Ethiopia Environment Outlook

Environment for Development

EPA

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INTRODUCTION

Background to the Report

The Federal Government of Ethiopia has formulated a national plan for the realization of accelerated and sustained economic development to end poverty in the country. In respect to this plan, it is apparent that environmental resources of the country would play a vital role during the implementation. Therefore, it is important to appreciate the contribution of environmental assets to socio economic development and human well-being. To understand the real value of the environmental assets, it is also important to critically analyze the linkages between environmental goods and services, development and human-well being and produce periodical reports on the State of the Environment.

The Federal Environmental Protection Authority is mandated to prepare and disseminate periodic state of the environment report of the country by the Proclamation No. 295/2002. The EPA has prepared the first State of the Environment Report in 2003. This report, which is named. "*The Ethiopia Environment Outlook*" is the second attempt to produce the State of Environment Report in the country.

The theme of this Report is*" Environment for Development"*. Hence, the report profiles the countries environmental resources as an asset for socio-economic development leading to improved livelihood conditions in the country. It also tries to assess the stress or pressures exerted on environmental assets due to social, economic, cultural and technological drivers and the impacts, as well as the measures taken by different bodies to improve conditions of the environmental resource base of the country.

Through the Ethiopia Environment Outlook report it is intended to convey some key messages, those assumed to be very critical for ensuring a better environment for both social and economic development in the country.

The main objective of this report is to provide information on what is happening to the Ethiopia environmental assets, why it is happening, what responsive measures have been taken by different bodies and what the future conditions of the environmental assets would look like in the country. Hence, the report would inform different target groups including policy makers, researchers and the public at large. It is also believed that the Ethiopia Environment Outlook report would initiate dialogue and policy debates between policy makers and others to put in place appropriate policies for the betterment and sustained utilization of environmental resources in Ethiopia.

This Ethiopia Environmental Outlook provides a comprehensive assessment of environmental state-and-trend, and the implications of this for human well-being and development.

In the preparation of this report , an attempt is made to adopt the Drivers, Pressure, State, Impact and Response (DPSIR) Framework methodology, which has been widely used by many countries in the world for environmental reporting purpose.

The process of preparing this report was participatory and consultative. The over all process was coordinated by the Environmental Information Center of the Federal Environmental Protection Authority. A number of qualified national experts, in social, cultural and environmental disciplines were involved in the preparation of the report.

Continuous consultations in the form of peer reviews and meetings were done during the report production process and the final report was reviewed and endorsed by a larger group, which constitutes regional representatives, federal government institutions, academia, research organizations, NGOs and the private sector.

The Ethiopia Environment Outlook report consists of six chapters. The first chapter highlights the context of people and livelihood as well as sustainable development in brief. Chapter Two reviews the state-and-trends on the country's environment assets based on each thematic area (Atmosphere, Land, Forests and Woodlands, Biodiversity and Freshwater). Cross cutting and emerging issues are discussed in Chapter Three, while chapter Four presents the possible future (the Outlook) of the country's environment based on the assumptions of different scenarios. Chapter Five presents the issue of policy and strengthening implementation status within the country, and chapter 6 provides a conclusive summary and recommendation for future direction towards achieving the country's hope for ending poverty.

In general, the report highlights important policy relevant issues as information to guide future policy formulation to achieve sustainable development by implementing the different plans and programs of the national priorities as well as the regional and global plans of action in the context of environment and sustainable development.

Country Overview

Ethiopia is located between 33^0 and 48^0 East Longitude, and 3^0 and 15^0 North Latitude, and has an area of 1.13 million Sq. Kilometers. The total projected population of the year 2006 is 75.07 million. Out of the total population 62.9 million is rural and 12.17 is urban. Ethiopia has a rugged topography featuring the vast Central Highlands separated from the Eastern Highlands by the Great Rift Valley running from the north–east to the southern part of the country.

Fig. 0.1 Administrative Map of Ethiopia

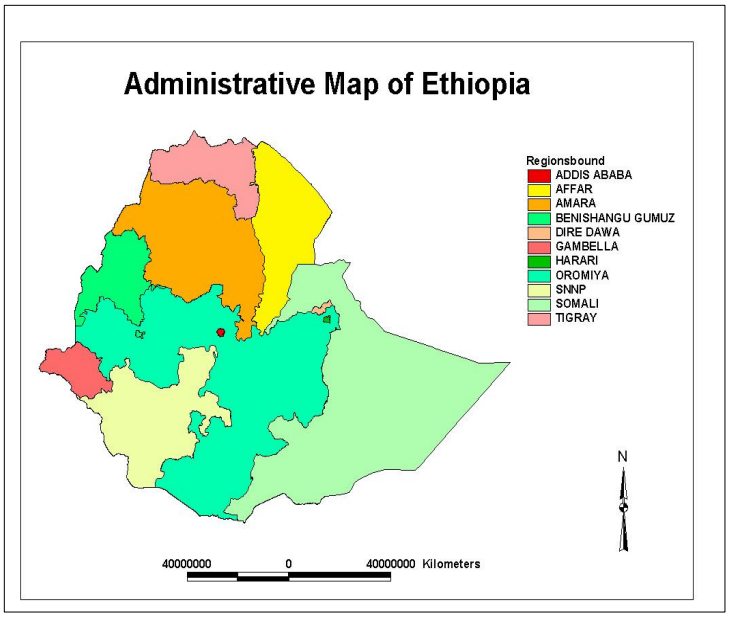
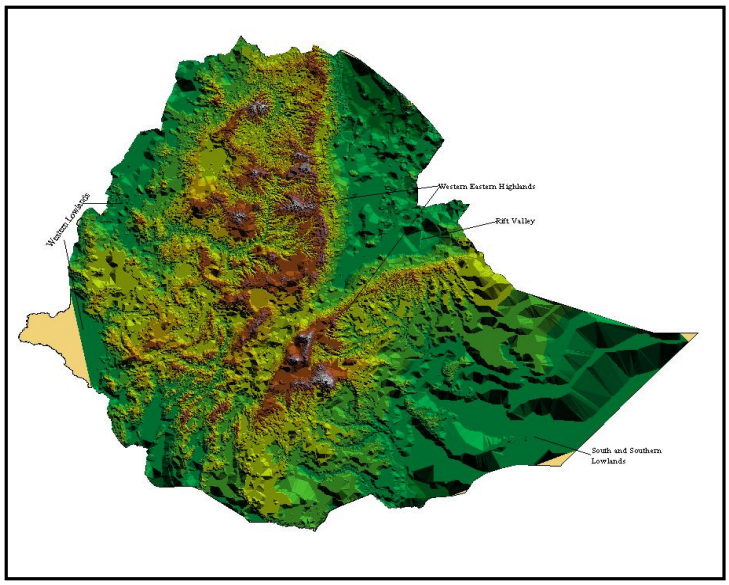


Figure 0.2. Relief Map of Ethiopia



The altitude ranges from the highest peak of about 4,620 meters above sea level at Ras Dejen in the north, and down to 110 meters below sea level at the Danakil depression in the North East. About 45% of the country is highlands with an altitude of 1500 meters above sea level, and 55 % is lowlands with an altitude of 1500 meters below sea level.

Heritages

Socio-cultural heritages

There are more than 80 languages and about 200 dialects spoken in Ethiopia. More than one half of the languages are spoken in the Southern Nations, Nationalities, and Peoples Regional Sate (SNNPRS).

Ethiopia is also known for its diverse culture and religion. Christianity and Islam religions are dominant religions followed by the majority of the Ethiopian people.

Archeological Heritages

The geological formation and characteristic situation of the Ethiopian rift valley has its own contribution to the archeological history of Ethiopia. The rift valley region is the home of various lakes and rivers, and varieties of plants and animals. In addition, it is a known site for patesnthological collections. As a result, various research projects in archeology, paleontology, palo anthropology, ethnology and related fileds of study are undergoing in different parts of the country.

Fig 0.3 Ethiopian Coffee ceremony.

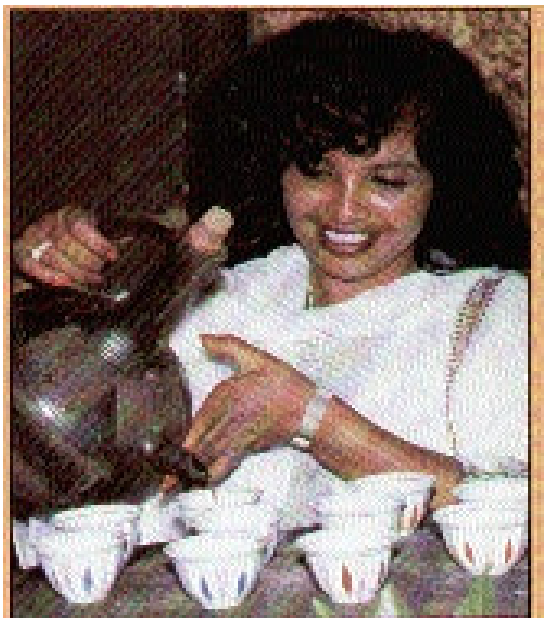


Fig .0.4 Hamer girls (SNNPRS)

Some of the major archeological sites include:

- The lower valley of the Awash, which is located in the Afar National Regional State, covers a large area including Hadar, where the most important partial skeleton known as “Lucy” (3.2 million years old) was discovered. This site was included in UNESCO’s World Heritage List in September 1980.

- In addition to Lucy, there are also various exciting findings such as Ramidus 4.4 million years old, Ardipithecus Ramidus Kadaba 5.8 million years old, and Australopithecus Garahi 2.5 million years old. These have contributed to the advancement of research in the origin of humankind.
- The pre-historic site of the lower valley of the Omo, which was discovered in 1902 and reg-

istered in the World Heritage List on 5 September, 1980.

- The Tiya site, which is about 90 k.m south of the capital, Addis Ababa a contains about 36 monuments. Out of these 32 are caved stelae having symbols inscribed on them. Tiya is one of the 160 archeological sites discovered so far in SNNPRS. The site was registered in the world heritage list in September 1980.
- The Melka Kuntre pre-historic site located in upper Awash Valley, and the Konso-Gardulla paleoantrhopological sites in the SNNPRS are also some of the important archeological sites.
- Axum town and its environs are also one of the known archeological sites in Ethiopia.

Fig. 0.5 The Axum Obelisk

Fig. 0.6 Fasiladas's Castle, Gonder

Historical Heritages

Ethiopia is endowed with rich historical heritages. Some of the many historic heritages include:

- Axum, which is believed to be found in the second century BC was once the capital of ancient Ethiopia. Axum's civilizations is regarded as one of the world's four major civilizations, and the site was registered as one of UNESCO's world heritage site in 1980.

- The Rock-Hewn Churches of Lalibela, are the most impressive collections of Ethiopia's very many caved churches. The ten monolithic churches, hewn out of red volcanic rock are named after the noble king Lalibela in 1181. The Rock– Hewn Churches of Lalibela are registered in the World Heritage List on 8 September, 1978.

- The Fassil Ghinbb, which means the "premise of king Fasiledes Castle", is found in the Gondar town of the Amhara Region. The Royal Headquarters (Fassil Ghibbi/ that is surrounded by 900 meter wall including 12 gates and bridges. Spanning the encircling roads there are several buildings which were constructed between the beginning of the 17th and the middle of the 18th century. Fassil Ghinbb is registered as World heritages since 1979.

- The Walled city of Harar and its gates are among the ancient cites of Ethiopia. The

wall is built to protect the town from attack or invasion. It has 5 well designed and strong gates. The wall has a height of 3.7 meters, thickness of 90 cm and length of 3500 meters. The Walled City of Harar has been recently registered by UNESCO as World Heritage.

- There are also many other natural and historical heritages such as the Blue Nile Falls-known as Tisisat, Lake Tana, Semien Mountains National park, Bale Mountain National Park, Sof-Omer Cave, the Mosque of Negashi, Jimma Aba-Jiffar Palace, and Monasteries in many part of the ountry. Moreover, Ethiopia has a number of national parks, waterfalls, sanctuaries, wildlife reserves and controlled hunting areas.

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C H A P T E R O N E

Sustainable Development and Livelihoods

Sustainable Development and Livelihoods

Development

Development is a broad concept that has many compounds with it. Development is a change in society's economic, cultural, institutional and political life. A change in one aspect of these development ingredients also does not make any difference unless supported by the others.

Development has to deal with allocation of available resources, which should not be misused or corrupted; and should consider the economic, social, political and institutional situations of a particular country.

In its broadest sense, therefore, development could be perceived as a process of improving the quality of life. The three equally important aspects of development are:

1. Raising peoples living standard; their income and consumption levels of food, medical services, education, etc. through relevant economic growth processes.
2. Creating conditions conducive to the growth of peoples self-stream through the establishment of social, political and economic systems and institutions that promote human dignity and respect; and
3. Increasing people's freedom by enlarging the range of their choice variables, as by increasing varieties of consumer goods and services. (Traders and Smith, 2003: 292)

Sustainability

The ultimate targets of every development endeavours shall be to bring about sustainability. Basically sustainability refers to meeting the needs of the present without compromising the needs of future generations. " (Traders and Smith, 2003, 464-465)

Livelihood

Livelihood comprises capabilities, assets and activities required for a means of living (Chamber and Conway 1988). A livelihood is sustainable when it can cope with and recover from the stress and shocks and maintain or enhance its capacities and assets both now and in the future without undermining the natural resource base.

Ensuring sustainable livelihood attempts to take a holistic perspective in determining problems and opportunities. This holistic perspective involves taking into account ecological, social, economic, political, historical and demographic trends that influence the livelihood of a given population and the risks to which they are exposed.

Realizing poverty eradication is, therefore, a mutually reinforcing imperative and has to be implemented in an integrated way in development initiatives. Such initiatives should be supported by information about the country's environment. The government of Ethiopia is striving to provide adequate services and ensure security, and adequately functioning infrastructure, and employment as part of ensuring a better livelihood for its population.

Environmental Sustainability

Environmental resources are the foundation for social and economic development in Ethiopia. They are the sources of the goods and services needed for such development and economic growth. The productivity and sustainability of natural capital is heavily dependent on the way that humans manage their asset, and this in turn can affect the availability , stocks, and functioning of the remaining assets; putting livelihood at

risk. In Ethiopia, mismanagement of natural resources, coupled with their underutilization has so far undermined their contribution to the country's overall development.

On the contrary, Environmental degradation in Ethiopia threatens physical and economic survival. It reduces the environment's ability to produce biomass for food, feed and household energy. It undermines prospects for fighting poverty and achieving sustainable development. On the other hand, poor people are often blamed for environmental degradation. However, where poor communities are degrading the environment through unsustainable practices, it is often the case that they have been denied the opportunity to access goods and services that promote their use of resources in sustainable ways. Various economic, legal, ethnic, or other barriers have contributed to this end. Hence, removing barriers that contribute to the unsustainable development requires ensuring good governance and economic leadership.

Demographic Change

Population is one of the driving forces for economic development and it is one of the influencing factors for the degradations of environmental assets. As of 2006, Ethiopia's population is estimated to be about 75.07 million, of which the male and female population constitutes nearly equal proportion. Out of the total population 62.9 million is rural and 12.17 is urban. The country's total fertility rate (TFR) was estimated at 7.7 children per woman in 1984 and 6.74 in 1994 censuses and according to the 2000 Ethiopian Demographic and Health Survey (DHS), the TFR for the country was estimated at 5.9 children per woman.

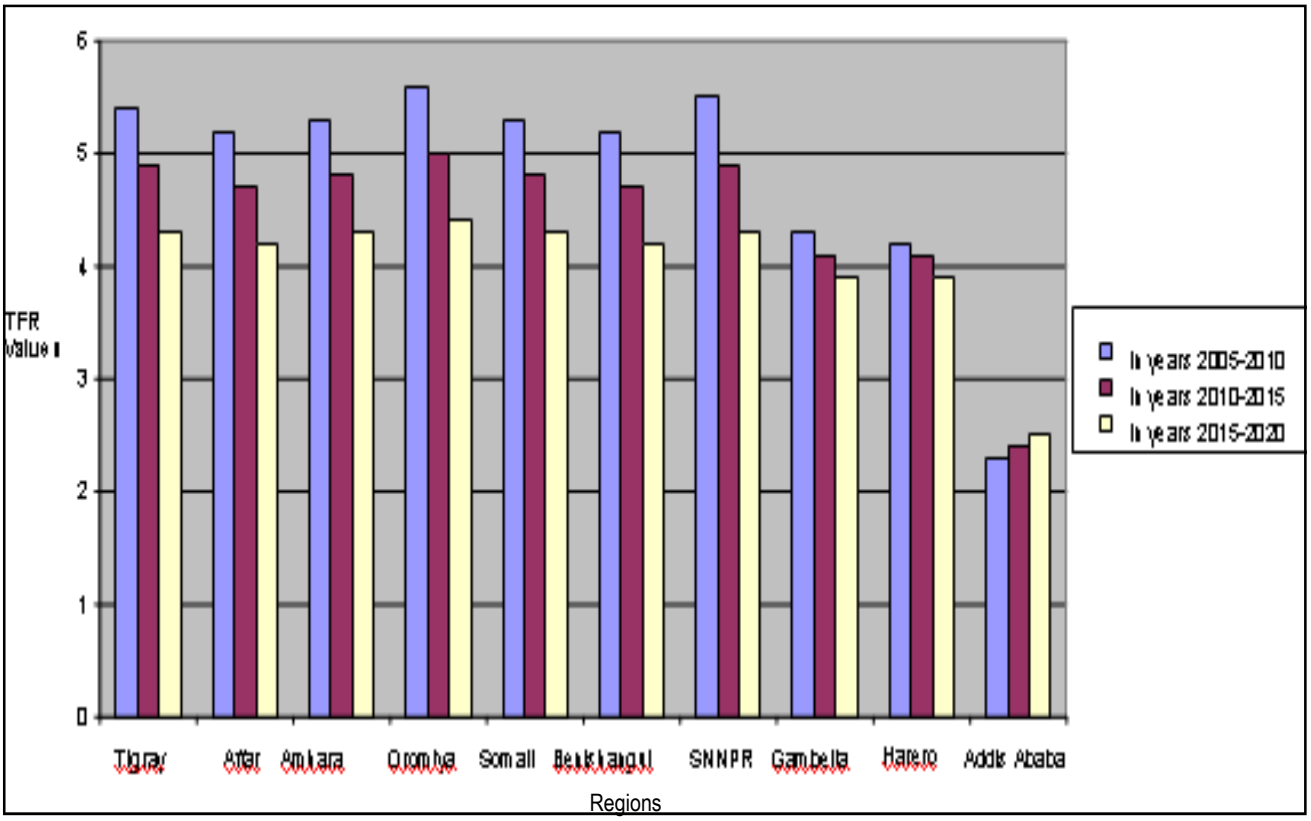
Social and economic backgrounds influence the TFR of a given country. Both the results of the censuses and the DHS survey revealed that there is variation among regions, differentials by place of residence, level of education, and type of occupation. The urban population than the rural; the educated than the illiterate have a lower TFR. The Central Statistics Agency (CSA) has estimated the TFR to decline to 3.32 by 2030 and the UN publication indicates the same decline in the coming twenty years.

The mortality rates of the country are among the highest in the world. According to the 2000 DHS of Ethiopia, the infant mortality stands at 112.9 deaths per 1,000 live births and the under-five mortality is 187.8. The CSA has produced an estimate of the mortality indicators for the coming years with a declining trend. According to this projection the infant mortality will be 61.0 per thousand for the period 2015-20 and 42.4 for the period 2025-30. Similarly the under five mortality will decline from 140 at the end of 2005 to 52 per thousand by the turn of 2030.

The population of the country is expected to increase. According to the CSA's medium variant projection, the estimated population, which is 75.07 million in 2006, will increase to 83.48 million by 2010 and to 94.52 million by 2015, and adding another 35 million the total population will be 129.05 million by the year 2030. Currently Ethiopia is the second populous country in Africa. The large regions like Ormiya and Amhara will add millions of people to their current population in the coming decades. For instance the current 26.55 million population of Oromiya will increase to 33.64 million by 2015, and that of Amhara region will add a population equivalent to the current population of Tigray, to reach 23.91 million from the current 19.12 million. The other large region, SNNPR will make a significant change in population size as it is expected to host 25.58 million people by 2030 from the current 14.90 million. The population of major urban centres including Addis Ababa and Dire Dawa is expected to grow at an alarming rate.

The current population growth rate stands at 2.73 percent per annum. In the coming decades the growth rate is expected to decline to 1.85 percent in the period 2025-30.

Fig.1.1 Projected Total Fertility Rates in the Regional States



Source: CSA 1999

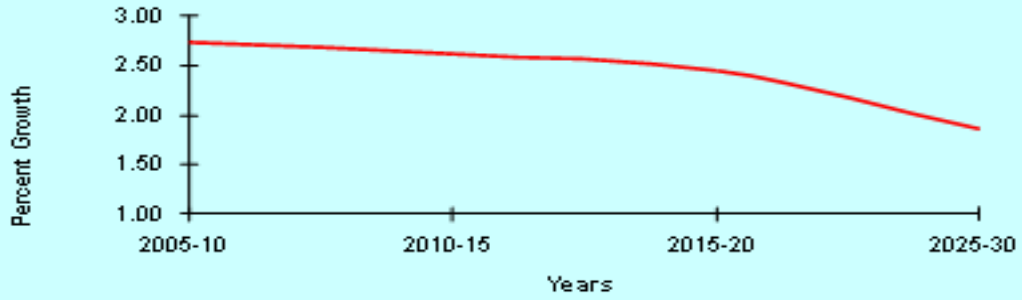
However, because of the population momentum, this does not mean that a down fall in the growth rate will entail an immediate decline in absolute population increment.

Whatever aggressive intervention programs materialized, because of the nature of the gradual effects of fertility and mortality on population growth, the endeavour to halt or reduce the growth will not be witnessed before a couple of decades to come (see Fig. 1.2). The composition of the age structure (45% of the population currently being under age 15, coupled with other socio-economic proxy determinants such as prevailing low level of literacy, early marriage, lack of knowledge and use of contraceptives, low economy, religious devotion, cultural and ethnic setups, are the factors that play major role to make the population increase with unparalleled increment to the economy, for a couple of decades to come.

In a developing country like Ethiopia the high rate of population growth might be taken as a single most important factor associated with social and economic development. The dissonance of the population growth with that of the economy, obviously, will endanger the livelihood of the people, aggravate environmental degradation and impede economic growth.

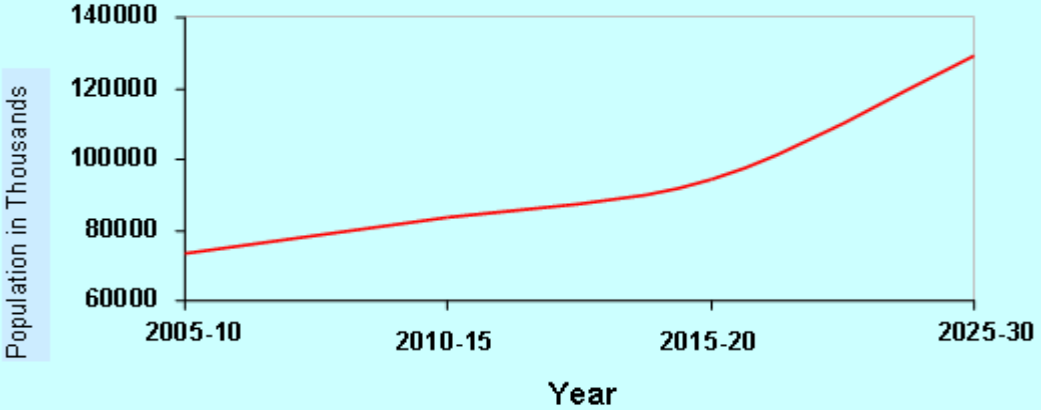
The increase in the rural population results in the increase of persons residing per hectare. The more dense a rural area becomes the less the share of households of cultivable and/or grazing land. In previous times farmers tried to fulfill the ever growing food demand by clearing new land for cultivation. In some parts of the highlands of the country this exercise is now coming to an end in a few years time, if not now. In fact it is evidenced that in the high-lands of Southern Ethiopia, average farmland per household has decreased to less than a quarter of a hectare. Currently there are four Woredas (the lowest administrative tire) in Oromiya Region and four-

Fig. 1.2 Population Growth



Source: CSA, 1999

Fig.1.3 Projected Population of Ethiopia



Source: CSA, 1999

teen in the SNNPR with a gross population density of well over 400 persons per square kilometer.

In the year 2000, this figure was two and eleven, respectively. According to Lester R. Brown and his colleagues of the World Watch Institute, Ethiopia will be one of the three countries, which include Pakistan and Nigeria having showed 38-56 percent loss of per capita grain area between1950-1998, should expect further loss of 55-63 percent by 2050. This shrink in grain area per person will obviously entail the loss of capacity to feed themselves.

The other feature of the population pressure in the rural areas of Ethiopia, where the economy highly depends on traditional farming, is degradation of cropland, which reduces productivity. In most places, due to the scarcity of fertile farmlands, farmers are now forced to plow ecologically vulnerable areas such as hillsides. Overfarming and landlessness are also the consequences of population pressure in Ethiopia.

The total population living in urban areas of the country has also increased from 7.58 million in 1995 to 11.6 million in 2005 and is expected to increase to 17.48 million in 2015.

Although the urbanisation level of the country is very low compared to many African States (the level for sub- Saharan Africa is 26 percent), the growth of the urban centres of the country needs a serious planning for the future.

Table 1.1 Projected Total & UrbanTotal and Urban Population in thousands (Medium Variant)

	2005		2010		2015		2030	
	Total	**%Urban**	**Total**	**Urban**	**Total**	**Urban**	**Total**	**Urban**
Ethiopia	73044	16.0	83483	17.2	94526	18.5	129059	23.1
Region								
Tigray	4223	18.5	4802	20.3	5423	22.3	7396	29.6
Affar	1359	9.2	1510	10.1	1663	11.1	2131	14.7
Amhara	18626	11.3	21182	12.4	23917	13.7	32735	18.1
Oromiya	25817	13.0	29612	14.3	33549	15.7	46224	20.8
Somali	4218	16.7	4798	18.3	5412	20.1	7258	26.6
Benishangul	610	9.7	689	10.7	773	11.7	1040	15.5
SNNPR	14490	8.4	16602	9.2	18798	10.2	416	29.9
Gambella	240	18.7	271	20.5	305	22.5	416	29.9
Harar	190	62.0	222	63.5	257	65.0	379	69.5
Addis Ababa	2887	100.0	3328	100.0	3792	100.0	5087	100.0
Dire Dawa	384	74.0	458	76.0	537	78.0	812	84.0

Source: CSA, 1999

Population increase in most of the urban centers of Ethiopia is mostly due to rural to urban migration and migration from smaller towns to the relatively big once. Population increase of urban areas means overcrowding , increasing demand for jobs, growing demand for housing, and utilities such as electricity, fresh water, sanitation facilities (toilet, waste disposal services...etc.)

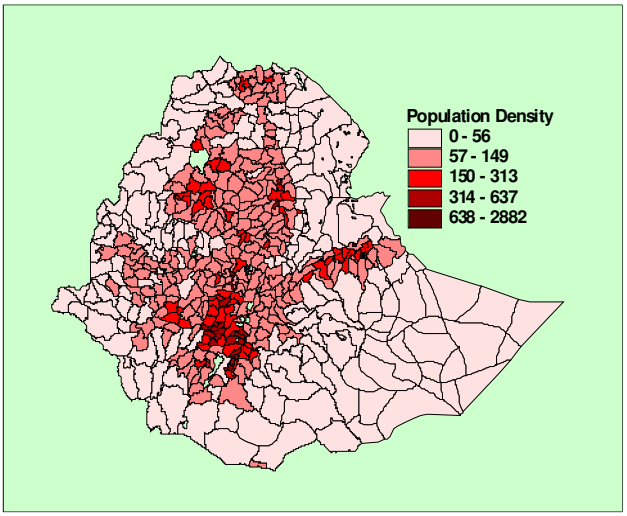
Unless significant progress is made in the implementation of the population policy and its strategies, the pace of environmental degradation and poverty will remain a challenge due to the prevailing population pressure.

Moreover, this increasing population should be matched with an equally high or even higher rate of economic development, and sustained economic growth, based on equity, enhancement of the livelihood of the poor, protection of the environment, and slower population growth.

The Economy

The Ethiopian economy is heavily dependent on rain–fed agriculture. Thus, the economy is vulnerable to climatic conditions, notably recurrent drought, with some regions being particularly drought-prone.

Fig 1.4 Population Density by Wereda



Source: Ministry of Finance & Economic Development

Gross Domestic Product (GDP) is one of the indicators of a country state of the economy. GDP grew at an annual average rate of close to 5 percent during 1992/93-2000/01, with sectoral growth rates of 2.5 percent for agriculture, 5.3 percent for industry, 6.3 percent for distributive services (i.e. transport and communication, trade and tourism), and 8.2 percent for "other" services.

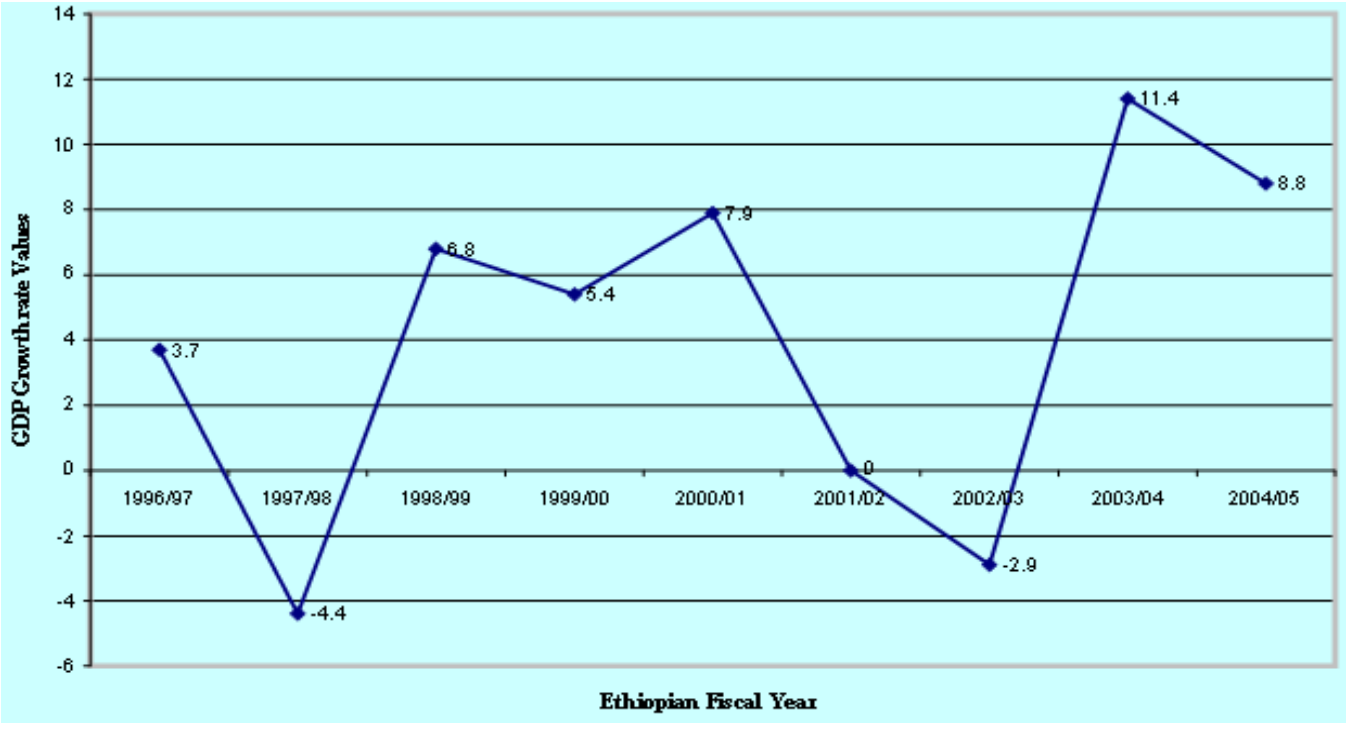
The GDP growth rate declined in the year 2002/2003 to -.29 percent due to the drought crises. However, the economy of the country recovered from the drought crises of 2002/2003 and registered an annual growth rate of 11.4 percent in 2003/2004 and 8.8 percent in 2004/2005.

Most of the statistical reports indicate that GDP has shown an increase from the mid 90s to date. The main contributor to this economic growth is the agricultural sector. The economic growth in GDP within the agricultural sector in 1988/89 and 1999/2000 was 2.5 and this growth has reached in year 2004/2005. Although the economic growth thus has direct relation to the exploitation of environmental resources, GDP 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. In reality increase in agricultural production and productivity is associated with the use of environmental assets such as expansion into uncultivated lands and supported by agricultural inputs. Hence, it is apparent that GDP growth can be sustained with sustainable use and management of environmental resources.

Measures towards achieving Sustainable Development Since 1992

Since the last two decades the government of Ethiopia has initiated different strategies, policies, laws and institutional arrangements to bring about an improved livelihood to the society. Following the Brundtland Commission's Report

Fig1.5 Trend in Percent GDP Growth Rate—at Constant Factor Cost



Source: Ministry of Finance & Economic Development

there has been a change of development thinking within the country. Since the 1992 United Nations Conference on Environment and Development in Rio dejanero Ethiopia is gradually engaged in major undertakings to ensure sustainable development. It has developed the first comprehensive national conservation strategy and environment policy. Following the national conservation strategy, each regional state has also developed its own respective regional conservation strategy.

This strategy comprises of 10 sectoral and 10 cross- sectoral issues (see chapter 5). Various legislative and institutional measures have also been taken. Proclamations on pollution control and environmental impact assessment have been enacted. Proclamation on the establishment of environmental organs, the instrument that has reestablished the federal environmental protection authority and stipulated the requirement for the establishment of the regional environmental organs and environment unit in major sectoral agencies has also been enacted. Ethiopia is active participant in many of the international environmental conventions. Ethiopia is also a party to many regional and multilateral environmental agreements. These include the UNCBD, UNCCD, UNFCCC, Cartagena Protocol on Biosafety, Kyoto Protocol, Basel Convention, Rotterdam Convention on PIC, Vienna Convention on the Protection of the Ozone layer, Stockholm Convention on POPs, Bamako Convention, etc.

Various sustainable development and environmental action plans and programs have been developed and being implemented. Some of these include:

- Plan for Accelerated Sustainable Development to End Poverty;
- National Action Plan to Combat Desertification,
- Biodiversity Strategy and Action Plan;
- National Action Plan for Implementation of the Stockholm Convention on POPs;
- National Adaptation Plan of Action to the Effect of Climate Change(Draft);
- Synergy Document on the National Implementation of the Rio Conventions;
- Nile Basin Initiatives;
- National Action Plan for the Beijing Platform of Action;
- Endorsement of the MDGs;
- Endorsement the NEPAD Environmental Action Plan.

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C H A P T E R T W O

State and Trend

This section discusses the state and trends of the environment in Ethiopia. The thematic areas explored in this section include: Atmosphere, Land , Forests and woodlands, Fresh Water and Bio-diversity. In each case status of existing situation, issues, opportunities, threats, and response are discussed, and conclusion and recommendations forwarded.

ATMOSPHERE

Climate

State and trend

Ethiopia is rich in its climate resources. These enable the country to have vast biodiversity resources. Besides this the country has great opportunity in the agricultural sector. Using its various agro climatic zones, the country can produce different types of crops as well as other agricultural products. Its climatic resource is also a source of tourism attractions.

The low level of air pollution problem is also another advantage to the country. With this respect, the country has great prospect to keep its air quality to a good standard and also contribute its part in the global efforts to reduce air pollution problem.

The south-north movement of the Inter Tropical Convergence Zone (ITCZ) largely controls Ethiopia's weather system. Besides the ITCZ, the rugged topography of the country modifies the local weather system.(figure 2.1). The ITCZ normally makes a zone of rising, moist air and heavy rainfall.

The amount and pattern of rainfall varies across the country. The average annual rainfall in the lowland areas in the south, southeast, east, and north eastern is below 500 mm, whereas some areas of the highland receive over 2000 mm (figure 2.2). In addition to this spatial variability, rainfall is highly variable over seasonal and inter-annual time scales (see figure 2.3a). In most areas of the country, there are two rainy seasons—the short spring rains (February-May) known as Belg, and the main rainy season (June-September) known as Kiremt. In between the rainy

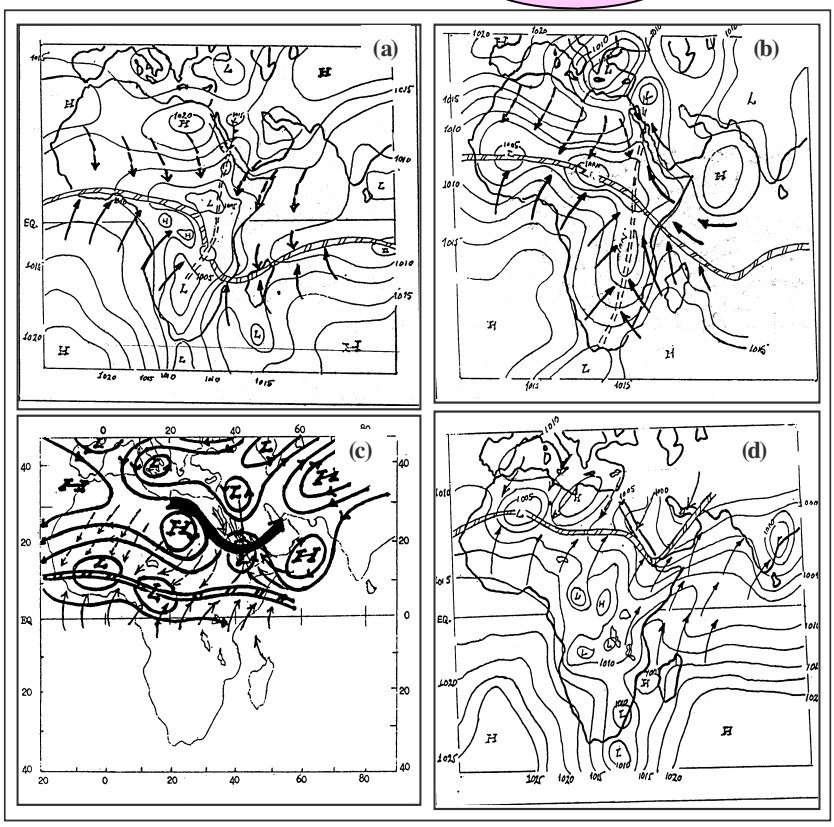


Figure 2.1.1 Movement of ITCZ

seasons there is dry spell known as Bega. In the western part of the country, however, there is only one rainfall peak during the year.

Temperatures are also very much modified by the varied topography of the country. Mean annual temperature of the country varies between 10^0C and 35^0C. The minimum mean temperature is manifested over the northwest, central and southeast highlands of the country and the maximum occurs over Northeastern lowland edges, which is part of the Great Rift Valley. Daily maximum temperature ranges between 37^0C over the lowlands of Northeast (Affar Triangle) and Southeast (Ogaden) and 15^0c over

Fig. 2.1.2a and 2.1.2 b Annual Mean Rainfall (in mm) and Daily Mean Temperature (^{0}C)

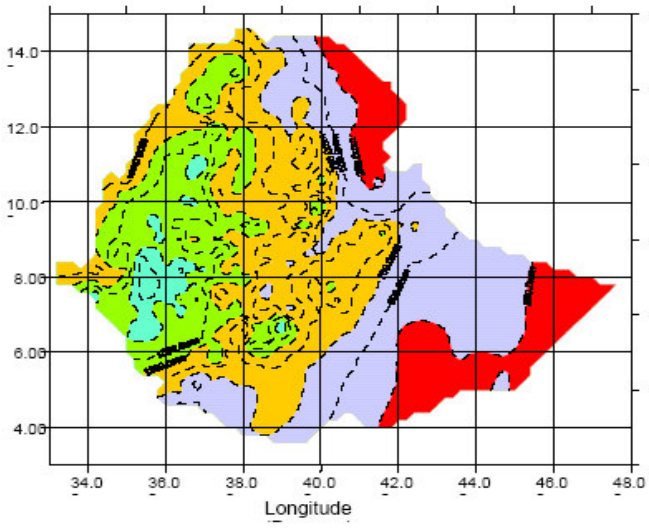


Figure 2.4 Cumulative Mean Annual Rainfall (mm)

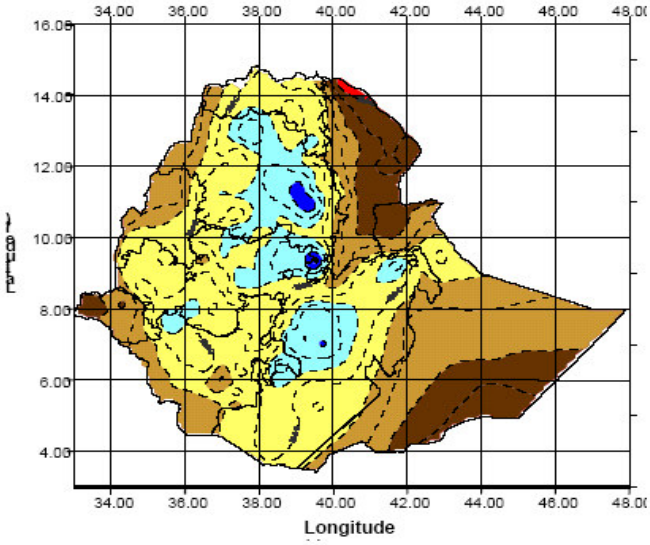


Figure 2.5 Daily Mean Temperature for the Year (ºC)

Source: National Meteorological Service Agency

the highlands of central and northern Ethiopia (Figure 2.3b). Generally, in most parts of the country, the hottest months are from March to May and the coldest periods occur in July and August.

Over the highlands, particularly between November and January the temperature get its lowest value and reaches frost point.

In terms of agro climatic zones, Ethiopia has various agro climatic zones. Based on the water balance concept and the length of the growing season (including onset dates) at certain probability levels, the National Meteorological Agency identified three distinct agro-climatic zones. These are areas without a significant growing period (N), areas with a single growing period (S) and areas with a double growing period (D) (See figure 14).

