Forum for Environment

Forum for Environment (FIE) is an indigenous, non-profit, non-political association of individuals concerned about the environmental challenges faced by Ethiopia. It serves as a platform for communication, advocacy and networking among people and institutions focusing on the Ethiopian environment, its problems and solutions. In order to carry out its mandate, FIE organises public meetings and debates on issues of environmental concern, produces Akirma (a magazine) and other publications resulting from its debates and research; prepares speaking engagements for prominent visitors and facilitates access to advisory services. It has established and supports local environment groups as well as networks both within and outside the country. FIE undertakes lobbying and advocacy campaigns with a wide range of stakeholders, including parliamentarians and other civil society groups, to draw the attention of citizens to the severity of environmental challenges and what can be done to tackle these.

Ethiopian Environment Review

The Ethiopian Environment Review is a periodic assessment of different thematic sectors of the Ethiopian environment, which helps to meet the need for reliable and up-to-date information on the status of the natural resources, people and legal situation in the country. The aim is to influence public thinking and aid decision-making.

The objective of this Review is to address the challenge of having reliable and relevant information on the environmental resources of Ethiopia available to both the public within the country as well as the many friends of Ethiopia abroad who are interested in these issues.

For further information please visit www.ffe-ethiopia.org

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IF WE TAKE CARE OF THE EARTH,
THE EARTH WILL TAKE CARE OF US

FORUM FOR ENVIRONMENT
ADDIS ABABA, ETHIOPIA
ETHIOPIAN ENVIRONMENT REVIEW NO 1

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The woreda town of Adi Shu in the Alagie Mountains, Southern Tigray (Photo, Sue Edwards September 2006)
ACRONYMS

AAAS – American Association for the Advancement of Science
AACG – Addis Ababa City Government
AAEPA – Addis Ababa Environmental Protection Authority
AASBPDA – Addis Ababa Sanitation, Beautification and Park’s Development Agency
AAU – Addis Ababa University
AAUAD – Addis Ababa City Administration Urban Agriculture Department
ADB – African Development Bank
ADR – age dependency ratio
ALRI – Acute Lower Respiratory Infection
ANRS – Amhara National Regional State
AR – Afforestation/Reforestation
BBC – British Broadcasting Corporation
BoARD – Bureau of Agriculture and Rural Development
BOD – Burden of Disease
BPR – Business Process Re-Engineering
BWUD – Bureau of Works and Urban Development
CBD – Convention on Biological Diversity
CBO – community-based organisation
CDG – Climate and Disaster Governance
CDM – Clean Development Mechanisms (CDM)
CEINFMP – Cooking Efficiency Improvement and New Fuels Marketing Project
CEPPE – Cooking Efficiency Planning Program in Ethiopia
CFSCDD – Community Forestry and Soil Conservation and Development Department
CGAA – Clean and Green Addis Ababa
CGAAS – Clean and Green Addis Ababa Society
CO2 – carbon dioxide
CO2e – carbon dioxide carbon emission reductions
COPD – Chronic Obstructive Pulmonary Disease
CORH – Consortium for Reproductive Health
CRDA – Christian Relief and Development Association
CSA – Central Statistics Agency/Authority
CSD – Commission on Sustainable Development
CSE – Conservation Strategy of Ethiopia
CSO – civil society organisation
DALY – Disability Adjusted Life Year
DCG – Drylands Coordination Group
DDCA – Dire Dawa City Administration
DFID – Department for International Development
DSM – Demand Side Management
DSM – demand-side management
EAEDPC – Ethiopian Alternative Energy Development and Promotion Center,
formerly EREDPC
EARO – Ethiopian Agricultural Research Organization
EC – Ethiopian Calendar
EDR – economic dependency ratio
EDRI – Ethiopian Development Research Institute
EEA – Ethiopian Economics Association
EEA – Ethiopian Energy Authority, formerly Ethiopian Electricity Agency
EEC – European Economic Commission
EELPA – Ethiopian Electric Light and Power Authority (now EEPCO)
EEPCO – Ethiopian Electric Power Corporation
EFAP – Ethiopian Forestry Action Program
EFY – Ethiopian Fiscal Year
EIA – Environmental Impact Assessment
EIAR – Ethiopian Institute of Agricultural Research (formerly EARO)
ENDA – Environment and Development Action
EPA – Environmental Protection Authority
ER – emissions reduction
ERA – Ethiopian Roads Authority
ERCS – Ethiopian Red Cross Society
EREDPC – Ethiopian Rural Energy Development and Promotion Center (now EAEPC)
ERTTP – Ethiopian Rural Travel and Transport Program
ESCRP – Environmental Change and Security Project
ESIF – Ethiopian Strategic Investment Framework
ESIF – Ethiopian Sustainable Land Management Investment Framework
ETB – Ethiopian Birr
EVDA – Ethiopian Valleys Development Authority
EWCO – Ethiopian Wildlife Conservation Organisation
EWDCA – Ethiopian Wildlife Development and Conservation Authority
EWNHS – Ethiopian Wildlife and Natural History Society
EWNRA – Ethiopian Wetlands and Natural Resources Association
FAO – Food and Agriculture Organisation (of the United Nations)
FARM-Africa – Food and Agriculture Research Management-Africa
FaWCDA – Forestry and Wildlife Conservation and Development Authority
FDRE – Federal Democratic Republic of Ethiopia
FfE – Forum for Environment
FFW – Food for Work
FGAE – Family Guidance Association of Ethiopia
FINNIDA – Finish International Development Authority
FIT – Feed-in Tariff
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>FP</td>
<td>family planning</td>
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<tr>
<td>FSS</td>
<td>Forum for Social Studies</td>
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<td>GC</td>
<td>Gregorian Calendar</td>
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<tr>
<td>GDP</td>
<td>gross domestic product</td>
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<td>GEF</td>
<td>Global Environmental Facility</td>
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<tr>
<td>GF</td>
<td>Global (Fund) Mechanisms</td>
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<td>GHG</td>
<td>Green House Gas</td>
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<td>GJ</td>
<td>Giga Joule</td>
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<td>GSE</td>
<td>Geological Survey of Ethiopia</td>
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<td>GTZ</td>
<td>Gesellschaft für Technische Zusammenarbeit</td>
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<td>GWh</td>
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<td>Giga Watt hour electricity</td>
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<td>ha</td>
<td>hectare</td>
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<td>HAPCO</td>
<td>HIV/AIDS Prevention and Control Office</td>
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<td>HSDP</td>
<td>Health Sector Development Program</td>
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<td>IAEA</td>
<td>International Atomic Energy Agency</td>
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<td>IAP</td>
<td>Indoor Air Pollution</td>
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<td>IBC</td>
<td>Institute of Biodiversity Conservation</td>
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<tr>
<td>ICRAF</td>
<td>World Agroforestry Centre (formerly International Centre for Research in Agroforestry)</td>
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<td>ICS</td>
<td>Interconnected System</td>
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<tr>
<td>IDR</td>
<td>International Development Research (Institute)</td>
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<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
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<td>IFPRI</td>
<td>International Food Policy Research Institute</td>
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<td>IHDP</td>
<td>International Human Dimensions Program</td>
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<td>IIEP</td>
<td>International Institute for Environment and Development</td>
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<td>International Labour Organisation</td>
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<td>International Livestock Research Institute</td>
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<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
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<td>IPP</td>
<td>Independent Power Producer</td>
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<td>ISD</td>
<td>Institute for Sustainable Development</td>
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<td>IUCC</td>
<td>Information Unit for Climate Change</td>
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<td>IUCN</td>
<td>International Union for the Conservation of Nature and Natural Resources</td>
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<td>JITCA</td>
<td>Japanese International Cooperation Association</td>
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<tr>
<td>kWh</td>
<td>kilo Watt hour</td>
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<tr>
<td>LPG</td>
<td>Liquefied Petroleum Gas</td>
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<tr>
<td>LRM</td>
<td>Land Resources Management</td>
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<tr>
<td>m asl</td>
<td>metres above sea level</td>
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<tr>
<td>M&amp;E</td>
<td>Monitoring and Evaluation</td>
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<tr>
<td>MAI</td>
<td>mean annual wood increment</td>
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<td>MDGs</td>
<td>Millennium Development Goals</td>
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<tr>
<td>MEAs</td>
<td>Multilateral Environmental Agreements</td>
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MELCA – Movement for Ecological Learning and Community Action
MER – Main Ethiopian Rift
MME – Ministry of Mines and Energy
MoARD – Ministry of Agriculture and Rural Development
MoCT – Ministry of Culture and Tourism
MoE – Ministry of Education
MoFED – Ministry of Finance & Economic Development
MoH – Ministry of Health
MoME – Ministry of Mines and Energy
MoPED – Ministry of Planning and Economic Development (now MoFED)
MoWR – Ministry of Water Resources
MW – Mega Watt
MWR – Ministry of Water Resources
NAP – National Action Programme
NAP – National Adaptation Programme
NAPA – National Adaptation Programme of Action
NFPA – National Forest Priority Area
NGO – Non-Governmental Organization
NHP – National Health Policy
NMA – National Meteorological Agency
NMSA – National Meteorological Services Agency
NOC – National Oil Company
NOP – National Office of Population
NORAD – Norwegian Agency for Development and Cooperation
NPoW – National Policy on Women
NPRDA – National Petroleum Reserve Depots Administration
NRM – Natural Resource Management
NTFPs – non-tree forest products
NWFPs – non-wood forest products
OEPO – Oromia/Oromiya Environmental Protection Office
OFWE – Oromia/Oromiya Forestry and Wildlife Enterprises
ONRNS – Oromia/Oromiya National Regional State
ORDA – Organization for Rehabilitation and Development in Amhara
ORSFE – Oromia/Oromiya Regional State Forest Enterprises
ORSFESA – Oromia/Oromiya Regional State Forest Enterprises Supervising Agency
OSSREA – Organization for Social Studies Research in Eastern Africa
PASDEP – Plan for Accelerated and Sustained Development to End Poverty
PCC – Population Census Commission
PDRG – Population Dynamics Research Group
PES – payment for environmental services
PFM – Participatory Forest Management
PHCC – Population and Housing Census Commission
PPA – Power Purchase Agreement
PROLINNOVA – Promoting Local Innovation (in ecologically-oriented agriculture and natural resource management)
PV – photovoltaic
REDD – Reducing emissions from deforestation and forest degradation
REF – Rural Electrification Fund
RELMA – Regional Land Management Unit
REST – Relief Society of Tigray
RET – Renewable Energy Technology
RH – reproductive health
SCS – Self Contained System
SFCDD – State Forestry Conservation and Development Department
Sida – Swedish International Development Agency
SLM – Sustainable Land Management
SLMP – Sustainable Land Management Program
SLU – Swedish University of Agricultural Sciences
SLUF – Sustainable Land Use Forum
SNNP – Southern Nations, Nationalities and Peoples (Region)
SNNPRS – Southern Nations, Nationalities and Peoples Regional State
SOS Sahel – “Save Our Souls” Sahel Ethiopia
SSRC – Social Science Research Council
SWC – soil and water conservation
SWCD – Soil and Water Conservation Department
SWM – solid waste management
TCBFM – traditional community-based forest management
TCF – Trillion Cubic Feet (1,012 Cubic feet)
TFR – total fertility rate
TGE – Transitional Government of Ethiopia
TWh – Terra Watt hour
UEAP – Universal Electricity Access Program
UN – United Nations
UNCCD – United Nations Convention to Combat Desertification
UNCED – United Nations Conference on Environment and Development
UNDP – United Nations Development Programme
UNECA – United Nations Economic Commission for Africa
UNEP – United Nations Environment Programme
UNESA – United Nations (Department of) Economic and Social Affairs
UNFCCC – United Nations Framework Convention on Climate Change
UN-HABITAT – United Nations Human Settlement Program

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UNICEF – United Nations (International) Children's (Emergency) Fund
UNIDO – United Nations Industrial Development Organisation
UNPA – United Nations (Office for) Population Affairs
UNSCEAR – United Nations Scientific Committee on the Effects of Atomic Radiation
UNSO – United Nations Sahelian Office
USAID – United States Agency for International Development
USD – United States Dollar
WASH – Water Supply, Sanitation and Hygiene
WB – World Bank
WBISPP – Woody Biomass Inventory and Strategic Planning Project
WFP – World Food Programme
WGCF – Wondo Genet College of Forestry and Natural Resources
WHO – World Health Organisation
WMERDB – Water, Mines and Energy Resources Development Bureau
WSDP – Water Sector Development Program
WSSD – World Summit on Sustainable Development
WWSDE – Water Works Design and Supervision Enterprise
PREFACE

Dear Readers,

The Ethiopian Environment Review is an effort by the Forum for Environment to close the information gap on the state of the environment in Ethiopia. We intend to monitor and analyze trends in environmental resources through such consistent documentation and make the information available to all users.

This publication is intended as a periodically-produced compilation of informative articles on the Ethiopian environment, the contents of which are authored by prominent experts in the respective fields. Each paper is then assessed and commented on by a selected reviewer and edited by the Editorial Board.

Utmost care is taken to make sure that the contents of the papers are of a good standard, accurate and up-to-date, while the expert opinions reflected in the papers remain the views of the authors.

We sincerely hope that this material will provide a good wealth and quality of information for students, academicians, researchers, policy and decision-makers as well as other interested persons in the general public particularly within Ethiopia, but also outside the country. We welcome comments and feedback from readers to help us develop this exercise into an important contribution to a better understanding of the Ethiopian environment and its many challenges.

The project is kindly supported financially by BothENDS, a partner organization based in Amsterdam, the Netherlands. We would like to thank BothENDS for this excellent and appropriate support.

We also feel highly indebted to the contributors, reviewers, and editors who spent a great deal of their time on this initiative.

We look forward to having the next issue of the Review with a similar, but not necessarily equivalent, set of articles available after a few months.

Happy reading

Negusu Aklilu

Director, Forum for Environment and Co-chair, Ethiopian Civil Society Network on Climate Change
Lichen festooned old Juniper trees in Dess’a Forest near Diwo Mariam Monastery, eastern Tigray overlooking the Afar
(Photo Sue Edwards March 2009)
This first issue of the Ethiopian Environment Review is being published in order to provide the general reader in Ethiopia and abroad with an opportunity to get up-to-date and comprehensive overviews of the status, gaps, and challenges facing different sectors of the environment of the country. The papers have been prepared by experts from colleges, universities and civil society organizations who are actively working in the area they have written about. Each paper was reviewed and returned to the authors to accommodate the comments, or not, as they saw appropriate.

There are eight papers in this Review. The focus was to give an account of the status of each included environment sector as of 2008. But, as this is the first issue of the Review, most of the authors also gave some background to the developments in their sectors and they also included topical issues that emerged in 2009 while they were preparing their contributions.

The first paper focuses on **Legal and Institutional Issues for Environment in Ethiopia**. As there is no regularly produced directory of newly enacted laws in Ethiopia, this assessment is useful for both lawyers and non-lawyers. The author introduces laws related to environmental protection passed into law at federal level since 2007 concerning radiation protection, wildlife, urban planning, forests, and industrial pollution. The laws enacted since 2006 for Amhara, Oromiya and Southern Nations, Nationalities and Peoples (SNNP) Regional States cover the powers and duties of their executive organs (Amhara and SNNP), rural land administration and use (Amhara, Oromiya and SNNP), administration of investments (Oromiya), and forest enterprises (Oromiya). The paper also includes the findings from a brief indicative survey to assess the relative powers of the different government organs over issues related to the environment.

The author concludes that encouraging steps are being taken regarding the issuing of environmental laws, but he also notes a number of concerns, particularly the absence of a comprehensive land use plan for the country. Another concern is the emphasis on the potential economic values of the environment, particularly with regard to investment, that can override the interests of local communities and the impression that land is an ‘infinite resource’ without support for eco-friendly works.

The second paper gives a comprehensive overview of **Population Dynamics and Environment in Ethiopia**. The authors start by reviewing the
population dynamics—its size, growth, structure and distribution dating back to 1900. Altitude, climate, absence of infectious diseases, particularly malaria, and access to good soil strongly influence the distribution of the population with nearly 80 percent living on only 37 percent of the total area of the country; in the Enset belt densities up to 800 persons per km² are found. By 2010, the urban population is expected to reach 17.6 percent. The components of population change—fertility, age at first marriage, trends in contraceptive use, mortality and migration—are described.

The section on the population-environment nexus summarizes the main schools of thought in the conceptual approaches to population and environment relationships starting from the linear views of Malthus and Boserup. The most complex is the systems approach which combines ecological, socio-economic and demographic systems into a web of inter-relationships. It considers that both the human population and the human-made infrastructure are fully embedded in the natural environment and are subject to the laws of nature. This leads to a discussion of agriculture with all its negative consequences for other natural resources, particularly forests.

The last section covers international conferences and the various policies and legal frameworks developed by the Ethiopian Government. The authors conclude that the recent demographic trends are a mix of encouragement and concern. Population pressure still contributes significantly to environmental degradation. The challenge is to identify the complex interactions in the Population-Environment nexus for a better understanding of how to deal with these issues.

The third paper provides a *Review of the Urban Environment in Ethiopia for up to 2008*. The author focuses mainly on the situation in the capital city of Addis Ababa as symptomatic of the problems facing all the fast expanding urban areas of the country. Biomass and kerosene are the two dominant domestic fuels because access to clean energy, particularly electricity, cannot be afforded by most households. The adverse health impacts of the use of these fuels are severe. Transport is another source of air pollution. The number of vehicles entering Ethiopia is growing at 20 percent a year, but over 50 percent of those on the road are more than 20 years old.

Improving access to safe drinking water, sanitation and hygiene (WASH) is essential for meeting the Millennium Development Goals. But in Addis Ababa, about 31 percent of households have no sanitation facilities while the proportion in other urban areas is nearly half of the inhabitants. Hence diarrhoea from water-borne diseases kills more children under five
years than any other infection, and chronic diarrhoea prevails throughout all urban populations.

Solid waste management is also a major challenge. A Solid Waste Management Proclamation was passed by the government in 2007, but much remains to be done for its implementation. The case of the Dynamic Sanitary Service is given to show how private enterprise can help in coping with the problem. Urban agriculture is gaining in popularity and support from local authorities, but there is a great shortage and degradation of urban green areas. More than 10,000 hectares in Addis Ababa designated for green areas have already been used for other purposes.

The fourth paper gives an *Ethiopian Energy Sector Review*. The authors summarize the status of Ethiopia’s energy resources categorized under bioenergy, electricity and petroleum products. The data show the trends in utilization mostly for the five years, 2004 to 2008. All data show the current exponential growth in demand for energy.

Much emphasis is given to bioenergy because it is the major source of energy in the country. Traditional biomass sources (wood, crop residues and cattle dung) supply 94 percent of the total energy requirement of the country with petroleum and electricity meeting the rest. But the government only controls the development and supply of the last two sources. Use of biomass sources is unplanned and uncontrolled as demand exceeds supply. This contributes significantly to degradation of natural resources with women disproportionately negatively affected. More recently, the government has been encouraging investment for biofuel and biodiesel production, with mixed results.

All electricity development is controlled by the government and dominated by hydropower development. For petroleum, the major activity has been the local development of ethanol production and mixing it with petrol at 5 percent to augment the fuel supply in Addis Ababa. The increase in population and economic growth has put an escalating demand on both traditional and modern energy sources. The problems that resulted in the severe rationing of electricity starting from 2006 are described indicating the need for effective inclusion of the private sector as well as the development of other renewable sources of energy, particularly wind.

The fifth paper on *Wetlands of Ethiopia: Overview of Recent Environmental Changes* gives emphasis to those under great threat associated with the Great Rift Valley. Wetlands are among the most productive ecosystems in the world. In Ethiopia, they include natural or artificial lakes, rivers and swamps. Wetlands are essential sources of ecosystem services to support both traditional and modern lifestyles and
development. But, wetland degradation and loss is inevitable wherever major developments involving land use conversion are present, such as irrigation schemes and drainage for crop cultivation, urbanization and industrialization.

The author refers to several studies into recent environmental changes in Ethiopia’s wetlands. These include dramatic changes in lake levels, particularly for Lake Abiyata, and the complete disappearance of Lake Haromaya. Other studies into changes in water quality are reported, e.g. Lake Ziway, where pumping for irrigated vegetable production has reduced its volume, increased its salinity and resulted in a substantial reduction in fish catches. Increased concentration of nutrients, particularly nitrogen and phosphorus, in water bodies from agricultural and industrial activities result in eutrophication and also find their way into the groundwater. Such a condition has been found in the Wonji sugarcane plantation area. Many lake and river catchments are being cleared for farmland increasing the runoff of water and silt into the water bodies and reducing their effectiveness.

An outstanding diversity of bird species have been recorded from Ethiopia’s wetlands, which attract bird watching tourists from all parts of the world. In the last section of his paper, the author gives an extensive discussion of what is needed to better protect and conserve Ethiopia’s wetlands including the need for legislation specifically directed to this sector and support for Ethiopia to become a signatory to the Ramsar Convention.

The sixth paper is a comprehensive Review of Forest, Woodland and Bushland Resources in Ethiopia. The authors point out the many functions and ecosystems services derived from natural vegetation, including protection and conservation of biodiversity, regulation of climate and storage of carbon stocks. A summary of the vegetation types found in country includes the extent of human disturbance. Data from various sources dating back to 1994 give the area and distribution of high forests, woodlands and bushlands/shrublands. The country is losing around 140 thousand hectares of forest each year, or an average of 1.0-1.5 percent per year since 1990. The rates of loss are supported by information from various studies.

Woody vegetation contributes greatly to the local economy: the fuel wood industry is worth approximately USD 420 million a year. Non-wood forest products, prominent among which is ‘wild’ coffee, are traded locally and internationally. More than 480 species of wild trees, shrubs and herbs have been recorded as important forest-food sources and medicinal plants vital for local food and health security. The most effective management of
forest and other woodland resources is by local communities and individuals. Plantation forests cover about 230 thousand hectares planted with both native and exotic species dominated by *Eucalyptus*. Site quality has a strong influence on productivity. Farm forestry, also dominated by *Eucalyptus*, is expanding rapidly and is among the largest source of non-food crop income for many rural households. Farmers’ choice of *Eucalyptus* is dictated by its rapid growth and marketability. The authors estimate that by 2008, farmers managed the equivalent of about 57,000 hectares of well stocked plantations throughout rural Ethiopia. The other management approach now being employed from dry woodlands to sub-humid forests is area exclosure. This enables natural vegetation to be rehabilitated with improvements to ecosystem services and the return of wildlife. The least satisfactory areas for forest protection are the National Forest Priority Areas that contain remnants of the natural forests, but continue to suffer from human encroachment and other forms of severe disturbance. New initiatives showing potential for improved forest management are bio-carbon initiatives and participatory forest management schemes.

The biggest challenges to the forestry sector come from the high instability in institutional arrangements, lack of adequate legal support backed-up by action, and the relegation of forestry as a small component in the agriculturally-oriented structure. The authors identify six major gaps and constraints in the forest sector. Suggestions are forwarded in the last section of the paper on how these gaps and constraints could be overcome.

The seventh paper is a *Review of Land Degradation and Land Management in Ethiopia*. Despite the potential of its natural endowment, Ethiopia is trapped in a vicious downward cycle of land resources degradation and poverty. Its annual receipt of food aid is the largest in Africa. After introducing the concepts of land, land degradation and sustainable land management (SLM), the author summarizes the legal framework for SLM in Ethiopia and internationally starting from the 1972 Stockholm Conference and finishing with the Copenhagen Conference on Climate Change in 2009. Several major studies into land degradation have been carried out, a major impact being loss of top soil with its associated nutrients. The author identifies the unprecedented population growth and lack of appropriate improved farming methods for Ethiopia’s smallholder farmers, plus lack of appropriate policies, as the driving force compelling farmers to cultivate land unsuitable for annual crop cultivation.

Because land degradation is a critical problem, many efforts by both local groups and the government are now being focused on promoting SLM practices. The Ministry of Agriculture and Rural Development established a SLM Secretariat in 2008. This Secretariat functions in partnership with
several other key government offices and higher learning institutions. The key stakeholders in this initiative also include NGOs and local communities. The SLM Secretariat has prepared a long-term project called the Ethiopian Strategic Investment Framework (ESIF) to be implemented over a 15-year period starting from 2009.

The author goes on to summarize the experiences of some selected NGOs and CBOs in land resource management. He continues by describing the present gaps and constraints to promote SLM and concludes with identifying the opportunities to scale up SLM.

The final eighth paper gives An Overview of Climate Change Impacts and Responses in Ethiopia in 2009. After giving a background to the global climate change crisis, the authors point out the especially vulnerable position of Ethiopia because of its geographical complexity and the fact that its economy has great reliance on climate sensitive sectors. These are food security (agriculture), water resources and health. The global responses to climate change are then described.

Climate change’s impacts on Ethiopia are already bringing many challenges because of its low adaptive capacity. Rainfall is becoming increasingly erratic and droughts followed often by floods are more frequent. An economic study reported in the paper has found that the prospects for economic development will get harder, first by reducing agricultural production and secondly by raising the degree of income inequality. Hence policymakers and other stakeholders have to integrate climate change adaptation into all aspects of the country’s development process.

Climate change is already having profound effects on health: malaria is prevalent in over 75% of the country putting 50 million of the population at risk.

Climate variability is not a new phenomenon for Ethiopia’s farmers, who have developed a range of coping mechanisms. These should be the basis for the choice of adaptation strategies. Modern technologies, such as the capacity to predict changes in local climate, should be made available to farmers on time and in a readily accessible form. Ethiopia has developed a National Adaptation Programme of Action than now needs to be supported by strategies and efficient implementation. Ethiopia also requires support in terms of finance, skills and technologies to take effective action to cope with climate change.
1. Introduction

A separate enactment of environmental laws is a recent phenomenon in the history of making of laws. This is true not only in Ethiopia but also throughout the world. Even so, there were legal provisions, which more or less dealt with environmental issues, scattered in various legal documents since long ago. The famous Fetha Nagast (The Law of Kings) of the thirteenth century had rules which dealt with environmental matters. The topics covered under environmental laws in Ethiopia range from proclamations on the hunting of wild animals to oversight of radiation with a variety of rules between these. Irrespective of these efforts, we need additional rules in the area of environment, as situations which cause environmental problems are continuing to increase.

Due to the fact that all laws which deal with environmental issues are not always enacted under the heading of ‘environmental law’, it is necessary to make a periodical assessment of laws related to environmental issues. This kind of assessment is not only useful for non-lawyers, but also for lawyers as there is no directory of newly enacted laws in Ethiopia.

This short assessment of environmental laws is intended to introduce laws which are related to environmental protection enacted in 2008 both at federal and regional levels. However, the assessment limits itself to laws of a few regions as there were time and resource constraints which inhibited the collection of legal documents from all regions. In addition to this, the assessment went back to 2006 (in dealing with regional laws) and 2007 (for both federal and regional laws). This, however, does not mean that all the environment related laws of 2006 and 2007 were assessed. Only the ones which are considered to be important to understand the 2008 laws have been considered.

Finally, a brief review is made in the assessment of the powers vested in government organs for making decisions on environmental issues. Readers must be aware that the results of this assessment cannot be conclusive, owing to the number of people who responded to the questionnaire and the geographic coverage. However, as indicated in the body of this work, the result was indicative of the situation.

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2. **Federal Laws**

2.1 **Radiation Protection: Proclamation No 571/2008**

The Proclamation (FDRE, 2008a) prescribes the need to establish an Authority that regulates radiation sources and related practices in order to protect individuals, society and the environment for current and future generations against the harmful effects of radiation, while such sources and related practices are used for the benefit of the public (Preamble). The Proclamation is applicable to radiation sources, accessories of radiation devices and related practices (Article 3(1)). Article 4 of the Proclamation established the Ethiopian Radiation Protection Authority, which is accountable to the Ministry of Science and Technology that replaced the Ethiopian Science and Technology Agency when the Proclamation was drawn up.

The main objectives for which the Ethiopian Radiation Protection Authority was established are to protect the society, property and the environment from hazards that could be caused by radiation sources and related practices and to carry out or promote study and research on issues that could support radiation protection activities (Article 6).

This Proclamation can be taken as one of the environmental laws of the country as one of its purposes is to protect the environment from hazards of radioactive substances and related activities. Sources of radiation can be found naturally or they can be generated by human-made devices. Naturally occurring radiation can be found all around us. Even if a radiation source is defined by the Proclamation as any material or device that may cause radiation exposure by emitting radiation (Article 2(2)), it does not seem to include the natural sources which do not cause serious problems to the environment as well as human health. The reason for this is simple. That is, radiation laws are enacted to regulate human induced problems to the environment and/or to human health and property.

There are many uses of radiation; in medicine, for security involving X-rays, in home-use devices such as smoke detectors, and industrial uses (radiation-sources-uses). The impacts of radiation on the environment as well as human health can be immense. The accident of 1986 at the Chernobyl Nuclear Power Plant in Russia is not to be forgotten. Thirty people were reported to have died on the site of the accident and in the few weeks following the accident. However, the effects of the accident were widespread, especially in Belarus, Ukraine and Russia, and theoretical calculations suggest that further illness and premature deaths are to be expected for the several years to come (Grimston, 1996). This is without taking into account its impacts on the natural environment.
Radiation has many negative impacts on nonhuman species and even on the abiotic factors in the environment. Studies indicate that protection of only human health is not sufficient even to safeguard humans from the dangers of radiation, see for instance Linsley (1989). Therefore, it is correct to conclude that the Radiation Protection Proclamation is not only intended to protect human health but also the natural environment.

The international body known as the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) periodically reviews the effects of radiation on the environment. The Committee, in 1996 for the first time, issued a report to the General Assembly that contained a review specifically focused on the effects of radiation on plants and animals. In the report it has been indicated that humans are one of the most radio-sensitive species (IAEA Bull 391).

As the utilization of radiation for various purposes in increasing in Ethiopia, it is appropriate to enact such a law. But this is not the first law of its kind in the country. This law is enacted by repealing the former Radiation Proclamation No 79 of 1993 (Article 30(1) in FDRE, 2008).

2.2 Development, Conservation and Utilization of Wildlife: Proclamation No 541/2007

This Proclamation (FDRE, 2007) has come into force through repealing two old laws namely, Wildlife Conservation Regulation No 416/1972; and Forestry and Wildlife Conservation and Development Proclamation No 192/1980. It, however, maintained other two even older laws, the Awash National Parks Establishment Order No 54/1969 and the Semien National Park Establishment Order No 59/1970 (Article 18 in FDRE, 2007).

The Proclamation recognized that the unplanned and inappropriate utilization of wildlife and the hitherto protection measures were found to be unsuccessful. Moreover, the Proclamation emphasizes the need for the active participation of local communities and private investors in the development, conservation and utilization of wildlife and the need to enact laws in conformity with the present day federal arrangement, as well as foster the role of wildlife in the economic development of the country (Preamble).

According to Fanuel (2005), one of the country’s leading conservation experts, Ethiopia’s wildlife population is declining at an alarming rate. Species such as lions, elephants, the Ethiopian wolf, the African wild ass, rhinoceros and many more are in danger of extinction. Mr Fred Duckworth and his wife Elise Duckworth visited Ethiopia twenty five years ago and they came again in 2002. They reported that the level of degradation in Ethiopia was shocking in almost all of the sites they visited (Duckworth,
They visited many of the National Parks in Ethiopia and concluded that:

*The parks are surrounded by intensive cultivation and invaded by thousands of grazing domestic animals and there is little chance of survival for the parks in such a situation.*

*Unethical hunting (even the ones conducted during the night time) practices by heavily armed (AK 47) groups was so rampant.*

These visitors talked to the wardens in various parks. The responses they got were quite depressing with a complete lack of focus and enthusiasm for their organization (now called the Ethiopian Wildlife Development and Conservation Authority). The wardens stated that they could do nothing about the devastation in the parks. Despite the devastations on the wildlife and the environment in general, there are some signs of hope that showed positive developments in few of the parks, according to the report made by Mr. Duckworth. There was, reportedly, some evidence of increment of Mountain Nyala in Bale Mountains National Park and Walia Ibex in the Semien Mountains National Park. Finally, Mr. Duckworth concluded that:

*... given the ongoing evolution of the rapid conversion of the natural habitats to areas of human cultivation, to feed the ever-increasing population, Ethiopia can be removed from the travel books as a tourist wildlife destination. (Duckworth, 2002)*

Proclamation No 541 of 2007 was enacted following the critical assessments. The Proclamation vests the power of wildlife administration in both the Federal and Regional Governments. National parks that are nationally and globally significant and known to have representative ecological zones and embrace great diversity of wildlife; national parks and wildlife sanctuaries that are inhabited by the country’s endemic and endangered species; any wildlife conservation areas geographically situated within two or more regions; any trans-boundary wildlife conservation areas that may be established in accordance with agreements with neighbouring countries shall be designated and administered by the Federal Government (Article 4(1)). The identities of the designated wildlife conservation areas to be administered by the Federal Government are to be issued by the Council of Ministers upon the recommendation of the Ministry of Agriculture and Rural Development (Article 4(2)). Those national parks, sanctuaries, etc. which are not designated and administered by the Federal Government are to be designated and administered by the Regional Governments according to regional laws (Article 5).
Accordingly, in 2008, the Council of Ministers (2008) enacted a regulation to implement this Proclamation. The regulation designated those wildlife conservation areas to be administered by the Federal Government and the Regional States, as follows. The wildlife conservation areas to be administered by the Federal Government are: Simien Mountains National Park, Bale Mountains National Park, Nechsa National Park, Omo National Park, Abijata Shala Lakes National Park, Awash National Park, Senkele Swayne’s Hartebeest Sanctuary, Babille Elephant Sanctuary, Gambella National Park, Alatish National Park, Kafta Shiraro National Park and Geralle National Park. Irrespective of this provision, the Authority may delegate its powers regarding the administration of these national parks to organs of a Regional State (Article 4(1)). Wildlife conservation areas other than those specified to be administered by the Authority shall be administered by the regional governments or by local communities (Article 4(2)).

Moreover, there is a possibility for the authorization of private investors or local communities to administer national parks, sanctuaries and other conservation areas (Articles 6 & 7 in FDRE, 2007). The Ministry of Agriculture and Rural Development has a number of powers in relation to this Proclamation. Some of these include: preparing draft policies and laws and submitting the same to the government; issuing hunting permits to foreign tourists; ensuring that the conservation practices meet international standards and the implementation of international treaties; establishing international relations; providing support to regions; supervising wildlife conservation areas administered by private investors, etc (Article 13). These are the powers which are exercised by the Federal Government; the Regional Governments also have some other and overlapping powers with the Federal Government. The powers exercised by the Regional Governments include: controlling illegal activities in both wildlife areas administered by them and by the Federal Government; supervising wildlife areas administered by private investors and local communities, issuing hunting permits to domestic hunters, etc (Article 14). It is important to note here that the powers exercised by the Regional Governments could be increased from the ones indicated in the Proclamation. This is because the Federal Government is empowered by the Proclamation to delegate some of its powers to other federal or regional organs (Article 13(10)). That is, the Federal Government, when it thinks fit and necessary, can entrust some of its powers to a Regional State.

The Proclamation provides for penalties in the form of fines and/or imprisonment to be given (minimum of ETB 500 and maximum of ETB 30,000 and/or minimum of one month and maximum of five years
imprisonment) according to the gravity of the offence (Article 16). It is observed from this that the general penalties under the Proclamation are greater than the ones stipulated in the 2005 Criminal Code. The Criminal Code (2005) imposes simple imprisonment for hunting, killing and other related offences against wild animals (Article 353(1)). However, the Criminal Code imposes graver penalties for offences committed against endemic animals. Accordingly, anyone who hunts or kills an endemic animal; or possesses, collects, transports, transfers or exports an endemic animal ... is punishable, according to the circumstances of the case, with simple imprisonment for not less than one year, or with rigorous imprisonment not exceeding twelve years and a fine from ten thousand to one hundred thousand ETB (Article 353(3)). Unlike the Criminal Code, the Wildlife Protection Proclamation does not impose different penalties for offences that are committed against endemic animals.

2.3 Ethiopian Wildlife Development and Conservation Authority Establishment: Proclamation No 575/2008

This Proclamation (FDRE, 2008b) clearly states that Ethiopia possesses diverse, rare and endemic species of wildlife which are of great value to tourism, education and science (Preamble). The Preamble also indicates that establishing a government body at federal level is helpful to provide proper attention for the development, conservation and utilization of the country’s wildlife resources and maximize their benefits. The Proclamation also establishes an autonomous federal government organ (the Ethiopian Wildlife Development and Conservation Authority) that is accountable to the Ministry of Culture and Tourism, which can have wildlife conservation area offices elsewhere, as may be necessary (Articles 3 & 4). Even if the Authority is accountable to the Ministry of Culture and Tourism, it is more autonomous and powerful than the former offices with this responsibility as it can now perform the functions which were vested in the Ministry of Agriculture and Rural Development (MoARD) under Proclamation No 541 of 2007. For instance, the Regulation issued by the Council of Ministers in 2008 was recommended by MoARD, but now this power is vested in the Authority itself, which is also the implementer of this Regulation. Moreover, the Authority can issue its own regulation pertaining to appropriate hunting methods (Article 8(3)).

However, Proclamation No 575/2008 does not give any power to the Authority over forests, the natural habitats of wildlife. The power of administering forests remains vested in the MoARD. This situation calls for an intimate coordination in the functions of the two government organs if both wildlife and forests are to be adequately protected and conserved in their own rights as well as for sustainable development.
2.4 Urban Planning: Proclamation No 574/2008

This Proclamation (FDRE, 2008c), in its Preamble, states that: “it is necessary to regulate the carrying out of development undertakings in urban centers, contemplated both by public and private actors so that they will not be detrimental to the general well being of the community as well as the protection of [the] natural environment;” Basically this Proclamation is not included as an environmental law. However, there are many points that make it appropriate for it to be considered as part of the environmental law of the country2. Its Preamble, where the law’s main objectives are stated, deals with the environment. Moreover, it stipulates that accountability (emphasis added) of the public and private actors must be assured if they happen to [negatively] affect the natural environment (Paragraph 3 of the Preamble in the Amharic version of the law). One of the basic principles of the Proclamation is safeguarding the environment (Article 5(7)). When any urban plan is initiated or prepared, safeguarding the environment is an issue that cannot be avoided. It seems that this is the reason why the Proclamation obliges the incorporation of environmental considerations when any structural plan is prepared (Article 9 (9.2.f)).

No development activity can be undertaken without a prior authorization from the concerned chartered city or urban administration upon satisfaction of the requirements of the development principles (Articles 25(1), 28(1)). One of the underlying principles for authorizing a development project is an environmental impact assessment (EIA) process (Article 26(2)). This Proclamation supports the provisions of Proclamation No 299/2002, which states: “Any licensing agency shall, prior to issuing an investment permit for a trade or an operating license for any project, ensure that the Authority or the relevant regional environmental agency has authorized its implementation” (FDRE, 2002). Even if the EIA Proclamation requires that the an EIA is to be made prior to issuing investment or other licenses, this important requirement is reversed by a later proclamation (FDRE, 2003) which states: “The appropriate investment organ shall, after issuing the investment permit, notify the concerned government institutions so that the latter could conduct the necessary follow up”. This Proclamation clearly reversed the requirement for an EIA before the developers could get an investment license.

However, the latest law (FDRE, 2008c) seems to have restored the requirement in the EIA Proclamation regarding development activities in

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2 A law should not necessarily be enacted under the heading of environment to be considered as environmental law. Its contents are sufficient to group it under environmental law.
urban areas. On this account, an application for a development permit may be rejected for some reasons; of which one is when the development is likely to have a negative impact on the environment and (emphasis added) generally for the public in the area. Note, however, that the wording may create practical problems in the implementation of this law as it may open a loophole for the argument that a negative impact must be there both (emphasis added) in its impact on the environment and on the public...

The Urban Planning Proclamation has made chartered cities and urban administrations one of the institutional areas for environmental protection in Ethiopia. This is a very important step in advancing the efforts of environmental protection activities in the country.

2.5 Forest Development, Conservation and Utilization:
Proclamation No 542/2007

This Proclamation (FDRE, 2007b) together with the accompanying policy document is one of the long awaited proclamations by Ethiopian environmentalists. It replaces the Policy and Strategy on Forest Development, Conservation and Utilization issued by the Ministry of Agriculture and Rural Development and adopted by the Council of Ministers in 1997.

There are two types of forest ownership recognised under the Proclamation; namely private and state (both federal and regional) ownership (Article 3 & Article 2(6)). The Ministry has major powers and duties in the administration of forests regarding technical and scientific issues. For instance, the Ministry determines which plants should be called trees (Article 2(4)), prepares a list of endangered indigenous tree species (Article 14(2)), coordinates the appropriate federal and regional bodies and provides technical support to them (Article 17(1)(a)), and initiates the drawing up of policies, laws and strategies (Article 17(1)(b)). The Proclamation vests more power in relation to direct forest administration in the Regional States than at the federal level (Article 18). However, there remain provisions that are difficult to understand without a regulation and/or directive for the implementation of the Proclamation being also developed. For instance, there is a provision stating that forest guards get directions from the Ministry or the appropriate regional body (Article 15). It is not clear from the Proclamation as to when and under what circumstance will the forest guards receive directions from federal/regional organs.

As one can see from the above, there are two types of forest ownership recognised under the Proclamation namely, private and state forests. During the discussion carried out on Sene 4, 1999 E.C. (11 June 2007) with the Standing Committee for Rural Development, Natural Resources and
Environmental Protection of the House of Peoples Representatives (1999/2007), one of the points raised was about the inclusion of community forests (p. 14, 20). Some participants even told success stories from Ethiopia and abroad about community forests (p. 21). The main argument presented by the representative of the Ministry of Agriculture and Rural Development not to include community forests was that the Ministry had already recognised these types of holdings as ‘private’ and hence they are already incorporated within the private forest ownership of the Proclamation.

The essence or concept of a ‘communal forest’ seems to be beyond the one recognized under a ‘private forest’. Community forests and forestry may have a wide range of rights vested with the communities, including the right to manage the whole ecosystem (mountains, riverbanks, wetlands, etc.) according to their traditional knowledge systems (community forest search result). This kind of territorial concept of right over the land (and also forests and other natural resources) is well considered by the ILO Convention (1989). Even if Ethiopia has not ratified this Convention, it is important to consider it for some guidance on actions that can be made which are believed to be beneficial to the local communities and their livelihoods.

2.6 Prevention of Industrial Pollution: Council of Ministers Regulation No 159/2008

Even if many environmental laws have been adopted by the House of Peoples’ Representatives, it is not common to have the subordinate regulations also enacted for the purpose of implementing these laws. This Regulation (Council of Ministers, 2008) has seen the light of the day after six years since the adoption of the parent legislation, which is Proclamation No 300/2002 (FDRE, 2002). Though late, it is good to have this kind of law which is important in implementing the parent law.

The Regulation imposed general obligations on factories subject to it. The following are some of these obligations:

- The concerned factories shall minimize the generation of every pollutant to an amount not exceeding the limit set by the relevant environmental standard and dispose of it in an environmentally sound manner (Article 4 (1)).
- Every factory shall have the obligation to handle equipment, inputs and products in a manner that prevents damage to the environment and to human health (Article 4(2)).
• If any factory loses a potentially dangerous pollutant, input or product it shall immediately notify the competent environmental organ (Article 4(4)).

These and other obligations imposed on the factories would contribute to the betterment of the environment if they are correctly implemented. As the scope of application of the Regulation goes up to when the factory ceases to operate or until such additional time as has been determined by the competent environmental organ (Article 3), it seems that the Regulation has adopted a cradle-to-grave liability approach. However, the Regulation is not applicable immediately on existing factories. An existing factory is one that is under operation or a project to which an application to obtain a license to establish a factory has been submitted before or on the date of entry into force of the Regulation (Article 2(5)). This does not, however, mean that existing factories are free from any kind of liability throughout their lifetime. An existing factory that is in an industrial sector listed in a directive issued pursuant to the Regulation shall, within 5 years, fully comply with the provisions of the Regulation (Article 12(1)). This Directive was also adopted by the Environmental Council in May 2008 and the enterprises (7 in number) on which the Regulation applies are named. These are the textile, leather, chemical, sugar, cement, metal and food and beverage industries.

