Convention on Biological Diversity (CBD)
Ethiopia's 4th Country Report

Institute of Biodiversity Conservation

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Acronyms

AAU	Addis Ababa University
ABRDP	Arsi and Bale Rural Development Project–Ethio-Italian Development Cooperation
AEZE	agro-ecological zones of Ethiopia
AHRI	Armaeur Hansen Research Institute
ARARI	Amhara Region Agricultural Research Institute
ARCCIKCL	Association for Research and Conservation of Culture, Indigenous Knowledge and Cultural Landscape
ARDU	Agricultural Rural Development Unit
ATVET	Agricultural Technical and Vocational Education and Training Colleges
AEWA	African-Eurasian Waterbird Agreement
AUA	Alemaya (Now Haramaya) University of Agriculture
AVNP	Abay Valley National Park
BESMP	Bale Eco-region Sustainable Management Program
BMNP	Bale Mountains National Park
BoARD	Bureau of Agriculture and Rural Development
BYDV	Barley Yellow Dwarf Virus
CADU	Chilalo Agricultural Development Unit
CBO	Community Based Organization
CBD	Convention on Biological Diversity
CCD	Convention to Combat Desertification
CIFOR	Center for International Forestry Research
CITES	Convention on International Trade in Endangered Species
CMS	Convention on Migratory Species
COP	Conference of Parties
CSA	Central Statistical Agency
CSC	Café Special Certificate
CSE	Conservation Strategy of Ethiopia
DAP	DiammoniumPhosphate
DOITAR	Development Oriented Interdisciplinary Thematic Action Research
EARO	Ethiopian Agricultural Research Organisation (now EIAR)
ECA	Ethiopian Customs Authority
EHNRI	Ethiopian Health and Nutrition Research Institute
EIA	Environmental Impact Assessment
EIAR	Ethiopian Institute of Agricultural Research

EMA	Ethiopian Mapping Authority
EOSA	Ethio-Organic Seed Action
EPA	Environmental Protection Authority
ESTC	Ethiopian Science and Technology Commission
ETC	Ethiopian Tourism Commission
EVDSA	Ethiopian Valleys Development Studies Authority
EWCA	Ethiopian Wildlife Conservation Authority
EWCO	Ethiopian Wildlife Conservation Organisation
EWDCD	Ethiopian Wildlife Development and Protection Department
EWCP	Ethiopian Wetland Conservation Project
EWNHS	Ethiopian Wildlife and Natural History Society
EWNRA	Ethiopian Wetland and Natural Resources Association
EWRP	Ethiopian Wetlands Research Project
FAO	Food and Agriculture Organization of the United Nations
FFE	Forum for Environment
GMO	Genetically Modified Organism
GoE	Government of Ethiopia
GTZ	German Technical Co-operation
FFS	Farmers' Field School
FRG	Farmers' Research Group
FZS	Frankfurt Zoological Society
GAM	Global Arbitration Mechanisms
GBA	Global Biodiversity Assessment
GEF	Global Environmental Facility
GIS	Geographical Information System
ha	hectare
hh	household
HLI	Higher Learning Institution
HPFI	Health and Performance Food International
HU	Haramaya University
IAO	Instituto Agronomico per l'Oltremare
ILO	International Labour Organization
IBC	Institute of Biodiversity Conservation
ICOMOS	International Council on Monuments and Sites
IK	Indigenous knowledge
ILRI	International Livestock Research Institute
ISD	Institute for Sustainable Development

ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IUCN	International Union for the Conservation of Nature, now named World Conservation Union
IWA	International Water Association
LMO	Living Modified Organism
LULC	Land Use and Land Cover
MDG	Millennium Development Goals
MELCA	Mahiber (Movement for Ecological Learning and Community Action)
MoARD	Ministry of Agriculture and Rural Development
MoCB	Ministry of Capacity Building
MoE	Ministry of Education
MoFA	Ministry of Foreign Affairs
MoFED	Ministry of Finance and Economic Development
MoI	Ministry of Information
MoJ	Ministry of Justice
MoWR	Ministry of Water Resources
masl	meters above sea level
NAPA	National Adaptation Program of Action of Ethiopia for Climate Change
NBA	National Biodiversity Assessment
NBSAP	National Biodiversity Strategy and Action Plan
NEQS	National Environmental Quality Systems
NRM	Natural Resource Management
EDRI	Ethiopian Development Research Institute
NISHM	National Information Sharing Mechanism
NGO	Non-governmental Organization
ORDA	Organization for Relief and Development of the Amhara Region
PASDEP	Plan for Accelerated Sustainable Development to End Poverty
PGRs	Plant Genetic Resources
PFM	Participatory Forest Management
PADPA	Parks Administration, Development and Protection Authority
pers. comm.	personal communication
RCS	Regional Conservation Strategy
REPA	Regional Environmental Protection Authority
RPSUD	Research Program on Sustainable Use of Drylands Biodiversity
REST	Relief Society of Tigray
SAREC	Swedish Agency for Research Cooperation with Developing Countries

SEA	Standard Environmental Assessment
SIDA	Swedish International Development Cooperation Agency
SLU	Swedish University of Agricultural Science
SMNP	Simen Mountains National Park
SNNP	Southern Nations, Nationalities and Peoples
SNNPR	Southern Nations, Nationalities and Peoples Region
SORPARI	Somali Region Pastoral and Agro-Pastoral Research Institute
SPM	Strategic Planning and Management
TBPAs	Transboundry Peace Parks
TNA	Climate Change Technological Needs Assessment Report of Ethiopia
TVET	Technical and Vocational Education and Training
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFAO	Food and Agriculture Organization of the United Nations
UNFCCC	United Nation Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
WADU	Welaita Agricultural Development Unit
WGCFNR	Wondo-Genet College of Forestry and Natural Resources
WHC	World Heritage Committee
WSD	Wildlife for Sustainable Development

Frontpiece: Traditional Zebu plow oxen in Edaga Hagos, Tigray, resting in a biodiverse meadow grasses, legumes and composites

Executive Summary

Introduction

In accordance with Article 26 of the Convention on Biological Diversity (CBD) and Decision VIII/14 of the Conference of Parties (COP), the Institute of Biodiversity Conservation (IBC), together with other stakeholders has prepared Ethiopia's Fourth National Report on the Implementation of the CBD in Ethiopia. The report has been prepared according to the guidelines for the 4th national report and contains five parts:

- Status of, trends in and threats to biodiversity;
- The National Biodiversity Strategy and Action Plan (NBSAP) implementation;
- Biodiversity integration into other sectors;
- Progress towards the 2010 targets and implementation of the Strategic Plan; and
- The Strategic Plan of the Convention, and Appendices.

Ethiopia's land area is 1.12 million square kilometers with a wide variety in topography, geography, climate and culture. There are eight terrestrial ecosystems within Ethiopia. These range from afroalpine and sub-afroalpine grasslands, through to moist evergreen and montane forest to desert and semi-desert scrubland ecosystems. In addition there are wetlands and aquatic ecosystems. Because of the diversity of ecosystems within the country and its long history, Ethiopia is endowed with a wide diversity of fauna and flora. The country is also a center of origin and diversity for a number of crop and animal genetic resources, reflecting its long history of agriculture.

Biodiversity Status, Trends and Threats

There are between 6500 and 7000 higher plant species of which about 12 per cent are endemic (Tewolde Berhan, 1991). With regard to animals, there are known to be 284 wild mammal, 861 bird, 201 reptile, 63 amphibian, 188 fish and 1225 arthropod species with about 10, 2, 5, 54, 0.6 and 21 per cent of endemism respectively. There is an immense variation in the farmer's varieties of different crops and breeds of livestock. More than 100 crop plant species are cultivated with a sizeable proportion of them having their center of origin or diversity in Ethiopia. There are also 30 cattle, 14 sheep, 14 goat, 4 camel, 4 donkey, 2 horse, 2 mule, 5 chicken and 5 honey bee breeds/ecotypes/populations recorded which are indigenous to the country. This biodiversity is of crucial importance in the socio-economic, cultural and political life of the people.