Crop productions of the country are based on *Kiremt* and *Belg* rainfalls and it ranges from 90-95% for *Kiremt* season and 5-10% for *Belg* season. However, in the south and southwestern parts, *Belg* production raise to 25-60% of the food production and it is also the major rainy season for southeastern pastoral lowland areas.

Climate variability refers to time scales variability ranging from months to decades, falling between the extremes of daily weather and the long -term trends associated with climate change.

The climate of Ethiopia is both varied and varying; *varied*, because it ranges from arid tropical climates to sub-tropical Mediterranean-type, and *varying* because all these climates exhibit differing degrees of spatial and temporal variability, particularly with regard to rainfall. Understanding and predicting the inter-annual, inter-decadal, and multi-decadal variations in climate is very difficult.

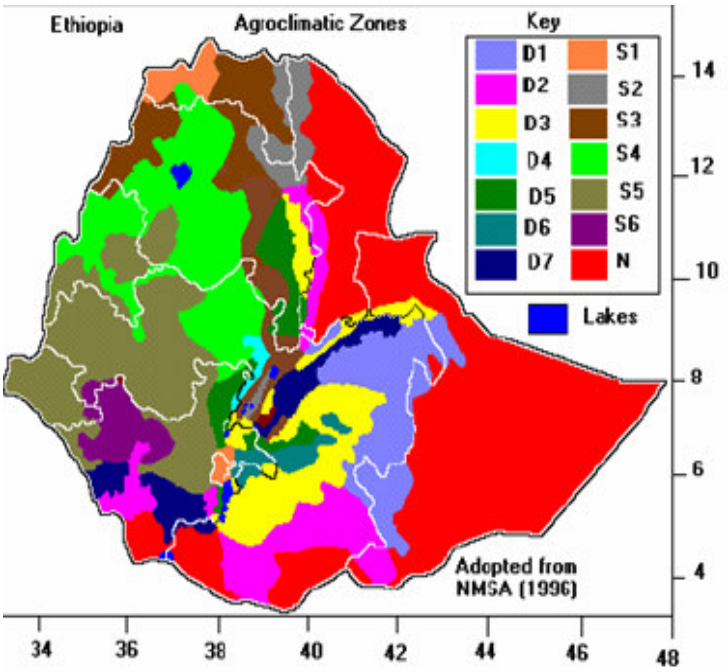
High inter-annual variability in rainfall is characteristic of both the *Belg* and the *Kiremt,* though the *Belg* rains tend to be less consistent. During periods of drought, the states and relationships of these atmospheric systems change.

For instance, a variation for a long-term annual average rainfall (for data years raging from 1 to 20) is observed in the case of some selected synoptic stations distributed in different parts of the country. Fig 2.1.4. depicts the temporal variability annual rainfall amount of the selected synoptic stations.

Increasing greenhouse gas (GHG) accumulation Increasing greenhouse gas accumulation in the global atmosphere and increasing regional concentrations of aerosol particulates are now understood to have detectable effects on the global climate system.

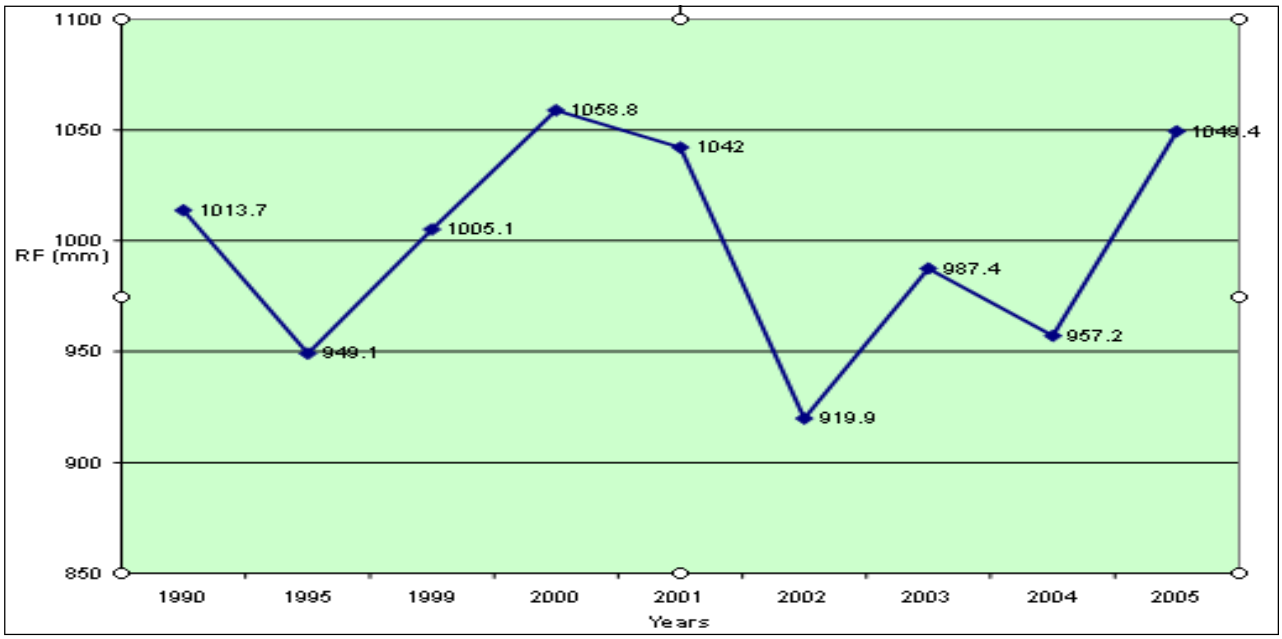
The contribution of Ethiopia to global and regional climate changes is apparently insignificant. National GHG inventory have been conducted under the condition to meet national reporting requirement of the UNFCCC. According to this assessment, the cumulative CO_2, CH_4 and N_2O emissions across the energy, industry, transport, commercial and residential sectors for the year 1994 resulted a total of about 48,003 Gg. CO_2-equivalents excluding CO_2 emissions/removals from the LUCF sector. For the same year, the per capital emission is estimated to be 0.8976 tonnes of CO_2-equivalents per year. The emission from agriculture sector contributes 80% of the total CO_2- equivalent emissions, and out of this, 80% of the total CO_2-equivalent emission is contributed by CH_4.

Fig. 2.1.3 Agro climatic zones of Ethiopia (NMSA



National Meteorological Agency

Fig. 2.1.4. Mean Annual Rainfall (mm) for 16 selected synoptic stations in Ethiopia



Source: National Meteorological Agency, 2006

There is a general increasing trend of GHG emissions in Ethiopia in the period 1990-1995. The relative comparison of GHG emissions for the years 1990 and 1995 shows that total (gross) CO_2 emissions (i.e. emissions from the Energy and Industrial Process sectors) have increased by about 24% while emissions of CH_4 and NO_X increased by 1% and 119% respectively. Aggregate emissions of GHGs in terms of CO_2 –equivalents has increased by 12%. The sink capacity of Ethiopia in the Land Use and Land Use Change and Forestry (LUCF) sector is also decreasing rapidly. It is noted that the rate of growth in GHG emissions varies across sectors and sub-sectors.

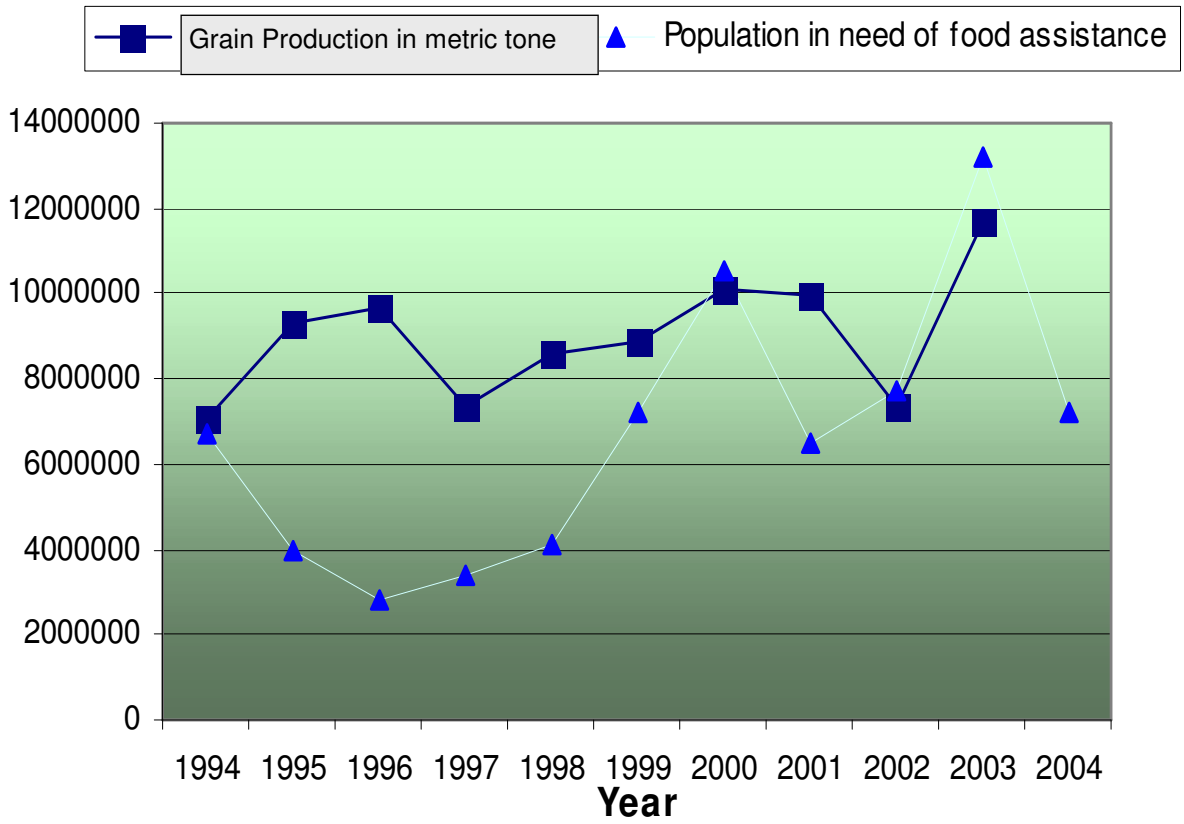
Impact and Threat

Impact of climate variability/ change

Shortage of precipitation and its space-time variability had led to recurrent and substantial shortfalls in agricultural production, which led to famine that claimed tens of thousands of human and animal lives . During drought years, the country suffered significant production deficit of about 20% in the agricultural sector, resulting in a significant decrease of total annual production, mainly involving cereals and pulses. The central highlands of Ethiopia, which play a great role in the country's agro economy, have suffered most, compared to other parts of the Ethiopian highlands.

As a consequence of increase in population, the expansion of agriculture onto marginal drylands, and unproductive and environmentally degrading agricultural and grazing practices, the direct dependency on rain-fed agriculture makes the nation exceptionally vulnerable to climate variability. The hazards and uncertainty associated with climate variability contribute significantly to both transitory and chronic poverty and food insecurity.

Fig. 2.1.5. Grain production and number of population in need of food assistance in 1997,1999 and 2002 drought years



Source : Disaster Prevention and Preparedness Agency,2005

Box 2.1.1 Average Drought/Famine occurrence frequency (after NMSA 1996) (*the record is supported by scientific observations)

Ethiopia has experienced droughts for hundreds of years, with major events (i.e., ones involving famine or documented suffering) including 1888-92, 1899-1900, 1920-22, 1933-34, 1973-74, 1983-84, 1987-88, 1990-91, and 1993-94. Mostly the occurrence of drought in Ethiopia is related to El Nino Southern Oscillation (ENSO) events.

It is not fully understood how ENSO events influence precipitation patterns in Ethiopia. It is thought that ENSO affects precipitation in Ethiopia by displacing and weakening the major rain bearing systems through its influence on the general circulation of the planetary atmosphere (Haile, 1988). Studies of drought events in Ethiopia indicate that the tropical easterly jet and Tibetan high become weakened, and the ITCZ both weakens and shifts to the southeast during times of drought. The physical connection between these changes in the atmospheric general circulation and ENSO is complicated and not well understood. Other factors, such as southern Atlantic and Indian sea-surface temperatures, also influence the rain-bearing systems in Ethiopia, and not all ENSO events correlate directly with drought in Ethiopia. The 1982-83 El Niño, for example, did not cause a particularly dry *Kiremt*, although one of the worst droughts in Ethiopian history occurred over 1983-84

Threat on Human Health

Most of Ethiopia's population is not supplied with safe drinking water. Even during the time of normal climate the population is exposed to waterborne diseases. And climate change exacerbates health crisis. It creates favorable condition for the occurrence of fever and malaria. It also creates fertile ground for breeding of diseases causing bacteria and viruses. The prevention or reduction of health problems caused by drought or climate change needs the assigning of additional budget and human resources. This can only be obtained by reducing the allocated budgets and human resource for education, health, road construction, water supply, environmental hygiene and other infrastructures development.

Therefore, the budget and time targeted for other development activities is shifted to mitigate sudden damages caused by climate change, and this weakens the development effort of the country.

Threat on Industry

Climate change or variability causes negative impacts on industrial firms which use natural resources as input. For example factories, which use a lot of water, like tanneries and textiles widely utilise human labour instead of technology. And problems caused by climate variability create water scarcity for such industries. This in turn leads to a decline in profitability, and a reduction of the workforces.

On the other hand, a decrease of rainwater or increase in evaporation brings negative effects on water requirement for hydropower generation. This causes different problems ranging from disturbing daily livelihood up to closure of a firm.

Threat on Farming

A frequent variability of the rainy season and air warming causes negative impact on the agriculture sector. The beginning and ending times of rainy and dry seasons shift due to climate change; and this would decrease agricultural production. It also interrupts the sustainability of irrigation based agricultural activities. And this would result in the occurrence of food shortage. The natural resource base, which is crucial for the agricultural sector would be affected. The agricultural economic sector is the leading economic sector and embraces the largest workforce of the country.

Threat on Rangelands

Pastoralists move from place to place, seeking fodder and water for their herds. The pastoralists believe that the movement would give chance for the recovery of abandoned rangeland after a period of time. However, the rangeland may not recover as believed because of seasonal shift due to climate change. And as a result both human beings and animals will be affected.

The effect of climate change is not only limited to the shortage of fodder supply, but also aggravates animal diseases. As a result of climate change, the quantity of product would decrease, the resource will be endangered and the market value of animals will go down. If contest for natural resources is created as a result of resource scarcity, social catastrophe could occur.

Threat on Soil Productivity

Flooding and wind caused by climate variability would result in the loss of fertile soils. It also intensifies the land degradation problem of arid, semi-arid and dry sub-humid areas which are already exposed to desertification. In Ethiopia, the coverage of these areas is extensive and the negative impacts of climate change on these areas have significant effect for the country as a whole.

Fig.2.1.6. Cattle feeding on a very dry pasture land

Threat on Water Resource

Discrepancy of the rainy season, which emanates from climate variability, results in water shortage. Consequently, the ecosystem, which is the source of rain and water resource, will be affected. Rainwater scarcity would affect the aquatic life by deteriorating the quality and quantity of a water body. For instance, water insufficiency endangers the fish resource, which is the cheap source of protein and leads to food shortage. In general, development activities based on water will be deteriorated as a result of water deficiency.

Threat on Wetlands

Climate change mostly affects sensitive ecosystems. As a result of rainfall variability and global warming, water scarcity may occur on wetlands. The degradation of wetland environment has distinct negative impacts. The capacity of wetlands to grow grasses for dry seasons would decline and their potential as a breeding area for birds would deteriorate.

Threat on Biodiversity

When forest resources diminish as a result of climate change, the flora as well as the fauna will be affected. Because of this, the flora and fauna biodiversity loss could occur. On the other hand, farmers would suffer from their animals' hunger and death due to fodder paucity. This catastrophe, besides aggravating poverty, reduces farm biodiversity.

Threat on Air quality

Air pollution is the presence of one or more contaminants in the atmosphere in such a quality and for such duration as is *injurious, or tends to be injurious, to human health or welfare, animal or plant life.* Studies indicated that in Africa, urbanisation and industrialisation have increased regional concerns with regard to certain air pol-

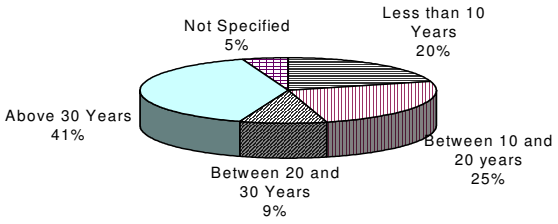
lutants such as sulfur and nitrogen oxides. It is projected that if African countries continue to develop in the predicted rates, then their emissions will exceed projected emissions levels of Europe and the USA, in the mid of 21st century. Similarly, if Ethiopia continues in its current pace of growth, the air pollution problem manifests itself sooner than expected.

So far there is no comprehensive air quality and health impacts of air pollution studies for Ethiopia. However, results of some pilot scale studies and general observations indicated that the level of air pollution problem in Ethiopia is low as compared to many other developing countries. Nonetheless, the global problem is threatening and the local pollution is also increasing at a relatively rapid rate. These days, air pollution problem manifests itself as one of the major environmental problems in large urban areas such as Addis Ababa.

The main causes of urban (outdoor) air pollution are mobile (vehicular) and stationary (industrial and house) sources. The number of vehicles is growing rapidly. As a result the share of mobile sources, in total, urban emissions has been increasing significantly . The main underlying factors are the expanding vehicle fleet, largely uncontrolled and on average quite aged, poor maintenance of old vehicles, the lack of effective traffic management and the decline of efficient public transport in most urban areas. The contribution of stationary sources to the volume of air pollution is not investigated. However localized air pollution problem are observed around industrial plants.

Beside these, air pollutions resulting from domestic activities such as cooking, lighting, smoking etc. are also considerably increasing.
Analogous to outdoor air pollution, there is no information on the level of indoor air pollution or its human health impacts for Ethiopia. However, levels of flue cases from domestic cooking, the products of incomplete combustion, are significant in indoor environments. The problem of

Fig. 2.1.7. Vehicles operational in 2000 grouped by age



indoor air quality may be acute in all parts of the country, since people use domestic cookers with poor quality fuels and without proper fuel combustion devices. Air pollution in and round the storage site of the obsolete pesticide and persistent organic pollutants is expected. However, the extent of the problem is not fully understood.

Responses

For rain fed agricultural economy, climate variability and climate change have significant barrier to the development of the country and adoption of technologies that have the potential to enhance production and livelihoods. As the smallholders rain fed agriculture is highly susceptible to climate variability, the crop failure and livestock losses in drought periods are quite significant. Bearing this in mind, the Government of Ethiopia prepared Rural Development Policy and Strategy, Agricultural Development Lead Industrialization Strategy, and Sustainable Development and Poverty Reduction Program (the Food Security Program), put emphasis among others on climate variability and climate change impacts. The current five-year plan, Plan for Accelerated and Sustainable Development to End Poverty (PASDEP) (2006-2010), is also designed to revolutionise the total dependency of rain fed agriculture by expanding irrigated farming.
Ethiopia has also ratified UNFCCC and the Kyoto Protocol as well as the Convention to Combat Desertification (UNCCD). Ethiopia has

produced its initial national communication to the UNFCCC and now it is preparing the National Adaptation Program of Action (NAPA). The NAPA is a document that specifies list of priority activities that will communicate immediate and urgent needs of the country, taking into account its high vulnerability and low adaptive capacity to climate change. Ethiopia also strives to meet the Millennium Development Goals and it is also committed to fulfill the NEPAD action plans.

The other way of responding to the impacts of climate change is through mitigation and adaptation to climate change. In spite of these experiences, environmental impacts of the past climate variability in Ethiopia, especially on changes in land use systems and land management practices, and their socio-economic consequences, were not addressed properly. Past development strategies envisaging resource management as a means to attain sustainable self-reliance failed to consider the investigation of the effect of climate on this macro objective.

The government of Ethiopia has taken various steps to mitigate the negative impact emanating from climate variability. The rural development policy and strategy acknowledges the need for different rural development strategy for different agro-ecological settings. Specialised agricultural extension packages for moisture stress areas have been designed. Safety net programs especially in food insecure areas are also operating to ensure food security through various intervention packages including environmental rehabilitation activitis. Besides, institutions such as the National and Regional Food Security Offices, Disaster prevention and Preparedness Agencies etc. are established to coordinate the above mentioned undertakings. Various bilateral and multilateral agencies are all also cooperating in the realisation of various development programs including the country's poverty reduction and food security programs. Many Local and international NGOs are also involved in such programs.

Conclusion and Recommendations

Ethiopia's unique climate offer an enormous opportunity for economic development as well as for the well being of its peoples. The climate allows a great diversity in agricultural practices. The temperate highlands are more suitable for habitation. Nevertheless, Ethiopia is vulnerable to climate variability and to global climate change. This climate variability has resulted in recurrent drought and periodic flooding in some parts of the country. This inturn has frequently affected the livelihood of the local population and the economy of the country at large. The shortage of water, due to climate variability has frequently affected the water volume in reservoirs with consequent power shortage that led to power rationing. Moreover, threat from global warming is alarming. Subsequent Global climate change may affect various sector of the economy including agriculture and forestry, water resource, industry, tourism etc. Changes in climate may also result in the spread of vector- and water -borne diseases, especially in areas with inadequate health infrastructure. Water resource scarcity induced by climate change may result in economic, social and political instability; declining biodiversity that might be irreversible; acceleration of desertification ; and critically affected ecosystems.

On the other hand Ethiopia is not a net contributor to the global greenhouse emission. The agriculture sector, especially the livestock sub-sector, is the main source of the greenhouse gas in Ethiopia. However, the enhancement of the sink capacity of the country needs special attention.

The air pollution problem has not yet been observed significantly. Very little studies are conducted in air quality assessment and air pollution impacts for the country. However, some indications are evident. Vehicular emission and particulate matter of geologic origin in the form of dust are common problems in major cities. Emission from the traditional stove and poor kitchen is the major source of indoor air pollution in Ethiopia.

Ethiopia as clearly indicated in its Environmental Policy, stated that the country even at its insignificant level of contribution to atmospheric pollution, has expressed commitment to the principle of mitigating climate change and to take appropriate control measures. In this respect, Ethiopia has ratified a number of Multilateral Environmental Agreements including: the UNFCCC, UNCCD and the Kyoto Protocol. In general there is a strong need for Ethiopia to strengthen its efforts to mitigate and adopt to the effect of climate change, and proactively manage the problems of air pollution.

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2.2. LAND

2.2 LAND

State and trend

The total area of Ethiopia is estimated at about 1.13 million square kilometres . Ethiopia exhibits diverse agro-ecological features. It is unique because of the high proportion of its land mass over 2000m altitude, where the climate is more temperate than tropics. Across the country, temperature vary from the hottest on earth to those found in the frost prone, Afro-alpine zone. The highlands in general are surrounded by hot, semi-arid and arid lowlands in the north, east and south, and by hot humid lowland in the west.

Soils in major agriculture area are predominantly formed on volcanic materials, which are often considered to be relatively fertile. The climate and soil conditions suggest the richness of agricultural potential of the country. Areas with good moisture regime including sub-moist, moist, sub-humid, humid moisture zones cover about 62 per cent of the country's total area (NRMRD 2000).

Ethiopia is bestowed with vast areas, which are suitable to grow diverse crops. Based upon countrywide land evaluation studies, it is estimated that about 42 percent of the country's landmass is suitable to grow diverse cereals, oil, fiber, vegetables and stimulant crops on rain-fed basis. Land -based resources are primarily utilised for agricultural use (crop and livestock production), nature-based tourism, raw material source for industry and extraction of mineral resources.

Ethiopia is gifted with unique ecological resources, providing ample opportunities for tourism. Protected areas including national parks, wildlife reserves, wildlife sanctuaries and controlled hunting areas cover about 5.5 million ha, representing about 5 percent of the country's land mass (Hailu 1998). However, land degradation, climate variability, poor land management practices, increase in agricultural population density, historically inappropriate policies and strategies, and inadequate institutional framework resulted in poor performance in agricultural sector.

Land degradation

Degradation refers to deterioration in the quality of the environment for humans, vegetations, animals and aquatic life. Soil degradation may be manifested by a reduction in the actual or potential productivity of soil to produce food, fodder, fiber, building materials and fuel. The six but interlinked categories of soil degradation process include water erosion, wind erosion, salinization and alkalinization, chemical degradation, physical degradation and biological degradation (FAO, 1979).

An assessment of the status of land degradation in Ethiopia was done 20 years back. Although it is believed that land degradation has continued with equal or greater intensity, there has never been a systematic and comprehensive assessment since then. Therefore according to this first assessment, the Ethiopian Highland Reclamation Study , in the highlands of Ethiopia (areas above 1500m), from all forms of soil degradation processes, sheet and rill erosion and the interrelated physical degradation process are the dominant degradation processes, in term of both aerial extent and their influence on land degradation. As shown in table 1.1, the annual soil erosion rate is estimated to be 1.5 billion tons (Hurni 1986). From all land use and cover types, the severity is worst on cropland, where the annual soil loss rate is in a range of 42 tons/ha/yr. The Ethiopian Highland Reclamation Study (EHRS) estimated that the annual soil erosion rate on the highlands is 1.9 billion tons, of which 10 percent of it is carried away irretrievably by the highland rivers (EHRS 1985). Though it cannot be unequivocally proven with research data, chemical degradation due to leaching and development of aluminum toxicity are found at local level and with limited extent, while chemical degradation due to "mining" of soil nutrients as a result of poor farming practices is likely to be widespread being serious to phosphorous (EHRS 1984). The on-site and off-site economic, social and environmental impacts of soil degradation are colossal, however, dearth data due to meager studies on the topic.

Table 2.2.1 Estimated soil loss rate by land use and cover

Land use and land cover types	Estimated area (%)	Estimated soil loss	
		Tons/ha/yr	Tons/yr
Cropland	13.1	42	672,000,000
Perennial crops	1.7	8	17,000,000
Grazing land	51.0	5	312,000,000
Currenlty unproductive land	3.8	70	325,000,000
Currently uncultivable land	18.7	5	114,000,000
Forests	3.6	1	4,000,000
Wood and shrub land	8.1	5	49,000,000
TOTAL	100	12	1,493,000

Source: Hurni (1986)

The general pressure and driving forces that attribute to land degradation share communalities across the country. Typical pressure factors include over cultivation, overgrasing and deforestation. The underlying factors include rainfall erosivity, soil erodibiltiy, land slope and land use factors (EHRS 1985; ILRI 2000; ILRI 2002).

Substantial proportion of the country's land mass exhibit moderately steep to very steep topography, covering about 67 percent of the country's total area highlighting the high potential erosion risk (see table 2.2.2). Deforestation, the removal of crop residue and dung for feed or fuel and continually shortening of fallow periods between annual crops have steadily reduced organic matter contents of the highland soils (biological degradation) making them both less productive and highly erodible. Inappropriate land use practices, which often expose the soil to erosive agents, not only devoid the soil's protective cover, but also affect soil erodibility and slope. Growing annual crops on steeper slopes, fine seed bed preparation, which often disturbs soil aggregates, and the time-match between bare farm field conditions with erosive rainfall events make the current cropping practice highly "erosive". The EHRS (1985) pinpointed the land use practices to be by far the most important determinant in influencing erosion.

Table 2.2.2. Extent of steep lands in Ethiopia

Land slope category (% slope)	Area (Km^2)	% of the total area
< 8	369	34
8 to 30	406	37
> 30	326	30
TOTAL	1101	101

Source: compiled from FAO/AGL (2003)

Land Tenure Situation

Land tenure is a cross-cutting issue, which influences wide range of subject areas including agricultural development, food security, poverty reduction, human rights, and environmental conservation and development.

The Constitution of the Federal Democratic Republic of Ethiopia grants the land user use right. The rural landholder has uninterrupted access to land with the right to transfer to decedents, lease and mange the land. However, there are three land holdings types recognized in Ethiopia, namely, individual, communal, and governmental.

Historically, available studies on the topic suggest that tenure insecurity as a major disincentive to improved agricultural production and natural resources management, environmental conservation and livelihood security. Among others, tenure insecurity has been cited as disincentive in investing improved land management practices such as tree planting, organic manuring or bunding.

Impact and threat

The "Off-site" impacts of soil degradation in general, erosion and sedimentation in particular have profound negative economic, social and environmental impacts. Increased downstream flood incidences cause the reduction in life span of dams and reservoirs and damages to irrigation structures and bridges and inflict heavy economic loss, resulting in the disruption of the social well being of downstream inhabitants and ecological balance. Massive and acute erosion/ sedimentation problems have inflicted serious economic and social damages to *Borkena, Godar and Koka* dam structures (MoWR 1997). The recent drying-up of a number of inland lakes such as *Haromaya* and *Adele* and the growing decrease in the volume of lakes *Ziway* and *Abi-*

jiata which partly are associated with erosion/ sedimentation process, resulted in deterioration of aquatic life, income and access to water to the surrounding communities.

Desertification

Land degradation in arid , semi-arid and dry sub-humid areas leads to desertification. According to UNCCD definition of desertification, areas prone to desertification are estimated to cover about 69 % of the country (EPA 1998). Based upon agro-ecological zones and with a general assumption that arid, semi-arid and dry sub-humid zones are prone to desertification process, about 54 percent of the country's land mass suffers the symptoms of desertification. The lowlands are ecologically more prone to the process. Given their ecological fragility, the increasing population pressure, the rising individualisation of tenure, inadequate institutional support and pressure on scanty natural vegetation escalate the desertification process in the lowlands of the country.

Livelihood Security

Agriculture is the primary source of livelihood for about 85 percent of Ethiopians that accounts for the majority of the poverty-affected population (FDRE, 2002a). Observing the general per capita crop and livestock production index for the last seven years (1993 to 2003), there is a general stagnation trend with incidental high figures during 1996, 1997 and 2001 (see figure-1). In Ethiopia cereal yield remained at 1.2 tons/ha between 1980 and 1997 (FDRE 1995c). The synergetic effect of drought and land degradation in Ethiopia has resulted in chronic and trasistory food insecurity. In recent years this phenomenon has expanded and its coverage in drought years has affected as up to a quarter of the population. Land degradation coupled with moisture stress often leads to reduced yield. For instance in production year 2002/03, which is the recent drought year, the agricultural yield per hectare for certain food crops, oil seeds and pulses has declined as compared to the other years (see table 2.2.4).

The impact of land degradation and moisture stress is further compounded by limited sources of alternative incomes, population pressure, limited technology, and lack of product diversification and market integration, and lack of institutional capacity.

The pastoral lowlands approximately constitute 50 percent of the land mass of the country. This land area suppprts millions of livestock population. Although the lowlanders have fewer numbers of livestock than the highlanders, their contribution is considerable.

The lowland breeds of cattle (eg. Unimproved

Table 2.2.3. Yield Of Selected Food Crops (qtl/ha)

Crop	2000/01	2001/02	2002/03	2003/04	2004/05
Wheat	13.79	14.37	10.75	14.69	15.57
Teff	7.96	8.95	7.35	8.43	9.48
Maize	18.25	21.16	15.01	18.60	17.19
Sorghum	11.54	13.65	9.70	13.57	13.69
Barley	10.82	12.08	8.75	11.73	12.12

Source: CSA-2003, 2005

Table 2.2.4. Yield of selected Oil Seeds and Pulses (Qt/ha)

Crop	2000/01	2001/02	2002/03	2003/04	2004/05
Linseed (flax)	4.91	5.18	3.24	5.41	6.06
Neug	3.54	3.63	3.42	4.22	5.22
Sesame	4.46	6.62	6.28	6.72	8.47
Faba beans	10.62	12.11	9.27	11.18	11.92
Chick peas	8.29	9.73	8.14	8.81	9.64
Field peas	6.90	8.40	6.73	8.05	8.98

Source: CSA-2003, 2005

Borena) and sheep (e.g. Somali black headed) are often regarded as superior to indigenous highland breeds in terms of size, productivity and/or consumer preference in the middle east. Lowland breeds of cattle and sheep made up over 90 make high percent of legal exports of live animals.

In the lowlands of Affar, Somali, southern Oromia, southern parts of the SNNPRS, and the western lowlands, where pastoralism is the predominant farming system, a combination of physical environment and socio-economic factors constrained the production status. In parts of the country , over stocking has led to over grazing, which further led to decline in the availability of fodder resources.

Degradation in the pastoral areas as a result is accelerating desertification. In many parts of the pastoral areas, grazing land is under serious impact from bush encroachment and invasive alien plant species such as P*artinum and prosopis juliflora*. The gradual resource shrinkage, inadequate livestock watering, and poor infrastructural facilities are some of the major problems in pastoral areas of Ethiopia, that compounds the challenge of environmental degradation in the country.

Response

An integrated land resource planning as an approach, among others, is an opportunity to bring about sustainable use of land resources. Attempts were underway to prepare and implement integrated land use plans at various levels: village to regional and to national levels. At the national level, a master land use plan was prepared based upon colossal nation-wide physical land resources and socio-economic database. However, this land use plan was hardly implemented. There have been high

Figure 2.2.1. Prosopis juliflora - in the Afar Rgional state-Ethiopia

tides in preparation and implementation of the Integrated River Basin Master Plan for major river basins in the country to undertake irrigation developments. Further, fragmented attempts are underway to implement integrated local and/or watershed level land resources planning.

Figure 2.2.2 Some of the lowland Goats and Sheep, Afar region

Foreign and indigenous soil and water conservation technologies are providing opportunities for sustained use of natural resources. Indigenous technologies have a wider chance to be diffused and adapted by land users due to their fitness to local socio-economic conditions.

Proven and well-adapted "foreign" technologies are also numerous, however, require local verifications to test their adaptability and acceptance by local farmers. In Ethiopia, researches have been underway primarily by Soil and Water Conservation Research Project(SCRP) on level and graded bunds, level and graded Fanya Juu and grass strips for duration of more than 20 years (as of 1981) in areas representing five different agro-ecological zones of the country (SCRP 1993). However, the release of research proven technologies under varied biophysical settings was constrained by lack of trained manpower and institutional failures.

- **Soil and water conservation**

Localized prospects for indigenous soil and water conservation technologies are enormous. There are as many as thirty-eight traditional soil and water conservation technologies in the highlands of Ethiopia, where erosion is sever (Kruger, et.al 1996). It is suggested that the high prospects of these indigenous technologies to be epted by farmers since they are dynamic to fit the local socio-economic and biophysical conditions.

To site some, the ingenuity of indigenous soil and water conservation practices of Konso and Gidole People in the SSNPRS, the Oromo of Hararge and the Amhara in northern Shoa are of high "technological opportunities" for conservation-based agricultural development.

Typically, the Konso people have a long-standing tradition in various soil and water conservation practices. Traditionally built extraordinary stone-faced bench terraces in Basso Kebele of Konso *Woreda* is shown in figure 2.2.5.

The area represents a typical steep mountainous landform with moderately shallow soils planted mainly with sorghum. On lower slopes contour farming is practiced using straws and stalks of sorghum along the contour referred as " contour trash lines". Along Arba Minch – Jinka approaching Karat town, a sorghum-plated field treated with contour trash line is shown on figure 2.2.6..

Figure 2.2.3. Reclaimed land in Adwa Mariam Sheweto, Tigray National Regional State

Figure 2.2.4. Area under conservation farming, in Ambalaje, Adi Sebhat– Tigray

Figure 2.2.5. Traditional stone-faced bench terraces in " Basso" village of Konso

Figure 2.2.6. Contour trash line on gentle slope farm (Konso)

- **Reclamation of saline and alkaline soils**

The process of salinisation and alkalinisation becomes important in areas where evapotranspiration exceeds the precipitation for much of the year resulting in upward migration of salts from ground waters into the upper parts of the soil profile . Primarily influenced by environmental settings, salinisation and alkalinisation commonly occur in arid and semi-arid agro climatic zones. To some degree, however, they occur in moist highlands where there are salt rich soils such as solonhacks. The extent of salt-affected soils in Ethiopia is not known. However, from the toal land area, 495 square kilometers of area is occupied by solonaks (characterised by high sodium accumulation). The causes of salinisation and alkalinisation are somehow, invariably a combination of natural phenomenon and human interventions and actions such as inappropriate irrigation water management that are not in harmony with the ecological environment.

There are several technological pathways, which provide a window of opportunity to reclaim and rehabilitate irrigation land suffering from salinisation or sodication. Technological opportunities range from hydraulic measures (proper drainage system and leaching and irrigation management), to physical practices (land leveling, tillage, deep ploughing, planting procedures) to chemical practices (chemical amendments like gypsum application and proper integrated plant nutrition management) to using appropriate biological practices (using organic manure, farm manure, growing legumes, mulching, crop residues and selection of salt tolerant crops). However, the testing and use of these technologies is too little, the exception being to the "Amibara" irrigation and drainage project.

- **Access to Improved Technologies**

Systemic generation and diffusion of improved

Figure 2.2.7 Rain water harvesting (Tigray region)

production and conservation technologies for land users are very limited, often skewed to crop technologies. Whatever is available, its distribution to the end users is constrained by a combination of technical, institutional and policy implementation factors.

In an effort to relieving the deep and ultimate causes related to poverty and land degradation, the government has undertaken a number of multi-sectoral actions in a holistic fashion to produce synergetic effects. Accordingly, varous rural environmental management extension packages including rain water harvesting, small scale irrigation and small scale forestry and soil and water conservation actirities are underway undergoing in many parts of the country. However, these efforts do not match with the match extent of land degradation in Ethiopia to reverse the degradation process in a noticeable scale.

- **Policies, strategies and programs**

A number of measures in policies, strategies and institutional reforms at both national and regional levels have been taken. In a move to enhance tenure security and to decentralize land administration institutions, the national rural land administration and land use law was promulgated (FDRE 2005). The Amhara, Tigray, Oromiya and SNNP Regional States enacted their regional land administration and use laws (ANRS 2000; TNRS 1996/97; ONRS 2002; SNNPRS 2003). Concomitant move is the stride in preparing national and regional strategies and programs to improve the food security /livelihood security of the population.

To operationalise, the agricultural development wing of the Agricultural Development Led Industrialization Strategy, the Participatory Demonstration and Extension Training System (PADETS) has become operational as of 1995/96. Further, to relieving the multifaceted constraints and issues surrounding poverty, Poverty Reduction Strategy Paper, also known as Sustainable Development Strategy and Poverty Reduction Program (SDPRP), Plan for Accelerated Sustainable Development to end poverty (PASDEP) have been launched in a five year cycle as part of the two programs , countrywide food security program comprising environmental rehabilitation has been operationalised.

CONCLUSION

The survival of the overwhelming rural population is directly dependant on direct exploitation of land resources (soils, water, plants, livestock, fish, etc). Centuries of land use practices compounded with growing population pressure and institutional deficiency as a process yielded deterioration in livelihood security and environmental degradation. These two core problem areas are inexorably linked determining the development pathways, the level of household security and the sustainability of the production systems. If land resources are to be used in sustainable fashion the many interlink of the ultimate and deep causes related to poverty and environmental degradation should be addressed and arrested in order to bring about a synergy effect. Salient recommendations for sustained use of land resources are summarised below.

1) A holistic and integrated land resources development approach with packages of interventions comprising of technical, policy and institutional aspects, should be at the core to attain sustainable development. The extensive past and on-going development experiences including the land resources planning approaches should rather form the basis to draw lessons and experiences.

2) Strengthen policy implementation through institutional capacity building at all levels for sustainable land management.

3) The promulgation of environmental and land administration and land use laws are encouraging, however, needs to be backed up

with strong institutional set-ups in order to effect their implementation. Concomitant action should be a close monitoring and evaluation of these laws for continuous improvements based on feedbacks.

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2.3 Forests and Woodland

2.3 Forests and Woodlands

State and Trend

Estimates on the amount of forests and woodlands vary depending upon the sources of information. Different estimates have been derived by the EFAP(1994) and the more recent forest resources assessment (FRA,2000) which used differing definitions and categories for classification. Up to date information has been published by the Woody Biomass Inventory and Strategic Planning Project (WBISPP) in 2004.

WBISPP has estimated a total high forest area of 4.07 million hectares or about 3.56% of the land area of the country. The distribution however, is uneven. Considerable differences in the extent of forest cover and the type of vegetation exists within each region. 95% of the total high forest is located in three regions namely Oromiya, SNNPR and Gambella regional states. Oromiya has the highest forest cover which is 63%. The distribution is as indicated in Table2.3.1.

Ethiopia constitute is so many forest types distributed over different areas . The Upland Dry Evergreen Forests (Juniperus procera), mainly constitute characteristic plant species of Olea europaea, Juniperus procera, Celtis africana, Catha edulis, Barbeya oleoides, Pistacia ethiopica, Schrebera alata, Rosa abyssinica, Mimusops kummel and Ekebergia capensis. These are common in Oromiya, Amhara and Tigray Regional States between 1500 and 2000 masl.

Table 2.3.1. Estimated high forest area

Regional State	Area in hectares (High Forest)	Percentage
Oromiya	2,547,632	63
SNNP	775,393	19
Gambella	535,948	13
Dire Dawa	0	0
Harari	216	0
Amhara	92,744	2
Tigray	9332	0
Benshangul	68,495	2
Afar	39,197	1
Somali	4257	0
Total Forest Area	4.07 million	

Source: WBISPP (2004)

Mixed Juniper-Podocarpus Upland Evergreen Forests are found as dispersed patches in Oromiya, SNNPRS and Amhara Regioal States. They are found between 1500 to 2700 masl. The main canopy species are Juniperus procera and Podocarpus gracilior. Other important trees included are, Allophyllus abyssinica, Celtis africana, Croton machrostachys, Ekebergia capensis, Olea hochstetteri and Prunus africana. At altitudinal range of 3000 to 3400 masl the forest changes to Hagenia abyssinica forest with scattered

Figure 2.3.1 Upland evergreen forest in South western parts of Ethiopia

clumps of Arundinaria alpina and Erica arborea.

The Humid Upland Broadleaved with Podocarpus forests are common on the southern and southwestern side of the Bale Mountain massif between 1500 and 2600 masl. The characteristic plant species include the commonly important trees in Ethiopia such as Aningeria-adolfi-frederecii, Podocarpus falcatus, Albizia gummifera, Celtis africana, Polyscias fulva and Schefflera abyssinica.

The Humid Upland Broadleaved with Aningeria dominant forests are common in Oromiya, SNNPR a nd Gambella Regional States between 1500 and 2600 masl.

The Riverine Forests are found along the major streams and rivers and the characteristic woody plant species are Celtis africana, Tamaridus indica, Mimusops kummel, Syzigium guineense. Other common species included are Cordia Africana, and Teclea nobilis.