The other point which should be discussed here about the Industrial Pollution Control Regulation is its penalty clause. The Regulation refers the penalty to the Criminal Code (Article 14). The parent law of this Regulation, the Pollution Control Proclamation No 300/2002 (FDRE, 2002) provides more elaborated and graver penalty clauses. It even specifically mentions the application of these penalty clauses for offences committed under it or any regulation to be issued for its implementation (Part Five (Offences and Penalties, Articles 12 to 17)).

The issuance of the regulation requires the concerned organs’, particularly the Federal Environmental Protection Authority’s and the Addis Ababa EPA’s vigilant activity by engaging other concerned organs, as most of the industrial firms are concentrated in the city of Addis Ababa. This in turn requires them to get well organized with respect to human and material resources for the work.

3. Regional Laws
As Ethiopia is a federal country, Regional States have a constitutionally guaranteed right to enact laws which will be applicable in their jurisdictions. It is the Federal State that is empowered to enact laws for the utilization and conservation of land and other natural resources, historical
sites and objects (FDRE, 1996, Article 51(5). However, it may, when necessary, delegate to the Regional States powers and functions granted to it by Article 51 of the Constitution (Article 50(9)). It is assumed that the Regional Governments are now exercising the right of enacting environmental laws by the power they got from the Federal State through delegation. Regional States can better take care of the environment than the Federal State, if they build their capacity, as they are nearer to the people, land, forests, water, etc. In some Regional States the environmental laws are even stronger than their Federal counterparts.

3.1 Amhara National Regional State (ANRS)

Very few laws have been enacted on environmental issues recently in the Amhara National Regional State. Even if some of the laws discussed here are not directly related to environment, they have direct relevance to the point of discussion.

3.1.1 The Amhara National Regional State Executive Organs Re-establishment, Organization and Determination of their Powers and Duties Proclamation No 120/2006

This Proclamation (ANRS, 2006a) made the Environmental Protection and Rural Land Administration and Use Authority autonomous and directly accountable to the Head of the Regional Government (Article 29(12)(b)). This arrangement is believed to increase the independence of the Authority in comparison to the previous organization where the Authority was under the Bureau of Agriculture and Rural Development. Irrespective of this provision, the Proclamation gives powers to the Bureau of Agriculture and Rural Development to prepare, in collaboration with relevant bodies, draft laws on the conservation and utilization of forests and wildlife resources in the Region; as well as follow up and coordinate the implementation of same (Article 16(2)).

3.1.2 The Revised Rural Land Administration and Use Determination: Proclamation No 133/2006

In its preamble this Proclamation (ANRS, 2006b) states that: “...it is found necessary to determine and provide the rural land administration and use [determination] to maintain its [the land’s] fertility and to be able to transfer to the next generation by using it properly and carefully...”

It is very common for environmentalists to claim that the recently introduced organization of the executive organs has taken away the autonomy of environmental protection bodies as they are mainly relegated to departments under agricultural organs. They say that agricultural organs do not give due attention to environmental issues. Even they claim that the agricultural organs consider environmental protection activities as a hindrance to the agricultural development activities.
The body part of the Proclamation provides for environmental protection obligations on the land users; such as to plant trees around the land and properly protect them, to take care of water sources so that they do not go dry due to improper farming, to exercise care for wildlife and birds found around the user's holding and the obligation to plough the land far from river or gully (Article 20(1)(b)(e)(h) & (2)). The Proclamation does not have its own penalty clause, but refers the penalty to the Criminal Code. It is not clear which of the provisions of the Criminal Code are specifically relevant for the rules of this Proclamation. The ones which are related to offences against property provide for offenses in relation to land and they are merely petty offences. Generally speaking, most of the penalties under the Criminal Code in relation to environmental offences are very weak.

### 3.2 Oromia National Regional State (ONRS)

#### 3.2.1 Proclamation No 138/2008 Issued to Amend the Oromia National Regional State Proclamation to Provide for the Reestablishment of Investment Administration No 115/2006

The Proclamation (ONRS, 2008) under its Article 8(6) provides that: "the Investment Committee of a zone shall facilitate conditions for the rehabilitation of the evicted persons due to investment activities." It is not stated whether this activity also includes environmental rehabilitation works. It is, therefore, not safe to imagine that this rehabilitation work includes environmental concerns. From some of the provisions of this Proclamation, it does not seem that land is viewed as a finite 'resource'. For example, Article 15(1) states that: "The organs with the duty to prepare investment land shall have the obligation to prepare investment lands continuously before the exhaustion of the prepared land." One may be amazed by this rule of the Proclamation as it does not indicate any condition as if land is a non-exhaustible and infinite 'resource'.

Of course, Ethiopia's biggest 'resource' is its land. It is not possible to ensure the sustainable livelihoods of its people without using its land. The fear here is an over generalized thinking that land is like any other commodity. Our relations with the land must be based on the ethic that would make certain that we do not establish a conflicting relation with

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4 See for instance, Article 851 ff of the Criminal Code. Article 746 (1) of the Criminal Code gives petty offences as: “Petty offences shall not be punished with rigorous or simple imprisonment prescribed for ordinary crimes. Petty offences differ from ordinary crimes by reason of the different penalties they merit.”
nature or land. As Aldo Leopold (1949), in his ground-shaking work of the 20th century stated, we must establish a very ethical relation with land.

The other point which should be mentioned here is that the investment organs at various levels in the Region, together with other actors, have enormous power over land allocation for investment purposes. However, no corresponding concern is raised about the environment. It is extremely important to express environmental issues in investment laws to show concern for the environment. Moreover, inclusion of environmental issues would remind the main actors of the investment law of the need to incorporate environmental considerations in investment activities without necessarily referring to environmental laws.


This Proclamation, (ONRS, 2007b) in the first paragraph of its Preamble, affirms that: “proper management and utilization of land and land resources is required in which the present use doesn’t compromise the development endeavors of the coming generation”. As in many other proclamations, this Proclamation provides an environmentally sound preambular statement, which may be used during its interpretation. The Proclamation imposes some duties on land users and some of the obligations are related with environmental protection. To mention some, it provides that: private investors are obliged to plant indigenous trees on at least 2% of the given land (Article 12(2)); rural land users are obliged to refrain from performing activities that cause damage to the wetlands and springs (Article 20(1)); mismanagement and improper utilization of wetlands is prohibited (Article 20(2)). Moreover, the Proclamation includes some rules which need to be implemented by the other concerned organs of the Region. The following are some of them:

♦ The investment land shall be determined in a way that it shall protect the natural resources of the surrounding (Article 12(3)).

♦ A guiding land use master plan, which takes into account soil type, landscape, weather conditions, vegetation cover and socio-economic conditions with a watershed-based approach, shall be developed and implemented by the Oromia Agricultural and Rural Development Bureau (Article 18(1)).

This is a long-awaited document from the Federal Government for many concerned people. If such a document comes from a Regional State, it is expected that it could solve at least part of the problem associated with its total absence in the country as a whole.
The biodiversity in rural wetlands shall be conserved and utilized as necessary in accordance with a suitable land use strategy (Article 18(10)). This rule and the ones mentioned above on wetlands are good beginnings on the shift in the state of mind that considers wetlands as wastelands.

The Proclamation further states that: “Rural land users are obliged to refrain from performing activities that cause damage to the wetlands and springs. Mismanagement and improper utilization of wetlands is prohibited”. (Article 20(1), (2))

3.2.3 Regulation to Provide for the Establishment of the Oromia Regional State Forest Enterprises Supervising Agency, No 84/2007

This Regulation (ONRS, 2007) has established an autonomous organ that is directly accountable to the Executive Council of the Regional Government (Article 4(2)). The Agency is established: to oversee attainment of a sustainable management and utilization of forests, and implementation of forest policies to provide the existing state forest enterprises with guidance and support so as to make them efficient, modern and sustainable; and to establish new forest enterprises that contribute to the realization of the sustainable management of forests and thereby play an appropriate role in the enhancement of economic growth of the population in the region (Preamble). The following are among the objectives for which the Regulation was enacted:

5 For instance, see Ethiopian Water Sector Strategy (2001), Ministry of Water Resources, Section 4.1.1 which states: “Reclaim existing wetlands, and prevent the formation of the new ones by using appropriate mechanisms. a) Undertake the inventory of existing wetlands. b) Develop preventive mechanisms to avoid formation of water-logged areas. c) Develop guidelines as to how to reclaim wetlands, and enforce these guidelines. d) Carry out appropriate drainage works on all (emphasis added) wetlands.”

The Water Sector Strategy document issued by the Ministry of Water Resources does not define wetlands and it is not possible to get a definition of wetlands from the Ethiopian Water Resources Management Policy of 1999, as the Policy does not mention wetlands in a single place. One has, therefore to resort to either an ordinary dictionary meaning or to meanings in international instruments. Even if Ethiopia has not yet ratified the Ramsar Convention, it is better to adopt its definition of wetlands. According to the Ramsar Convention Article 1(1), “wetlands are areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters”. From this definition one can conclude that if the Ethiopian Water Sector Strategy is seriously applied, all of our wetlands are at risk.
Legal and Institutional Issues for Environment in Ethiopia in 2008

♦ To oversee and supervise the management of state forest enterprises (Article 6(1));
♦ To implement the regional state’s forest conservation policy (Article 6(4)).

The Regional State is the first region in Ethiopia to establish this kind of organ for the purpose of supervising forest enterprises already existing and to be established in the future. The Agency has powers and functions that relate to the management of forests, finance, administration and the like. One of these powers and functions is to issue and implement guidelines on the proper management and utilization of forests (Article 7(7)).

3.3 Southern Nations, Nationalities and Peoples Regional State (SNNPRS)

3.3.1 The Revised SNNPRS Determination of Executive Organs’ Powers and Responsibilities Proclamation No 106/2007

This is the Proclamation (SNNPRS, 2007) that has determined the powers and responsibilities of the executive organs of the Regional State. Unlike the Amhara National Regional State Executive Organs Re-establishment Proclamation, there is no autonomous environmental protection organ in this region. In fact, from the Proclamation it is not possible to see the environmental protection organ in the Region. Practically it can be observed that the environmental protection organ is organized as one part of the Bureau of Agriculture and Rural Development. The Proclamation has clearly given the power of environmental protection activities to this Bureau. The following are the environmental protection powers of the Bureau, in addition to its mainline functions of agricultural development activities:

♦ Supervises protection and development of natural resources and parks; implements, causes the implementation of and controls wildlife protection and utilization laws (Article 23(1));
♦ Controls forest fires (Article 23(14));
♦ Initiates biodiversity protection policy, issues directives and implements same (Article 23(18));
♦ Issues and implements directives that would protect the natural resources and the environment (Article 23(19));

It is anticipated that it is the environmental structure under the Bureau that is going to be entrusted with these functions. But the Proclamation also indicates that the Agriculture and Rural Development Bureau shall prepare land for agricultural investment (Article 22(3)). It is
not clear from this provision of the Proclamation what the roles played by the environmental organ should be in relation to this task.

3.3.2 SNNPRS Land Administration and Use Proclamation No 110/2007
This Preamble of the Proclamation (SNNPRS, 2007b) states that it is issued to sustainably conserve and develop natural resources and pass [these] over to the coming generations through the development and implementation of a sustainable rural land use plan based on the different agro-ecological zones of the region and to put in place legal conditions which are conducive to enhance and strengthen the land use right of farmers to encourage them to take the necessary conservation measures in areas where mixed farming of crop and animal production is prevalent and where there is threat of soil and forest degradation. The Preamble also describes other uses of this Proclamation. The Proclamation also imposes environmental obligations, which are nearly similar to those discussed under the section dealing with Oromia Land Law (see section 3.2.2 above).

3.3.3 SNNPRS Rural Land Administration and Use Regulation No 66/2007
This Regulation is issued to implement Proclamation No 110/2007. Article 13 of this regulation is devoted to the restrictions imposed on the use of rural land. The restrictions are mainly focused on the use of sloping lands and wetlands. Detailed rules have been given to limit the use of sloping lands and wetlands. For instance, row cropping and growing annual crops on steep slopes having 15-30% slope with shallow soil depth, low soil fertility, and being exposed for erosion, is not allowed (Article 13 (1)(D)). This is the rule. This rule has an exception. That is, it is possible to use such lands only by applying appropriate soil conservation measures (Article 13 (1)(D)). The concerned administrative and judicial organs are expected to interpret this exceptional provision restrictedly by applying the rules of legal interpretation.

The other restriction is on the use of wetlands. Unlike the water sector strategic document of the Federal Government, this regulation prohibits the draining of wetlands for farming and other purposes (Article 13(2)(2)). Again this is the rule and only exceptionally is it possible to use wetlands based on a study supported by a local development plan, which can be detailed by directive (Article 13(2)(2)).
4. Questionnaire Responses on Decision Making Powers of Government Organs on Issues Related to Environment

To test how far the institutional and legal regime is properly working on the ground, a questionnaire was prepared and distributed to different experts in four towns, namely Dire Dawa (DD), Awassa (AW), Asella (AS) and Arba Minch (AM). Tables 1 and 2 summarize the responses.

From the above table it can be seen that the greatest powers, according to the observation of the respondents, in relation to passing decisions regarding land allocation for investment purposes are concentrated in the hands of the Woreda, Zone or Regional administrations. Conversely, less power is vested in the environmental organs. If there is a comprehensive land use plan, having the decision-making power in the hands of the administration is not a problem. However, the fear is that such a practice may aggravate environmental degradation in the country.

Table 1: Rating of various organs in relation to the powers they have in making decisions on activities that affect the environment

<table>
<thead>
<tr>
<th>Organ</th>
<th>Number of respondents</th>
<th>Arba Minch (AM)</th>
<th>Asella (AS)</th>
<th>Awassa (AW)</th>
<th>Dire Dawa (DD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Bureau</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No %</td>
<td>10</td>
<td>12</td>
<td>16</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>3 (6.25%)</td>
<td>3 (6.25%)</td>
<td>18 (37.5%)</td>
<td>27 (56.25%)</td>
<td>48</td>
</tr>
<tr>
<td>Great power</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No %</td>
<td>12</td>
<td>18</td>
<td>22</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>22.92%</td>
<td>37.5%</td>
<td>45.83%</td>
<td>37.5%</td>
<td>48</td>
</tr>
<tr>
<td>Less power</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No %</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>10.42%</td>
<td>10.42%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Woreda, Zone, or Regional Administration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No %</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>75%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Great power</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No %</td>
<td>36</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>75%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less power</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No %</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Organs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No %</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Great power</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No %</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>12.5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less power</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No %</td>
<td>42</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>87.5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Municipality</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No %</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>37.5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It must be clear to the reader that the population size as well as the number of towns in the sample survey is extremely small. It is not possible to draw a valid conclusion from the results obtained. However, it is believed that the results are indicative.

As this statement is made based on the responses of small focus groups of persons, it would be not correct to take it as conclusive. However, it can be safely said that it is indicative.
It is clear that administration organs at various levels are the key actors in the decisions which have impacts on the environment. The people in administration have so many commitments and tasks to perform that the environmental agenda may be one of the marginal issues for these people. Unless there is a strong political will to consider advice from environmental experts before making decisions, they may decide to the detriment of the environment as part of their obligation to fulfil many of their other objectives.

Table 2: Response to a question as to which organ has become greater in power as compared to others in recent years

<table>
<thead>
<tr>
<th>Town</th>
<th>AM</th>
<th>AS</th>
<th>AW</th>
<th>DD</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Bureau</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>6.25%</td>
</tr>
<tr>
<td>Investment Agency</td>
<td>-</td>
<td>1</td>
<td>5</td>
<td>-</td>
<td>6</td>
<td>12.5%</td>
</tr>
<tr>
<td>Woreda, Zone, Regional Administration</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>8</td>
<td>35</td>
<td>72.92%</td>
</tr>
<tr>
<td>Environmental Organs</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>4.17%</td>
</tr>
<tr>
<td>Municipality</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>4.17%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>10</td>
<td>12</td>
<td>16</td>
<td>10</td>
<td><strong>48</strong></td>
<td></td>
</tr>
</tbody>
</table>

Most respondents (72.92%) have realized that the powers of the administration at various levels are becoming stronger as compared to other organs, regarding the decisions that have impact on the environment. On the other hand, only a small proportion of the respondents believed that the powers of environmental organs are becoming stronger as compared to other organs.

5. Conclusion

Encouraging steps are being taken as far as issuing environmental laws are concerned. These laws are getting wider in scope. Historically, the Ethiopian environmental laws had focused on resource utilization such as restriction of hunting. Over time, the environmental laws have come to include from mere resource utilization to pollution and radiation control and other regulatory aspects such as environmental impact assessment.

In some instances, Ethiopian environmental protection has moved from a more autonomous structural organization to a more relegated position under another organization, but the reverse is also seen in the examples given. This institutional instability has its own negative impacts on the development, protection and appropriate utilization of the environment. Even if there is no identical approach of structural organization of environmental organs today among regions, some are being organized in a
more autonomous way. An example comes from the Amhara National Regional State, where the environmental organ is now more autonomous and accountable to the Head of the Regional State. This does not mean that because environmental organs are autonomous that would, by itself, solve our environmental problems, which are the result of more complicated factors.

It is a step forward that the present day environmental laws, almost unanimously, state that the environmental laws preceding them were not effective or do not conform to the prevailing circumstances of the country and it is necessary to adopt new or revised and relevant laws. These kinds of statements have to be seen very positively, as they show the need for more effective and comprehensive laws. The very purpose of law is to solve societal problems by updating itself with societal dynamics.

Absence of a comprehensive land use plan for the country as a whole is considered to be one of the serious problems in this country to deal with environmental issues as decisions may be arbitrarily made, even against the interests of local communities. For instance, discontent has been repeatedly expressed by the people of some woredas of the Southwest, such as Sheka and Mejengir areas, due to land allocation for agricultural investments. As it has been stated in the body of this work, land and forests are by far more than simple commodities for some people in Ethiopia and all around the world. Had there been a comprehensive land use plan, the interests of such communities would have been well considered. There are now glimpses of hope in some regional laws as they expressly provide for the issuance of land use plans, at least at regional level. The Oromia Land Law seems to have taken the lead in this regard and it is expected that it could be a lesson for others too. The Oromia Regional State is also the first in establishing the Forest Enterprises Supervising Agency, which oversees the development, protection and sustainable utilization of forests in the Region. Again this kind of structural arrangement is hoped to reduce unwise utilization of the forest sector in the Region.

Irrespective of these positive developments, some forbidding approaches are also observed in the environmental laws enacted recently. For instance, the purpose of the Wildlife Development and Conservation Authority Establishment Proclamation No 575/ 2008 (Preamble) is purely economic. That is, we conserve wildlife to get economic benefits from such activity. This is an anthropocentric approach and has great dangers in it. That is, if we get more economic benefit by eliminating wildlife, there is not any ethical reason to stop us, as we are guided by economic principles alone. This kind of approach is against the principle of the Environmental Policy of Ethiopia, Section 2(3)(q), which states: “Species and their variants have the
right to continue existing...” This should be one of the purposes of conserving wildlife.

The other concern is that some laws seem to have considered land as an ‘infinite resource’. Investment laws are known to provide for preparing land for investment continuously. It is understood that such a rule is required to encourage agricultural investment. Unless such rules make the availability of the required land conditional on some factors, they may be interpreted that every piece of land should be allocated for this purpose. The situation can only be aggravated through the absence of a comprehensive land use plan. In addition to this, investment laws, especially the ones that deal with the incentive mechanisms, are [not] required to consider environment-friendly investment activities. The investment laws are not trustworthy in this regard. The recent “Investment Incentives and Investment Areas Reserved for Domestic Investors Council of Ministers (Amendment) Regulation No 146/2008” does not have any provision to provide incentives for those investors who want to invest in eco-friendly works.

References
Community forest search result: http://www.google.com.et/search?hl=en&client=firefox-a&channel=s&rls=org.mozilla%3Aen-US%3Aofficial&hs=ZJd&q="Community forestry may vest wide range of rights on the communities, including the right to manage the whole ecosystem (mountains, river banks, wetlands, etc.) according to their traditional knowledge systems”, accessed on 29 September 2009.

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POPULATION DYNAMICS AND ENVIRONMENT IN ETHIOPIA: AN OVERVIEW

Selome Bekele¹ & Assefa Hailemariam²

1. Introduction
A consideration of population, the total of all human beings, is vital in any discussion on environmental change. There is no doubt that population changes and environmental factors influence each other. Population dynamics refer to the changes in population size and structure due to changes in fertility, mortality and migration. According to Botkin & Keller (1995), environment refers to all factors, both living and non-living, which affect an individual organism or a population at any point in its life cycle.

People have sought to understand the relationship between population dynamics and the environment since the earliest times. This link has been expressed at different times in somewhat different contexts, such as the relationship of population growth to governance (Plato, 360 B.C. cited in Jowett, 1986 and Aristotle, 354 B.C. cited in Swanson and Stephan, 2004), to food production (Malthus, 1960), to agricultural growth (Boserup, 1965), to resource availability (neo-classical economists) and recently to pollution and land degradation (Panayotou, 2000) as well as climate change.

In this paper, an attempt is made to review trends in population dynamics and to highlight their relationships with environmental change in the Ethiopian context. It is hoped that an understanding of such relationships could provide a sound basis for the integration of population variables in a better understanding of environmental issues.

2. Population Dynamics
Population dynamics examines the short- and long-term changes in the size and age composition of a population, and the biological and environmental processes influencing those changes. It deals with the way populations are affected by birth and death rates, and by immigration and emigration. It also studies topics such as ageing populations or population decline. As shown below, an understanding of population is central for many service areas (Figure 1).

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Thus, this section describes the population dynamics of Ethiopia—its size and growth, age and sex structure as well as its distribution in space.

2.1 Population Size, Growth, Structure and Distribution

2.1.1 Population Size and Growth

Absence of accurate time series data for population limits the estimation of past size and growth rates of the Ethiopian population. Although figures on the size of the population started appearing as early as the mid-nineteenth century, these were based on guesses made by travellers and visitors (Assefa, 1990). Until about the mid-1960s, no population data existed for the whole country. In 1964/65, the first national sample survey was conducted by the then Central Statistical Office [now Central Statistical Agency (CSA)], and since then, various sample surveys have been undertaken that have provided estimates for population data for the country. However, these data had their own limitations and permitted only a crude approximation of the actual size of the Ethiopian population (Assefa & Teller, 2005).

In order to make demographic estimates on the current status and future trends of a population, data from censuses and vital statistics recording systems supplemented by demographic sample surveys are required. Ethiopia has conducted several demographic sample surveys and three population and housing censuses in 1984 (PHCC, 1991), 1994 (PHCC, 1999) and 2007 (PCC, 2008) but a registration system for vital events (births, deaths, etc.) is not yet in place. Based on data from the first population and housing census of 1984 and earlier estimates, CSA made a reconstruction of the population size from 1900 to 1980. Figure 2 illustrates the pattern of Ethiopia's population growth since 1900 using various estimates and counts from the three censuses.

As Figure 2 shows, the Ethiopian population has been steadily increasing since the turn of the 20th Century. It took 60 years to double from
11.8 million in 1900 to 23.6 million in 1960 but only 27 years to double again and reach 47.2 million in 1987.

Figure 2: Trends in population size (Assefa, 1994; PHCC, 1991 & 1999; PCC, 2008)³

Figure 3: Rate of population growth, 1900–2007 (Assefa, 1994; PCC, 2008)

The rate of population growth increased from about 2.2 percent annually in 1960 to a peak of 3 percent in the late 1980s and early 1990s (Figure 3). Consequently, the population increased by more than three times its 1960 size reaching 73.8 million in May 2007. Figure 3 indicates that the

³ The population size of Eritrea and Assab Administrative Regions counted in the 1984 census was deducted from the total count as these two areas ceased to be part of Ethiopia in 1993.
growth rate has begun to slow down from the mid-1990s. However, the rate at which it is declining is very slow indicating that the overall population will continue increasing rapidly in the years to come.

2.2 Population Structure

2.2.1 Age and Sex Structure
Age structure is both a determinant and consequence of population growth. A population is said to be young or old depending on the value of the median age, the proportion of children or the proportion of the elderly. Generally, populations with a median age under 20 years, proportion of children 40 percent and above, and proportion of elderly less than 5 percent are considered to be young. Table 1 gives the values for these three measures of population in the last 25 years for Ethiopia.


<table>
<thead>
<tr>
<th>Census year</th>
<th>Median age (in years)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Under 15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>65 and above</td>
</tr>
<tr>
<td>1984</td>
<td>16.1</td>
<td>49.8</td>
</tr>
<tr>
<td>1994</td>
<td>17.0</td>
<td>45.4</td>
</tr>
<tr>
<td>2007</td>
<td>17.1</td>
<td>45.0</td>
</tr>
</tbody>
</table>

Considering the first and last censuses, although the proportion of children decreased by 5 percent between 1984 and 2007, the overall size was still well above 40 percent. The share of the elderly decreased by 0.2 percent and was much lower than the threshold (5%). The median age increased by one year but was still under 20 in 2007. Thus, the Ethiopian population is a young population with a median age not more than 18 years, 45 percent of the population under 15 years of age and only 3.2 percent are 65 years or above. These are features of a rapidly growing population.

Another way of assessing the age and sex structure of a population is using the population pyramid. Population pyramids are effective means of comparing the male and female population over a range of ages. Figures 4, 5 and 6 present the age sex structure (population pyramids) of the Ethiopian population in 1984, 1994 and 2007. These pyramids are wide at the bottom and narrow rapidly with increasing age indicating high birth and death rates. This is a typical characteristic of a developing country population with a high potential for future rapid population growth.
Figure 4: Population pyramid of Ethiopia for 1984 (PHCC, 1991)

Figure 5: Population pyramid of Ethiopia for 1994 (PHCC, 1999)
A simple comparison of the bottom bars (children under five years) with their adjacent ones indicates a slight decline in birth rates from 1984 to 2007. However, a closer look at the three pyramids further suggests the phenomenon of *population momentum* which refers to the in-built tendency for a population to continue growing because of its present youthful age structure. This means that even if future families have fewer children, there is a continuing growth factor because the number of people that are entering into their reproductive ages (new parents) is greater than the number of people leaving those ages. As the high proportion of children aged less than 15 years grow and enter the reproductive ages, the cohort of women in the childbearing ages will continuously increase in size and produce more children. Thus, population continues to grow rapidly for many decades even after birth rates have declined to mere replacement level.

### 2.2.2 Age and Economic Dependency Ratios

Age dependency ratio (ADR) represents the relation of the combined child population and aged population to the population of intermediate age. It measures the burden of dependency that the working age population must bear. It is a very useful tool to study the economic advantages of the age structure. It should, however, be noted that the age dependency ratio is a measure of age composition, not of economic dependency. The economic dependency ratio may be defined as the ratio of the economically inactive population to the active population over all ages. The two ratios are expressed as follows:
Population Dynamics and Environment in Ethiopia: An Overview

\[ ADR = \frac{P_{0-14} + P_{65+}}{P_{15-64}} \times 100 \]

where, \( P_{0-14} \) is the size of population under 15 years (children), \( P_{65+} \) is the size of population 65 years and above (elderly), and \( (P_{15-64}) \) is the size of population between 15 and 64 years (working ages).

\[
\text{Economic Dependency Ratio} = \frac{\text{Economically inactive population}}{\text{Economically active population}} \times 100
\]

where, the \textit{economically active population} is made up of all persons who supply labour for the production of goods and services while \textit{economically inactive population} is those persons of a minimum age not meeting this characteristic.

Table 2 shows the economic advantage of the age structure (through the Age Dependency Ratios) for the population of Ethiopia counted in the three censuses. The table also includes the economic dependency ratios for the first two censes for which the data are available, whereas for the third census, data on economic activity have not yet been released.

Table 2: Overall age dependency ratios and economic dependency ratios  
\textit{(PHCC, 1991 & 1999; PCC 2008)}

<table>
<thead>
<tr>
<th>Census year</th>
<th>Age Dependency Ratio</th>
<th>Economic Dependency Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>111.9</td>
<td>48.8</td>
</tr>
<tr>
<td>1994</td>
<td>94.6</td>
<td>37.9</td>
</tr>
<tr>
<td>2007</td>
<td>92.8</td>
<td>NA</td>
</tr>
</tbody>
</table>

\( NA = \text{data not available} \)

In both censuses, the questions on economic activity were referred to those household members aged 10 years and above. The minimum age was fixed at ten because it is presumed that most children start to participate in the production of economic goods and services at young ages, particularly in the rural areas (PHCC, 1999). As can be seen from Table 2, the values for Age Dependency Ratio and Economic Dependency Ratio are quite different because the first (ADR) implies only “age dependents” per 100 persons of working age while the second indicates the ratio of economically inactive to active persons. For example, an ADR of 111.9 in 1984 implies that every 100 persons of working age must bear the burden of another 112 young and old persons. On the other hand, an Economic Dependency of 48.8 in the same year means there were about 49 economically dependent persons for every 100 economically active persons. In other words, for every one economically dependent person, there were two economically active persons to provide
support in 1984. The economic dependency is less than the ADR by about 56 percent confirming the fact that in Ethiopia persons outside the conventional working age (15–64) are involved in the production of economic goods and services.

### 2.3 Population Distribution and Urbanization

#### 2.3.1 Population Distribution

Population distribution refers to the manner in which population numbers are spread over a geographical area. One of the measures of population distribution is population density, also known as crude density. This relates the number of people inhabiting a land area to its size. Ethiopia has a land area of 1.1 million square kilometres. The crude density was 67 persons per km² in 2007. This indicates that the overall population density is fairly low in Ethiopia. However, large disparities in the distribution of the population exist among the different parts of the country.

The distribution of Ethiopia’s population is influenced greatly by altitude, climate, availability of good soil, and the presence or absence of infectious diseases such as malaria. These physical factors explain the high concentration of the population in the highlands. About 14 percent of the population lives in areas with an altitude of 2,400 metres above sea level (m asl) or higher, in climates similar to the temperate zone outside the tropics. About 75 percent live between 1,500 and 2,400 m asl where temperature is moderate and the rest live below 1,500 m asl where temperatures are high. The hot zone encompasses more than half of Ethiopia’s territory but contains only 11 percent of the population (Aynalem, undated).

Teller et al. (2007) also state that the Ethiopian population has traditionally been concentrated in the highlands. The highest population density prevails in the Enset Belt which covers Guraage, Hadiya, Kambata and Wolayta Zones of Southern Nations, Nationalities and Peoples Regional State (SNNPRS). Population density in these areas ranges from about 400 to over 600 persons per km². There are pocket areas such as Damot Gale in Welayta Zone where population density exceeded 700 persons per km² in 2005. In the lowland areas bordering Sudan, Kenya and Somalia, population density varies from 2 to 40 persons per km² (see Density Map of Ethiopia, Figure 7). This shows that nearly 80 percent of the population lives on only 37 percent of the total area of the country, while the remaining 20 percent lives on 63 percent of the country’s land area.

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4 *Enset* is a highly productive root crop belonging to the family Musaceae.
2.3.2 Urbanization

The two distinguishing features of urbanization in Ethiopia are the low proportion of the population in urban areas but the rapid rate of urban population growth (Figure 8). In 1960, the urban population was 6 percent of the total population as compared to 7.4 percent for Eastern Africa and 18.7 percent for Africa as a whole. In 1980, the proportion had increased to 10.4 percent compared to 14.7 percent for Eastern Africa and 27.9 percent for Africa as a whole, while in 2007 the proportion in Ethiopia reached 16 percent compared to 21 percent for Eastern Africa and 36 percent for all of Africa. By 2010, the proportion of the urban population is expected to reach
17.6, 23.7 and 40 percent for Ethiopia, Eastern Africa and Africa, respectively (Figure 8). This suggests that the country is still relatively non-urbanized even by African standards.

The average annual rate of growth of the urban population was six percent during the period 1960–65, which was a little lower than that for Eastern Africa (Figure 9). In fact, Eastern Africa maintained a higher average annual rate of growth than Ethiopia in urban population for the two decades from 1960–65 through 1980–85. For Ethiopia, however, there was a sharp decline in the rate of growth of urban population during the same period. It declined from about 6 percent in 1960–65 to 3.6 percent in 1975–80. This decline may have been due to the Military Government’s policy that restricted rural-urban migration. The rate of growth of urban population increased slightly between 1980–85 and 1990–95. Compared to other countries in Eastern Africa, Ethiopia has sustained a higher rate of growth of urban population since the 1980s (see Figure 9).

Urban centres in Ethiopia are characterised by small-sized settlements and the dominance of a single primate city, the national capital, as the main administrative, economic and financial centre accounting for more than a fifth of the total urban population (Table 3). However, the number of urbanized localities has been increasing rapidly. In 1984, there were about 320 localities with a population of 2,000 or more but within ten years, it increased by two-thirds and reached 530 in 1994. In spite of the low level of urbanization, inadequate housing resulting in homelessness or in overcrowded living arrangements, poor sanitation and shortage of health...
and educational services as well as limited employment opportunities are common features of most urban centres in Ethiopia (Teller et al., 2007).

Table 3: Percentage urbanization in Ethiopia, 1984 to 2007 (PHCC 1991 & 1999; PCC, 2008)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban population</td>
<td>11.2</td>
<td>13.8</td>
<td>16.2</td>
</tr>
<tr>
<td>Share of Addis Ababa</td>
<td>31.9</td>
<td>28.8</td>
<td>22.9</td>
</tr>
<tr>
<td>Urban growth rate</td>
<td>--</td>
<td>4.8</td>
<td>3.9</td>
</tr>
<tr>
<td>Population growth rate</td>
<td>2.9</td>
<td>2.8</td>
<td>2.6</td>
</tr>
</tbody>
</table>

According to PHCC’s (1999) medium variant projection, by 2020, one out of every five Ethiopians will be living in an urban area, and by 2030, half of the country’s population will be living in urban centres.

3. Components of Population Change

The size, growth rate and composition of the total population in a country are influenced by the three demographic phenomena, namely fertility, mortality and international migration (immigration-emigration). However, in Ethiopia the two basic factors in determining population changes are fertility and mortality, while the influence of international migration has been found to be negligible (Kebede, 1994): none of the three censuses collected data on international migration. These two basic components of change (fertility and mortality) as well as internal migration (because of its relevance in the population-environment relationship) are discussed below.
3.1 Fertility

Fertility refers to the actual childbearing performance of a population. It is a major explanatory force in population dynamics and a major counteracting force to population attrition through mortality. In the absence of substantial migration, at any level of mortality, changes in fertility cause variations in the rate of natural increase and exert a powerful influence on the age structure (Assefa, 1990; 1991).

There are two major difficulties in studying past trends in Ethiopian fertility. The first is the lack of detailed data describing fertility and its determinants, and the second is that the existing demographic data are plagued by reporting errors typical of less developed countries (Assefa & Allen, 1997; Selome, 2006). Despite these difficulties, data and other information pulled together from a wide variety of sources show that fertility has been changing in Ethiopia.

Fertility in Ethiopia appears to have been increasing beginning from the late seventies or early eighties until the early 1990s and then it declined moderately. For instance, the total fertility rate (TFR) was 5.2 children per woman in 1970, increased to 6.4 in 1990 and to 6.7 in 1994 (Assefa & Teller, 2005). It then declined to 5.5 in 2000 and further declined to 5.4 in 2005.

There is a considerable difference between urban and rural fertility (see Figure 10). While urban fertility has shown a continuous and speedy decline by almost four children per woman between 1984 and 2005 (from 6.3 to 2.4), the decrease in rural fertility was only two children per woman, i.e., from 8.1 to 6 children during the same period. In 2005, rural women had three more children per woman compared to their urban counterparts (6.0 against 2.4). However, because of the fact that nearly 84 percent of the Ethiopian population lives in the rural areas, total fertility for the country as a whole is closer to that of the rural than urban population (5.4 against 6.0).

Urban fertility has been declining since 1990 suggesting an earlier start of fertility transition in urban Ethiopia, while rural fertility has been lagging behind. Early and universal marriage and the high social and economic value attached to children, the depressed status of women and the extremely low use of contraceptives (Assefa, 1992), can explain the high reproductive performance in the population. The recent decline may be due to an increase in the age at first marriage, decline in the proportion of women married in their early teens and increasing use of modern contraceptives.


### 3.1.1 Age at First Marriage

Age at first marriage marks the point in a woman’s life when childbearing becomes socially acceptable. There is an inverse relationship between age at first marriage and fertility in populations where little or no fertility control is practiced and childbearing outside wedlock is uncommon. The earlier marriage takes place, the higher the fertility and vice versa. The median age at first marriage has risen slowly over the last two decades from 15.8 years for women age 35–49 to 16.6 years for women age 25–29 and 18.1 years for the younger cohort (age 20–24) (Figure 11).

### 3.1.2 Percentage of Married Women

According to CSA and ORC Macro (2001), there has been a marked decline in the percentage of women married at the time of the different surveys, from 72 percent in 1990 to 64 percent in 2000. This proportion remained almost the same in 2005 (CSA and ORC Macro, 2006).

The proportion of women married in their early teens has also shown a sharp decline. The percentage of women married by age 15 has declined from 38 percent among women age 45–49 to 12.7 percent among those aged 15–19 in 2005. Close to 71 percent of those aged 45–49 were married by age 18, but this declined to less than 50 percent among the younger cohort (20–24) (Figure 12). Increasing support for and awareness of the importance of female education in the recent past is likely to have contributed to these
changes in pattern of marriage in Ethiopia. In 2000, the Ethiopian government made 18 the minimum legal age at marriage for both men and women (FDRE, 2000). Although this law is not universally adhered to, particularly in rural areas, it can also contribute to rising the age of first marriage for women.
3.1.3 Trends in Contraceptive Use

The use of contraceptive methods tripled, from 5 to 15 percent, during the 15-year period between 1990 and 2005 (CSA and ORC Macro, 2006). However, the mix of contraceptive methods had not improved much as there continued to be a heavy reliance on temporary methods, as observed from the three fertility surveys carried out in Ethiopia (Table 4).

Table 4: Contraceptive method mix in the three surveys, 1990-2005 (CSA and ORC Macro, 2006)

<table>
<thead>
<tr>
<th>Method</th>
<th>1990</th>
<th>2000</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any method</td>
<td>4.8</td>
<td>8.1</td>
<td>14.7</td>
</tr>
<tr>
<td>Any modern method</td>
<td>2.9</td>
<td>6.3</td>
<td>13.9</td>
</tr>
<tr>
<td>Pill</td>
<td>2.2</td>
<td>2.5</td>
<td>3.1</td>
</tr>
<tr>
<td>IUD</td>
<td>0.3</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Injectables</td>
<td>0.0</td>
<td>3.1</td>
<td>9.9</td>
</tr>
<tr>
<td>Condom</td>
<td>0.1</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Implant</td>
<td>NA</td>
<td>0.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Female sterilization</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Traditional</td>
<td>1.9</td>
<td>1.7</td>
<td>0.8</td>
</tr>
</tbody>
</table>

NA = not available

The high fertility in the past was mainly due to early age at marriage and absence of the means for fertility control. Moreover, as children are psychologically, socially and economically valuable in the society, there has been a strong desire for more children. This is changing as children are becoming more and more expensive to bring up and educate.

Their direct economic value at the household level is also declining with more and more children going to school than ever before. The gross enrolment in primary schools, which was 62 percent in 2001/02, had risen to 80 percent in 2004/05 (MoFED, 2006). With increasing population, farm size is decreasing and the need for farm labour is falling. Also the decline in infant and child mortality ensures the survival of most children to adulthood. Thus, there is some indication that a fertility transition that started long ago in urban areas is being extended to rural areas as well.

3.2 Mortality

Mortality is one of the components of population change. It is a general term for the incidence of deaths in a population. In the absence of a civil registration system in Ethiopia, data for mortality estimates are obtained

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5 The average cultivated area per household in the 2007 Agricultural Sample Survey was 0.96 ha (CSA, 2008).
from censuses and sample surveys. As can be seen in Table 5, mortality levels declined in the population during the last decade, with the greatest decline between 2000 and 2005.


<table>
<thead>
<tr>
<th>Measures</th>
<th>Year</th>
<th>1984</th>
<th>1994</th>
<th>2000</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant mortality rate</td>
<td></td>
<td>110</td>
<td>116</td>
<td>97</td>
<td>77</td>
</tr>
<tr>
<td>Under five mortality rate</td>
<td></td>
<td>160</td>
<td>171</td>
<td>166</td>
<td>123</td>
</tr>
<tr>
<td>Life expectancy at birth (years)</td>
<td></td>
<td>52.0</td>
<td>50.7</td>
<td>43.9</td>
<td>51.8</td>
</tr>
</tbody>
</table>

Mortality statistics, such as infant mortality rate and life expectancy at birth, show a decline in mortality in the recent years. Infant mortality rate declined from 116 deaths per 1,000 live births in 1994 to 97 in 2000. It further declined to 77 deaths per 1,000 live births in 2005. Life expectancy at birth slightly shortened from 52 years in 1984 to 50.7 years in 1994, probably because of the HIV/AIDS pandemic. According to the MoH & HAPCO (2007) Single Point Estimate, adult HIV prevalence between 2005 and 2007 was 2.1 percent. HIV/AIDS prevalence is likely to stabilize or begin to decline as a result of the prevention and control measures being taken (Assefa & Teller, 2005). According to the estimates from the Human Development Reports (UNDP, 2002 & 2007/8), life expectancy at birth for Ethiopia was about 44 years in 2000, but the longevity has recently begun to rise reaching almost 52 years in 2005.

### 3.3 Migration

Migration is the occurrence of population movements between countries (i.e., international migration) and within the same country (i.e., internal migration). It involves a change of usual place of residence between clearly defined geographic units. The common forms of internal migration are rural-urban, rural-rural, urban-rural and urban-urban.

Adequate data are lacking to examine the levels and trends in migration in Ethiopia. However, there is sufficient evidence that both temporary and permanent internal movements of people have been a common feature of the Ethiopian society. In the 1960s and early 1970s, for example, partly because of the feudal type of landholding system and low productivity of peasant agriculture, and partly because of the expansion of mechanized farms, tens of thousands of persons migrated to the urban centres and to the cotton and sugar plantations in the Rift Valley to work as seasonal and permanent farm labourers. A substantial number of peasants and pastoral nomads lost their traditional farming and grazing areas when
their lands were taken over by the emerging commercial farmers and many migrated to coffee growing areas to work as coffee pickers or labourers in the expanding large farms of the south and southwest (Assefa, 1994).

In addition to rural-rural migration, significant rural-urban migration also existed in pre-1974 Ethiopia. For instance, it was reported that in the 1970s, rural-urban migration accounted for half of the growth in the urban population in Ethiopia (Hailu, 1982). Although the Military Government imposed restrictions on population movements immediately after the 1975 Land Reform Proclamation, some form of population movement continued throughout the period. The land reform itself pushed many of the previously land owning families and individuals to urban areas by dispossessing them of their land. Local movement of people also continued because of the unpopular and coercive villagization and resettlement programmes of the Military Government in addition to the more extensive movement of the victims of drought and war.

Under the Haile Selassie government, there had also been some small international migration but with the coming to power of the Military Regime in 1974, it tremendously increased. Due to drought, famine and war, population movements across international borders increased substantially. Large numbers of Ethiopians migrated to the bordering countries of Djibouti, Kenya, Somalia and the Sudan as refugees. Many of these returned soon after the Transitional Government was formed in 1991. During the military government, a number of highly trained Ethiopians also went to countries in Europe, the United States and Canada, among others. Many more that managed to get permission to study abroad, particularly in the Russian Federation and Eastern Europe did not return but stayed or moved to countries in the ‘west’.

In fact, Ethiopia has sustained a tremendous loss in trained manpower during the last four decades. Much of the developed world has tailored its immigration policies to accept the educated or those with skills. This institutionalized brain drain poses further and long-term difficulties for the developing world in terms of maintaining social capital and its ability to generate, retain and utilize the highly educated members of its populations, which are very necessary to solve problems and implement development programmes. There are few countries today that are as severely affected by brain drain as Ethiopia is. It is worth pointing out that citizens from neighbouring countries, particularly from Somalia and the Southern Sudan, have also been moving into Ethiopia in large numbers on account of political instability in their own countries (Assefa, 1994).
The migration statistics reported in the 1984 and 1994 censuses stated that out of the total population enumerated by the two censuses, 16.4 and 14.1 percent, respectively, were reported to be migrants (PHCC, 1991 & 1999). In both censuses migrants are those who, in the course of their lives, have lived elsewhere other than the area of enumeration, i.e., where they were ‘counted/recorded’, while non-migrants are those who have resided in the area of enumeration continuously since birth. Table 6 gives the flow of migration in 1984 and 1994 according to the four common forms of internal migration. The level of migration reported in the 1984 Census (16.4%) was reduced to 15.9 percent (Table 6) due to adjusting the calculation for the separation of Eritrea from Ethiopia in 1993\(^6\). According to PHCC (1991), Ethiopia experienced a relatively high level of internal migration in 1984 despite the country’s low economic development, heterogeneous cultures and difficult physical terrain, etc. that could adversely influence population movements. The level of internal migration was reduced almost by two percent in 1994. This means that the growth rate for migration was much lower than the rate of population growth observed during the 10 years between the two censuses (5.4 million migrants in 1984 against 6.9 million migrants in 1994).

