|---------------|
| Urban | 13.8 | 14.2 | 2.9 | 60.1 | 9.1 | 0 |
| Harari | 2.4 | 19.4 | 20.9 | 44.8 | 12.5 | 0 |
| Rural | 5.4 | 38.2 | 46.8 | 9.1 | 0.4 | 0 |
| Urban | 0.3 | 6.1 | 2.7 | 69.9 | 21.1 | 0 |
| Addis Ababa | 0.4 | 0.6 | 0.6 | 63.7 | 34.7 | 0 |
| Rural | 18.7 | 18.3 | 31.0 | 30.9 | 1.1 | 0 |
| Urban | 0.2 | 0.3 | 0.1 | 64.2 | 35.2 | 0 |
| Dire Dawa | 2.2 | 14.1 | 10.0 | 64.3 | 9.1 | 0.3 |
| Rural | 8.6 | 52.7 | 34.2 | 4.5 | 0 | 0 |
| Urban | - | 0.5 | 1.4 | 85.4 | 12.2 | 0.4 |

Source: Central Statistical Authority 2001.

State Of The Environment Report For Ethiopia

Annex 11:

TYPE OF VEHICLES AND THEIR YEARS OF SERVICE IN THE YEAR 2002

| Type of vehicles | Service year | | | | | |
|------------------------------|--------------|--------------------|---------------|---------------|----------------|------------|
| | Total | less than 10 years | 10 - 20 years | 20 - 30 years | above 30 years | Unknwn |
| Government Vehicles | | | | | | |
| Automobile/Station wagon | 6,988 | 1,911 | 2,174 | 497 | 1,912 | 494 |
| Dry Cargo | 2,748 | 449 | 1,271 | 305 | 719 | 4 |
| Liquid cargo | 131 | 2 | 54 | 7 | 58 | 10 |
| Service | 586 | 156 | 214 | 63 | 149 | 4 |
| Enterprise vehicles | | | | | | |
| Automobile/Station Wagon | 9,432 | 2,830 | 1,508 | 432 | 2942 | 1720 |
| Dry Cargo | 19,258 | 4,844 | 3,094 | 2,077 | 9107 | 136 |
| Liquid Cargo | 2,162 | 319 | 377 | 266 | 1187 | 13 |
| Public transport | 3,842 | 913 | 923 | 364 | 1621 | 21 |
| Privat Vehicles | | | | | | |
| Automobile/Station Wagon | 42,439 | 6,073 | 10,917 | 4,866 | 18456 | 2127 |
| Dry Cargo | 2,029 | 326 | 542 | 200 | 942 | 19 |
| Liquid Cargo | 4 | | 3 | | 1 | |
| Service | 698 | 113 | 186 | 91 | 304 | 4 |
| Taxi service Vehicles | 9,841 | 1,534 | 3,796 | 842 | 3466 | 203 |
| Other Vehicles | | | | | | |
| Automobile/Station Wagon | 12,126 | 3,665 | 3,148 | 557 | 3811 | 945 |
| Dry Cargo | 3,286 | 616 | 1,436 | 314 | 916 | 4 |
| Liquid Cargo | 136 | 6 | 55 | 7 | 58 | 10 |
| Service | 709 | 198 | 249 | 66 | 192 | 4 |

Source:- Ethiopian Roads Authority, 2003, response to questionnaire

Annex 12:

TOURIST ATTRACTIONS

| Name and type | Location |
|-------------------------------------|----------|
| Natural Attractions | |
| • Bale Mountains National Park | Oromia |
| • Awash National Park | Oromia |
| • Abijata Shala Lakes National Park | Oromia |
| • Omo National Park | SNNPR |
| • Mago National Park | SNNPR |
| • Nech Sar National Park | SNNPR |
| • Yangudirasa National Park | Afar |
| • Gambella National Park | Gambella |
| • Simien Mountains National Park | Amhara |
| • Babile Valley | Oromia |
| • Sof Omar Cave | Oromia |
| Lakes & Waterfalls | |
| • Langano Lake | Oromia |
| • Abijata Lake | Oromia |
| • Shala lake | Oromia |
| • Ziway Lake | Oromia |
| • Fincha Lake | Oromia |
| • Awasa Lake | SNNPR |
| • Abaya Lake | SNNPR |
| • Chamo Lake | SNNPR |
| • Tana Lake | Amhara |
| • Abay Falls | Amhara |
| Hot Springs | |
| • Sodere | Oromia |
| • Wendo Genet | Oromia |
| Historical attractions | |
| • Hadar /prehistoric site/ | Afar |
| • Lalibella Rockhewn churches | Amhara |
| • Axum | Tigray |
| • Tigray rock hewn churches | Tigray |
| • Gonder castle | Amhara |
| • Harari town(Jegole) | Harari |
| • Tiya Natural Stones | SNNPR |
| • Tana Monastries | Amhara |

Source: Ethiopia Tourism Commission, 2001, response to questionnaire.

Annex 13:

**INSTITUTIONS THAT RESPONDED TO QUESTIONNAIRES
IN THE PREPARATION OF THIS REPORT**

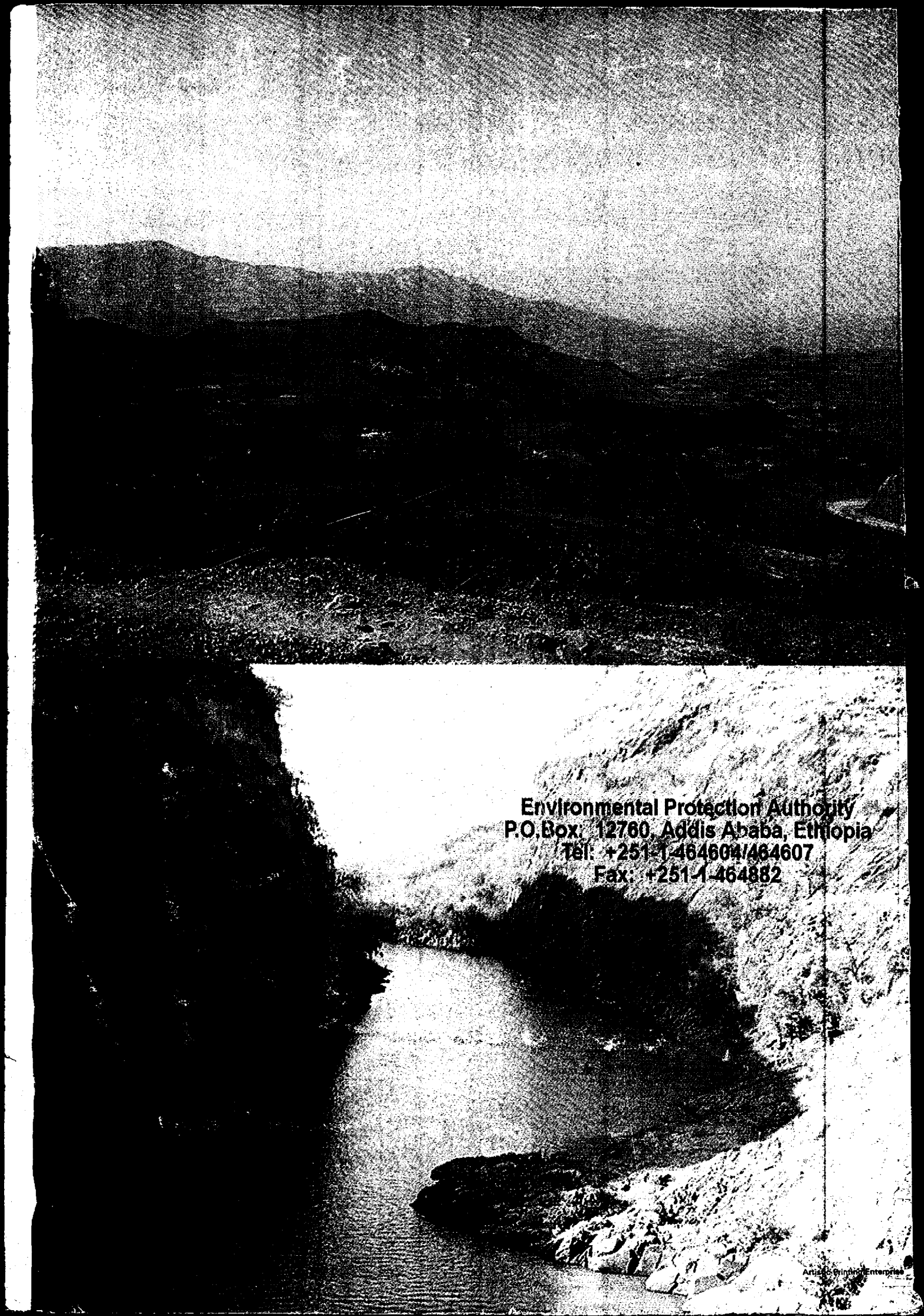
Disaster Prevention and Preparedness Commission
Ethio-Djibouti Railway Company
Ethiopian Agricultural Research Organisation
Ethiopian Civil Aviation Authority
Ethiopian Customs Authority
Ethiopian Electric Power Corporation
Ethiopian Investment Authority
Ethiopian Mapping Agency
Ethiopian Petroleum Organisation
Ethiopian Roads Authority
Ethiopian Rural Energy Development & Promotion Center
Ethiopian Science and Technology Commission
Ethiopian Wildlife Conservation Organisation
Institute of Biodiversity Conservation and Research
Ministry of Agriculture
Ministry of Education
Ministry of Health
Ministry of Mines
Ministry of Transport and Communication
Ministry of Water Resources
Ministry of Works and Urban Development
National Fertilizer Inputs Agency
National Meteorological Services Agency
Natural Heritage Study and Conservation Organisation
Radiation Protection Authority
Tourism Commission