Woodland and Shrub land types are the most widespread forest types. The Woodland is estimated to cover 29.24 million hectares covering 25.5% of the total land area. The shrub land is estimated at 26.4 million hectares covering 23.1% of the total land area.

Table 2.3.2. Estimated Woodland and Shrub land

Region	Area in ha. woodland	Percent	Area in ha. Shrub land	Percent
Oromiya	9823163	34	7750422	29
SNNPR	1387759	5	2434779	9
Gambella	861,126	3	146103	1
Dire Dawa	0	0	36635	0
Harari	0	0	7497	0
Amhara	1,040,064	4	4352672	16
Tigray	294,455	1	1841182	7
Benshangul	2,473,064	8	1422191	5
Afar	163,657	1	3024697	11
Somali	13,194,662	45	5,384022	20
Total	29242949	25.54	26400200	23.06

Source: WBISPP (2004)

Their distribution and percentage cover is shown in table 2.3.2.

Broadleaved Deciduous Woodlands: They occur between 300-1700masl with an annual rainfall of between 800-1400 mast. These woodlands dominate the woodlands and shrub lands of the western and southern lowlands in the Tekeze, Abay and Omo-Gibe valleys. They are not heavily used economically mainly due to malaria and tsetse fly. The presence of Oxytenanthera abyssinica makes them suscaptible to frequent fires. Characteristic species of this woodland type are Combretum collinum, Combretum molle, Acacia polyacantha, Acacia seyal and Terminalia brownii.

Acacia Woodlands: They are the climax vegetation for the higher rainfall areas of the rift valley in Amhara and Tigray Regions. They are found between 1500-2000 masl with an annual rainfall of between 800-1000mm. They are dominated by Acacia species such as A. tortilis, A. seyal, A. etbaica, A. mellifera and A. nilotica.

Lower Semi-arid Boswellia-Commiphora-Acacia woodland-shrub land: They are found in areas with lower annual rainfall ranging from 700mm down to 500mm. They have been depleted in recent years in order to supply wood for charcoal. Much of the vegetation has also been cleared for agriculture particularly in the rift valley. This together with overgrazing has left much of the soil bare which is susceptible to both wind and water erosion.

Lower Semi-Arid to Arid Acacia-Commiphora woodland-shrub land: They occur mainly in the southern, eastern and central parts of the country between altitudes of 900-1900m. Annual rainfall is between 500mm and 350mm. It has Acacia tortolis, Acacia seyal, Acacia senegal, Acacia etbaica. They have been depleted in order to supply wood for charcoal. They are also cleared for agriculture mainly in the rift valley.

Arid Sparse Shrubland: The vegetation consists of deciduous shrubs mostly Acacia species with annual rainfall below 350mm. The vegetation consists of shrubs of Acacia tortilis, Salvadora persica and Zizyphus spp.

Forest Plantations

Forest Plantation programs have been initiated on a large scale in selected regional forest priority areas to rehabilitate formerly forested areas and produce industrial and construction wood. They are mainly of exotic tree species with Eucalyptus covering the largest area of hardwood plantations. The total area of planted forests is estimated at 216,000 ha and comprises industrial, fuel wood and communal plantations.(FAO,2001) Management of these plantations has been poor so is productivity.

Currently, trees outside forests (Trees on Farm) are important sources of wood and non-wood forest products. Households' main fuel and construction wood needs are obtained from these resources. They are also increasingly becoming cash crop for farm households in many parts of the country. The main cash crop tree is eucalyptus species.

There are two types of bamboo resources in Ethiopia which cover over 1 million hectares. These are high land bamboo (Arundinaria alpina) and low land bamboos (Oxythenanthera abyssinica). The high land bamboo are found scattered in Oromiya, Southern and Amhara regions in an altitude range from 2400m to 3100 m a.s.l. The low land bamboo occurs mainly in the Benshagul Gumuz and Amhara between 700 and 1700 m a.s.l.

The economic contribution of forest resources to the national development as well as to household livelihood are not adequately documented. A variety of forest products and services that constitute a major source of livelihood for rural households are not formally traded or not monetary valued. Therefore, forestry's contribution is underestimated to the national economy. As a result, forestry tends to be undervalued in national policies and priorities. Forests and woodlands are therefore, converted to other land uses as the economic values of these areas are unrecognized. The contribution of forests to GDP is not yet fully accounted but the officially reported figures estimated that the sector comprised 2.75% of GDP in 1986, 3.3% in 1991/92 and 6.3 % in 2001.

Forest Resources Contribution to Household Livelihood

Forest resources play a vital role in income generation especially for the poorest population. The most common uses of forest for income is the sale of wood both firewood and construction wood. Other products such as honey, bees wax, gum and incense; generate considerable cash income. Many handicrafts, such as wood carving, furniture, agricultural tools, household implements, baskets rely upon forest products.

In some areas, domestication of forest species such as spices and coffee are being developed as sources of income at household level. Some efforts are also made to promote community based ecotourism through mountain trekking and trophy hunting.

Timber, either from natural forests or plantations are sold in areas when agricultural production is insufficient to supplement household income.

Contribution to Food Security: The contribution of forests and woodlands to food security ranges

Box 2.3.1. Forestry Contribution to household level welfare

The Bonga Natural forest is the source of raw materials used for house construction and homemade household assets, including wooden stools, beds and food utensils. Depending on house type, the average wood requirement varies between 1.7 and 4.2 cubic meters for the initial construction of a house, and between 1.4-37 cubic meters for its maintenance. In addition, an estimated 1300 kgm of wood constitute the annual per capita household consumption of fuel wood. The monetary value of per capita household benefits ensuing from wood used for own house construction and maintenance and as a source of domestic energy and lighting roughly amounts to Birr 1281 per annum. Mean total annual household income obtained from sales of one or more types of forest resource products was birr 537.

Source: MoA, 2002

from direct supply of domestic cooking energy

and food items to provisions of jobs and revenues. Many households, both rural and urban depend on fuel wood for domestic energy supply, wild medicinal plants for health care, and various food plants for food security. The contribution of honey, game hunting and eco-tourism, bamboo, natural gum and medicinal plants to food security is significant.

Fuel wood and charcoal: Natural forests and woodlands are the most important sources of woody biomass resources. Fuel wood is a major source of household energy in Ethiopia. Since most production and consumption of wood fuel takes place in the informal sector, quantity estimates are not precise. Of the total amount of wood produced, 93% is used for household energy source. The consumption varies depending on the availability of woody biomass resources or other alternative options**.**

Wood working: The most commonly used forest species used for wood working and making furniture are Cordia africana, Podocarpus falcatus. Farmers are also cultivating bamboo for use from natural stands to earn additional sources of income.

Carbon sequestration: One of the important ecological roles of forests is the provision of carbon sinks. Forests offer opportunities to sequester carbon or avoid emissions and so play emission reduction benefits.

Income from NWFPs: The most important non-wood forest products of Ethiopia are exudates, medicinal plants, honey and beeswax. Other NWFPs include edible leaves, fodder, latex, tannins, incenses, spices, dye staffs and ropes. Although they play an important role in the rural economy, information on their overall contribution except for a few species of commercial importance does not exist. Bekele-Tessema et.al.(1993) identified 199 trees and shrub species that were used for food and medicine(123), fodder (108 species), as well as for various other purpose. Income from few selected NWFPs is shown below.

Table 2.3.3. Products gained from natural forests (type & quantity in kg.)

Type of Product	Year					
	1995	1996	1997	1998	1999	2000
incense and gum	8294,2	12,300,39	21000,63	15000,9	18000,02	24,000,68
Natural honey	5,13	31,37	135,2	35,616	216,21	28,08
Korerima	133,2	158,2	161,4	286,49	424,68	227,17

Bekele-Tessema et.al, (1993)

Box 2.3.2. Participatory Forest Management and Eco-tourism

One of the RFPAs in Oromiya, Adaba- Dodola which causes an area of 1399 km^2 has only 50,000 hectares. An estimated 4000 families or 20,000 people, live inside the forest, and a much larger number live adjacent to the forest. Since 1995, the GTZ integrated Forest Management Project has been working in the area, seeking ways to promote participatory sustainable management and rehabilitation of the forests. The project has been seeking ways to increase the incomes that members of local communities' can earn from the forest, to provide additional incentives for forest conservation and sustainable use. The project has initiated the promotion of eco-tourism. Five mountainguest huts have been constructed, and local community members have been selected as hut caretakers. Other community members earn income from eco-tourism activities by providing service as guides and horse assistants as well as renting horses to tourists. In recent years, an estimated 300 local community members have been getting a yearly provision of more than USD 6000 per year.

Source: MoA (2002)

Eco-tourism: Now a days there is a tendancy of promoting eco-tourism in the country.For example, in Adaba Dodola forest priority area, a number of mountain huts have been constructed which are managed by local communities. These huts are to be rented to tourists, researchers or other visitors.

Protection of Agricultural Production Systems and Watersheds: Forests and forest resources, significantly contribute to agricultural and livestock production systems. For example, trees, woody shrubs and bushes play vital roles in maintaining soil fertility and moisture, providing shelter or serving as windbreaks, and providing forage/fodder for livestock, forage for bees as well as home for wildlife. Many rural people protect naturally regenerating trees, or plant trees, in their agricultural fields, adjacent to their homesteads, or in their pasture (grazing) lands. Forests also play essential functions in watershed protection, which is essential for the country's rivers and streams, and sources of hydroelectricity.

However, the real value of forest resources is not properly accounted. Ethiopian forests offer a wide range of both material and intangible benefits all of which have a value but only few are expressed in monetary terms. The value of forestry in terms of its contribution to GDP is difficult to estimate mainly because:-

- Much of the output remains unrecorded and goes to subsistence consumption meeting the basic needs of rural population;
- Forest produce are traded informally and illegally; and Many of the forest outputs and services are difficult to estimate in monetary terms because of technical methodological limitations.

On the other hand, inadequate regulation and enforcement of existing laws designed to protect and manage forests are either insufficient or non-existent. Limted capacity and infrastructure to enforce existing instruments in the forestry sector has aggravated the rate of deforestation.

. **Impact and threat**

- **Unsustainable Exploitation of Forest Resources**

The basic causes of deforestation are the same in all the regional states. They stem from growing demand for land and forest products and the lack of sustainable resources management due to the economic, social and institutional constraints.

The high population growth rate and the subsequent rising demands for crop and grazing land, construction materials, fuel wood and charcoal are the main factors responsible for the decline of forest areas. Moreover, encroachment, resettlement and recurrent droughts have all undermined the forest and woodland resource base.

According to the Woody Biomass Inventory and Sustainable Planning Project (WBISPP, 2004) the annual forest land change due to agricultural expansion is 50,000 hectares mainly in Oromiya, SNNPRS and Gambella. Land cover interpretation from satellite imagery dating from 1987-1990, indicated that the natural forest to be cleared from 1990-2020 is 1.33 million hectares only from these regions. Of this, the annual rate of clearing is estimated at 1.16% for Oromiya, 2.35% for SNNPRS and 1.28 % for Gambella. Today, the forest resources are steadily disappearing and those that are left in the South West are being degraded.

Today, one can only find some stands of Natural High Forests within Oromia, Southern and Gambela Region. In an effort to cope with the rapid depletion of forests in recent years, the Government has classified 58 of the most important High Forest areas as National Forest Priority Areas (NFPA) (EFAP,1994). Nevertheless, the analysis clearly shows, that in some NFPAs no Natural High Forests are remaining at all, whereas in most of them, the forest stands have been either partly deforested or at least severely degraded.

The most important effects of deforestation are the loss of productive forest lands and the revenues following the loss of wood and non-wood forest products. The species composition and tree density have been decreasing in almost all forested areas which consist now mainly, of deformed and over-aged trees. Natural regeneration is scarce due to the high impacts of livestock.

The destruction of the natural forests results directly in the loss of unaccounted plant and animal species as well as in a shortage of fuel wood, timber and other forest products. Indirectly, it leads to more aggravated soil erosion, deterioration of water quality, further drought and flooding, reduction of agricultural productivity and finally to an ever increasing poverty.

Figure 2.3.2. Illegally felled tree by encroachers in the SNNPR

Responses

In an effort to cope with the rapid depletion of forests in recent years, the Government has classified 58 of the most important High Forest areas as National Forest Priority Areas (NFPA) (Efap, 1994).

Recent changes in the policy and institutional framework for forestry emphasize decentralization of forest management with the participation of local people in combating deforestation. Forestry's integration with other land use practices has been emphasized and sectoral integration in sustainable development is adopted as a strategy.

Figure 2.3.3. Forest land conversion in to other uses (SNNPRS)

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

Ethiopia is signatory to conventions on biological diversity, climate change and combating desertification that have direct relevance to the forest resources conservation and development.

The development of participatory management system, in which local communities play an important role through joint forest management has gained acceptance. This is one of the new arrangements being tried by many stakeholders including the government through the Ministry of Agriculture and Rural Development.

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

The country has prepared a number of forestry and environmental plans and strategies. In December 1994, the Government finalized an Ethiopian Forestry Action Plan (EFAP). This forestry plan was an important contribution to the development of the National Conservation Strategy of Ethiopia (CSE), presented in May 1994.

The Ethiopian Forestry Action Plan proposed a set of 4 major action programs:

1. Tree and forest production,
2. Forest resource and ecosystem management,
3. Forest industries development, and
4. Wood-fuel energy efficiency development,

Subsequently, based upon the EFAP, Regional Forestry Action Plans have been prepared in many of Ethiopia's Regions. The regional governments have not gone beyond the preparation of the documents and implementation of investment programs have not been in place.

Conclusions and Recommendations

The available information on the forest and woodland covers is limited and inconsistent. This has been major impediment to planning and im-

plementing sustainable forest management. The present management practices have not been able to control or stop the loss of forests. Yet, the rate of plantation development is far below the rate at which the natural forests disappear. If the existing situation prevails, the overall prospects of improvement in the forestry sector are not bright. The pressure on the remaining forests will continue to increase.

Therefore a new management strategy that meets the basic needs and interests of the local communities living within and around the forests has to be in place to protect the remaining forests and promote afforestion. Focus has to be on mainstreaming forestry into other land uses to develop a strong agricultural sector.

It can be concluded that the major limitation of forest development and conservation are poor valuation of forest and woodland resources, under-development of NTFPs , ineffective monitoring of forest resources, limited involvement of local people, lack of off-farm employment opportunity and gap between sustainable yield supply and demand of forest products. Included are also low regulatory framework and inadequate institutional setup and capacity, low policy emphasis to the forestry sector, conflict of interests in existing high forest areas . It is therefore recommended to:

- Enhance local community participation in the management of forest and woodland resources;
- Improve the institutional frameworks of forestry for effective management;
- Recognize NTFPs in National Accounting and preparation of technical packages to promote the use of these resources;
- Enhance income and employment opportunities to local people to relief pressure on the existing forest and woodlands;
- Integrate forestry into all land uses so that trees become an integral part of all land use practices;
- Enhance the supply of fuel wood and improving the efficiency of its use; and
- Carry out Valuation of forests through update of data on the resource.

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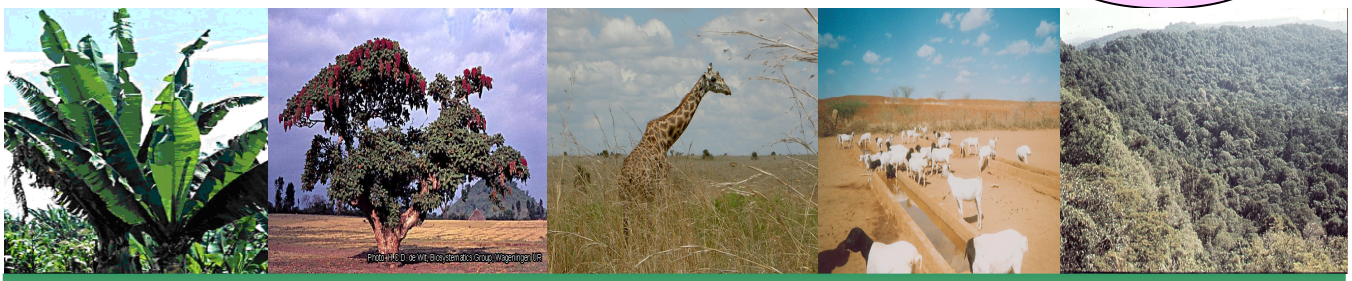
2.4
BIODIVERSITY



2.4. BIODIVERSITY

State and trend

Ethiopia's biodiversity provides an important opportunity for socio-economic growth and development. The country's biodiversity is also vital for ensuring ongoing provision of ecosystem services such as production of clean water through good catchments management, soil formation and protection, carbon storage, clean air, diseases/pests control, invasive alien species control, provision of wild foods, energy, power, irrigation and provides job opportunity.

South of the Tropic of Cancer almost 50 percent of all land above 2,000 m and nearly 80 percent of all land above 3,000 m lie within the borders of Ethiopia. These vast plateau, divided by the Rift Valley into northwestern and southeastern massifs, with an average altitude of about 2,200 meter above sea level (masl) but rising to more than 4,600 m in the Semien Mountains. Consequently, Ethiopia is endowed with a broad range of ecosystems with great varieties of habitats contributing for the occurrence of high faunal and floral diversity.

Ethiopia is a country rich in avifauna, with a total of about 861 species (39.14 percent of the total for the main Africa continent and associated islands). There are 665 resident species occurring in Ethiopia. Moreover, there are 119 Palearctic Migrants - birds in Asia and/or Europe spending the Northern winter in Ethiopia (e.g. Shoveler), 47 Intra-African Migrants - living in Ethiopia for part of the year and spent the rest of the year in other areas of Africa (e.g. Abdim's Stork) and 21 Passage Palearctic Migrants - breed in Europe and/or Asia and winter in Africa, only passing through Ethiopia to its wintering grounds (e.g. European Bee-eater).

Of the 42 sites in Africa known as centers of avian endemism, three of them, namely, the Central Ethiopian Highlands, the South Ethiopian Highlands and the Juba and Shebele Valleys occur in Ethiopia (Mohamed *et al*., 2003).

About 201 species of reptiles are known to occur in Ethiopia, which include 87 snakes, 101 lizards, one species of crocodile, and 13 species of tortoises and turtles.

A total of 63 species of amphibians have been recorded in Ethiopia. Of these, 23 species (38.1 percent of total) are currently listed as endemic; the great majority of these being clearly associated with montane forest, grassland or moorland at altitudes above 1800 m. An eco-geographic analysis of the amphibian species indicate that 52 percent of these fauna is primarily associated with savanna habitats.

Myriapoda includes the millipedes and centipedes and both groups are important in the functioning of the dryland and arid ecosystems, which are important and integral part of the Ethiopian landscape. They are involved in improvement of soil structure through burrowing, humification and mixing of the soil. Very little taxonomic work has been done so far on both categories in Ethiopia. However, Hill (1989) recognized 8 species in Family Eriophydae, 1 species in Family

Tarsonemidae, 7 species in Family Tetranychidae, 1 species in Family Tenuipalpidae and 2 species in Family Acaridae. About 57 Copepod species of Crustacea have been documented in Ethiopia. Though the country's insect fauna is considered to be diverse in terms of species and distribution, it is not well known and documented. From the works of Hillman (1993), and insect collections of Natural History Museum of Addis Ababa University, hundreds of insect species are identified in Ethiopia. In addition, 7 endemic butter fly species are also identified.

Agro-biodiversity

Field crops biodiversity

Ethiopia has a very high genetic diversity in four of the world's widely grown food crops (wheat, barley, sorghum, peas), in three of the world's most important industrial crops (linseed, castor, and cotton), in the world's most important cash crop (coffee), in a number of food crops of regional or local importance (teff, finger millet, cowpeas, lentil, enset, etc) and in a number of forage plants of world importance (clovers, lucerns, oats, etc.).

Ethiopia is considered as the primary gene center for field crops such as noug (*Guizotia abyssinica*), tef (*Eragrostis tef*), and Ethiopian mustard (*Brassica carinata*).

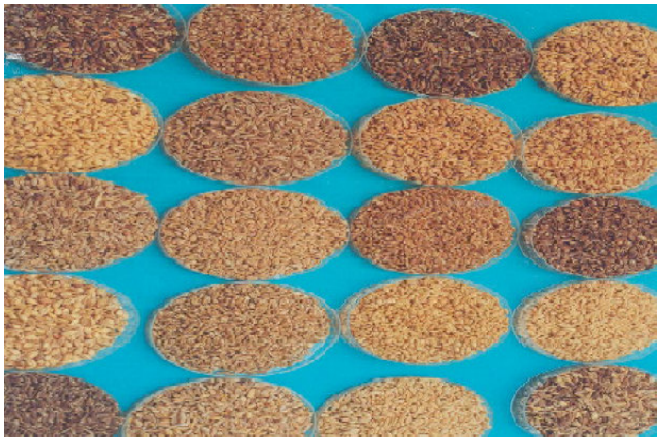


Figure 2.4.1. *Variation in durum Wheat*

Figure 2.4.2. Variation in Barley

Horticultural Crops Biodiversity

In Ethiopia several indigenous and exotic root and tuber crops are produced as a source of food and cash income. The most important root and tuber crops, which are native to Eastern African countries, such as anchote (*Coccinia abyssinica*), enset (*Ensete ventricosum*), yams (*Dioscorea* spp.), and "Oromo dinich" (*Coleus edulis*).

Ethiopia is either primary or secondary centre of origin for the universally known spices such as korarima (*Aframomum korarima*), chilies (*Capsicum spp*)

Figure 2.4.3. The Enset plant (*Ensete ventricosum*)

Pasture and forage plants biodiversity

Ethiopia posses naturally occurring pasture and forage plant habitats of potential economic and environmental importance. Ethiopia is known to be a center of origin and diversity to a number of herbaceous legumes such as the genera *Trifolium*, *Vigna*, *Lablab*, among others.

Medicinal plants biodiversity

There are about 887 medicinal plants that are used by Ethiopians, and these plants are distributed across 114 families of which *Asteraceae* (11 %), *Fabaceae* (11%), *Lamiaceae* (5 %), *Euphorbiaceae* (4%) and *Poaceae* (4 %) are the major ones (Tesema Tanto *et al*., 2003).

Domestic Animals Biodiversity

Ethiopia has also domestic mammalian interspecies diversity including sheep, goats, camels, donkeys, horses, mules, dogs and cats where as avian species include chicken (poultry) and other domestic birds (turkey). Honey bee species, stinging and stingless bees are found. There is no any significant conservation of domestic animals genetic resources initiated in Ethiopia.

Microbial Biodiversity

Ethiopia has a wide diversity of microbial genetic heritage (viruses, bacteria, fungi, phytoplankton and zooplankton), but not yet well explored. Amongst the little known ones, so far, are those used in the natural fermentation process in foods and beverages, biological pest control, soil fertility, disease control, reduction of pre- and post-harvest losses, improving animal and human health (in areas of drug research and medicine), improving environmental safety, waste-reduction of bio-conservation into useful products and biodiversity conservation. Many of these abundant resources are endangered and of great conservation concern.

Figure 2.4.4. Some of the Ethiopian wild animal Species

Wild Animals Biodiversity

Ethiopia is endowed with diverse mammalian species. The larger mammals like Elephant, Buffalo, Black Rhino, Giraffe, Lion, Leopard, Cheetah are found in different part of the country. There are A total of 277 species out of which 29 species are endemic and are almost exclusively confined to the central plateaux. Five of the endemic species namely, Walia Ibex (*Capra walie*), Gelada Baboon (*Theropithecus gelada*), Starck's Hare (*Lepus starcki*), Mountain Nyala (*Tragelaphus buxtoni*) and Ethiopian Wolf (*Canis simensis*) are the big ones.

Wild Plants Biodiversity

Ethiopia is rich in wild plant biodiversity. The Ethiopian flora project has registered about 7000 higher plant species of which 12 percent is endemic to the country.

The vast biological resource of Ethiopia comprises of the aforementioned categories. However, Ethiopia did not utilize its biological resources to full potential. Genetic diversity in domestic species and their wild relatives enables researchers to develop improved varieties of animals and plants for human needs. Diversity in wild plant species is potentially a major medicinal resource, and it is insurance for further food security. It should also be noted that species that might not have known direct economic value today may turnout to be economically important in the future.

The conservation of biodiversity is fundamental to achieving sustainable development. It provides flexibility and options for our current (and future) use of natural resources. Conservation of biodiversity is crucial to the sustainability of sectors as diverse as energy, agriculture, forestry, fisheries, wildlife, industry, health, tourism, commerce, irrigation and power.Ethiopia's development in the future will continue to depend on the foundation provided by living resources and conserving biodiversity.

The spectacular escarpments and gorges of most of the eastern Africa afro-alpine and sub afro-alpine ecosystems provide extremely breathtaking scenery, and therefore, have great scenic values. The rare and endemic wild fauna and flora attract tourists and generates foreign revenue. Montane grassland of East Africa is linked to subsistence agriculture such as crop production and livestock husbandry, since this ecosystem is relatively more hospitable to human life. The Dry Evergreen Montane Forests provide fuel wood, construction material, farm implements, edible fruits, honey, medicinal plants, water and game for hunting. As one of the major activities of the local people is livestock production, it provides grazing areas. It also provides food, shelter and breeding areas for many wild animals.

The forest prevents soil erosion and regulates the watershed in the surrounding and some of the forests are important water catchments for rivers. The evergreen scrublands are traditionally used for grazing, cereal cultivation and fuel wood collection. They are sources of traditional medicine and also serve as source of non-cultivated food plants.

The montane moist forests are important sources of timber, non-timber forest products, agricultural and pasture land, coffee and tea production, and source of raw material supply for various development works including construction. *Coffee arabica* accounts for more than three-quarters of the world's coffee production and its genetic pool is largely in the montane moist forests of the south and southwest Ethiopia. The local people harvest forest coffee from this ecosystem. This ecosystem holds important bird habitats including some of the notable endemic species such as *Rouget's Rail* and *Abyssinian longclaw*.

Figure 2.4.5 Partial view of a natural torest ecosystem in SNNPR State

Forest resources in general and the montane moist forests in particular are important components of the planet to sequester the CO_2 gases in the atmosphere and, therefore, a major 'Carbon sink' reducing the Green House Gases (GHG). Current estimates in Ethiopia has shown that forests sequester nearly 27,579 Gt of CO_2 per annum from the atmosphere (Bekele, 2001) and the net GHG emission of the country is only 2,596 Gt per annum (NMSA, 2001).

Plants with high traditional values and economic importance found in *Acacia-Commiphora* ecosystem include *Cordeauxia edulis*, which has very nutritious fruit and highly favoured by the local people, and several species of *Boswellia* and *Commiphora*, which provide the frankincense myrrh of local and international trade. The semi-desert and scrub ecosystem is also considered as the basis of an expanded ecotourism. Big game and bird fauna are abundant in the Rift Valley and the lowland. A number of national parks including Awash and Omo National Parks are found in this ecosystem.

Ecosystems, vegetation types or forests are repositories and gene pools for several domesticated and/or wild important plants and wild relatives of domesticated crops as well as wild animals and microbes and other life forms. The genetic diversity in a given vegetation type or forest contributes to the stability of ecosystem particularly in the face of climate change.

Farmers in Ethiopia draw clear association between each grain types (landraces or farmers varieties) and its use. For example, the white large-grained forms of barley are preferred for making porridges; the white, black, or purple large-grained types are made into bread and other baked foods. Partially naked grains are usually roasted or fried. Small-grained types (mainly black and purple) are used for beverages.

In general, the anthropocentric value of biodiversity and ecosystems derives from the value of the goods and services they provide, which includes direct-use values, indirect-use values, and non-use or passive values. Biodiversity supports ecosystem functioning and processes, which, in turn, support the production of marketed goods and services. In economic terms, biodiversity is equivalent to a portfolio of assets.

Impacts and Threats

Most protected areas are adjacent to rivers that are important to people living in the vicinities. These people depend on the rivers to satisfy the need of water for their household and livestock for part of or all the year round. This condition forces the people to move illegally in some important wildlife areas in the parks. In Bale Mountains National Park, for instance, there are several mineral water points distributed at various sites; in Awash National Park people have to cross the main park proper to reach the Awash River. The same is true in Mago, Omo and Nechsar National Parks. At Abijata-Shalla Lakes National Park, livestock holders move to and from the lakes through the Park. Therefore, this movement in protected areas force the cattle to make an opportunistic grazing which adversely affect the park's resources, resulting in overgrazing of vegetations and poaching of wild animals.

The geometric growth of the human population demanded more and more natural ecosystem to be destroyed and used for crop cultivation. This inturn led to the alteration of the well-refined food chain to unidirectional energy flow. Hence, man-made control of insect pests replaced natural control, which operates in natural ecosystem. These lead to pest resurgence and dominance of few or one species of insect. On the other hand, many insect species have disappeared or their distribution has been reduced due to several factors. Among these are repeated applications of broad-spectrum insecticides and destruction of natural ecosystem and replacement with agro-ecosystem.

Poverty in Ethiopia is also often manifested in a lack of control over resources. A desperate economic situation coupled with lack of control often leads to short-term resource management strategies. People use whatever they can to support themselves, with little time or resource left to invest in resource conservation. For example *Boswellia* spp, which are sources of incenses are used for charcoal production. To a large extent aromatic plants are harvested from the wild with little, or no consideration, for their sustainable utilization. The major threat to genetic diversity of coffee in the southern part of Ethiopia is forest clearance, while in the east is its replacement by Chat (*Catha edulis*) to fetch more money.

The broad range of genetic diversity existing in Ethiopia, particularly the primitive and wild gene pools, is presently subjected to serious genetic erosion and irreversible losses. This threat, which involves the interaction of several factors, is progressing at an alarming rate. The most crucial ones include displacement of indigenous landraces by new, genetically uniform crop cultivars, changes and development in agriculture or land use, destruction of habitats and ecosystems, and drought. The drought that prevailed in Ethiopia in the last decade has directly or indirectly caused considerable genetic erosion, and at times has even resulted in massive destruction of both plants and animals. The famine that persisted in some parts of Ethiopia, for example, has forced farmers to eat their own seed in order to survive or to sell the seed as a food commodity, and this often resulted in massive displacement of native seed stock by exotic

seeds provided by relief agencies in the form of food grains (Fassil Kebebew *et al*., 2003). These authors also argue that, in general, native barley and durum wheat are probably among the most threatened by new improved/introduced varieties and/or by other crop species such as teff and bread wheat, which are expanding within the cereal growing highlands of central and southern highlands of Ethiopia, because of greater market demand.

The major threat of pasture grasses is overgrazing, which causes the disappearance of the palatable and high yielding species. The genetic threat of herba-

Figure 2.4.6. Acacia woodland area with very little charcoaling *intervention in Abiyatta-Shalla – Oromiya National Regional State*

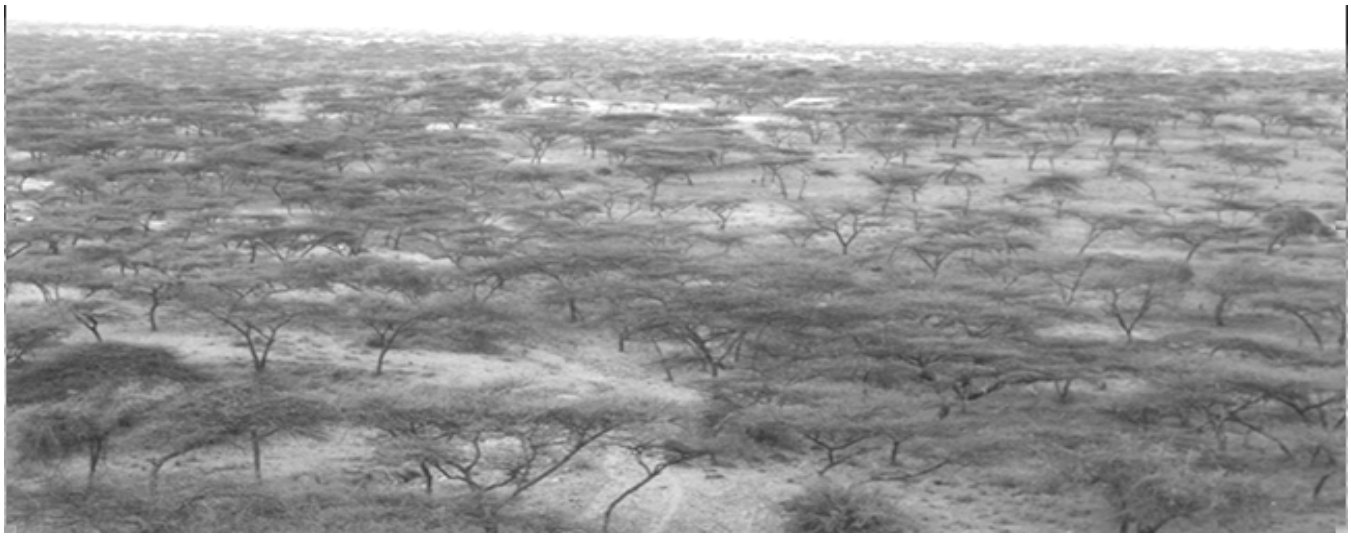


Figure 2.4.7. Acacia woodland area with very high charcoaling *in Abijatta-Shalla* .

ceous legumes is particularly serious since they are more palatable and subsequently selectively fed upon by livestock. As land degradation continues, the rangelands become overstocked and overgrazed resulting in a cascading deterioration of rangeland resources.

Shortage of food as a result of degradation of rangelands/grazing areas and overstocking are the major threats to domestic animal genetic resources. Additional threats emanate from artificial insemination and interbreeding and inbreeding; diseases such as Trypanosomiasis infection on sheep breeds, and Nosema and Amoeba on honeybees.

From the results of the preliminary survey made in Ethiopia and few other eastern Africa countries, 38 different invasive alien species have been reported. These species consist of 21 plants, 5 vertebrates, 9 insects, 1 invertebrate, and 2 microorganisms. Ethiopia has experienced the impacts of invasive species and in some cases the infrastructure necessary to control such species is also present, but there is too little knowledge, and the measures for monitoring and control are severely limited (Second National Report to the COP-6, 2001). These invasive alien species are deadly threats to the country's biodiversity.

Box 2.4.1. **Change in spatial extent of vegetation**

The case of the Four Rift Lakes Areas of Ethiopia

The area around the four Rift valley Lakes namely: Lake Ziway, L. Langano, L. Abijata and L. Shalla were believed to have quite a good spatial converge of vegetation at earlier days. Acacia trees were predominantly covering the area while quite a good stock of grass coverage was present. There is an assumption that there would be a change in the spatial extent of the vegetation cover in the area. This assumption has to be verified through supportive data and figures. Data and figures concerning changes on vegetation cover of an area of concern can be acquired through different techniques such as surveys and Remote Sensing and aerial photography.

In this case study, Remote Sensing Technique was used to quantitatively observe the change occurred during a certain time span. A Remotely Sensed Image of LandSat TM for years 1986 and 2000 of the study area were used as a row data sets for the change detection.

Figure 2.4.8. Raw Satellite Image (1986) of the Study area

Figure 2.4.9 Raw Satellite Image (2000) of the Study area

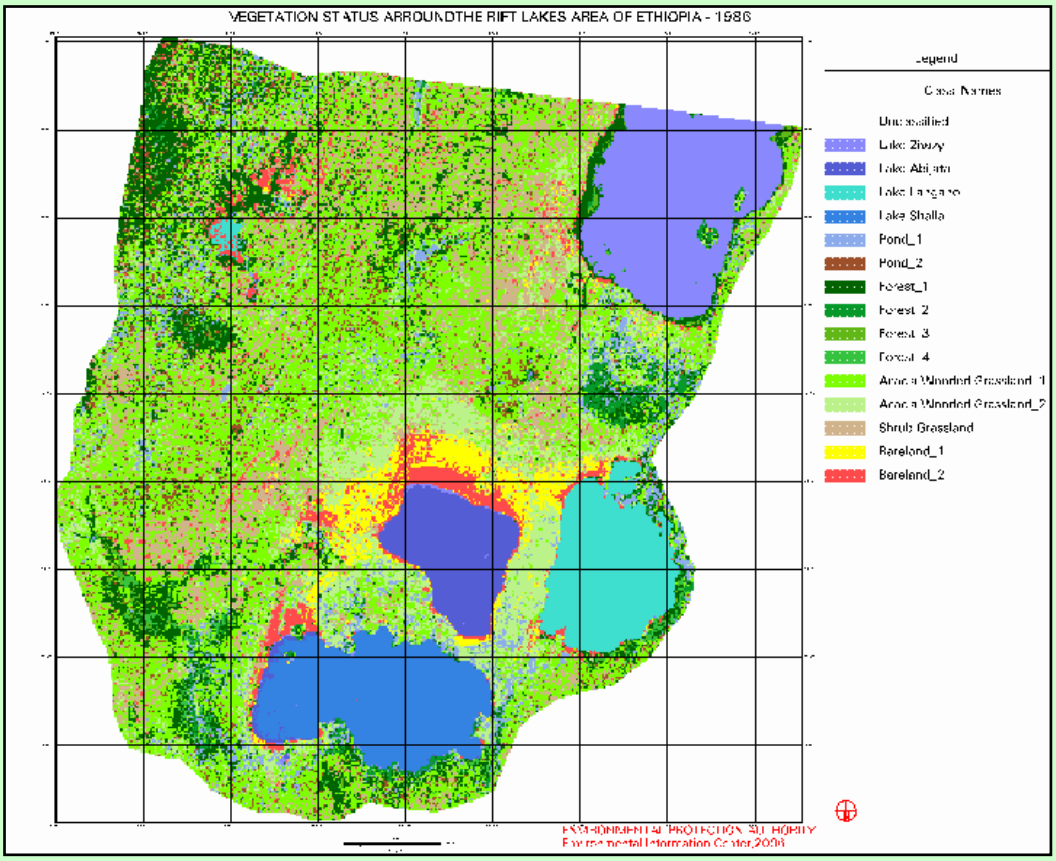
A study Area, which equals to 540,291.4 hectares, is delineated and sliced out from the full scene of both year images (see figure 2.4.8).

The Remote Sensing software "ERDAS" was used throughout the change detection analysis in *the study*. Different algorithms, including image enhancement procedures were utilized in order to come up a general land cover map of the study area. As the focus area of this study was to see the vegetation change within 15 years time, the status of other cover types within the study area is not presented in this document.

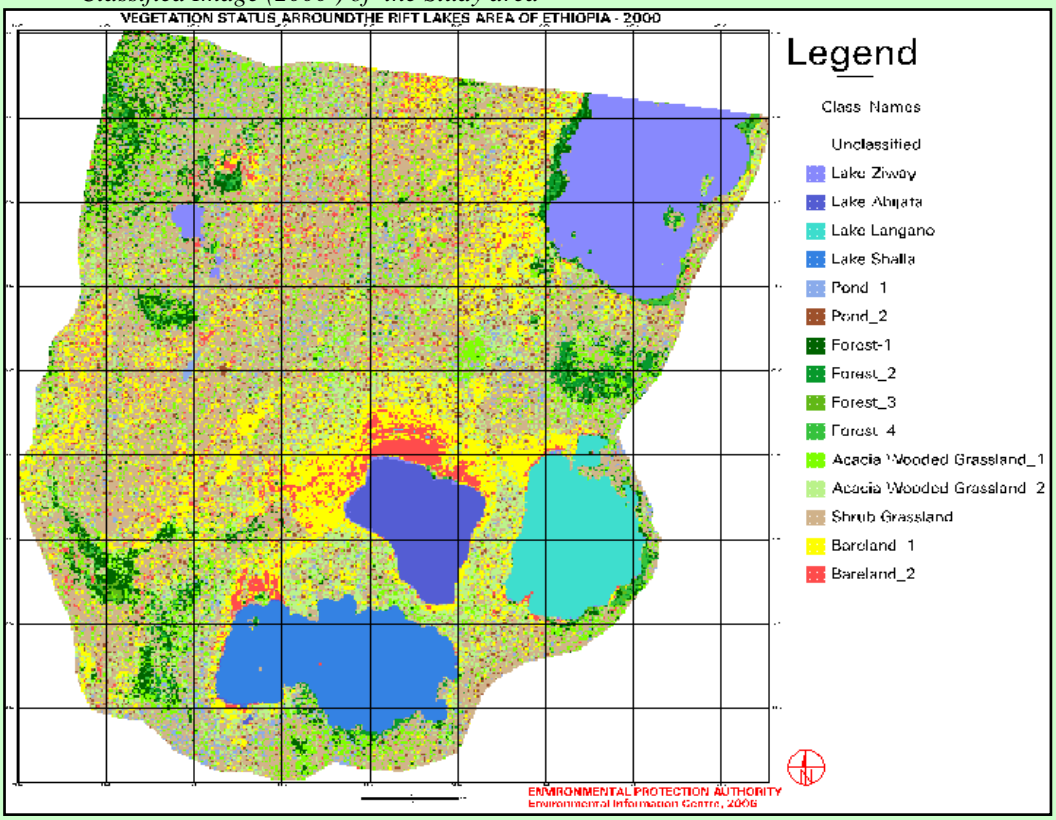
The result of the analysis indicated that there was a marked change in the spatial extent of vegetation cover in the study area within a 15 years time span.

Box 2.4.1. Cont'd..