**Table 6: Forms of migration in relation to the total migrants and to the total population counts of 1984 and 1994 (PHCC, 1991 & 1999)**

<table>
<thead>
<tr>
<th>Year</th>
<th>1984</th>
<th>1994</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migration form</td>
<td>% of migrants</td>
<td>% of total population</td>
</tr>
<tr>
<td>Rural-Rural</td>
<td>57.9</td>
<td>9.2</td>
</tr>
<tr>
<td>Rural-Urban</td>
<td>27.0</td>
<td>4.3</td>
</tr>
<tr>
<td>Urban-Rural</td>
<td>2.1</td>
<td>0.3</td>
</tr>
<tr>
<td>Urban-Urban</td>
<td>13.0</td>
<td>2.1</td>
</tr>
<tr>
<td>All migrants</td>
<td>15.9</td>
<td></td>
</tr>
<tr>
<td>Non-migrants</td>
<td>84.1</td>
<td></td>
</tr>
</tbody>
</table>

Similar to many other African countries, the dominant form of internal migration was rural-rural migration accounting for 58 percent of the total migrants or 9.2 percent of the total population counted in 1984. The second major form was rural-urban (27%) followed by urban-urban (13%). Of all forms of internal migration, urban-rural accounted for the least, i.e., only 2.1 percent of the migrants or 0.3 percent of the total population. The ranking in the forms of migration remained the same from the first to the second census. However, percentage decreased in the first two dominant forms.

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\(^6\) The population size and the number of migrants (in all forms) of Eritrea and Assab Administration Areas counted in the 1984 Census were deducted as these two areas ceased to be part of Ethiopia and obviously not covered by the subsequent censuses.
and increased in the third and fourth (in rank) forms of migration between the two censuses. These could partly be explained by the two-thirds increment of localities that were recognized as urban (see the section 2.3.2 Urbanization in this review). The other likely reason could be the displacement of people, such as the demobilization of the military, during the change of government in 1991.

4. Population–Environment Nexus
There are various conceptual and theoretical frameworks that often guide current research undertakings on the population–environment nexus. However, reviews of literature on the subject appear to show that the Malthusian and the Boserupian perspectives have dominated such frameworks.

Malthus (1960) put forward the theory that whereas human population has a tendency to grow geometrically, agricultural/food production grows only arithmetically. In this way, population growth tends to outstrip the capacity of agriculture/food production and hence the productive capabilities of land resources to support the population. The result is that ‘positive’ checks, such as famine and increased mortality, or ‘preventive’ checks, such as postponement of marriage and limitation of family size, work to reduce population growth. The Malthusian viewpoint relies on the concept of ‘carrying capacity’, which implies that the ability of land to produce food is limited; and exceeding those limits will result in degradation and declining productivity. In more general terms, the Malthusian viewpoint suggests that limited natural resources place a restriction on population growth. According to UNESA (1994), this viewpoint has been used as a benchmark for much of the popular discussion on population-environment relations, for example Ehrlich & Holdren (1971 and 1974). This viewpoint emphasises the "limits" to population growth.

Malthus had not foreseen the technological changes that have allowed agricultural output to increase faster than population growth. Writing after the agricultural and industrial revolutions, Boserup (1965) took the technological change into account. She suggested that in some cases population growth and resulting increased population density might induce technological changes that allow food production to keep pace with population growth. The Boserupian perspective has had an influence on global and regional research, which examines the relationship between population growth and changes in agricultural production (e.g., Simon, 1981; 1990). Julian Simon went further to suggest that population growth

7 Named after the agricultural economist, Esther Boserup.
may induce sufficient technological change to expand food output faster than population.

The dominance of either Malthusian or Boserupian viewpoints in the discussion of population–environment relations has led to two opposing perspectives—‘limits to growth’ or ‘Cornucopian’ perspectives (Hogan, 1992). These opposing stands and related approaches are the source of variations that shape the analysis and understanding of population-environment relations. Marquette and Bilsborrow (1997) identified the commonalities and differences of the various perspectives and approaches and classified them into five categories as summarized by Marquette (1997) and Panayotou (2000) (Figure 13). A brief discussion of each of these is provided below.

1. **Linear perspectives**
   - Malthus: Population ↔ Environment
   - Boserup: Population ↔ Technology ↔ Environment

2. **Multiplicative perspective**
   Environmental impacts = (Population size) x (Affluence or per capita consumption) x (Level of Technology)

3. **Mediating perspectives**
   - Social, Economic, Political Context
   - Population ↔ Environment

4. **Development dependency perspective**
   - Development Processes
   - Population ↔ Environment

5. **Complex systems perspectives**
   - Ecological Systems
   - Human Systems

Figure 13: Schematic summary of conceptual approaches to population and environment relations (Marquette, 1997)
4.1 Linear views: Malthus and Boserup

Neither Malthus nor Boserup specifically address population-environment relations but rather both deal with the narrow topics of land use and food production. Implications for general linkages between population and resources, however, are frequently inferred from their work and their ideas probably represent the two dominant viewpoints within the topic. Both these perspectives emphasize the reciprocal, linear, and direct relationships, which exist between populations and their environment. Malthusian theory, formulated before the agricultural revolution, presumes that the productivity of environmental resources such as land is fixed.

The Boserupian hypothesis holds that agricultural production increases with population growth owing to the intensification of production (greater labour and capital inputs). As Turner & Shajaat Ali (1996) point out, the main difference between the theories of Malthus and Boserup is that Malthus saw technology as being exogenous to the population-resource condition and Boserup as endogenous.

4.2 Multiplicative perspectives: the "IPAT" equation

The multiplicative approach sees the environmental impacts as the product of population size with the level of affluence or per capita consumption and the level of technology in the form of the now-familiar I=PAT equation. It is, thus, the interaction of population with consumption and technology that determines environmental change (Ehrlich & Holdren, 1971 and 1974; Harrison, 1992; Commoner, 1991 and 1992). In this setup, the environment remains unchanged if population growth is offset by a corresponding reduction in consumption per capita or improvements in technology that reduce waste per unit of consumption. The IPAT equation sees the combined interaction rather than independent effects of population size, consumption, and technology as important in determining environmental change, and this is its shortcoming.

Shaw (1989a, 1989b, 1989c; 1992) has proposed an alternative multiplicative scheme in which the interactive effects between population, consumption, and technology are further spelt out. He distinguishes between ultimate causes, or the driving forces behind environmental impacts, and aggravating factors. In the case of environmental degradation,

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8 IPAT describes the multiplicative contribution of population (P), affluence (A) and technology (T) to environmental impact (I). Environmental impact (I) may be expressed in terms of resource depletion or waste accumulation; population (P) refers to the size of the human population; affluence (A) refers to the level of consumption by that population; and technology (T) refers to the processes used to obtain resources and transform them into useful goods, services and wastes.
consumption and technology are ultimate causes while population is an aggravating factor which increases the intensity of impacts which ultimate causes have on the environment (Shaw, 1989c; Hogan, 1992).

4.3 Mediating perspectives
The *mediating-factor approach* puts forward the theory that not only the magnitude but also the direction (sign) of the effect of population on the environment is determined by other factors, such as poverty, market demands, government policies, and social and cultural factors. These conditions and factors determine whether population growth would lead to technological innovation or to environmental degradation or out-migration (McNicoll, 1990; Bilsborrow, 1992a, 1992b; Schmink, 1994; Marquette & Bilsborrow, 1997). In this perspective environmental change is viewed as a social as well as a natural process.

4.4 Development-dependency perspectives
This approach advocates that it is the development process that mediates the population-environment interface. In particular, the dependency of the South or the North on export markets for natural resources, technology, foreign investment and a variety of other international economic and political dependencies shape both the observed demographic and environmental outcomes (Jolly, 1991; Martine, 1992). In this approach, population growth and environmental degradation are spuriously (rather than causally) related, both being driven by a third factor, the South-North development dependency.

4.5 Complex systems and adaptive strategy perspectives
The *systems approach* to the population-environment relationship combines ecological, socioeconomic and demographic systems into a web of inter-relationships of which the population-environment nexus is only one. In such complex, integrated systems, structural changes along a country’s development path cause non-marginal shifts in population-environment dynamics. The systems approach has been employed both at the macro level (e.g., Hawley, 1986; Cleaver and Schreiber, 1992) and at the micro or household and community level (e.g., Wilk, 1991; Fricke, 1993).

From the perspectives discussed above, the Malthusian and Boseropian approaches present the most straightforward theory on population and environment in that they present clear propositions about relationships. However, their contrasting conclusions have frequently turned research on population and environment into a battleground for an ideological war waged between the so-called ‘Neo-Malthusian’ and ‘Cornucopian’ researchers (Hogan, 1992), the latter advancing the idea that everything is for human beings.
A review of the population–environment debate and analysis uncovers a tremendous variation in findings and interpretations (Panayotou, 2000). One source of the variation is undoubtedly the different historical perspective or vantage point of the various writers (neo-Malthusians versus Cornucopias). A second source of variation among the studies analyzing the population and environment relationship is the diversity of approaches and methods of analysis. Some are linear and static; others are non-linear and dynamic, etc. Recognizing this prevailing situation, Lutz, Prskawetz and Sanderson assembled eight chapters on aspects of population-environment research, ranging from literature surveys to synthetic critiques to case studies, and published a book entitled: “Population and Environment: Methods of Analysis” (Lutz et al., 2002). In this book, the editors characterized population-environment (P-E) analysis “as a chair with four legs”: population dynamics, environmental dynamics, and the influences of each on the other. They suggested that a full P-E study should ideally cover all four aspects jointly. The editors further stated that in the presentation of conceptual models in the P-E field, one typically finds different boxes connected by arrows showing population as a box influencing the environment in another box. They argued:

It seems very strange to think of the human population and the natural environment as two independent autonomous systems. One cannot draw a line about nature and see the human population as outside this line. Nothing is independent of the environment, including the human species, which is part of nature and in all basic life-supporting functions depends on the environment. Rather than viewing population-environment linkages in terms of a linear causal chain of separate boxes, it should be visualized as a series of concentric circles where the inner circles are fully embedded in the broader ones.

The conceptual framework for P-E analysis developed by Lutz et al. (2002) is presented in Figure 14. The innermost circle has the human population classified by individual characteristics, such as age, sex, location, educational, and other socioeconomic characteristics. The next larger circle is called the human-made environment. It includes a wide variety of items from infrastructure, the economy, the government, politics, social structures, traditions and history, technology, and information.

The outermost area contains the natural environment and it includes everything from the levels of troposphere and stratospheric ozone, to biodiversity, to the availability of solid waste dumpsites and the accessibility of mountain views. In order to deal with it in a systematic
manner, it can be classified into broad categories having to do with air, water, land, and other species on this planet.

Figure 14 emphasizes that every life on earth, every economic activity, and every kind of development is embedded in the laws of nature. In this sense, the environment is seen not only as a constraint, but also as the basic life-support system that makes all human life and activities possible. Within the sphere of the human-made environment, people are the agents. They are the ones who conduct the activities, develop routines, traditions, cultures, knowledge, and infrastructure, and change the natural environment.

In the most general sense, the population-environment relationship is about how humans interact with their environment—how they affect and in turn are affected by the environment. This can best be explained by the framework (Figure 14) which puts people at the centre indicating that they are agents or drivers of environmental change and in return people are affected by or they are recipients of the same.
Environmental resources are the foundation of social and economic development as they are the sources of goods and services needed for economic growth. Their mismanagement coupled with their underutilization has so far reduced their contribution to Ethiopia’s overall development. Land is the most critical resource and the basis of survival of all Ethiopians. Overgrazing and the expansion of farming into unsuitable land caused by increasing population without increasing productivity are leaving the land bare. High population density in large areas of Ethiopia has resulted in negative impacts on agricultural production and environmental security. Studies show that due to increasing human and livestock population pressure on arable land and forest resources, large areas of the country, particularly in the northern and central highlands, have highly degraded land where the soil has lost its fertility and there is an overall ecological imbalance. These are major causes for food insecurity and poverty in Ethiopia (MoFED, 2006; see also Birhan Gessesse, as well as Mulugetta Lemenih & Tadesse Woldemariam, this volume).

Terefe Degefa (2001) stated that in agriculture-based economies like Ethiopia, a growing population demands both additional resources and new areas of employment. In the absence of major opportunities in and outside agriculture, population growth causes a decline in the resource-people ratio and depletes resources. This is because people must satisfy their subsistence needs, and thus usually go scavenging for available resources. It is this premise on which explanations of environmental degradation with reference to population factors are based.

The environmental situation of Ethiopia reported in several publications is very alarming and depressing to say the least (e.g., Badege, 2001; Assefa, 2003; Demel et al., 2003; Ermias, 2003; Sahlu, 2004a, 2004b; Mogues, 2007; Tadesse & Masresha, 2007; Getachew, 2008; Melaku, 2008, Abera, 2009; Akilu & Alebachew, 2009). For example Demel et al. (2003) reported that erosion has seriously degraded over 50 percent of Ethiopia’s arable land and projected a grim future:

While the soils in the Ethiopian highlands have a high inherent fertility, the continuous removal of nutrients without replacement as well as the steep and dissected terrain with extensive areas of slopes of over 15%, coupled with the high intensity of rainfall, have led to accelerated soil erosion reaching up to 400 tons/hectare/annum. In 1986, half of the arable land in the highlands has been estimated to be moderately to seriously eroded. Of the remaining half, 50% had soils susceptible to erosion that required proper management. ... At the same time, about 20,000–30,000 hectares of cropland in the highlands is being abandoned annually since cropping can no
longer be supported by the soil. It is projected that land degradation at the present rates could destroy the farmlands of some 10 million highland farmers by 2010.

Assefa (2003) noted that less than three per cent of the country is currently forested and pointed out:

*As population pressure increases, particularly in the highlands, farmers intensively exercise deforestation. This will leave farmlands and grazing lands exposed to erosion, followed by massive land degradation.*

According to data from the agricultural sample surveys conducted by CSA, and compiled in Sørensen & Selome (2009) for ten consecutive years, national production of major crops (cereals, pulses and oilseeds) has almost doubled from 86 to 161 million quintals. Within the same period the area cultivated for crop production increased from 8 to 11 million hectares (Table 7). The increase in crop production may partly be from improved crop yields. However, from the strong correlation of the area cultivated with production of major crops (r = 0.95), it can be concluded that expansion of the area cultivated may mainly account for the increment of crop production during the period. This has happened at the expense of alternative land uses such as forestry, pasture, etc., and with the risk of the further degradation of lands unsuitable for cultivation and forests.

<table>
<thead>
<tr>
<th>Period</th>
<th>Area (ha)</th>
<th>Production (quintals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998–1999</td>
<td>8,016,310</td>
<td>85,838,420</td>
</tr>
<tr>
<td>1999–2000</td>
<td>8,216,700</td>
<td>88,909,960</td>
</tr>
<tr>
<td>2000–2001</td>
<td>9,445,480</td>
<td>106,159,850</td>
</tr>
<tr>
<td>2001–2002</td>
<td>7,813,021</td>
<td>99,361,757</td>
</tr>
<tr>
<td>2002–2003</td>
<td>7,859,494</td>
<td>73,694,452</td>
</tr>
<tr>
<td>2003–2004</td>
<td>8,669,295</td>
<td>103,564,132</td>
</tr>
<tr>
<td>2004–2005</td>
<td>9,811,070</td>
<td>119,068,102</td>
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<tr>
<td>2005–2006</td>
<td>10,170,911</td>
<td>133,821,275</td>
</tr>
<tr>
<td>2006–2007</td>
<td>10,592,755</td>
<td>149,554,981</td>
</tr>
<tr>
<td>2007–2008</td>
<td>10,954,723</td>
<td>161,166,575</td>
</tr>
</tbody>
</table>

5. Conferences, Policies and Legal frameworks on Population

The conference on the *Human Environment*, which was the first world intergovernmental conference on the protection of the environment, was held in Stockholm, Sweden, in June 1972. It led to the Declaration of the UN
Plan of Action for the Environment (UN, 1973). The Declaration affirmed that “the natural growth of population continuously presents problems for the preservation of the environment, and adequate policies and measures should be adopted, as appropriate, to face these problems”. The first global, intergovernmental population conference was held in Bucharest in 1974. The World Population Plan of Action adopted at the United Nations World Population Conference (UN, 1975) put the environmental question in terms of per capita use of world resources. The Plan urged developed countries to adopt appropriate policies in population, consumption and investment, bearing in mind the need for fundamental improvement in international equity (UNESA, 2001).

Environmental issues were not particularly prominent in the overall agenda of the second global conference on population, The International Conference on Population, held in Mexico City in 1984. However, recommendations from the Conference for the further implementation of the World Population Plan of Action (UN, 1984) went beyond the outcome of Bucharest by putting environmental issues as a dimension of the population-development relationship on the global scale. It urged all countries in which there were imbalances between trends in population growth and resources and environmental requirements to implement policies to redress such imbalances. Using language that was to become the cornerstone of the developmental paradigm for the 1990s, namely sustainable development, the Conference emphasized that the formulation of national population goals and policies must take into account the need for long-term environmentally sustainable economic development (UN, 1984).

The United Nations Conference on Environment and Development held in Rio de Janeiro, Brazil, in 1992 was a milestone in the evolution of an international consensus on the relationships among population, development and environment, based on the concept of sustainable development articulated a few years earlier by the World Commission on Environment and Development. The Commission defined sustainable development as development that “meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987). The Rio Declaration on Environment and Development (UN, 1992) identified population policies as an integral element of sustainable development. Principle 8 of the Rio Declaration stated that “to achieve sustainable development and a higher quality of life for all people, states should reduce and eliminate unsustainable patterns of production and consumption, and promote appropriate demographic policies”. Chapter 5 of Agenda 21 (UN, 1993) covered demographic dynamics and sustainability and stated that
“the growth of world population and production combined with unsustainable consumption patterns place increasingly severe stress on the life-supporting capacities of our planet” (UNESA, 2001).

Following the recommendations of the Mexico City and Rio Conferences, the Transitional Government of Ethiopia developed Ethiopia’s Population Policy (TGE, 1993a) with support from the United Nations Population Fund. The Population Policy was launched on the 11th of July 1993 prior to—and probably in preparation for—the 1994 *International Conference on Population and Development* in Cairo. At the time, few countries in Africa had population policies (Sahlu, 2004a).

The major goal of the National Population Policy of Ethiopia (NPP) is the harmonization of the rate of population growth and the capacity of the country for the development and rational utilisation of its natural resources (TGE, 1993a). In order to achieve this goal, the policy set the following general objectives:

(i) closing the gap between high population growth and low economic productivity through planned reduction of population growth and increasing economic returns;

(ii) reducing the rate of rural-urban migration;

(iii) improving the carrying capacity of the environment by taking appropriate environmental protection and conservation measures;

(iv) raising the economic and social status of women by freeing them from the restrictions and drudgeries of traditional life and making it possible for them to participate productively in the larger community; and

(v) significantly improving the social and economic status of vulnerable groups like women, youth, children and the elderly.

In line with these objectives, the policy identified four major areas of population activities requiring priority attention (TGE, 1993a). These were:

(i) improvements in the quality and scope of reproductive health service delivery;

(ii) population research, data collection and dissemination;

(iii) expansion and strengthening of domestic capacity for training in population; and

(iv) expansion of IEC (Information, Education and Communication) activities and social mobilization.
The Environmental Policy of Ethiopia, issued in 1997, is the output of the Conservation Strategy of Ethiopia, a policy document initiated in 1989 and approved in 1997. The policy aims at improving the quality of life of the people through sustainable development of natural as well as cultural resources (Melaku, 2008).

In highlighting the achievements, the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) stated that:

... all regional states have established environmental agencies or have assigned environmental responsibilities to existing agencies. Amhara, Tigray and SNNP Regional States as well as the Dire Dawa City Administration have issued their respective environmental proclamations. The Ministry of Water Resources, the Ethiopian Road Authority and the Ethiopian Electric and Power Corporation have established their respective Environmental Units. The other sectors are also to follow suit as required by the Environmental Establishment Proclamation (MoFED, 2006).

Since population activities are multi-sectoral in nature, they should be complementary with sector policies such as National Health Policy and the National Policy on Women. The National Health Policy (NHP) of the country focuses on expanding access to community-based primary health care services and restructuring the health delivery system as well as strengthening preventive health care services (TGE, 1993b). The NHP gives due consideration to Family Planning (FP) services for the optimal health of the mother, child and family. It also gives due emphasis to improving access to and quality of FP services. The Ministry of Health has adopted a Health Sector Development Program (HSDP), which is a general health care strategy, and an action plan to translate the NHP statement into action (MoH, 1999).

The National Policy on Ethiopian Women integrates gender issues in national development efforts. It advocates mitigation of the impact of inequitable customary laws, increased access of women to economic and productive resources, and better legal back up. The policy also states that “the government shall ensure women the right to have access to basic health care facilities, information about traditional and modern FP methods ...” as one of the strategies to empower Ethiopian women (TGE, 1993c).

The launching of these policies has created an enabling environment for the provision of information and services for family planning.

Since the launching of the National Population Policy, some efforts have been made by governmental and non-governmental organizations (NGOs) to
implement the policy. The NGOs have been encouraged to work and contribute to fulfill the goal of the Policy. In return, the NGOs have provided services in various fields. Most of them have been engaged in reproductive health services, mainly provision of contraceptives, training and services. Prior to 1993, the Family Guidance Association of Ethiopia (FGAE) was the only non-governmental organisation providing family planning services in the country and its services were limited to a few clinics. Since then, however, considerable progress has been made in creating effective partnerships between groups in civil society and government. Not only FGAE’s service delivery points increased dramatically but also several NGOs not previously involved in FP/RH services reoriented their programs and included these services as a major component of their programmes. Thus, at present, according to the list compiled by the Consortium for Reproductive Health (CORH), there are more than 120 NGOs providing FP/RH and related services throughout the country. Some of these NGOs are providing RH services integrated with other development activities while others are providing RH services only. Moreover, a large number of providers from the private for profit sector are also giving RH services.

In addition to the provision of FP/RH services as one of the major areas of policy implementation, considerable effort has also been made in other areas such as removing legal and customary barriers preventing women getting improved economic and social rights. For instance, the 1957 Ethiopian Penal Code (Article 805) that prohibited the widespread use and advertising of modern birth control methods was repealed in 1998. Also, the minimum legal age at marriage increased from 15 to 18 years and affirmative actions are being taken to increase the participation of women in education, employment and decision-making (FDRE, 1998 and 2000).

Legal measures have also been taken to ensure that women are given proper treatment through affirmative action. Consequently, female enrolment in education has been increasing; the number of women assuming managerial roles in the public and private sectors has also been increasing (Assefa et al., 2006).

The sectoral policies that have programmes and action plans for the implementation of activities (e.g., the health, women and education policies) also address certain aspects of the Population Policy. However, no programme or plan of action has been prepared following the formulation of the Population Policy in order to monitor and evaluate its implementation. This has led to the use of un-coordinated donor programs and component projects for partial implementation of the Policy.
Although the policy clearly stated the duties and responsibilities of agencies implementing the National Population Policy at the national and regional levels, these agencies were not given a legal framework in which to operate (Assefa & Sisay, 2004). This has seriously affected the coordination among and execution roles of these agencies. As a coordinating agency, but lacking legal entity, the National Office of Population could not officially deal or negotiate with donors interested in supporting population activities in the country. The same is true with the regional offices of population (Getachew, 2008).

6. Conclusion
The recent demographic trends are a mix of both encouragement and concern. On the positive side, fertility in the urban areas has dropped dramatically, modern contraceptive prevalence has tripled in the past 15 years and age at first marriage risen slowly over the last two decades. Total fertility rate declined from 6.5 children per woman in 1990 to 5.4 in 2005 a decline by more than one child per woman. Very importantly as indicators of overall health and well-being, infant and child mortality have been declining steadily.

On the other hand, rural fertility is still very high; use of contraceptives is very low, with method mix mainly short-term. The population growth rate remains high (almost two million persons added annually) and the speed of the decline very slow—from 3 percent in 1993 to 2.6 percent in 2007. Given the low proportion of the population living in urban areas, this puts more pressure on the natural resources and reduces the size of arable land available per head of the population.

Population and demographic changes interact with environment in a variety of complex ways. The challenge is to identify these complex interactions and effects of population on environment and vice versa. Using the concept of the Population-Environment nexus is found to be a better way to study and analyse the interaction sector-wise or as a whole. It was suggested that a full Population-Environment nexus study should ideally cover all four aspects jointly. That is population dynamics, environmental change, influences of population on environment and influences of environment on population.

It is clear that population pressure, especially in the highlands of Ethiopia, among other factors, contributes significantly to environmental degradation. Well planned, voluntary-based resettlement programs with appropriate infrastructure development should be encouraged to partly address the problem.
Limited rural-urban migration caused by the conditions for maintaining the usury right to land coupled with tenure insecurity and the lack of non-agricultural employment opportunities has contributed to the low level of urbanization in Ethiopia. Although the level of urbanization is very low, the rate at which the urban population is growing is faster than the national population growth rate. This results in more people requiring more of everything including housing, water and other services necessary for a safe and healthy urban way of life. Given the current socio-economic conditions of the country, it is therefore necessary to plan balanced urban growth that gives time for government and relevant institutions to respond to changing conditions and demands.

To sum up: during the last sixteen years of the implementation of the Population Policy, considerable progress has been made in the major areas requiring priority attention. These have had strong influences in meeting the specific objectives of the policy. Nevertheless, a major weakness has been the lack of a mechanism (a programme) to monitor and evaluate its goal, objectives and targets. Still, some achievements have been recorded and these would not have been realized without the Policy. It should, however, be noted that the achievements are attributed not only to the Population Policy in itself, but also to other related policies that have programmes and action plans for the implementation of activities that support and can work synergistically with the Population Policy.

References


Figure 15: Students of Genta Meyche Primary School in front of the trunk of an ancient tree (Photo: Sue Edwards, March 2009)
1. Introduction

Urbanization—both as a social phenomenon and a physical transformation of landscapes—is one of the most powerful, irreversible and visible anthropogenic forces on earth (Masakazu, 2003; UN-HABITAT, 2008). It has been the dominant demographic trend throughout the entire world during the last half century. Uncontrolled/unplanned growth of city and town populations, lack of infrastructure, congested traffic, housing shortages and environmental degradation have become the major issues faced by cities and towns (Mogues, 2007).

Though urbanization is not yet a major problem in Ethiopia, the rate of population growth in urban areas is much higher than in rural areas, mainly due to in-migration. Ethiopia’s regional urban centres, secondary cities such as Adama, Bahir Dar, Mekele, Hawassa, Dire-Dawa and particularly the capital city Addis Ababa are growing at an unprecedented rate (Brooke et al., 2009, Aynalem, 2007). In 2007, 16.1 percent of the population was dwelling in urban areas (PCC, 2008). The environmental impacts of urbanization in Ethiopia include the negative health consequences of crowding and increased exposure to concentrated waste, unsustainable resource consumption and settlement on environmentally fragile land (UNDP, 2004; Alemu & Kohlin, 2008).

Urbanization does not have only local environmental impacts but it also has a large ‘ecological footprint’ beyond its immediate vicinity. Intensive and extensive exploitation of natural resources to support the urban economy includes use of high amounts of energy resources (including fuel wood), quarrying and excavation of sand, gravel and other building materials on large scales, and over extraction and inefficient delivery and use of water. These all contribute to degradation of the natural support systems and irreversible damage and loss of critical ecosystem functions, such as the hydrological cycle, carbon cycle and biological diversity in areas both near and far from the urban centres using the resources. In addition, conflicts can arise with rural users over access to such limited resources. Other effects can be felt further afield, such as pollution of waterways, long-range air

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1 Tadesse Amera (MPH): P.O.Box 7706, Addis Ababa, Ethiopia; e-mail: atadesse2002@yahoo.com
pollution that have impacts on human health as well as on vegetation and soils at considerable distances (Brooke et al., 2009).

A study by UNDP (2004) in five Ethiopian secondary cities (Adama, Hawassa, Bahir-Dar, Jimma and Mekele) indicated that due to urbanization, almost all the secondary cities and the capital city, Addis Ababa, are increasingly plagued by various environmental problems. These include water and air pollution, settlement of low-income groups in highly polluted peripheries and pockets within settled urban areas without the fear of eviction, and widespread removal of vegetation to support urban ecosystems. All these have put additional pressure on nearby areas that may be ecologically sensitive.

2. Energy and Urban Environment in Ethiopia

Energy use is an important aspect of urban environmental sustainability, and environmental burdens are associated with urban energy consumption patterns—whether for cooking, lighting, transport or industry (Masakazu, 2003). Since gas and electricity are too expensive for most households, many of Ethiopia’s city dwellers, as for other East African city dwellers, use other sources of energy including charcoal, firewood and kerosene. This has negative environmental impacts that increasing numbers of urban dwellers will only increase (IHDP, 2005, UN-HABITAT, 2008).

Heavy reliance on biomass fuels, particularly woody biomass and dung, contribute to deforestation, forest and land degradation. This is partly because use of these fuels in urban areas is an important source of cash income for people in both urban and rural areas. (Aynalem, 2007).

A study conducted in seven major cities in Ethiopia by Addis Ababa University's Department of Economics, in collaboration with the University of Gothenburg, found that wood and kerosene were the two most important fuels in terms of their share in total energy expenditure, 31 and 32 percent, respectively. Female-headed households were more likely to choose either solid fuels only (wood and charcoal) or a mix of solid and non-solid (kerosene) fuels as their main fuel. Older household heads were more likely to choose solid fuels only as their main fuel, perhaps from habit as non-solid fuels are relatively more recent and getting increasingly expensive, and younger household heads are more likely to adopt non-solid fuels (Alemu & Kohlin, 2008).

For example in Addis Ababa, the energy used for cooking is mainly kerosene and firewood. Electricity is one of the least used sources because of constraints related to affordability of the equipment and getting a private connection (Wondimu, 2005).
Use of biomass fuels for cooking is a major cause of health problems in developing countries due to indoor air pollution. For example, the World Health Organization (WHO) estimates that 1.5 million premature deaths per year are directly attributable to indoor air pollution from the use of solid fuels (Mogues, 2007). In Ethiopia, nearly all of the households in rural areas and over 20 percent in urban centres depend on firewood for their cooking requirements. These biomass fuels are burnt using smoky and inefficient traditional stoves with very poor combustion in unventilated kitchens producing a high concentration of dangerous pollutants: primarily carbon monoxide and particulate matter, and also nitrogen oxides and polyaromatic hydrocarbons (WHO, 2007). The World Health Organisation (WHO) estimates that exposure to indoor air pollution increases the risk of Acute Lower Respiratory Infections (ALRI) in children and Chronic Obstructive Pulmonary Disease (COPD) in adults.

3. **Biogas Latrines and Their Contribution to Urban Energy and Sanitation**

Biogas digesters are technologies that can produce methane gas for cooking and lighting as well as organic, nutrient-rich bioslurry for use as a fertilizer. Methane is produced by the anaerobic breakdown of organic materials, particularly cow dung, but other organic wastes including sewage can also be fed into well-managed digesters. The resulting bioslurry has a reduced load of parasitic diseases (Tesfaye, 2009) and pathogenic bacteria, but further processing, for example through composting, is needed to eliminate these pathogens (Dereje, 2007).

An over dependence on fire wood and a booming urban population has resulted in a sharp decline in woody biomass in Africa. Some African countries are already deep into an energy crisis while others are faced with an imminent crisis. The ever increasing price of fossil fuels has further aggravated the energy supply crises in the continent. High population pressure and unplanned urbanization driven by poverty is worsening the sanitation situation for urban communities in many parts of the developing world. In Ethiopia, improving the management of human waste, particularly sewage, is inhibited by traditional attitudes so even the meagre facilities installed to improve sanitation are very poorly planned and managed. This situation is accelerating the pollution of soil and water resulting in poor health of the population due to the chronic prevalence of parasitic diseases and pathogenic bacteria (Mogues, 2009).

Biogas has been identified as a possible solution to both the energy and sanitation crises since the 1970s. This technology has not been sufficiently adopted by institutions, businesses and communities to replace dependence
on fossil fuels and wood. In Ethiopia, biogas was introduced into Ambo Agricultural College in 1957/58 in order to generate the energy required for welding agricultural tools and other equipment. Between 1980 and 2000, more than 1,000 biogas plants were constructed by government and non-government institutions, the private sector and communities. Most of these were established for demonstration purposes, and not linked to practical use. As a result, the awareness and uptake of the technology did not go beyond such places (Mogues, 2009). There is now a renewed interest and investment in biogas technology for both households and institutions in urban and rural environments.

4. Air Pollution from Traffic in the Urban Environment

The number of vehicles entering towns and cities in Ethiopia is growing at 20 percent a year. Even so, the road network expansion and improvement is not coping with this increase. According to the study conducted by Abiyu & Getaneh (2009), the total number of vehicles registered in Addis Ababa in the year 2007 was estimated to be 167,391: this figure corresponds to about 75 percent of the total vehicles in Ethiopia. The data also indicated that 53 percent of the total vehicles in Addis Ababa were more than 20 years old. These old vehicles, particularly those with diesel-powered engines, generally have low engine efficiency and consume more fuel per kilometre than modern vehicles, thereby contributing significantly to the air pollution in the city.

5. Water Supply, Sanitation and Hygiene (WASH) in Relation to Urban Environment

5.1 General challenges of WASH

Access to safe drinking water and basic sanitation are essential for the achievement of the Millennium Development Goals (MDGs). It is a fundamental requirement for effective primary health care, increasing enrolment of boys and girls in schools, and a pre-condition for success in the fight against poverty, hunger, child mortality and in achieving greater gender equality.

According to an estimate by the WHO, for every Ethiopian Birr (ETB) invested in safe water and basic sanitation, the economic returns can range from 30 to 340 ETB, depending on the region and the technology. Realizing the targets for clean water supplies, sanitation and hygiene (WASH) will also save many lives. Diarrhoea causes nearly 1.5 million deaths each year, mostly among children under five years old, and is the third largest cause of death from infectious diseases globally, but particularly in the least developed countries including Ethiopia. One child dies approximately every
20 seconds from diarrhoea and about 90 per cent of those deaths could be prevented through safer water, sanitation and hygienic practices (DfID, 2009).

WASH activities in Ethiopia are being carried out through a multi-stakeholder approach coordinated among the Ministries of Health, Water Resources, and Education, UNICEF, WHO, World Bank and a number of NGOs as well as CBOs and the private sector. All the stakeholders work for the realization of the MDGs with the focus on the Universal Access Plan for Water and Sanitation which has a target of 98 percent safe water supply and 100 percent sanitation coverage by the year 2012 (WHO & UNICEF 2008).

The current urban proportion of the Ethiopian population is relatively low at only 16 percent (PCC, 2008) but the annual rate of growth is high at 5.4 percent so this proportion is likely to rise to 30 percent by the year 2020.

5.2 The situation in Addis Ababa
About 31 percent of households in Addis Ababa have no sanitation facilities, while in other urban areas the proportion is about 48 percent (MoFED & UNIDO, 2005: AASBPDA, 2008). The serious deficiencies in sanitation services and the inadequacy of the sewerage infrastructure force many urban dwellers to defecate in open places, such as beside water courses, under bridges, in ‘unused’ plots, etc, in urban areas; this creates dangerous health and other environmental problems. Water courses (rivers and streams) passing through Addis Ababa and other large urban centres have become open sewers and are one of the main sources of infections resulting in the chronic prevalence of diarrhoea and other water-borne diseases. Privacy is almost impossible as communal latrines are shared among many people and even simple doors are often corroded or absent.

5.3 The situation in Dire Dawa
Apart from periodic floods, the water supply for Dire Dawa is very low. According to the Water Supply and Sewerage Authority of Dire Dawa City Administration (DDCA, 2006b), the water supply coverage in 2006 was only 56 percent. The absence of any form of water harvesting either in the town or in the catchment area above the town, increase in the number of inhabitants and the growing number of industries are bringing further challenges to the water supply situation.

Sanitation in Dire Dawa is also a pressing issue. The problem is more pronounced in the informal settlements, but it also affects other residents, as drains fill and get blocked with mud and other urban waste such as plastic bags and bottles during storms and flooding, and maintenance is poor. Of all the houses in the city, 22 percent have no toilet and people use the dry gorges, open ditches and streets to relieve themselves. Only 48
percent of the solid waste is collected. All these and other factors contribute to the worsening of the WASH problem in the city.

5.4 Overcoming the challenges for WASH

Major problems in the urban water supply services of all the urban centres include low production levels, inadequate distribution systems and leakages in many areas: it is estimated that more than 30 percent of the water passing through the distribution network is lost before it reaches its delivery points. Generally, water supply and sanitation issues have not been addressed in an integrated manner either in the past or more recently. Lack of sufficient involvement from project beneficiaries has undermined the success and sustainability of most projects. Promotion of inappropriate technology and experimentation on low cost options has resulted in few sustainable alternatives.

To improve access to safe water and sanitation, the Ministry of Water Resources is working on the Water Sector Development Programme (MoWR, 2002). This comprises five programmes that have set targets for water supply and sewerage, irrigation and drainage, hydropower development, general water resources programmes and institutional capacity building for the country as a whole.

The Ministry of Health has also approved and is working on the Health Sector Development Programme III (HSDP III) giving special emphasis to Environmental Health and Hygiene (MoH, 2006). Seven of the sixteen packages namely: proper and safe excreta disposal system, proper and safe solid and liquid waste management, water supply, food hygiene and safety measures, healthy home environment, arthropod and rodent pest control, and personal hygiene, aim to improve the conditions for effective WASH for urban inhabitants.

6. Solid Waste Management

6.1 The situation in Addis Ababa

Inadequate solid waste management has resulted in the accumulation of solid waste on open lands, in water ways and drains (Figure 1), and in and around the living areas of many people. This is causing a growing public nuisance becoming the source of pests and diseases with foul-smelling pools, environmental pollution through leachates from piles of rubbish, which results in water and soil pollution, and the burning of waste resulting in air pollution, and the clogging of drains. This situation can increase the risk of epidemics, which in turn presents formidable threats to public health and productivity (World Bank, 2004).
In Ethiopia, as in all the other countries of the south, city councils and municipalities have insufficient means to solve the problems of solid waste management. The major source of these problems is the lack of resources in terms of manpower and particularly finances. There is no clear cost recovery structure related to solid waste management in Ethiopia, hence, there is an extremely low level of returns for efforts put into dealing with solid waste. The solid waste management institutions not only lack funds, but their capacity to work in partnership with the local communities is also limited.

Since the year 2001, most municipalities and city councils in Ethiopia have become aware of the negative consequences of poor solid waste management and have devised and implemented a system to collect and dispose of solid waste that involves waste collection associations. A study conducted in 2004 by UNDP in Bahir Dar, Mekele, Adama, and Hawassa showed that their municipalities collected and disposed of 46, 48, 54, and 50 percent of the solid waste generated daily, respectively (UNDP, 2004). At the time of the study almost all of the municipalities used open dumping systems for the collected solid waste. A Solid Waste Management Proclamation was passed by the government in 2007 (FDRE, 2007) but much remains to be done for its implementation.

In the case of Addis Ababa, performance in some aspects of solid waste management is beginning to improve with improvements to the planning and implementation of services since 2003/4 – see Table 1.
Table 1: The amount of solid waste generated and disposed of, in m³, by the AASBPDA and private institutions within the last five years in Addis Ababa

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<tr>
<td>Amount of solid waste generated</td>
<td></td>
<td>760,244</td>
<td>789,134</td>
<td>819,121</td>
<td>850,247</td>
<td>882,557</td>
</tr>
<tr>
<td>Amount of solid waste collected and disposed by the agency</td>
<td></td>
<td>531,258</td>
<td>475,266</td>
<td>493,868</td>
<td>529,189</td>
<td>352,018</td>
</tr>
<tr>
<td>Amount of solid waste collected and disposed by private institutions</td>
<td></td>
<td>13,431</td>
<td>42,090</td>
<td>44,519</td>
<td>86,147</td>
<td>80,553</td>
</tr>
<tr>
<td>Total amount of solid waste collected and disposed</td>
<td></td>
<td>544,689</td>
<td>517,356</td>
<td>538,387</td>
<td>615,336</td>
<td>432,570</td>
</tr>
<tr>
<td>Amount of solid waste unattended</td>
<td></td>
<td>215,555</td>
<td>271,778</td>
<td>280,734</td>
<td>171,969</td>
<td>449,986</td>
</tr>
<tr>
<td>Percentage of unattended waste</td>
<td></td>
<td>28%</td>
<td>34%</td>
<td>34%</td>
<td>20%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Source: AASBPDA, 2003-2008

This was after the establishment of the Addis Ababa Sanitation, Beautification and Park’s Development Agency (AASBPDA) in 2004 (AACG, 2004) and the development of a Sanitation, Beautification and Park’s Development Sectoral Plan (AASBPDA, 2004). By 2008, the Agency had solid waste divisions in all 10 sub-cities and 99 kebele administrations. In addition to AASBPDA, there are now various civil society associations (youth group associations, women associations, etc.), community based organizations, NGOs, private institutions and government offices carrying out different waste management activities. Their activities range from doing primary and/or secondary collection of solid waste to composting, and reusing and recycling various components of municipal solid waste. Though these actors are doing their part to alleviate the problem, no research has
been done to find out more about the exact status of solid waste management in the city.

In Addis Ababa, almost all households have the habit of separating out certain types of solid waste that can either be used for a different purpose, such as bottles or paper, or sold, such as cans and plastic water bottles. In addition to households, some individuals and informally organized groups called ‘quorales’ carryout waste separation in different areas including at the disposal site. But there is no well organized system or organization that frequently collects sorted solid waste items.

On the other hand, different institutions are available that can use the sorted waste. For instance, the paper factory, plastics factory, iron factory, glass factory, and others have a high demand for the separated waste as raw materials. In addition to solid waste pre-collection, this sorting activity can create job opportunities for unemployed people by organizing them to have facilities to purchase the sorted waste from those who bring it. Therefore, waste separation of all types is a good practice that has to be included in the city’s waste management system.

### 6.1 Case Study: Dynamic Sanitary Service

Dynamic Sanitary Service emerged from the pioneer solid waste collectors group called Dynamic Youth, which was established by one motivated young woman (Eden Melkie) who initiated the service by organizing street youth in Addis Ababa. As a pioneering solid waste collector group, Dynamic Youth passed through lots of challenges and now the collection is given to other organized youth and the Dynamic Sanitary Service (a company that emerged from Dynamic Youth) has become a private solid waste management company with 6 waste collection trucks (3 compactors and 3 lifters) – see Figure 2. This company now has 35 permanent and 15 temporary workers and the minimum-maximum salary scale is 300-2,000 ETB per month.

![Figure 2: Dynamic Sanitary Service solid waste collection trucks](image)
Dynamic Sanitary Service has 60 big institutions (hotels, factories, hospitals governmental and non-governmental organizations) as clients and it also takes sub-contracts from the Akaki Kality and Bole sub-cities Sanitation Beautification and Parks Development Agencies to collect the waste that the agencies could not collect. The average collection capacity of the company is 180-200 m$^3$ of solid waste per day for which it gets an average payment of 30 ETB per cubic meter of solid waste.

The company has one compound for sorting of reusable and recyclable waste components, see Figure 3.

![Figure 3: Sorting activities at Dynamic Sanitary Service](image)

Cardboard, paper, plastic and glass are segregated at their compound and sent to the factories which can use these items as raw materials. A small amount of the organic bio-degradable component of the solid waste is used for composting but the larger proportion of it is mixed with other residual waste components to be disposed in the landfill. This is because the plot of land given to Dynamic Sanitary Service for composting was re-taken by the city government. They could, therefore, not continue making compost, which they used to produce and sell to many international organizations including embassies in Addis Ababa. The land policy of the City Region and the process by which land is assigned for different purposes is indicated by the company as the main challenge they are facing.