The rich biodiversity of the country is under serious threat from deforestation and land degradation, overexploitation, overgrazing, habitat loss, invasive species

and some water pollution. The underlying causes for these problems emanate from poverty, population growth, lack of alternative livelihoods, inadequate policy support, inappropriate investment and inadequacy of law enforcement. A number of endemic wild animals, birds, trees and herbaceous plants are reported to be endangered or critically endangered. Farmer's varieties are being replaced by uniform improved varieties, and livestock breeds are also similarly threatened through cross-breeding with exotic breeds. Resettlements and agricultural investment in commercial crop farms are aslo exerting pressure on the country's precious biodiversity.

Efforts to save some of the wildlife and the vegetation by a number of government institutions, NGOs and public-private partnership initiatives are being made and progress is being achieved. To cite some examples, the conservation status of the Walia ibex has improved from being critically endangered to endangered while on sites where area closure has been applied, rehabilitation of the land has occured and restoration of species which were on the point of local extinction have been reverted. It appears that soil seed banks are still rich even in the most denuded and degraded areas, and protection alone can result in sizeable recovery. Such success stories show that active conservation programs can revive the biodiversity; however, these alone are far from adequate in the face of the alarming magnitude of the threats.

Implementation of the National Biodervisty Strategy and Action Plan (NBSAP)

Cognizant of the problems and in order to discharge its commitment as a signatory to the Convention on Biological Diversity (CBD), Ethiopia has developed a National Biodiversity Strategy and Action Plan (NBSAP). The objectives of this strategy include:

- Conserving representative examples of Ethiopia's remaining ecosystems through a network of effectively managed protected areas;
- Having all remaining natural ecosystems outside of the protected areas under sustainable use and management by 2020;
- Sharing equitably the costs of conserving and benefits from the sustainable use of biodiversity; and
- Conserving the rich agro-biodiversity of Ethiopia effectively through complementing *in situ* and *ex situ* conservation programs;

Though the process of preparing the Strategy and Action Plan had been participatory, adequate familiarization of it at the grass-root level, the provision of training and follow-up on whether the stakeholder institutions are using the document as a roadmap, has not been effectively carried out. The NBSAP is a vital strategic document that should guide biodiversity conservation, sustainable utilization, as well as access and benefit sharing. Nonetheless, none of the stakeholders, including the Institute of Biodiversity Conservation (IBC), which is

the focal point institution, have used it as a governing guide to undertake development, research and conservation activities. The Institute of Biodiveristy Conservation (IBC) needs to work aggressively in the coordination and monitoring of the implementation of the Strategy. There are fragmented efforts by institutions at federal and regional levels, one way or the other, to address the problem through biodiversity conservation related projects/activities, which reflect the NBSAP.

Biodiversity Integration and Mainstreaming

Sectoral and cross-sectoral integration of concerns for biodiversity is crucial for the effective conservation and sustainable utilization of natural resources. Beyond the sectors that directly deal with biodiversity and environmental issues, there are many other sectors in the country that are supposed to, but that have failed, to integrate biodiversity issues into their strategies and programs. Some of those that have failed include; the health, mining, investment, tourism, and trade and industry sectors. Although many of these sectors are considered as key stakeholders and actors for mainstreaming the NBSAP, their achievements with regard to the integration of concerns for biodiversity are far from adequate. However, some of the research and education sectors are striving to address biodiversity in their programs. In regards to the higher learning institutions, biodiversity related aspects are addressed by designing full courses or by incorporating it as chapter(s) in courses.

There is some progress in mainstreaming appreciation of biodiversity which, to some extent, can be attributed to the NBSAP. Some of the regional states (e.g. Southern Nations, Nationalities and People (SNNP) and Tigray Regions) have taken crucial steps towards assigning experts to oversee the conservation of biodiversity. Mainstreaming in the education sector, particularly in higher education, is an area where substantial progress has been achieved. Curricula in agricultural and natural sciences are incorporating biodiversity both at undergraduate and graduate levels. Topics related to biodiversity constitute a considerable component of the overall research in higher learning institutions. Substantial information has been generated from these research activities. What is lacking is making optimal use of this information and building on the results of such research. Although not adequate, raising public awareness through the use of the media and the celebration of the "Biodiversity Day" is being used to bring the message to the grass-roots level.