Classified Image (1986) of the study area



Classified Image (2000) of the Study area

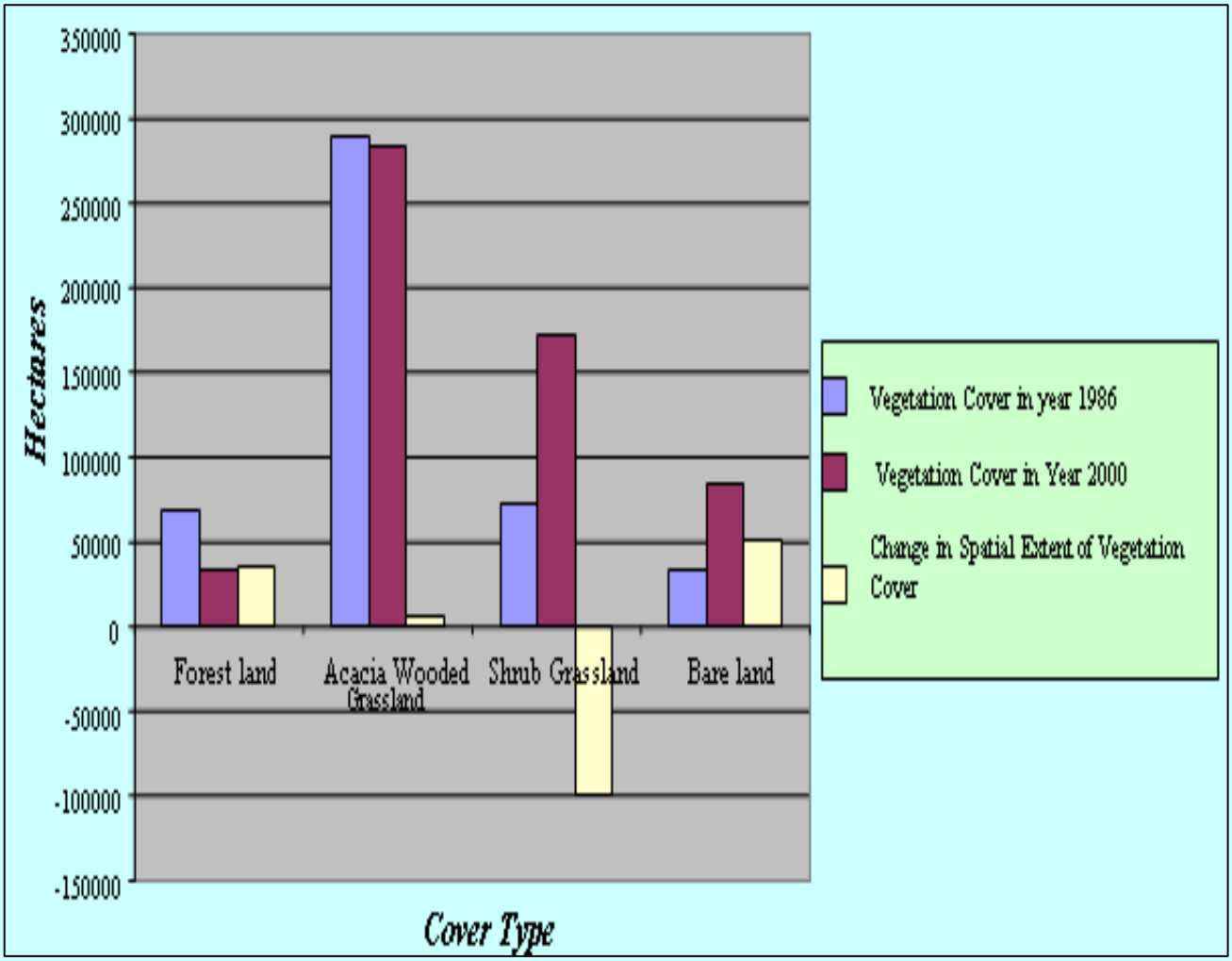


Box 2.4.1. Cont'd..

The image analysis result revealed that the vegetation cover which was 357294.24 hectares in year 1986 has changed to 315915.3 hectares in year 2000. The reduction in the spatial extent of vegetation cover in the area amounts to 41388 hectares. Forest areas mainly on hill tops and river banks have reduced by 51 Percent. Similarly 2 percent reduction in acacia wood land area was observed in the area. On the contrary the analysis indicate that an increase in bare land area , which amounts to 150 percent.

The reduction in vegetation cover in the area could be attributed to so many reasons. The cases for such decrease in vegetation cover and the over all social, economic and environmental impacts due to the removal of vegetation cover in the area has to be studied.

Spatial extent and change in vegetation cover in the four Rift Valley Lakes area - Ethiopia



Responses

Biodiversity conservation is an integral part of the environment policy of Ethiopia and the conservation strategy. The National Biodiversity Conservation and Research Policy provides policy guidance towards the effective conservation, rational development and sustainable utilization of the country's biodiversity and utilization. The National Biodiversity Strategy and Action Plan (NBSAP) is completed. The goal of the Ethiopian Biodiversity Strategy and Action Plan has been formulated as "Effective systems are established that ensure the conservation and sustainable use of Ethiopia's biodiversity, that provide for the equitable sharing of the costs and benefits arising there from, and that contribute to the well -being and security of the nation". The Plan provides an implementation schedule of proposed actions to prioritise those that could be implemented immediately and at low cost.

Ethiopia has established ex situ gene banks and few others such as community based in situ (on-farm) conservation. In situ conservation of farmers' varieties/landraces has given access to the farmers to acquire germplasm from the central ex situ gene bank and to undertake restoration of their own materials. The community based in situ conservation of root and tuber crops, forest coffee along with the associated spices such as Korarima (Aframomum korrorima) and long pepper (Piper capsicum). The Institute of Biodiversity Conservation in Ethiopia also undertakes ex situ conservation of Arabica coffee at the Choche field gene bank.

To conserve medicinal plants, the Institute of Biodiversity Conservation has recently established *ex-situ* field gene bank at Wondo Genet and *in-situ* site at the Bale Mountain in collaboration with Traditional Healers Association and the local government respectively.

In order to protect and conserve the declining population of wildlife in the country, the government has established protected areas at different levels and allocated 193,600 km^2 to wildlife protected areas.

The Ministry of Agriculture and Rural Development (MoARD), The Federal Environment Protection Authority (FEPA), the Institute of Biodiversity Conservation (IBC), the Ethiopian Wildlife Conservation Department of the Ministry of Agriculture and Rural Development and regional environmental organs are the main institutional response of the government for the conservation and sustainable use of biodiversity resource of the country.

Conclusions and recommendations

Biodiversity provides ecosystem services worth hundreds of billions of Ethiopian Birr every year that are crucial to the well being of Ethiopia's society. These services include clean water, pure air, soil formation and protection, pollination, crop pest control, and the provision of foods, fuel, fibres and drugs. As elsewhere, these services are not widely recognised, nor are they properly valued in economic or even social terms. Reduction in biodiversity affects these ecosystem services. The sustainability of ecosystems depends largely on the buffering capacity

Table 2.4.1. Protected areas of Ethiopia designated for wildlife conservation

Category	Number	Area (km^2)	Percentage area
National Parks	9	20,829	1.8
Wildlife Sanctuaries	4	9,532	0.8
Wildlife Reserves	8	24,810	2.2
Controlled Hunting Areas	18	133208	11.7
Total	39	188, 379	16.5

Source: Mohamed Abdi et al., 2003

provided by having a rich and healthy diversity of genes, species and habitats.

Loss of biodiversity leads to ecosystem degradation and subsequent loss of important services that harm the rural majority people more directly. The achievement of sustainable development and poverty reduction is dependent on how effectively biodiversity is conserved. Losing biodiversity is like losing the life support systems that we, and other species, so desperately depend upon. Thus, conserving, protecting and maintenance of biodiversity is an insurance policy for the future of the country's development.

Effective conservation and sustainable utilization of biodiversity depends, among other things, on the meaningful and effective integration of activities in all the relevant sectors and avoiding of fragmented approach at all levels. Effective implementation of the National Biodiversity Strategy and Action Plan (NBSAP) brings about the required integration., and enforces the implementation of NBSAP.

There is legal gap in some sectors or subjects, for instance, in the area of aquatic resources, particularly fishery resources, and in land use, forest, fishery, protected area, wild and domestic animal. Therefore, the legal gaps should be filled and some existing laws be updated.

Information on Ethiopia's biodiversity should be compiled and located in Ethiopia in a central biodiversity information system where it could be made available and accessible to government and non-government institutions, the private sector, individuals (including researchers), etc. who would like to make use of them.

The contribution of biodiversity should account in the country's GDP to portray the value of biodiversity resources and prove justification for investment on conservation of biodiversity.

Strengthening the role and capacity of local communities and the private sectors to sustainably utilise and manage the biological resources should be encouraged.

Efforts should also be made to enhance regional, national and international cooperation in biodiversity conservation and sustainable utilization.

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2.5 FRESH WATER RESOURCES

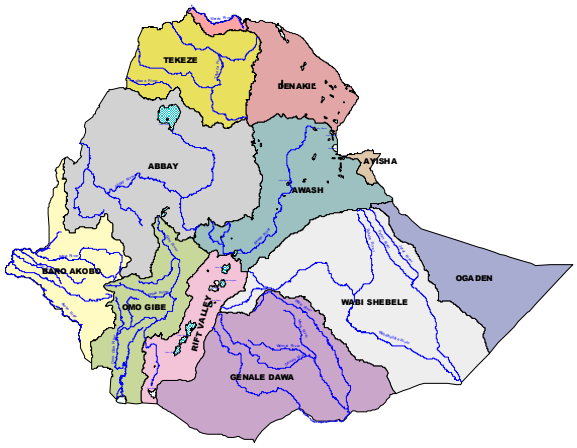
2.5 FRESH WATER RESOURCES

State and Trend

Ethiopia possesses considerable potential on fresh water resources both surface and ground-water.

The surface water includes rivers, lakes and wet-lands. Most of the surface water resources appear in the form of runoff in the 12 major river basin systems, where the pick flows are confined to the shorter periods (2-3months) of the rainy season. Ethiopia has abundant water resources. These potentials are not always readily available for use. For example, The surface water resources potential of Ethiopia is described by the river systems of the country.

Figure 2.5..1. Major river basins systems of Ethiopia



Source: Ministry of Water Resources

In Ethiopia, there are 12 Major river basins. Of these major river basins much of them discharge into neighbouring countries. The, trans-boundary nature of the surface water resources is another challenge for sustainable water resources devel-opment.

Table 2.5.1. Surface water resources by major River Basin (Mm^3)

No	River Basin	Catch-ments Area (Km^2)	Annual Runoff (BM^3)	Specific Discharge (l/s/ Km^2)
1	Abbay	199,812	52.6	7.8
2	Awash	112,700	4.6	1.4
3	Baro-Akobo	74,100	23.6	9.7
4	Genale –Dawa	171,050	5.80	1.2
5	Mereb	5,700	0.26	3.2
6	Omo-Gibe	78,200	17.90	6.7
7	Rift Valley	52,740	5.60	3.4
8	Tekeze	89,000	7.63	3.2
9	Wabe Shebele	200,214	3.15	0.5
10	Afar-Danakil	74,000	0.86	-
11	Ogaden	77,100	0	-
12	Aysha	2,200	0	-
	Total	**1,136,816**	**122.00**	

Source: Ministry of Water Resources

Ground water is one of the most useful and exploitable natural resources, and the more available resource than surface water particularly in the arid parts of the country. About 80% of the existing sources for drinking water supplies originate from ground water sources. Despite this fact, detailed study that enables efficient utilization is very limited or almost non-existent. The mapping coverage for groundwater is small. However, existing water sector data estimates the potential to be approximately 2.6 billion cuibic meters.

The current per capita fresh water resources is estimated to be 1924 cubic meters per annum.

Although, Ethiopia can be considered as one of the water rich countries in the continent, the level of access to safe drinking water is very low even compared to countries of similar socio-economic development. Currently, only 34% of the Ethiopian population has accesses to safe potable water out of which coverage for the rural is about 25% and that of the urban is about 85%.

Figure 2.5.2 Women Fetching Drinking Water in Eastern Arsi Zone, Oromiya

Figure 2.5.3 A long queue of plastic Jerrycan to Collect drinking water

Among the contributing factors for the low level of the services, population growth and disparity of water resources distribution, financial constraints and absence of sufficiently qualified human resources further compound the low level of utilization of the fresh water resources. In addition, lack of data and information, required for efficient sector planning and management has been identified as one of the major constraints of the water sector (WSDP, 2002)

As mentioned early on, Ethiopia often suffers from the spatial and temporal unevenness of availability water resources. On the other hand, rainfall has erratic nature, which has led to frequent droughts. Consequently, agricultural production has been under serious challenge with accompanying widespread food insecurity. Therefore, the proper use of the country's water and land resource particularly exerting significant efforts on irrigation development has been considered imperative in the country's development strategies.

The country has 3.7 million hectares of irrigation potential. Currently only 386,603.25 hectares are

put into development through traditional and modern irrigation schemes.

Based on the type of management, irrigation schemes are classified into traditional and modern irrigation. The total area presently under traditional schemes is estimate to be 13,821.25 hectares out of 199 identified sites. Under the modern irrigation schemes, there are 466 small with area under 200 hecatar, 102 medium with area between 200 and 3000 hectare, and 9 large scale with area over 3000 hectares (Ministry of Water Resources, September, 2005 Report.)

These are small-scale irrigation schemes built under a self-help program of peasant farmers on their own initiative. Each scheme generally varies in size from less than 50 ha to 100 ha.

The schemes are operated and maintained by the farmers themselves. Cereals, pulses, oil crops, coffee, enset, chat, vegetables, sugarcane and fruits are irrigated under traditional irrigation schemes. Traditional water use associations led by elected chiefs, undertake the operation and maintenance of traditional irrigation schemes.

The idea of modern communal schemes had its origin with the severe drought of 1973. Their main objective is to enhance food security and to improve the livelihood of peasant farmers by providing cash income through the production and marketing of the produce. Modern communal schemes are generally based on river diversion, but may also involve micro-dams for storage. Water users associations execute operation and maintenance of the schemes. In some regions government supports them. In regions such as Tigray, Amhara, Oromiya, SNNP and recently in Afar there are commissions for irrigation authority.

Modern private irrigation is a recent phenomenon that re-emerged with the adoption of a market based economic policy in the early 1990s. Virtually all irrigated state farms were initially privately owned until the nationalisation of private property in the mid 1970s.

Currently 18 modern private irrigation projects are operational.

There are also irrigation scheme owned and operated by public enterprises. Currently, these schemes constitute an estimated area of about 61,000 ha. The largest concentration of public irrigation schemes, about 73% of the total, is found in the Awash Valley.

The MDG needs assessment target for year 2005 to 2015 is set at 381,000 ha with beneficiaries of 1,525,000 NP and LO households, each household owning 0.25 ha. This will give on average annual target of 34,600 ha, and an average annual growth rate of about 35%.

Figure 2.5.4. Irrigation practice on a private farm plot

According to the water sector development program the target is set to be 336,400 ha for medium and large-scale irrigation schemes. This is in the order of about 30,600 ha average annual target.

Construction of water harvesting structures is among the interventions considered. 700,000 households constructed water harvesting structures in the year 2003/4 and was used as a base

for the MDG needs assessment. Projecting this annual achievement for the years 2005 to 2015, the MDG target is set at 7,700,000 households to be beneficiaries of such intervention. Of these, Pond/citern users are projected to be 40%, hand dug wells 30%, and springs with night storage 30% of the total target households.

Social, Cultural and Economic Value of Water

Water plays an important role in the socio economic development of human beings. It is the center of every development. However, the benefits are a function of management and its utilization. The role it plays depends on the level of investment made on water and other related projects. In Ethiopia, the resources (fresh water resource) are abundant and should not be a constraint to support the socio-economic development of the Ethiopian people. However, for various reasons this resource is not exploited to fulfil even the minimal needs of the Ethiopian people. Some of the reasons attributing to the under utilization of the resource are:

- Spatial and temporal variability of water/ rainfall;
- Low level of investment for resources assessment, protection and development;
- Depletion of water resources through pollution, environmental degradation and deforestation; and
- frequent occurrence of drought and famine.

Valuing water is very much dependent upon the social and cultural setting of people. The context of these important elements determines the way how people react against technological parameters. In Ethiopia, the implementation of some principles/issues such as cost recovery in rural water supply schemes and willingness to pay are based on the social and cultural understanding of communities. Generally people attach religious and social values to water. The values of drinking water, domestic use, irrigation and industrial use emanate from the social and cultural perceptions of people. The social and cultural behaviour of people differs from place to place and so is the value of water, which is the reflection of the context. In the water resources management policy document, water is recognised as both a social and economic good.

Water Supply Coverage

Population with access to safe water supply, which is about 34% is very low compared to other countries of similar economy.

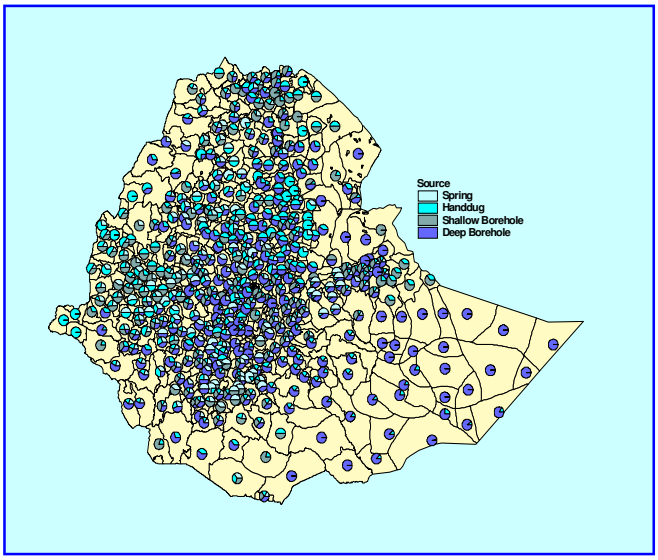
In Figure 3, the source of water supply is presented at Wereda level. Most of the services are confined in the highland parts where it is dominated by the concentration of population settlement. The service centers are sparsely located in the lowland parts. Deep boreholes dominate the supply source for the southern east of the country.

- **Impact and Threats**

The problems and challenges of the water sector development are numerous. Some of the constraints common to all sub sectors of the water

sector- irrigation, water supply and sanitation,

Figure 2.5.5. Ground water source utilization



(Source : M oWR)

hydro-power, are:

- The trans-boundary nature of most of the river basins;
- The spatial and temporal variability of climate and rainfall;
- Accelerated land degradation leading to flooding, excessive sedimentation with consequent effect of degradation and disappearance of the water bodies;
- Increased demand for water due to population growth;
- Pollution and environmental degradation ;
- Poor capacity for sustainable water resource;
- Lack of willingness to pay for water services, particularly by local communities;
- Low institutional capacity and effectiveness;
- poor coordination among the various implementing institutions: Federal Government, Regional (States) Governments, NGOs and Donors and others involved;
- Lack of appropriate technology at the level,
- Lack of data and information required for efficient sector planning and management, and
- Low water use efficiencies in all water consuming sectors.

Settlement pattern is one of the challenges to deliver water supply services. As a tradition most of the settlers in the highlands tend to settle near or on top of mountain peaks, which makes it very difficult to supply water using gravity systems. On the other hand, most of the lowland settlements are of nomadic type. They don't have permanent location and therefore the supply of services faces a challenge.

Responses

- ***River Basin Master Planning***

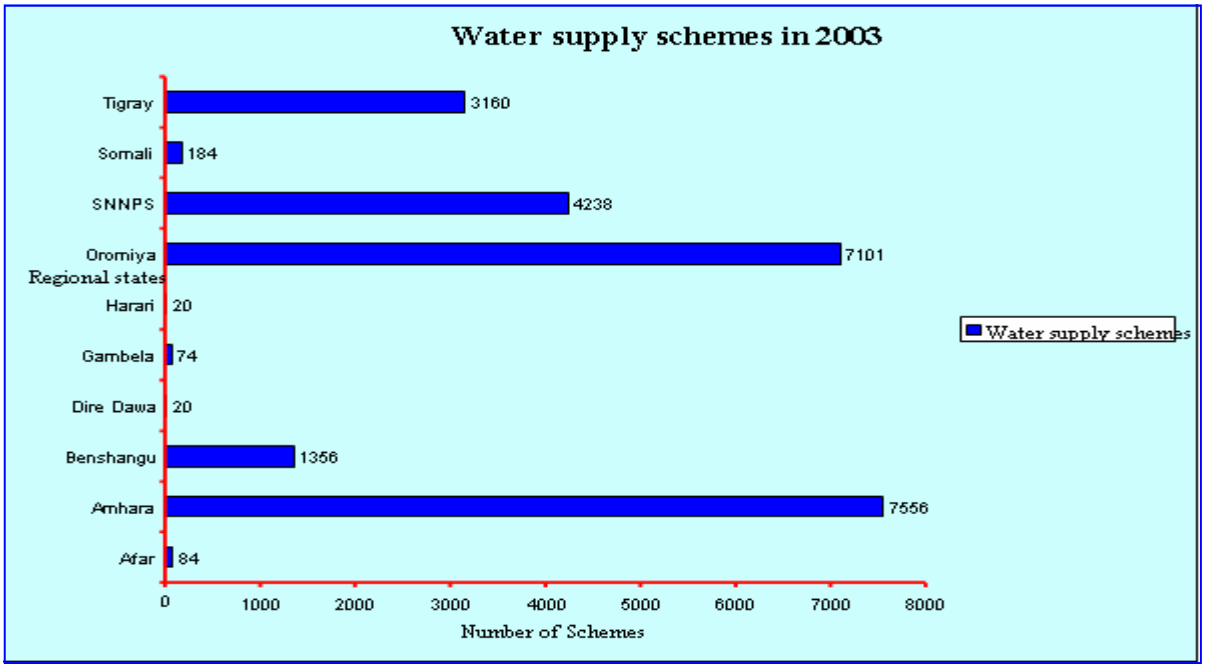
The Government of Ethiopia since the early 1990's vested keen interest to support the undertaking of river basin integrated development master plan studies for the twelve major river basins of the country. The ultimate objective of the river basin studies is to formulate an integrated natural resources utilization plan with a focus on water resources. The management of water resources in a river basin approach is believed to be an immediate need to advance planning and development activities in the basins. Integrated river basin development master plan has principal objectives. These are:

- To prepare water allocation and utilization plans under alternative development scenarios and to generate data, information and knowledge that will contribute to the future water use related issues.
- The preparation of the River Basin Development Master Plan that will guide the development of the resources of the basin particularly with respect to the occurrence, distribution, quality and quantity of the water resources for the coming 30 – 50 years.

In Ethiopia, there are 12 major river basins; out of which integrated River Basin Development master plan study has been completed for six. These includes: Omo-gibe, Baro-Akobo, Abbay, Tekeze, Mereb, and Wabi-shebele river basins.

At this moment there is also an on-going study for the Genale-Dawa river basin. What has been covered so far (including the on-going study) comprises an area of 818,076 km2, which is about 72 % of the total area of the country. The three largest river basins (Abbay, Baro-Akobo and Omo-Gibe) contribute 76% of the total run-off from catchments comprising only 32% of the total area of the country.

Figure 2.5.6. Regional Distribution of water supply scheme



Source: Ministry of Water Resources

- ***Institutional and Policy Response***

The Ministry of Water Resource is the leading responsible organization for the development, administration and management of the water resources of Ethiopia. Other federal organizations also contribute to the planning and development of the water sector in the country.

The government's decentralisation program created an opportunity for the implementation of projects and programs by regions. This approach led to maintaining the interests of local communities through participation in planning and development of programs and projects. Water resources planning and development activities are carried out by the federal and regional organisations, the private sector and NGOs.

To enhance the development of water resources in the country, the Federal Democratic Republic of Ethiopia issued The Ethiopian Water Resources Management Policy in 1999. The policy outlines some fundamental policy principles such as: Ethiopian citizens shall have access to sufficient water of acceptable quality to satisfy basic human needs; The policy gives top priority to drinking water supply over other uses; Water is both an economic and social good; Water resources development should be based on rural centered, decentralized, management and participatory approaches; The policy recognizes the hydrologic boundary or basin as the fundamental planning unit.

To transform the policy into action, a National Water Sector Strategy is formulated. The water sector strategy implementation focuses on three sectoral areas: Irrigation, Water Supply and Sanitation and Hydropower. The National Water Sector Strategy is backed by "Water Sector Development Program", which has a planning duration of 2002-2016.

- ***Millennium Development Goal (MDG) and water sector development in Ethiopia***

The International Community has adopted the millennium development goals (MDG) in the year 2000. The MDG targets to cut by half the proportion of people without access to essential

services. Following this decision, developing countries including Ethiopia have been preparing frameworks to achieving the MDG targets. Towards this end, needs assessment have been conducted. The MDG goal related to water supply stipulates cutting by half the proportion of the world population without sustainable access to safe drinking water and basic sanitation.

In Ethiopia prior to the MDG, there has been an attempt by the Water Sector Development Program (WSDP) to define coverage levels of sectoral developments for irrigation, water supply and sanitation and hydro-power. The planning horizon of the sector program is 2002-2016. According to this program the following coverage level has been formulated for the water supply.

Though the above coverage's are formulated by the program, later project studies depicted that due to some constraints such as securing loan and financial assistance and low capacities for implementation, achieving those goals have been challenged.
To serve the purpose of the MDG needs assessment, the medium variant population forecast of CSA 1999 has been adopted.

Access to freshwater or an improved water source is defined as the population with reasonable access to an adequate amount of water from an improved source, such as borehole, protected well and spring. Reasonable access is defined as the availability of at least 20 litres for a person a day from a source within one kilometer of the dwelling (WHO and UNICEF Global Water Supply and Sanitation assessment Report 2000). In the Ethiopian context, reasonable access is defined by: availability of at least 20-25 litres for a person a day, whereby 20 lcpd for the first five years (2005-2010) of the MDG implementation period and increasing it to 25 lcpd for the period 2010-2015 is adopted.

Table 2.5.2. Water supply coverage targets

Water Supply Coverage	2000	2004	2005	2010	2015
Urban Water Supply					
Percentage Coverage	74.4	82.5	85.2	95.4	98.00
Population reached (millions)	7.05	9.24	9.947	13.68	17.14
Rural Water Supply					
Percentage Coverage	23.1	31.4	34.1	49.1	67.2
Population reached (millions)	12.48	18.77	20.93	33.97	51.76
Country level					
Percentage Coverage	30.8	39.4	423	57.2	72.9
Population reached (millions)	19.53	28.00	30.96	47.76	68.94

Source: Ministry of Agriculture

Table 2.5.3 Adopted values of water supply coverage for year 2004

Region	Population in '000	Coverage in %	Population in '000 with access to safe water
Addis Ababa	2,805	85.00	2,384
Afar	1,330	28.20	348
Amhara	18,143	38.20	6,931
Benishangul	594	32.40	192
Dire Dawa	370	66.10	245
Gambela	234	23.90	56
Harari	185	26.80	50
Oromiya	25,098	41.00	10,290
Somali	4,109	19.40	797
SNNPR	14,085	34.40	4,845
Tigray	4,113	45.30	1,863
National	**71,066**	**39.40**	**28,002**

Source: Ministry of Water Resources

Conclusion and Recommendation

Fresh water resources availability in general is under continuous threat by environmental degradation. Particularly, in Ethiopia the problem is much aggravated by problems like population growth, land degradation etc. Therefore, taking steps and tangible measures incompliance with these efforts should be considered as a key to minimizing associated problems and improve the level of access.

The water resource of the country is quite abundant; however, the level of utilization is very low due to various reasons. The service level of the water sector in the areas of irrigation, water supply and sanitation and hydropower needs special attention. The government needs to prove allocation of resources and improve the situation of governance. Formulating programs and projects without a concerted effort to allocate sufficient financial resources for implementation of no use / will not help to attain the envisaged goals.

Monitoring and evaluation of projects and programs is a key to check the success or failure of the situation. It needs to be exercised on a regular and planed manner on a continuous basis.

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CHAPTER THREE

Crosscutting and Emerging Issues

CROSS–CUTTING AND EMERGING ISSUES

3.1 Cross-Cutting issues

3.1.1Gender and Environment

Gender refers to the socially constructed roles behaviors, attitudes and responsibilities that the society assigned to women and men in a given culture. Gender differences are determined by social, cultural, religious, legal, moral and economic norms. Hence, women and men play different role in the community, which exposes them to different constraints, opportunities needs and they also act differently on the environment. These social relations also determines the use of natural resources in a given area, in most cases, women are constrained with socio-culturally imposed limitation, which deny the right and control over productive resources, such as land and other fixed capital. Access to and control over these resources varies according to gender relations.

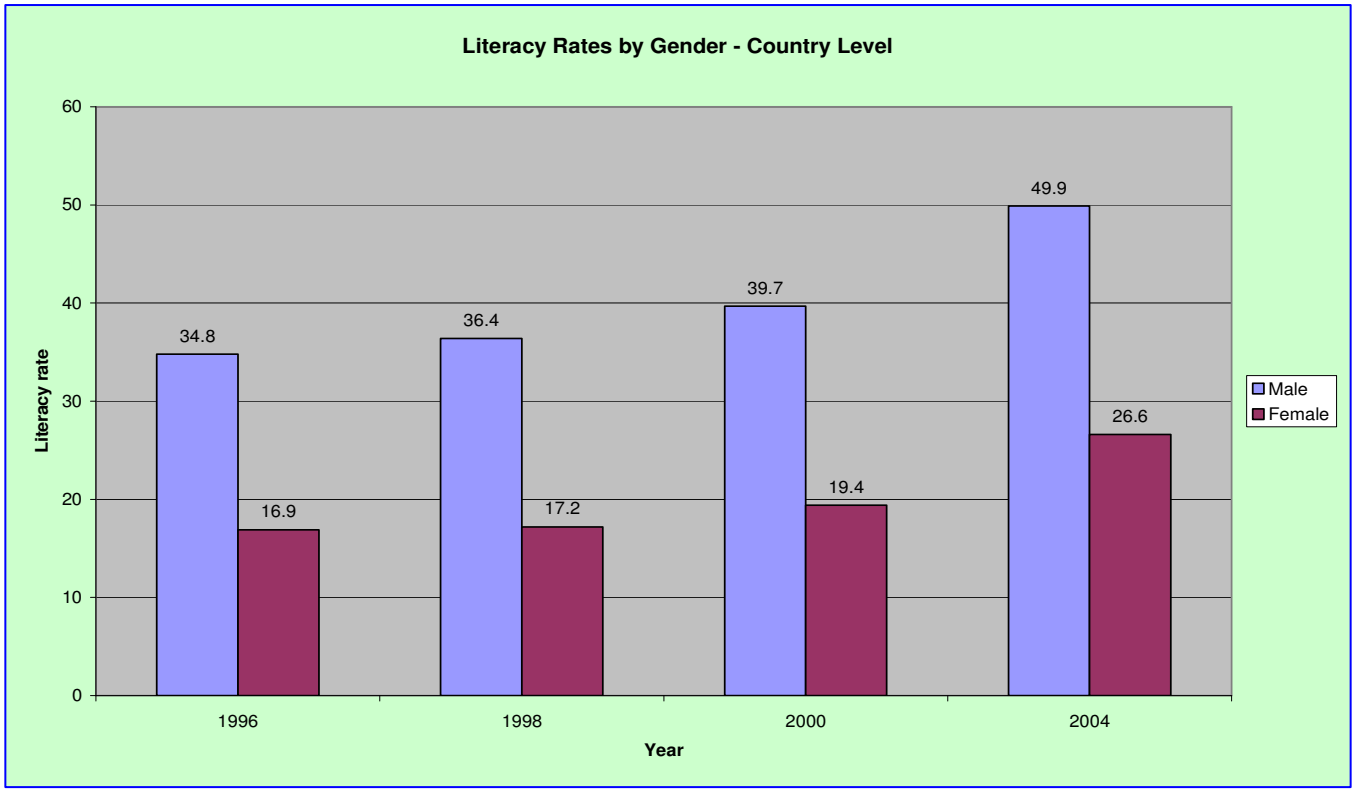
In almost any country, women and men have different access to environmental and economic resources and varying power to make choices that affect their lives, as a consequence of the state of gender relations that exists in a given society (MoFED, 2002).

- **State and trend**

Out of the total population of Ethiopia, which is estimated to be 73,044,000 (as of 2005), women constitute nearly half of the population i.e. 36,440,000. From the total women population, 16.1% and 83.9 % live in urban and rural areas respectively. Based on the CSA estimate rural women constitute 49.8 % of the total rural population, while the urban women constitute 50.3 of the total urban population.

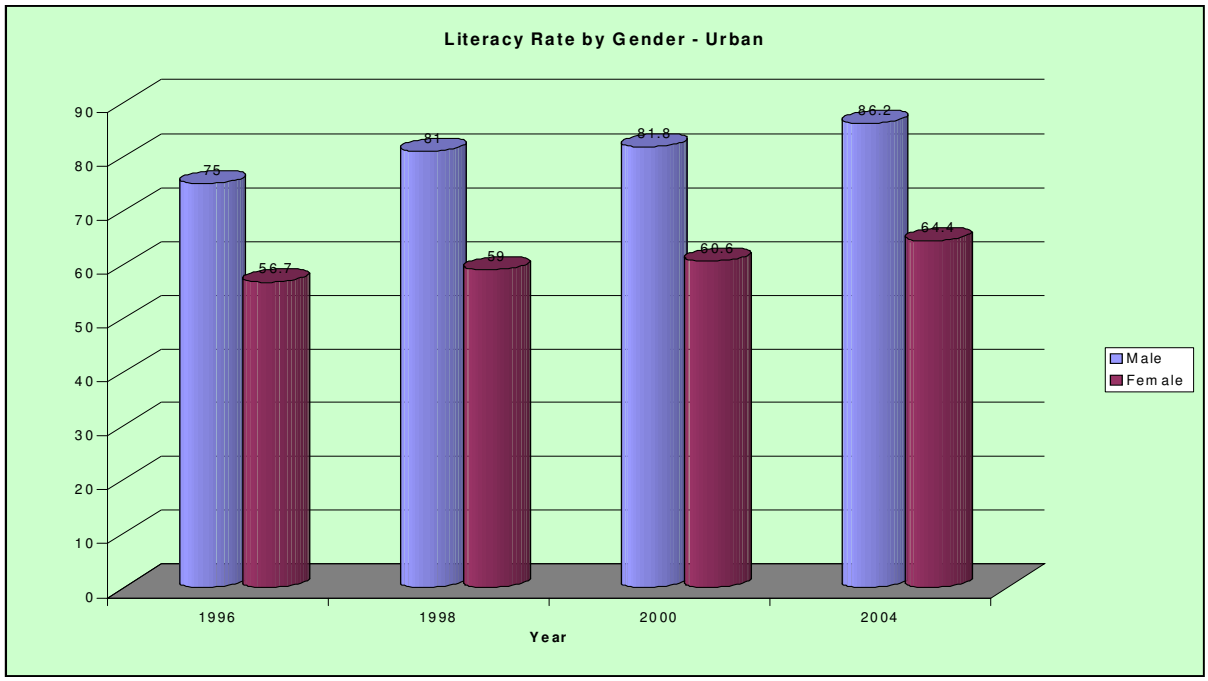
It is obvious that education plays a vital role in environmental management and sustainable development of the country. This implies that if

Figure 3.1. Literacy rate by gender— country level



Source: Ministry of Finance & Economic Development , 2004

Figure 3.2. Literacy rate by gender—urban



Source: Ministry of Finance & Economic Development , 2004

they are well educated they can play more roles in environment and sustainable development endeavors within the country. Hence, the issue of educational service becomes an issue of gender equity.

The trends in gender disparity in primary enrollment for decades indicate that there has not been perfect equality between boys and girls in the enrollment of primary education. Currently the illiteracy rate of women is very high. In year 2004/2005 women constitute 26.6% of literate population of the country. Hence, in order to increase the contribution of women in environment and sustainable development giving due attention for girls' participation in education is crucial. According to the wealth monitoring surveys in Ethiopia, irrespective of the sex of the person the proportion of literate population (at all levels) is increasing. In rural areas the literacy rate increased from 18% in 1995/1996 to 31% in 2004/2005. This disparity is also reflected significantly between male and female.

- **Impact**

Ethiopian women play major role in the economy of the country mainly in agricultural activities. Their tasks in agriculture and animal husbandry as well as reproductive role make them the daily managers of the living environment. Hence, the CSA 2004 report on the Agricultural Sample innumerate survey indicates that women spend a considerable amount of time in the agricultural production process. (See Table 3.1). Rural women spend 13 to 17 hours a day (CSA, 2004) in productive and reproductive activities.

Women contribute a lot in the protection of environmental resources and sustainable development through the maintenance of the country's ecosystems, bio-diversity and natural resources. Hence, promoting gender equality implies a profound support in achieving the goals and targets of the PASDEP as well as improving the current status of environmental assets.

Rural women have been greatly involved in land husbandry practices such as soil and water con-

servation, reclamation of degraded lands etc. Some of these women could be mentioned as a model example. One case of such a model women is presented in text box .3.1

Although degradation of the environment affects both women and men, women are most affected segment of the society. It directly affects their living situation, which resulted in food insecurity and severe poverty. On the other hand women also contribute to the degradation of the environment by exploiting the scarce natural resources due to the heavy burden they carry to fulfill the family responsibility. The relationship between women and natural resource emanates from the socially created roles and responsibilities such as health care, feeding and other reproductive activities. The share of rural women in managing their environment in tree planting, soil conservation and land management is highly considerable in the rural settings. Although Ethiopian women (especially the rural women) play significant role in environmental protection and its management, their contribution to the betterment of the environment is not well recognized. This might be related to their low level of empowerment in environmental decision-making processes.

Rural women in Ethiopia play significant role in forest resources management and conservation. They are not only forest resource extractors, but they are potential resources for improving and managing the forest resources of the country. The inter-linkages between forest resources and the rural women in Ethiopia are very high. Forests are alternative sources of income particularly for poor women in urban areas as well as alternative energy sources for the majority of rural women. Both urban and rural women bear the responsibility for gathering firewood either for generating income or household cooking purpose. The availability of firewood in close proximity to both rural and urban women will reduce their burden in terms of time and workload. However due to the past continuous forest and wood land resources depletion rural women particularly suffer from scarcity of firewood and they are obliged to travel long distance to fetch firewood. For example, according to the Welfare Monitoring Survey (1996), 11% of rural households need to go for 10 or more kilometers to collect firewood.

Table 3.1. Distribution of women /men aged 10 years and above in the household by proportion of time spent on different agricultural activities 2001/02 (1994 E.C)

Agricultural Activities	One- forth		Half		Three-Forth		Full Time		Not Participated		Not Applicable	
	Male	Fem	Male	Fem	Male	Fem	Male	Fem	Male	Fem	Male	Fem
Ploughing	20.8	79.1	57.7	42.2	80.6	19.3	96.6	3.3	8.97	91.0	25.9	74.0
Snowing	19.2	8.74	46.1	53.8	78.6	21.3	92.7	7.28	10.9	89.0	34.02	65.9
Weeding	27.0	22.9	43.6	56.3	64.3	35.6	70.6	29.3	21.3	78.6	48.8	51.2
Feeding /Treating	36.3	63.6	47.4	52.5	58.2	41.7	62.1	37.9	41.8	58.2	51.6	48.3
Milking	49.1	50.8	43.7	56.2	38.6	61.3	15.7	84.2	66.7	33.2	61.10	38.8
Marketing of agricultural products	46.8	53.1	46.9	53.0	51.3	48.6	46.1	53.8	57.5	42.4	56.6	43.3

Source: Central Statistical Agency

Text box 3.1 **Women Farmer Innovator in Land Husbandry**
The Case of W/ro Ayelech Fikre

Ms. Ayelech Fikre 66, is an illiterate woman widowed farmer living in Ankober Woreda, North Shewa Zone of the Amhara National Regional State. The total area of her farmland is about 1 ha. She has been applying various structural indigenous soil and water conservation measures such as stone bunds, cut-off drains and traditional ditches by her own initiatives. However, she has recognized that these structural measures alone are not enough to get better crop yields. As a result, she started applying various types of soil fertility management practices including application of composted manure, intercropping, crop rotation and planting of *Croton macrostachyus* in a line below each stone bund. Moreover, to address the problem of water shortage, she has used various water harvesting techniques and successfully obtained more crop yield.

Apart from the different indigenous land husbandry techniques applied directly on her farmland to conserve soil and water, Ayelech has also treated the steep land above her farmland by constructing hillside terraces and planting Gesho (*Rhahmnus perinoides*), Also known as 'hops', which is used for local beer brewing and for which there is a high demand on the local market. In addition, she allows other indigenous tree species, such as *Juniperus procera*) and African olive (*Olea africana*) to regenerate naturally on this slope. She prunes the juniper branches so that the trees will attain the desired height and diameter quickly to be sold as timber. She taught herself about the effect of pruning by leaving some trees un pruned and comparing their growth with that of the pruned trees. She uses the pruning for fuel.

In general, Ms. Ayelech has integrated various indigenous land husbandry practices by her own initiative and knowledge. For her work of indigenous natural resources conservation practices, she received a prize from the Food and Agriculture Organization (FAO) of the United Nations and the then Ethiopian Ministry of Agriculture on World Food Day in October 1998. It is now widely recognized (by various visitors including farmers, experts and higher officials) that she has integrated various indigenous techniques of land husbandry, applied by different farmers, in a unique way on her own farm so as to make optimal use of the resources available to her and make them more productive.

Responses

The gender perspective on environment and development calls for a specific focus on the contributions, needs and visions of women, as their positions have too often been neglected in environmental area stressing the value of examining sustainable development through gender perspective, explores specific polices, strategies and practices in environmental use and conservation.

Cognisant of this fact, The Government of Ethiopia has committed itself to gender issue by clearly stating the Federal Democratic Republic of Ethiopia equal rights of women and men in the Constitution, Article 35. The Constitution recognises the right to affirmative measures for women and provides special attention to them so as to enable to compute and participate on the basis of public and private institutions. These concerns are further reflected in the national policy of Ethiopian women.

Furthermore, the government has renewed its commitment to address gender inequalities that deter long-lasting change and equitable development. Apart from endorsing the National Policy for Ethiopian women, the government has undertook supportive legislative measures, which include: the national economic policy and development strategies, the population policy, Health & education policies and other sectoral policies such as Water resource and Environmental policies. In addition, the country has developed the National Action Plan for gender equality and established the Ministry of Women Affairs as a major institutional response. Recognizing this fact and the value of education and training the government of Ethiopia developed the Educational Policy in 1994 by giving due consideration to girl's education at all levels.

However, there are constraints for female students particularly in rural villages. To alleviate this problem the government constructed schools in many parts of urban centres and rural villages to reduce a long distance travel. In addition affirmative action has been taken to reduce gender disparity particularly at higher level of education. As a result, there is significant change on the women/men education disparity situation but still small number of female attend post-secondary school compared to male in the country.

Recent change made in the Family Law, and attempts by the sector ministries, commissions, and authorities to institute sectoral policy guidelines to address gender issues within their operational framework, have resulted in an improvement in the policy environment and programmatic directions. However, over time it has been observed that progress in women's actual lives is not proportionate to the progress made in the policy and legal environment. This calls for expediting the socio-economic development process with the required gender sensitivity. (MoFED, 2002) .