The cars they have; the cooperation they get from AASBPDA, the sub-contracts they are getting from the government, the reputation they have with their clients and their own motivation to work more were indicated by the company as its main strong points.

### 6.2 Challenges of urban solid waste management

The low level of public awareness and lack of consistent separation at the source, particularly from households, results in 70-75 percent of the organic decomposable waste, which can be used for making compost or producing methane to generate energy, being taken to the landfill/dumpsite. The challenges for operators in solid waste management include:
There are also challenges coming from the producers of solid waste at all socio-economic levels as well as the industries and service producers. These include:

- lack of promotion and education on waste reduction, recycling, recovery, composting and energy generation;
- rapid, basically unplanned, increase in the populations of cities through both births and rural-urban migration increasing the volume of the waste generated; and
- communal containers are not properly collected and emptied when full, causing the areas around skips to become littered and foul smelling, thus encouraging illegal dumping.

Furthermore, complications in effective solid waste management result from the geographical layout, lack of proper access roads and the terrain of many urban areas that make some neighbourhoods, particularly the most densely populated areas, inaccessible for waste collection.

7. Urban Agriculture

Urban agriculture is a proven means of livelihood and source of food for many urban dwellers, particularly low-income households in developing countries. However, its contribution towards urban food security and sustainable livelihoods has never been clearly recognized, simply because urban agriculture is largely assumed to be a poor replacement for rural agricultural activities. Therefore, it is not encouraged and built into the planning process as cities develop. As a result, the sector has never received the support it deserves. But in recent years in Ethiopia, urban agriculture has gained in popularity and is being promoted as a means of sustaining the livelihoods of poor and otherwise unemployed urban dwellers (Gete et al., 2007).

As is the case in Ethiopia, urban agriculture can be characterized in to three farming systems on the basis of location. These are the peri-urban, household or homestead gardening, and vacant-space cultivation. The peri-urban cultivation takes place on lands just outside the built up areas of the
city. Vacant-space cultivation is done in open spaces usually in residential areas, beside water ways (natural and man-made such as drainage channels), and road sides. Household or home gardening takes place within and around homes (AAUAD, 2006). Households from all income levels carry out urban agriculture, but for the very poor this activity is very crucial for their food security and improved nutrition. As there is no social security for the unemployed who are therefore chronically food insecure, urban agriculture can provide them with some essential cash income.

Even if urban agriculture is being practiced in all the major urban areas of Ethiopia, data are available only for the capital, Addis Ababa. Urban agriculture in Addis Ababa is a traditional practice that is taken as a means of livelihood especially for low income communities and it is practiced in a formal and informal manner with practitioners utilizing their spare land at home, beside rivers, and in idle public land. Compound guards are often found cultivating small patches, particularly with 'gomen', next to their guard posts. However, general observations indicate that informal roadside cultivation, except for ornamental plants, is not taking place in Addis Ababa, particularly when the situation is compared with that in Nairobi, Kenya, where it is prevalent. In terms of spatial occupation, urban agriculture in Addis Ababa covers about 16,000 hectares of which 11,182 hectares are intensively cultivated. The sector is known to involve some 50,000 people who get their livelihoods from this work (Gete et al., 2007).

The main agriculture activities in the city are crop production (field crops and vegetables), raising and keeping animals (particularly dairy cows and chickens), bee keeping and ornamental plants. This sector provides employment, food security and enhances the nutrition at household level through the production of fresh vegetables, dairy products, etc within the city. The city has a suitable agro-ecology for production of temperate vegetables. Thus, urban agriculture activities can be practiced in all the ten sub-cities of Addis Ababa, although the potential varies from one sub-city to another. Sub-cities such as Akaki Kaliti, Bole, Nefase Silk Lafto, Kolfe Keranyo and Yeka have the highest potential to practice urban and peri urban agriculture either because they are towards the periphery of the city or have better quality housing and planning with more open spaces, where as the other sub cities have a lower potential due to their congested settlement pattern (AAUAD, 2008).

7.1 Urban agriculture policy in Ethiopia
Even though there is no published policy for urban agriculture, the city government of Addis Ababa has a positive outlook and recognizes its benefit and contribution to the city’s development effort. Urban agriculture is considered as one of the land use components in the 10-year structural plan
of the city, 2001-2010. The plan reserves 7,175 hectares of land for urban agriculture, representing 13.82 percent of the total land within the city. The city council has also established the Urban Agriculture Department under the Addis Ababa City Administration Trade and Industry Development Bureau to provide agricultural extension services. The City Council supports the sector by allocating it an annual budget and other facilities. Sub-city urban agriculture offices are also established in their respective sub-cities to assist the local communities and individuals interested in practicing urban agriculture.

7.2 Challenges of urban agriculture

Despite the positive attitude of the Addis Ababa City Administration, groups and individuals wishing to take up urban agriculture as an income generating activity face a number of challenges. These include:

- the City’s Land Use Policy still considers the contribution of urban agriculture as secondary to other economic activities within the city;
- lack of technical assistance such as improved and appropriate technologies for intensification of production;
- lack of research support on urban agriculture in order to generate new technologies and methods of work;
- lack of incentives and/or support to encourage the sector considering its contribution towards meeting the needs of the city’s inhabitants, particularly the poor and unemployed;
- the high level of water pollution due to poor coverage by adequate sanitation in many areas, the uncontrolled discharge into the water ways from public toilets, broken sewerage and storm drains, factories and offices, health centres, garages, institutions such as schools and colleges etc., all of which increase the contamination of vegetable products by pathogenic organisms and increase the concentration of heavy metals in the soil that can also be taken up by the crops grown on the contaminated soil;
- lack of skilled technicians for promoting and training urban agriculture skills;
- no clear urban agriculture extension and marketing approach to meet the demands of the urban community, both producers and consumers; and
- challenges to established producers, such as urban dairy farmers, due to resettlement and relocation into unsuitable areas to continue
their enterprise—hence, dairy production is decreasing while the demand for fresh milk is increasing.

8. Urban Green Areas

Green areas can be classified as formal and informal. Formal green areas are open spaces with specific functions and management, such as parks, street gardens, play grounds, sport fields, squares, institutional vegetation cover, private gardens, cemeteries etc. Informal green areas include forest patches, river valleys, urban agricultural and grazing land, open spaces left in housing or other development areas, land reserved in expansion areas (BWUD, 2001). They are termed ‘green’ because they can be used for recreation, beautification and income generation, and are usually associated with some kind of plant cover.

In Addis Ababa, open areas that can be used as green areas are being encroached on by small buildings and micro enterprises, such as shops. This creates serious problems for urban dwellers to live in an area with access to a clean and green environmentally friendly place as is their right clearly put in the Ethiopian Constitution. This negative situation contributes to undermining the quality of life for the people by diverting their behaviour towards immoral, unhealthy and dangerous actions. Though the problem is found in all urban areas of the country, the case of Addis Ababa is the best known.

Demographic data from the 2007 Population Census showed that Ethiopia is a country of young people with 66 percent of the population of 74 million younger than 25 years old. If those aged 25-29 are also included, this gives 74 percent of the population, or 55 million children and youth. This balance is also found in the Ethiopian urban youth population with 51 percent aged 15 to 19, but that of Addis Ababa being 56 percent (ISD, 2009). These young people present an enormous potential for Ethiopia to lift itself out of poverty and into a path of sustainable development. However, the resources (economic and social) available to help them realize this role, both in the rural and urban environments, are very limited.

Despite the government’s considerable efforts to construct blocks of apartments, called ‘condominiums’ for people of low-income backgrounds, the plan does not consider the social value of green areas for recreation and play grounds, especially for children and the elderly. This forces many children to stay at home and have excessive access to television and radio rather than having social interaction and playing with their age mates in play grounds. Similarly, the elderly cannot find a convenient and clean place to meet and enjoy each others’ company.
Neighbourhood Green Areas, which include play-lots, playgrounds or playing fields, need to be made available for population sizes of about 1,500, 5,000 and 10,000 inhabitants, respectively. These areas are very critical for providing the settings for diversified socio-cultural activities, including as places to play formal and informal games. Such areas are most frequently accessed by children and elderly people. Addis Ababa is not, however, lucky enough to have these critically important spaces included as one of its main components for healthy livelihoods. The trend is for more and more condominium construction without any consideration for the inclusion of playgrounds. This can easily provide a negative environment where youngsters can be led into substance abuse and the development of other anti-social and violent behaviour.

The area covered by trees (termed ‘forest’), mostly eucalyptus, in Addis Ababa is 7,734 hectares. This is about 15 percent of the total area covered by Addis Ababa, but only 35 percent of the planned green border for the city. This shows that the city is lagging by 65 percent on its green areas target. The recent intensified boost to construction activities in the town is taking away even the remaining rudimentary green areas. The existing traces of indigenous forest in some of the older church compounds are now being indiscriminately chopped down to make way for burial space and business buildings. However, it is wise to acknowledge the contribution of the Ethiopian Orthodox Church for its stand in conserving indigenous forest for different ritual purposes and a basic respect for nature (Wondimu, 2007).

The public park coverage of Addis Ababa is estimated to be only 196 hectares (AASBPDA, 2003-2008). This amounts to only 0.7 m²/person, which is by far below the minimum standard of 5 m²/person indicated by Wondimu (Wondimu, 2007). Public parks, however, are important for a range of services including providing places to hold weddings and other gatherings. They also generate income from entrance fees, restaurants, nursery sites, and provide employment.

The Addis Ababa City Development Plan for 2001-2010 designated 3,000 hectares of the city’s land for developing public recreational parks, but by 2009, no evidence of this plan being put into operation could be seen. If this plan was implemented, it would increase the ratio of green area to 8 m²/person. The estimated population during the planning period was 3.8 million (Wondimu, 2007).

The probable causes for the deterioration and degradation of green areas in Addis Ababa are:
lack of proper planning (including scaling up), implementation, monitoring, and evaluation of the activities related to the use and conservation of green areas;

a wrong perception by decision makers in particular and the public in general about the purpose of green areas and their relation with other development spaces;

a ‘tragedy of the commons’ situation in which a resource that belongs to everybody is nobody’s responsibility;

illegal settlers;

use for illegal dumping of waste and as open toilets; and

invasion by residential and/or commercial development activities.

Green areas are usually mentioned in plans for Addis Ababa while, in practice, they are absent on the ground. This has many negative social and cultural impacts on the day to day activities and attitudes of the inhabitants to green areas. In most developing countries, the real challenge is the capacity to implement what is planned at different levels. This bottleneck can be either in financial availability or capacity of skilled people, or both, to implement what is planned.

8.1 Trends in the development of green areas

Though there seems that a lot of attention is being given for the green areas in the Addis Ababa City Development Plan, the real situation is the opposite. More than 10,000 hectares of the planned green area has already been used for purposes other than its original intended use. In all corners of the city, the situation is getting worse and worse (Wondimu, 2007). At the same time the availability of other recreational facilities is also very limited. For example, the availability of sports’ facilities in Addis Ababa is one for every 21,700 people (CGAA & CGAAS, 2004). Although not specifically studied, it is highly likely that this situation can be found in all of the other main urban centres of the country.

References


MoH (2006), Health Sector Development Programme III (HSDP III), Ministry of Health, Addis Ababa, Ethiopia


1. Introduction

The Ethiopian energy sector relies on a limited range of energy sources the use of which has a substantial impact on the local environment. Traditional biomass sources (wood, crop residues and cattle dung) supply 94 percent of the total energy requirement with petroleum and electricity meeting the rest. Provision of electrical power is dominated by large hydropower plants, while the modern transport sector is exclusively petroleum based. Access to modern energy services is very low: about 30 percent for petroleum and electricity. Efficiencies in energy production, distribution and use are low and result in considerable losses. Reliance on the use of natural resources has contributed to significant local environmental impacts including land degradation of forests and other woody vegetation, soils, water, and indoor air pollution which has considerable negative health impacts on children and women.

The challenges for the Ethiopian energy sector are significant but manageable. These are being addressed by state and non-state actors at the policy, institutional and operational levels. Both Federal and Regional governments are engaged in developing activities for sustainable resource management, increasing energy access, and improving energy use efficiencies. Non-government actors are contributing to the policy debate, promoting resource conservation, providing technical assistance, and raising awareness.

2. Energy Resources

Ethiopia’s energy resources are principally renewable: biomass, hydro, wind, solar, and geothermal. Proven fossil fuel resources include coal, natural gas and oil shale that are limited in diversity and volume, and have yet to be exploited. Table 1 summarizes the information available on the indigenous energy resources potential and their annual utilization as in 2008.

Energy from biomass (bioenergy) comes mostly from wood, cattle dung and agricultural residues. This is the most important source of energy meeting more than 94 percent of the total energy demand in the country. Gross annual yield for bioenergy is estimated to be about 96 million tonnes.

1 Ethio Resource Group (ERG), Addis Ababa
Bioenergy is predominantly used for domestic and commercial cooking. The proportion of cattle dung and agricultural residues in the total bioenergy supply has increased over the past several decades due to diminishing access to wood for fuel by rural households (EEA, 1989).

Hydropower is the main source of electric power in Ethiopia. The exploitable hydro energy potential is estimated to be about 159 TWh/year (Terra Watt hour/year). Nearly 50 percent of this resource is in the Abay River Basin and 22 percent is in the Omo-Gibe River Basin. By 2007/08, only about 3.6 TWh/year, or 2.4 percent of the exploitable potential was being used. Hydro energy generation is expected to rise to 8.5 TWh in 2010 and 16.5 TWh in 2013, increasing the exploited share to 5 percent in 2010 then 10 percent in 2013 (EEPCO, 2006).

Ethiopia also has substantial resources in wind, solar and geothermal energy. Solar energy is used in small decentralized systems for electricity generation in rural areas and for heating water in the major cities. Wind energy is used for pumping of potable water from deep wells, mainly in the central Rift Valley, and for pumping water for irrigation along the banks of the Omo River. There is one non-functional geothermal electric plant owned by EEPCO with 7 MW installed capacity in the Rift Valley (EEPCO, 2006).

Proven fossil fuel reserves in Ethiopia are limited to coal, natural gas and oil shale. The coal reserve, most of which is located in the Eastern part of the country, is estimated to be about 199 million tonnes. Proven reserves of natural gas (situated in the southeast) are about 4.0 TCF (trillion cubic feet = 10^{12} cubic feet). Oil shale reserves are 168.2 million tonnes.

3. Energy Supply and Use

Bioenergy, petroleum products and electricity make up 94, 5 and 1 percent of the aggregate energy supply in the Ethiopian national energy balance, respectively.

3.1 Bioenergy

Bioenergy comes from wood and leaves used directly as fuel, charcoal, crop residues and cattle dung. It continues to the most important source of energy in both rural and urban areas. At a per-capita biomass energy consumption of 11 GJ (Giga Joule), or 0.7 tonne of wood equivalent^{2}, the aggregate national biomass energy consumption exceeds 50 million tonnes. More than 95 percent of the bioenergy is used for domestic cooking (MoARD, 2002). Rural households mostly use wood and various types of agricultural

^{2} Calculation based on energy balance for 2006
Table 1: Indigenous Energy Resources, their potential and annual exploitation, as in 2008

<table>
<thead>
<tr>
<th>Source</th>
<th>Unit</th>
<th>Potential</th>
<th>Annual exploitation</th>
<th>Exploited percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woody biomass</td>
<td>Million tonnes/year</td>
<td>45</td>
<td>50</td>
<td>111%</td>
</tr>
<tr>
<td>Crop residue &amp; cattle dung</td>
<td>Million tonnes/year</td>
<td>51</td>
<td>8</td>
<td>16%</td>
</tr>
<tr>
<td>Hydropower</td>
<td>GWh (Giga Watt hour)</td>
<td>159,300</td>
<td>3,600</td>
<td>2.4%</td>
</tr>
<tr>
<td>Wind</td>
<td>GWh</td>
<td>100,000</td>
<td>0.10–0.20</td>
<td>~0.0%</td>
</tr>
<tr>
<td>Solar</td>
<td>kWh/m² day (kilo Watt hour)</td>
<td>5.5–6.5</td>
<td>10GWh</td>
<td>~0.0%</td>
</tr>
<tr>
<td>Geothermal</td>
<td>GWhe (GWh) (Giga Watt hour electricity)</td>
<td>3,000 (22,000)</td>
<td>0.0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Natural gas</td>
<td>TCF (trillion cubic feet)</td>
<td>4.0</td>
<td>0.0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Coal</td>
<td>Million tonnes</td>
<td>199.0</td>
<td>0.0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Oil shale</td>
<td>Million tonnes</td>
<td>168.2</td>
<td>0.0</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Notes: Woody biomass stock and yield data is from MoARD (2002; 2005); wind resource estimate is for a wind speed of 7.5 m/s and above wind at 50 m asl and at 5MW/km², and exploited energy is estimated for about 100 deep well wind pumps; solar energy use is based on 6MW installed capacity; geothermal resource is based on 700MWe and 5000MW total capacity at 50% plant factor.

residues while charcoal is used mainly in urban areas. Cattle dung, in the form of dung cakes, is used by both rural and urban households, particularly for baking bread in temporary ovens. Wood for cooking is also used in commercial establishments (i.e. bakeries, hotels, restaurants, local brewing businesses, etc) mostly using inefficient traditional conversion technologies. The tobacco and tea industries make up the major share of biomass demand in the industrial sector (MoARD, 2005).

Demand for bioenergy is generally projected to grow at the same rate as that of the population, i.e., at about 2.7 percent a year in rural areas and 4.5 percent a year in urban areas. However, the share of bioenergy in the energy balance is declining gradually since the demand for petroleum products and electricity are increasing twice as fast as that for bioenergy. It is also due to the increasing penetration of energy efficient household stoves in both rural and urban areas (e.g. Megan Power Ltd., 2008).

Bioenergy is, however, still dominant and the volume of bioenergy consumed is growing steadily at an estimated rate of at least 3 percent a year. The share of crop residues, cattle dung, and charcoal appears to be rising: residues because of diminishing access to wood for fuel in rural areas and cattle dung in the form of dung cakes and charcoal due to increased urbanization and monetization of the rural economy. But, bioenergy conversion and overall end use efficiencies are generally low. Therefore, their contribution in useful energy terms is significantly lower than their aggregate share (ILO, 1986).

### 3.2 Electricity

Electricity production by the Ethiopian Electric Power Corporation (EEPCO) was 3.5 TWh in 2008. Although there are a number of private, municipal and cooperatively-owned small scale power producers in areas not served by the Corporation, their combined contribution is estimated not to exceed two percent of the EEPCO capacity.

EEPCO runs two systems; the Interconnected System (ICS) and the Self Contained System (SCS). The ICS, which generates more than 98 percent of the total supply capacity, comes mainly from a set of large hydro systems with some thermal back up. The SCS is a much smaller system of decentralized mini-grid and off-grid systems supplied by small hydro plants and diesel generators – see Table 2 and Figure 1.

Table 2 and Figure 3 show the rapid increase in the use of electricity by customer class. The most rapid increase since 2004 has been by the industrial sector. However, between 2004 and 2008, the number of domestic, commercial and industrial customers almost doubled in each group.
Table 2: Electricity generation (GWh) by type of system 2004–2008

<table>
<thead>
<tr>
<th>System</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICS</td>
<td>2,263</td>
<td>2,515</td>
<td>2,839</td>
<td>3,260</td>
<td>3,369</td>
</tr>
<tr>
<td>Hydro</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal</td>
<td>16</td>
<td>18</td>
<td>6</td>
<td>10</td>
<td>132</td>
</tr>
<tr>
<td>SCS</td>
<td>16</td>
<td>10</td>
<td>19</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Hydro</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal</td>
<td>23</td>
<td>36</td>
<td>33</td>
<td>36</td>
<td>27</td>
</tr>
<tr>
<td>ICS &amp; SCS</td>
<td>2,318</td>
<td>2,580</td>
<td>2,896</td>
<td>3,310</td>
<td>3,530</td>
</tr>
<tr>
<td>Hydro</td>
<td>2,279</td>
<td>2,525</td>
<td>2,857</td>
<td>3,265</td>
<td>3,371</td>
</tr>
<tr>
<td>Thermal</td>
<td>39</td>
<td>55</td>
<td>39</td>
<td>45</td>
<td>159</td>
</tr>
</tbody>
</table>

Source: EEPCO Statistics

Figure 1: Growth in hydro and thermal power generation, 2004–2008
Table 3: Growth in electricity consumption (GWh) by customer class, 2004–2008

<table>
<thead>
<tr>
<th>Customer</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>626</td>
<td>731</td>
<td>796</td>
<td>999</td>
<td>1,117</td>
</tr>
<tr>
<td>Commercial</td>
<td>455</td>
<td>528</td>
<td>584</td>
<td>663</td>
<td>794</td>
</tr>
<tr>
<td>Industrial</td>
<td>716</td>
<td>804</td>
<td>989</td>
<td>921</td>
<td>1,237</td>
</tr>
<tr>
<td>Other</td>
<td>50</td>
<td>33</td>
<td>40</td>
<td>54</td>
<td>74</td>
</tr>
<tr>
<td>Total</td>
<td>1,847</td>
<td>2,096</td>
<td>2,409</td>
<td>2,637</td>
<td>3,222</td>
</tr>
</tbody>
</table>

Source: EEPCO Statistics

3.3 Petroleum products

Petroleum fuels constitute 5 percent of the total energy consumed in the country. Diesel, gasoline and jet fuel for transport account for about 70 percent of the total petroleum consumed. In the industrial sector fuel oil is used for thermal energy; in the small-scale industry sub-sector diesel is used to run engines for mills, water pumps, and for electrification. In the household sector kerosene is used for cooking in urban areas and for lighting in rural areas.

In 2008, total petroleum consumption was 1.9 million tonnes and the import bill reached Birr 1.6 billion, making 24 percent of the total value of
imports, double the percentage value in 2004 – see Table 4. Figure 3 shows the rise in total value of all imports, petroleum and all exports between 1996 and 2008. By 2007, the value of petroleum imports exceeded the value of total exports for the first time. Petroleum import volume on the average has been rising at 9.7 percent annually in the five years up to 2008; the import bill has risen much faster at 38 percent annually in the same period because of the rising global petroleum price.

Petroleum consumption by fuel types is shown in Table 5, covering 2004-2008, and Figure 4, covering the forty years of 1968 to 2008. This shows that diesel has always been the most consumed fuel with a very rapid increase since 1998. Jet fuel and kerosene are the next two types of petroleum fuels with an increasing demand.

Table 4: Value in million USD of petroleum imports, total imports and exports, 2004-2008

<table>
<thead>
<tr>
<th>Item</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>All imports</td>
<td>2,587</td>
<td>3,633</td>
<td>4,593</td>
<td>5,126</td>
<td>6,811</td>
</tr>
<tr>
<td>Petroleum imports</td>
<td>310</td>
<td>667</td>
<td>860</td>
<td>875</td>
<td>1,621</td>
</tr>
<tr>
<td>Percent petroleum</td>
<td>12</td>
<td>18</td>
<td>19</td>
<td>17</td>
<td>24</td>
</tr>
<tr>
<td>All exports</td>
<td>600</td>
<td>818</td>
<td>1,000</td>
<td>1,185</td>
<td>1,466</td>
</tr>
</tbody>
</table>

Source: National Bank of Ethiopia, Annual Statistics

Figure 3: Value in million USD of petroleum imports, total imports and exports, 1991-2007
Table 5: Petroleum fuel consumption in ‘000 tonnes, 2004-2008

<table>
<thead>
<tr>
<th>Fuel type</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>123</td>
<td>133</td>
<td>123</td>
<td>144</td>
<td>145</td>
</tr>
<tr>
<td>Jet fuel</td>
<td>283</td>
<td>333</td>
<td>356</td>
<td>401</td>
<td>492</td>
</tr>
<tr>
<td>Fuel oil</td>
<td>141</td>
<td>161</td>
<td>158</td>
<td>159</td>
<td>181</td>
</tr>
<tr>
<td>Diesel</td>
<td>678</td>
<td>747</td>
<td>758</td>
<td>904</td>
<td>1,094</td>
</tr>
<tr>
<td>Total</td>
<td>1,225</td>
<td>1,374</td>
<td>1,394</td>
<td>1,608</td>
<td>1,911</td>
</tr>
</tbody>
</table>

Figure 4: Consumption of different fuel types in ‘000 tons over the forty years, 1968-2008

4. Institutional framework

The Ministry of Mines and Energy (MoMENME) is the leading government institution in the energy sector. The Ministry oversees resource assessment and development as well as regulation of the sector through a number of institutions and departments under and within the Ministry. The vision and mission of the Ministry are expressed as follows:

*The MME envisions a future where Ethiopia’s mineral and energy resources are fully developed to support the socio-economic development of the country and where all citizens share the benefits.*
The mission of the MME is to lead and coordinate sector activities for rapid sector development and its activities encompass the following:

- Assess the mineral and energy resources of the country;
- Ensure that development in the sector safeguards the environmental and social assets of the society;
- Develop mineral and energy policies and laws that are gender mainstreamed;
- Create conducive environment for investment in the sector;
- Provide adequate quality energy services at affordable prices;
- Provide support to enhance the competitiveness of agricultural and industrial products in the international market.

The Ministry completed its Business Process Reengineering\(^3\) (BPR) work in June 2009 (MoME, 2009). This identified new work processes as, briefly explained below in Table 6, somewhat analogous to the departments in the previous structure that were focused on functions. A process-based instead of function-based work organization has also been introduced in all institutions under the Ministry (MoME, 2009).

\textbf{Table 6: A summary of the new work processes within the Ministry and institutions under it, from MoME (2009)}

<table>
<thead>
<tr>
<th>Work Processes within the Ministry</th>
<th>This Process, replacing the old Planning and Programming Department, is responsible for policy, planning, and M&amp;E for both mining and energy. The Process is now leading the review of the National Energy Policy.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy, planning and M&amp;E (monitoring &amp; evaluation)</td>
<td>This Process is responsible for regulating the exploration and development of oil and gas in Ethiopia. It licenses explorers and developers, monitors and evaluates their activities. This Process scope is limited to “upstream” activities starting from exploration and ending at development of oil and gas resources.</td>
</tr>
<tr>
<td>Petroleum Operations</td>
<td></td>
</tr>
</tbody>
</table>

\(^3\) Business Process Reengineering (BPR) has been undertaken by all sectors of the Government at all levels and has involved a comprehensive and participatory in depth analysis of the processes (functions, roles, relationships and responsibilities) of the whole system. The aim is to dramatically change the way in which the government conducts its activities for improved effectiveness and efficiency.
### Work Processes within the Ministry

<table>
<thead>
<tr>
<th>Process</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Information (new)</td>
<td>This Process is established with the objective of facilitating integrated sector wide energy planning. The Process will document all energy related information and will serve as a single source of data for all institutions in and outside the Ministry.</td>
</tr>
<tr>
<td>Downstream Petroleum Operations (new)</td>
<td>This Process will regulate “downstream” oil and gas development activities. Downstream activities include petroleum distribution and use. The Process will regulate technical standards (including facilities and fuel quality).</td>
</tr>
<tr>
<td>Biofuel Development Coordination and Support (new)</td>
<td>This process is formed with the objective of coordinating activities of relevant government institutions. It will also support biofuel developers by enabling fast and easy access to resources including land, finance, technologies and market information. The new Process through Stakeholder Forums will coordinate planning, implementation, monitoring and evaluation of activities. A Forum for relevant government institutions is already functional; another forum for other stakeholders is expected to be formed soon.</td>
</tr>
<tr>
<td>Environment and Community Development (new)</td>
<td>This Process ensures that mining and energy development activities adhere to domestic environmental laws and that the interests of local communities are respected. The Process will review EIA (Environmental Impact Assessment) documents of mining and energy developers and will work to maximize local community benefits through community development projects.</td>
</tr>
</tbody>
</table>

### Institutions under the Ministry, each of which have carried out their own BPR

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geological Survey of Ethiopia (GSE)</td>
<td>Resource assessment for underground resources (including energy resources) is carried out by the Geological Survey of Ethiopia (GSE).</td>
</tr>
<tr>
<td>Ethiopian Electric Power Corporation (EEPCO)</td>
<td>EEPCO is a statutory entity established in 1939 and later restructured in 1997 by regulation No. 118/97 of the Council of Ministers. The Corporation is engaged in the business of energy generation, transmission, distribution and sales.</td>
</tr>
</tbody>
</table>
Institutions under the Ministry, each of which have carried out their own BPR

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Ethiopian Electric Agency (EEA)</td>
<td>The Ethiopian Electric Agency is established by proclamation No. 86/1997 with the power and duties to oversee or regulate the generation, transmission, distribution and sale of electricity. The EEA controls quality, standards of electricity and licensing of electricity operators and contractors. The EEA is to be renamed the Ethiopian Energy Agency and thus will regulate not only the electricity sub-sector but also other sub-sectors. The Agency has two main processes: the energy efficiency process, which will promote energy efficiency, and the tariff setting process, which will regulate energy tariffs.</td>
</tr>
<tr>
<td>Ethiopian Rural Energy Development and Promotion Center (EREDPC)</td>
<td>The EREDPC was legally established in 2002 by Proclamation No. 269/2002. The Center is responsible to carry out national energy resources studies, data collection and analysis, rural energy policy formulation, technology development and promotion. The EREDPC is to be renamed as the Ethiopian Alternative Energy Development and Promotion Center (EAEDPC) after the BPR study. This means its mandate is expanded to cover rural as well as urban areas. The Center has two main processes: the technology development process, which is responsible for selection and development of technologies, and the technology promotion process that disseminates technologies to users.</td>
</tr>
<tr>
<td>National Petroleum Reserve Depots Administration (NPRDA)</td>
<td>Strategic petroleum reserves are held by the National Petroleum Reserve Depots Administration. The NPRDA was established in 1997 under Proclamation No. 82/1997 with the main objective of building and administering national petroleum reserves.</td>
</tr>
</tbody>
</table>

5. Major Activities in the Sector

Addressing energy issues at government level in Ethiopia can perhaps be traced back to the late 19th century. The earliest notable intervention in the energy sector was the introduction of eucalyptus trees around the 1890s to address the growing demand for fuel wood and construction material by the population in the emerging capital city, Addis Ababa. Since then, government intervention in the energy sector, including the brief Italian occupation, has been mainly in the power sector.

Power generation first started when Emperor Menelik II introduced a generator set, obtained as a gift from the government of Germany in 1898, to power his palace. In 1903, the Emperor imported the second generator for the purpose of supplying power to machines that were used to print his image on coins. This was the first power generator used for an industrial
application. Later, in the early 1930s, use of electricity was extended to public services such as street lighting.

Biomass, despite its importance as the main source of energy which the majority of the population of the country totally depends on, has long been forgotten to obtain government’s attention. Production and marketing of biomass fuels had always been managed and executed by the private sector until the energy crisis in the 1970s and 1980s.

5.1 Bioenergy
Being the major source of energy in the country, bioenergy has not been given the attention it deserves. Use of this resource has been at the expense of the natural resource base. Compared to the benefits bioenergy gives to the nation, corresponding efforts by governments and other stakeholders for the development of the resource have never matched its importance. Most of the production, harvesting, transport and marketing of bioenergy, mainly firewood and charcoal, have been managed by the private sector involving formal and informal players at various scales. Besides, the annual turnover of the bioenergy ‘industry’ is several hundred millions of dollars and has created one of the largest employment opportunities in the country. Revocation of land ownership in 1975 by the ‘Derg’ government worsened the situation as private plantations and natural forest resources that had been under the control of local communities came under government ownership without effective management resulting in their unsustainable exploitation.

Several bioenergy supply enhancement, fuel substitution and end-use efficiency measures were introduced in the 1980s. These measures were rather emergency reactions than planned proactive measures to tackle the perceived household energy crisis (ILO, 1986). Kerosene was introduced as a household cooking fuel as an interim solution. Households, the service sector and industries were encouraged to shift to electricity for their energy requirements. Both of these measures were introduced to temporarily relieve the brunt of the energy crisis. Several government peri-urban fuel wood plantation programmes with support from international donors, such as the World Bank and the African Development Bank, were introduced in the peripheries of Addis Ababa and around several other major cities in the country as lasting solutions to the household energy problem (EEA, 1989). Following the change of government in 1991, the ownership and management of these plantations has been distributed to regional government organizations (MoME, 1994).

Along with protection, rehabilitation and expansion of plantations, cooking energy efficiency measures were also introduced. Government
organizations, including the Ministry of Agriculture and Rural Development (MoARD), Ministry of Mines and Energy (MoME), and several non-government organizations, have been implementing projects to improve cooking efficiency. The MoARD, under its Rural Technology Promotion Centres and Agriculture Extension structure, has been involved in the dissemination of improved stoves.

One of the emblematic cooking efficiency projects was the World Bank supported “Cooking Efficiency Improvement and New Fuels Marketing Project (CEINFMP)”. It was implemented by the Ethiopian Rural Energy Development and Promotion Centre of the Ministry of Mines and Energy. CEINFMP designed the ‘Lakech’ charcoal stove and the ‘Mirt’ injera stove and established a commercial dissemination strategy for improved stoves. The marketing and commercialisation strategy adopted by CEINFMP can be regarded as a success as the penetration rate for ‘Lakech’ and ‘Mirt’ stoves in Addis Ababa today is about 50 and 10 percent respectively (Megan Power Ltd., 2008). This strategy has now been adopted by regional bureaus and NGOs that are involved in commercial dissemination of improved stoves.

Much of the efforts in bioenergy have been to address the cooking energy problem at the household level. These efforts have also expanded to deal with the cooking energy problems in the commercial establishments, such as hotels, restaurants and commercial injera bakers.

In the industry sector, sugar factories, tea and tobacco processing industries, and brick factories are those that use bioenergy intensively. Much has not been done to improve the end-use devises in this sector. However, as part of the effort to introduce new fuels, increasing the density of biomass fuels such as bagasse, agricultural residues like wheat straw and coffee husk has been tried by the Ministry of Mines and Energy in the late 1980s and early 1990s. Briquetting machines were imported and installed in a few agro-industries, but, due to a combination of several factors, the effort was not a success. Some of these factors were lack of market for the products, supply shortage of biomass—mainly in the case of wheat straw, technical and management issues. Even though briquetting bagasse has not been a success, the sugar industries directly burn bagasse for cogeneration for captive power and thermal requirements (EEA, 1989).

Following the price hike of oil and the world’s focus to find cleaner and renewable sources of fuels, the government, NGOs and the private sector have been promoting the development of biofuels. Fincha Sugar Factory is a pioneer in producing liquid biofuel. It produces ethanol from molasses, a by-product in sugar production. The factory has a capacity to produce 12 million litres of ethanol annually. Currently, annual production of ethanol
at Fincha Sugar Factory is 8 million litres. Much of the ethanol used to be exported at a price lower than the value that it could have got if it were sold locally. Realizing this, the factory around 2002 started blending ethanol with kerosene in equal proportions—the fuel was called K-50—and supplied it to households as a cooking fuel. Since the kerosene wick stoves that households commonly use are not designed to safely burn K-50, the outcome was a total disaster causing several burning accidents. Later on, safe ethanol burning stoves were introduced and distributed to about 2000 refugee households in the eastern parts of the country by the Gaia Association, an NGO working in the promotion of ethanol fuel and clean cook stove in Ethiopia. Since October 2008, much of the ethanol produced has been blended at 5 percent with petrol for automotive fuel.

Apart from sugarcane, the first commercial plantation for biofuel development was around 2004 in Benshangul Gumuz Regional State. The initial plan of the project was to develop 80,000 hectares of land for plantation of jatropha for the production of biodiesel. This project was terminated as the productivity of jatropha was not as expected. Following in the footsteps of the first biofuel developer, several international and national developers found Ethiopia an attractive location for biofuels development. By the end of 2008, there were about 50 registered developers of which about 14 had already started plantations. As interests in biofuels grew both locally and internationally, it was necessary to streamline its future direction for development in Ethiopia. Hence, in 2008 MoME formulated and released the “Biofuel Development and Utilization Strategy” document. Mitigation of climate change is often cited by governments as a key policy goal for biofuels development. In the case of Ethiopia, however, the government is explicit in its objective of promoting biofuels—energy security through the use of biofuels, and improvement of the balance of trade by import substitution and new export market development (MoME, 2008).

Another notable intervention in the bioenergy sector is the ambitious national biogas program (Getachew et al., 2006). This program is initiated by SNV Ethiopia in partnership with the Federal and Regional governments. The program plans to build 14,000 domestic biogas digesters in the rural and semi urban parts of the country. SNV has a success story in Nepal where it supported the building of over two hundred thousand domestic biogas digesters.

5.2 Electricity
In 1936, an Italian power company called Campagni Nazionale Imprezi was established in Ethiopia and started selling electricity to the public for the first time. In the 1940s there were seven diesel-powered generators that supplied electric power to Addis Ababa and seven other towns. Hydro-
electric power generation was introduced by this company for the first time in the country in 1940 with three generators installed at Abu Samuel on the Akaki River with total installed capacity of 3060 kW. The second hydropower plant was constructed in Jimma with a capacity of 120 kW.

After the Italian occupation, Shewa Electric Power was established in 1948 by the government of Ethiopia to take over and manage the existing power generating plants. Shewa Electric Power continued expansion of electricity to other parts of the country. Then in 1955, the Ethiopian Electric Light and Power Authority (EELPA) was established with the main objective of power generation, transmission, distribution and selling throughout the country. EELPA remained to be the sole actor in the power sector until it was restructured in 1997 as part of the power sector reform. After restructuring, EELPA became the Ethiopian Electric Power Corporation (EEPCO) to be engaged in the business of generation, transmission, distribution and sales of electricity. The Ethiopian Electricity Agency (EEA) was also created in 1997 as a regulatory agency in the development of the power sector. The power sector reform also allowed private sector involvement in power generation and sales but limited responsibility for distribution and transmission only to EEPCO (EEPCO, 2006).

EEPCO has remained for a long time as a powerful parastatal monopolizing the power sector. It still sees a centralized electricity grid with large-scale hydropower as the only model for providing electricity access to the people. EEPCO seems to have a biased ideology towards large-scale hydropower showing little enthusiasm to support other suppliers and energy supply options.

The electrification rate in Ethiopia is very low. Access to electricity, according to the official definition in Ethiopia, refers not necessarily to direct connection in a household but to having a low-voltage distribution line nearby. Under the Universal Electricity Access Program (UEAP), EEPCO has the target of providing electricity to over 6,000 towns and villages through a continuous expansion of the national electricity grid with loans obtained from the World Bank. As of 2008, EEPCO announced that under UEAP electricity access had increased to 22 percent of the country connecting 1,700 towns and villages to the grid. On the supply side, in 2008, the total electricity generation installed capacity in the country was 813.8 MW with a total annual generation of 3,600 GWh. EEPCO’s mid-term expansion plan to 2015 aims to increase the generation capacity to 4,475 MW and 10,800 GWh (EEPCO, 2006). With the exception of the recently planned 120-MW wind farm, EEPCO’s expansion plan is based on building more large hydropower plants. It believes that supply security can be ensured through over sizing of
the supply capacity. It also plans to export surplus electricity when the largest plants come online (EEPCO, 2006).

Parallel to continuous expansion of the electricity grid, an off-grid rural electrification program through the installation of isolated or stand-alone systems has been ongoing since 2005. With support obtained from the Global Environment Facility (GEF), a Rural Electrification Fund (REF) was established to support the rural electrification program. REF encourages development and utilization of renewable energy technologies (RETs) through the provision of concessionary loans. However, very few projects have come forth for funding so far as most of such projects hardly become economically feasible without a subsidy to compete with the main supply system.

Renewable energy technologies could play a very important role in providing access to electricity for communities in areas where further expansion of the grid to meet very low and dispersed demands does not make economic sense. However, as of 2008, renewable energy technologies are not put on an equal platform to compete with conventional power generation systems.

Despite lack of a supportive policy environment, solar PV (photovoltaic) systems and micro hydropower schemes have been promoted and used by a few government institutions, NGOs and the private sector. So far, installed capacity for solar PV systems is estimated to be about 5 MW of which about 70 percent is accounted for by the telecom sector providing power to local online telecommunications centres in small towns and villages. Installed capacity for micro hydropower is estimated to be about 6 MW. Renewable energy technologies need a supportive policy environment and important technical and non-technical barriers removed for them to become competitive.

5.3 Petroleum
Up until 1996, crude oil used to be imported and refined in the Asab petroleum refinery plant. Now, only refined petroleum products are imported. Established in 1967, the Ethiopian Petroleum Enterprise (EPE) is a publicly owned parastatal mandated to procure, import and control the wholesale of petroleum products in the country. EPE imports all petroleum products except Liquefied Petroleum Gas (LPG) and lubricants. LPG and

4 Authors’ own estimation based on information obtained from various sources including Ethiopian Telecommunication Corporation, major PV suppliers, and other sources.
lubricant prices are not regulated and are totally in the hands of private businesses.

Distribution of petroleum products was an exclusive business for only four international oil companies: Shell, Total, Mobil and Agip until 2005. Now there are six national and international oil distributing companies in the country. These are Kobil, National Oil Company (NOC), Nile Petroleum Company, Olibya, Total, and Yetebaburut.

Even though petroleum accounts for only about five percent in the national energy balance, it is the single most important provider of energy for the crucial transport and industrial sectors. Since Ethiopia is fully dependent on imported petroleum, the government has developed adaptation mechanisms to mitigate the impacts due to price fluctuations and supply shortages in the international market. The mechanisms introduced are regulation of petroleum fuel prices and transportation tariffs, establishment of a petroleum price stabilization fund, price revision mechanism, and setting up of national petroleum reserves. Because of the social and political implications of petroleum price hikes, the government has to regulate petroleum fuel price and transportation tariffs. The petroleum price stabilization fund serves to dampen the local impact of sudden price surges in the international market.

Use of ethanol as an additive in transport fuel, as described under section 5.1, is also another adaptation mechanism introduced to reduce the impact of petroleum price rises. An ethanol blending plant was set up in 2008 and five percent ethanol has been blended in to gasoline to produce E-5 fuel to augment the transport fuel supply in Addis Ababa. With increased availability of ethanol the government plans to increase distribution of E-5 and a higher percentage of ethanol blended gasoline fuel throughout the country.

It is very important at this stage to consider the promotion of fuel efficient and cleaner vehicles. Most vehicles in Ethiopia are old and consume more fuel per kilometre and emit more pollution wasting fuel obtained with hard earned foreign currency.

6. Issues and Constraints
The Ethiopian energy supply and consumption pattern is dominated by traditional biomass fuels. Despite many years of efforts to increase the share of modern energy sources in the national energy balance, traditional biomass is still the dominant fuel and will remain to be so in the foreseeable future.
The increase in population and economic growth recorded over the last few years have, together, put an unprecedented demand on both traditional and modern energy sources.

Demand for electricity has increased mainly due to the increased coverage of the country by the Interconnected System of EEPCO that provided 1,117 GWh for domestic consumers and the growth in industrial activities that used 1,237 GWh in 2008 – see Table 3 and Figure 2.

Petroleum fuels are mostly used in the transport and industrial sectors. Out of the total of 1.9 million tonnes of petroleum imported into the country in 2007/08 (Table 5), the consumption for cooking and lighting accounted for only about 13 percent while the rest was consumed by the transport and industrial sectors. As Ethiopia is dependent on imported petroleum, the price hike in oil has seriously affected the trade balance. In 2008, the expenditure for oil surpassed the national export earnings – see Figure 3.

6.1 Bioenergy

Heavy reliance on traditional biomass fuels with very inefficient conversion technologies for their use raises several issues that are of critical national concern. The first concern is that most woody biomass comes from an unsustainable resource base and the rate of exploitation is increasing with growing population pressure. Studies made by the Woody Biomass Inventory and Strategic Planning Project (WBISPP) found that there is a woody biomass deficit in over 60 percent of the ‘woredas’ (districts) in the country (MoARD, 2002). In other words, the consumption of woody biomass in these woredas exceeds the sustainable yield. Other biomass sources, particularly cattle dung and agricultural residues are also being over exploited to supply energy instead of being used for soil fertility maintenance in farm lands. This situation is negatively impacting the livelihoods of rural households, local communities and the society as a whole with further consequences for the local and global environment.

The impact of poor resource management on the local and global environment is quite high. Even though greenhouse gas (GHG) emissions from energy conversion alone in Ethiopia is very low compared to that contributed by developed countries, the high rate of depletion of the biomass resources seriously affects the local environment. Flooding, erosion, formation of gullies and loss of productive land are local environmental impacts that many parts of the country are experiencing today as consequences of unsustainable utilization of the resources.