ANNEXES

Annex 14:

LIST OF PERSONS WHO PARTICIPATED IN THE PREPARATION OF THE STATE OF THE ENVIRONMENT REPORT

| No | Name | Profession | Place of work & Job Title |
|----|-----------------------|-----------------------------|---|
| 1 | Ato Sitotaw Birhanu | Resource Management | Head, Planning & Programming Service |
| 2 | Ato Girma Mikru | Economist | A/head, Department of Economic and Social Affairs |
| 3 | Ato Getachew Eshete | Forester | Head, Ecosystem Department |
| 4 | Ato Tesfaye W/yes | GIS Specialist | Head, Information Center |
| 5 | Ato G/Selasie G/Amlak | Agricultural Economist | Head, Regional affairs coordination Service |
| 6 | Ato Ababau Anage | Forester | Biodiversity team leader, Ecosystem Department |
| 7 | Ato Yigzaw Ayalew | Geographer | Team Leader, Planning and Programming Service |
| 8 | Ato Tamiru Sebsibe | Natural Resource Management | Expert, Planning and Programming Service |
| 9 | Ato Solomon Kebede | Biologist | Head, Impact Assessment Service |
| 10 | Ato Shimelis Fekadu | Human Ecologist | Expert, Planning and Programming Service |
| 11 | Ato Birhanu Solomon | Geographer | Expert, Environmental Education Department |
| 12 | Ato Amanuel Malifu | Economist | Team Leader, Pollution Control Department |
| 13 | Ato Belete Geda | Biologist | Expert, Ecosystem Department |
| 14 | Ato Birhanu Tekaligne | Biologist | Expert, Ecosystem Department |
| 15 | Ato Ahmed Negash | Cartographer | Expert, Environmental Information Center |
| 16 | Ato Mekuria Asfaw | Economist | Expert, Planning and Programming Service |
| 17 | W/O Tsedale Waktola | Agronomist/ Soils/ | Head, Womens Affairs Department |
| 18 | W/t Helen Asfaw | Secretary | Secretary, Planning and Programming Service |
| 19 | W/t Estegenet Dagna | Secretary | Secretary, Planning and Programming Service |
| 20 | W/t Meaza Bekele | Secretary | Secretary, Office of the Director General |



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