Health and Environment

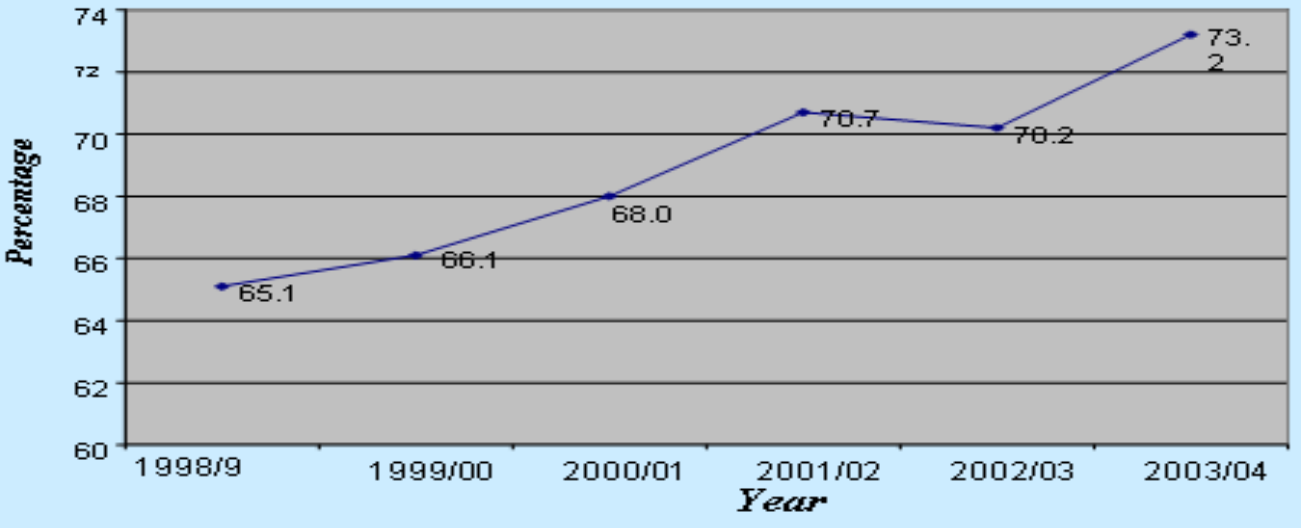
State and trend

With respect to environmental health the main concerns are the need to address the issue of adequate clean water supply, provision of health services, improved sanitation facilities and management of waste in different parts of the country.

The potential health services coverage percentage (including the services provided by private health facilities) has increase from 57.3 in 1998/99 fiscal year to 73.2 in 2003/04 and 82.9 in 2004/05. (See fig. 3.4.)

Currently there are major rural-urban differences in accessing health services. In rural areas only about a third of the population has some kind of facility within 5 km; whereas almost all of the urban population does. The proportion of population living in more than 20 km. away from a

Figure 3.3. Potential health service coverage

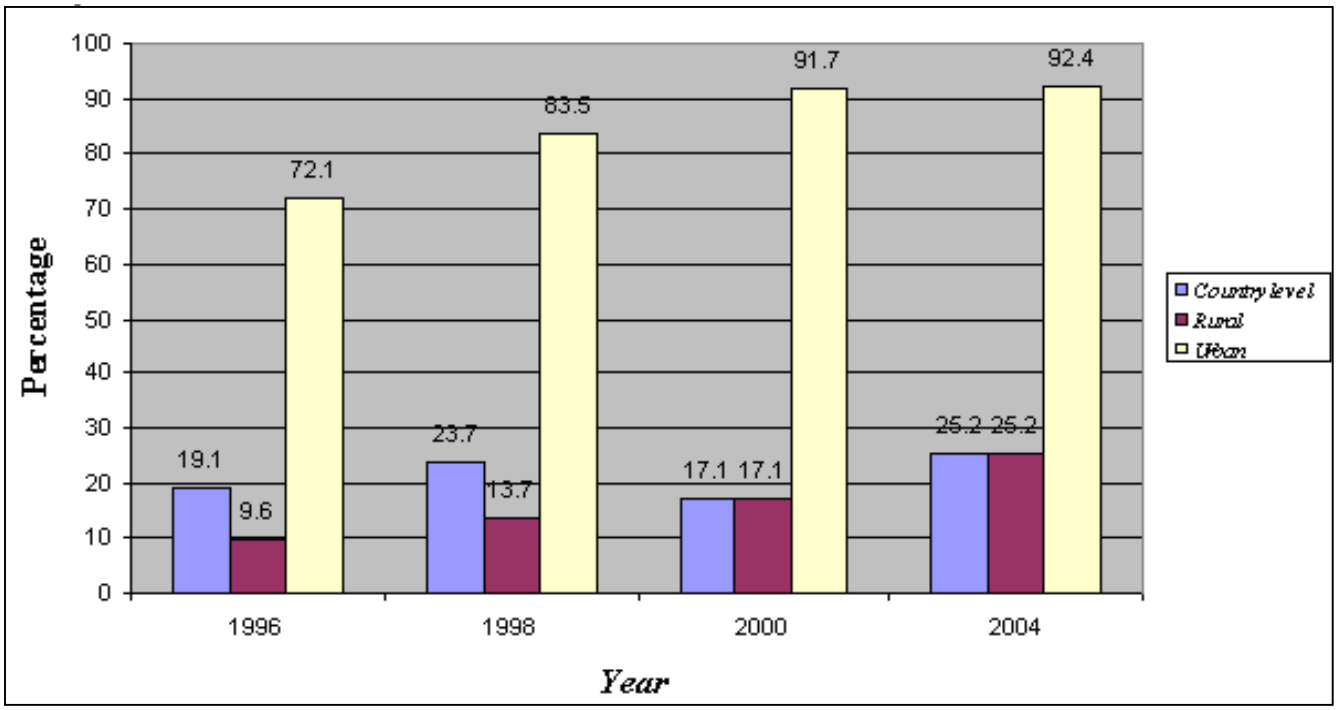


Source : Ministry of Health, 2004

health facility has fallen from 20% of households in 1996 to 13% in 2000. Over half of the rural population is now less than 10 km. From either a health post or clinic in 2004; although to get to a hospital 77% of rural families still need to travel more than 20 kilometres (MoFED, 2004).

Ethiopia is one of the poor countries hosting a large proportion of low-income societies, with a rapidly growing population. Hence the provision of safe drinking water becomes a greater challenge as economic development and population growth place increasing demands on limited water resource. However, access to safe drinking water has shown an increasing trend in the coun-

Fig 3.4. Percentage distribution of households to safe water



Source : Ministry of Health, 2005

try. For instance, from the total population, the proportion of people who have access to safe drinking water was 23.1 in 1997/98, 28.4 in 2001/02 and 37.3 percent in 2003/ 2004.

According to MOFED (2005), 36 % of the households have access to safe and clean drinking water while the remaining 64% use unclean drinking water in year 2004. Of households that have access to safe water, 12.9% of households use water from a protected well or spring, 18.8% from a public tap, and 4.2% have their own tap.

The problem is much more severe among rural households than urban. Only 25% of rural households have access to clean water, as opposed to more than 90% of urban households.

The percentage of households with access to safe drinking water was 19.1, 23.7, 27.9, 35.9 in the years 1996, 1998, 2000 and 2004 respectively. Within the same years the proportion of urban households who have access to safe drinking water accounted for 72.1, 83.5, 91.7 and 92 percent, while the rural house holds accounted for 9.6 , 13.7, 17.1 and 25.2 percent.

As with other measures, there is substantial regional variation. Over 70 percent of the households in Amahara and Beneshangul-Gumuz Regions use unsafe water from rivers, lakes and unprotected wells/springs. The findings, on the other hand, have indicated that Harari (73.3 percent), Addis Ababa (99.0 percent) and Dire Dawa (90.8 percent) regions have better access to clean water (MOFED, 2005)

An increasing trend is observed in the case of accesses to toilet facilities from mid 90's to date and a decreasing trend in the use of open fields for excreta disposal (see table 3.2). Although there is a positive trend, only about 28% of households have access to a pit latrine; and the vast majorities (69%) do not have access to any kind of toilet facility. Among rural households, more than 78% do not have any toilet facility, and 20% have pit latrines. Although a decreasing trend is observed, from a sanitation and health

Table 3.2. Percentage access to safe water and toilet facility in regional states (2004/05)

Region	Safe water	Flash Toilet	Pit Latrine (	Field/ Forest
Tigray	54.0	80.7	13.9	5.0
Afar	48.6	78.2	18.3	2.8
Amhara	28.0	87.0	11.2	1.3
Oromia	32.0	74.8	23.3	1.6
Somali	39.0	73.6	24.4	1.6
Ben.Gumuz	27.2	65.9	32.9	1.0
SNNPR	34.3	42.4	54.8	2.4
Harari	73.3	42.9	49.6	6.4
Addis Ababa	99.0	7.0	74.3	16.9
Dire Dawa	90.8	31.5	64.5	3.6

Source: Ministry of Health , 2oo5

Table 3.3 Households by type of toilet facilities & place of residence,2004

Type of Toilet Facility and Place of Residence	Survey Year			
	1996	**1998**	**2000**	**2004**
Country				
Flush Toilet	0.9	1.4	1.7	2.5
Pit Latrine	12.1	14.6	16.3	28.1
Container	0.1	0.3	0.1	0.2
Field/Forest	84.4	83.3	81.5	68.9
Others	2.5	0.4	0.5	0.2
Rural				
Flush Toilet	0.6	0.9	0.8	1.3
Pit Latrine	4.4	6.6	8.1	20.0
Container	0.1	0.2	0.0	0.2
Field/Forest	92.0	92.0	90.7	78.2
Others	2.9	0.4	0.4	0.2
Urban				
Flush Toilet	2.4	4.4	7.0	8.8
Pit Latrine	55.6	63.3	64.6	71.4
Container	0.2	0.9	0.7	0.3
Field/Forest	41.7	30.6	26.9	19.2
Others	0.2	0.8	0.8	0.3

Source: MoFED, 2004

point of view, it is even more serious to observe that almost a fifth of urban households do not have access to any kind of toilet facility, and have to use open fields.

Looking to the regional states, 70% of the urban households in Tigray, 35.8% in SNNPR, 61.5% in Amhara and 39.9% in Oromiya did not have toilet. The emerging towns such as Gambella (66.9%), Asaita (58.3%) Assosa (35.8%) did not have toilet facility at all. The experience of large towns such as Gonder (50.2%), Bahir Dar (50%), and Dessie (37.9%) shows that satisfying the need for the country's urban basic amenities is beyond imagination.

While these results are striking by international standards, it is important to note that there has been substantial improvement in toilet facilities i.e. 13% in the year 1996 to 31% in 2004.

The Issue of Malaria

The lead indicators for malaria are incidence and prevalence rates that lead to high morbidity and mortality rate in Ethiopia. The indicators for incidence and prevalence of malaria are, therefore, thought to be generally outpatient visit, hospital admission and death rates of malaria

Increase in temperature and change in rainfall would have direct and indirect impact on the prevalence of malaria. It will in particular influence weather and climate sensitive diseases by increasing population of vectors such as misquotes, increasing heat stress, etc. Climate, altitudinal and topographic diversities in Ethiopia create micro and macro-climatic conditions that result in a widespread distribution of malaria .

The environmental and temperature changes in the country led to the spread of malaria, which could also, led the morbidity and mortality rates reaching epidemic proportion in the past.

Malaria is a major public problem in Ethiopia. It occurs in most parts of the country and is unstable in its nature, mainly due to topographical and climatological conditions. The transmission of malaria is dependent on temperature, rainfall and humidity. Since 1958, major epidemics of malaria occurred at intervals of approximately 5-8 years, but recently, there is a trend of more frequent small or large scale epidemics occurring in the same or different parts of the country.

Currently, there are a number of factors precipitating epidemics in addition to natural environmental or climatological factors including drug resistance of malaria, high-scale population movement (due to resettlement and labor forces in agro-industrial development areas) and expansion of development activities such as irrigation schemes.

State and trend

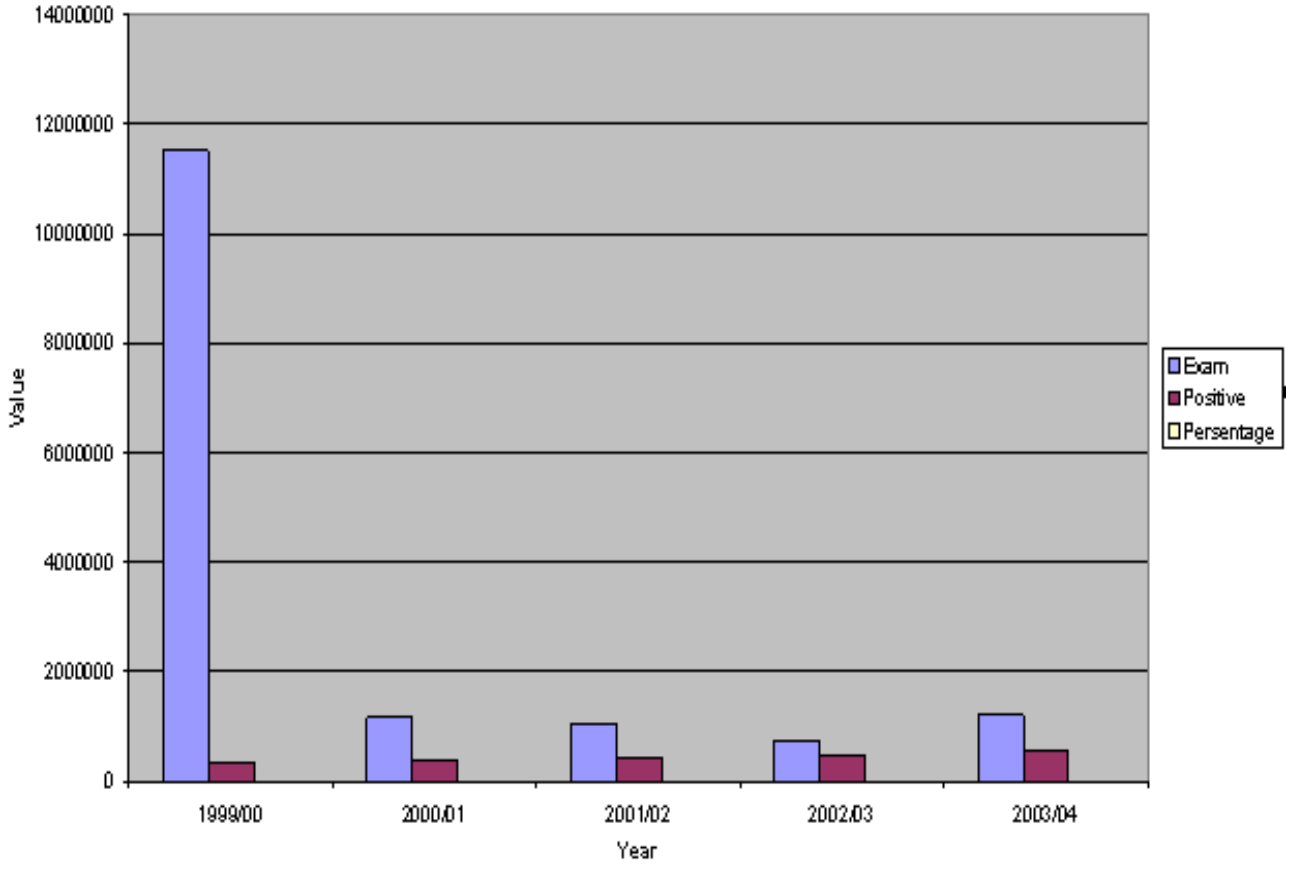
Malaria accounts for 11-15% of the total outpatient morbidity/visits and 18-20% of all hospital admissions in Ethiopia. It also accounts for 15% of outpatient visits and 21% hospital admissions for female and 11-15% of outpatient visits and 18 -20% hospital admissions for infants. Malaria is one of the top leading causes of deaths and its case fatality rate in all cases is 27% , in female 27% and in infants 21%.

Based on the occurrence of malaria, the country can be divided into malaria, and non-malaria areas. The non-malaria zone with an altitude above 2250m is the area where no indigenous transmission occurs. This area comprises 15-20% of the total landmass and is inhabited by about 25% of the total population. The malaria zone, which refer to the land below 2200m makes up 80-85% of the total landmass; roughly a minimum of 35-40% of the population live in this region and are at risk of malaria infection.

Impacts

People living in the malarious area were suffering from the disease and the disease brought an economic burden because of the decreased population in the productive age group. These

Figure 3.5. . Reported malaria cases (1999-2004)



Source: Ministry of Health,2005

communities are especially vulnerable to climate change, as most of the mitigation measures are beyond their resources.

The emergence/occurrence of malaria in new areas; with for example, the 1988, large -scale and severe malaria epidemics occurrence in most highland areas in the country. The out patient visits, hospital admissions and death rates are increasing from time to time in the country and hence put socio-economic burden from the treatment of malaria on the health services.

Responses

The Federal Ministry of Health has formulated different intervention mechanisms for the prevention and control of malaria. These are:

- Establishment of surveillance system and integrated vector control approach;
- Conducting awareness raising program on malaria prophylaxes, environmental control, and treatment;
- Encouraging the use of malaria bed net and developed guideline on environmental health management for settlements and during disasters, which include the control of malaria.

The issue of Waste

State and Trend

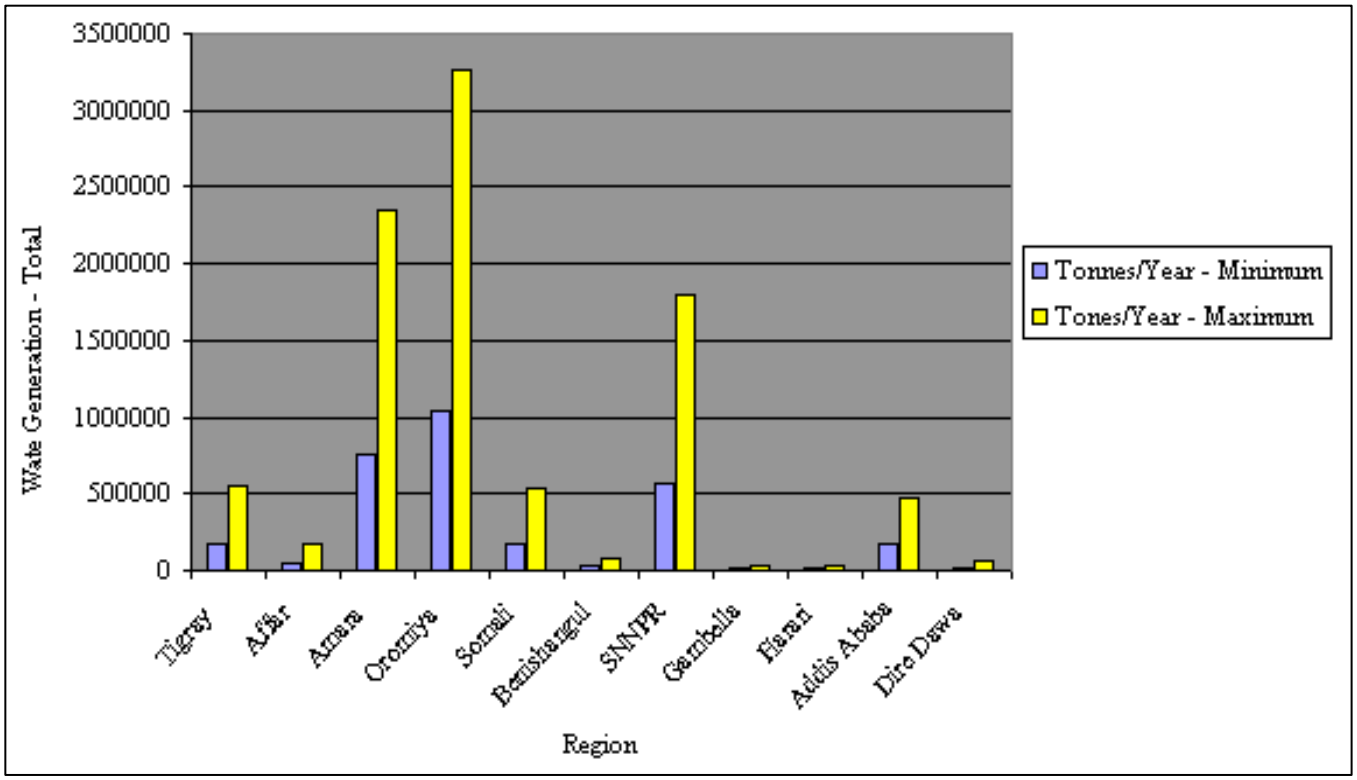
Currently, solid and liquid waste problems also are major issues currently in Ethiopia. There is limited information available on waste quantities generated in Ethiopia. However, the 2003 survey report entitled "Baseline Review of the Current Waste Management Situation in Ethiopia", has generated a substantial and indicative data on the generation of solid waste in Ethiopia.

This waste inventory has used standard waste factors that range from 0.17 to 0.48 kg/person/day for urban areas and 0.11 to 0.35 kg/person/day for rural areas and combined with population data to estimate the potential range in waste generation. Accordingly the total generation of Municipal Solid Waste in Ethiopia in 2003 is estimated to be between 2.8 and 8.8 million tones. Out of this approximately 0.6 – 1.8 million tones of waste is generated from urban areas and 2.2 – 7.0 million tones is generated from rural areas. This survey has also reported that the estimated generation of Municipal Solid Waste for Addis Ababa is between 170,000 and 475,000 tonnes in year 2003. The solid waste generation in Addis Ababa is expected to increase by at least 30% by the year 2010.

Similarly, solid waste generation in other capital cities of regions and zones is also expected to increase with the rapid increase of their population and fast expansion of urban settlements.

Wastewater sources are mainly residences, public toilets, commercial centers (hotels, restaurants, etc), hospitals and institutions (GOs, NGOs). Industrial wastewater sources are beverages, Tanneries (leather and foot waters), textiles food, pulp and paper, petrochemicals (dying, plastics and related and foot wears), soap & de-

Figure 3.6. Estimated waste generation for Regional States in 2003



Source:EPA/World Bank,2004

tergents, iron & steel, non-ferrous metals, rubber, tobacco, pharmaceuticals and wood industries. Industrial wastewater is estimated qualitatively. The average wastewater production per ton of individual products by industry type ranges from 0.09 cubic meters for soap and detergents to 87.09 cubic metres for pharmaceuticals.

Accordingly, the quantity of industrial waste produced in Ethiopia between 1990 and 1997 amounts to 35.65 million cubic meters (on average ~4.45± 0.275Mm^3/yr). Its average growth rate is 2.36%. Besides, few portion of waste water not more than 2% of the total produced, is treated by the handily system whereas the remaining major portion (99%) of domestic wastewater is simply disposed-off in open fields or left in the environment uncollected and/or untreated.

The sewerage system is very limited in its coverage, whereas the majority of the urban population use open fields for disposal of wastes. The storm water drainage system (both of drain-pipes and open-ditch drains) is mismanaged and abused for wastewater conveyance.

Both the liquid and solid waste generated from different sources are disposed in to the environment mostly with out due consideration to the environment. At country level more than half of households use the waste as manure (fertilizer) in their fields. These are by large rural households. A substantial proportion of the people dispose their waste by just throwing it away. Only a small proportion has access to a waste disposal vehicles/containers – almost exclusively in urban areas.

In most of the cities in Ethiopia the Municipalities are responsible for waste collection. The Municipality owns waste skips and containers with a capacity of 4 m^3, which are located at various points in the city. There is a wide variation in performance in relation to waste collection in the cities of Ethiopia. In many cities there are not enough skips to cover the population and vehicles are typically poorly maintained and out of service for long a period of time. An integrated urban-rural development study undertaken by *NUPI et. al* in 1988 showed that among 11 project towns (Addis Ababa, Akaki, Assela, Ambo, Arssi Negele, Goba, Mizan Teferi, Robe, Woliso, Ziway, Shashemene), only Addis Ababa had a centralised waste disposal system. This study also revealed that most of the towns do not have waste collection trucks.

Figure 3.7. Trucks used to transport solid waste in Addis Ababa City

Table 3.4. Distribution of households by method of waste disposal

Method of Waste Disposal	Survey Year			
	1996	1998	2000	2004
Country	2.1	2.6	2.7	4.8
Waste disposal vehicle Container	3.1	4.4	3.1	6.3
Dug-out	86.2	83.9	49.8	31.9
Throw-away	-	3.2	3.5	4.1
Burning the Waste	-	-	39.8	52.0
Used as Manure	8.6	6.0	1.1	0.9
Others				

Source: MoFED,2005

Waste management service coverage is currently in a very weak state in Ethiopia in terms of infrastructure and capacity. The efficiency of waste management practices and access to waste management services could be measured by the two major indicators i.e. proportion of population with access to waste management services and proportion of environmentally friendly functioning waste management and treatment facilities.

In Addis Ababa there is one official waste dump site operated by the Sanitation, Beautification and Parks Development Agency of the Addis Ababa Municipality. The dump site is at Rappi, in the South-west of Addis Ababa, 13Km from the city centre. The site occupies an area of about 25 hectares. It has been in operation since 1968. The operational performance at the dump site is poor. For example:

- There is no covering of waste, which results in odours, wind-blowing of waste, and leachate run-off during rains;
- There is no leachate management, and there is no linning to the landfill, resulting in potential leaching of heavy metals and other toxic pollutants into the ground water, as well as surface run-off of these pollutants;
- There is no fencing and there is limited security at the dump site – there are many unorganised waste pickers working on the site, etc.
- The dump site which was once in the periphery of the city is now well within the boundaries of the city centre, due to the expansion of Addis Ababa.

There are numbers of illegal dump sites at river banks and open spaces in urban centres of Ethiopia and some institutions and companies are practicing illegal dumping. Although there are effort to collect waste and dispose it properly, there is a shortfall in collection points in the urban settings in Ethiopia, and therefore these collection points often overflow with waste.

Municipal Service only exists in some urban centres Solid Waste Management(SWM), but in most rural areas there is no SWM function.

Most of the urban centres do not have appropriate type of solid waste collection trucks except few municipalities that have assigned appropriate type of vehicles to collect waste. Among those which provide service with appropriate type of vehicle, the coverage is very low and inadequate.

However, the operational performance at the dumpsite, causing negative environmental impacts and high health risks.

Currently, the private sector participation in SWM is also limited mainly to informal pre-collection companies in some urban centers.

Many micro-enterprises have been set up to carry out, waste pre-collection services, receiving

Figure 3.8. Partial view of waste disposal site in Addis Ababa City ("RePi " site)

payments from households to collect waste and transport it to the municipal waste containers. These microenterprises have taken the initiative to start these services, recognising the previous shortfall in this step of the system. The micro-enterprises collect waste from houses using a variety of transport methods ranging from wheel-barrow to donkey and cart, tractor and trailer to a waste collection truck. Some of the more basic forms of transport are more appropriate for the many streets of Addis Ababa that have difficulty in terms of accessibility (particularly in the rainy season). Many of the microenterprises provide bags, buckets or other containers to households for waste storage (e.g. 25-30 litres capacity).

Most of these micro-enterprises are very small in scale and only transport waste to the municipal containers. These smaller companies obtain their licence from the Sub-City Administrations. A few of these companies own larger transport vehicles and are allowed to transport the waste to the dumpsite. These companies obtain their licence from the Sanitation, Beautification and Parks Development Agency. As the number of start-up companies increases and the competition for collection of waste from households intensifies, there is a strong need for improved coordination and control.

There is a shortfall in collection points / containers in the sub-cites, and therefore these containers often overflow with waste, which limits the activities of pre-collection companies. The containers / skips are generally metal and most are $8m^3$ in size. There are also a few 1.1m3 containers. In Addis Ababa, it is estimated that there are a total of 512 x $8m^3$ size and about 500 x $1.1m^3$ size containers. Some of the municipal collection services are inefficient due to lack of resources. The collection from containers and transport to the dumpsite is operated by the Sub-city Administrations.

The skips are emptied at an average of one to three times per day in highly populated and high waste generation areas, but on average containers are expected to be emptied once every 3-4 days. Door-to-door collection service is carried out once or twice in a week by organized waste collection associations. The coverage of waste collection services is estimated at 50-60 % of the total waste generated in different cities.

There are generally no formal solid waste management programs in the rural areas of Ethiopia. In most areas there is no waste management service and people therefore do not pay charges. Each household is responsible for its own SWM

Figure 3.9.. Private waste collector operating with trucks

– in most cases household waste is burned in the backyard of houses. Open dumping and spreading on farmlands of waste is widely practiced. Members of the household are sometimes provided with advice by Health Centre staff during outreach programs.

Impact

Due to inadequacy in safe drinking water supply and sanitation facilities, the population is highly exposed to different kinds of health problems. The inadequacy of water and sanitation services contributes to the problem of water borne diseases form personal hygiene and sanitation. For instance, 40 percent of childhood death and 88 percent of the burden of disease is attributed to unsafe water, sanitation and hygiene practices. The average Ethiopian child has five episodes of diarrhea per year before he or she is five years old.

Improper waste disposal systems have adverse repercussions on environmental sanitation, and impeding efforts to control diseases and pollution. Due to poor operational performance at the dump site there are negative environmental impacts and health risks, because of:

- Lack of covering of waste, which results in odors, wind blowing of waste, and leachet run-off and
- Leachate management, and lining to the landfill, resulting in potential leaching of heavy metals and other toxic pollutants into the ground water, as well as surface run-off of these pollutants.

There are significant environmental and health impacts from poor waste collection and disposal practice in urban settings and low impacts in rural areas since waste generation rate is very low. Some 96% of industrial wastewater is disposed-off in the environment without any treatment. This shows that there is a potential risk to air, water and soil pollution in areas where untreated industrial wastewater discharges exist. For example streams and rivers crossing the city are affected by domestic, industrial and heath care wastes and wastewater.

Figure 3.10. Private waste collectors operating with hand pushed Wheelbarrow

Texts box 3.2 ***Impact of water pollution due to solid and liquid wastes: The case of Akaki River***

Due to the pollution problems of the Akaki River negative impacts on the social, economic and environmental condition have been observed. Regarding human health problems, all people using Akaki River water are affected by pathogens. The most common types of symptoms of human health problems were gastro intestinal disorders, diarrhea, abdominal pain, respiratory problems such as asthma, cough, wounds lesions, rashes on skin and weakness. Abortion, child and maternal mortality are also the most common types of health problems. Diarrhoea, Ascaries and trachoma on children and elders are frequently observed health problems in the area. The health problem on children of school age due to river water is a more pronounced problem that may have negative impact on their school attendance and educational performance.

Toxic substances in the river can be health hazard to livestock when ingested with water. Mostly animals become affected after consuming the water. Death in young animals (calves) is considerably as high as 50% in villages adjacent to the river. Furthermore, the whole area of the riverside is completely covered with pieces of plastic bags that can be injected with grass and block intestine of animals leading them to death.

In addition to toxicity, water turbidity is quite high and observed to be inconvenient for fish breeding. The polluted water contains high phosphorous and nitrogen, which resulted in eutrophication, increasing the growth of algae and weeds. The emergence of water hyacinth (water weed), which now widely covers the dam has made Aba Samuel Lake totally inaccessible and it is also becoming a problem for the Hydro Electric Power generation.

Aquatic weeds in the Akaki River

Water Hyacinth weeds on Aba Samuel Dam

Text box 3.3. Reversing an open waste site to a small paradise: The case of Addis Ababa

It is apparent that individuals, if committed, can significantly contribute to the improvement of their surrounding environment. This has practically been a reality in small plot of area in Addis Ababa City by an individual. His name is Mr. Gezaw Atlabachew. Mr.Gizaw who is 52 is one of the residents of Addis Ababa.

Mr. Gezaw observed that the Akaki river bank is one of the areas that require immediate reaction towards contributing to the cleanness of the city. Then he decided to create *little paradises* in various spots in Addis Ababa, and contribute his part to the cleanness of the city.

Thus, he started his action on changing a 750 sqieare meter plot of area where a substantial amount of solid waste is pilled. This area is located along the Akaki river bank in Wereda 15 Kebele 23 in Yeka sub-city of the Addis Ababa city Administration.

The project idea was supported by different bodies including the Federal Environmental Protection Authority (FEPA). Thus the FEPA provided technical and financial support. Within 3 years Mr. Gezaw changed the waste site into a green garden. The area now is serving as a recreational site for the surrounding people. A small paradise is created on the waste accumulation area.

If one person like Gizaw could change the unclean small plot to a clean site, obviously Addis Ababa would be clean if millions of hands of the city's residents collaborate and get committed to make it a paradise.

Pilled solid waste on the Akaki River bank

Mr. Gizaw: ready for changing the waste site to a clean plot

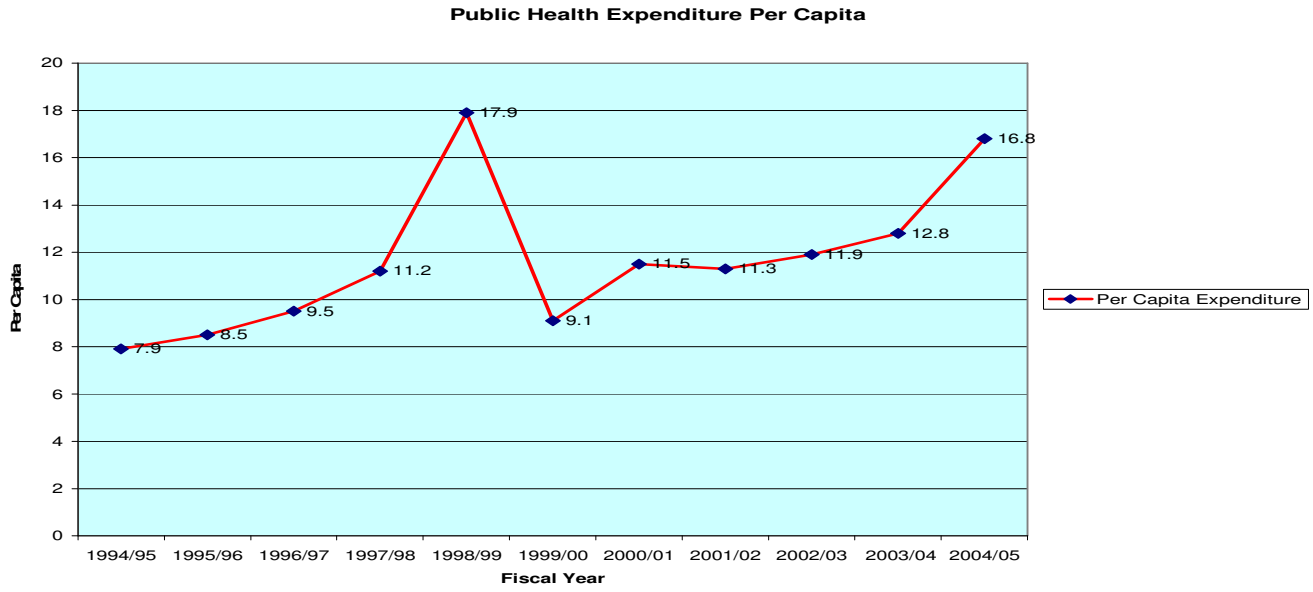
Mr. Gizaw and his team on action

Current status of the site after Gizaw's intervention

Responses

In improving the different health and environment related problems, government's expenditure on public health has shown an increasing trend. The health expenditure that was 7.9 in the fiscal year 1994/95 has reached to 16.8 in the fiscal year 2004/05 (see fig.3.11). This clearly de per capita public health expenditure has also shows the government commitment and demonstrates the response from the government to improve the poor health situation of the country.

Figure 3.11. Public health expenditure per capita



Source: MoFED, 2005

The Government of Ethiopia has also dedicated line ministries, the Ministry of Health (MoH) and Ministry of Water Resources (MoWR) that are responsible for developing appropriate national policies, strategies and subsequent government initiatives.

The Federal Ministry of Health intended to have an efficient, safe and environmentally friendly health care and waste management that will be the only means of ensuring of contamination from infectious wastes and disposable syringes and needles to avoid accidental needle stick injuries. This important activity included:

- Formulation of a policy stating that disposal is part of the syringe lifecycle and that healthcare services have a duty to manage a sharps waste.
- Assessment of the waste management system, including expressed and real needs
- Selection of appropriate waste disposal systems for all levels of healthcare facilities
- Implementation of a regulatory framework (enforcement) and human and financial resources in place; and
- Implementation of a waste management system and supervision and monitoring mechanism in place.

The Ministry of Water Resources has also developed a drinking water supply and sanitation service improvement plan that is going to be implemented in the coming 7 years (2005/2006 to 2012/2013). Through the implementation of this plan, it is expected that 50.9 million people who do not have access to safe drinking water and 66.9 million people who do not have adequate sanitation feasibilities will fully be accessed with safe drinking water and adequate sanitary facilities.

There is no overall national strategy for solid

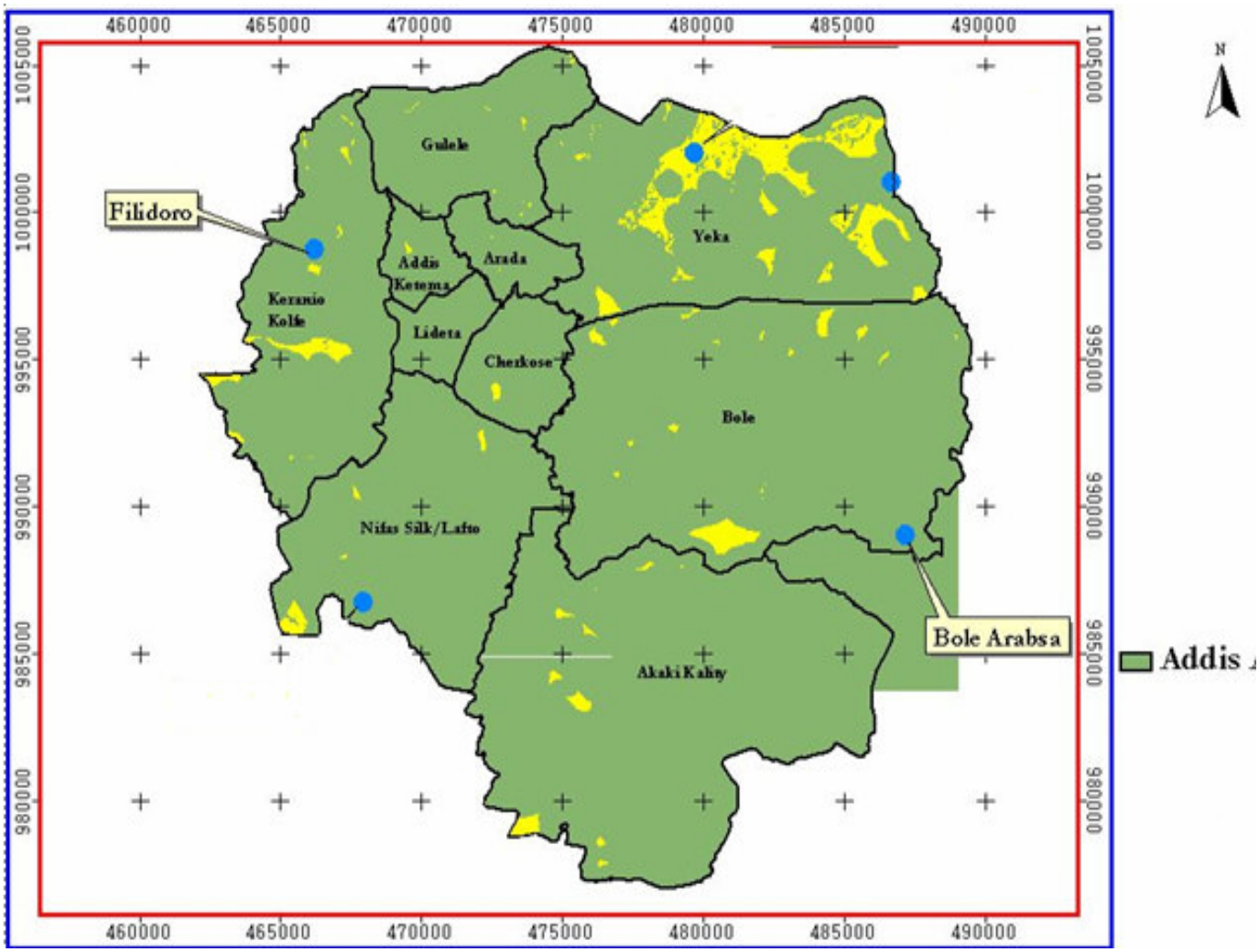
waste management improvements in Ethiopia. In most rural areas of Ethiopia solid waste management is not carried out in an organized manner. However, the Federal Environmental Protection authority has developed a national framework for private sector participation and working on developing national solid waste management strategy.

The Government of Ethiopia has developed a WSDP (Water Sector Development Plan), which looks at organising capacity building at regional and district (woreda) level throughout Ethiopia. NGOs on the whole tend to fill this funding and capacity gap in the bottom of the rural supply chain currently.

Cognisant of the fact, some urban centres have established a responsible body to manage solid waste. For instance, the Addis Ababa City Administration has established an institution, which is responsible for waste management. And decentralised the management to sub-city level (keble) to make them responsible in dealing with their own waste management problems; conduct public awareness programs on television and radio; plan on improving river banks, streets and greenery of open areas, expansion of composting activities and pre-collectors and strengthening the capacity of informal recyclers.

The City Administration has recently developed a master plan and has clearly indicated three waste

Figure 3.12. Map of newly proposed waste disposal site in Addis Ababa



Environment Information

Environmental Information is one of the tools that support environmental planning and decision making. Currently, it is believed that integrating environmental concerns in any socio-economic development policies, strategies and programs is a pre-requisite to attain sustainable development.

To integrate environmental concerns in socio-economic planning and decision making process, policy level experts and decision makers, first and foremost, need to have a good understanding about the state and conditions of the natural environment and knowledge about what is happening to the environment, why it is happening at local, national, regional and global levels and what practical measure are being taken to the prevailing environmental situation. This in turn requires regular assessment and review of the state of the country's environment and avail the information to users.

The practices of generating and managing environmental information have experienced challenges. The major once are: lack of cooperation among institutions and absence of networking; duplication of efforts, problems related with data quality and standardisation, inaccessibility of data/information; absence of meta-database: lack of adequate institutional capacity and lack of qualified personnel in Information Communication Technology (ICT) area, etc.

Nowadays, it is believed that a lot of information, about the conditions of the different environmental assets, their utilization status and about the ongoing or passed activities towards improving the conditions of these assets, is available in the country. This information is widespread to so many government, non-government organisations and private sector institutions. Apparently, access to the available information is one of the bottle-necks in the process of environmental management and socio-economic development planning.