Moreover, over exploitation of the natural biomass resources to meet the ever-increasing energy demand added to the clearing of forests for the expansion of agricultural land, have made the effort of fetching fuel wood
more burdensome as the source gets further and further away from the households where it is used. In Ethiopia, women are primarily responsible for fuel wood collection and preparation of food. Hence, the problem of getting household energy disproportionately affects women. Studies show that about 80 percent of rural travels are made by women fulfilling basic household chores including firewood collection, fetching water and getting grains ground into flour at mechanical mills (ERA, 2004).

In Ethiopia, nearly all of the households in rural areas and over 20 percent in urban centres depend on firewood for their cooking requirements. These biomass fuels are burnt using smoky and inefficient traditional stoves with very poor combustion in unventilated kitchens producing a high concentration of dangerous pollutants: primarily carbon monoxide and particulate matter, and also nitrogen oxides and polyaromatic hydrocarbons (WHO, 2007). The World Health Organisation (WHO) estimates that exposure to indoor air pollution increases the risk of Acute Lower Respiratory Infections (ALRI) in children and Chronic Obstructive Pulmonary Disease (COPD) in adults.

In 2002, the WHO assessed the burden of disease from indoor air pollution at the national level. This evaluation was based on the percentage of the population using biomass fuels and the relative risk of ALRI, COPD and lung cancer when exposed to these pollutants (WHO, 2007). Disability-Adjusted Life Year (DALY)\(^5\) is the measure typically used to quantify mortality and morbidity due to a given disease or risk factor. In Ethiopia, the total DALY attributable to solid biomass use was 1,790,800 life years. It was also reported that a total of 56,700 deaths in 2002 due to ALRI and COPD could be attributed to the use of solid biomass. The percentage of the national burden of disease due to the use of solid biomass in Ethiopia was 4.9 percent in 2002 (WHO, 2007). This corresponds well with the National Statistics reported by the Ministry of Health where acute respiratory infection is the second most prevalent disease following malaria (MoH, 2006). In most cases it is women and children who endure the most prolonged exposure to indoor air pollution and that are disproportionately affected by it.

Biomass as a fuel can be used in solid, liquid or gas forms, but, modern technologies have not been developed in Ethiopia. Previous efforts to promote the adoption of technologies such as biogas and biomass briquettes have not been successful. This has been mainly due to lack of proper

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\(^5\) DALY combines the years of life lost due to disability with the years of life lost due to death.
planning and implementation strategies in previous programmes. However, there is a renewed interest among government organizations and NGOs for the development, dissemination and promotion of modern biomass technologies, including efficient biomass cook stoves, biogas plants, liquid biofuels and cogeneration of bioenergy. Cautious development of modern biomass technology including biofuels which takes the social and environmental consequences into consideration could improve the sustainable utilization of the resource (MoME, 2008).

6.2 Electricity
Access to electricity is limited to urban areas. Under its Universal Electricity Access Programme (EEPCO, 2006), EEPCO increased access to electricity by urban households from 15 percent in 2005 to 22 percent in 2007. For rural areas, access is estimated to have been increased from less than 2 percent to about 5 percent in the same period. Similarly, EEPCO managed to increase electricity per capita consumption from 28 kWh in 2004 to about 40 kWh in 2008/09. Despite this effort, electricity per capita consumption is still the lowest in the world even among developing countries.

Electrification in Ethiopia is mainly through a continuous expansion of the Interconnected System (ICS)—see Table 2. The ICS, as it expands, takes over locations previously served by local self-contained systems (SCS) putting several small-scale power generation plants out of use. The SCS includes much smaller non-EEPCO suppliers such as municipalities, cooperatives and private individuals. Continuous expansion of the ICS raises several important issues.

Due to the high rate of ICS expansion, electricity demand grew faster than EEPCO’s capacity to generate the power. Peak demand and sales in the ICS have grown by about 14 percent since 2005—double the rate prior to 2004. As a result, available capacity is no longer able to meet the demand and EEPCO has been forced to ration power since 2006. The acute power deficit in 2008/09 was partly due to the delay in bringing the new hydropower plants on-line, which had been anticipated to increase the ICS capacity to meet the growing demand. The economic implication of this is quite significant as it is estimated to have cost the country about one percent loss of the expected GDP (gross domestic product) in the 2008/09 budget year (National Bank of Ethiopia).

The electrical power system in Ethiopia has a very low level of diversification with over 95 percent of the power generated from hydro. Moreover, all power plant additions in the mid-term will also come from hydro. In terms of life-cycle cost analysis, hydropower plants can be least
cost options. However, the high capital investment and long period of construction required for hydro plants, as well as their vulnerability to climate change and geohazards should also be seriously considered when planning the power distribution for the country. The abundance of hydropower resources in Ethiopia seems to have made power sector planners overlook other potentially usable resources such as biomass from agro-processing industries, geothermal, and other renewable resources. Diversification of power generation comes at a cost but increases supply reliability and security.

Effective (rural) electrification requires an appropriate energy policy and well-integrated strategy that considers the use of all available sources for energy as well as various cost effective technology options. Along with large scale EEPCO-owned hydro plants, small scale and distributed generation plants from non-EEPCO suppliers (i.e. Independent Power Producers) can play important roles in meeting demands near the point of generation. Such types of plants can be stand-alone or put on-line/integrated into the ICS distribution networks near demand centres which could reduce the load on transmission lines and hence reduce system losses. System losses were as high as 22 percent between 2001 and 2005 (Ethio Resource Group, 2007). As the grid expands, losses are expected to be higher.

The power sector reform, which helped establish the Ethiopian Electricity Agency as a regulatory body in the power sector, also allows independent power producers (IPP) to generate and sell power (MoME, 1994). However, because of the absence of a power purchase agreement (PPA) or feed-in tariff (FIT) law, many community, cooperative and privately owned isolated systems are being made non-functional. Existing self-contained power plants and new independent plants need to get access to the grid so that they can secure their investment through selling power to the grid. However, EEPCO does not incorporate self-contained power plants as it goes into new areas (Ethio Resource Group, 2007).

Expansion of the national electricity grid has a limit beyond which transmission losses and the consumption capacity of new demand centres could make the investment uneconomic. Other supply and supplier alternatives and resource options should also be given favourable opportunities so that they can be put on an equal platform to compete with the existing technologies.

Development of large hydropower units brings social and environmental consequences that can be significant unless properly accommodated. Reservoirs flood large areas that could result in major losses of biodiversity and farm lands, relocation of communities and spread of malaria. Reduction
in the flow of water downstream can affect the livelihoods of the communities living downstream.

6.3 Petroleum Products

Driven mainly by demand from the transport sector, petroleum consumption has increased by about 75 percent from 1.03 million tonnes in 2000 to 1.9 million tonnes in 2008 – see Table 5. The transport sector in 2008, including land and air, took about 75 percent of the petroleum consumption distantly followed by the household/commercial and industrial sectors, each taking 13 and 10 percent respectively. Compared to 2000 petroleum consumption in 2008 by the transport, household/commercial and industrial sectors had grown by 80, 115 and 60 percent respectively – see Table 5 and Figure 4.

The demand for petroleum fuels has been driven mainly by population and economic growth. But, in 2008, it was also partly due to the increased operating hours of the backup thermal generation plants /generators/ following the drastic deficit in and hence rationing of hydropower. The thermal plants in 2008 contributed 132 GWh, which was a ten-fold increase over the previous year (Figure 1). Even though the share of petroleum fuels is less than five percent of the total national energy consumption, the increasing demand and the global price hike for oil have hit the national economy very hard. As a net importer of petroleum, Ethiopia is highly vulnerable to price shocks and supply problems of petroleum in the world market. It is, therefore, the Government’s priority to develop alternative fuels to partially substitute imported petroleum.

The need for improved efficiency of fuel use by the transport sector is of crucial importance both from the economic and the environmental points of view. Efficiency measures should include improved vehicle performance, overall urban traffic management as well as improving existing systems and introducing electrical systems of public transport. Emissions from vehicles are, at present, primarily responsible for the prevailing poor urban air quality in the country (see Tadesse Amera, this volume).

Distribution of kerosene and LPG (liquefied petroleum gas) for household cooking has improved but is still limited to major urban centres leaving biomass to be the only available cooking fuel in all the smaller towns and in rural areas. Kerosene as a household fuel was initially introduced in response to the energy crisis that occurred in the 1970s (ILO, 1986). It was intended to be an interim solution to the then household energy problem while supply enhancement programmes through fuel wood plantations were introduced as lasting solutions. However, many of the supply enhancement efforts could not meet the rapidly rising demand for cooking fuel. Hence, kerosene has become the lasting solution as supply has increased and
distribution coverage widened. The use of kerosene as a household fuel is now seen to be “a step up” in the energy ladder: a progress towards modern fuels. Even though kerosene has played an important role in substituting for unsustainably harvested biomass fuels, overall it has not eased the burden on the resource-base (see Mulugetta & Tadesse, this volume) nor reduced the problem of indoor air pollution. The supply of kerosene to meet the growing demand has also increased the burden on the national economy and the dependency on imported fuel.

Because of the concern about the global environment, the current attitude does not encourage increased consumption of fossil fuels. Sustainable utilization of renewable energy resources is rather the preferred choice. Such a trend will again leave biomass to remain as the major source of fuel in Ethiopia. Energy supply side management and end-use technology options need to be thoroughly assessed in all sectors in order to bring about lasting solutions to the prevailing energy and environmental problems.

7. Recommendations and Future Directions

- Data on the status of the specific resources available in Ethiopia to produce energy and knowledge on technological developments for efficient and effective use of these resources need to be kept up to date and available to planners and other stakeholders in order to make informed decisions about choices of supply options to meet the energy demands for sustainable development of all sectors of the economy.

- Emphasis on improving the current management of the supply of biomass for household energy through the wide scale dissemination of improved stoves and introduction of modern fuels such as ethanol are important intervention strategies to help reduce the unsustainable exploitation of the natural resource base, support recycling of animal dung and agricultural residues for maintaining soil fertility, and reduce the burden of infections in women and children from exposure to indoor air pollution.

- Ethiopia has substantial potential for the development of biofuels. Careful development of appropriate biofuels which considers and avoids negative social and environmental consequences can help address the household and transport fuel crises and associated air pollution as well as environmental problems.

- Demand side management (DSM), with relevant supporting policy, are measures to involve consumers in making decisions to support the development and availability of energy efficient equipment and
other devises. Through appropriate pricing structures, the consumers themselves can help raise the required funds for investment in the development.

♦ Energy planners, including from the electricity power sector, need to investigate potential demand side technologies that can bring improvements in efficiency or energy substitution opportunities such as improving performances of electric motors, replacing electric water heaters and boilers (geysers) with solar water heaters, efficient lighting and cooking appliances, particularly for the commercial enterprises and institutions and small scale enterprises such as bakeries.

♦ An overall assessment of the Ethiopian power sector has highlighted measures that need to be incorporated into its planning. Along with the development of new power plants, measures such as DSM, reduction of transmission losses, and assessment and implementation of alternative resources and supply options need to be considered, including support for independent power producers and self-contained systems that could also help reduce losses.

♦ Appropriate laws need to be formulated so that private investments in the power sector will be encouraged and protected. Power purchase agreements and a feed-in-tariff law should be introduced so that independent power producers can sell power to the grid and improve the electricity supply mix in the grid.

♦ For transport, fuel efficient vehicles and cleaner fuels need to be made available. Moreover, the transportation system should be improved through the development of modes of transport suitable for the country, such as electrified public transport in urban areas.

♦ A better understanding by stakeholders needs to be developed through integrated efforts in capacity building and awareness creation, documentation and exchange of information about resource potentials and technologies.

♦ Although national policies are generally supportive of renewable and other alternative power generation options, implementation strategies need to be developed to encourage development in the sector as realities and priorities are changing dynamically.

♦ Strategic Environmental Assessment must be applied for periodic evaluation of Ethiopia’s policies and regulations. Legal enforcement is also required to ensure that developers carry out EIA
(environmental impact assessment) with proper public participation prior to the commencement of power plant developments and implement EIA measures as outlined in approved EIA documents.

References


Figure 1: Energy efficient rural kitchen in Hitossa Woreda with biogas burner and fuel efficient metad for baking injera (photo Sue Edwards, December 2009)
1. Background

Ethiopia owns diverse vegetation resources, from tropical rain and cloud forests in the southwest and on the mountains to the desert scrubs in the east and north east and parkland agroforestry on the central plateau (Demel et al., 2010). The large terrestrial land surface with biologically productive climate and soil also presents the country with a huge forestry development potential. The forest resources\(^3\) are an important endowment of the country. They contribute production, protection and conservation functions in the form of:

- fertile croplands to sustain agricultural productivity, the mainstay of the country's economy;
- natural rangelands (including forest grazing) to sustain one of the largest national livestock populations in the world;
- biomass for energy;
- diverse non-wood forest products that contribute to subsistence and cash needs of millions of rural and urban households;
- wood and other building materials; and
- herbal medicines to safeguard human and livestock health (Mulugeta, 2008).

The natural vegetation also provides diverse ecosystem services such as protection of soil from erosion, regulation of climate and water flow, protection of watersheds, conservation of biodiversity and storage of large carbon stocks (Tsegaye, 2008). Ethiopia is the world’s only gene pool reservoir of ‘wild’ Arabica Coffee (*Coffea arabica*), and the wild relatives of teff (*Eragrostis tef*). It, and some neighbouring districts in Sudan, also contains important gene pools of wild and cultivated enset (*Ensete...\(^1\) Wondo Genet College of Forestry and Natural Resources, P.O. Box 128, Shashamane, Ethiopia. e-mail: elerohi@yahoo.com

\(^2\) Ethiopian Forest Coffee Forum, P.O. Box 28513, Addis Ababa, Ethiopia.

\(^3\) ‘Forest’ in this review includes the broad range of woody vegetation types from forests of varying complexity with a closed canopy, through woodland with an open canopy to bushland/shrubland where most of the woody plants are multi-stemmed from the base or near the base.
ventricosa), sesame (Sesamum indicum), Niger seed, ‘noug’ in Amharic, (Guizotia abyssinica) and several other globally important crops (Edwards, 1991).

Ethiopia’s forests and other types of vegetation have also been subject to intense human use for millennia, going back at least 5000 years. Ethiopia harbours two of the 34 global biodiversity hotspots, namely the Eastern Afromontane and Horn of Africa biodiversity hotspots. The forest resources, though rich, are severely threatened by degradation. This suggests that past and present management efforts are far from being sufficient to achieve sustainable conservation and use of the country’s biodiversity, although such sustainable management is crucial for the country’s population that relies on this stock of natural resources for the bulk of its economic activities. Overall, vegetation resources in Ethiopia are mined rather than managed and their degradation has reached a critical stage.

Past forest management efforts are characterized by unstable institutional arrangements with frequent restructuring and changes in emphasis stemming, in part, from the ideological and political history of the country. In this article, we have attempted to review the state of the forest, woodland and shrubland/bushland resources, which make up the forestry sector as a whole in its widest sense, from the recent historical past to the present. We have also tried to capture the major characteristics of the various management efforts, policies and institutional frameworks, as well as the challenges encountered by both the resources and the sector.

2. Forests and Other Vegetation Resources

2.1. Vegetation types found in Ethiopia

Diverse vegetation formations exist in Ethiopia. These range from the dry to very dry Acacia and Commiphora bushlands in the arid and semi-arid areas of the northeast, east and south to the tropical rain forests in the southwest and the cloud forests on the eastern escarpment and the mountains. Many attempts have been made to classify the vegetation of the country. By combining features of climate with vegetation formations and species associations, nine broad vegetation types have been recognized (Sebsebe, 1996; CSE, 1997; Zerihun, 2000). These are:

(i) the dry evergreen Afromontane vegetation,

(ii) Combretum–Terminalia (broad-leaved) deciduous woodland,

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(iii) *Acacia-Commiphora* (small-leaved) deciduous woodland,

(iv) the lowland dry forests,

(v) the lowland semi-desert and desert vegetation,

(vi) the evergreen scrub,

(vii) wetland (swamps, lakes, rivers and riparian) vegetation,

(viii) the moist evergreen montane forest, and

(ix) Afroalpine and sub-Afroalpine vegetation.

Table 1 gives the vegetation types with their general location and distribution, characteristic species, as well as extent of human disturbance as of 2008. More detail about these vegetation types can also be found in Sebsebe (1996) and Zerihun (2000).

**Table 1: Vegetation types, location and distribution, some characteristic species and state of human disturbance in Ethiopia as of 2008**

<table>
<thead>
<tr>
<th>Vegetation Type</th>
<th>Location and Distribution</th>
<th>Characteristic Species</th>
<th>Extent of Human Disturbance</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Dry evergreen montane forest</td>
<td>Location and Distribution: from 1500 to 3400 m asl in the central, eastern, south-eastern and northern highlands.</td>
<td>Juniperus procera, Afrocarpus (Podocarpus) falcatus, Prunus africana, Ekebergia capensis, Olea spp., Apodytes dimidiata, Allophylus abyssinica, Euphorbia ampliphylla, Olinia rochetiana, Myrsine melanophloeos, Dovyalis abyssinica, Myrsine africana, Calpurnia aurea</td>
<td>The most extensively inhabited vegetation zone in Ethiopia, where crop cultivation and grazing is widespread; forests have significantly diminished.</td>
</tr>
<tr>
<td>ii) <em>Combretum-Terminalia</em> (broad-leaved) deciduous woodland</td>
<td>Location and Distribution: between 500 and 1800 m asl, confined to western, north-western and parts of south-western lowlands.</td>
<td>Boswellia papyrifera, Terminalia glaucescens, Acacia polycantha, Grewia spp., Stereospermum kunthianum, Acacia polycantha, Sterculia setigera, Oxytenanthera abyssinica, Balanites aegyptiaca, Annona senegalensis, Acacia senegal, Acacia seyal, Combretum adenogonium, Combretum collinum, Combretum molle</td>
<td>Human influence is growing with settlements, mechanized crop cultivation (particularly sesame) and over grazing becoming threats to the vegetation.</td>
</tr>
<tr>
<td>iii) <em>Acacia-Commiphora</em> (small-leaved) deciduous woodland</td>
<td>Location and Distribution: between 900 and 1900 m asl, found in the southern and central Rift Valley, and eastern and south-eastern lowland.</td>
<td>Acacia seyal, Acacia albida, Acacia senegal, Acacia etbaica, Acacia mellifera, Acacia drepanolobium, and other Acacia spp., Balanites aegyptiaca, Commiphora africana, Commiphora myrrha, and other Commiphora spp., 4 Boswellia spp., Moringa spp.</td>
<td></td>
</tr>
</tbody>
</table>
many of which are regionally restricted endemics.

**Extent of human disturbance:** Traditionally occupied by pastoralists and agro-pastoralists, but the woodlands in the Rift Valley are being affected by cropland expansion, overgrazing, drought and unsustainable fuel wood harvest and charcoal making.

<table>
<thead>
<tr>
<th>iv) Lowland dry forest</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location and Distribution:</strong> a special type of forest found only in Gambella Region and adjacent parts of southern Sudan between 450 and 600 m asl.</td>
</tr>
<tr>
<td><strong>Characteristic species:</strong> Acalpha neptunica, Alstonia boonei, Baphia abyssinica, Celtis gomphophylla, Celtis toka, Milicia excelsa, Mimulopsis solmsii, Xylopia parviflora, Acacia mellifera, Combretum spp., Terminalia spp.</td>
</tr>
<tr>
<td><strong>Extent of human disturbance:</strong> Previous threats were mostly from settled refugees and refugee camps, but now expanding due to dams, large scale farming and discovery of oil.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>v) Desert and semi-desert scrub</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location and Distribution:</strong> Areas below 900 m asl, found in the Afar at the northeastern end of the Rift Valley and eastern Somali lowlands.</td>
</tr>
<tr>
<td><strong>Characteristic species:</strong> Deciduous shrubs, mostly <em>Acacia</em> spp., <em>Hyphaene</em> spp., some evergreen shrubs, many in the Euphorbiaceae, succulents and dwarf shrubs ‘forbs’. Patches of <em>Commiphora</em> and <em>Boswellia</em> spp. also exist.</td>
</tr>
<tr>
<td><strong>Extent of human disturbance:</strong> Pastoralism practiced for millennia, now being undermined by insecurity and refugee camps that are considerably affecting the vegetation negatively.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>vi) Wetland (swamps, lakes, rivers and riparian) vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location and Distribution:</strong> Along all the major river valleys, the Rift Valley Lakes, Lake Tana, and other smaller lakes and seasonally inundated valley bottoms of the plateau.</td>
</tr>
<tr>
<td><strong>Characteristic species:</strong> <em>Celtis africana</em>, <em>Ficus sycomorus</em>, <em>Mimusops kummel</em>, <em>Maytenus senegalensis</em>, <em>Acacia</em> spp., <em>Syzygium guineense</em>, <em>Afrocarpus falcatus</em> and others woody species recruited from adjacent vegetation. Also numerous herbaceous species, including many endemic Orchidaceae, Poaceae, and Cyperaceae.</td>
</tr>
<tr>
<td><strong>Extent of human disturbance:</strong> Woody species significantly affected by cutting for fuel wood and construction. Herbaceous species by changes in land use, e.g. expanding rice cultivation and drainage for cultivation of other crops, particularly vegetables.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>vii) Evergreen scrub</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location and Distribution:</strong> Replacing dry evergreen montane forest above 1500 m asl on steep slopes of the highland plateaus.</td>
</tr>
<tr>
<td><strong>Characteristic species:</strong> <em>Euclea schimperi</em>, <em>Dodonaea angustifolia</em>, <em>Carissa edulis</em>, <em>Scolopia theifolia</em>, <em>Rhamnus staddo</em>, <em>Myrsine africana</em>, <em>Calpurnia aurea</em>, <em>Rosa abyssinica</em></td>
</tr>
<tr>
<td><strong>Extent of human disturbance:</strong> Clearing for crop cultivation despite steep slopes and high erosion rates, woody plants collected for fire wood and fencing.</td>
</tr>
</tbody>
</table>
viii) Moist evergreen montane forest

Location and Distribution: the typical high forest (tropical) type of the country found in the south western parts, which are the wettest in the country, and southern slopes of the Bale Mountains; contains the most important timber species of the country.

Characteristic species: Pouteria (Aningeria) adolfi-friederici, Pouteria (Aningeria) altissima, Olea capensis, Prunus africana, Albizia schimperiana, Cordia africana, Mimosops kummel, Wahlenbergia capensis and others.

Extent of human disturbance: Previously inaccessible except by the local people, the moist forest was little affected by modern developments. However, since the 1970s, its rich timber resources have been heavily exploited, there have been extensive settlements from drought prone areas of the country, and many other commercial activities have attracted a huge human influx. It is now under severe threat from over logging as well as conversion into tea and other commercial plantations.

ix) Afroalpine and subafroalpine vegetation

Location and Distribution: Areas over 3000-3200 m asl, on the upper slopes and tops of high mountains in the north, central eastern and south-eastern parts of the country; characterized by temperatures below freezing at night, over 10 C during the day, shallow soils, intense radiation and high rainfall.

Characteristic species: Erica forest with Hypericum revolutum and Hagenia abyssinica at the lower altitudes, i.e. around 3000 m asl; above this clumps of giant Lobelia rhynchopetallum, bushland with dwarf Erica, Alchemilla haumannii and Helichrysum spp. and a taxonomically diverse herb flora including Kniphofia spp., Crassula spp., Aeonium leucoblepharum, Trifolium spp., grasses and sedges, with a high rate of endemism. This vegetation area is a uniquely rich ecosystem with its endemic birds and mammals such as Spot-breasted Plover, Abyssinian Wolf, Mountain Nyala, Walia Ibex and others.

Extent of human disturbance: Although people and their animals have used these areas for grazing for a long time, negative human impacts in this vegetation zone is a recent phenomenon. Population growth and land shortage are pushing people into this harsh and inhospitable environment as is clearly seen in the Simien Mountains National Park and the Bale Mountains ecoregion.

2.2. Spatial coverage and regional distribution of forests

Access to reliable information on the status of a country’s forests is one of the prerequisites for formulating effective strategies because information supports efforts towards sustainable forest management. However, in Ethiopia, like most developing countries, reliable information on the vegetation resources such as their spatial coverage, distribution, changes over time (deforestation or re-growth), growing stock in the standing vegetation, regeneration and recruitment status and other essential information are lacking or difficult to get because it is scattered (Demel et al., 2010). There is no national database, regular resource inventory and monitoring to provide reasonably good and up to date information. Consequently, conflicting statistics are often found in different reports (Table 2).
More importantly, most of the documents reporting on Ethiopian forest resources lack clarity on how, when and who collected them. The work of the Woody Biomass Inventory and Strategic Planning Project (WBISPP, 2004) was the first national inventory that provided reasonably reliable statistics on the forest resources. According to WBISPP (2004), Ethiopia owns a total of 59.7 million hectares covered by woody vegetation among which 6.8 percent are forest, 49 percent woodland and 44.2 percent shrubland or bushland. Regarding regional distribution, Oromiya (62.5%), Southern Nations, Nationalities and Peoples (SNNP) (19%) and Gambella (9%) are the three largest natural high forest owners, while Somali (33%), Oromiya (32%) and Amhara (10%) regions share the largest area of woodlands and shrublands/bushlands (Table 3).

2.3. Productivity, species composition and regeneration status
Overall, the productivity of natural forests and woodlands in Ethiopia is very low due to poor stocking. This has resulted from the continuous and uncontrolled illegal logging that creams off selected timber species, such as Cordia africana, Hagenia abyssinica, Afrocarpus (Podocarpus) falcatus and a few others. Removal of the valuable timber species from the natural forests has degraded the biodiversity and, thus, the productivity and regenerative capacity of the natural forests.

Species richness in the vegetation resources of Ethiopia also varies from as low as five\(^5\) in the lowland woodlands (Dagnew, 2006) to about 450 in the rainforests such as that of Yayu (Feyera, 2006; Feyera et al., 2007; Fite, 2008; Tadesse et al., 2008). Important about the species composition of the vegetation of Ethiopia’s forests is the fact that they harbour important gene pools of several important crops, including Coffea arabica and Afrormomum corrorima, as well as plants supporting beneficial insects and birds such as pollinators. Moreover, the dominance of pioneer species, mostly shrubs like Bersama abyssinica make wood productivity of the high forests very low.

There is heavy human disturbance in the forests from grazing animals, fire and continuous unregulated access for timber and firewood, all of which are negatively affecting their regeneration and recruitment. In the woodlands, fire, unregulated removal of fuel wood and open grazing are the major problems (Berihanu, 1996; Mulugeta et al., 2007; Getachew, 2008).

\(^5\) Species richness refers to number of taxonomically different plant species recorded using plot sampling in a given vegetation type.
Table 2: Forest resource statistics for Ethiopia as provided by different bodies, in chronological order

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (million ha)</td>
<td>Growth stock (m³/ha)</td>
<td>Area (million ha)</td>
<td>Area (million ha)</td>
<td>Area (million ha)</td>
</tr>
<tr>
<td>Natural High Forest</td>
<td>2.3</td>
<td>5.755</td>
<td>4.506</td>
<td>4.072</td>
<td>12.509</td>
</tr>
<tr>
<td>Slightly Disturbed Forest</td>
<td>0.7</td>
<td>90-120</td>
<td>1.680</td>
<td>0.235</td>
<td>-</td>
</tr>
<tr>
<td>Highly Disturbed Forest</td>
<td>1.6</td>
<td>30-100</td>
<td>4.075</td>
<td>4.271</td>
<td>12.509</td>
</tr>
<tr>
<td>Woodlands</td>
<td>5.0</td>
<td>10-50</td>
<td>31.554*</td>
<td>29.24</td>
<td>44.650</td>
</tr>
<tr>
<td>Bushlands</td>
<td>20.0</td>
<td>5-30</td>
<td>26.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plantations**</td>
<td>0.2</td>
<td>0.216</td>
<td>0.216</td>
<td>0.419</td>
<td>22</td>
</tr>
<tr>
<td>Farm Forests</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Relative reliability ranking</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

* both woodlands and bushlands combined; ** the FAO statistics on plantations refer only to productive (commercial) plantations, while the others did not distinguish the type of plantation; NA = data not available.
<table>
<thead>
<tr>
<th>Region</th>
<th>High forest</th>
<th>Woodlands</th>
<th>Shrublands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total (ha)</td>
<td>% of total</td>
<td>Total (ha)</td>
</tr>
<tr>
<td>Oromiya</td>
<td>2,547,632</td>
<td>62.5</td>
<td>9,823,163</td>
</tr>
<tr>
<td>SNNP</td>
<td>775,393</td>
<td>19.0</td>
<td>1,387,759</td>
</tr>
<tr>
<td>Gambella</td>
<td>535,948</td>
<td>13.2</td>
<td>861,126</td>
</tr>
<tr>
<td>Amhara</td>
<td>92,744</td>
<td>2.3</td>
<td>1,040,064</td>
</tr>
<tr>
<td>Tigray</td>
<td>9,332</td>
<td>0.2</td>
<td>294,455</td>
</tr>
<tr>
<td>Beneshangul-Gumuz</td>
<td>68,495</td>
<td>1.7</td>
<td>2,473,064</td>
</tr>
<tr>
<td>Afar</td>
<td>39,197</td>
<td>1.0</td>
<td>163,657</td>
</tr>
<tr>
<td>Somali</td>
<td>4,257</td>
<td>0.1</td>
<td>13,199,662</td>
</tr>
<tr>
<td>Others (Harari, Dire Dawa)</td>
<td>216</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>4,073,214</td>
<td>100</td>
<td>29,242,950</td>
</tr>
</tbody>
</table>
2.4. Production and supply of forest products

Ethiopia’s forest resources, although limited, supply most of the wood products used within the country, and a large volume of diverse non-timber forest products. While most of the industrial wood products, e.g. round wood and sawn wood, come from industrial plantations, the remaining small stands of natural forest are also supplying a quite high volume of industrial wood mostly from illegal harvests. Farm forests (not quantified in Table 2) are supplying the bulk of the poles and posts for the construction industry and some industrial round wood, while fuel wood comes from all types of vegetation with woody biomass—natural high forests, woodlands, bushlands, industrial and peri-urban plantations and farm forests.

In the year 2000, the total biomass in the forests of Ethiopia (natural and plantation) was estimated at 363 million tonnes (79 t/ha), while the total volume was estimated at 259 million cubic metres (56 m$^3$/ha). In the same year, the forests produced 2,459 thousand cubic metres of industrial round wood, 60 thousand cubic metres of sawn wood, 25 thousand cubic metres of wood panels (FAO, 2001a), and about 98 million cubic metres of fuel wood. These figures show that the most significant use of wood in Ethiopia in terms of volume is for fuel. Industrial wood production and supply in Ethiopia is dwindling due to declining forest coverage. For instance, lumber and plywood production have declined from 65 and 1.9 thousand cubic metres in the 1970s to 16 and 1.6 thousand cubic metres, respectively, in early 2000. Consequently, importing has begun to play an important role in balancing the supply and demand for wood products (see 3.1 and Table 5). For instance, in the year 2000, Ethiopia imported 12,000 cubic metres, 7,000 tonnes and 20,000 tonnes of wood-based panels, pulp for paper, and paper and paper boards respectively, at a cost of 15.3 million USD (Mulugeta, 2008).

Besides wood, Ethiopia’s vegetation resources supply large volumes of different non-tree forest products (NTFPs). The most important are forest coffee, gum & incense, and honey & wax (see 3.1 and Table 6). About 30 to 35 percent of the annual coffee production in the country originates from either wild or semi-managed coffee forests (Demel, 1999; Feyera, 2006). A large quantity, an average of 4,107 tonnes, about 2,667 tonnes of which is exported, of gums and resins is harvested annually from the woodlands (Mulugeta 2008). About 56 thousand tonnes of medicinal plants are harvested and used per annum in Ethiopia, most of which are harvested from wild plant stocks. The majority of the Ethiopian population—over 85 percent in rural areas and a very significant number in urban areas—and 90 percent of the livestock herders depend on traditional medicine for their primary health care for themselves and their animals (WHO, 1998). So far,
about one thousand indigenous species, most of which are wild plants, have been recorded to have herbal medicinal applications. These are used in the traditional health care system to treat around 300 physical disorders, from childhood leukaemia to toothaches and mental disorders (Fekadu, 2001, 2007).

Forest grazing and browsing is a major source of feed for the vast livestock population of Ethiopia. It is estimated that 175 thousand square kilometres, or nearly 35 percent, of the rangelands in Ethiopia are covered by mainly bushland and shrubland. Fodder derived from forested areas provides 10 and 60 percent of the livestock feed in the wet and dry seasons, respectively (Mulugeta, 2008). In pastoral areas, grazing and browsing constitute the dominant land use system.

2.5. Deforestation and forest degradation

Deforestation and consequent land degradation are global menaces, and so are they in Ethiopia. However, similar to the problem with forest statistics, there is no reliable source for data on rates of forest degradation and deforestation in Ethiopia. While some historians argue that deforestation has been taking place over thousands of years in Ethiopia (Melaku, 1992, 2003; Pankhurst, 1995; Wöien, 1995; Ritler, 1997; McCann, 1995, 1999; Nyssen et al., 2004, 2009), foresters are arguing that deforestation has accelerated over the last 150 years driven largely by the high growth in the population of the country (Breitenbach, 1962; Pohjonen and Pukkala, 1990; Reusing 1998).

Whether recent or earlier, forests and other natural vegetation resources have been with no significant efforts to reverse the trend. Indeed, even the inadequate database shows the extent of annual loss at national level, and it is very clear that Ethiopia has lost and is continuing to lose much of its vegetation cover. FAO (2005) gives a summary of the general situation for the country – see Table 4.

| Table 4: Changes in the forest resources of Ethiopia from 1990 to 2005, (FAO, 2005) |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Forest          | Other land with woody biomass |
| Area x1000 ha   | Annual change rate x1000 ha | Area x1000 ha |
| 15,114 13,705 13,000 | -141 (-1.0) | -141 (-1.1) | 44,650 44,650 44,650 |
This is clearly seen in the reports from several studies in local regions of the country. For instance, Dereje (2007) investigated forest cover change between 1973 and 2005 in four districts in the south-western rainforest and found a 67 percent decrease over 32 years, which corresponds to 2.1 percent per year deforestation rate. Gessesse and Kleman (2007), working in the Awassa watershed, reported an 80 percent (4.4 percent per year) forest cover decline between 1972 and 2000, which is a comparable rate with the 4.3 percent per year forest decline reported by Kebede (1998) for the Munessa-Shashamane forest. Fite (2008) also reported a forest decline rate of 1.3 percent annually for Yayu forest. In southern Wollo, Kebrom and Hedlund (2000) reported 3 and 14 percent forest and shrubland cover decline between 1958 and 1986. Near Ambo, bush cover and woodlands decreased from 42 to 33 percent between 1957 and 1994 (Van Muysen et al., 1998), while Gete & Hurni (2001) reported a 27 percent natural forest cover disappearance in parts of Gojam since 1957. The report by Reusing (1998) gave annual rates of clearing for agriculture in three regions to be 1.16 percent in Oromiya, 2.35 percent in SNNP and 1.28 percent in Gambella. WBISPP (2004) also analyzed deforestation rates in districts where there are still some natural high forests, and predicted a loss of 1.33 million hectares between 1990 and 2020. This loss accounts for about one percent of the annual decline in the forest resources of the country. Similarly, Reusing (1998) indicated a deforestation rate of 163,600 woody plants per hectare a year between 1986 and 1990 (1 percent per year), and the report of FAO (2005) also indicated a deforestation rate of 0.93–1.04 percent per year between 1990 and 2005. By combining these different studies, it can be shown that Ethiopia is losing an average of 1.0–1.5 percent of its woody biomass annually through deforestation.

Resettlement programs, migration, biofuel development initiatives and ever-present poverty are fuelling the rate of deforestation and forest degradation in Ethiopia. In some regions, resettlement is a major driver of deforestation (Behailu, 2006; Mulugeta et al., 2007). Although the objective of the resettlement program is to assist food insecure households get access to productive farmlands, the strategy, in most cases, is taking place through the clearing of natural vegetation, particularly forested areas. For instance, between 2000 and 2004, about 220,000 household heads or 1.2 million people were resettled in the four National Regional States of Amhara, Oromiya, SNNP and Tigray. These households carved out cropland and made settlement housing by clearing areas of their natural vegetation and using the woody resources unsustainably.
3. Socio-Economic and Ecological Importance

3.1. Contribution to the national economy

From the national perspective, the forest sector plays a number of key economic roles. The contribution of forests, woodlands, shrublands / bushlands and other trees resources to the national economy through exports, import substitutions, employment generation and expansion of the gross domestic production base are considerable (Mulugeta, 2008). The predominant source of energy used in the country is biomass, and forests, woodlands, bushlands and trees outside forests are the major suppliers of this energy. FAO (2005) puts the annual harvest for fuel wood at 109 million cubic metres a year; this makes the industry worth approximately USD 420 million per year (Mulugeta, 2008). Data for the various forest sectors together show an estimated USD 2.02 billion for the total annual gross financial turnover in the forest sector (Table 5), even though this figure should be qualified further as it is not exhaustive.

Ethiopia’s forests and woodlands are also renowned for a number of commercial non-wood forest products (NWFPs). Prominent amongst these are forest ‘wild’ coffee, honey and bees wax, gums and incense, spices and civet musk. These products are exported in large quantities to generate foreign currency (Table 6). In fact, some of the products supplied by forests and other wooded vegetation of the country occupy key positions in the country’s economy (Mulugeta, 2008; Demel et al., 2010).

Coffee, for instance, is synonymous with Ethiopia in terms of culture and economy. It contributes to about 60 percent of the country’s foreign currency earnings; 10 percent of the gross domestic product and supports the livelihoods of around 20 million people in one way or another. Coffee production is predominantly the occupation of smallholder farmers, whose production is mostly forest-based. The three known traditional coffee production systems are forest coffee, semi-forest coffee and forest garden coffee, which account for 10, 35 and 35–40 percent of the total coffee production in Ethiopia, respectively, totalling 80 percent of the total national production (Demel, 1999; Feyera, 2006).

Throughout rural Ethiopia, people extract diverse products from the forests and other wooded areas for consumption and the local market that have never been captured by formal market assessments (Mulugeta, 2009). The value of these forest-derived goods can be seen by reviewing various local level studies.

In Bale, various non-tree forest products provide about half of household annual income (Arsema, 2008; Neima, 2008). Arsema’s study (2008) showed that 47 percent of the annual cash income of households in
Shedem Peasant Association in Goba district is derived from the sale of bamboo. Neima’s study (2008) in the same region reported that various products extracted from vegetation contribute to, on average, 54 percent of total annual household income. In Goba town, annual firewood turnover is worth 8,434,002 ETB (equivalent to USD6 887,790): 70 percent of the firewood is supplied by women. In Bench Maji, 52 percent of annual cash income of households is obtained from non-tree forest products, while in Sheka they contribute to about 41 percent of household income (Mohamed, 2007). In Gore district, 88 percent of households collect non-tree forest products and generate 23 percent of their average annual income of 1,895 ETB (Berhanu, 2004) from them. Such non-timber products also contribute a similar figure of 27.4 percent to the average annual income of households around Menagesha Forest (Aramde, 2006). The mean annual income from beekeeping among households in Walmara (Welmera) district was between 450 and 3,300 Birr (USD 47–347) or 11.6 and 81.9 percent of total household income depending on the wealth status of the household (Debissa, 2006). Revenue from sale of fuel wood, fodder, honey and construction materials is also significant in the livelihoods of households in Dendi district, contributing an average of 39 percent to annual incomes (Getachew et al., 2007). These studies show that at aggregate national level, products from forests and other woody vegetation contribute for over a quarter of annual income of households in Ethiopia. Various species of the genera *Acacia*, *Boswellia* and *Commiphora* that grow in the lowland woodlands are used for extraction of gums and resins, which are important export products for Ethiopia. These products are gum arabic, frankincense, myrrh and opoponax (or sweet myrrh from *Commiphora guidotti*). Ethiopia falls in the gum belt of Africa and is one of the main gum-resin producing countries in Africa. Over the last decade, average annual gum-resin production in Ethiopia was about 4,107 tonnes, while the export quantity stands at about 2,667 tonnes per year, with the rest being important in local markets. The amount of foreign currency earned from the export sale was about USD 3.7 million per year (Mulugeta, 2008).

Ethiopia has a long tradition of honey production intimately associated with forest resources. The forests support apicultural production by providing nectar, habitat for bee colonies, raw material for hive construction and space for hanging hives. There exist an estimated 10 million bee colonies in the country, out of which about 7.5 million are confined in hives and the remaining exist in the forest in wild form. Honey and bees wax production are about 26,000 and 3,000 tonnes per year (Hussein, 2000).

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6 Exchange rate at the time of reporting was 1 USD = 9.5 Eth Birr
Table 5: Annual import, production and consumption quantities and value of wood products in Ethiopia and their related values (Mulugeta, 2008)

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Import</th>
<th>Export*</th>
<th>Production</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit</td>
<td>Quantity (x1000)</td>
<td>Value USD (x1000)</td>
<td>Quantity (x1000)</td>
</tr>
<tr>
<td>Sawn wood</td>
<td>m³</td>
<td>1.8</td>
<td>455</td>
<td>–</td>
</tr>
<tr>
<td>Wood-based panels</td>
<td>m³</td>
<td>15.1</td>
<td>3,913</td>
<td>–</td>
</tr>
<tr>
<td>Veneer sheets</td>
<td>m³</td>
<td>3.1</td>
<td>1,030</td>
<td>–</td>
</tr>
<tr>
<td>Industrial round wood (logs)</td>
<td>m³</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Fuel wood</td>
<td>m³</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Round wood for construction (poles, posts, etc)</td>
<td>m³</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Wood pulp</td>
<td>tonnes</td>
<td>12.0</td>
<td>9,960</td>
<td>–</td>
</tr>
<tr>
<td>Other fibre pulp</td>
<td>tonnes</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Recovered paper</td>
<td>tonnes</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>15,358</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* There is some intermittent export of round wood, e.g. to the Sudan, but quantities are not known (Abebe et al., 2009)
Although only a small portion of the honey produced is exported, the sector generates quite high foreign currency, particularly from beeswax. For instance, in 2005 the foreign exchange obtained by exporting beeswax was about 1.2 million USD (Mulugeta, 2008). But the bulk of both the honey and wax are used inside the country, and are very important in the local economy and culture.

**Table 6: The gross annual value in USD x1000 of the major non-wood forest products of Ethiopia, (Mulugeta, 2008)**

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Estimated annual turnover in USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wild Arabica coffee (average 90,000 tonnes/yr)</td>
<td>130,590</td>
</tr>
<tr>
<td>Gums/incense (gum arabic, olibanum, myrrh, etc.)</td>
<td>3,700</td>
</tr>
<tr>
<td>Honey &amp; bees’ wax</td>
<td>86,510</td>
</tr>
<tr>
<td>Herbal medicine</td>
<td>2,055,484</td>
</tr>
<tr>
<td>Ecotourism (20% of the tourism industry)</td>
<td>15,400</td>
</tr>
<tr>
<td>Bamboo</td>
<td>10,555</td>
</tr>
<tr>
<td>Forest grazing (fodder)</td>
<td>–</td>
</tr>
<tr>
<td>Forest food</td>
<td>–</td>
</tr>
<tr>
<td>Essential oils</td>
<td>–</td>
</tr>
<tr>
<td>Live wild animals</td>
<td>–</td>
</tr>
<tr>
<td>Spices (average 1,208 tonnes/year)</td>
<td>2,700</td>
</tr>
<tr>
<td>Civet musk (average 400 tonnes/year)</td>
<td>183</td>
</tr>
<tr>
<td>Total value</td>
<td>2,305,123</td>
</tr>
</tbody>
</table>

Herbal medicines taken from the natural vegetation of the country are playing an important curative role in the Ethiopian healthcare system, while also contributing to government expenditure savings. The total value added to the economy from traditional medicine in the year 2005 was estimated at ETB 2 billion. The industry provides some 346,000 income earning opportunities. About 56,000 tonnes of medicinal plants are used
each year in Ethiopia, most of which are harvested from stocks of wild plants (Mender, 2006).