The Ethiopian Constitution provides the rights to the public to be informed and participate in decision taking. If this constitutional right is adequately and effectively changed in to action, it will create informed citizens that can make appropriate decisions in the area of environmental management and sustainable development.

In respect to the provision of Environmental information to the government and the public, the Proclamation for the Establishment of Environmental Protection Organs (Proclamation No. 295/2005), provides the powers and duties to the Federal Environmental Protection Authority to periodically prepare the country's State of the Environment Report. In the same proclamation, Article 6.13 provides the EPA the responsibility of establishing an Environmental Information Systems (EIS), by bringing all pertinent stakeholders institutions into a common platform that facilitates data/information management and exchange within the country and with the international community.

Accordingly during 2004, an environment information network initiative was launched with the support of UNEP/DEWA.

The Ethiopian Environment Information Network (Ethio-EIN) is a multi-stakeholder and partnership building process that aims at strengthening national, regional state and wereda level capacity to produce and use quality information on environmental assets; and improve access to environmental data/information and provide information on the country's state of environment.

The main objectives of the Ethio-EIN are to: maintain an environment information network, establish mechanism to standardize and harmonize environmental data/information; develop core environmental data sets usable for the production of the national environment outlook report; facilitate access to environment data/ information resources; access to environmental information documentation service delivery system and build capacity of partner institutions to

enable them regularly generate, integrate, analyze and process environmental data/information and provide input for the African Environment Outlooks preparation process.

At the beginning of the network development, 12 sectoral government institutions from the federal level and 5 regional states – Tigray, Amhara, Oromiya, SNNP and Benshngul - Gumuz have joined the initiative as stakeholders. It is also assumed that the network will expand in terms of stakeholders' inclusion and spatial extension up to wereda and grassroots level.

Emerging issues

The issue of HIV/AIDS

One of the major emerging issues that affect the livelihood of the society is human vulnerability to HIV/AIDS. This issue particularly has high impact on women and they are the most affected category of the society. Young women are vulnerable to HIV infection for both biological and social reasons. Physiological differences make transmission of the virus through sexual contact more easily from men to women than vice versa.

Over 80% of the cases of HIV/AIDS in Ethiopia are between the ages of 20 and 49, the most economically productive age groups of the population. The highest prevalence for HIV/AIDS occurs between 20-29 for females and 20-39 for males.

The rate of morbidity and mortality are mainly used as measures of the rate of prevalence and impacts of HIV/AIDS on Ethiopia's society and economy. In addition, sero- positive cases, hospital admission and death rates could indicate the rate of prevalence of HIV/AIDS in the country.

The main driving forces for the prevalence of HIV/AIDS in Ethiopia include economic and socio-cultural factors. Some of the major underlying factors that fuel the spread of the disease include are poverty, low level of literacy, stigma and discrimination, gender disparities and the existence of commercial sex, population movement including rural/urban migration, and harmful traditional practices. There are many cultural factors that accelerate the spread of the disease. Known risk factors include the presence of sexually transmitted infections (STls), multiple sexual partners, and harmful traditional practices such as female genital mutilation, uvulectomy, blood letting, skin cutting, and piercing practices.

State and trend

According to the Federal Ministry of Health (2004), present computer model using previous and present raw NSS data estimates the national adult prevalence in 2003, to be 4.4 % of which 12.6% is urban and 2.3 rural. The trend of the HIV epidemic from 1982 till 2003 suggests three key points: a continuing gradual rise in national prevalence (3.2% for 1995 4.1% for 2001, 4.2 for 2002 and 4.4 for 2003) an urban epidemic that has peaked and plateaued at high prevalence levels; and a very gradual but steady rise in HIV prevalence in rural Ethiopia.

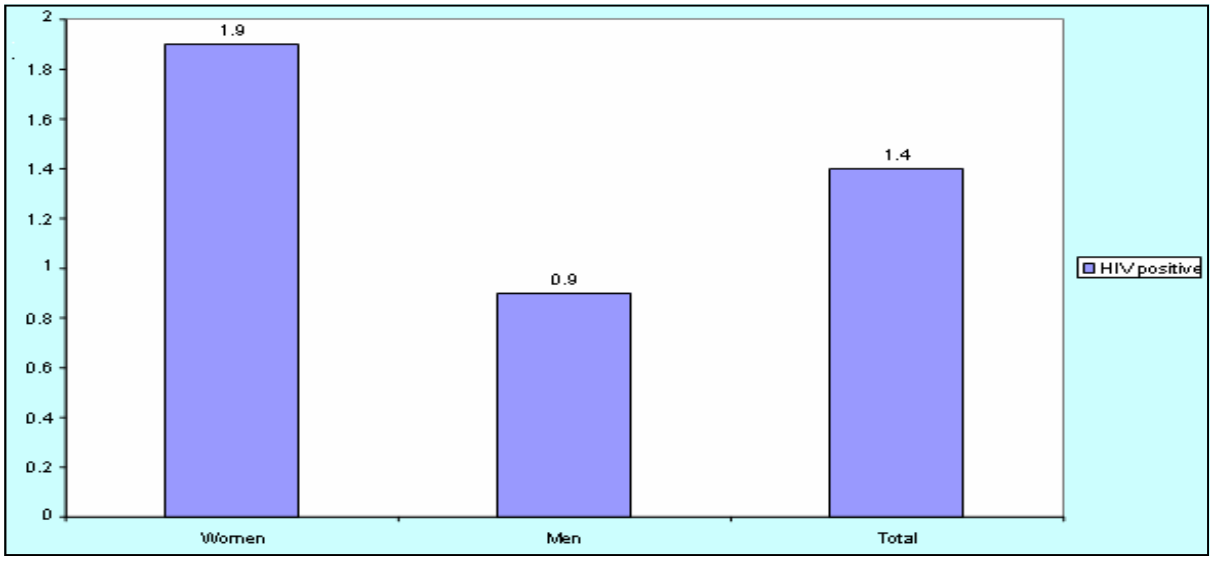
The 2003 HIV prevalence is higher among women (5.0%) than men (3.8%) and is higher in the urban (12.6%) than the rural population (2.6 %). The 2003 estimate of the PLWHA is 1.5 million, including 96,000 children. Younger females who are living with HIV/AIDS outnumber males, while more males are observed in older age groups (30^{+} years). A total of 4.6 million children less than 17 years old in the country are estimated to be orphans for different reasons, of which 537000 were due to AIDS.

Results from the year 2005 Ethiopian Demographics and Health Survey (EDHS) indicate that 1.4 percent of Ethiopian adults age 15-49 are infected with HIV (see figure..). HIV prevalence in women is nearly 2 percent, while for men 15-49, it is just under 1 percent. The female- to- male infection ratio of 2:1 is higher than what has been previously assumed in the Ethiopian situation.

(CSA-Ethiopia and ORC Macro, 2006)

As indicated by the EDHS, 2005 result , for both men and women that HIV prevalence levels rise with age, peaking among women in their late 30s and among men in the early 40s. The age pattern suggests that young women are particularly vulnerable to HIV infection compared to young men. Among women age 15-19, for example 0.7 percent are HIV infected compared to 0.1 percent for men age 15-

*Figure. 3..13. HIV prevalence among women and men age 15-49 (E*2005)

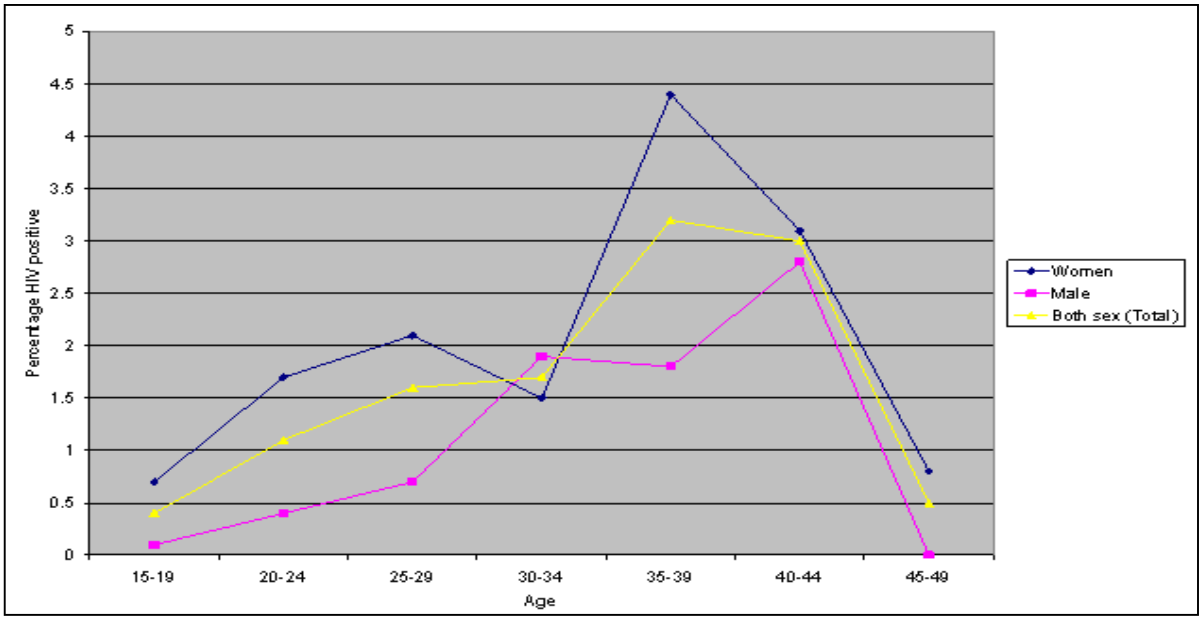


Source: CSA-Ethiopia and ORC Macro, 2006

19.

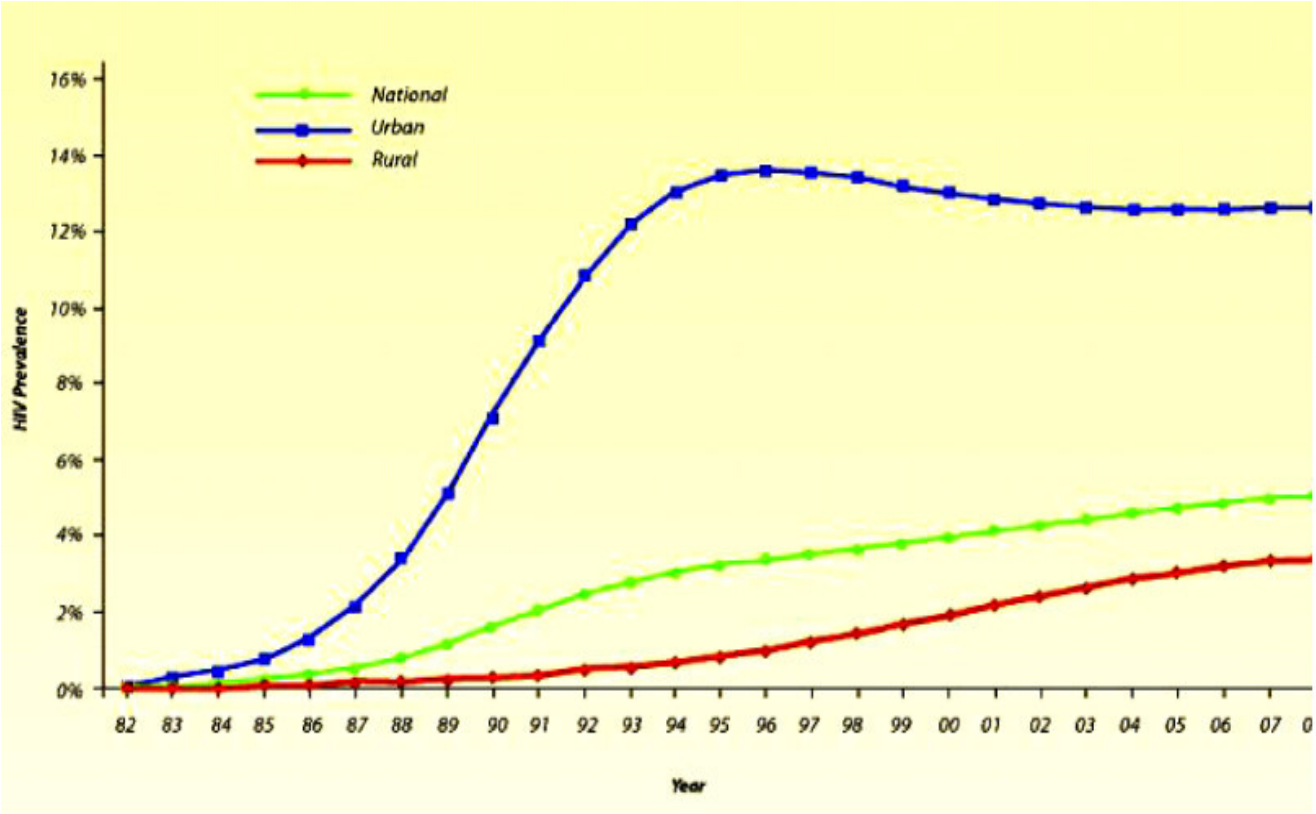
The result of the EDHS 2005 indicated that urban residents have a significantly higher risk of HIV (6 percent). Than the rural residents (0.7 percent). The risk of HIV infection among rural women and men

Figure 3.14. HIV prevalence by age



Source: CSA-Ethiopia and ORC Macro, 2006

Figure 3.15. Projection of number of orphaned children due to HIV/AIDS (2002-2015



is almost identical, while urban women are more than three times as likely as urban men to be infected

The national HIV incidence rate in Ethiopia is leveling off and the rate at which it is progressing is declining over the last few years and the epidemic appears to be stabilising, particularly in urban areas, indicating some behavioural change in the population. This is also supported by the level of awareness about the disease, the tremendous increase in condom distribution and the increasing utilization of voluntary counseling and testing services by different social groups. We need to capitalise on these achievements and do more.

Impacts

The issue of HIV/AIDS has important implication for development. In Ethiopia where 85% of the population is rural and its economy is based on agricultural activities, the epidemic appears to be a potential thereat to the socio-economic development of the country.

The HIV /AIDS epidemic has a profound impact on the lives of women, due to their economic dependence on men and the low socio-cultural status that render them power less to reject risky behaviours or negative preventive action.

One of the main consequences of HIV/AIDS epidemic is orphanhood. In 2003 alone, it was estimated that 539,000 children lost one or both of their patents due to AIDS. With the advent of the epidemic, an increased number of people were also requiring care and support.

AIDS impacts on the economy of the country in a number of ways. The loss of young adults in their most productive years of life is most likely to affect the overall economic output. The loss of trained professionals such as teachers, medical workers, engineers, development workers, etc. to AIDS would do the same and more as it will

greatly affect the human resources development of the country. AIDS also increases the cost of medical care, drug and funeral expenses. It has been estimated that the foreign exchange requirements for imported drugs would escalate to millions of dollars (MoH, 2004). HIV/AIDS also exacerbates the poverty situation, thus creating the vicious cycle of aggravating the individual and community vulnerability to infection.

Some of the observed HIV/AIDS impacts to the country include:

- Increase on annual TB cases, which accounted for an estimated 38% or 54,000 of all TB case in incidence in 2003;
- Death of people, which accounted to about 900,000 in year 2003 and is projected to reach 1.8 million by 2008 if present trends continue;
- Death of young adult, which accounted for about a third of all young adult deaths in the country.
- An average reduction on life expectancy (LE
- An increase in the number of AIDS orphans.

Response

Cognisant of the potentially huge devastating impact of the HIV/AIDS epidemic, the government's response was initiated as early as 1985. The national AIDS Policy was issued in 1998 and the Strategic Framework for the National Response updated in 2002. Both documents still serve as the basis for the multi-sectoral national response.

The National AIDS Council (NAC) chaired by the president of the country was established in 2000. Similar structures were formed in all the regional states and down to the Kebele level. In 2002 the HIV/AIDS Control Office (HAPCO) was established to coordinate and spearhead the multi-sectoral national response.

The National AIDS Control Program (NACP) was established and two medium-term prevention and control plans were designed and implemented in 1989 and 1996 respectively. Currently, a team under the Disease Prevention and Control Department functions as the focal point of the health sector's response to HIV/AIDS and has representation from the federal to the district levels of health care management.

The HIV AIDS Policy was formulated by MoH and adopted by the Council of Ministers in 1998. This created an enabling environment for HIV AIDS prevention and control. The policy supplemented several policies such as the Health Policy, Women's Policy, and the Education and Training Policy, calling for a multi-cultural response; guaranteeing rights for PLWHAl; and facilitation of the development of policies on the supply and use of anti-retroviral (ARV) drugs, among other things. The HIV/AIDS Prevention & Control Office (HAPCO) was established in 2002, under the Prime Minister's Office. It is responsible for resource mobilisation, advocacy, and for the coordination of the sectoral responses. HAPCO has developed the National Strategic Framework as a national response to HIV/AIDS.

The priority interventions implemented in the country include: information education and communication/behavior changes communication; condom promotion & distribution; voluntary counseling and testing; management of sexually transmitted infection; blood safety; universal precaution; prevention of mother-to –child transmission (PMTCT) of HIV; care and support to the infected and affected; legislation and human rights; surveillance; and research.

Some of the major achievements of the national response to date include:-

- Expanded coverage of services (more than 300 woredas out of the 550 covered);
- Increased levels of awareness and positive trends in behavioural change;
- Increased demand for distribution and utilization of condoms;

- Increase in the number of voluntary counseling and testing sites and the demand for the service;
- Initiation and expansion of prevention of Mother-to-Child Transmission (PMTCT) and ART services;
- Initiation and expansion of Home-Based Care Services;
- Care and support for orphans and vulnerable children (OVC) are expanding, 80,000 orphans are now receiving support in the form of food, clothing, school fees, and/or counseling;
- Positive trends in the reduction of stigma and discrimination;
- Increased advocacy for policy and legal issues regarding the rights of PLWHA.

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CHAPTER FOUR

Outlook

The objective of this chapter is to portray the likely outcome of different courses chosen by a society and important actors [including the major decision makers] on the different aspects of environmental priority thematic areas and human situations in Ethiopia. The scenarios try to articulate the human behaviours and societal choice as well as the human circumstance if certain policy direction prevails within the country as well as, if it is the dominant global order. This is not without acknowledging the role of uncontrolled forces both human and natural in contributing to the course of events. However, this is to emphasie that informed decision making also has a real and vital role to play in the process of shaping the future. Therefore, by explaining an array of possible future, scenarios help today's decision makers to get a clear picture of what tomorrow might bring and what the impact of their decision will be.

4.1 Introduction

The scenario building efforts are made to explain the interaction of various political, economic, social and ecological force that shape the future. The challenge, however, is that many of these forces cannot be predicted with certainty. On the other hand, much of what will happen has been set in motion by the policy decisions that have already been taken. The future also depends on the natural and global forces that dictate the society to take particular course of action. The resent phenomenon such as the ending of cold war, the globalisation processes, terrorism, regional integration such as the EU and AU or fragmentation such as the soviet block, ever-escalating oil price, the emergency of new economic power etc, can compound the factors shaping the future.

Scenarios draw both on science, on our understanding of historical patterns, current conditions, and physical and social processes, and on the imagination in order to conceive, articulate and evaluate alternative pathways of development and the environment. In so doing, scenarios can illuminate the links between issues, the relationship between global and regional development, and the role of human actions in shaping the future. It is this added insight- leading to more informed and rational action-that is the foremost goal of scenarios, rather than prediction of the future. [AEO 2002]

A set of driving force that shape the future has been considered to articulate what the likely future will be because of the behaviour of the driving forces under a given scenario. The premise is that the 'current state' of the system is the outcome of an historical process, which is driven forward by a set of 'driving forces'. According to AEO, the capacity of human beings to imagine alternative futures and to act intentionally means that images of the future can act as 'attractive forces' and 'repulsive forces' in shaping a scenario. These forces have been kept in mind especially during back casting in the policy reform scenario and great transition scenarios. In addition, there is the possibility that surprising and extreme occurrences-called 'sideswipes'-could affect development. Many unexpected events could be involved (for example, a breakdown of the climate system, war, cheap fusion power, a major natural disaster or a rampant global epidemic such as HIV/AIDS, avian flue), but probabilities cannot be assigned, nor can all the possibilities be imagined.

In view of this, four scenarios have been considered in this report. These scenarios are: the *Market Forces Scenario, the Policy Reform Scenario, Fortress World Scenario and the Great Transitions Scenario.* These scenarios were adapted from the UNEP's African Environment Outlook. The scenarios are selected, primarily, because they can benefit Ethiopia in visualising the future provided that Ethiopia takes on one of the four courses. These are the likely courses given the historical and current practices in the country.

Ethiopia is out of the feudal imperial government only 3 decades ago and a decade and half since the downfall of the totalitarian military government. Ethiopia has experienced widespread social and political inequality and frequent civil unrest in its history. Since 1991, a gleam of policy reform has emerged to promote development. The second reason for adopting the four scenarios is to benefit the reporting of African Environment Outlook. It enhances comparability with other African countries and thus makes regional synthesis possible.

The characteristics of the four scenarios may be summarized as follows:

- Market Forces scenario: market-driven global development leads to convergence toward dominant values and development patterns;

- Policy Reform scenario: incremental policy adjustments steer conventional development towards environmental and poverty-reduction goals;
- Fortress World scenario: as socio-economic and environmental stresses mount, the world descends toward fragmentation, extreme inequality and widespread conflict; and

- Great Transitions scenario: a new development paradigm emerges in response to the challenge of sustainability, distinguished by pluralism, planetary solidarity, and new values and institutions.

The African environment outlook 2002 suggests some key issues to consider in the formulation of scenarios include: the boundary; the current state; the definition and determination of driving forces; the narrative, or storyline; and images of the future.

- The boundary of the scenario is specified in several senses: spatially (for example, national or local); thematically (for example, coverage of sectors and issues); and temporally (the time horizon of the analysis).

- The current state covers a range of dimensions: economic, demographic, environmental, institutional and so on. In the Ethiopia Environmental Outlook (EEO), the dimensions are land, biodiversity, forests, freshwater.

- The important driving forces are those which condition and change the system. These are described as demographics, economics, social issues, culture, technology, environment and governance.

- The narrative, or storyline, provides the plot by which the scenario stories

Scenario development proceeds in one of two directions. In the first case, one begins with the current position and then proceeds to make projections into the future. Such a strategy may be described as 'forecasting; on the other hand, one can begin with the desirable future, and seek to manipulate variables and resources to achieve this future. Such an approach is described as 'back-casting'. Two of the scenarios described above (the Market Forces scenario and the Fortress World scenario) may be achieved by methods of forecasting; while the other two scenarios (the Policy Reform scenario and the Great Transitions scenario) are best achieved by methods of back casting, [ibid].

The thematic areas selected for this first Ethiopia Environment Outlook are the land, biodiversity, forest and woodlands, and fresh water. The selection is based on the practical reasons such as experience in preparing such documents, and priority environmental issues in the country. The group engaged in the preparation of the report decided to limit to the four thematic areas as a first effort.

4.2 Driving Forces

The socio economic factors that bring about environmental change are called drivers. How these factors evolve can shape global, regional as well as national development and the state of the environment in the future. Depending on the intensity of these factors trends may lead to convergence or divergence between circumstances in the country as in the different regions of the world (AEO 2002). The scenarios explained under this section are based on certain assumptions about how these driving forces will evolve and interact with prevailing situations and potential future.

Driving forces considered in this outlook are demography, economic development, science and technology, governance, culture, human resource development and environment chance. There are assumptions made about these forces underlying the scenarios that follow. How these assumptions differ from scenario to scenario is described below.

Table 4.1.. Behavior of the drivers under each scenario

Drivers	Scenarios			
	Market Force	**Policy Reform**	**The Fortress World**	**Sustainability First**
Demography/ population	· Population growth rate will not be regulated	· Policy measures may lead to slightly slower population growth rate ·	· Government may not give attention to population growth · Population will continue to grow at its present rate	· Population growth rate will decline to its sustainable level
Economic Development	· Economic efficiency will increase · Economic disparity and inequality will increase · Skilled labor will be favored · Unskilled labor will be disfavored · Monopoly will prevail · The market will fail · Regional disparity will prevail · Competitiveness will decrease · Social infrastructure development will be minimized	· Policies may lead to balance development · Disparities may be narrowed · Redistribute policies may reduce inequality · Fair international integration and trade will prevail	· No measures to correct market failure · Inequalities and disparities among people, localities, and regions · No redistribute policies · Retarded economic development · Inconsistent cooperation between countries and regions	· Changes in values will result in correction of market failure · Increased and sustainable economic development · Inequalities, disparities and discrimination will be eliminated · Better cooperation among groups of society, regions and countries · Fair international trade · Well developed infrastructure
Science and Technology	· Technological transfer by the market will advance · Increased opportunity/ incentive for use of science & tecnology. · new opportunities will prevail · Market driven science & technology · Intellectual property right (IPR) issue (GMO) will either positively or negatively develop · priority to basic research will be less.	· Opportunity for use of appropriate science and technology · Policies attempt to regulate technology and adoption (e.g GMO) · R&D will focus on appropriate technology · Fair Intellectual property rights	· Low incentives for advancement and adoption of appropriate technologies · No all rounded technological advancement · Enclaves/elites will favor technology their interest · Focus on defense and security technology	· Incentives for the development of appropriate technology · All rounded technical development · Technical development will become environmentaly friendly

Table 4.1. Cont'd...

Drivers	Scenarios			
	Market Force	**Policy Reform**	**The Fortress World**	**Sustainability First**
Governance	· Globalization and liberalization (World Trade Organization (WTO) rules) will prevail · Increased international competition · Competitiveness will dictate good governance · Inequality in wealth distribution · Minimum government intervention · Low government capacity to manage the economy	· Government intervenes when there is a need to correct market failures · Attempts to reduce poverty and inequality · Actions taken to regulate market power and dominance of multi-national corporations · Increased capacity of governance	· Autocratic governance, corruption and civil strive will result · Elites dominate the majority · Increased inequalities, disparities and discrimination among individuals, groups of society and regions · Attempts to solve society objections by force, · Ineffective government will result in breakdown of parts of society	· Government will use all opportunities and full public participation · Decentralized governance · Inequalities and disparities reduced · Freedom and solidarity of society maintained
Culture	· Pro-environmental conservation (value for nature) may be under threat · More openness to external culture (homogenization of culture) · Degradation of social capital · Openness to external culture due to high information technology and communication · Accelerated shift to outside culture (individualism, consumerism)	· Regulated global cultural exchange · Attempts to maintain pro-environmental culture · Individualism and consumerism regulated via appropriate policies	· Values of Individualism and consumerism persist · Unregulated openness to external culture · No attention to cultural development · Dualism (traditional and modern) culture co-exist	· Consumerism and individualism will be replaced by sustainable values · Well regulated cultural exchange · Built-up social capital · Conservation and sustainable use of natural resources will get more value

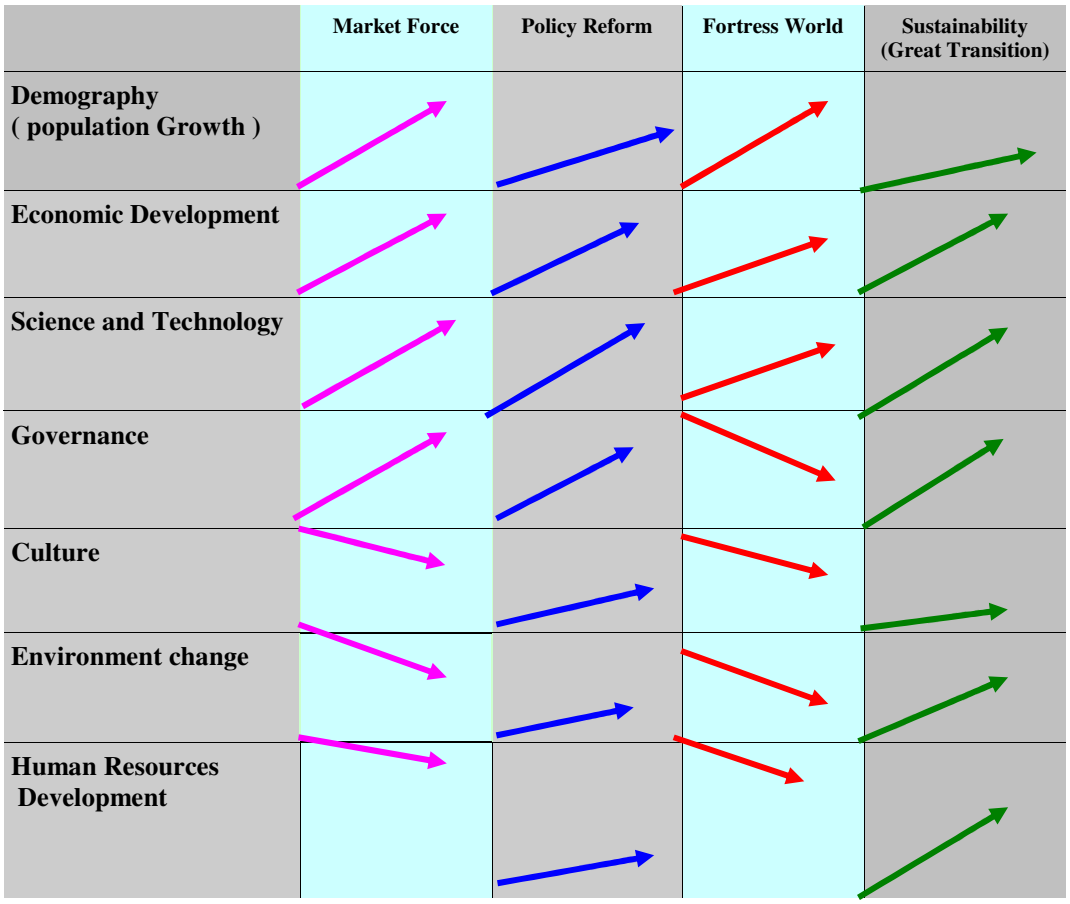
Table 4.1. Cont'd...

Drivers	Scenarios			
	Market Force	**Policy Reform**	**The Fortress World**	**Sustainability First**
Governance	· Globalization and liberalization (World Trade Organization (WTO) rules) will prevail · Increased international competition · Competitiveness will dictate good governance · Inequality in wealth distribution · Minimum government intervention · Low government capacity to manage the economy	· Government intervenes when there is a need to correct market failures · Attempts to reduce poverty and inequality · Actions taken to regulate market power and dominance of multi-national corporations · Increased capacity of governance	· Autocratic governance, corruption and civil strive will result · Elites dominate the majority · Increased inequalities, disparities and discrimination among individuals, groups of society and regions · Attempts to solve society objections by force, · Ineffective government will result in breakdown of parts of society	· Government will use all opportunities and full public participation · Decentralized governance · Inequalities and disparities reduced · Freedom and solidarity of society maintained
Culture	· Pro-environmental conservation (value for nature) may be under threat · More openness to external culture (homogenization of culture) · Degradation of social capital · Openness to external culture due to high information technology and communication · Accelerated shift to outside culture (individualism, consumerism)	· Regulated global cultural exchange · Attempts to maintain pro-environmental culture · Individualism and consumerism regulated via appropriate policies	· Values of Individualism and consumerism persist · Unregulated openness to external culture · No attention to cultural development · Dualism (traditional and modern) culture co-exist	· Consumerism and individualism will be replaced by sustainable values · Well regulated cultural exchange · Built-up social capital · Conservation and sustainable use of natural resources will get more value

Table 4.1 Cont'd...

Drivers	Scenarios			
	Market Force	**Policy Reform**	**The Fortress World**	**Sustainability First**
Environment	· land and water pollution will increase · Increase in invasive species · Climate change will prevail leading to increased desertification · Flooding intensity will increase · Environmental degradation and concentrations of greenhouse gases will increase. · Resource use conflict (geopolitics) may arise	· Pollution taxes and environmental standards implemented · International environmental agreements adopted · Attempts to solve unequal environmental endowments · Measures will be taken to combat desertification	· Pollution and environmental degradation aggravate conflicts · Unequal environmental endowment will persist · Lack of environmental regulations will accelerate degradation · Decreased productivity of the environment will further aggravate its degradation · Desertification and environmental hazard will persist	· Environment it self will be made to contribute for its own maintenance · Added value of the environment · Minimized environmental degradation and hazards · Desertification combated
Human Resources Development	· unequal access to basic services (health, education etc) · Increased insecurity to the large public · Added value to Freedom · Foreign Capital repatriation prevails · Inequality prevails · Regional state disparity prevails	· Provision of basic services (education, health, social security etc,) improved · Poverty reduction programs becomes effective · Inequalities among groups of society reduced · Reproductive health programs implemented	· Greater inequalities in access to basic services · Physical security takes precedence over social welfare · Greater inequality and poverty among individuals and groups of society · Less attention to reproductive health	· Basic needs provision by the public sector, private business and NGOs · Values of solidarity, tolerance, transparency, accountability, freedom, identity and participation will take the upper hand

Figure 4.1 Illustrative patterns of the changes over time of key scenario assumptions



4.3 National Scenario Narratives

Under national scenario narrative section, effort is made to articulate the likely impact on and state of the environment and probable societal responses. The argument is made taking in to account the assumed changes in the driving forces as illustrated in figure 4.1. The Scenario narrative discusses each scenario implications and the plausible future of environmental themes of the report namely: Land and Biodiversity, Forests and Woodlands, Fresh Water.

4.3.1 Market Forces Scenario

4.3.1.1 Assumptions

The Market Forces scenario assumes that world development evolves without major discontinuities, changes in values or other structural ruptures from the position as it existed at the end of the 20th century. However, in this scenario, the world becomes increasingly more integrated, both economically and culturally. Globalisation of product and labour markets continues pace, catalysed by free trade agreements, unregulated capital and financial flows, and information technology. A number of important initiatives pave the way. The World Trade Organization (WTO) provides the legal basis for the global trading system. Barriers to trade and capital movements gradually vanish, as protectionism becomes a thing of the past. New institutional instruments promote market openness and global competition. Virtually all national governments advance a package of policy adjustments, which include: modernisation of financial systems; investment in education to create a workforce that is competitive in the emerging global market; privatisation; reduced social safety nets; and, in general, reliance on market-based approaches.

In the context of Ethiopia, the Market Forces scenario is based on the assumption that alike other African countries, Ethiopia will adopt, willingly or otherwise, the range of policy reforms promoted by the World Bank, the IMF and other international institutions. These reforms aim to improve the economic performance of developing countries by encouraging them to restructure their economies. The objective is to limit budget deficits and to allow market determined interest rates and exchange rates, more free trade, capital flows and unencumbered foreign direct investment. The reforms also include: privatization of state enterprises; extension and consolidation of private property rights; and a shift in public expenditure away from subsidies and administration towards infrastructure development and support for sectors of the economy-such as primary health care and education-which are likely to provide ultimately greater economic returns and more equitable income distribution. From a trade perspective, the main outcomes of this strategy are: global integration of commodity markets; opening up of investment markets; more mobile labour markets; and the application of global standards and regulations.

The assumptions of the Market Forces Scenario may be summarized as follows:

- The dominant western model of development prevails, with the spread of consumerism/materialism and individualism. The world economy converges to this mode;
- Policies promoted by international financial institutions are adopted, either willingly or otherwise, and they are found to have positive impacts on aggregate growth as the scenario progresses;
- The most effective poverty reduction strategy is growth promotion. Growth will tend to be broad based and will trickle down. Effective institutions will emerge and spread ;
- Economic growth will automatically contribute to recover the environmental damage incurred as a result of development; and
- An active policy-making environment will be in place. However, although policies are implemented, they tend to be market-based.

4.3.1.2 Environmental Implications

Land and Biodiversity

Ethiopia is one of the least developed countries (LDCs). Its economic growth and development is intrinsically linked to the development of its agriculture sector, as the country is highly dependent on this sector for income, employment and export earnings. The agriculture sector is dominated by smallholders and contributes about 45% of GDP. It serves as the primary source of income for as much as six-seventh of the population and accounts for up to 90% of total exports. The sector also supplies factor inputs to the country's manufacturing sector. In addition to this, export earnings from the sector finance importation of goods necessary for the socio-economic development of the country. The Agriculture Development Led Industrial Strategy emphasizes the need for intensive and extensive utilization of the country's land resource and the abundant labour to achieve rapid economic development.

The pressure on land expected to be gradually relieved as the thriving industrial sector, creates employment and takes most people away from the farming. As the domestic and foreign investment grows, commercial farming becomes more dominant. Land market makes it possible for individuals with capital to invest in land or to appropriate lands from those who will not be in a position to utilise it. High value crops will get greater attention. Consequently, intensive agriculture will receive attention, which makes use of modern technology. This will have a negative consequence to the biodiversity of the country and pollution of ecosystem. This has already been witnessed in some localities.

On the other hand, the population of the country is generally expected to grow at 2.7 percent. This will aggravate the pressure by increasing the demand of land for agriculture and pasture as well as for other uses. Land value will increase the care for land, while intensity of use and land fragmentation may induce land degradation. Expansion to marginal area may further aggravate land degradation. Enforcement of land use policy may be less effective as the prevailing market force may dictate the land use. Market Forces Scenario is not expected to ensure equity, which therefore force sectors of the population to resort to the less capable land and discourage crop rotation and encourage mono cropping which results in land degradation. While the technological and scientific advancement may increase land use efficiency, increased use of irrigation may result in incidence of soil salinity and water logging of agricultural land, which puts land out of productive use.

In the Market Forces Scenario, biodiversity can offer an economic opportunity. In Ethiopia together with cultural and historical heritage, biodiversity takes centre stage as a fulcrum for tourism development, which has an immense economic potential. The private sector becomes interested in biodiversity conservation as all possible riches are explored for tourism consumption, for example, bird watching, ecotourism and nature tourism. An interesting step has already been taken to involve private sector in management of Nech Sar National Park in southern Ethiopia. The government will also identify the biodiversity hotspots which should be accorded maximum protection, and gazettes them as national parks or strict nature reserves. The Ethiopian wildlife policy and the draft wildlife proclamation is one of such government steps. Deliberate efforts are directed towards rehabilitating degraded ecosystems and restoring species richness. Some ecosystems, however, are subjected to so much pressure that their credibility as areas of significant biodiversity importance is diminished, and is eventually overrun by industrial development or urban settlements. For instance, Awash National Park, Abijata-Shala National Park, and Nech Sar National Park are important ecosystem of such vulnerability. Where this involves protected areas, degazetting procedures are undertaken, involving Environmental Impact Assessment (EIA).

On the other hand, because of the increased attention to the high value of flora and fauna species, the biodiversity may be at stake. For instance, the short cycle, fast growing and exotic tree species are favoured to the long cycle and slow growing indigenous trees. Thus, exotic tree species tend to displace indigenous tree species. Demand for fish may result in over fishing and leaves less means to discourage such consequence. Economically disadvantaged sectors of the population may also be engaged in fishing which may jeopardise the sustainability of the fish resource production. It may also encourage the introduction of high productivity exotic species. For instance, the Nile perch in Lake Chamo has been under serious threat from over fishing by the local community and commercial fishing firms.

Forests and woodland

Under Market Forces Scenario it is assumed that population growth may continue. The historical trend of deforestation and degradation of forest and woodland areas continues, as a result of both the need for more land for human settlement and agriculture. Moreover, the domestic demand for forest product as well as the drive to exploit forest resources to boost export earnings puts added pressure on the forest and woodland resource. The rate of afforestation may increase as market demand for forest product grows. This will be expected to improve forest cover in already degraded highly populated highlands. This may be followed by domination of few fast-growing exotic species of tree. Increased attention on exotic species of tree on the other hand will displace indigenous trees risking the biodiversity and genetic resources of the country.

On the other hand, the economic derive will increasingly create conflicting interest in land use in the existing high forest and woodland areas of the country. The existing forest and woodland areas will be under pressure from increased interest in tourism industry including ecotourism on one hand and land for high value agricultural crops. Planned or spontaneous settlement of population from highly degraded highlands will also increase deforestation. The increase in ecotourism provides additional incentives to conserve forests (though this is offset to some extent by the increase in land use conflict pressures). In order to secure the future of forested areas, as well as to spread the benefits of their conservation more widely, communities living in the forests and surrounding areas will join hands to take part in forest management, sustained use and conservation. This may contribute to slowing down the rate of deforestation in high forest areas while at the same time because of the short run economic motive of the local community, the same forest may be converted to high value crop farming which risks forest based biodiversity.

The value of consumerism may not give attention to the causes of global warming, thus climate change may increasingly challenge restocking of forest. The prolonging drought minimises the survival rate of plantation forest. Prolonged drought may also induce forest fire risk.

Fresh water

In the Market Forces Scenario, pressures of growing population are not just confined to land-based resources. The demand for water increases-as consequence of both for more people overall, and greater demand for water for agricultural, industrial and urban domestic uses. In an attempt to meet these demands, more dams are built and more groundwater and other water sources are extracted. This affects the distribution of water, and increases the cost of provision. Groundwater levels decline, amplifying the cost of extraction. Water pricing is introduced in order to recoup the costs of supply and to establish a mechanism for the economically efficient allocation of a limited resource. As water becomes more valuable, water use is expected to be more economical including reuse and recycling. Pollution of water bodies by agricultural, industrial and domestic effluents will gradually increase. However, the increasing concern of the international community on the ecological footprint of goods and services they consume, will encourage pollution regulation. This regulation may not be efficient as economic gain is giving overriding priority over environmental goals.

Presently, there is limited private sector involvement in water sector development, and lack of adequate investment in the area of irrigation. But access can be increased due to private sector development. At the same time the increased industrial and agro-chemical use might bring land and water pollution.

The construction and rehabilitation of water supply in urban and rural areas will enable residents to improve their livelihood and avoid risks of using contaminated water sources. However, due to limited investment, water resources are unavailable to meet the needs of the population.

Ethiopia is in a critical stage of emerging from a mainly subsistence agriculture into a market economy. For the Ethiopian farmers this means that they need to develop not only their primary production and farm structure, but also to organize and to improve the efficiency of their agricultural supply chains, through harnessing the available freshwater to ensure their livelihood security. Hence, freshwater supply remains the main focus. Measures will be undertaken and investment is targeted to satisfy demand in the deficit areas. Increased incomes from the industrial sector make these investments possible. The concept of rainfall harvesting is actively promoted, where precipitation is adequate and even in moisture deficit areas. This increases freshwater access in rural areas. In the Market force scenario water use efficiency is expected to increase as the water

increasingly becomes a scarce resource. The water resource scarcity in the north eastern Africa sub-region is also expected to boost investment in water use planning and in water technology that promotes efficiency. The regional cooperation will bring additional capacity for water science and technology development.

4.3.2. Policy Reform Scenario

4.3.2.1 Assumptions

The beginning of the millennium saw a renewed commitment to address issues of sustainability and the environment. A consensus emerged on the urgent need to temper what had come to be called the Market Forces Scenario, with policies to secure environmental resilience and to reduce poverty. The Policy Reform Scenario is not a radical deviation from the Conventional Development Scenario. The emphasis on economic growth, trade liberalization, privatization and modernisation endures. The integration of the global economy proceeds apace, as poorer regions converge very gradually toward the model of development of the rich countries. The values of individualism and consumerism persist, transnational corporations continue to dominate the global economy, and governments modernise their economies and social welfare structures. The defining feature of the Policy Reform Scenario is the emergence of the political will to constrain market-driven growth with a comprehensive set of sustainability policies.

The Policy Reform Scenario is based on a set of social and environmental goals adopted by the international community. These guidelines are adjusted periodically in light of new information. Social and environmental targets are set at global, regional and national levels, and include a mix of economic reform, regulatory instruments, voluntary actions, social programs and technology development.

Unlike the Market Forces Scenario, the Policy Reform Scenario tempers market-driven prescriptions with strong social and environmental policies. It thrives on the harmony between different stakeholders and otherwise divergent policies. It is consistent with development which, not only promotes liberalizations of trade and capital movements, but also emphasises transparency, accountability, democratic governance, fighting corruption, alleviating poverty, gender equality, increasing aid, debt relief and market access to developing countries.

The assumptions of the Policy Reform Scenario may be summarised as follows:

- It is similar in many ways to the Market Forces Scenario;
- It is based on a set of social and environmental goals adopted by the international community, and set at global, regional and national levels;
- There is an emergence of the political will to constrain and to guide market-driven growth with a comprehensive set of sustainability policies;
- Policy initiatives for achieving goals are regionally differentiated, but include a mix of economic reform, regulatory instruments, voluntary actions, social programs and technological development;
- The 'western' model still prevails, and 'western' values still spread; and
- There is less trust in automatic positive results from markets, and more emphasis on targeted policies.

4.3.2.2. Environmental Implication

Land and Biodiversity

Under the Policy Reform Scenario, various measures will be taken to regulate the population growth. Consequently, the population growth rate will tend to decline. The general economy of the country is also expected to grow with changes in the economic structure i.e. secondary and tertiary sectors of the economy getting more and more

importance in the share of the GDP. This is expected to draw significant proportion of the population out of agricultural employment. The increasing shift from agriculture to other sectors coupled with the moderating growing population is expected to gradually relieve pressure on land and biodiversity.

The targeted policy intervention by government and the favourable policy support from the international community is expected to support sustainable natural resource development and management. Land reform programs are supplemented by comprehensive land use policies. As a result, all major land use programs will undergo Strategic Environmental Assessment (SEA) to identify environmental issues and ensure mainstreaming environmental considerations. This will provide an opportunity for implementation of environmental zoning, which helps to integrate biodiversity conservation in the landscape. Zoning is also expected to stipulate land capability and regulate their use, which ensure the protection of land degradation. The policy will also favor good land management.

Universal primary education policies increase literacy, and as a result the possibility for popularizing sustainable land management policy will be more streamlined. Moreover, literacy combined with proper population policy and social value change, will have a ripple effect in contraceptive prevalence and family planning. As discussed early on, this is expected to results in a subsequent reduction in the population growth rate, thus relieving pressure on land. Urban migration is reduced, because there are deliberate policies to increase land-based employment opportunities in rural areas. Moreover, there will be a deliberate intervention to increase urbanisation and diversification of the economy by developing small towns and urban centres with subsequent effect of reducing proportion of population depending on farming. The livelihood diversification will give an opportunity to reduce rural poverty with subsequent gradual decline in the poverty driven environment degradation such as deforestation and cultivating marginal lands. These coupled with the increased access to science and technology is expected to enhance sustainable land management.

Biodiversity will be one of the most important assets of Ethiopia for it forms the basis of the agriculture sector as well as the growing tourism industry. In the Policy Reform Scenario, tourism will gain importance with a significant contribution to Ethiopia's GDP and foreign exchange earnings. Policies to protect sites with unique biodiversity are established and enforced. Deliberate efforts are directed towards curbing illegal activities, such as poaching in the protected areas. International and regional conventions and agreements on biodiversity resources are actively implemented. Donor assistance is also sought to enhance institutional capacity for conserving biodiversity resources.

The increased attention for human centred conservation strategy will provide additional incentive for biodiversity conservation. The benefit sharing mechanism from protected areas will motivate local community to conserve wildlife and their habitat. Recognition of indigenous knowledge as well as benefit sharing arising from the use of the genetic resource of the country will enhance the continuity of indigenous knowledge and conservation of the country's biological diversity.

On the other hand, the government will implement pollution regulations that will eventually reduce pollution load. Increased attention to integrated pest management will reduce pesticide use with positive outcome of biodiversity conservation including soil flora and fauna.

Forests and woodlands

In the Policy Reform Scenario, the high population growth rate gradually declines, for it is a national concern for sustainable development, delivery of social services and management of natu-

ral resource. Forests also continue to be the major source of energy, and construction material especially for the poor segments of the population. The government takes deliberate actions to promote agro-forestry in its poverty eradication action plans.

Therefore the dependence on forest and forest products for biomass (the traditional fuel) will continue, while energy requirements in the country may be satisfied from alternative sources such as the hydropower, thermal, and other forms of renewable and non-renewable sources. Moreover, more economic use of forest resources will be promoted and re-afforestation would be in place. As a result, the rate of deforestation may relatively be reduced. However, this effort will be seriously constrained by the scattered settlement pattern of the population in the rural areas.

Under this scenario, it is expected that biodiversity related conventions including the UN Convention on Biological Diversity UN, Convention on Combating Desertification UN, Kyoto Protocol (CDM) and other conventions and policy measures would be implemented at different levels with increased cooperation from the international community. Various environmental management tools will be in place including environmental impact assessment of projects and programs. Pro-forest development and conservation of indigenous knowledge and culture will be encouraged and maintained. Hence, forest conservation will be accorded greater attention not only for its ecological function, but also for its great economic and social value. Private investment is attracted to the sector for both direct forest products and eco-tourism. The forest can gradually be one of the major supplier of timber products to the neighbouring sub-regions. The role played by forest in catchments protection is highly appreciated and therefore the government will devise incentive mechanism for participation of local community in forest conservation.

The conservation will target soil and water conservation, and protecting the reservoirs and water bodies from damage by silt load. These efforts will also be acknowledged for the conservation of Nile water and bilateral agreements are reached to increase investment in catchments forestry, with significant contribution from the lower riparian states.

Carbon trading becomes an active commercial transaction for Ethiopia, alike other east African countries. This opportunity may induce political will to maintain the forests for carbon sequestration as well as planting of new forest in the context of CDM in the implementation of Kyoto Protocol.

Forests and woodlands will be one of the tourist attraction areas, both in the context of ecotourism and conventional tourism. The global recognition for the sustainability will also promote products such as forest coffee and other eco-products extracted in sustainable manner. All these constitute an added incentive for forest ecosystem conservation..

Fresh water

At present, there is a minimal use of existing water resources and high dependency on rain fed agriculture in Ethiopia . Poverty is widespread in the country with as many as half of the population living on less than a dollar a day. In addition to entrenched poverty, the impact of HIV/AIDS pandemic in the country is affecting the development of the sector. In some areas, there is a major conflict over water resources usage. On the other hand, realising the resources limitation, there are endeavours on the application of modern technologies like drip and sprinkler irrigation. The introduction of water harvesting is also one of similar intervention. Traditional practices are also gaining leverage through the support of emerging technologies. Improved institutional framework and adequate budget allocation are part of the argument for the improvement of livelihoods of the population.

In the Policy Reform Scenario, although an increasing population exerts pressure, particularly on water and land resources, the introduction of integrated water resources management ensures that the needs of the people are adequately met, even though the per capita resources available are reduced.

In the Market Force Scenario, it has been discussed that it will lead to the confinement and concentration of the water sector services to urban areas and their peripheries, where there is a relatively better economy and influence of modernisation. On the contrary, in the Policy Reform Scenario, the government is concerned on the distribution and equitable utilization of the resources. To ensure the implementation of this policy direction, the scenario assumes the implementation of projects even if they are not economically attractive since the social dimension receives greater attention.

Water distribution networks are upgraded in order to minimize water losses. Appropriate technology enables local authorities and the private sector to monitor water distribution. The technology also helps to reduce water piracy along distribution lines. A complete mapping of urban groundwater supplies, using the latest technology in geographic information systems, enables authorities to improve decision-making and to enforce punitive tariffs.

Irrigation equipment is improved in order to reduce water losses. The technology enables to intensify agricultural production throughout the year. Dependency on rain fed agriculture, particularly commercial farming, is reduced, lowering food insecurity at different levels. Food security strategy will encompass focusing on food production through efficient utilization of land and water resources including rainwater harvesting. Proper water tariff policy will motivate water use efficiency and professionalism in water works.

Government policies to promote industrial development and to increase access to safe drinking water to majority of the population make freshwater a focal issue in government strategies. The private sector will be a key player in the water sector, as realistic values are attached to fresh water. As its value increases, appropriate measures are undertaken to protect and tap this valuable resource. Projects are initiated to take water to deficit areas where the demand and social values are desirable (for example, the lowlands). Appropriate water pricing reduces wastage and promotes the conservative use of water. Social development programs are designed and implemented by governments, focusing on the supply of freshwater to the poorer segment of the population.

In the Policy Reform Scenario, some profound damage to aquifers proves irreversible in the medium term. Continual problems arise as a result of the heavy use of water for irrigation by agriculture, industry and domestic use. However, soil and water conservation and catchments protection programs will improve the availability of ground water as proved in some localities.

The primary target of the reform will be: target poverty reduction and promote economic integration, develop the water resources of the country in sustainable and equitable way and ensure efficient water resources management and the optimal use of the resources. To achieve these objectives, the government will formulate a water sector development policy including water sector development program as part of its millennium development goals. As a result of the dramatic increase in population and consequent water demand, the government anticipates to utilize well fields of high potential areas. Water managing institutions, researchers and practitioners will actively work to address the challenge.

4.3.3 The Fortress World Scenario

4.3.3.1 Assumptions

In the Fortress World Scenario, the failure of the world to pay attention to the need for strong policy reforms on the environment leads to a state of complacency, with governments retreating from social concerns and responsibilities. In such a situation, development declines as poverty rises. Environmental conditions deteriorate as pollution, climate change, land change and ecosystem degradation interact to amplify the crisis. Environmental degradation, food insecurity and emergent diseases foster a vast health crisis. Free market values are unable to constrain environmental externalities. The affluent minority is alarmed by rampant migration, terrorism and disease, and reacts with sufficient cohesion and strength to impose an authoritarian 'Fortress World', where they flourish in protected enclaves in rich nations and also in strongholds in poor nations. The fortresses are bubbles of privilege amidst oceans of misery. The élite halts barbarism at its gates, and enforces a kind of environmental sustainability.

African countries are led to the emergence of a Fortress World Scenario, in which African societies are split into two groups: a small group of élite and public officials, who live in a relatively prosperous conditions, but in a highly protected world; and a poor majority, deprived of basic services and rights. The irony of a fortress world crisis is the suffering, hardship and impoverishment incurred by the vast majority of people at a time when a minority of elites live modern, prosperous lives. The fortress world is a grim outlook for the future, in which social and environmental problems increasingly lead to the authoritarian 'solutions' of a minority of affluent people. Under such circumstances, members of the élite organise themselves to live in protected enclaves, while the poor majority outside of this fortress have few options and resources. A fortress world in Africa could eventually lead to the complete breakdown of society, and also to the emergence of new paradigms for a brighter future.

The assumptions of the Fortress World Scenario may be summarized as follows:

- Increasing social and environmental problems lead to authoritarian 'solutions';
- Members of the elite live in protected enclaves. These may or may not involve a physical wall, and they may be within a country or between countries;
- Those in the fortresses reap the benefits of globalisation. Those outside the fortresses have few options and few resources, and are excluded from the privileges of the elite; and
- Components of the environment may actually improve under this scenario, because the elite controls valuable environmental resources. This improvement is not necessarily unsustainable, but it may not be feasible to maintain it for an indefinite time.

4.3.3.2 Environmental Implication

Land and Biodiversity

In Ethiopia, it is expected that, in the Fortress World Scenario, land degradation outside the fortress is rampant, due to overcrowding and insecure land tenure. This will be further aggravated by the lack of access to appropriate land management practices and technology because of indifference of the government to the need of the population outside the fortress. Investment in land improvement, especially outside the fortress, is very limited because of the lack of land tenure security, general disparateness and low awareness. Soil erosion will account for the major share of environmental degradation in the country.

The poor are driven off the prime land into more fragile areas, such as wetlands, steep slopes and lowland areas. Conflicts over resource use and access increases. Conflicting land use interest will be serious in the lowlands where land and

water are perceived as relatively abundant. Conflict will be especially over grazing land, irrigated crop cultivation and wildlife protected areas.

Land is devastated by warfare, civil strife, and reversion to subsistence agriculture. Soil erosion continues to be a major problem, as a result of massive deforestation in all areas driven by continuous displacement of the poor majority to marginal areas and the strive of the poor to generate livelihood.

In the Fortress World Scenario, biodiversity and its ecosystems come under severe pressure, with natural ecosystems reduced to small pockets of protected areas with limited access for the majority. These pockets of the protected areas may sooner or later deteriorate by the enhroachment of disadvantaged majority. National and international conservation and protection efforts decline, as a result of: lack of biodiversity conservation frameworks; strategic and financial resources; and unfair activities which cause significant habitat destruction, resulting in a greater number of extinctions and species under threat. Furthermore, as ethics and cultural values degrade, trade regulatory mechanisms completely break down, legitimizing trade in endangered species. This will risk large mammals such as the elephant and rhinoceros. These species are already under serious threat leading to local extinction. Endemic flora and faun species will also be threatened to extinction. Loss of biodiversity and invasion by alien/exotic species are increasingly widespread, causing increased outbreaks of pests and disease, resulting from a lack of natural predators and ecosystem destabilisation.

Unfair sharing of the benefits of biodiversity continues, with royalties accruing to multinationals. The long undervalued biodiversity becomes valued, but is overshadowed by inequity and market forces. Biodiversity comes under use in ecotourism, which is controlled and managed by the élite, who also reap much of the benefits.

Patenting of GMOs continues and threaten agricultural biodiversity, especially of wild species. For example, there is narrowing of gene biodiversity through the introduction of terminator genes, and genetic pollution of indigenous species. In addition, Ethiopia can face new weed and pest problems, arising from GMOs.

Critical ecosystems and forests are more strictly protected. However, as the Fortress World Scenario persists, the cost of protecting large numbers of sites increases, and the focus shifts to prime sites-including national parks. Biodiversity declines steeply during this period, for instance with serious loss of bird life, and with no large mammal survivals, apart from humans dominating.

Forests and Woodlands

In the Fortress World Scenario, deforestation and land degradation of forest areas will continue at higher rates. Biodiversity and its ecosystems come under severe pressure, with natural ecosystems reduced to small pockets of protected areas with limited access, mainly to the elite. The pressure might be minimal in these areas. Nevertheless, the high demand for forest products in the local and global market may force the elite to act as resource extractors leading to over exploitation of the forest resources. The poor people who make the majority of the population will fall back on extensive use of forest resources, which they have access to; thereby aggravating the rate of deforestation, and leading to loss of biodiversity.

National and international conservation and protection efforts decline, as a result of: lack of biodiversity conservation frameworks; strategic and financial resources; and unfair activities, which cause significant habitat destruction, resulting in a greater number of extinctions and species under threat.

Forests and woodlands under the control of the

elite strictly protected, and the government strengthen the policing functions of the relevant agencies. However, as the Fortress World Scenario persists, the cost of protecting large numbers of sites increases, and the focus shifts to prime sites-including national parks. Disadvantaged groups have no choice for survival, but resort to the cutting of trees for sell and for acquiring land for producing food. Protected areas may be subjected to distraction by the dissatisfied local community both as a protest to the rule to which they are subjected, and as a means of alternative livelihood. As a result, resource related conflicts would be widespread. The population in the highlands will no more be able to support itself by the agriculture of the highlands. Consequently, people could migrate to the lowlands, increasing the pressure on the fragile ecosystem of the low lands.

Forest and woodlands will be under severe pressure from agricultural practices such as livestock rearing and crop production charcoal production, construction, and fuel wood consumption. This in turn will escalate conflict with the pastoral and semi pastoral community who are commonly residing in the lowland areas and who have maintained the woodlands for dry season browsing.

Fresh Water

In the Fortress World Scenario it is assumed that there will be minimal use of existing water resources. Limited households and community representations are not comfortable with dependence on rain fed agriculture. They will voice their concerns and aspirations and to be part of the decision making process. Besides, due to the current limited technology and land protection measures, dams and reservoirs are also silted. Trans-boundary conflicts will be aggravated due to increased scarcity and inappropriate management of water resources. Conflicts increased between the upstream and downstream users. There is a huge freshwater potential that could be developed. In Ethiopia, the rapidly increasing population, together with widespread activities in the agricultural and manufacturing sectors, will bring about the depletion and pollution of freshwater resources. However, due to various socio-economic constraints that could occur, addressing this issue may not be given priority. There are a lot of Trans-boundary Rivers in Ethiopia. In recognition of its unsustainable use, without the consent of the riparian countries, the Ethiopian government will be engaged in difficult negotiations to achieve an equitable share of the water resources. Although there will be so much dependence on water development, if success is achieved, it would play a great role in poverty reduction. The outcomes of the negotiations would also serve as a model for the river basins and watersheds development in Africa, and would strengthen peace and stability within the region and beyond.

Although there is abundant water resource in Ethiopia, there are areas, where water is scarce. Water inadequacy results in poor health, low productivity and food insecurity, and constrains economic growth. About 60 percent of the diseases burden in Ethiopia is attributed to lack of proper water supply and sanitation. In the Fortress World Scenario, since few elites are favored ,the situation is likely to be worsened. In this scenario the government fails to conserve and protect water as a valuable resource; rather it will be ignored and becomes a vulnerable resource.

Due to the above fact, increased poverty, access to water and sanitation will remain low. This in turn, causes high incidents of communicable diseases, which diminish and hinder economic development. Water continues to be under utilised in energy and hydropower generation. In addition, infrastructure collapses, due to poor maintenance and lack of resources for modernisation.

In the Fortress World Scenario, the infrastructure for the management of water resources deteriorates. This could be expressed by inadequate institutional and financial arrangements, lack of data and weak human capacity. Problems with

water and land management further aggravate food shortages. Groundwater, especially in shallow aquifers, is highly degraded and depleted. Regional cooperation on transboundary water issues is not only weakened further, but is strained by escalating tensions and conflicts, as openness and transparency are eroded.

In the Fortress World scenario, water stress can be more serious with the advent of desert encroachment due to deforestation and land degradation. As far as agriculture is concerned, production is reduced and conflicts worsen due to water resource issues. In view of the lack of sewage water recycling, high population and an obsolete hydraulic (sewage water) system, urban areas experience shortages in potable water, and there will be an upsurge in water-borne diseases.

In the Fortress World Scenario, pollution, the destruction of dams and smaller water storage systems, the vandalisation of pipes and pumps in civil strife may create continual water shortages, with a devastating impact on animal and human life.

The Fortress World Scenario ignores or disrespects the rights of the majority of the population and utilises the water resources as much as possible in self-centerdness. This hinders, to a larger extent, governance and the culture of the people.

4.3.4 Great Transitions Scenario

4.3.4.1 Assumptions

The Great Transitions Scenario Stems from developments at the start of the new millennium. These include a conviction regarding the need to embrace a new sustainability paradigm. A paradigm, which transcends the dictates of both the Market Forces and the Policy Reform Scenarios, which, at the same time, prevent the occurrence of the ills associated with the Fortress World scenario. Associated with these is a philosophical dimension, at both personal and group levels, which holds that an end must be put to consumerism as a way of life, and that a search must be made for issues that can provide a renewed sense of meaning and purpose to life. Consequently, the values of simplicity, tranquility and community begin to displace the values of consumerism, competition and individualism. Voluntary reduction in work hours frees time for study, art and hobbies.

In the Great Transitions Scenario, lifestyles become simpler, in a material sense, and richer, in a qualitative sense, as the old obsession with possessions gives way to intellectual and artistic pursuits. In the new sustainability paradigm, markets remain critical, in terms of achieving efficiency in the production and allocation of goods, but well-designed policies constrain the level and structure of economic activity, so it remains compatible with social, cultural and environmental goals. A variety of mechanisms enforce these principles, including regulation, international negotiation and market signals, such as revised tax systems which discourage the production of environmental 'bads', and which reward restorative practices. Environmental, economic and social indicators track real progress at all scales-business, regional, national and global-giving the public an informed basis for seeking change.

The assumptions of the Great Transitions Scenario may be summarized as follows:

- Neither the Market Forces Scenario nor the Policy Reform Scenario possesses strategies that are adequate for addressing the ills of the assault on the environment;
- Given current trends in the adoption and implementation of treaties on environmental issues, policies alone cannot be sufficiently effective against social inequities and environmental uncertainty;
- While market forces are not abandoned as a policy tool, social, cultural and environmental goals take precedence in thinking about development;
- The notions of sustainability fundamentally change the values and lifestyles of peoples (an

Ethiopian Renaissance);
- In general, there is a cultural renaissance, which is not only critical of past behavior and effects on the environment, but which also outlines new ways of thinking, and which fosters environmental goals;
- The affluent, being disillusioned with consumerism, other ills of society and the negative impacts of development on the environment, undertake steps to develop new values and value systems. These are gradually introduced, and promote a new set of ethics in society; and
- A new generation of thinkers, leaders and activists join and shape national and global dialogue towards environmental sustainability.

The Great Transitions Scenario can, therefore, be seen as involving situations where a new emphasis would be placed on issues including: the content and structure of education and training; culture; governance; and the creation of effective organs and institutions, working in harmony to create the desired future. The Great Transitions Scenario also involves increased regional cooperation on environmental issues, such as water and food availability, mineral resources exploitation, and wildlife management. The goals of a desired and sustainable future require much more imagination than is available in the Policy Reform Scenario. But, in this scenario, 'back casting' is a major tool of analysis.

4.3.4.2 Environmental Implications

Land and biodiversity

In the Great Transition Scenario, all the drivers are expected to shape situations in a more positive ways to enhance sustainable environment and development. Various measures will be put in place by government to further stimulate the sustainable transition of the society. For instance implementation of land reform policies and the emergence of values associated with land market will bring more value to land and a significant decrease in land degradation. Individuals take deliberate measures to maintain productivity of their land parcels. Over all human development will favor sustainable land management. Organic agricultural production will get a strong hold with its positive ecological impact. Increased productivity on the sustainably utilized land, on the other hand, ensures food security. An increase in land-based income will enable more people (even those without land) to afford food. To ensure sustainability of land use, the government will employ varieties of instruments constituting scientific, economic and regulatory measures. Environmental zoning and land use planning will be implemented in harmony with traditional land management system. The increased proportion of the organic agriculture will gradually decrease the chemical input in agriculture with a consequent reduction of the general chemical pollution. This reduction of pollution will certainly enhance the land quality through conservation of soil flora and fauna.

Biodiversity, ecosystems and habitats receive adequate national and international protection, as a result of policies and practices that prevail. The value of biodiversity, ecosystems and habitats is recognized, with a fair share of benefits from sustainable use accruing to local communities and the government. Trade in rare species is fairly regulated, and is driven by ethics and moral values. Incremental loss of biodiversity due to human activity is reduced. There will not be threat to endangered species as the policy purposely discourages the value shift that prevails.

In the Great Transitions Scenario, there is active collaboration between modern conservation methods and traditional conservation practices. There is also development and strengthening of sub-regional cooperation, in the area of Environmental Information, which puts data on the state of the environment at the disposal of decision makers, and which ensures the conservation of Protected Areas Resources. The conservation programs, will attract sustained international financial support and cooperation as the policy ad-

dresses both local and global environmental goals.

Pressure from global stakeholders focuses the attention of government on biodiversity management. More national resources are channelled into the implementation of relevant conventions. National laws are enacted or reviewed, to bring them in tandem with these conventions. Ethiopia promotes new products and processes, which enhance the potential biodiversity resource, including medicinal plants. This elevates the profile of biodiversity resources and the need to protect them. Consequently, a better conservation and sustainable utilization of biodiversity is fostered. Sustainability paradigm is also expected to reduce the pollution load from all sectors. This will also favour the conservation of biodiversity.

Forest and Woodlands

In this scenario real recognition is given to sustainable use of forest and woodland resources. Communities are environmentally aware and are empowered to care for the environment. Access to forest and woodland resources increases and forest quality improves as a result of realisation of the true value of forest resources, and improved forest management. Human and environmental vulnerability are minimised. High protection of the environment (forest and woodlands) and fragile ecosystems will be the norm. Alternative sources might substitute forest products. The technological development may relieve the pressure on forest and woodlands. Improved technology expands the scope of species utilised, and improves wood processing through recycling and the use of small dimension timber and so on. Tree improvement biotechnology, which is proved sound for its environmental performance, will lead to high productivity plantations. However, the transition to the above mentioned situation might take some time.

Owing to Ethiopia's diverse ecosystem, increased liberalization opens up the forest sector to both national and foreign direct investment. The rate of deforestation will decline as the involvement of private sector investment in the afforestation program increases. Massive reforestation is in hand, with the target of planting trees per person or planting enough trees for wood and ecological function per community. This ends the devastating decade of depletion of forests and woodlands.

It is also expected that the emergence of regional groupings such as the COMESA and associated free trade policies, also increase the movement of forest products from resource-rich states to those with deficits, adding greater value.

Fresh Water

In the Great Transitions Scenario, water remains vital to both agricultural and the industrial development sector. In Ethiopia, there is abundant but uneven distribution of water and land suitable for agriculture. This affects water resources and agricultural development potential and results in the reduction of per capita water availability. Therefore, to overcome this problem, the issue of water shortages should be carefully addressed and minimised.

Localised freshwater availability continues to be a problem, especially in the semi-arid parts. There is a need for intervention to reach the needy. In view of this, in the Great Transition Scenario, investment in small, medium and large-scale water supply and irrigation schemes is likely to take place. Medium and large-scale irrigation schemes could receive high attention to be developed in the lowlands. Concerted diplomatic moves could be witnessed in the direction of shared water resources, in order to ensure fair and equitable use in the sub-region. Sub-regional groupings (ENTRO and EBTRO) in the Nile Basin in connection with the implementation of the Nile Basin Shared vision Programs; could provide additional opportunity for regional cooperation in sustainable use of water resources.

In the Great Transitions, the hitherto lack of enforcement of environmental legislation on water protection will become a thing of the past. Governments call for community service orders to join communities in environmentally clean projects, as an alternative to custodial care.

This scenario assumes that there is high water resources potential that could be used, and given the advancement of the technology, makes efforts bridging the Urban-Rural gaps. It tries to advance use of improved technology such as recycled water and reduce risks of using contaminated water sources in urban and rural areas, and thereby improve livelihood of the people.

The use of traditional as well as scientific knowledge and skills for improved water use and for resolving conflicts will take place. Sustaining the functioning of water supply and irrigation schemes remains to be a real challenge, but the relevant policy and legislative framework will get a leverage to strengthen and allow the evolving of indigenous arrangement. With population growth, the once assumed inexhaustible natural resources would have a careful utilization by all communities in perspective. The same is true for surface and groundwater resources, which seem to be excess but not readily available for use.

In the Great Transition Scenario, the efficient management and utilization of water resources plays key role in overcoming the consequence of current drought and famines. To this end, the Government will have long-term strategies and programs to develop the country's water resources. Through such kind of strategies more land could be put under irrigation to produce enough food, provide raw materials for industries and could lead to the production of cash crops for the export market. Each major river valley could become an economic growth centre for developing agriculture, livestock, electricity, and agro-industry. These would then facilitate employment opportunity, expand and diversify the export base and encourage growth in remote and marginal areas. In the Great Transition Scenario, good governance is practiced and the culture of the people will receive better attention.

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CHAPTER FIVE

Strengthening Implementation and Policies

5.1 Introduction

Ethiopia is home for diverse plant and animal species. The country is also rich in natural and cultural heritages. Renewable natural resources are the major foundation of the economy.

The major environmental issues of the country are: land degradation, including serious soil erosions, soil fertility depletion, biodiversity losses, disruption of hydrologic cycle in rural areas; and pollution, including municipal solid waste, industrial and chemical pollution in urban centers. These have resulted in reduced agricultural productivity, reduced biomass availability for energy and other uses, which inturn has resulted in energy crisis, and increased public health problems, as well as recurrent drought and starvation. The underlying factors are low level of awareness and information, high population pressure, poor environmental management and stewardship by industries, unsustainable agricultural practices [crop and livestock], limited capacity to implement sustainable development policies and strategies.

On the other hand, the Ethiopian economy is intrinsically linked to the productivity of its environmental resources. Thus, sustainability of the Ethiopian economy can only be ensured if environmental resources are protected, conserved and sustainablly utilised. This requires multifaceted interventions.

In order to reverse the above-mentioned environmental problems and promote sustainable development, the government of Ethiopia, among others, has taken several institutional, legal and policy measures.

This section of the report reflects the key measures that have so far been taken, their adequacy and recommendations for future action.

The Sustainable development framework of the country is being guided and supported by major policy instruments, including the FDRE Constitution, Plan for Accelerated Development to End Poverty, the Conservation Strategy of Ethiopia, the various development strategy documents, and the Environment Policy of Ethiopia.

5.2 Sustainable Development Framework of the Country (SDFC)

Ethiopia, alike many African countries, has endorsed the Millennium Development Goal. Ethiopia has also elaborated a poverty reduction strategy. The Ethiopian Poverty Reduction and Sustainable Development Program first cycle has just ended and a new program entitled, Plan for Accelerated Sustainable Development to End Poverty (PASDEP) has been launched.

PASDEP constitutes five-year goals and targets in agriculture and rural development, infrastructure, health, education, trade and industry and in many other cross-cutting issues that interact with these sectors. The plan intends to accelerate poverty reduction through integrated intervention in line with the Millennium Development Goals.

PASDEP constitutes goals and targets to achieve Millennium Development Goals (Goal 7, target 9). PASDEP builds on the achievements of previous Poverty Reduction and Sustainable Development Program and intends to end poverty through Accelerated Sustainable Development.

The government of Ethiopia has recognised that for this plan to be successfully implemented, a meaningful integration of environment is a cardinal and critical imperative. They are intractably

intertwining subjects. Therefore, solving or adequately addressing the environmental issues is one of the constituents of an exit strategy from poverty.

Environmental issues are addressed in the PASDEP both in the relevant sectors and as a cross-cutting issue. Sustainable land management, biodiversity conservation, afforestation, water supply and sanitation and public health have been addressed in the traditional sectors- agriculture, water and health. Environmental issues are also treated as cross-cutting issues and therefore, specific goals and targets are set in the PASDEP. The principal outcomes of the environment component are: improvement in rural environment that ensures gender equity and equality in development through improved and sustainable livelihoods, pollution prevention and waste management; accelerated environmentally sustainable socio-economic development.

The Plan For Accelerated Development to End Poverty has acknowledged the intrinsic linkage between poverty reduction and environmental degradation, and therefore incorporated addressing environmental issues in unprecedented manner. However, considering the level of appalling environmental degradation prevailing in the country, there is a need for more concerted and continuous effort.

On the other hand, various challenges are expected in the implementation of the plan. Limited financial resources, skilled human resource, access to technology, limited institutional capacity, low-level of environmental awareness at all levels and among the public, as well as poor coordination among and between agencies are expected to constrain the implementation of the plan to various degree.

5.3. Agricultural Development-Led Industrialisation (ADLI)

The framework economic development strategy of the Federal Democratic Republic of Ethiopia is the Agricultural Development-Led Industrialisation (ADLI). The strategy envisages agriculture as the engine of the country's economic growth. Agricultural intensification, commercialisation and increasing the proportion of marketable outputs are identified as strategy to set this engine into motion and to achieve the ADLI objectives. In line with this strategy, the government has declared the pursuit of a liberalisation policy, including the withdrawal of input subsidies, deregulation of different markets, and tariff reduction. In addition to this, government efforts have continued to focus on rural development and measures to improve productivity of smallholder peasant agriculture through "extension packages" as well as rural credit services, primary education, health care, domestic water supply and rural road construction.

However, environmental impacts of the use of agrochemicals, irrigated agriculture, and other agricultural practices have not been adequately addressed in the extension package. Recently, the government has taken an important step to promote organic agricultural products such as coffee. Therefore, it is expected that organic agriculture and conservation-based agriculture will gradually get importance in Ethiopia.

5.4. Environment Polices and Legislations

5.4.1 The FDRE Constitution (Proclamation No.1/1995)

The rights to clean and healthy environment are provided as fundamental rights of citizens (articles 43 and 44). The provisions encompass among other things, the right of citizens to participate and be consulted in national development programs, policies, projects affecting their live. Citizens are also entitled to improved living standards, capacity enhancement for development

and meeting their basic needs; appropriate compensation and state assistance when affected by development initiatives. The Constitution has provided a comprehensive basis for promoting sustainable development.

5.4.2 Conservation Strategy and Environment Policy of Ethiopia

The Conservation Strategy of Ethiopia (CSE) provides an umbrella strategic framework, detailing guiding principles, and strategies for environmental management. The CSE as the sole environmental management package includes the baseline information on the natural resources of the country, policy and strategy descriptions, the institutional arrangements and action plans needed for its realization. In line with this framework, all the Regional States and City Administrations have prepared their respective Conservation Strategies.

The Environmental Policy of Ethiopia [EPE], which emanated from the Conservation Strategy of Ethiopia, constitutes ten-sectoral and ten cross -sectoral policy pronouncements. The sectoral and cross sectoral policy elements of the environment policy of Ethiopia are:

- Soil Husbandries and Sustainable Agriculture
- Forest, Woodland and Tree Resources
- Genetic, Species and Ecosystem Biodiversity
- Water Resources
- Energy Resource
- Mineral Resources
- Human Settlements, Urban Environment and Environmental Health
- Control of Hazardous Materials and Pollution from Industrial Waste
- Atmospheric Pollution and Climate Change
- Cultural and Natural Heritage
- 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 (EIA)
- Environmental Education and Awareness

The overall policy goal is “to improve and enhance the health and quality of life of all Ethiopians, as well as the promotion of sustainable social and economic development through the sound management and use of natural, human-made and cultural resources.”

5.4.3. Environmental Proclamations

There are three mainstream proclamations in the environment arena, namely-the Environmental Organs Establishment Proclamation (295/ 2002), the Impact Assessment proclamation (299/2002), and the Pollution Control Proclamation (300/2002).
The environmental organs establishment proclamation (295/2002) is an important enactment that provides for institution for environmental management at federal and regional levels. This proclamation provides for the establishment of The Federal Environmental Protection Authority at federal level with broader mandates and strategic standing, being accountable to the Prime Minster’s Office. The proclamation demands the establishment of regional states environmental agencies as well as sectoral environmental units. This has created favourable conditions to mainstream environmental concerns into sectoral development initiatives as well as in the regional state's environmental protection agendas. However, there are many practical challenges associated with the enforcement of this proclamation. For instance, operational sing the environment council has remained to be a challenge which has resulted in poor interagency coordination. Sev-

eral sectoral institutions are yet to establish their respective environmental units. Although, regional states have recently embarked on the establishment or designation of environmental agencies, their effectiveness has been limited because of many factors. Regional environmental organs lack necessary capacity in terms of human power, financial and infrastructure.

Impact Assessment Proclamation (299/2002) is intended to guide the socio-economic development projects, programs, plans and public instruments planned and executed sustainably. Several of these initiatives have benefited from the EIA tool. However, their effectiveness has also remained to be limited. Various factors contribute to the poor performance of EIA, among which, poor monitoring and follow-up, low capacity to conduct and implement EIA, low awareness at all levels, and poor inter-agency and federal-regional coordination are worth mentioning.

Pollution Control Proclamation (300/2002) is proclaimed to put into effect constitutional provisions on sustainable development and environmental protection. It is specifically designed to prevent pollution as undesirable social and economic consequence of social and economic activities. However, the implementation of this proclamation is also limited by various factors. Subsidiary laws such as pollution control regulation, pollution control standards and guidelines are not yet in place. Law level of awareness at all levels, limited human and financial capacity and poor techninological basis are some of the limiting factors to the effective implementation of the proclamation.

5.4.4 Sectoral Policies

5.4.4.1. National Level Polices

Agricultural and Rural Development Policies and Strategies (ARDPS, 2002)

The strategies include among others, improving rural land administration, reducing the country's vulnerability to drought and other natural calamities. The Food Security Strategy (FSS, 2002) has also been developed with special attention to increasing the supply of food; improving access to food and strengthening Ethiopia's emergency response capability. The strategy among others, is attempting to enhance and scale up:

- safety net measures , participatory development and social mobilization;
- environmental protection, management and rehabilitation.

The desire to support the efforts of ensuring food security through rehabilitating and enhancing the natural resources base has fallen short of expectations, in many respects. In this regard, an integrated effort is yet to be required to achieve conservation based approach to ensuring food security and creating employment opportunity. However, the Environmental and Social Management Framework for safety net program is an encouraging step.

Water Resources Management Policy (WRMP, 1999)

The WRMP overall goals are to enhance and promote efforts towards an efficient, equitable, and optimum utilization of the available water resources and thereby contribute to the country's socio-economic development on sustainable basis. The policy acknowledges the use of environmental impact assessment in the water resource development projects and programs. It is also consistent with the environment policy of the country

National Policy on Biodiversity Conservation and Research (NPBCR, 1998)

The NPBCR policy objective is based on a holis-

tic ecosystem approach to sustainably conserve, develop, and utilise the country's biodiversity resources. Integration of the biodiversity conservation and development into federal and regional sectoral development initiatives and mobilisation of international cooperation and assistance have been identified as the principal strategy for the implementation of the policy.

However, in practice, the policy implementation is very much skewed towards conservation rather than sustainable utilization. This is the legacy of past tradition which is protection oriented to biodiversity management rather than conservation and sustainable utilization. In addition, integration of biodiversity conservation into sectoral plans and programs has not been as effective as promised. There is also lack of clear strategy, regarding for instance, the management of invasive species.

Protection of biodiversity related traditional indigenous knowledge and communities benefit sharing arrangements is not yet effective. The potential for exploiting biodiversity related opportunity is not yet taped to enhance sustainable livelihood to its desired levels. However, recently there is a general understanding to changing the management approach to bring about desirable level of benefit.

National Science and Technology Policy and Strategy (NSTPS, 1993)

Its main objective is to build the country's science and technology capability to maximize its contribution towards realising the national development objectives. The policy accords priority to promote agriculture, natural resources, including biodiversity resources and environmental protection and water resources developments. Besides, the draft Biotechnology Policy and Strategy, which focuses at enhancing agricultural and industrial production, productivity and product quality as well as improve health; protect and rehabilitate the environment has been tabled and awaited government approval. However, the bio-safety issues related to new and emerging issues notably, genetic engineering has not been addressed explicitly. National bio-safety frame work law and guidelines have been drafted by Federal Environmental Protection Authority.
The EPE promotes developing and disseminating technologies which are biologically stable, appropriate under the prevailing environmental and socio-cultural conditions for farmers, economically viable and environmentally beneficial.

5.4.4.2 Regional State Policies and Strategies

Based on the Conservation Strategy of Ethiopia, all the Regional States and City Administrations have prepared their respective Environmental Protection and Conservation Strategies. The Amhara and Oromiya Regional States have also prepared their respective Environmental Protection andLand Use Administration Proclamations. The regional conservation strategy is a document that elaborates regional environmental issues and goals with region specific strategies. The document is envisaged to guide the regional planning practices. Regional land use and administration laws stipulate the condition under which land is used and associated responsibility of land users as well as guarantee uninterrupted access to land by land user. This will create the policy environment for increased participation by local community to conserve land based resources.

However, the regional conservation strategies cannot be argued to be implemented in their full scale. This is partly due to limited institutional, human resource, financial, and technical capacity.

Recently, all regional states have completed regional capacity self assessment for environmental protection and sustainable development. Capacity needs prioritized and action plan elaborated. A

consolidated national Capacity Needs Self Assessment for Global Environmental Management has been completed

Rural Land Administration and Use Proclamation (MoANRD,2005),

The important feature of this proclamation is that it stipulates rural land use and restrictions based on proper land use planning and provides for proper use of various class of land such as sloppy, gully and wetlands; and on utilization of rural land for villagisation and other social services. Besides, it is envisaged that this proclamation will create a sense of ownership among the large majority of the rural population to take initiatives and join hand in environmental activities.

Forest Resources Conservation Proclamation (MoANRD,1994)

This proclamation has incorporated provisions that aim at ensuring the conservation of forests and determines how forests shall be developed and utilised. It also recognise that sustainable utilization of the country's forest resources should be achieved through the participation of the people and benefit sharing by the concerned communities; as well as by formulating policies and programs in conformity with other economic sectors particularly, agricultural development.

5.4.4.2 Regional State ...

5.5 Multilateral Environmental Agreements

Ethiopia is a party to a number of Multilateral Environmental Agreements [MEA] such as UNCBD, UNFCCC, UNCCD, Cartagena Protocol on Biosafety, Kyoto Protocol on Climate Change , Vienna Convention on the Protection of Ozone Layer, Montreal Protocol on the Ozone Depleting Substances, Basel Convention on the Transboundary Movement of Hazardous Wastes and other Wastes, Stockholm Convention on POPs, Rotterdam Convention on PIC .

A number of measures have been taken to implement MEAs. National Action Plan to Combat Desertification, Biodiversity Conservation Strategy and Action Plan, National Plan of Adaptation and Mitigation to the Climate Change, National Implementation Plan for the implementation of the Stockholm Convention on POPs, National Biosafety Framework and Guidelines, have been prepared and are being implemented.