The forest sector provides quite a large employment opportunity at the national scale, formally and informally. The forests and woodlands also provide diverse and essential environmental protection services that support other economic sectors such as agriculture, construction, tourism and energy so that they can operate in a sustainable manner.

3.2. Contributions to household economy

Forests, woodlands and their biodiversity play vital and diverse roles to ensure food security and provide sustainable livelihoods for millions of households throughout rural Ethiopia. They address all dimensions of food security (Mulugeta, 2009). They provide food from cultivated and wild plants and from and for animals, and energy for cooking and insuring food safety, they generate cash income to increase the ability of individuals and households to purchase food and other basic necessities to combat poverty, and, above all, they provide immeasurable environmental services to ensure sustainable grain and animal production (Figure 1) for both forest dwellers and the rural communities outside forests.

More than 480 species of wild trees, shrubs and herbs have been recorded as important traditional forest-food sources in Ethiopia (Zemede & Mesfin, 2001). Forests, woodlands and other tree resources also provide considerable income to households (see section 3.1 above). Income from forest/woody and other vegetation-based products is the second largest sources of non-agricultural income for rural households in the country (Turnbull, 1999; Jagger & Ponder, 2000; Zenebe et al., 2007). Zenebe et al. (2007) indicate that the sale of eucalyptus products from farm forestry contributes to, on average, 28 percent of the annual cash income for a household in Lode Hetosa District of Arsi, and is second only after crop farming. At the national level, it has been estimated that fuel wood entrepreneurs receive the equivalent of USD 420 million per year, herbalists USD 216 million per year, wild coffee producers USD 130 million per year, honey and beeswax producers USD 86 million per year (Mulugeta, 2008), but no estimates have been found for furniture makers. All of these are totals from estimated incomes received at individual or household levels.
Figure 1: The roles of forests and associated vegetation resources in household food security

- Supply edible food items (leaves, seeds and nuts, roots and tubers, bush meat, honey, mushrooms, fruits, saps and gums, oils and fats, etc)
- Sustaining food production system (crop and animal) through soil & water conservation, shade, N-fixation, material for compost, windbreaks, erosion control, and fodder provision
- Contribute to human and livestock health (traditional herbal remedies for human and animal ailments)
- Provide energy (wood, charcoal) to consume safe and well cooked food
- Provide employment in forest management and forest based industry = able to purchase food
- Non-wood products (honey, coffee, spices, wax, gum, bamboo, essences such as perfumes, cosmetics, etc.) to generate cash and buy food
- Provide wood products (lumber, poles, etc.) for sale and to buy food
- Contribute to human and livestock health (traditional herbal remedies for human and animal ailments)
3.3. Role of forests and woodlands in agricultural sector production

Forests and woodlands serve multiple economic, ecological and social purposes. The most prominent importance of forests and woodlands is the provision of productive (fertile) virgin land for crop cultivation. Ethiopia is an old agrarian nation, and agriculture remains the dominant economic and employment generating sector with around 65 to 70 million people employed in the sector. Despite its old history, agriculture in Ethiopia remains low in modern technological inputs and dependent on nature. In such a traditional agricultural system, horizontal expansion predominates as a strategy to sustain and increase productivity. Thus, forests and other naturally vegetated areas have been supplying fresh and fertile productive land to maintain agricultural productivity for millennia (Nyssen et al., 2004). Nyssen et al. (2004) attributed the overall rise in total food production in Ethiopia since 1995 to both the improved climatic conditions and the extension of cropped areas and increased grazing lands.

When unconverted to cropland, areas of natural vegetation in Ethiopia serve as rangelands for the largest livestock population in Sub-Saharan Africa. Grazing in Ethiopia is free roaming with forests and woodlands providing 10 and 60 percent of livestock feed during dry and wet seasons, respectively. Forests and woodlands are thus valuable resources supporting the broad rural agrarian as well as pastoral and agro-pastoral populations of the country.

3.4. Forest based investments and forest entrepreneurship

The forestry sector offers lucrative investment opportunities. However, in Ethiopia, forest investments are predominantly in small and medium-sized forest-based enterprises (SMFEs). These consist of various sub-sectors from wood based small furniture makers/wood workshops to non-wood based productions such as herbalists, wild coffee producers/entrepreneurs. Tree farming by private farm households and entrepreneurs is a growing area of small investment throughout rural and urban Ethiopia.

A survey made in 2005 found that 737 carpenters were producing furniture and construction timber in Addis Ababa alone (Adugna, 2004). There is one paper factory in the country, and a few newer establishments such as particleboard factories in Awassa and Maychew as well as a Bamboo furniture factory at Mojo. Another survey carried out in six major towns other than Addis Ababa registered 7,415 small and medium-sized forest-based enterprises, 30 percent of which are informal (unregistered for tax) (Abebe et al., 2009). Large furniture industries and saw mills (primary wood processing industries) are very few: Finfinne Furniture Factory, Salvatore de Vita & Family, and Wanza Furniture Industry are the best known. Primary wood industries consist of larger sawmills, predominantly operat-
ing today under the state-owned Oromiya Forestry and Wildlife Enterprises (OFWE).

3.5. Other productive uses
Forest ecosystems also contain buffer stocks of biodiversity. They have been serving as an emergency relief for millions of food insecure citizens through formal and informal immigration and/or resettlement.

4. Forest Management Efforts
In Ethiopia, reforestation and afforestation activities began over a century ago, but the amount of attention given to forest management has varied widely over the last one hundred years. This reflects the instability in the sector’s institutional set-up and the relative importance given to ‘forests’ in development plans. In general, it can be stated that, except for limited and intermittent conservation and management efforts, there has never been a well organized, persistent and long-term effort for planned national scale management of the country’s forest resources, including planned logging, enrichment planting, assisted regeneration, tree species improvement programs, protection against fire as well as maintaining and improving the overall health and quality of the forests in Ethiopia.

Some substantial forest and woodland resources are being managed effectively by local communities and individuals that are able to use diverse traditional management practices either communally or privately. Moreover, since the last two decades, the involvement of civil society (CSOs and NGOs) in forest management is increasing with commendable multi-dimensional successes such as lobbying for improved policy and introducing and testing new community-based forest management schemes. Past and present management measures and interventions are directed at preventing further degradation; for example, through area exclosures/enclosures, use of protected area and plantation forests as buffers, or at regulating access to forests and harvesting of products through participatory forest management and traditional institutions for forest management, or both. In the following sub-sections, we have attempted to summarize some of the prominent forest management measures being implemented in the country.

4.1 Plantation developments
Plantation forests are industrial forests established to supply sawn wood and lumber, peri-urban forests meant for the supply of poles and firewood to urban centres, or catchment protection forests. In 2003, the Ministry of Agriculture and Rural Development estimated that plantation forests covered about 230 thousand hectares (Gebrekidan, 2003), not including the small scale tree plantations by local people on private land as farm forestry or as community woodlots. The trees planted include both exotic and native
species, though exotics predominate in terms of area coverage. The exotic species of *Eucalyptus* and *Cupressus lusitanica* cover 59.3 and 20.6 percent, respectively, of the planted forest area in industrial plantations. These are followed by indigenous *Juniperus procera* that covers 5.7 percent.

The industrial plantations are usually established from potted seedlings at a density of 1500–2500 plants per hectare. The plantations in Ethiopia are confined to the dry Afromontane forest ranges (1800–2500 m asl). Productivity of planted exotics is very high: up to 40–55 cubic metres per hectare per year for eucalyptus on a 5–10-year rotation (Örlander, 1986; Zerihun, 2002), and about 30 cubic metres per hectare per year for stands managed for longer than 10 years rotation (Pohjonen and Pukkala, 1990). As expected, productivity varies considerably with site quality, even within species. The average mean annual wood increment (MAI) of 30 cubic metres per hectare per year at the national scale for *Eucalyptus globulus*, one of the successful species in the country, is considered fair when managed on short rotation (e.g. Pohjonen and Pukkala, 1990). For species like *Pinus patula* and *Cupressus lusitanica*, productivity varies between 18 and 25 cubic metres per hectare per year depending on site factors, intensity of applied silvicultural treatments (e.g. thinning) and the length of the rotation cycle, generally 20–25 years. The total annual clear cut yield is usually between 350 and 560 cubic metres (Örlander, 1986). *Eucalyptus* species are managed mainly by coppicing, while other exotic and indigenous plantations are clear felled and replanted using seedlings.

Throughout rural Ethiopia, farmers plant trees on a small scale, either in rows or patches as woodlots, around fields or scattered on farmlands as agro-forestry, in pasturelands or other open areas, and particularly near homesteads. This practice of farm forestry is expanding at a high rate (Figure 2). It has dual objectives: to satisfy the demand of households for wood products and to generate cash income. It is amongst the largest source of non-food crop income for rural households in the country (Turnbull, 1999; Jagger & Ponder, 2000; Zenebe et al., 2007).

Although retaining some indigenous tree species is a common component of farmers’ tree cultivation tradition, in terms of density and area coverage, the fast growing exotic species, principally eucalyptus, predominate (Tesfay, 1996; Motuma et al., 2008). Farmers’ choice for eucalyptus is dictated by its several merits such as rapid growth and wood production, straight trunks, coppicing ability, established wood market with

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7 Coppicing involves cutting the main stem near the base and then allowing several stems to develop from that base.
8 Clear-felled is when the whole trunk is cut at the base and removed.
good price, easy management and being unpalatable to animals (Tesfaye, 2005; Jagger & Pender, 2000; Zenebe et al., 2007). Even in Sidama and Gedio, where traditional agroforestry is an age old and advanced practice, eucalyptus species predominate in terms of stand density and wood volume. For the Sidama traditional agroforestry systems, Tesfaye (2005) showed that *Eucalyptus camaldulensis* alone accounts for up to 61 percent of the tree population, while 116 other tree species altogether represented only 39 percent of the tree stem density. Another study reported that the share of eucalyptus species in tree stocks of a household can be as high as 98 percent (Mesele, 2002).

When established as a woodlot, farmers manage the species usually on a short rotation basis of 5 to 10 years, and plant it at an extraordinarily high density of equivalent to 10,000 to 25,000 trees per hectare (Tesfaye, 2005; Zerihun, 2002; Zenebe et al., 2007); even densities of up to 40,000 trees per hectare can be found. This is four to seven times denser than the planting density used in state industrial plantations.

![Figure 2: Expansion of eucalyptus planting as farm forests in Arsi Negele District, Central Ethiopia (Dereje, 2009)](image)

In 1995, WBISPP estimated that there were 51 million on-farm trees in Ethiopia, predominantly of eucalyptus, with an estimated yield of 15 cubic metres per hectare per year (WBISPP, 1995), which can equate to 51,000 hectares of planted forest estates. By putting together data from various MSc and PhD studies that covered over 450 households and different parts of the country, we estimated that at least 143 million trees, equivalent to
about 57,000 hectares of well stocked plantations, can be found planted by individual farmers throughout rural Ethiopia.

Farm forests are playing a vital role in supplying wood products for households and local communities. Zenebe *et al.* (2007), for instance, found that 92 percent of rural households in the Arsi highlands use eucalyptus species for poles, 74.7 percent for timber, 85 percent for firewood, 40 percent for charcoal, 93 percent for posts, 91 percent for farm implements and 25 percent for traditional medicine, mainly for treating the common cold. In terms of cash income, these farm forests contribute up to 5 percent of household annual income for the relatively wealthy, 20 percent for medium, 72 percent for the poor households, and, on aggregate, the income from the sale of eucalyptus products is second only after crop farming, contributing 28 percent of the total annual average household cash income (Zenebe *et al.*, 2007). By providing these products, eucalyptus and other plantation forests are, indeed, buffering the much reduced but biologically rich natural forests and woodlands of the country against accelerated degradation from wood harvests.

Many exotic species such as those of *Eucalyptus*, *Cupressus*, *Pinus* and *Grevillea* have shown great success and wide acceptability among Ethiopians because of their several merits compared to native species. The wide use of exotic tree species in afforestation and reforestation programmes is not a new phenomenon and is widely exploited both in less vegetated and heavily vegetated countries around the world. We should never forget that plantations of exotic species have contributed a significant part of the wood products in the country. Many scholars have argued that the introduction of species of *Eucalyptus* and other exotic species to Ethiopia is a great success, not a curse. Even native biodiversity is able to survive alongside exotic species. (Henry, 1973; Davidson, 1989; Feyera & Demel, 2001; Eshetu, 2002; Feyera *et al.*, 2002; Mulugeta, 2004; Mulugeta & Demel, 2005; Tesfaye, 2007; Mulugeta, 2008; see also Fig. 4). It is undeniable that these plantations have played and will continue to play a critical role in meeting the fuel and construction material demands in Ethiopia (e.g. Jagger and Ponder, 2000; Zenebe *et al.*, 2007).

The claimed environmental detrimental effects, if any, from these exotics can be successfully controlled by targeted research as is well demonstrated in countries like South Africa. In Ethiopia, there is a misconception that *Eucalyptus* species consume more water than any other tree species and agricultural crops. There are quite a number of research results which found that *Eucalyptus* species are efficient water users. For instance, Davidson (1989) reported that on a “leak-proof hectare” at Nekemt with annual rainfall of 2,158 mm, *Eucalyptus saligna* and *E. grandis* could
produce 46.6 cubic metres per hectare a year depending on rainfall only without drawing on other water reserves. Comparable data for biomass production from coniferous, acacia and broadleaf species were 16.4, 16, and 12.4 cubic metres per hectare a year, respectively. These figures show that for the same amount of water consumed *Eucalyptus* produces a higher amount of biomass which is economically profitable and acceptable. Most *Eucalyptus* species need, on average, 785 litres of water per kilogramme of biomass produced as opposed to cotton/coffee/banana (3,200 litres), sunflower (2,400 litres), field pea (2,000 litres), cow pea (1,667 litres) soybeans (1,430 litres), and potato, sorghum and maize (1,000 litres each) for each kilogramme of biomass produced (Davidson, 1989).

Given the present low level of forest cover and the large demand for forest products due to the expanding construction sector and emerging urban middle class, the propaganda to swiftly switch to mainly ‘native species’ is not necessarily a constructive move. As we are fighting food insecurity with maize and many other crops of foreign origin, lack of forest products can best be fought successfully through the selection and promotion of fast growing tree species, both exotic and native.

### 4.2 Area exclosure for forest regeneration

Area exclosure refers to the practice of land management that involves the exclusion of grazing livestock and people from openly accessing an area that is severely degraded. The purposes are to prevent further degradation of ecosystems, and to enable the natural restoration of the biodiversity, overall ecological conditions and services of the areas. Although much of the restoration/rehabilitation in area exclosures is only through natural regeneration, in some cases management involves enrichment planting with native and/or exotic species as well as putting in soil and water conservation structures to supplement and support the rehabilitation.

This management approach is now being employed in a wide range of forest ecosystems from the very dry woodlands to the sub-humid Afromontane forest. In particular in Tigray, area exclosure is widely applied for forest and woodland regeneration so that by 2004, the areas covered eight percent (400,629 ha) of the Region (Nyssen et al., 2004). Studies of these and other protected areas show that the natural vegetation is rehabilitated, wildlife returns (see Figure 3), erosion is halted, leaf litter accumulates and soil chemical and physical soil properties are improved (Mastewal, 2005; Tefera et al., 2005; Muluberhan et al., 2006; Wolde et al., 2007).

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9 Enclosure is the term more usually used, but as the main aim is to exclude destructive activities, exclosure, as used here is also appropriate.
Figure 3: Graphs showing general trend in increases of density and species richness in woody plant (A) and wildlife (B) along a chronological sequence of closely located exclosure areas in Douga Tembien, Tigray. The X-axis is a log scale; the decline in density and species richness in the 10 year exclosures compared to these at 8 years might be due to spatial variability between the exclosure sites (source: Mastewal, 2005)
Figure 4: Plantation forests in Munessa (right photo) and on Entoto above Addis Ababa (left) showing the re-colonization of indigenous species, particularly Podocarpus and Juniperus
Figure 5: Plantation forest on Entoto above Addis Ababa showing the re-colonization by Juniperus
Muluberhan et al. (2006) carried out a replicated study across three sites in which they recorded 16 woody species per hectare in exclosures as compared to only 9 in open grazed land nearby. Tefera et al. (2005) also recorded a woody plant density of 3,705 stems per hectare in exclosures compared to 3,048 stems per hectare in non-protected plots. Figures 4 and 5 are photographs of exclosure areas in Munessa Forest and on Entoto above Addis Ababa.

However, mishandling, such as lack of a responsible managing body or loosely defined ownership over such areas (Tefera et al., 2005), has also led to the failure of several area exclosure initiatives, particularly in central and southern parts of the country (Betru et al., 2005).

4.3. Protected (priority) area demarcation and protection

Another effort used for forest conservation in Ethiopia is the protected area approach where most of the remnant natural forests of the country have been designated as National Forest Priority Areas (NFPAs). These forest patches and blocks total an area of 2.8 million hectares (Table 7) with the principal objective of protecting and conserving their biodiversity (Demel et al., 2010). Most of the major remaining forest patches and some plantations have been included. Some of the lowland forests and woodlands are included in national parks and wildlife sanctuaries (e.g. Awash, Nechi Sar, Mago, Abijata–Shalla, Yabello, Sinkile and Babile), which are another form of protected area management. Unfortunately, the current status of these protected areas including the parks is discouraging. They are suffering from continuous human encroachment and other forms of severe disturbances (see Mellese, this volume).

<p>| Regional State(s) | Number | Area (ha) | | | Total area (ha) |
|------------------|--------|-----------|-----------|----------------|
|                  |        | Slightly Disturbed | Heavily Disturbed | |
| Amhara National Regional State (ANRS) | 4 | – | | 39,100 |
| Gambella National Regional State (GNRS) | 2 | 442,350 | 45,000 | 487,350 |
| Oromiya National Regional State (ONRS) | 31 | 288,200 | 720,200 | 1,008,400 |
| SNNP Regional State (SNNPRS) | 5 | 132,000 | 243,000 | 375,000 |</p>
<table>
<thead>
<tr>
<th>Regional State(s)</th>
<th>Number</th>
<th>Slightly Disturbed</th>
<th>Heavily Disturbed</th>
<th>Total area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tigray National Regional State (TNRS)</td>
<td>1</td>
<td>–</td>
<td>11,500</td>
<td>11,500</td>
</tr>
<tr>
<td>Dire Dawa City Council &amp; ONRS</td>
<td>1</td>
<td>1,500</td>
<td>–</td>
<td>1,500</td>
</tr>
<tr>
<td>GNRS &amp; SNNPRS</td>
<td>1</td>
<td>80,000</td>
<td>35,000</td>
<td>115,000</td>
</tr>
<tr>
<td>ONRS &amp; SNNPRS</td>
<td>4</td>
<td>407,900</td>
<td>165,000</td>
<td>572,900</td>
</tr>
<tr>
<td>GNRS, ONRS &amp; SNNPRS</td>
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<td>40,000</td>
<td>100,000</td>
<td>140,000</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>1,391,950</td>
<td>1,358,800</td>
<td>2,750,750</td>
</tr>
</tbody>
</table>

### 4.4. Bio-carbon initiatives and their role in forest conservation and regeneration

Climate change is a major global concern of our time. To mitigate and adapt to global climate change, government parties to the United Nations Framework Convention on Climate Change (UNFCCC) are taking various actions to either sequester the carbon from atmospheric carbon dioxide or mitigate emissions of the green house gases that are indicated as causing the changes in the earth’s climate. In Ethiopia, various bio-carbon initiatives are recognized that have forestry implications. Among these are the CDM\textsuperscript{10}-based Afforestation/Reforestation (AR) projects and REDD\textsuperscript{11} initiatives. A number of CDM projects are recognized today in Ethiopia that comprises:

- **Humbo Assisted Natural Regeneration Project** targeting an area of 2,728 hectares;
- **Abote District Afforestation/Reforestation project** with an area of 2,000-3,000 hectares;
- **Ada Berga District Afforestation/Reforestation project** with an area of 4,500-6,000 hectares;

\textsuperscript{10} CDM = Clean Development Mechanism
\textsuperscript{11} REDD = Reducing emissions from deforestation and forest degradation in developing countries
♦ Sodo Farmers Managed Natural Regeneration & Agro-forestry project with an area of 2,200 hectares, and

♦ An Afforestation/Reforestation project in Amhara National Regional State under discussion, and comprising over 20,000 hectares.

Ethiopia is also making good progress with REDD+ initiatives. As of today, there are about three REDD+ based project initiatives in Ethiopia. These are: (i) the Bale eco-region (500,000 ha), (ii) Yayu & Gedo forests (190,000 ha) and (iii) Baro-Akobo in the southwest forest (7,610,300 ha). These initiatives are expected to contribute to better management of the existing forests while encouraging forest regeneration.

Ethiopia has recently developed what has come to be known as the Ethiopian Strategic Investment Framework (ESIF) for sustainable land management, which is a 15-year (2009-2024) program. Within the ESIF, the country has designed a Sustainable Land Management Program (SLMP), which is a multi-sectoral, multi-stakeholder and multi-donor financed program that brings communities, the government, donors and the private sector together on a common platform. Its goal is to improve the livelihoods of land users while restoring ecosystem functions and ensuring sustainable land management (see Birhan, this volume). With support from the World Bank and Global Environmental Facility (GEF) the program has already begun in 35 watersheds that cover about 300 thousand hectares.

Sustainable land management involves both the conservation of and improvement to the present vegetation cover, such as through enrichment planting, enhancing soil fertility and carbon stock in agricultural soils, rehabilitating degraded lands and popularizing the cultivation of high value crops to enhance the income generating capacity of the local communities and, hence, reduce pressure on and destructive use of other natural resources.

4.5. Participatory Forest Management (PFM)
In the early 1990s, Participatory Forest Managements (PFM) was introduced to Ethiopia to solve the problems associated with open access to forest resources. It promotes sustainable forest management through involving the local communities living near and in a forest to take part as co-managers and share the benefits accruing from it. Experiences from around the world show that shifts from state-centred toward local level forest management, such as PFM, have resulted in successful forest conservation and development (e.g. Wily, 2002). FARM-Africa, SOS Sahel, GTZ and JICA are the NGOs that have been most active in promoting and supporting the development of PFM in Ethiopia.
Pilot PFM activities include projects in the forests of Chilimo, Bonga, and Borana run jointly by FARM-Africa and SOS Sahel, one at Adaba Dodolla run by GTZ and another at Belete Gera supported by JICA (Zelalem et al., 2007; Terefe, 2002). These pilot projects have attempted to introduce the following:

- devolution of certain bundles of property rights from the state to the community;
- allowing local people to manage the forest resources sustainably; and
- allowing partial utilization of the forest resources for livelihood support.

The introduction of PFM was expected to achieve the dual goal of contributing to the sustainable management of the forest resources and the improvement of the socio-economic status of the local communities. Nonetheless, whether the PFM has achieved these integrated objectives as expected, and what lessons can be drawn for the future, in terms of a contribution to forest conservation and the lifting of the socioeconomic conditions of the local people, has not been systematically studied.

By 2008, 140,857 hectares of forest land in the country was being managed through PFM schemes (Tsegaye Tadesse, unpublished). Experiences gathered from the existing PFM programmes have demonstrated good successes in enhancing forest regeneration, improving forest protection, regulating access and, thus, good forest conservation management. For instance, a study in Adaba Dodola recorded more healthy seedlings that had been neither trampled nor browsed, and more regeneration of indigenous plant species in the PFM forests compared with those not covered by this management approach (Tsegaye et al., 2004). Similarly, in Bonga the forests managed by the local communities through the PFM approach had an average of 5,167 seedlings of woody plants per hectare as compared to 3,258 seedlings per hectare in non-PFM managed forests (Tsegaye, 2008).

4.6. Traditional forest management and conservation practices

In many places, local people use indigenous knowledge and well organized indigenous institutions to manage their forest resources. Some of these traditional community-based forest management (TCBFM) systems involve communal efforts such as those for the *Acacia–Commiphora* woodlands managed as rangelands by the Borana people with the Gada governance institution (Watson, 2003), and the management of Afromontane forests in the southwest for extraction and use of non-timber forest products by the
Kobo system (Dereje & Tadesse, 2007). Others are smaller private efforts involving various forms of traditional agroforestry.

The Kobo system is a forest (tree) tenure institution that grants first claimers an exclusive use right over a block of forest, usually for collection of forest coffee, hanging beehives and access to other non-timber forest products. Once claimed, the forest block is de facto individual property, respected by fellow citizens of the area, and the owner has the right to exclude others. This way, the system has resolved what could have been an open access system with threat of degradation by one that allows the interests of the ‘owner’ in maintaining a sustained supply of products to also prevent access by ‘outsiders’ and hence prevent degradation (Dereje & Tadesse, 2007). The Borana Gada system embeds a hierarchical rangeland management institution within it. The most important part of the rangeland management institution is the obligation for animal movement to be regulated according to the patterns outlined by elders based on range availability, rangeland condition and seasonal carrying capacity of the natural resources of the Borana plateau to avoid degradation (Watson, 2003). In this way, the institution has managed the rangelands for generations.

The other common form of traditional community-based forestry management in Ethiopia is the diverse systems of traditional agroforestry. A typical example is the homegarden agroforestry system in the drylands of south and south-west Ethiopia, which are estimated to cover 576 thousand hectares (Tesfaye, 2005). Most of the homegardens evolved from forests, where farmers maintain the upper story trees and clear the understory vegetation to open up space for planting enset, coffee and other food and cash crops. Tesfaye (2005), for instance, found 120 tree and shrub species in 144 home gardens with 83 percent indigenous species, an average of 20.7 tree species per farm, an average wood standing volume of 50.4 cubic metres per farm (24 m³ ha⁻¹) and an average density of 855 trees per farm (Tesfaye, 2005). Tree stem density in traditional agroforestry varies from area to area and according to the size of land holding. For instance, in Sidama, tree stem density ranged from 13 to 64 per hectare, with species richness from 3 to 35 per hectare. Moreover, parkland agroforestry is almost the rule throughout the country (Motuma et al., 2008). Households maintain woody plants in these agroforestry systems mostly by preserving selected tree species in the processes of transforming forest lands into cultivated fields. Farmers also maintain diversity and density of woody plants in their fields through enrichment planting using indigenous and exotic species, with species of *Eucalyptus* predominating. Some of the traditional agroforestry systems even host a higher diversity of woody species than their nearby natural
woodlands or forest lands, thus providing safe haven for conservation of diverse native plant species (Motuma et al., 2008).

Significant patches of forests are conserved and managed as sacred groves in and around churches, monasteries, graveyards, mosque compounds and other sacred sites in several parts of Ethiopia. Particularly, the northern highlands are almost devoid of forests in other areas as these have been converted into farms and grazing lands leaving few patchy remnants mainly around churches (Alemayehu, 2007, Alemayehu et al., 2009). For instance, Alemayehu et al. (2009), in their study of sacred groves associated with 28 Orthodox Churches in northern Ethiopia found a total of over five hundred hectares of remnant forests around them with an average of 17.9 hectares per church, and recorded 160 indigenous and eight exotic woody species (100 trees, 51 shrubs and 17 lianas). The total number of species per church ranged from 15 to 78. The species composition of these church forests is old growth type in which Juniperus procera, Olea europaea and Celtis africana predominate. According to Alemayehu (2007), there are 35 thousand similar churches with traditional sacred groves throughout Ethiopia that could contribute to the conservation of considerable areas of remnant dry forests. These groves are not only remnants of old-growth vegetation but also provide diverse forest products and services. They can also act as sources of genetic materials for restoration of degraded dry Afromontane forests. Linked through appropriate vegetation corridors they may form a unique landscape matrix for large-scale landscape and forest restoration. Recent studies on management interventions (e.g. seed sowing, seedling planting, soil scarification, excluding destructive activities) in and around these forests are starting to show promising results (Alemayehu et al., 2009).

5. Institutional and Legal Issues

5.1. Forest policies

For long, policies related to forest resources management in Ethiopia were vague, and can only be inferred from various related legal instruments such as institutional mandates or other documents. However, more specific forest policy and laws have been enacted since the 1990s. In 1994, a new forest law was enacted with Proclamation No. 94/1994. The aim of this forest law was to contribute to forest development and protection for its ecosystem services and economic functions. Important improvements to this law compared to its predecessors was the introduction of the principle of benefit sharing with local communities and the invitation for public participation in forest management. In this law three types of forest ownership, namely: federal forest, regional state forest and private forest, were recognized.
In 2007, a new Forest Management, Development and Utilization Policy (MoARD, 2007) and strategy was passed to implement Proclamation No. 524/2007 (FDRE, 2007). This is the first ever comprehensive forest policy for Ethiopia. The main objective of this policy is ‘to meet the forest product demands of the society and increase the contribution of forest resources to the national economy through appropriate management’. It identified the following six strategies to achieve the stated objective:

- promoting private forest development and conservation;
- promoting forest development technologies;
- strengthening forest product markets;
- administering and managing state forests;
- preventing deforestation; and
- establishing an up-to-date information database.

This Proclamation replaces the Forest Proclamation No. 94/1994. The new Forest Development, Conservation and Utilization Policy of 2007, contrary to the 1994 forest law, recognizes state and private ownership of forest. There are divided opinions on the interpretation of the property rights indicated over the forests in the new policy. While some argue that the term ‘private’ can also include the right of (organized) communities to own natural forests, others state that such an interpretation is liable to misuse, and, if any, does not spell out the rights of communities to own natural forests. The latter group assumes that the ‘private ownership’ is included to refer to forest plantations developed by individuals or organized private investors. However, several articles and sub-articles of the new forest policy and its proclamation encompass issues that articulate communities’ rights over and the need for their participation in managing natural forests. It also legalizes communities’ access to forests for non-wood forest products. For instance, Part II, Article 4 of the Proclamation about the promotion of forest development in Ethiopia, has six sub-articles and two of them are community oriented:

1. Management plan shall be developed, with participation of the local communities, for forests that have not been designated as protected or productive state forests, and such forests shall be given to the communities, associations or investors so that they conserve and utilise them in accordance with directives to be issued by the appropriate body;
2. Any person who develops forest on his land holding or in state forest area given to him on concession shall be given assurance to his ownership of the forest.

Similarly, Part III, Article 9 under Conservation, Development and Administration of State Forest suggests community participation as follows.

Sub-article 3: Forest development, conservation and utilisation plans shall be formulated to allow the participation of local communities in the development and conservation, and also in the sharing of benefits from, the development of state forests.

Sub-article 8: Conditions shall be facilitated whereby inhabitants within a state forest shall continue living in the forest, in a manner that shall not obstruct forest development; or, based on a study and in consultation with the appropriate body, they shall evacuate the forest area and settle in other areas suitable for living.

In particular, there are important provisions for use of non-timber forest products in state forests by the local communities, e.g. Part III, Article 10: Utilization of State Forests provides many provisions such as:

Sub-article 2: The utilisation of a state forest in accordance with Sub-article (1) of this article shall be undertaken by government organisation or persons who are given concessions;

Sub-article 3: Notwithstanding the provisions of Sub-Articles (1) and (2) of this article, the local community may reap grasses, collect fallen woods and utilize herbs from a state forest in conformity with the management plan developed for the forest by the appropriate regional body;

Sub-article 4: Notwithstanding Sub-Article (3) of article 15 of this proclamation, the harvesting of forest products, grass and fruit as well as the keeping of beehives in state forests may be permitted based on the objective realities of the locality; and

Sub-article 5: State forests shall be used to generate income from tourism.

Since the 1990s, the Federal Democratic Government of Ethiopia has also developed a number of other proclamations, policies, strategies, programmes and plans that directly and indirectly concern the conservation and development of forest resources. Among these are the Ethiopian Forestry Action Program, (EFAP, 1994), the Conservation Strategy of Ethiopia (CSE, 1997), the Environmental Policy of Ethiopia (FDRE, 1997), Rural Land Administration and Land Use Plan, Policy and Strategy (MoARD,
2004), and Plan for Accelerated and Sustainable Development to End Poverty (PASDEP, 2005). The Environmental Policy of Ethiopia has a strong element of encouraging peoples’ participation in forest management. Under forest, woodland and tree resources sector, the policy addresses the complementary roles of communities, private entrepreneurs and the state in forestry development; integration of forestry development with land, water, energy, ecosystem and genetic resources development in addition to crop and livestock production. Selection of suitable species for afforestation/reforestation with particular emphasis on indigenous tree species is one important statement included in this policy. The policy emphasizes that utilization of forests should be based on the regenerative capacity of the forest. Hence “forest management” is needed so that the sustainable supply of forest products should be without affecting the environmental and social amenities derived from the forests. The policy states that such sustainability is attained by formulating and implementing socially suitable, environmentally sound and economically acceptable management plans. Since free range grazing affects natural regeneration of valuable indigenous trees, the policy restricts free range grazing in protected forest areas.

The Rural Development Policies, Strategies and Methods, and the Rural Land Administration and Land Use Proclamation issued in 2005 clearly stated the need for proper land use in order to maximize the economic return of the land. In line with this the Rural Land Administration and Land Use Proclamation No. 456/2005 was issued in 2005. In this proclamation, “rural lands, the slope of which is more than 60 percent, shall not be used for farming and free grazing; they shall be used for the development of trees, perennial plants and forage production.” PASDEP (2005) includes a plan to increase the forest cover of the country to nine percent between 2005 and 2010.

Regional states have also produced their own respective regional polices: for example, Oromia Rural Land Administration and Use Proclamation No 130/2007 (ONRS, 2007). Following the federal based decentralization of governance, natural resource management has been the responsibility of regional agricultural and rural development bureaus, which also are responsible for the preparation of plans and budgets for the forestry administration in their respective regions. The constitution in Article 52 (2) (d) authorizes the regional states to “… administer land and other natural resources in accordance with federal laws …” The regional states were also given the power to formulate their respective policies, raise their own revenue as well as plan and execute their own forest development
activities in accordance with the framework of the overall policies of the federal government.

5.2. Institutional arrangements in the forest sector

The institutional arrangements in the forest sector have been unstable suffering from frequent restructuring. Some scholars (Yonas, 2002; Melaku, 2008) found that the forest sector has undergone over 35 to 40 rounds of institutional restructuring since the 1930s, which is once every two years. Even after decentralization of responsibilities to regional states, forestry organizations have continued to experience restructuring. Such lack of stability in the sector's organizational structure is often cited as one of the major bottlenecks for the lack of coordinated, effective and long term management and development successes in Ethiopian forestry. Currently, the existing institutions, particularly the one at federal state level, are severely understaffed. During the 1980s, the federal forestry department consisted of around 60 staff: by 1995 it had been expanded into a Ministry of Forestry and Natural Resources with over 300 employees. But by 2004 it had been relegated to a section with less than 10 foresters. Today, in 2009, forestry is almost non-existent at federal level with only three foresters hidden under the newly formed Sustainable Land and Watershed Management sector of the MoARD (Abebe et al., 2009).

The major development in the institutional arrangements for the forest sector since 1991 is the decentralization of forestry administration. Responsibility for forestry administration and management has been handed over to the National Regional States. At regional level, although differences between regions are obvious, interest in forestry is growing. The best example is the establishment of the Oromia Forestry and Wildlife Enterprise (OFWE) in the Oromiya National Regional State, and the active engagement of civil society organizations such as the Organization for Rehabilitation and Development of Amhara (ORDA) in Amhara National Regional State and the contribution of the Relief Society of Tigray (REST) in Tigray National Regional State in forest development and improved conservation.

Oromiya has the largest forest resources in the country and has led the way in establishing OFWE as a new institution responsible for managing the forest resources in the region. The establishment legislation of OFWE and its sub-enterprises vested full authority on them to own, develop, utilize and retain revenue generated from forests of their respective concession areas. The objective of these enterprises is to ensure the sustainable development of forest resources through the generation of forest revenue and the appropriate use of this revenue for forest resources development and sustainable management. In Amhara and Tigray, the regional affiliated
NGOs of ORDA and REST, together with their respective Regional Bureaus of Agriculture and Rural Development, are doing commendable forestry development activities. For instance, in Tigray Region, nearly 8 percent of the land area has been put aside for rehabilitation (area exclosure) with the concerted efforts and management contributions of REST and BoARD.

However, the decentralization of forest sector administration and forest resources management does not appear to have fully resolved the issues of forest ownership and access. Despite their advocacy for popular participation, local people’s access to and right to participate in the management of and ownership over forests and woodland resources is still limited or even absent even though it is supported by the available national and regional policies, legislations and proclamations. Implementation at the grassroots level does not appear to be in line with the provisions in the legal documents. In some regions, participatory management schemes piloted by NGOs have demonstrated good success but at high costs. Such experiences are not scaled up and out or mainstreamed as much as expected in order to become viable alternative systems of forest resources management. OFWE is an exception in that it attempts to adopt participatory forest management (PFM) principles in its management of some of the forests under its concession (see section 4.5 of this paper). Similarly, in Tigray, measures to transfer greater responsibility for forest management and afforestation from government agencies to local authorities, communities, and individual stakeholders are underway.

A serious bottleneck for forestry development at the regional levels is the fact that forestry activities are merged with other sectors and stand as small sub-components in a large and complex agricultural-oriented structure. This has a number of drawbacks in terms of budgetary allocation, human capacity building, priority setting and logistic allocations, as many sectors compete for limited resources. Economic resources usually allocated to the forest sector are the least (<10%), and this is usually incapable of ensuring good forest management as it restricts human and logistic deployment. Overall, despite the availability of legally recognized policies and strategies, which, if properly implemented, can ensure good forest sector development, the sector suffers from the absence of strong implementing institutions.

5.3. Law enforcement

Most of the policies have been accompanied by regulations for law enforcement. The new Proclamation appears to recognize the need for better forest governance and law enforcement. The two regulatory instruments employed in the legislation are business licensing and permits for the movement of forest products. Penalties for forest offences have been raised
to a maximum of 30,000 Birr (about USD 300) and/or five years imprisonment, depending on the type and degree of offence. Uniformed forest guards and forest products movement inspectors are to be the primary enforcers of the legislation, though custom officers and the regular police can enforce in their absence. A reward system is also indicated for informers against offenders. However, law enforcement still appears a major bottleneck in the forest sector. The reasons are: (i) weak institutions in the sector to follow up forest offence cases, (ii) poor linkage between law enforcing and forestry institutions, and (iii) high corruption due to the lucrative business in the illegal trade in forest products.

6. Global Issues and Their Implications for Sustainable Forest Development

Forest ecosystems, particularly tropical forests, provide many diverse services for the well-being of all life including people. However, with deforestation and forest degradation, the services they provide are under increasing pressure. Global communities are concerned about tropical deforestation for many reasons. First, tropical forests are the storehouse of 70 percent of the world’s biodiversity. Ecological, social and economic values of this biodiversity richness are what led to the development of the Convention on Biological Diversity (CBD) by the United Nations. Furthermore, deforestation and forest degradation in drier climatic zones are known to lead to desertification, and these have also led to a global Convention on Combating Desertification (UNCCD). Furthermore, the reality of global climate change, which has also a direct link with tropical deforestation and forest degradation, has resulted in the United Nations Framework Convention on Climate Change (UNFCCC). In fact, these conventions alone were not and will not be able to stop rapid global forest losses, despite some successes. Between 2000 and 2005, roughly 13 million hectares of forests disappeared each year, all of the losses occurring in the biologically rich tropical forests of the developing world (FAO, 2005). Other systems such as forest certification schemes, treaties on endangered species and the like are all parts of global movements to slow down tropical forest losses and conserve their bio-richness.

These Conventions have subsidiary initiatives that provide financial and technical support to enable tropical countries to manage their forest resources sustainably. For instance, the Global Environmental Facility (GEF), the Special Climate Change Fund, Global Mechanisms (GF), Least Developed Countries fund and similar arrangements offer financial and technological support to countries in the south from countries in the north for supporting sustainable forest management. Particularly, a post 2012
climate change agreement is expected to include Reduced Emissions from Deforestation and Forest Degradation (REDD+) and enhancing forest regeneration in Developing countries (REDD++). REDD+ initiatives, as they are currently being discussed, propose to pay developing countries for conserving their forests for their carbon value. It is believed that these payments could shift the balance away from the economic incentives currently favouring deforestation, thus making sustainable forest management a more profitable alternative. Consequently REDD+ and similar initiatives have the potential to generate substantial benefits in addition to the reduction of greenhouse gas emissions. These include positive impacts on biodiversity and sustainable development, including poverty reduction. REDD+ is a carbon trading system whereby countries, individuals, communities or any forest owner will be paid for working towards reducing forest degradation and conserving the forest for its carbon stock value. It literally means being paid for conserving our own forests. The 1997 Kyoto Protocol of the UNFCCC also included incentives for Afforestation/Reforestation programs through its Clean Development Mechanisms (CDM). This was an opportunity little captured by Africa in general and Ethiopia in particular, partly because the process of obtaining support through CDM was long and complicated. Several other approaches with support from international donors such as the World Bank and the United Nations Development Programme (UNDP), and bilateral donors to make use of these opportunities are now being actively promoted. These opportunities can contribute to sustainable forest management and development and have to be optimally utilized to finance and support forest sector development in Ethiopia. For instance, a project idea note prepared for REDD+ project in Bale Eco-Region that comprises 0.5 million hectares estimated the possibility of generating around 80 million tonnes CO₂e emission reductions (ERs) in 20 years, which at US$ 4 per tonne CO₂e can fetch US$ 320 million (Tsegaye, 2008). This is a huge sum of money to be received without cutting down the forest or any part of it, but just for conserving it. Ethiopia must be keen to work hard to capture these opportunities.

7. Gaps and Constraints

7.1. Major constraints characterizing the forest sector

Forests and other vegetation resources in Ethiopia continue to be degraded in most parts of the country. This indicates severe constraints, particularly in the implementation of policies and strategies. Efforts so far have focused on developing policies and strategies, while much has not been done at the field level. It is not enough to have good policies and strategies if they are not supported by capacity in the form of adequate numbers of qualified personnel, sufficient economic resources, institutions and organizations.
equipped to effectively implement the policies and strategies. The frequent restructuring of the sector’s organization can be considered as one of the major bottlenecks to building up the needed capacity.

Another major constraint for the sector is the inadequate budget and lack of logistic support. At both the federal and regional levels, less than 10 percent of the budget of the Ministry of Agriculture is spent on forestry, and the total budget for the Ministry is only a tiny fraction of total government expenditure. Most of the budget allotted to forestry is taken by salaries, allowances, extension services and very little is spent on practical forest development work.

The transfer of managerial responsibilities to the regional states has, in some cases, overlooked the lack of capacity in terms of skilled personnel to shoulder the responsibilities. Furthermore, some forest resources and their ecosystem services such as watershed protection, water flow regulation and biodiversity conservation are important public goods with values that extend beyond the mere interest of a National Regional State. The importance of such services extends to national or even international levels. There must be a federal state forest agency with a clear mandate to intervene and have a strong share in the responsibilities for managing and administering forests to insure the sustainability of their ecosystem services.

In general, the following constraints and gaps have been identified concerning the forest sector in Ethiopia:

7.1.1 Forests/woodlands under de facto open access

In the Constitution of the country (FDRE, 1995), the State is the legal owner of the natural forests and woodlands of the country. However, the State has failed to put in place organizations that give strong support to the forestry sector. The absence of effective institutions plus the weak law enforcement means the forests and woodlands of the country are to all intents and purposes open for all forms of exploitation. People access them for firewood, charcoal, timber, other construction material, as well as forest grazing and browsing because there is no control, regulatory or overseeing body over the harvesting of the products or other uses. Forests and woodlands are, thus, harvested well above and beyond their sustainable yield.

Globally different forms of forest ownership prevail: private, state (public) and communal. Each of these forms of ownership demonstrates success and failure under different conditions. For example, when the State ‘owns’ the forest resources but fails to put in place effective management, the outcome is definitely open access. It has been repeatedly said that the forest ownership arrangement overlooks the needs, traditions, and
perceptions of local communities on access rights to forest products and the strong dependence of their livelihoods on forests. This arrangement undermines the role of local communities, their traditional institutions and knowledge in forest management. Without the legal recognition of the right to use forest products, local people have neither the interest nor the courage to continue protecting and developing ‘their’ forests. Such systems rather generate incentives that force local peoples to illegally exploit forests.

Open access is hindering the achievement of forest sector development in many ways. It inhibits private sector involvement as it undermines confidence. It also prevents Ethiopia from benefitting from current global conservation initiatives such as bio-prospecting, carbon trading including the upcoming REDD++ initiatives, and many other forms of payment for ecosystem/environmental services (PES). These initiatives need an institutional framework that is stable and transparent so that it can build on past successes.