5.6 Conclusion and Recommended Future Action

5.6.1 Conclusion

Ethiopia has taken important and encouraging measures towards implementing environmental policies and strategies. The policy documents have fairly enshrined the principles of sustainable development. There are no significant policy gaps for sustainable development practices and environmental protection. However, in practice there are wide gaps between the policy intentions and actual decision on the ground. Consequently, the desired goal is far from being realized. A number of interacting factors contributed to the poor implementation of the policies and strategies in Ethiopia. Some of these include:

- Skewedness towards quick economic achievement;
- Weak and unstable institutions at the Regional levels;
- Absence of Sectoral Environmental Units in the Federal Sectoral Institutions;
- Lack of adequate infrastructure and skilled human resource;
- Weak environmental legislations enforcement capacity ;
- Financial limitations;
- Absence of functional linkages among and between various state and non-state actors;
- Lack of environmental awareness and limited

integration of environmental issues in formal education;
- Inadequate environmental information and lack of environmental information system and networking;
- Absence of environmental accounting systems in the National Income Accounting of the country or regions; and therefore inability to express degradation of environmental capitals in monetary terms;
- Lack of awareness on environmental investment opportunities among the private sectors;
- Poor capacity in identification and acquisition of appropriate technologies, absence of research and development programs to solve local environmental problems and environment - livelihood challenges, absence of dissemination of appropriate environmental technologies and best practices; and
- Poor implementation of punitive and incentive measures enshrined in different environmental instruments.

5.6.2 Recommended Future Directions

Taking into consideration the key problems outlined under the conclusion, the following recommendations are made.

- Promote environmental awareness in general and specifically on environmental and related policies, existing action plans and sustainable development issues at all levels;
- Establish and/or strengthen the regional environmental agencies and sectoral environmental units;
- Strengthen the federal and establish and/or strengthen regional Environmental Laboratories;
- Establish Ethiopian Environmental Information System and Networking and establish environmental monitoring mechanism;
- Develop and implement human resources development program;
- Strengthen national environmental policy and strategy coordination mechanism;
- Strengthen measures to integrate environmental concerns into formal, informal and non formal education systems;
- Initiate environmental accounting and subsequently integrate it into the national income accounting system;
- Promote Eco-investment and market based strategy to environmental protection;
- Promote environmental research and development and build capacity for identification, acquisition and dissemination of appropriate environmental technologies and practices;
- Implement and /or develop appropriate incentive measures to enhance enforcement of environmental policies and legislation;
- Develop the enforcement capacity of federal and regional environmental agencies promote community empowerment to enhance their participation in setting local environmental agendas and to implement priority actions.

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CHAPTER SIX

Concluding Summaries and Recommendation

Introduction

This chapter constitutes major findings of the EEO. Analisis of each chapter are summarized and major insights are drawn. Recommended directions are outlined based on the prevailing objective conditions and likely future directions. Effort is made to build on the findings of each chapter and cross-fertilize the analysis of different chapters so as to benefit the reader to capture the major element of this exercise.

General

Ethiopia's location, which is 3 ^{0} and 15 ^{0} North Latitude and 33 ^{0} and 48 ^{0} East Longitude, is part of the tropical region, coupled with physiographic characteristic of the country, has contributed to the ecological and cultural diversity.

Ethiopia has land area of 122,900 Sq. Kilometers and a total population of 71,066,000. Out of the total population 59,867,000 are rural and 11,199,000 are urban. The highlands, which are the area with altitude of above 1500 metres above sea level, have an annual rainfall range of 500 - 2000 mm and the northeast and southeast low lands, which are below 1500 metres above sea level, have unreliable and erratic rainfall ranging from 300 - 400 mm.

Ethiopia has a federal administration system that constitutes 9 Regional States and two City Administrative Council. Only 16 % of the total population of the country lives in urban areas and 84% of the population lives in the rural parts of the country.

The country has a wide range of wildlife resources consisting of animals and birds. The diversity in climate situation and topography has contributed to a wide varity of flora and fauna. Presently, it is believed that there are some 277 species of mammals, 861 birds species, 201 reptiles, 63 amphibians, 150 fish species and over 6000 species of flora.

Sustainable Development and livelihood

The environmental resources are the backbone of Ethiopia's economy. Agriculture, which entirely depends on the environmental resources [fresh water, land, climate and biodiversity], employs more than 80 percent of the population of Ethiopia. Failure of agriculture has been the cause for frequent human suffering. Environmental degradation in Ethiopia has a close association with the recurrence of drought, food insecurity, and declining farm productivity. In 2005 it was reported that about 7.5 million people were affected by drought leading to serious food shortage. It is now widely accepted that much of the famine incidence in Ethiopia has to do with the anthropogenic environmental degradation. Therefore, the livelihood of the majority of the population and the overall economic development of the country directly depends on environmental resource.

Rural Ethiopians depend heavily on their surroundings environmental goods and services for their livelihood. These include land for food and cash crop production, grazing, shelter and other socio-cultural services, forest and biodiversity resources for fuel, food, medicine, shelter construction, regulation of springs, rivers and ground water, including for their religious and cultural attributes.

Since the livelihood of rural Ethiopians is closely intertwined with land, water and biodiversity resources, the degradation of these resources directly affect their survival and the consequences of sever degradation of these resources are manifested through wide spread food insecurity and poor quality of life.

The Government's economic development strategy is also agricultural development led industrialisation. This is an induction that agriculture will remain the engine of the economy for a foreseeable future. A set of interacting factors contribute to the success of the sector including, the state of the environmental resources.

The agriculture sector has contributed a great deal to a significant economic growth in recent years. However, the rate of change of living standard is slow because of the prevailing high rate of population growth and base poverty level.

Both the results of the censuses and the DHS revealed that there is variation among regions, in the Total Fertility Rate [TFR], differentials by place of residence, level of education, and type of occupation. The urban population than the rural; the educated than the illiterate have a lower TFR. The Central Statistics Agency has estimated the TFR to decline to 3.32 by 2030.

Ethiopia has launched a population policy with the general intention to harmonize the rate of population growth with the economic development and thereby improve the welfare of the people. The specific objectives/targets of this policy are among others:

- Reducing the current total fertility rate of 7.7 children per woman to approximately 4.0 by the year 2015;
- Ensuring spatially balanced population distribution patterns with a view to maintaining environmental security and extending the scope of development activities;

- Mounting an effective country wide population information education programme addressing issues pertaining to family size and its relationship with human welfare and environmental security.

Many communities in Ethiopia had indigenous environmental management practices. However, these practices in many cases could not survive external interference. Community institutions were intentionally dismantled by rulers. Consequently, the traditional environmental management practices and values begin to deteriorate, with resultant widespread environmental degradation. On the other hand, environmental problems have long been recognised but addressed in a fragmented manner. It is only since the Rio United Nations Conference on Environment and Development in 1992, that environmental issues were accorded a holistic view. Since then the Conservation Strategy and the Environment Policy of Ethiopia were put in place. Various policies and legislations incorporated environmental issues to certain degrees. However, it cannot be argued that enough is being done in the environment and sustainable development arena.

Therefore, the future course should recognise the intrinsic linkage between environment and development. In this regard, the following are suggested:

- In tandem with major international instruments such as the Johannesburg plan of implementation, millennium development goals and agenda 21, there is a need for comprehensive sustainable development strategy which could build on the existing conservation strategy and poverty reduction programmes;
- a poverty reduction strategy and actions should recognize the intrinsic linkage between environment and development in Ethiopia; and
- There is a need for strong institution and coordination among major actors

State and Trend of the Ethiopian Environment

ATMOSPHERE

Rainfall varies enormously across the country. While precipitation in the lowlands in the south, southeast, east, and north averages below 500 mm/year, some areas of the highlands average over 2000 mm/year. In addition to this spatial variability, rainfall is highly variable over seasonal and inter-annual time scales. In most part of the country, there are two rainy seasons—the short spring rains (February-May) known as *Belg,* and the main rainy season (June-September) known as *Kiremt.* In the western part of the country, however, there is only one rainfall peak during the year.

High interannual variability in precipitation is characteristic of both the *Belg* and the *Kiremt,* though the spring rains tend to be less reliable. The large-scale atmospheric dynamics that affect the Ethiopian climate are quite complex.

The direct dependence of Ethiopians on rain-fed agriculture makes the nation exceptionally vulnerable to climate variability. The substance rain-fed agricultural activities of the people are frequently affected by rainfall variability in amount and/or pattern and as a result famine is a frequent feature.

NMSA (1996) deduced the average frequency of occurrence of drought/famine from the available records. Some findings stated that drought in Ethiopia has periodicity or quasi periodicity of 2 to 10 years, while some others argued that there is no long-term patterns, be it trend or cycle for Ethiopian drought.

Regarding the GHG emission, about a decade ago, in 1994, the per capita emission would be 0.8976 tonnes of CO_2-equivalents per year. The emission from agriculture sector contributed 80% of the total CO_2- equivalent emissions and 80% of the total CO_2- equivalent emission comes is contributed by CH_4. During 1990 to 1995 aggregate emissions of GHGs in terms of CO_2 – equivalents has increased by 12%. The sink capacity of Ethiopia in the LUCF sector during the same period was also decreasing rapidly. It is noted that the rate of growth in GHG emissions varies across sectors and sub-sectors.

Ethiopia, although not among the net contributors of GHG, it is among the vulnerable countries to the effects of climate change. It is expected that climate change will induce high climatic variability in Ethiopia. Therefore, it is important to know the impacts of climate change in many sectors. It is important to know, for instance, in the water resources sector, not only changes in volume and timing, but also on system characteristics, changing pressure on the system, how management system evolves, and what adaptation to climate change are implemented. Generally, climate variability has effects on water sector especially by change in municipal and industrial demands and may substantially affect irrigation withdrawals.

On the other hand, as long as climate variability remains one of the major causes of food insecurity in the country, it is of paramount importance to enhance the potential benefits of applying climate related information in addressing food insecurity problems in general and formulating sustainable agricultural strategies as well as planning and implementing appropriate emergency interventions in particular.

Nevertheless, the current status of climate information in the country is far below the desired level. This is mainly due to lack of capacity to analyse and disseminate the information and also due to lack of know-how from the users side.

Air pollution in Ethiopia is not a serious concern. However, there is some concern in urban areas. The major causes of urban air pollution are mobile and stationary sources. The urban mobile

sources are rapidly growing in number and so are their emissions. Although the total number of vehicles in Ethiopia is low, the pollution caused by old vehicles is high. Empirical evidence shows that the vehicle fleet, both public and private, which is aged 20-year on average, emits twenty fold of the new ones.

Similar to outdoor air pollution, little attention is given to indoor air pollution in Ethiopia. Very little is known about the indoor concentrations of indoor air pollutants. Levels of fuer gases from domestic cooking, the products of incomplete combustion are known to be a serious health concern.

Therefore, Ethiopia needs to consider some strategic directions such as:

- Continuous cooperation with the international community on climate change mitigation and adaptation initiatives;
- Building capacity to monitor climate change and the effects thereof and build early warning system and preparedness to the effects of climate change;
- Developing integrated national plan for mitigation and adaptation to climate change and integrate it to the national development plan;
- Building capacity for air quality and its health impact monitoring;
- Addressing the wide spread indoor air pollution as a matter of priority for health, gender, and quality of life issues.

LAND RESOURCES

The diverse agro-ecological setting in the country offers ample opportunities to produce multiple high value crop products, which will have high demands at both domestic and international markets. However, the bulk of subsistence farmers produce staple food for their own consumption and little to external markets.

Ethiopia possesses vast unique ecosystem areas (national parks, wildlife reserves, wildlife sanctuaries and controlled hunting areas). implementing intensive management program offers great opportunity not only for increased potential for increased foreign exchange earning through tourism but for biodiversity conservation through in-situ conservation of resources.

Ethiopia suffers a serious land degradation problem. The underling challenges and constraints range from weak institutional factor to deficient policies, technical stagnation and instabilities.

In the highlands of Ethiopia (areas above 1500m), from all forms of soil degradation processes, sheet and rill erosion and the interrelated physical degradation process are the dominant degradation processes, in term of both aerial extent and their influence on land degradation.

Though it cannot be unequivocally proven with research data, chemical degradation due to leaching and development of aluminum toxicity are found at local level and with limited extent, while chemical degradation due to “mining” of soils nutrients as a result of poor farming practices is likely to be widespread being serious to phosphorous. The on-site and off-site economic, social and environmental impacts of soil degradation are colossal, however, dearth of data due to meager studies on the topic, there is no actual figure on the magnitude.

The “Off-site” impacts of soil has resulted in increased downstream flood incidences, cause the reduction in life span of dams and reservoir, damages irrigation structures and bridges, which resulted in the disruption of social well beings of downstream inhabitants and ecological balances. Massive and acute erosion/sedimentation problems have inflicted damages to *Borkena, Gondar and Koka* dam structures. The recent drying-up of a number of inland lakes such as *Alemaya* and *Adele* and the growing decrease in the volume of lake *Ziway*, are partly associated with erosion/ sedimentation process.

Recently, the use of chemical fertilizer is increasing. Countrywide, the average rate of fertilizer (nutrients) application per hectare of cultivated land was about 17.5 kg in 1995. In 2004 more than half of the sampled households used less than 50 kg of fertilizer including both UREA and DAP in the four large regions. After the change of policy, fertilizer consumption has increased sharply from 152.7 thousand tons in 1992 to 281.3 thousand tons in 1998.

In a move to enhance tenure security and to decentralize land administration institutions, the National Rural Land Administration and Land Use Law was promulgated (FDRE 2005). The Amhara, Tigray, Oromiya and SNNP regional states enacted their regional land administration and use laws.

If land resources are to be used in sustainable ways, the many interlink of the ultimate and deep causes related to poverty and environmental degradation should be addressed and arrested in order to bring about a synergy effect. Salient recommendations for sustained use of land resources are summarized below.

- A holistic and integrated land resources development approach with packages of interventions comprising of technical, policy and institutional aspects, among others should be adopted;
- Profound and persistent efforts should be undertaken to institutionalize a strong and stable agricultural extension frameworks that integrate sustainable land management and that take into account the diverse agro-ecological and socio-economic settings across the country;
- The promulgation of environmental and land administration and land use laws are encouraging. However, it needs to be backed up with strong institutional set-ups in order to effect their implementation. Concomitant action should be a close monitoring and evaluation of these laws for continuous improvements based on feedbacks;
- Build on the existing best practices and experiences of land management of the country so as to promote the accumulation and organic growth of knowledge which is to be passed to successive generations; and
- Strengthen policies implementation capacity (in all-relevant sectors) and strengthen both formal and informal organizations.

FOREST RESOURCES

The major types of high forests in the country can be classified into: Upland Dry; Evergreen Forests (*Juniperus procera*); Mixed Juniper-Podocarpus ;Upland Evergreen Forests; Humid Upland Broadleaved with Podocarpus; Humid Upland Broadleaved with Aningeria dominant; and Riverine Forests. Of the total forest stock in Ethiopia, 95% is located in Oromiya, SNNPR and Gambella regions. Forestry's integration with other land use practices has been emphasized and sectoral integration in sustainable development is adopted as a strategy by the government.

Plantation programs have been initiated on a large scale in selected regional forest priority areas to rehabilitate formerly forested areas and produce industrial and construction wood. They are mainly of exotic tree species with Eucalyptus covering the largest area of hardwood plantations. The total area of planted forests is estimated at 216,000 ha and comprises industrial, fuel wood and communal plantations.

Trees outside forests are important sources of wood and non-wood forest products and households main fuel and construction wood needs are obtained from these resources. Of the total amount of wood produced 93% is used for household energy source. The consumption varies depending on the availability of woody biomass resources or other alternative option.

The forest resources are steadily disappearing and those that are left in the South West are being degraded. The basic causes of deforestation are the same in all the regional states in Ethiopia. They stem from growing demand for land and forest products and the lack of sustainable resources management due to economic, social and institutional constraints.

Encroachment, resettlement, overgrazing and recurrent droughts have all undermined the forest and woodland resource base. Over-grazing has been a problem especially, in arid and semi-arid areas.

On the other hand, inadequate regulations and enforcement of existing laws designed to protect and sustainably manage forests, and insufficient or non-existent instruments capacity and infrastructure for forest and woodland resources have aggravated the rate of deforestation. The forest sector's contribution to the gross national product on the other hand, has also been underestimated.

In an effort to cope with the rapid depletion of forests in recent years, the Government has classified 58 of the most important high forest areas as National Forest Priority Areas (NFPA) (EFAP, 1994). Nevertheless, the analysis clearly shows, that in some NFPAs no Natural High Forests are remaining at all, whereas in most of them, the forest stands have been either partly deforested or at least severely degraded.

Therefore, The present management practices have not been able to control or stop the loss of forests. Because there is no up-to-date statistics, the rate of plantation development is expected to be below the rate at which the natural forests disappear. Considering this situation and the growing population, pressures on the remaining forests will continue to increase.

It can be concluded that the major limitation of forest development and conservation are poor valuation of forest and woodland resources, under-development of NTFPs, ineffective monitoring of forest resources, poor involvement of local people, lack of off-farm employment opportunity and gap between sustainable yield supply and demand of forest products. Included are also low regulatory role and institutional capacity, low Policy emphasis to the forestry sector, policy conflict and exclusion of local communities from forest and woodland management. It is therefore recommended to :

- Enhance local communities participation in the management of forest and woodland resources;
- Improve the institutional frameworks of forestry for effective management;
- Recognise NTFPs in National Accounting and preparation of technical packages to promote the use of these resources;
- Integrate forestry into all land uses so that trees become an integral part of all land use practices;
- Enhance the supply of fuel wood and improving the efficiency of its use; and
- Carry out Valuation of forests through update of data on the resource.

B I O D I V E R S I T Y

Ethiopia encompasses a broad range of ecosystems with great varieties of habitats contributing for the occurrence of high faunal and floral diversity. South of the Tropic of Cancer almost 50 percent of all land above 2,000 m and nearly 80 percent of all land above 3,000m lie within the borders of Ethiopia. These vast plateau, divided by the Rift Valley into northwestern and south-eastern massifs, with an average altitude of about 2,200 metres above sea level (masl) but rising to more than 4,600m in the Semien Mountains.

The Ethiopian Afro-alpine flora has gained some attention and being investigated since the start of the Ethiopian Flora Project in 1980, particularly the Bale Mountains on the south-eastern plateau.

Ethiopia's biodiversity provides an important basis for economic growth and development in obvious ways such as agricultural led industrial development, rangelands that support commercial and subsistence farming, horticultural and agricultural industry based on indigenous species, fishing industry, tourism industry, and commercial and non-commercial applications of indigenous resources.

On the other hand farmers in Ethiopia draw clear association between each grain type (landraces or farmers varieties) and its use. For example, the white large-grained forms of barley are preferred for making porridges; the white, black, or purple large-grained types are preferred for bread and other baked food. Partially naked grains are usually roasted or fried. Small-grained types (mainly black and purple) are used for beverages.

In general, the anthropocentric value of biodiversity and ecosystems derives from the value of the goods and services they provide, which include direct-use values, indirect-use values, and non-use or passive values. Biodiversity supports ecosystem functioning and processes, which, in turn, support the production of marketed goods and services. In economic terms, biodiversity is equivalent to a portfolio of assets.

In order to protect and conserve the declining population of wildlife in the country, the government has established protected areas at different levels and dedicated 193,600 km^2 of its land to wildlife protected areas. The protected areas of Ethiopia are divided into two, namely, Principal Wildlife Conservation Areas, which include all national parks and wildlife sanctuaries where conservation processes have been relatively active, and Secondary Wildlife Conservation Areas, which include all wildlife reserves and controlled hunting areas. Since the establishment of these conservation areas, considerable success has been gained in the preservation of some species of animals, which were at the verge of extinction.

Conditions force the people to move illegally in to some important wildlife areas in the parks. In Bale Mountains National Park, for instance, there are several mineral water points distributed at various sites; and in Awash National Park people have to cross the main park proper to reach the Awash River. The same is true with Mago, Omo and Nechsar National Parks. At Abijata-Shalla Lakes National Park, livestock holders move to and from the lakes through the Park. Therefore, this movement adversely affects the park's resources, resulting in overgrazing of vegetations and poaching of wild animals.

People are also forced to abuse environmental resources. For example *Boswellia* spp, which are sources of incenses are used for charcoal production. To a large extent, aromatic plants are harvested from the wild with little, or no consideration, for their sustainable utilization. The major threat to genetic diversity of coffee in the southern part of Ethiopia is forest clearance, while in the east is its replacement by Chat (*Catha edulis*) to fetch more money.

The displacement of indigenous landraces by new, genetically uniform crop cultivars, changes and development in agriculture or land use, destruction of habitats and ecosystems, and drought are a widespread problem. The drought that prevailed in Ethiopia in the last decade has directly or indirectly caused considerable genetic erosion, and at times has even resulted in massive destruction of both plants and animals. The famine that persisted in some parts of Ethiopia, for example, has forced farmers to eat their own seed in order to survive or to sell the seed as a food commodity, and this often resulted in massive displacement of native seed stock by exotic seeds provided by relief agencies in the form of food grains.

Shortage of food as a result of degradation of rangelands/grassing areas and overstocking are the major threats to domestic animal genetic resources. Additional threats emanate from artifi-

cial insemination and interbreeding and inbreeding; diseases such as Trypanosomiasis infection on sheep breeds, and Nosema and Amoeba on honeybees.

Moreover, from the results of the preliminary survey made in Ethiopia and few other eastern Africa countries, 38 different invasive alien species have been reported. These species consist of 21 plants, 5 vertebrates, 9 insects, 1 invertebrate, and 2 micro-organisms. Ethiopia has experienced the impacts of invasive species. There is too little knowledge about the impact of the IAS, and the measures for monitoring and control are severely limited. These invasive alien species are deadly threats to the country's biodiversity.

Therefore, effective conservation and sustainable utilization of biodiversity depends, among other things on the:

- Meaningful and effective integration of activities in all the relevant sectors;
- Effective implementation of the National Biodiversity Strategy and Action Plan (NBSAP)
- Fulfillment of legal gaps and up-dating of obsolete laws;
- Compilation of information on Ethiopia's biodiversity and establishment of biodiversity information system;
- Initiation of biodiversity valuation in the context of environmental accounting;
- Strengthening of the role and capacity of local communities to sustainably utilise and manage the biological resources; and
- Efforts to enhance regional, national and international cooperation in this regard.

FRESH WATER

The country is divided into four major hydro geological formations. These are: Western and Eastern highlands, Western lowlands, Rift Valley and South East and Southern lowlands. Spatial and temporal variation of rainfall is closely related to this divide. The South-Western Highlands, for example, receive annual rainfall of 2700 mm, while the North Eastern Lowlands receive only 100 mm annually. The spatial and temporal variation affects the proper utilization of the water resources and so is the life of the people of Ethiopia.

At current per capita fresh water resources of 1924 cubic meters, Ethiopia is endowed with one of the largest fresh surface water resources in Sub-Saharan Africa. However, only 2 percent of this potential is annually utilised, 86% of it for irrigated agriculture.

Though the country is blessed with these abundant potential resources, it remained untapped to serve the basic needs of its population. The service level is very low even compared to countries of similar socio-economic development. According to recent reports, only 34% of the Ethiopian population has accesses to safe and clean water. Disaggregating this figure into urban and rural areas, the coverage for the rural is about 25% and that of the urban is about 85%. About 45 Million people i.e. more than 65% of the population have no access to safe water resources.

Moreover, the country is facing recurrent drought due to the erratic nature of rainfall. As a result, food shortage is affecting the living situation of millions practically every year. The government's food security strategy and poverty reduction program underlines to work more on increasing the supply or availability of food and improving access/entitlement to food. Addressing these key strategic elements, calls for proper planning and management of the natural resources particularly, the water resources of the country.

Recently, there is a change of direction by the government, with respect to medium and large-scale irrigation development. For instance, the government has allocated funds for the development of large-scale irrigation in the Awash valley, namely, Tendaho and Kessem Irrigation Projects with a total areas of about 90, 000 ha.

Various threats are posed on the fresh water resources of the country. Some of these are, the spatial and temporal variability of climate and rainfall; continuing land degradation leading to flooding, excessive sedimentation and shrinkage of some of the water bodies; absence of institutional and legal arrangements for planning and managing trans-boundary water resources; population growth, pollution and environmental degradation; Lack of sustainable planning in adherence to the needs of the communities; Lack of willingness to pay for the services, particularly by local communities, are among the main ones.

Another, perhaps more important dimension of the quality problem lies in the emerging pollution problems due to the growing industrialisation and their indiscriminate waste discharges; intensified agricultural activities and practices that emphasize on the use of fertilizers and pesticides; increasing population from urbanisation and mining.

In Ethiopia, the implementation of some principles/issues such as cost recovery in rural water supply schemes and willingness to pay are constrained by the social and cultural understanding of communities. Generally, people attach religious and social values to water. The values of drinking water, domestic use, irrigation and industrial use emanate from the social and cultural perceptions of people and therefore, people claim free access to water. The social and cultural behaviour of people differs from place to place and so is the value of water. In the water resources management policy document, water is recognised as both a social and economic good.

In general, the water resource of the country is quite abundant; however, the level of utilization is very low due to various reasons. The service level of the water sector in the areas of irrigation, water supply and sanitation and hydropower needs special attention. These include:

- Improvement of the allocation of resources and the situation of governance;
- Strengthening international cooperation in sustainable water resources development;
- Promoting an integrated pollution management strategy especially, those of industrial and municipal waste pollution;
- Recognising the ecological values of water bodies and wetlands and strengthen institutional mechanism ;
- Coordinating environment and sector policy implementation and strengthen policy enforcement capacity;
- Building institutional capacity for sustainable utilization of the fresh water resource;
- Strengthening Monitoring and Evaluation of water resource projects and programs from wider perspective of sustainable development;
- Strengthening water quality and quantity monitoring capacity; and
- Adopting watershed management to minimise the impact of sedimentation and to enhance groundwater recharge as well as to minimise the flooding thereof.

CROSS CUTTING AND EMERGING ISSUES

- **Gender and Environment**

Gender refers to the socially constructed roles, behaviours, attitudes and responsibilities that society assigned to women and men in a given culture. These social relations also determine the access to natural resources by women and men

deferentially. Women in rural areas are constrained with socio-culturally imposed limitation, which in many cases deny their right to have access to and control over productive resources, such as land and other fixed capital. In this regard, women constitute the majority who are affected by absence of equity, environmental degradation and pollution.

Women play significant role in environmental protection and management, but their contribution to the conservation of the environment is not visible. They also lack decision-making power. Lack of decision-making power and their invisibility have excluded them from social, economic and political processes that affect their lives.

In Ethiopia, there is lack of gender-disaggregated data. As a result this obscures the visibility to consider women in development endeavours as well as to enhance their participation in development processes.

Regarding pollution, the majority of rural women in Ethiopia are exposed to in door pollution. However, indoor concretions of and exposures to so many important pollutants are found in both rural and urban households of the country. Wood and cow dung are used as a source of fuel and it has high impact on the human health. Exposure to biomass smoke is a significant cause of health problems such as acute respiratory infection.

Because of forest depletion, particularly rural women, suffer from absence of forest nearby and this obliges them to travel long distance to fetch firewood. The unavailability of water sources within the proximity will also compound the burden on women and girls.

This situation increases burden on rural women and reduce their contribution to the country's development. On the other hand, a significant number of women depend directly on natural resource for their livelihood. In urban areas for instance, many poor women and girls are engaged in collecting fuel wood for selling. In Addis Ababa, more than 15,000 women and girls are engaged in fuel wood collecting activities as a means of living. Studies carried out by ILO Women Fuelwood Carriers (WFC's) Project (1996) indicated that 90% of households in Addis Ababa use biomass fuel and 35% of which is supplied by the women fuel wood carriers found in and round Addis Ababa.

Women in Ethiopia, have a particular role in environmental management. They are the owner of indigenous knowledge in conservation and utilization of biodiversity resources. Their role can force them to overexploit environmental resources as lack of alternatives dictates them to do so. They are also particularly vulnerable to the effects of environmental degradation.

Therefore, the gender analysis is of particular interest to the realization of environmental policy objectives in Ethiopia. The following suggestions are made to enhance the participation of men and women equally in environmental management:

- A clear strategy and guidelines is required to mainstream gender into the country's sustainable development programs;
- There is a need to enhance the visibility of women's role in development, to avail gender disaggregated data;
- There is a need for wide scale awareness and education to promote women and men equality and equity between women and men in general and to recognise the role of women in environmental management;
- Recognize the differential vulnerability of women and child girl to the impact of environmental degradation in environmental policy making and program and project design;

- **Health and Environment**

Access to water supply and sanitation are the lowest even in Sub-Saharan African countries

context. Coverage of potable water supply and improved sanitation services are generally calculated as proportion of population with access to safe water and basic sanitation. In Ethiopia, this is below 35%. Hence, meeting the millennium development goals demand a huge investment to develop new facilities and to operationally existing malfunctioning water supply schemes and basic sanitation facilities.

The general access to improved sanitation is estimated between 6% - 18%. In Ethiopia, lack of access to improved sanitation and hygiene is responsible for about 60% of the prevailing disease burden in the country. The child mortality attributed to poor sanitation and improper hygiene is estimated at 25 000 per annum. In spite of such pressing issue in the sector, the budgetary share of the sub -sector is less than 1% of the total health sector budget. On the other hand Ethiopia, has to provide sanitation facility to one million households each year to reach the millennium development goal in sanitation sub-sector.

Major constraints in the sub-sector are:

- Low profile of sanitation at all levels;
- Sanitation is preserved as having lower priority without understanding its role in preventive health intervention in contrast to other pressing perceived need at household, community and different administrative levels;
- Access to clean water supply is low and even then, water is not supplied as part of an integrated environmental health package; it is supplied in isolation as an end in itself;
- Unclear institutional framework, roles and responsibilities;
- Shortage of skilled human resource;
- Improper promotion methods i.e. overemphasize health benefit; and
- Traditional pit latrines have a bad reputation.

The government of Ethiopia is promoting health extension by training and deploying health extension agents all over the country. Hygiene and sanitation are important components of the health extension.

Municipal solid waste management (SWM) is also poorly managed in Ethiopia. The main problem of SWM is poor waste collection, inadequate standard collection points, shortage of equipment and personnel, lack of budget, poor disposal facility and operational procedure, and poor cost recovery. At present private, sector participation in SWM is also limited mainly to informal pre-collection companies in some urban centres.

There is a wide variation in performance in relation to waste collection in urban centres of Ethiopia. In many cities there are not enough skips to cover the population and vehicles are typically poorly maintained and out of service for long period of time. The operational performance at the dump site is poor in relation to environmental impacts and health risks.

Waste water sources are mainly residences, public toilets, commercial centres (hotels, restaurants, etc), hospitals and institutions and industries. The average waste water production per ton of individual products (by industry type) ranges from 0.09 cubic metres for soap and detergents to 87.09 cubic meters for pharmaceuticals. Accordingly, quantity of industrial waste water produced in Ethiopia between 1990 to 1997 amounts to 35.65 million cubic metres (on average 0.275Mm^3/yr). Its average growth rate is 2.36%.

In general, environmental quality is compounding the health problems and poor quality of life in Ethiopia. Poor water supply and sanitation service together with poor personal hygiene practice contributes to 60 percent of diseases burden in the country. Moreover, pollution from municipal and industrial waste and chemicals is worsening environmental health concerns in the country. Lack of coordinated and concerted effort and widespread lack of awareness at all levels mutu-

ally reinforces each other to weaken the achievement of desired change.

Therefore, the following suggestions are made:

- There is a need for more aggressive implementation of the relevant environmental and sector policies and strategies;
- All municipalities should embark on developing participatory municipal waste management strategic plan and implementation;
- Strengthen the ongoing health extension in rural areas;
- Promote awareness and education at all levels;
- Monitor environmental health impact of pollution; and
- Coordinate the efforts of major actors [NGO, GO, bilateral and multilateral institutions].

- **HIV/AIDS**

The first AIDS cases were reported to the Federal Ministry of Health (MoH) in 1986. HIV/AIDS surveillance activities began in 1989 and since then the HIV epidemic appears to be steadily increasing in Ethiopia. There are many cultural factors that promote the spread of the disease. Known risk factors include the presence of sexually transmitted infections (STls), multiple sexual partners, and harmful traditional practices such as female genital mutilation, uvulectomy, blood letting, skin cutting, and piercing practices.

The estimated national audit HIV prevalence in 2003 is 4.4%, of which 12.6% are urban and 2.6% rural. High HIV prevalence in urban area could partially be attributed to the growing urbanisation and associated increase in urban slums. Moreover, environmental quality could have compounded the health problem of the HIV infected population.

HIV/AIDS can be considered as a total societal crisis. Environmental degradation and HIV/AIDS can have a long reaching interaction. HIV/AIDS has a threat of losses of indigenous knowledge, by creating discontinuity of generation, which has paramount importance in environmental conservation in general, and biodiversity resource conservation in particular. More importantly, poor environmental quality may aggravate the situation of the AIDS patients. Therefore, it is necessary that one be addressed in the context of the other. The suggestions are therefore:

- Mainstream HIV/AIDS in environmental and relevant sector policies, strategies and programs; and
- Conversely HIV/AIDS strategies and initiatives should take into account environmental factors.

- **Malaria**

The non-malaria zone with an altitude above 2250m is the area where no indigenous transmission occurs. This area comprises 15-20% of the total landmass and is inhabited by about 25% of the total population. The malaria zone, which refers to the land below 2200m makes up 80-85% of the total landmass; about 75 % of the population live in this region and about 35 - 40 % are at different level of risk of malaria infection.

People living in the malaria area have been suffering from the disease and brought an economic burden because of decreased participation of the population in production activities. The recent expansion of the malaria infection area is attributed to climatic change. This expansion is expected to increase as global warming progress.

The emergence/occurrence of malaria in new areas is increasing. The outpatient visits, hospital admissions and death rates are increasing from time to time in the country. Hence, malaria is putting high burden on the socio-economic situa-

tion of communities and on the health services. On the other hand, malaria is the prime mover of the use of DDT in Ethiopia. DDT is known to be a persistent organic pollutant with a serious pubic health and ecological consequence. Environmental management is also an important component of integrated malarial control strategy.

Therefore, with regard to malaria, the following suggestions are made:

- Gradually phase-out the use of DDT;
- Adopt integrated vector management strategy to minimize the use of DDT;
- Develop monitoring mechanism for malarial expansion that could result of from climatic change or otherwise, and
- Strengthen the implementation of the existing Federal Ministry of Health's different intervention mechanisms for the prevention and control of malaria which includes: establishing surveillance system and integrated vector control approach; conducting awareness raising program on malaria prophylaxes, environmental control, and treatment; and encouraging the use of malaria bed net and developing guideline on environmental health management for settlements and during disasters, which includes the control of malaria.

- S C E N A R I O S

Scenario portrays the likely outcome of different courses chosen by a society and important actors [including the major decision makers] on the different aspects of environmental priority thematic areas and human situations in Ethiopia. The scenarios try to articulate the human behaviours and societal choice and the human circumstance if certain policy direction prevails within the country and if it is the dominant global order. This is not without acknowledging the role of uncontrolled forces both human and natural in contributing to the course of events. However, this is to emphasize that informed decision making also has a real and vital role to play in the process of shaping the future. Therefore, by explaining an array of possible future, scenarios help today's decision makers to get a clear picture of what tomorrow might bring and what the impact of their decision will be.

In scenario building, efforts are made to explain the interaction of various political, economic, social and ecological forces that shape the future. The challenge, however, is that many of these forces cannot be predicted with certainty. On the other hand, much of what will happen has been set in motion by the policy decisions that have already been taken. The future also depends on the natural and global forces that dictate the society to take particular course of action. The recent phenomenon such as the ending of cold war, the globalisation processes, terrorism, regional integration, such as the EU and AU or fragmentation such as the soviet block, ever-escalating oil price, the emergency of new economic power etc, can compound the factors shaping the future.

A set of driving force that shape the future has been considered to articulate what the likely future will be because of the behavior of the driving forces under a given scenario. The premise is that the 'current state' of the system is the outcome of an historical process, which is driven forward by a set of 'driving forces'.

Four scenarios have been considered in this report. These scenarios are: the Market Forces Scenario, the Policy Reform Scenario, Fortress World Scenario and the Great Transitions Scenario. The four scenarios were adapted from the UNEP's African Environment Outlook. The scenarios are selected, primarily, because they can benefit Ethiopia in visualizing the future provided that Ethiopia takes on one of the four courses.

Environment related policy

Ethiopia has taken important and encouraging measures towards implementing environmental policies and strategies. The policy documents

have fairly enshrined the principles of sustainable development. There are no significant policy gaps for sustainable development practices and environmental protection. However, in practice there are wide gaps between the policy intentions and actual decision on the ground. Consequently, the desired goal is far from being realized. A number of interacting factors contributed to the poor implementation of the policies and strategies in Ethiopia. Some of these include:

- Skewedness towards quick economic achievement;
- Weak and unstable institutions at the regional levels;
- Absence of Sectoral Environmental Units in the Federal Sectoral Institutions;
- Lack of adequate infrastructure and skilled human resource;
- Weak environmental legislations enforcement capacity;
- Financial limitations;
- Absence of functional linkages among and between various state and non-state actors;
- Lack of environmental awareness and limited integration of environmental issues in formal education;
- Inadequate environmental information and lack of environmental information system and networking;
- Absence of environmental accounting systems in the National Income Accounting of the country or regions; and therefore inability to express degradation of environmental capitals in monetary terms;
- Lack of awareness on environmental investment opportunities among the private sectors;
- Poor capacity in identification and acquisition of appropriate technologies. Absence of research and development programs to solve local environmental problems and environment - livelihood challenges;
- Absence of dissemination of appropriate environmental technologies and best practices; and
- Poor implementation of incentive measure enshrined in different environmental instruments.

Taking into consideration the key problems outlined under the conclusion, the following recommendations are made.

- Promote environmental awareness in general and specifically on environmental and related policies, existing action plans and sustainable development issues at all levels;
- Establish and/or strengthen the regional environmental agencies and sectoral environmental units;
- Strengthen the federal and establish and/or strengthen regional Environmental Laboratories;
- Establish Ethiopian Environmental Information System and Networking and establish environmental monitoring mechanism;
- Develop and implement human resources development program;
- Strengthen national environmental policy and strategy coordination mechanism;
- Strengthen measures to integrate environmental concerns into formal, informal and non formal education systems;
- Initiate environmental accounting and subsequently, integrate it into the national income accounting system;
- Promote eco investment and market based strategy to environmental protection;
- Promote environmental research and development and build capacity for identification , acquisition and dissemination of appropriate environmental technologies and practices;
- Implement and /or develop appropriate incentive measures to enhance enforcement of environmental polices and legislation;
- Develop the enforcement capacity of federal and regional environmental agencies; and
- Promote community empowerment to enhance their participation in setting local environmental agendas and to implement priority actions.

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ABRIVATIONS

OESPA	Oromia Economic Study Project Office
AIDS	Acquired immune deficiency syndrome
ANRS	Amhara National Regional State
ARDPs	Agricultural & Road Development Policy & Strategy
ARV	ANTIRETROVIRAL
$C0_2$	Carbone dioxyde
CDM	Cleaner Development Mechanism
COMESA	Common Market for Eastern and Southern Africa
CoP	Conference of the Parties
CSA	Central Statistical Authority
CSE	Conservation Strategy of Ethiopia
DAP	Diammonia Phosphate
DHS	Demographic and Health Survey
EDHS	Ethiopian Demographic & Health Survey
EEA	Ethiopian Economic Association
EFAP	Ethiopian Forestry Action Program
EHRS	Ethiopian Highland Reclamation Study
EIA	Environmental Impact Assessment
ENSO	El Nina Southern Oscillation
ENTRO	Eastern Nile Technical Regional Office
EPE	Environmental Policy of Ethiopia
FAO	Food and Agricultural Organisation
FDRE	Federal Democratic Republic of Ethiopia
FEPA	Federal Environmental Protection Authority
FRA	Forest Resources Assessment
FSS	Food Security Strategy
GDP	Gross Demotic Products
GEO	Global Environment Outlook
GHG	Green House Gases
GMOS	Genetically Modified Organisms
GOs	Government Organizations
GTZ	German Technical Cooperation
HAPCO	HIV/AIDS Control Office
HIV	Human Immunodeficiency Virus
IBC	Institute of Biodiversity Conservation
IBCR	Institute of Biodiversity
ILCA	International Livestock Center for Africa
ILRI	International Livestock Research Institute

ABRIVATIONS Cont'd...

ITCZ	Inter Tropical Convergence Zone
LDCs	Least Developed Countries
LUCF	Land Use Change & Forestry
LUPRD	Land Use Planning & Regulatory Department
MADS-SEA	Management of Degraded Soils in Southern & Eastern Africa
MDGS	Millennium Development Goals
MEA	Multilateral Environmental Agreements
MEDAC	Ministry of Economic Development and Cooperation
MoA	Ministry of Agriculture
MoFED	Ministry of Finance and Economic Development
MoH	Ministry of Health
MoRAD	Ministry of Agriculture & Rural Development
MoWR	Ministry of Water Resources
MRMRD	National Resource Management & Regulatory Department
NAC	National AIDS Council
NACP	National AIDS Control Program
NBSAP	National Biodiversity Strategy & Action Plan
NEPAD	New Partnership for Africa's Development
NGO	Non-Government Organisation
NMSA	National Meteorological Services Agency
NRMRD	Natural Resources Management and Regulatory Department
NWFPs	Non-Wood Forest Products
ONRS	Oromia National Regional State
OVC	Orphan and Vulnerable Children
PADETS	Participatory Demonstration & Extension Training System
PASPED	Plan for Accelerated & Sustainable Development to End Poverty
PMTCT	Prevention of Mother to Child Transmission
POPs	Persistent Organic Pollution
RFPAs	Regional Forest Priority Areas
SCRP	Soil and Water Conservation Research Project
SDPRP	Sustainable Development Strategy & Poverty Reduction Program
SINET	Ethiopian Journal of Science
SNNP	Southern Nations & Nationalities Peoples
SNNPRS	Southern Nations, Nationalities, & Peoples Regional State
SWM	Solid Waste Management
TFR	Total Fertility Rate
TNRS	Tigray National Regional State
UNCBD	United Nations Conventions on Biological Diversity

ABRIVATIONS Cont'd...

UNCCD	United Nations Conventions to Combat Desertification
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Conventions on Climate Change
UNICEF	United Nations Children's Fund
USA	United States of America
USD	United States Dollar
WBESPP	Woody Biomass Inventory & Strategic Planning Project
WHO	World Health Organization
WSDP	Water Sector Development Program