Open access can be curbed by properly transferring responsibility for forest/woodland management to local communities backed up by appropriately trained forest professionals and local administrations. Already there are experiences available in Ethiopia that have demonstrated the possibility of forest resources being successfully managed by promoting the participation of local people and giving them the responsibility. In fact, most policies and strategies advocate for public participation. However, at field level, largely alienate communities are still being blamed for bad forest management practices. Moreover, the weak capacity among forestry experts to take on effective participation approaches is another bottleneck hindering facilitation of community participation in forest management.

7.1.2 Absence of monitoring and evaluation of impacts of past forest development efforts

There are many development actors working in the area of forestry in Ethiopia. Examples are the work of NGOs supporting participatory forest management (PFM) as well as the rehabilitation of degraded land by afforestation and area exclosure. The achievements from these efforts have not been properly assessed and documented by government bodies. For instance, there is a claim for good forest regeneration in Tigray Region. Much academic research has now been carried out in these areas, particularly at the post-graduate level, but the results are not published. If the results of the research were made available, particularly in a form appealing to policy makers, such experiences could have been scaled up and out to other regions or could be adopted as national strategies.
The lack of effective monitoring and evaluation of different forestry development initiatives is also preventing the sector identifying future directions. However, there is much discussion around the various forest development possibilities for the country. But these are unconsolidated with the various development actors advocating different approaches and different techniques. Many scholars, mostly non-foresters and environmentalists are adding to the confusion by pursuing their own research interests. For instance, the possibility of reforestation and afforestation using exotic species is being challenged today in Ethiopia, while this is against the global trend. China is the leading country in global reforestation and afforestation for industrial wood production. Brazil and Indonesia are two of the most forested countries in the world. But these two countries are also where reforestation and afforestation programmes are ongoing at an unparalleled rate.

7.1.3. Low resource (budgetary and logistic) allocations for the sector
Funding for the forest sector in Ethiopia is tiny. At both the federal and regional levels, less than 10 percent of the budget of the Ministry of Agriculture and Rural Development is spent on forestry and this falls short of requirements. Thus, the sector largely depends on foreign assistance to secure modern forestry equipment and other facilities that are important for the implementation of sustainable forest management.

7.1.4. Poor inter-sectoral coordination in policy implementation
The effects of non-forestry policies and strategies on sustainable forest and woodland management are huge. Given the high degree of dependence on natural resources and the environment in Ethiopia, there is a need to integrate economic development with environmental protection and sustainable forest and other natural resource management.

At the national level, there is a growing realization of the value of forests as a renewable resource and their role in the production of a range of goods and services. However, at the practical level, this realization is not being turned into action. For example, despite the growing public concern about forests, the increases in population and pressures for social and economic development continue to drive more forest clearance. This problem is further increased by the domination of short-term economic and market forces over environmental considerations, which frequently results in the acceptance of unsustainable activities.

7.1.5 Poor research and educational capacity
Compared to many other sectors, the forest sector is marginalized in research and education. There is only one institute—Wondo Genet College of Forestry and Natural Resources—devoted to training human resources in
forestry although forestry is also taught as part of a degree in Natural Resources Management and Environmental Protection in Mekelle University. Similarly, the forestry research budget is the least compared to other agricultural fields. For instance, of the annual research budget of the Ethiopian Institute of Agricultural Research (EIAR), the share allocated to forestry research is always less than 5 percent (personal communication, Director of Forestry Research).

### 7.1.6 Poor Technical Capacity

There are few professional foresters available in the country. Many of these are also dispirited, and a considerable number have changed their profession or left the country to work elsewhere. Consequently, the capacity to prepare and implement forest management plans, carry out frequent assessments of the status of forests and woodlands with proper accounting of their economic contributions, design and implement workable forest regeneration strategies and other essential activities are very poor.

Vital information about the forests and other vegetation resources of the country are generally unavailable. This information includes:

- spatial coverage of the various vegetation resources;
- stock of wood and non-wood products;
- their ecosystem service values;
- their status in terms of conservation or degradation,
- who uses them and how much;
- their productivity (incremental yield) and their national scale socio-economic significance in terms of contribution to GDP, and
- employment generation and role in food security.

Moreover, basic information on the biology and ecology of most species, except for a few timber or multipurpose species, are lacking. There is insufficient information on the reproductive ecology, seed ecology, strategies for restoration, impacts of disturbances, for most of the species in the forests and woodlands of Ethiopia. Furthermore, from a technical silvicultural point of view, information and experience on sustainable forest and woodland management hardly exists in the country.

### 8. The Way Forward

#### 8.1 Differentiating Production and Conservation Areas

Understanding about the contribution of forestry, apart from its conservation value, among experts and policy makers is poor. Not many
people understand and believe that forestry is a viable economic sector, which is able to take a nation out of poverty. It is also this misunderstanding that creates confusion when it comes to programmes and projects dealing with forest restoration, reforestation/afforestation activities. For instance, the fact that many scholars argue against the use of exotics and in favour of native species in forest development emanates from their narrow understanding of forest as a conservation sector and not a production sector. For this, we have forwarded a separate recommendation, see 8.5 below.

Differentiating forests and woodlands to be used for production and those to be managed for conservation is a critical requirement to enhance the economic and ecological role of forestry in the nation. Then, among stands distinguished for production, management should be geared to optimize economic benefit, while for those designated for conservation strict protection should be the target with permission for local communities to collect non-tree forest products sustainably.

8.2 Improving local community participation in forest conservation and development

Global experiences show that the positive contribution of local communities in the conservation and sustainable use of forests and other natural resources is tremendous. The participation of local people living in and around forests in the management of the resources have improved the condition of forests while also contributing to poverty alleviation through appropriately arranged benefit sharing with the State. These experiences have led to the wider scaling up and out of participatory forest management by hundreds of development actors, particularly NGOs.

In Ethiopia, experiences in participatory forest and other natural resources management are limited to pilot projects run by a limited number of NGOs. The areas covered by PFM pilot projects are only 140,857 hectares, which makes up less than 4 percent of the high forests or less than 0.2 percent of the total areas covered by forests and woodlands combined.

Improving comprehensive participation in forest management should be promoted more widely to make the local communities the immediate custodians of the forest. They are the stakeholders most concerned about the state of the forests as they are dependent on them for a wide array of products and services. They are the best placed actors to ensure effective husbandry. Local involvement would bring in important considerations of equity and social justice in using and managing forests as reflected in many international environmental conventions.
In the absence of efficient and effective formal governance, natural forests in Ethiopia are threatened by open access leading to unsustainable extraction of forest products and, thus, degradation. These can be reversed by using local institutions that have managed to conserve natural resources for millennia.

**8.3 Bridging inter-sectoral policy conflicts**

Development efforts in different sectors compete for the same scarce resources, particularly land and water with finance dictating which development path is approved and supported. Lack of coordination between sectors can result in catastrophic impacts of one sector on another. In recent decades, non-forest policies such as those for food security, agriculture development, resettlement, investment, and other rural development strategies have resulted in reducing the perceived value of the forest sector. Some of the activities supported by these policies and programmes have resulted in direct clearance of large areas of forests and other vegetation for, e.g. resettlement and investment. Bridging and resolving the conflicts between sectors and recognizing the natural interdependence between the different resources and sectors for sustainable functioning are essential and urgently needed. In fact, by providing diverse ecosystem services and raw materials, forestry is fundamental in ensuring the sustainability of many other sectors such as agriculture, construction, water supply and energy. A sustainable economy and society are hardly imaginable without a sustained and healthy environment, and a healthy environment is unimaginable without healthy forests and other types of vegetation.

**8.4 Have a balanced and visionary policy direction for taking decisions with respect to reforestation and afforestation**

The first priority in Ethiopia must be to rehabilitate the country’s degraded landscape. This requires massive efforts in reforestation, afforestation and forest restoration. However, forest development propaganda in recent years seems to favour the use of native and an abhorrence of exotic tree species. The reality, however, is that commendable forestry development cannot be achieved by using ‘natives’ only, and this has never been and will never be the situation in any part of the world.

Plantations are useful forests of national and global significance. They are great assets that offer rural economies jobs and income, and wealth for the nation at large. Foresters and farmers should be well versed with which tree species are best suited for which ecology.

Consequently, forestry in Ethiopia needs to take up the planting of tree species and provenances of known quality. Whether exotic or native, the genetic stock should be fast growing, provide multiple services and be able
to adapt to a degraded environment in order to improve the forest cover of the country. If Ethiopia intends to achieve food security by adopting high quality crop genetic materials from both indigenous and external sources, the forest sector should also do the same. The scientific community needs to put much effort into scientific studies to optimize the positive outcomes from planting of important species and reducing their negative impacts. Other countries, particularly with emerging economies such as China, Brazil, and Indonesia, besides their large natural forest estates, are also expanding their plantation forests by recognizing their potential and actual economic and environmental benefits.

8.5 **Building technical and research capacities**

Forestry involves managing complex interactions among trees, their ecosystem, and the people who use them. This should be based on sound scientific principles and proven techniques to be effective and sustainable. This, in turn, requires rigorous and scientifically tested and environmentally tailored methods and research outputs in natural and social sciences. These are poor to very poor in relation to forestry in Ethiopia and need to be considerably built up and improved if the forest sector is to meet expectations and achieve major successes.

8.6 **Encouraging and providing incentives for involvement of non-state actors and investment in forestry**

The State should not be the only actor to develop and conserve forests and woodland resources in the country. Other actors in the rural community should be encouraged to be involved in forest development in various forms such as small-scale farm forestry, out-grower schemes, and small to medium-scale enterprises. In encouraging involvement of the private sector in forestry, it is important to recognize the long gestation period for an investment to become financially viable. Therefore, particular attention is needed with respect to property rights over forests, and the need for long leasing arrangements for land where forest investments are to take place. Efficient systems for certifying and recognizing forest products produced from private forest estates to facilitate delivery of products to market should be worked out. Formal acknowledgement of the rights of rural peoples over the trees growing on their farmland and facilitation for officially recognized sustainable harvesting and marketing of the products from such forest estates would provide a major incentive for development of the sector by non-government actors.
8.7 Improving information/data collection and knowledge management

Good data on the status of the country’s forest resources are critical at all levels of decision-making. But reliable statistics on forest resources are largely absent or, where available, not kept up to date. Without knowing what exists, what is being lost, what drives loss or regeneration and the like, it is difficult to produce relevant policies and strategies. Therefore, there is a need for accurate documentation of this information and good knowledge management to share the data and analyses with all concerned.

8.8 Appropriate valuation of forest services and products

The contribution of forests and woodlands to local livelihoods, the agricultural sector, environment and society at large is not properly accounted for and valued. Thus, there is a need for appropriately quantifying the subsistence and environmental benefits of forest resources, and the contribution of the sector to other sectors such as water, agriculture, energy, etc.

8.9 Supporting forest-based enterprises, value addition and marketing

Value added processing of forest products will significantly increase the economic value of forests. This is also how we can realize true support to farm foresters (farmers) and investors in forestry by developing and expanding forest-based enterprises, linking them with markets, and promoting their products, as clearly stated in the new forest policy. This, in turn, will push the expansion and development of forest resources, processing and marketing of forest products without much government intervention. These various forest-based enterprises should be seen at different scales if the sector is to make a viable economic contribution in poverty alleviation. This includes, but is not limited to:

- small-scale enterprises with low investment catering for the needs of local communities in terms of employment, resource use and marketing;
- medium-scale enterprises that are more specialised with improved technology for efficient resource use and improved product quality; and
- integrated large-scale enterprises requiring heavy investment in high quality plantation forests for supplying the raw materials, the processing technology and the marketing.
8.10 Improving the institutional arrangements for the forest sector
Lack of stability in the government’s institutional arrangements for forestry is one of the principal causes for the problems prevailing in this sector in Ethiopia. Improvements are, therefore, needed in framing and setting up a capacitated, stable and fully mandated agency/institute to deal with the sector at federal level as well as in the national regional states.

8.11 Capturing global opportunities for better financing of the forest sector
There are many global initiatives set up to support the development of the forest sector in developing countries like Ethiopia. Capturing these opportunities can help to supply sufficient funding and capacity building opportunities for better management, development and conservation of the forest resources in the country.

8.12 Introduce PES between different sectors within the country
A proper valuation of the forest sector occurs when the ecosystem services it provides are properly accounted for. Introducing payment for ecosystem services (PES), such as watershed protection, water flow regulation and reduction of soil erosion, can support better coordination among the various sectors dependent on these services: forestry, water resources including municipality water supplies, production of hydro-electric power, agriculture, tourism and culture, trade and industry.

8.13 Strengthen complementary development initiatives
Forest development cannot stand alone. Pursuing complementary initiatives such as rural electrification, introducing and subsidizing alternative energy sources, improving agricultural productivity through adoption of integrated nutrient and land management systems for smallholder farmers, controlling population growth and introducing diversified means for people to earn a viable income are crucial to achieve success in forest development and conservation.

References


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**Figure 6: Farm forestry - trees in farmland in Haik**  
*(Photo, Sue Edwards July 2010)*
REVIEW OF LAND DEGRADATION AND LAND MANAGEMENT 
IN ETHIOPIA UP TO 2008/09

Berhan Gessesse¹

1. Introduction

1.1 Background

With a population of about 73.9 million in 2007 and growing by 2.6 percent annually (PCC, 2008), Ethiopia is one of the largest and most populated countries in Africa. The country can also be regarded as the home of important biodiversity due to its range in physiographic features with altitudes ranging from 116 metres below sea level in the Dallol to 4,620 metres above sea level on Ras Dejen. Ethiopia’s economy is primarily based on agriculture, which accounts for 50 percent of the gross domestic product (MoARD & WB, 2007). Some 83.9 percent of Ethiopia’s population lives in rural areas (PCC, 2008) and depends on the local land resources (soil, water and vegetation) to meet its basic needs for wellbeing (MoARD SLM Secretariat, 2008). Although 60 percent of the total land area is estimated to be potentially suitable for agricultural production, less than 15 percent is currently under cultivation. In spite of its vast agricultural potential, Ethiopia has been trapped in a vicious downward cycle of land resource degradation and poverty. As a result, the country has become dependent on external food support: it is one of the largest recipients of food aid in Africa (Sisay & Tesfaye, 2003).

Land degradation is the major environmental problem resulting in low and, in many places, declining agricultural productivity and continuing food insecurity (Mesfin, 1992; Markos, 1997; Yeraswork, 2000; Woldeamlak, 2003; Aklilu, 2006). The average annual soil erosion rate nationwide was estimated at 12 tonnes per ha, giving a total annual soil loss of 1,493 million tonnes. The soil erosion hazard is much higher for land under annual crops as compared to that under grazing, perennial crops, forest and bush. In spite of covering only 13 percent of the country’s area, annual crop land contributes to about 45 percent of the estimated total soil loss from the country (MoARD & WB, 2007).

There have been considerable efforts to address land degradation in Ethiopia. But these attempts have largely failed. Therefore, there is a need

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to identify what works where and provide land users a range of potentially effective land resource management (LRM) options, as well as addressing constraints that inhibit adoption of potentially useful measures through appropriate policies and investment programs (Shiferaw & Holden, 1998).

1.2 Purpose and objectives of the review
The purpose of this review is to characterize the nature and extent of land degradation, practices and experiences in improved land management, as well as identify gaps, constraints and bottlenecks for the adoption of appropriate technologies for improved land resource management. The review also provides some remarks to help improve the use of effective land resource management practices in Ethiopia. The specific objectives are to:

- review recent literature related to the nature, extent, features and characteristics of land degradation and use of LRM technologies;
- synthesize measures being taken by the state and non-state actors to address land degradation; and
- identify opportunities, gaps and constraints related to the adoption of sustainable land management (SLM) practices in Ethiopia.

2. Concepts of Land, Land Degradation and Sustainable Land Management
The concepts underlying the use of the terms land, land degradation and sustainable land management require definition to understand the subsequent discussions. In a broad sense, land refers to climate, water resources, landforms, soils, and vegetations (FAO, 1976; FAO, 1980). Wit & Verheye (2000) stated that land resource is comprised of the earth’s surface, including all elements of the physical and biological environment that influence land use. Thus, land resource refers not only to soil but also to landforms, climate, hydrology, vegetation and fauna, together with conservation practices such as terraces, agro-forestry and drainage works. Land is an environmental, social and economic asset and is a key resource for the realization of development opportunities (UNEP, 2006).

Land degradation is a complex phenomenon influenced by natural and socio-economic factors. It generally refers to the loss of the land’s biological and/or economic productivity. It is a deterioration or total loss of the productive capacity of the land for present and future uses (FAO, 1980). Land degradation results from one or a combination of processes including water and wind erosion, a long term reduction in the amount and/or diversity of natural vegetation, salinization or acidification. In some instances, land degradation is taken as synonymous with soil degradation. However, the scope of land degradation is more than soil degradation (Woldeamlak, 2003;
Kangalawe et al. 2005; Mahmud et al., 2005). Soil degradation is one aspect of land degradation which refers to a process that lowers the soil’s current and potential capacity to support life and provide services. In light of this, soil degradation is a term for the deterioration of soil quality in terms of its physical, chemical and/or biological attributes as well as its removal by erosion. The specific processes recognized as the main factors triggering soil degradation are water and wind erosion, water logging, chemical, biological and physical degradation (MoARD & WB, 2007; MoARD SLM Secretariat, 2008).

Sustainable land management refers to the use of land resources for agricultural and other purposes to meet individual and community needs while simultaneously maintaining the long-term productive potential of the resource and the maintenance of environmental services through systematic use of indigenous and scientific knowledge and technologies (World Bank, 2008). It involves more than the use of physical soil and water conservation (SWC) measures. It includes the use of practices for soil fertility and agricultural water management, forestry and agro-forestry, as well as the application of these measures in a more integrated manner to satisfy present local community needs while solving ecological problems and maintaining the land in a condition for supporting future generations (Gete et al., 2006).

3. Legal Framework and International Conventions Supporting Sustainable Land Management

3.1. Legal issues related to SLM in Ethiopia

An appropriate system of land administration has the potential to significantly influence investments in agriculture, improve rural livelihoods, reduce land degradation and improve resource use (ARD, 2004). Along with other interventions, formulating land use and administration policy and implementing it is vital in creating an environment in which the rural population is able to prosper and, at the same time, to adapt to land degradation challenges and other related environmental shocks. In the light of this, the Ethiopian Constitution (FDRE, 1995) includes a broad framework for land policy in the country. Article 40(3) states: “The right to own rural and urban land as well as natural resources belongs only to the state and the people. Land is an inalienable common property of the nations, nationalities and peoples of Ethiopia and shall not be subject to sale or to other means of transfer” (FDRE, 1995). The 1997 Ethiopian National Rural Land Administration Proclamation delegates responsibility for land administration to regional governments. This law defines the scope of individual land use rights and states that such rights can be leased and bequeathed, and also provides important general guidelines that the
regional governments must follow in crafting regional laws. More recently, in 2008, the Ethiopian Strategic Investment Framework (ESIF) for Sustainable Land Management was formulated by the MoARD in order to combat land degradation and support the scaling-up of sustainable land management in the country (MoARD SLM Secretariat, 2008).

3.2. International conventions and conferences related to SLM
For the last 30 years, the realization of how unsustainable growth and environmental degradation have impacted on poverty has contributed to a renewed emphasis on environment and development as a global collective issue. In part, this is motivated by a concern that environmental disasters result in devastating problems, but also by the recognition that the majority of environment and development related problems cannot be solved by one country acting alone. To address this issue at the international level the following major international conventions have been developed with Conferences of the Parties2 held regularly to discuss and negotiated how they should be implemented.

3.2.1 The 1972 Stockholm Conference on the Human Environment
The foundations for global environmental governance were laid down at the Stockholm Conference on the Human Environment in 1972. This was the first international forum aimed at addressing global environmental challenges. Attended by 113 countries, the meeting considered the need for a common outlook and for common principles to inspire and guide the peoples of the world in the preservation and enhancement of the human environment. The Conference resulted in the establishment of the United Nations Environment Programme (UNEP) (Khor, 1997). UNEP is the agency with global responsibility for the environment. It has as its main functions: promoting international environmental cooperation and recommending policies for this; providing policy guidance for the direction and coordination of environmental programmes in the UN system; regularly reviewing the world’s environmental situation; and implementation of environmental and natural resource conservation programmes and strategies within the UN system. UNEP’s list of achievements includes the initiation of negotiations on many major environmental issues, several of which were concluded in the Rio Earth Summit (Bilsborrow & DeLargy, 1991).

3.2.2 The 1992 Rio Earth Summit
The United Nations Conference on Environment and Development (UNCED) was held in Rio de Janeiro in 1992; it is popularly as known the ‘Earth Summit’. It was the world’s largest environmental meeting, attracting 103

2 A Party is a government that has signed and ratified an international convention.
Heads of State and 179 governments (Khor, 1997). Rio established the growing recognition amongst the world’s political leaders that cooperative global action on a number of key issues is essential. The Earth Summit produced several landmark documents to chart a course that would halt natural resource destruction, poverty and inequality. The Summit marked the coming of age of sustainable development. It emphasized that economic and social progress depends critically on the preservation of the natural resource base with effective measures to prevent environmental degradation. It also pointed out that developing countries should cooperate in addressing global threats to their natural resource base. The Rio Principles, the United Nations Framework Convention on Climate Change (UNFCCC or FCCC), the United Nations Convention on Biological Diversity (CBD), the Rio Forestry Principles, the United Nations Convention to Combat Desertification (UNCCD), and the Commission on Sustainable Development (CSD) are the most important environmental and natural resource management strategy outcomes of the 1992 Rio Earth Summit.

### 3.2.3 The World Summit on Sustainable Development, Johannesburg 2002

Since the Stockholm Conference of 1972, many global environmental agreements have been approved by governments. Collectively, they are often referred to as the Multilateral Environmental Agreements—the MEAs. The World Summit on Sustainable Development (WSSD) in September 2002 reaffirmed land degradation as one of the major global environmental and sustainable development challenges of the 21st century, calling for action to address root causes of desertification and land degradation in order to restore land and address poverty resulting from land degradation (Khor, 1997). The commitment toward environmental protection is motivated by land resource deterioration mainly desertification, soil degradation and frequent drought. As a result it was agreed that addressing land degradation, desertification and poverty would contribute significantly to achieving the Millennium Development Goals (MDGs) of reducing by half the proportion of people in poverty by 2015 and ensuring environmental sustainability (Mustafa, and Zahir, 2007).

### 3.2.4 The Copenhagen Conference on Climate Change

The Conference of the Parties (COP) 15 for the UNFCCC was held in Copenhagen, Denmark, in December 2009. The goal was to discuss the revision of the Kyoto Protocol that is due to end in 2012 and to develop other stronger agreements for implementing the Climate Change Convention as had been agreed in an earlier meeting in Bali in 2007. Central to combating climate change is the need for governments to implement policies and
strategies to reduce and stabilize greenhouse gas concentrations in the atmosphere. These gases are generally accepted to be responsible for the observed increase in the average global temperature at sea and land level, presently around 14°C, which is bringing about changes in weather patterns including increasing numbers of extreme events such as droughts, rain storms and hurricanes. Changes in climate at local, national, regional and global levels are predicted to bring major changes to the overall global environment resulting in increased economic and social risks, posing challenges and requiring decisions to mitigate and adapt to the problems that are and will continue to arise. It was hoped that the COP 15 in Copenhagen would result in a major revision of the Kyoto Protocol and/or a similar effective and stronger agreement on how to combat climate change starting from the year 2012. No agreement was made. Instead, a political agreement of intent, called the ‘Copenhagen Accord’, was concluded and signed by the majority of the governments in the meeting. One part of the agreement contains a commitment for 30 billion USD dollars to be given as compensation for developing countries over the next three years, rising to 100 billion USD dollars per year by 2020 for climate change mitigation and adaptation, environmental rehabilitation particularly focused on forests and other management measures that can have a positive impact on addressing environmental degradation. However, the document is not legally binding and does not contain any obligatory commitment for reducing emissions.


Ethiopia is one of the countries in sub-Saharan Africa that is well endowed in terms of its natural resources including biodiversity, and particularly its agricultural biodiversity. Its location in the tropics combined with wide altitudinal variations allows the country to enjoy both temperate and tropical climates and grow a very wide range of crops. This gives a wealth of biophysical resources including rich biodiversity, relatively fertile soils, and good fresh water resources (Gete et al., 2006). Although the country is endowed with an enormous land resource potential, it has been affected by multifaceted environmental problems including land degradation and declining biodiversity (Sisay and Tesfaye, 2003). In recent years, many research studies have been conducted on land degradation in Ethiopia, specifically in the highlands (Mesfin, 1992; Yeraswork, 2000; Lakew et al., 2000; Woldeamlak, 2003; Mahmud & Pender, 2005; Aklilu, 2006; MoARD SLM Secretariat, 2008). Some of these studies attempted to provide nationwide

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3 The major greenhouse gases, after water vapour, are carbon dioxide, methane and nitrous oxide.
estimates of on-site and off-site costs of land degradation. According to Mahmud & Pender. (2005), the Ethiopian Highlands Reclamation Study of 1986; the Soil Conservation Research Project of 1988; the National Conservation Strategy of 1993; the World Bank’s reassessment of 1995; estimates by Sonneveld in 2002 and the various reports of the Woody Biomass Inventory and Strategic Planning Project (WBISPP, 2004) are the major studies carried out in relation with land degradation and land management practices on the Ethiopian highlands. Based on estimates of the severity and extent of erosion, these studies concluded that land degradation, particularly in the form of soil degradation and/or erosion, nutrient depletion and deforestation is severe particularly in the highlands.

Among the different forms of land resource degradation processes, soil erosion by water is the most widespread and critical problem that poses a threat to the food security of the population and future development prospects of the country (Hurni, 1988; Woldeamlak, 2003; Berry et al., 2003). Soil erosion is not a new phenomenon in Ethiopia; it is a process as old as the history of agriculture in the country (Hurni, 1993). However, over that past one hundred years, this process has been accelerated by political upheavals and population growth that has brought with it more deforestation and environmental changes. With the increase of population pressure, development of agricultural production involves an increased risk of land degradation through deforestation and expansion to new lands that are often fragile and susceptible to erosion making them marginal for crop production (Sisay and Tesfaye, 2003).

According to the Ethiopian Highlands Reclamation Study of 1986 (cited in Mahmud & Pender, 2005), about 130 tonnes of soil per hectare are lost from cropland; the average for the country as a whole is about 35 tonnes of soil per hectare. Furthermore, the study concluded that 50 percent of the highlands were significantly eroded, some 25 percent seriously eroded and 4 percent of the highlands had reached a point of no return, i.e. were totally eroded. In terms of cereal production loss, it was calculated that about 120,000 tonnes of cereal output was being lost every year, which was equivalent to a two percent loss from total production per annum (FAO 1986a, FAO 1986b, cited in Mahmud & Pender, 2005). Water was estimated to erode about 30 thousand hectares of land annually and two million hectares of land had been severely damaged. For forest and woodland, it was estimated that about 62 thousand hectares were being lost annually.

More recent studies after 2000 have estimated that one billion tonnes of top soil is lost each year taking with it soil nutrients equivalent to 30 kg/ha of nitrogen and 15-20 kg/ha of phosphorus (WB, 2001; UNDP, 2002, as cited in
MoARD & WB, 2007). As a result the country is considered as one of the most environmentally degraded countries in the world.

**4.1 Causes and costs of land degradation**

Land degradation in Ethiopia is triggered by complex processes and factors (Fistum, *et al*., 1999, Lakew *et al*., 2000; Bezuayehu *et al*., 2002; Aune *et al*., 2003). Although influenced by natural forces, the challenge of land degradation is mainly the result of unprecedented population growth in the highlands, that leads to exploitative subsistence agriculture (Markos, 1997), and lack of appropriate improved farming methods for Ethiopia’s smallholder farmers (Mesfin, 1992). These circumstances, combined with the breakdown of traditional land management practices and the increasing cultivation of lands unsuitable for annual crop cultivation, contribute to land degradation and declining agricultural productivity. The direct causes of land degradation in Ethiopia are the expansion of annual crop cultivation into steep lands without adequate investments in measures to arrest loss of soil and water, erratic and erosive rainfall patterns, declining use of fallow, limited recycling of dung and crop residues to the soil, limited application of external sources of plant nutrients, deforestation and overgrazing (Markos, 1997; MoARD & WB, 2007).

Socio-economic and institutional factors are the underlying causes that affect land degradation through their impacts on farmers’ decisions with respect to land use and land management practices. These factors include population pressure, poverty, the high costs of and limited access to agricultural inputs and credit, the low profitability of agricultural production, fragmented landholdings, short time planning horizons, and lack of information about appropriate alternative technologies for farmers (Fitsum *et al*., 1999; Lakew *et al*., 2000; Hoben, 2001; Bezuayehu *et al*., 2002). Government policies have largely failed to deal with providing relevant infrastructure and market development, input and credit supplies, land tenure, agricultural research and extension, conservation programs, and land use regulations. The need for effective local governance and collective action are other related factors required to tackle the problem of land degradation in the country (Fistum *et al*., 1999, Hoben, 2001; Aune *et al*., 2003; Mahmud *et al*., 2005). In addition, absence of a comprehensive land use and administration policy, proclamations, laws, regulations and master land use plans developed in a participatory way at federal, regional, and community levels are the major factors that have contributed to the unchecked land degradation in the country.

The cost of land degradation for Ethiopia is massive. Low and declining agricultural productivity, continuing food insecurity as well as rural poverty due to loss of topsoil and plant nutrients, forest removal, loss of livestock
carrying capacity, decline in productivity of cropped areas, loss of environmental services are some of the direct (on-site) costs (MoARD & WB, 2007). Secondly, once soil and excessive runoff leave the boundaries of individual farms, it causes off-site (indirect) impacts and result in costs and/or loss of benefits that are external to the farm household. Clark (1996), cited in Mahmud & Pender (2005), lists various types of off-site costs of soil erosion, of which the most important are in-stream problems of water quality and quantity, sedimentation effects in reservoirs, the degradation of potable water, a decrease in the availability of irrigation water, increased siltation, accelerated runoff leading to localized flooding, reduced hydrological cycling and recharge of ground water. However, it is important to recognize that not all external impacts of land degradation are necessarily negative. For example, soil erosion may lead to beneficial inflows of soil and plant nutrients to downstream sites. A notable example is the way the Erob people on the steep eastern escarpment in Tigray have captured soil and water behind stone dams in steep-sided waterways to build substantial pockets of soil where they cultivate oranges and other crops for their own use and to market in Adigrat.

4.2. The need for sustainable land management practices

The various studies cited here on land resources management in the Ethiopia context conclude that land degradation is a critical problem and a major factor contributing to declining agricultural productivity and increasing poverty in the country. Overall, insufficient efforts have been made to effect sustainable land use through the widespread adoption of appropriate practices. Hurni (1993) describes sustainable land management as a system of technologies and/or planning that aims to integrate the biophysical elements of the environment (such as land, soil, water and biodiversity) with socio-economic and political requirements for the effective management of land for agriculture and other purposes. In line with this, Gete et al. (2006) argue that sustainable land management should be composed of:

- the use of different technologies/practices and integration among them to solve ecological and socio-economic constraints;
- the need for participatory land management planning to meet community needs and sustainable use of the renewable natural resources without compromising their environmental functions; and
- the need for an appropriate policy environment to undertake the above major tasks on an equitable basis.

Practices for sustainable land management are not only the use of physical soil and water conservations measures, which is a common mistake
made by many of the actors in the country (Gete et al., 2006), but also include the use of appropriate soil fertility management practices, agricultural water management, forestry and agro-forestry, forage and rangeland management, and the application of these measures in a more integrated way to satisfy community needs while building ecological services. Many studies show that decisions by Ethiopian farmers on what soil and water conservation practices to adopt is affected by a complex set of factors including the households’ endowment of physical and human capital, access to markets, off-farm opportunities, institutional support, population pressure, profitability, and tenure over resources.

4.3 Institutional setup and stakeholders involved in sustainable land management practices

4.3.1 The institutional setting
As indicated by the MoArd SLM Secretariat (2008), the key federal and regional government institutions with a mandate for issues related to land management include Federal and Regional Government Institutions, and Woreda Offices.

The Ministry of Agriculture and Rural Development (MoARD) replaced the former separate Ministries of Agriculture and Rural Development in January 2004. The MoARD has responsibility for activities related to sustainable land management such as: (i) enhancing market-led agricultural development; (ii) food security; (iii) water harvesting and small-scale irrigation; (iv) conservation and utilization of forests and wildlife resources; (v) monitoring events affecting agricultural development and maintaining early warning systems (disaster prevention and preparedness activities); (vi) control of plant and animal diseases and migratory pest outbreaks, (vii) overseeing the distribution of high quality agricultural inputs; and (viii) promotion and expansion of extension services to the small-scale farmers, pastoralists and private investors including establishing and running a network of agriculture and rural technology training centres – the farmers’ training centres (FTCs).

Besides, the MoARD is the lead agency for the development and implementation of the Ethiopian Strategic Investment Framework (ESIF) for Sustainable Land Management formulated in 2008. The ESIF is to be implemented by bringing together federal, regional, woreda and local/community level stakeholders within a multi-level cooperative partnership. The federal ESIF multi-stakeholder platform comprises a National SLM Steering Committee, which is chaired by the State Minister for the Natural Resource Directorate in the Ministry, and the
National SLM Technical Committee (NTC)\(^4\), both of which are supported by the SLM Secretariat which is located in an office in the Natural Resource Division of the MoARD.

The Environmental Protection Authority (EPA) has direct responsibility for the implementation of the Ethiopian environmental policy and national action plan to conserve natural resources (such as land, biodiversity, soil, water and many others) and combat desertification. The role of EPA is to coordinate environmental matters amongst the different sectoral ministries and agencies, as well as to ensure that all development interventions comply with the country’s environmental norms and established guidelines.

The Ethiopia Institute of Agricultural Research (EIAR) is responsible for coordinating the various research programs of the national network of agricultural research stations including on-farm research and demonstrations. It is also responsible for the research component of the Rural Capacity Building Project, which includes support for: (i) natural resources management; (ii) crop research; (iii) livestock research; and (iv) agricultural mechanization.

The Ministry of Finance and Economic Development (MoFED) has the lead responsibility for facilitating the flow of funds to those agencies responsible for the implementation of land resources management activities. It also has overall responsibility for the formulation of the country’s economic development policies and plans.

The Ministry of Education (MoE) has lead responsibility for the development and promotion of environmental education in general and land resource management education in particular within the formal education sector.

The Ethiopian Development Research Institute (EDRI) has a mandate to undertake sectoral and cross cutting policy research studies related to economic, social and environmental development within Ethiopia.

Higher Learning Institutions include government universities and colleges that provide higher learning and research opportunities related to land resources management. For example, Addis Ababa University, Haromya, Mekele, Hawassa, Arbaminch and Jimma Universities

\(^4\) The NTC comprises representatives nominated from among senior technical staff of institutions including MoARD, Ministry of Water Resources (MoWR), Environmental Protection Authority (EPA), Ethiopian Institute of Agricultural Research (EIAR), Institute of Biodiversity Conservation (IBC), the Ethiopian Development Research Institute (EDRI) and other development partners with SLM programmes.
address the issue of land degradation/desertification and run land resource conservation programs through their various regular educational and research programmes.

Regional Government Institutions: The Ethiopian Constitution has established a decentralized federal system with the country divided into Regional States. Most responsibilities for the planning and implementation of development policies and programs, including the management and utilization of their natural resources, have been devolved to the Regional States. Each region has its own set of government institutions which largely replicate those at the federal level.

Woreda Offices: In 2002 the government introduced an important phase of decentralization making the woredas the centre of socio-economic and technical development with the aim of empowering local (woreda) administrations, thereby bringing the government closer to the people, and enabling it to be more responsive to local needs. The woredas now have economic autonomy and receive direct block grants from their regional governments. With the empowerment of the woredas, the role of federal and regional agencies is changing. Originally, decentralization meant that implementation was the responsibility of the regional bureaus. As a result of this second phase of decentralization, the regional level now focuses mainly on policy and supervisory activities. Management and responsibilities for the use of resources for service delivery and project implementation have been moved to the woredas with their various technical offices, including those responsible for the implementation of sustainable land management activities.

4.3.2 Stakeholders involved in sustainable land management practices
It would be unthinkable to attain sustainable land management without the full participation of relevant stakeholders. In Ethiopia, there are a number of stakeholders who are directly or indirectly involved in these activities. Stakeholders are the groups that play significant roles for the promotion of strategies and practices for sustainable land management in the country. They fall into the following categories: government development agencies, research institutes, agricultural and/or environmental education institutes, farmers, regulatory agencies, donors and NGOs (Gete et al., 2006; MoA & WB, 2007; MoARD SLM Secretariat, 2008).

Government Development Agencies: The Federal Ministry of Agriculture and Rural Development (MoARD), the regional and zonal bureaus, and woreda offices and community level development agents (DAs) are
major players for land resources management under this category. This group plays decisive roles in the promotion as well as the adoption of technologies, including those for effective land management, in the country. The group determines the approach, types of technologies to be promoted, amount and mechanisms of implementation (MoARD SLM Secretariat, 2008).

**Research Institutes:** This includes the national and regional research organizations, regional agricultural research institutes, federal and regional agricultural research centres, and higher learning institutes and the international research centres. The roles of these organizations with regard to land resources management are to generate and/or adapt land management technologies that are suited to the different agro-ecological zones of the country, undertake systematic studies to help their successful implementation, help policy makers to make informed decisions, assist the extension agencies to be well equipped with required information and mechanisms of promotion, assess impacts and suggest possible areas of improvement. Moreover, this group has responsibility to bring in international experiences and also technologies that have proved to be effective and suited to local conditions elsewhere (Gete et al., 2006).

**Regulatory Agencies:** According to Gete et al. (2006), this group includes the Environmental Protection Authority (EPA) and the Environmental Protection and Land Administration Authorities at regional and lower levels in Ethiopia. One of the most important umbrella polices is the Environmental Policy of Ethiopia (FDRE, 1997). This policy addresses a wide variety of sectoral and cross-sectoral environmental concerns in a comprehensive manner. The major aim is to ensure the sustainable use and management of natural, human made and cultural resources, and the environment. Moreover, land use and land administration policies and strategies have been developed by the different Regions with autonomous organizations established to implement them. Recently, most of the regional authorities (Amhara, Tigray, Oromiya and SNNPR) have formulated regional land use and administration policies and implementation has been started. It is hoped that this will increase investment in sustainable land management practices.

**Agricultural and environmental education institutes:** The higher learning institutes that include agriculture and environmental education in their curricula are responsible for giving training to agriculture and natural resources management specialists with different qualifications. Recently the numbers of institutes and graduates have been substantially increased (MoARD & WB, 2007). This is considered as a
major breakthrough to promote as well as implement sound land resource management practices in Ethiopia.

Non-Governmental Organizations (NGOs): This includes international and local NGOs. Environmental rehabilitation is often a major component of projects developed by NGOs involved in agricultural development. This group is also engaged in applying and/or developing innovative methods and approaches to promote sustainable land resources management, such as the integration of land management with income generation, credit, value-added chains linked to marketing, etc. These efforts have resulted in some examples of success. Currently, there are about 300 NGOs directly involved in activities related to sustainable land management, investing some USD 30 million annually in the promotion of a range of sustainable land management interventions (MoARD SLM Secretariat, 2008).

Land users and/or managers (farmers and local communities): This is the group who should decide whether or not to take up certain land resource practices. In the past, land management was based on indigenous knowledge. But, with the development of the Ministry of Agriculture and its extension activities in the 1950s, other land management measures were introduced and implemented without getting the farmers’ and communities’ willingness and consent (Habtemariam, 2007). Because of this, the adoption of many technologies was not successful or sustainable.

International development partners and donors: According to MoARD & WB (2007), a number of multi-lateral and bilateral donors as well as international development agencies have provided, and are continuing to provide, financial and technical support to the federal and regional governments for improved management of the country’s land resources. The projects and programmes being developed by these international development partners will provide much of the basic funding for the proposed ESIF activities.

4.4. Measures taken by the state and non-state actors to enhance the adoption of sustainable land management

4.4.1. Measures taken by the government
Government institutions have been involved in planning and implementing practices for the management of land resources at different levels including the setting up of institutions, designing relevant policies and strategies, giving agricultural education, technology generation and dissemination (Gete et al., 2006; MoARD & WB, 2007; MoARD SLM Secretariat, 2008). The Government organizations initiated land rehabilitation programmes
starting from the 1970s with the aim of arresting land degradation and improving rural livelihoods in the country. Soil and water conservation programmes were implemented through food-for-work schemes (Mesfin, 1992, Sisay and Tesfaye, 2003).

In order to have institutions responsible for the programmes, two units in the Ministry of Agriculture acted as the executive authorities for land resources management during the first half of the 1980’s: one was mainly responsible for soil and water conservation activities, and the other primarily concerned with afforestation schemes (WFP, 1990 as cited in Yeraswork, 2000). The first of these was the Soil and Water Conservation Department (SWCD). The second was the Forestry and Wildlife Conservation and Development Authority (FaWCDA). When the MoA was reorganized in 1984 G.C., the new Community Forestry and Soil Conservation and Development Department (CFSCDD) and the State Forestry Conservation and Development Department (SFCDD) became responsible for the programme.

The achievements of this national effort during the 1970s and 1980s were impressive in quantitative terms (Yeraswork, 2000). Between 1976 and 1985, it is estimated that some 800,000 km of soil and stone bunds on croplands and about 600,000 km of hillside terraces were constructed, and some 100,000 ha of land was closed for natural regeneration (Hurni, 1988). Aside from the measures introduced for soil and water conservation, reports indicate that the interventions increased the farmers’ awareness of problems related to soil erosion.

In 2008, the SLM Secretariat prepared the Ethiopian Strategic Investment Framework (ESIF) for Sustainable Land Management with support from the World Bank. The ESIF is planned to be implemented in three phases over a fifteen-year period (Phase I: 2009-13), Phase II: 2014-2018 and Phase III 2019-2023). The goal is to provide a national level strategic plan to guide the prioritization, planning, and implementation, by both the public and private sectors, of current and future investments in land management with the aim of addressing the interlinked problems of poverty, vulnerability, land degradation and declining productivity of agricultural land at the rural community level. In addition, the other central concern of ESIF is to develop an integrated strategic planning framework under which government and other stakeholders can work together to remove the barriers to sustainable land resource management and promote its scaling up within Ethiopia.

Rebuilding Ethiopia’s natural capital assets by overcoming the causes and mitigating the negative impacts of land degradation on the structure
and functional integrity of the country’s ecosystems is the overall environmental objective of the ESIF. On top of that, the basic guiding principles of ESIF to combat land degradation and promote the sustainable use of Ethiopia’s land resources include the sustainability of ecological, economic and social services, and maintaining cultural, livelihood and institutional stability. According to the MoARD SLM Secretariat (2008), the methodologies being promoted to bring about change and scale up sustainable land management include:

- active community-based participation;
- holistic participation by leadership;
- securing land user rights;
- control of livestock grazing;
- designing supportive policies;
- maintaining ecosystem and cultural diversity;
- ensuring immediate tangible financial and social benefits to the community or individual;
- innovation in implementing appropriate sustainable land management technologies;
- offering a choice of technologies rather than single standard solutions;
- understanding and addressing the root cause of land degradation; and
- designing a multi-sectoral integrated approach.

The investment is in field-based projects and programmes for promoting and scaling up sustainable land management through:

- improving the land administration and certification system;
- building the capacity of public and private sector SLM advisory and other service providers;
- improving the enabling policy, legal, institutional and financial environment for SLM;
- building an ESIF SLM knowledge base; and
- management and implementation of the ESIF itself.

During 2008 and 2009, activities included prioritization and delineation of watershed areas as well as the development and transfer of technology packages for sustainable land management.

4.4.2. Experiences of selected NGOs and other development partners in land resource management

According to the MoARD SLM Secretariat (2008), the number of NGOs integrating components of natural resource management into their work is increasing. These include community-based organizations (CBOs), both local
and international Non-Governmental Organizations (NGOs) and other development partners who are directly or indirectly involved in sustainable land management activities. Among the NGOs operating in the country, the Christian Relief and Development Association (CRDA) is the largest organization representing an alliance of around 350 local and international NGOs for the purpose of coordinating development efforts, promoting information exchange, networking for advocacy and lobbying, and building capacity.

In Ethiopia, though the official recognition by the government of NGOs as stakeholders in environmental issues is a recent phenomenon, they have been involved at different levels and at different scales for many years. The environmental issues include:

- environmental education and rehabilitation;
- soil and water conservation;
- afforestation;
- land use planning; and
- urban environmental problems (Ginjo, 2001).

For example, the Ethiopian Wildlife and Natural History Society (EWNHS), Lem Ethiopia, Ethiopian Heritage Trust, Forum for Environment (FfE), Institute for Sustainable Development (ISD), Forum for Social Studies (FSS), and many others are doing their best in advocacy and awareness raising through organizing forums and workshops on topics relevant to environment and development, policy analysis and carrying out applied research on issues relevant to sustainable development. The Ethiopian Red Cross Society (ERCS) is a significant NGO for both for its size and its novel approach when it introduced a project for land rehabilitation in and around the Upper Mille and Cheleleka Catchments in South Wollo. This was an integrated conservation-based rural development scheme with considerable tree planting and soil conservation activities.

Starting from the beginning of the 1990s, international NGOs like GTZ, World Vision International Ethiopia, Action Aid Ethiopia, SOS-Sahel, FARM Africa, CARE Ethiopia, the World Food Programme (WFP), the International Fund for Agricultural Development (IFAD), the United Nations Development Programme (UNDP), the Global Environment Facility (GEF), the African Development Bank (ADB) and others have been actively involved in a range of activities through promoting the sustainable utilization of natural resource for improved food security (Ginjo, 2001; MoARD SLM Secretariat, 2008). These organizations shifted their attention from relief to rehabilitation and, later, to community-based development and natural resource conservation programs. Diversified environmental components,
such as reforestation and soil and water conservation became part of their integrated rural development programmes (Ginjo, 2001).

The Swedish Development Agency (Sida) is one of the outstanding donors that has continued to give support since the 1980s to the land rehabilitation and resource management efforts in Wollo, mainly in and around Upper Borkena, Mille, and Alawuha watershed areas. Its support has been in the form of material contributions such as vehicles, stores, hand tools, etc that supplemented the major food-for-work inputs following the devastating drought of 1984-85 (Sida, 1987, as cited in Yeraswork, 2000). The United Nations Sahelian Office (UNSO) and the Finish International Development Authority (FINNIDA) are two donor agencies that supported the development of fuel wood plantation schemes for the benefit of a number of urban centres. UNSO established a fuel wood plantation some 30 km from Debre-Birhan and FINNIDA developed another near Dessie starting in 1983/84 and 1984/85, respectively. The former was designed to have a total of 3,600 ha of land under trees, and the later 4,200 ha (Taddese, 1988, cited in Yeraswork, 2000). USAID also provided substantial support for activities related to sustainable land management through a recently completed Amhara Micro-Enterprise Development, Agricultural Research, Extension and Watershed Management Project. USAID is also continuing to support the Ethiopian Land Tenure and Administration Project, Pastoral Livestock Improvement Project, Policy Research Support Programme, Ecotourism, and the Government Safety Net Programme. All of these include practices that support improved sustainable land management (SLM Secretariat, 2008). Other bilateral donor countries like Norway, Sweden, Finland and The Netherlands have provided support in the past for a number of soil and water conservation programs undertaken in different parts of the country (Yeraswork, 2000; Ginjo, 2001). These donors are expected to provide further support through the ESIF SLM Programme with special focus on land administration and tenure as well as the scaling up of sustainable land management activities (MoARD SLM Secretariat, 2008).

5. Gaps, Constraints and Bottlenecks to Promote and Scale-Up Sustainable Land Management

The Soil and Water Conservation Department of the Ministry of Agriculture was established in collaboration with various stakeholders to undertake systematic and planned land resources management and conservation programs. The activities were, however, scattered and implemented through food-for-work in drought affected areas with mass campaigns. The gaps as well as constraints that fostered the problem of land degradation and inhibited the implementation of successful practices for better land resources management have been identified by Pender et al. (2002),
Mahmud et al. (2005), Gete et al. (2006), MoARD & WB (2007), and the MoARD SLM Secretariat (2008). Following are the key gaps and constraints that negatively affect the quality of intervention and up-scaling of successful practices for sustainable land management in Ethiopia.

5.1 Lack of awareness by policy makers, researchers, development planners and practitioners regarding the causes, extent and impact of land degradation

Land degradation is a long-term and subtle process where its effects and expansion are hardly noticed until it manifests itself through disastrous droughts and famines. This is partly explained by the fact that land degradation is often only associated with the dry statistics such as ‘tonnes of soil lost per hectare per annum’ or ‘depletion of hectares of forest coverage’ and these do not seem to impress policy makers (MoARD & WB, 2007). The use of some improved agricultural inputs, even without proper land management practices in place, can mask the effects of land degradation, especially in areas with relatively better and deeper soils, and more reliable rainfall. Because of this, many stakeholders have regarded land degradation as a problem of drought-prone areas only. This misunderstanding is created because very little has been done to show the costs of land degradation and the benefits of applying sustainable land management practices (Mahmud et al., 2005). Moreover, there have been very few attempts to develop easy-to-apply diagnostic tools such as models to help decision makers and planners to make informed decisions about land degradation.

5.2 Lack of professionalism and technical standards

Another very important constraint, not only among policy makers but also among many experts, is that construction of physical soil and water conservation measures is considered as the main solution to halt land degradation. In almost all cases, the results are hastily evaluated and criticized without understanding their purpose. Integration among the different sustainable land management technologies to make soil and water conservation measures more effective and enhance soil productivity is seldom considered.

Moreover, the technical requirements for the effective maintenance and use of these measures are often forgotten. Unfortunately, attention is mostly given to the number/quota of interventions but not their quality, standard, sustainability, and integration with other soil and land management practices. For this reason, some technologies have been pushed to be used beyond their applicability domains; for example, the blanket recommendations for fertilizer application in areas with high moisture stress, construction of water harvesting ponds in highly permeable soils, soil
bunds along the contour in high runoff areas, etc. These ‘mistakes’ have sparked disillusionment among local experts and development agents as well as resentment among farmers so that both develop a tendency to disregard professional opinions (Gete et al., 2006).

5.3 Top-down planning approach to technical assistance

Although overcoming the current level of poverty in the country is a pressing concern, technology dissemination requires time and a careful approach to address community needs, build capacity and trust, and to demonstrate flexibility and share risks. Development can only incorporate effective sustainable land management when the actual beneficiaries of the technical assistance feel they are equal partners and that they, rather than the government, are the owners and drivers of the process. Long-term sustainability is more likely to be achieved if development is driven from the bottom-up and if it addresses farmers’ and communities’ immediate needs and constraints. From the findings of Gete et al. (2006), for example, the extension approaches exercised have very few elements of genuine participation from the bottom-up, particularly with regard to promoting sustainable land management. Quick solutions rather than sustainability, quantity rather than quality, area coverage rather than impacts, command and control rather than participation, are the approaches that have dominated the extension system.

5.4 Weak linkages among various disciplines during SLM technology generation, dissemination and implementation

According to Gete et al. (2006), although the government has invested huge sums of public money in setting up the institutional framework for the national agricultural research, education, and extension systems, there seems to be no strong functional linkages among them. Poor coordination among research, extension and education has affected formal technology development and the transfer of technologies from researchers to local experts and local communities, particularly the farmers. Even following the decentralization of the administration system down to woreda level, no clear and strong linkages, and hence a formal and inbuilt system for information exchange and sharing, has emerged among all the actors. The federal and regional research institutes participate in annual reviews of their research agendas, but the active involvement of other stakeholders is very weak and there are no efficient feedback mechanisms (MoARD & WB, 2007). Hence, the weak linkage among the various disciplines, institutions as well as others stakeholders and the end users is a decisive constraint that undermines the proper implementation and up-scaling of successful sustainable land management practices in the country.
5.5 Limited capacity to plan and implement sustainable land management at all levels

Limited capacity to plan and implement practices for sustainable land management is due to lack of focused in-service training and often poor quality of training, high staff turnover (especially at woreda level), weak technical backstopping, lack and/or poor availability of appropriate guidelines etc. These are considered to be among the major constraints to realize sustainable land management. There are also serious limitations in the capacity of the research system to conduct appropriate research as well as skill and knowledge transfer. Dealing with land issues is complex but most research lacks integration across disciplines to holistically address problems. Most of the researchers working on land issues, especially in the regional centres, are junior and lack sufficient reference materials and appropriate leadership. Within the natural resource wing of research systems, there are critical knowledge gaps with respect to land degradation, soil and water conservation, agricultural water management and engineering as compared to soil fertility and forestry (MoARD & WB, 2007).

5.6 Limited information flow and networking for SLM

Appropriate information on the resource base, the extent of land degradation, the costs and benefits of applying sustainable land management as well as information on the nature of the different practices available is required to make decisions at different levels. However, none of the above is available in an organized way to meet the needs of the different stakeholders. Although there are some efforts here and there, either they are poorly organized, do not address the full picture, or they are too old to be able to represent the current situation. Most studies address only a piece of the dilemma, and even then are not formulated in such a way as to help policy makers and beneficiaries make informed decisions (Mahmud et al., 2005, Gete et al., 2006).

5.7 Policy, legislation and implementation constraints

Ethiopia has designed a number of important policies and strategies related to the environment. However, setting sound policies and strategies is not an end by itself. The goals stated in the different policies can only be achieved if, and only if, that policy is properly implemented. Although poor implementation of policies and strategies remains a major constraint, some other policies and strategies are hindering proper implementation of effective and sustainable practices for land resource management, for example, the investment policy or policies of the regions. There is still a need for more policies and strategies to be developed or some to be modified (Pender et al., 2002; Gete et al., 2006).
5.8 Socio-economic and bio-physical constraints

There are many socio-economic and bio-physical constraints that hinder decisions to invest and sustain appropriate practices for overcoming land degradation. To begin with, poverty is one of the fundamental problems affecting land resources management, which most of the Ethiopian population continues to face. It is a chronic problem which causes enormous environmental damage as the poor are forced to mine the rapidly deteriorating natural resources in their surroundings. Thus, there is a strong nexus between land degradation and worsening poverty in the country (Grepperud, 1996; Holden et al. 1998, both cited in MoARD & WB, 2007). Rural poverty is typically linked to loss of soil productivity and forces the poor to depend on scavenging the remaining natural resources, inducing more degradation and damage to the ecology.

Of the biophysical constraints, climate variability is a significant factor. The dry lands (arid, semi-arid, and dry sub-humid areas) of Ethiopia, which cover some 70 percent of the total area of the country, are particularly vulnerable to climate change, desertification and drought. Climatic variability causes recurrent droughts and this is associated with high rainfall variability (both in space and time), which contribute to the decline in vegetation cover, loss of biodiversity and worsening land degradation. Climate variability worsened by human induced environmental degradation in turn negatively affects the sustainability of practices for better management of the land (Gete et al., 2006).

5.9 Frequent restructuring of government institutions

According to Gete et al. (2006) and MoARD & WB, (2007), even though tackling land degradation through the rehabilitation of degraded lands has been a priority for the country, institutions dealing with natural resources management have frequently been restructured, and this undermines a sense of ownership by program staff, results in high staff turnover, wastes institutional capacity, and causes discontinuity of activities and initiatives and loss of institutional memory. The frequent restructuring not only erodes all the above functions but the stage has been reached where non-professionals are often assigned to initiate activities in natural resources management, particularly at woreda level. Whenever restructuring is planned, it is often done without serious consideration of the consequences, and, as a result, many important documents, established linkages and joint activities, site specific information of high value, skills and methodological approaches resulting from years of experimentation etc get lost.
5.10 Shortage of resources and incentives

The problem of land degradation requires a huge investment in different forms. It requires efficient utilization of available resources (human, financial and non-monetary resources) for better impact. However, this has not been the case in Ethiopia and, as a result efforts in land resources management have not been commensurate with the level required because of the following reasons:

♦ the resources allocated to fight degradation are relatively meagre as compared to the magnitude of the problem;
♦ the available resources are scattered and efforts are un-coordinated mostly addressing only pieces of the predicament;
♦ they are attached to rigid fund utilization procedures;
♦ a lack of integration between public investment (mainly in fertilizer) and donor support (mainly cash, food and non-food items for environmental rehabilitation);
♦ resources are often not available on time;
♦ often the capacity building component of many donor supported environmental rehabilitation projects is very insignificant and results in poor implementation of the project and lack of continuity after the project phases out; and
♦ except in some donor assisted projects, most have no inbuilt monitoring and evaluation mechanisms (Gete et al., 2006; MoARD SLM Secretariat, 2008).

5.11 Incomplete technology packages

Lack of proper integration of introduced practices with indigenous knowledge and practices, incompleteness of available technologies to address the requirements of the diverse agro-ecological conditions of the country, and lack of proper consideration of the socio-economic setting of the different communities during introduction of technologies are some of the other factors reported by stakeholders as negatively affecting the success improvements to land resource management (Gete et al., 2006).

6. Opportunities to Promote and Scale-Up Sustainable Land Management in Ethiopia

Attempts by the government and non-governmental actors in halting land degradation have shown some valuable examples of successful projects and many opportunities. It is believed that making good use of these examples should be the starting point to promote successful initiatives for improving
land resource management in the country. The focus of many studies has so far been more on pinpointing problems or constraints rather than capitalizing on opportunities. This section points out key opportunities to help improve the quality of interventions and up-scale successful practices.

**Existence of environmental policies and strategies:** Ethiopia has made admirable efforts in terms of policy and strategy responses to address environmental degradation (Gedion, 2001). One of the most important umbrella polices is the Environmental Policy of Ethiopia. This policy addresses a wide variety of sectoral and cross-sectoral environmental concerns in a comprehensive manner. The major aim is to ensure sustainable use and management of natural, human made and cultural resources and the environment (FDRE, 1997). Moreover, land use and land administration proclamations and strategies have been developed by the different regions and an autonomous organization has been established to implement them. Very recently, the federal government also approved the national land use and land administration policy.

**Rich experience on participatory watershed management:** The need for genuine participation of communities at all levels of the decision making process is one of the key requirements for successful land resource management undertakings. Although there are many issues which need further study, there are very good experiences in the country. The government has recognized the need for participatory watershed management and recently the MoARD developed a national guideline known as the Community Based Participatory Watershed Development (Lakew et al., 2005). This is one of the most important steps taken by the government for effecting good land resource management in the country with the full participation of the local communities.

**Organizational setup of MoARD and National Research System:** The organizational set-up of the MoARD, with regional and local bureaus of agriculture extending down to the kebele level with three development agents in each kebele have taken the process of decentralized governance to the local community level. The national agricultural research system, which is composed of one federal and regional institutes with research centres that cover almost all the major agro-ecological zones, and the system of higher learning institutes together offer key opportunities that could be exploited to successfully implement sustainable land management in the country. The existence of international research organizations in the country is another opportunity to bring in international experience (MoARD & WB, 2007).
Availability of both indigenous knowledge and scientific technologies: Local communities are rich in indigenous knowledge and practices that can be further enhanced to maintain sustainable land resource management. Moreover, over the last four decades, many technologies for land resource management have been introduced or generated by research in the country (Yeraswork, 2000, Gete et al., 2006), including many new and innovative measures for soil and water conservation. Hence, the task ahead is to take note of the different indigenous and introduced land management technologies and practices in the country, as well as those generated by the national research system, and characterize them including possible integration within and across different ecologies. Disseminating this information and devising systematic technology introduction could be regarded as one of the immediate tasks.

Existence of donor support and development partners: According to Pender et al. (2002) and the MoARD SLM Secretariat (2008), there are several donors and development partners interested to assist interventions for improving land resource management. The key issue here is the effective utilization of the resources available. This is related to the high level of bureaucracy in using resources, most of which emanates from donor procedures and requirements, and lack of donor resource harmonization. Beyond this, additional resources are needed to arrest land degradation.

7. Concluding Remark
In this paper an attempt has been made to review the nature and extent of land degradation and existing opportunities that could help to address land degradation and promote profitable and sustainable practices for land resource management in Ethiopia. Land is critical to the economic and social development of the country. However, the country continues to face land resource degradation and needs to adopt both indigenous and modern technologies for improving land resource management in a sustainable way.

References


View of deforested and degraded slopes above Lake Chamo, Arba Minch Zuria (Photo, Sue Edwards March 2009)
AN OVERVIEW OF CLIMATE CHANGE IMPACTS AND RESPONSES IN ETHIOPIA IN 2009

Aklilu Amsalu¹ & Dereje Gebremichael²

1. Background

It is now widely recognized that the global climate is in a state of change. In its fourth assessment report, the Intergovernmental Panel on Climate Change (IPCC, 2007) concluded that climate change is already happening with multifaceted effects for human society and the environment. This change is rapidly emerging as one of the most serious threats that humanity may ever face. Evidence shows that the atmospheric concentration of carbon dioxide and tropospheric ozone³ have each increased by 35% during the last 50 years, the concentration of methane has increased by 151% since 1970 and the global average temperature has risen by about 0.6ºC (Ennis & Marcus, 1993; IPCC, 2001). Evidence indicates that anthropogenic factors are the major contributors of the currently prevailing global climate change (Ribot, 1996; Rayner & Malone, 1998; UNEP, 2006; IPCC, 2007). The global impacts range from sea-level rise along coastlines, melting ice caps and glaciers in the polar and mountain regions to increased incidences of catastrophic droughts, flooding and disease burdens in the tropics and subtropics (Eriksen et al., 2008; IPCC, 2007).

Developing countries who have contributed least to greenhouse gas⁴ emissions are among the most vulnerable to the impacts of climate change. These countries have limited adaptive capacity as compared to the developed countries because of their limited financial resources, skills and technologies, high levels of poverty, and their excessive reliance on climate sensitive economic sectors such as agriculture (Orinda & Murray, 2005; Reid & Huq, 2007). In Africa, climate change is seen as a major obstacle to the continents’ struggle to develop unless it is properly addressed and

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³ This is the ozone in the lower layer of the atmosphere which is on the rise and become a greenhouse gas. It does not help to protect against ultraviolet rays. The ozone in the upper layer of the atmosphere is useful to protect against ultraviolet rays, but it is depleting, i.e. getting thinner.
⁴ The major greenhouse gases are water vapour, carbon dioxide, methane and nitrous oxide.
managed across a range of sectors. Projections indicate that the population at risk of increased water stress in Africa will be between 75-250 million and 350-600 million people by the 2020s and 2050s, respectively (IPCC, 2007). Climate change is predicted to reduce the area of land suitable for rainfed agriculture by an average of 6%, and reduce total agricultural GDP in Africa by 2 to 9% (TerrAfrica, 2009).

According to Stern (2007), Africa will be under severe pressure from climate change: many vulnerable regions, embracing millions of people, are likely to be adversely affected. In addition, the continent will be exposed to coastal flooding and increased risks to human health. Non-climatic factors including endemic poverty, hunger, prevalence of diseases, chronic conflicts, low levels of infrastructure development, and weak governance complicate the problem. Climate change adaptation in Africa basically requires a deeper understanding of a range of issues affecting immediate development. Orinda and Murray (2005) indicated the need for African countries to formulate comprehensive climate change adaptation strategies that focus on the needs of the poor and are integrated into the wider development agenda. Specifically, the existing livelihood coping strategies that have a low demand for costly external inputs and technologies should be strengthened rather than trying to replace them with new high-tech solutions.

Ethiopia is especially vulnerable to climate change because of its geographic coverage and complexity, low income, and great reliance on climate sensitive economic sectors particularly agriculture and pastoralism. The livelihoods of many millions of people in the country are critically dependent on climate. IPCC’s regional review of the impacts of climate change identified the three vulnerable sectors in Ethiopia as food security, water resources and health (IPCC, 2001). There is wide consensus that climate change will worsen food security, mainly through increased extremes and temporal/spatial shifts in the weather. The country is already experiencing a major deficit in food production in many areas through increased aridity, degradation of natural resources, and loss of soil moisture. This paper aims to review the impacts of climate change and adaptation strategies in Ethiopia based on available research findings and notes, and also identify the major challenges and prospects for meeting these challenges. Although the review is intended to focus on existing information published until 2008, some important references from 2009 are used. It should be noted that a more comprehensive assessment of the situation will be given in the 2009 review.
2. Global Responses

Over the past few decades, climate change has become a major item on the international agenda. The global nature of the problem and its transboundary effects require concerted global action. Many regional and global summits have dedicated discussion sessions to climate change based on the recognition that the global climate is changing and this has become more evident in recent years.

The first time climate change was recognized as a serious problem by an international gathering was in 1979 in the first World Climate Conference (UNEP, 1990). The meeting issued a declaration calling on the world's governments to foresee and prevent potential man-made changes in climate that might be adverse to the well-being of humanity and its life-support systems. Since then a number of international climate change conferences have been convened. In 1992, the first global convention on climate change was adopted, i.e. the United Nations Framework Convention on Climate Change (UNFCCC) as part of the United Nations Conference on Environment and Development—the Rio Earth Summit. However, as a framework treaty, the UNFCCC set no mandatory limits on greenhouse gas emissions for individual nations and contained no enforcement provisions. Rather, the treaty included provisions for updates (called protocols) that would set mandatory emission limits and means to achieve them.

A principal update was the Kyoto Protocol, which was adopted in 1997 and ratified by 182 countries. It places great emphasis on mitigation efforts by fixing mandatory targets for reducing greenhouse gas emissions for some developed countries. Nonetheless, the Protocol has so far been without tangible success and hence practical steps against further emissions could not be realized (Helm, 2008). The Kyoto Protocol has also been criticized for the difficulty of establishing full accounting and verification procedures for carbon sinks, which makes monitoring and enforcement of the Convention difficult and complicated (Retallack, 2006).

International climate negotiations are handicapped by the conflicting interests of nations and special groups, particularly multinational corporations. As a result, the UNFCCC and the Kyoto Protocol have faced several challenges that have interfered with achieving their prime objectives of reducing emissions. Of all, lack of political will and commitment on the part of some developed nation governments like the United States of America have been a major obstacle in global efforts to deal with climate change and its impacts. Due to the very rapid growth in their economies, some developing countries such as China and Brazil are concerned about the impacts of the Convention on their economic growth and insist that they should not be penalized for climate change problems largely caused by the
already industrialized countries. While the science for understanding the climate and the empirical evidence mount up, the policy responses have so far had little or no impact on the build-up of emissions (Helm, 2008).

Until 2007, climate change negotiations had been dominated by concerns about reducing emissions primarily by the industrialized countries. Adaptation had not been included. However, preparing for adaptation to the impacts of climate change by carrying out climate change impact assessments is one of the commitments of the Parties\(^5\) under Article 4.1 of the UNFCCC.

Recently, adaptation has gained increased recognition including the need to assist those countries that are least able to adapt. Hence, there are now attempts to bring climate change into the wider development agenda (Huq et al. 2006). Furthermore, the interaction between adaptation and mitigation that had previously been overlooked is now receiving greater attention because of the potential synergies and trade-offs (IPCC, 2007). Therefore, developing or reinforcing adaptive mechanisms to deal with the negative effects of climate change must be a high priority. According to Huq et al. (2006), without addressing climate change issues, much effort in other development policy and practice will be wasted since most climate change impacts will fall predominantly on the world’s poorest people.

In December 2007, the Conference of the Parties adopted the Bali Action Plan when they met in Bali, Indonesia. This launched a comprehensive process to enable the full, effective and sustained implementation of the Convention through long-term cooperative action up to and beyond 2012. The four major components in the Bali Action Plan are:

1. **Adaptation:** Changes in policies and practices designed to deal with climate threats and risks. Adaptation can refer to changes that protect livelihoods, prevent loss of lives, or protect economic assets and the environment. Examples include changing agricultural crops to deal with changing seasons and weather patterns, increasing water conservation to deal with changing rainfall levels, and developing medicines and preventive behaviours to deal with spreading diseases.

2. **Mitigation:** Policies and behaviours designed to reduce greenhouse gases and increase carbon sinks or carbon sequestration, i.e. taking CO\(_2\) out of the atmosphere and build it into living organisms and the soil.

\(^5\) The Parties are the governments that have signed and ratified the Convention.
3. **Technology transfer**: The flow of knowledge, equipment, and resources among stakeholders that helps countries, communities, firms, or other entities adapt to or mitigate climate change.

4. **Finance**: Financing mechanisms from the developed countries to support the Clean Development Mechanisms (CDM) and National Adaptation Programmes in developing countries.

### 3. Climate Change in Ethiopia

Ethiopia is a country with a very diverse climate. In general, climate patterns are highly variable and unpredictable. The country also has a history of experiencing climate extremes, such as droughts and floods, increasing temperature, and unreliable rainfall (NMA, 2007). The country’s geographical location within the tropics and extremes of topography in combination with the low adaptive capacity of the people and their resources result in a high degree of vulnerability to the adverse impacts of climate change. Rainfed agriculture remains the dominant means of production for the national economy. It directly supports over 85 percent of the population in terms of employment and livelihood, accounts for about 50 percent of the country’s GDP (gross domestic product), and generates on average over 90 percent of the foreign exchange earnings (MoFED, 2009). The sector is dominated by small-scale farmers engaged in subsistence level production.

Historically, a strong link has been observed between climate variations and the overall performance of the country’s economy, mainly due to the direct impacts of unreliable weather on agriculture and the indirect links to other sectors of the economy. The contribution of agriculture to the country’s total GDP clearly explains the relationship among the performance of agriculture, climate and the total economy. According to Hansen (2006), years of drought and famine (1984/1985, 1994/1995, 2000/2001) are associated with very low contributions, whereas years of good climate (1982/83, 1990/91) are associated with better contributions to GDP. Though agriculture is expected to play a key role in ensuring food security and overall development of the country’s economy, its performance is primarily constrained by changing and unreliable weather conditions and the associated disasters such as drought and flooding.

#### 3.1 Extent of Vulnerability

Ethiopia’s direct and disproportionately high dependence on natural resources and climate sensitive livelihoods coupled with the prevalence of rampant poverty places the country in a most vulnerable position. According to the National Meteorological Agency (NMA, 2007), agriculture, water and range resources, biodiversity and human health are vulnerable to climate variability and change, with huge social and economic impacts. According to
a recent mapping of vulnerability and poverty in Africa, Ethiopia is identified as one of the countries most vulnerable to climate change because of its low adaptive capacity (Thornton et al., 2006; Conway et al., 2007). The country’s smallholder farmers and pastoralists are those with livelihoods most vulnerable to changes in climate. Despite this vulnerability, the country is one of the nations least prepared to cope with the impacts of climate change. There is limited knowledge regarding the magnitude of the country’s vulnerability to changes in climate across agro-ecological zones and socio-economic groups. This is a serious challenge in the formulation of appropriate policies and the development of effective adaptation strategies.

Rainfall variability and associated droughts have been major causes of the food insecurity and famine with a long history in the country particularly over the past several decades. At least five major droughts have prevailed since 1980, along with dozens of localized ones (World Bank, undated). Studies show that the frequency and magnitude of droughts has increased over the past few decades, especially in the lowlands (Lautze et al. 2003; Aklilu & Alebachew, 2009a; Eyasu, 2009). Drought cycles create poverty traps for households constantly thwarting efforts to build up assets and increase income to enable them to absorb shocks. With nothing to fall back on, and no cash to buy their way out of danger, drought simply pushes poor communities into dangerously precarious situations by depriving them of their food supplies and assets (Robinson, 2003).

Many places of the country are also vulnerable to the risks of flooding, and floods, unfortunately, often follow droughts and famine. The country was exposed to major floods in 1988, 1993, 1994, 1995, 1996 and 2006 leading to considerable loss of life and property (NMA, 2006). Floods destroy biodiversity, degrade rangelands, remove top soil with its nutrients, undermine livestock and food production. The destruction of local natural resources can result in resource-based conflicts that drive the vulnerability of local people further. The limited economic, institutional and logistical capacity to deal with these challenges and adapt to climate change exacerbates the vulnerability of many people and their communities.

Temesgen et al. (2008) analyzed the vulnerability of Ethiopian farmers (including pastoralists) to climate change by creating vulnerability indices and comparing these indices across regions. They found that the farmers in the Regions of Afar, Somali, Oromia, Amhara and Tigray are relatively more vulnerable to climate change as compared to those in Southern Nations, Nationalities and Peoples (SNNP) and Benshangul Gumuz. While the vulnerability of Afar and Somali is attributed to their low level of regional development, the vulnerability of farmers in Tigray and Oromiya is
attributed to the higher frequencies of droughts and floods with low access to appropriate technology, institutions, and infrastructure.

A study of water resources in the Awash and Abay River basins found a high degree of vulnerability to change in climate in which runoff will decrease under warmer and drier conditions (Huq et al., 2003). According to IFPRI (2008), the predicted increase in temperature by 2050 is greatest for Afar and Tigray regions and lowest for SNNPR, and the predicted change in precipitation is highest for Somali region and lowest for SNNPR. The study further indicated that even under a very moderate climate change scenario, both water supply and cereal grain production in Ethiopia would decline, despite higher expected rainfall. For instance, climate change is projected to reduce yields of the wheat staple crop by 33% (NMA, 2007). This implies that preparations are required not only to combat the currently prevailing impacts but also for adapting to the predicted changes and their impacts.

### 3.2 Impacts of Climate Change

Climate change is likely to harm developing economies that generate the major portion of their GDP from climate sensitive sectors such as agriculture (Mideksa, *in press*). In Ethiopia, changes in the weather can seriously undermine the contribution of the agricultural sector to the country’s economy (Temesgen et al., 2008). There is a general absence of studies on the impacts of climate change on Ethiopian agriculture and the farm-level adaptations that farmers can make to mitigate the potential impacts (Hansen, 2006). Accordingly, little is known about how climate change may affect the country’s agriculture. This seriously limits policy formulation and decision-making in terms of adaptation and mitigation strategies (Hansen, 2006).

Mideksa (*in press*) made a study that analyzed the economic impact of climate change in Ethiopia. He found that climate change will make the prospects for economic development harder in at least two ways: first, by reducing agricultural production and output in the sectors linked to the agricultural sector, which is likely to reduce the country’s GDP by about 10% from its level in 2005, which is used as a benchmark. Second, by raising the degree of income inequality, it is likely to further decrease economic growth and fuel poverty. Therefore, securing Ethiopia’s economic and social well-being in the face of climate change requires that policymakers and stakeholders work together to integrate climate change adaptation into the country’s development process (Assefa & Berhanu, 2008).

Extreme events, like droughts and flooding, lead to the destruction of capital stocks in the country such as agricultural land, crops, livestock, and infrastructure. In particular, pastoral and agro-pastoral communities, which
are heavily reliant on livestock for their livelihoods, suffer severe asset losses during droughts. It takes many years for pastoralists to reconstitute, if at all possible, their cattle herd after each drought (Eyasu, 2009). The changes affect pasture availability and quality, which in turn reduce livestock health and productivity. According to Aklilu & Alebachew (2009a) the number of livestock possessed by pastoral households in the southern lowlands has shrunk considerably over the past two decades. Weak livestock markets adversely affect the terms of trade as prices fall sharply relative to cereal prices particularly at times of severe droughts. There is also growing evidence that there are links among conflict, security and disasters, as pressure on resources often leads to increased mobility and the probability of conflict (Chibber & Laajaj, 2008). A study by Aklilu et al. (2009) in Oromiya and SNNP attempted to link the concepts of population, fertility and family size to notions of vulnerability and resilience to climate change in Ethiopia. The study found that people in the study areas link population pressure to the effects of climate change and said that families should consider having fewer children in order to avoid as much hardship in making a living and in utilizing the natural resources for survival. The particular vulnerabilities of women and children were also highlighted.

Climate change is already having profound effects on health in Ethiopia though available studies are limited and patchy. Malaria is prevalent in over 75% of the country, putting over 50 million of the total of 77 million people at risk (UNICEF, 2007). This disease is the major cause of mortality in the country. According to NMA (2007), climate change is projected to cause encroachment of malaria from lower altitudes in Somalia and Afar regions to higher altitudes in Tigray and Amhara.

Research so far has mostly focused on the direct health impacts of climate change such as thermal stress, extreme weather events, and outbreaks of infectious diseases. In the southern lowlands, for instance, communities link the emergence and spread of diseases to changes in wind patterns, temperature and rainfall regimes, and blame the recurrent and long droughts (Aklilu & Alebachew, 2009b). However, the health impacts of climate change should be seen as part of a wider spectrum of health risks that result from social, demographic and economic disruptions caused by change and variability in climate (McMichael et al., 2006). Poor health arises from a combination of factors including reduced food and water security, increase in water-borne diseases due to reduced water quality, floods and drought, and the spread of diseases.

Arndt et al. (2009) developed a model to identify economic sectors that are most likely to be affected by changes in climate in Ethiopia in order to evaluate potential adaptation policies. They found that a substantial
potential exists for increases in agricultural productivity through
investment in water harvesting, irrigation and road infrastructure to
combat climate change impacts in the relatively near term. The results
further highlight the relative weakness of the country’s non-agricultural
sectors to absorb surplus labour. This is because existing opportunities for
labour (either local or migratory) are still largely dependent on the outputs
from rain-fed agriculture, implying that creating employment opportunities
outside of agriculture will remain a major challenge both to development
and for successful adaptation to climate change.

One of the most significant impacts of climate change is likely to be on
the hydrological system, and hence on river flows and water resources.
Deksysos & Abebe (2006) developed a model to predict the impacts of climate
change on the hydrology of the Lake Tana sub-basin. They found that river
flows will be reduced by amounts ranging from 15% to 80% of the monthly
mean, in some months of the year, all over the basin.

3.3 Local Responses
The people of Ethiopia are not unaware of the influences of climate
variations. They have been facing the impacts in various forms over
millennia and have developed a range of coping mechanisms to deal with
the impacts (McKee, 2008). The most important coping mechanisms widely
used include:

♦ changes in cropping and planting practices,
♦ reduction of consumption levels,
♦ collection of wild foods,
♦ use of inter-household transfers and loans,
♦ increased petty commodity production,
♦ temporary and permanent migration of people and animals,
♦ hidden secure grain storage,
♦ sale of assets such as livestock and agricultural tools,
♦ mortgaging of land / taking credit from merchants and money
  lenders,
♦ use of early warning systems, and
♦ appeals for food and other forms of aid (NMA, 2006).

Most of the traditional coping mechanisms focus on agriculture and are
based on local knowledge. Hence, they may not be able to counter all of the
challenges to be faced in the future. But, the local perceptions of the changes
and the challenges people face should be the basis for the choice of adaptation strategies. The analysis of farmers’ perceptions of climate change in the Nile Basin of Ethiopia indicates that farmers are aware that the temperature is increasing and the level of precipitation is declining (Temesgen et al., 2008). The study further indicated that farmers living in the cool highlands (dega areas) were most aware of the changes.

Farmers have a range of strategies to cope with drought. However, intense and repeated droughts have seriously eroded their capacities to withstand the shocks and they have thus become more vulnerable. Based on a study in the Nile Basin of Ethiopia, Yesuf et al. (2008) found that farmers’ decisions to adopt yield-enhancing adaptation strategies are influenced by:

- informal and formal institutional support,
- the availability of information on possible future changes in climate,
- the amount of rainfall during the belg (small rains between March and May), and
- the socio-ecological setting —household-specific characteristics of size and age, and literacy levels of the household head.

Local responses vary according to the local environmental, socio-cultural and economic situation. For instance, in South Omo, people prefer to stay on the islands of Lake Turkana during prolonged droughts in order to have easy access to water, pasture and fish, and to have less risk of livestock raiding by other ethnic groups (Wongtschowski et al., 2009). Pastoralists in the southern and eastern lowlands of Ethiopia have gradually shifted from raising cattle, which are grazers, to camels and goats as these animals are browsers and relatively drought resistant (Aklilu & Alebachew, 2009a; Wongtschowski et al., 2009). The local institutions in several of the communities were found to still contribute to the management of the natural resources such as water and grazing areas as a strategy to cope with scarcity, although the influence of these institutions has progressively been weakened. This indicates that the capacity of local coping strategies could reach limits to effectively deal with the problems unless supported by appropriate policy and institutional arrangements.

### 3.4 Institutional Responses

The Ethiopian government has recognized climate change as a threat to its national development aspirations. The country has signed most of the international environment conventions including those specifically focused on climate change: it ratified the UNFCCC in May 1994, UNCCD\(^6\) in June

\(^6\) United Nations Convention to Combat Desertification
1997, and the Kyoto Protocol in February 2005. The country prepared a National Adaptation Programme of Action (NAPA) to fight the impacts of climate change and desertification. However, by 2008, Ethiopia had no explicit policy for dealing with climate change. The country has formulated a number of policies, strategies and action plans aimed at promoting environmental protection, poverty reduction, and sustainable development (see Mellese Damtie and Birhan Gessesse, this volume). However, lack of focused policies and legislation are serious impediments to deal with the adverse impacts of changes and variability in climate (Wondwossen, 2008). Hence, as Daniel (2008) stated, it is important and high time to take climate change issues into the country’s policies, programmes and guidelines. Despite the relatively high knowledge of the subject among policy-makers, and the prominent role being played by Ethiopia in international climate change negotiations, Ethiopia was still formulating its response in 2009 (Selam, 2009). Until 2009, climate change received little government attention. Cipryk (2009) suggested bringing the benefits of the livelihoods discussion on climate change to a household level in Ethiopia to gain a better understanding of the potential impacts on people and the need of proactive policies to address how to deal with future vulnerabilities.

While Ethiopia is concerned with the protection of both the local and global environment, priority so far has been given to poverty alleviation and socio-economic development (NMSA, 2001). Nonetheless, these efforts will be challenged by the impacts of a changing climate unless such issues are well integrated with these plans. For instance, the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) is based on improving the way the country’s natural resources are used and raising agricultural productivity. But, PASDEP does not include plans to adequately cope with the coming changes in climate. It will need to be diversified in order to support dynamic and adaptable rural and urban communities that will be required to support changes in livelihoods and cope with vulnerabilities (Cipryk, 2009). According to Temesgen et al. (2008), since vulnerability to climate change in Ethiopia is highly related to poverty through loss of coping or adaptive capacity, integrated rural development schemes can play the double role of reducing poverty and increasing adaptive capacity for dealing with climate change.

Based on a study in the Nile Basin of Ethiopia, Yesuf et al. (2008) suggested that farmers need timely information on predicted changes in climate in a readily accessible form to empower them to take appropriate steps to adjust their farming practices, such as adopting yield-enhancing adaptation strategies. The early warning system in the country is based on crop forecasts and assessments of food stocks, and deals mainly with
preparedness for food emergency relief rather than providing the rural communities with advance information for coping with climate related hazards. Furthermore, efforts should also be made to reduce the risks of disasters, and extend access to credit markets and extension services in order to facilitate adaptation.

The Government’s response so far has been challenged by shortage of funds, inadequate infrastructure and lack of institutional capacity. Hence, the role of non-state actors is very crucial and their contribution in enhancing local adaptive capacities is generally encouraging. However, as observed in the southern lowlands of the country (Aklilu & Alebachew, 2009a), most of their efforts suffer from lack of cooperation among each other, fragmented approaches, weak institutional linkages, and problems of continuity.

4. Overview of Challenges and Prospects
Climate change is an inevitable challenge that Ethiopia is facing and will continue to face in the foreseeable future. The country’s dependence on rainfed agriculture for meeting food and development needs makes the challenge serious. A significant portion of the country’s population and the national economy are very vulnerable to slight changes or fluctuations in the rainfall pattern. However, there is paucity of information regarding the extent of the country’s vulnerability to climate change. For instance, lack of long-term and reliable climate data with a reasonable spatial coverage is recognized as a constraint to the understanding and monitoring of current and future changes and variability of climate in the country. This is among the major gaps that undermines the detection capacity for climate related hazards and impacts. Understanding the extent of risk would be helpful to plan and take appropriate steps to reduce the vulnerability of the most exposed sectors and populations.

According to Huq et al. (2006), developing country governments should develop strategies to implement their National Adaptation Programmes of Action (NAPAs). Ethiopia is not an exception. The country needs to put in further work on the NAPA to assess its feasibility and devise strategies for effective and efficient implementation. Development agencies—international, bilateral and national—and governments need to take increased and serious responsibility to deal with the challenges and develop appropriate adaptation strategies. These strategies should build on and reinforce already available local coping mechanisms. Local people have valuable traditional adaptation strategies that have helped them deal with climate change related problems in the past. However, these strategies have limits and should not be romanticized (Wongtschowski et al., 2009).
Recent developments indicate that the commitment of the Ethiopian government in standing against the impacts of climate change is encouraging. The country is playing a leading role in international climate change negotiations though the outcome of these negotiations is yet to be seen. However, the government should also give due attention to local adaptation strategies by enhancing the capacity of local communities. Developing appropriate policies and development programs considering the actual state and vulnerability of the people would significantly contribute to enhancing local efforts of adaptation.

The impacts of climate change are likely to increase for Ethiopia and other vulnerable countries of the world even if international mitigation efforts are effectively put in place. It is therefore highly probable that the frequency and intensity of droughts will increase. This will particularly worsen food security for the country. In the pastoral areas the problem will be accompanied by increased insecurity and conflicts.

The country will also likely face increased disease burdens linked to rising temperatures such as the spread of malaria and rift valley fever into areas that have never been hit before, along with outbreaks of meningitis and other infectious diseases and pervasive malnutrition because of food insecurity. Considering such an inevitable trend, the country should develop strategies to reduce vulnerabilities and risks of disaster through having an effective and organized system to provide early warning about and response to such disasters. As Cipryk (2009) indicated, robust disaster risk reduction plans ensure that shocks that do hit are responded to rapidly, efficiently and effectively and provide the protective function that saves lives and livelihoods. Therefore, there is an urgent need for appropriate mainstreaming of climate change adaptation into the various sectoral policies and strategies of the country.

5. Conclusion
Ethiopia is one of the countries most vulnerable to the impacts from climate change. Already, symptoms of climate change and its impacts are found in many parts of the country. Over the past decades, there has been an increase in rainfall variability and rising temperatures. The people of Ethiopia are especially vulnerable to climate change because of their low income and reliance on climate sensitive livelihoods based on agriculture and pastoralism. The livelihood of many millions of people is decisively dependent on the blessings of the local climate. The changes are already creating unrelenting pressure on agricultural production and available water, forest, and other natural resources. This exacerbates food insecurity
and makes the people and their environment more vulnerable and less resilient to future changes in climate.

The country has a limited capacity to deal with the impacts of most of the changes because of limited financial resources, skills and technologies, and the high level of poverty. Data show that the number of people exposed to the vagaries of climate and, in turn, affected by climate related hazards, has been growing particularly over the last thirty years, i.e. since the major drought of 1984/85. But, little is known about the extent of the country’s vulnerability to climate change and its impacts. Furthermore, the potential impacts of climate change extend to the overall performance of the country’s economy and are likely to make the prospects for economic development harder to achieve. These challenges could thwart the country’s development aims unless appropriate measures get underway. This requires preparation and a well thought-out response at different levels from households and local communities to policy makers. In line with this, the following points require urgent attention.

- Strengthen climate monitoring and early warning systems for disasters through increased investment for capacity building, and networking in data collection, analysis and knowledge management with the stakeholders in order to boost the spatial and temporal coverage of climate data and provide information about predicted changes.

- Although the country is generally considered highly vulnerable to climate change impacts, local differences in terms of vulnerability are not known. It is therefore necessary to uncover the type and extent of localized vulnerabilities for appropriate and timely targeting of the responses.

- Reduce the vulnerability of communities by enhancing their adaptive capacity including through the use of locally available knowledge and resources. Further, it is crucial to minimize vulnerabilities and disaster risks through appropriate and targeted risk reduction and management interventions that are well integrated with climate change adaptation strategies.

- The fact that the impact of climate change is linked to poverty requires integration of poverty reduction policies and programmes with climate change adaptation strategies in order to reduce vulnerability and enhance adaptive capacity.

- Enhance the role and contribution of non-state actors as the intensity and wide spatial coverage of the problem is too big a
challenge for the government to effectively address alone. Non-state actors could, therefore, play a fundamental role in developing appropriate programmes and action plans that respond to climate change impacts. But, to be more effective, enhanced cooperation and concerted efforts are needed among the non-state actors.

Further studies should be undertaken in order to understand local variations in vulnerability and adaptation in different contexts in order to develop differentiated adaptation strategies appropriate for local circumstances.

6. References


An Overview of Climate Change Impacts and Responses in Ethiopia


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End of the rainy season in Central Tigray, (photo, Sue Edwards September 2008)