Progress towards the 2010 Targets and Implementation of the Strategic Plan

Ethiopia has taken a number of fundamental measures after the ratification of the Convention on Biological Diversity (CBD). The upgrading of the former Plant Genetic Resources Center to the Institute of Biodiversity Conservation (IBC), the development of a National Policy on the Conservation and Research of Biological Resources and a National Biodiversity Strategy and Action Plans (NBSAP), the

enactment of Access and Benefit Sharing, Breeders Rights and the Protection of Indigenous Knowledge laws are manifestations of the country's commitment to the implementation of the Convention.

Some positive progress has thus been made in the implementation of the Convention, including:

- Improvements in the conservation status and trends of some endemic mammals
- A slight increase in the number and size of protected areas;
- The conclusion of "Access and Benefit Sharing Agreements" for teff and *Vernonia galamensis*.
- Field gene banks of endangered forest, medicinal, and forage and pasture plant species have been established and are expanding;
- The implementation of area closures, particularly in northern Ethiopia, resulting in the restoration of some locally extinct fauna and flora; and
- The Ethiopian 3rd Millennium initiative that resulted in the planting of about 1.6 billion tree seedlings in degraded areas and areas designated for Millennium Parks in many localities.

The implementation of the Strategic Plan of the Convention and the achieving the 2010 Biodiversity Targets are still inadequate: they have not been adopted as national targets in a way that can change implementation at the grass-roots level.

The following are the basic impediments hampering effective implementation:

- Funds to implement projects that address the objectives of the Convention that have so far been received by Ethiopia are nominal;
- Stakeholder institutions, communities and individuals were not well-informed about the global processes and negotiations regarding the Convention, and are not involved in developing the country's positions on it;
- The Strategic Plan of the CBD and the 2010 targets were not known to the majority of the stakeholders;
- The Strategic Plan of the CBD and the 2010 targets are not known by the majority of the stakeholders;
- The Focal Point Institution, IBC, has failed to coordinate and monitor the implementation of the NBSAP, and there has been inadequate communication with key stakeholders at federal (national) and regional levels, as well as with NGOs, local communities and the private sector;
- There is no binding provision or legal obligation for stakeholders to consider the NBSAP in their planning;
- There is no formal system for monitoring and reporting progress on the implementation of the NBSAP; and

- There is no funding mechanism or trust fund for implementing the NBSAP.

Conclusion

The importance of biodiversity conservation and benefits of ecosystem services are not well-understood by a large number of people at all levels, particularly by policy makers in Ethiopia. The focal point institution of the CBD should embark on an economic valuation of these precious resources together with the relevant and capable stakeholders in order to enhance the understanding of and increase biodiversity concerns in the development agenda. The key stakeholders should be well-informed about the global processes and negotiations, and they should be involved in developing country positions to be presented in the various fora organized by the CBD Secretariat.

Although the NBSAP is a vital strategic document that should guide the conservation and sustainable utilization of biodiversity, stakeholders have not used it as a national guidebook in their planning processes. However, it is believed that NBSAP familiarization workshops have influenced some of the national regional states, such as the Southern Nations, Nationalities and Peoples (SNNP), and Tigray regions, to take crucial steps towards assigning experts to oversee the conservation of biodiversity in their areas.

Strengthening the achievements obtained in the rehabilitation of degraded areas through area closures and planting of indigenous trees, and the consequent improvement in the conservation status of some plants and wild animals are very important. The degree of threat to the country's biodiversity is serious and urgent action in policy and on the ground implementation is required. Resettlement, inappropriate investment, inadequate law enforcement and the absence of alternative means of livelihoods appear to be the most important areas that need focus.

1. Biodiversity Status, Trends and Threats

1.1. Introduction

This part of the report provides a brief overview of Ethiopia's biodiversity; a summary of the status of different components of biodiversity; and the existing trends. For the major part, trends were evaluated based on the observations of various stakeholders and on experts' opinions, due to lack of quantititavie data (particularly time series data) rather than by developing indicators based on data. Where data are available indicators are included. In addition to the status and trends, an explanation of the principal threats to biodiversity in Ethiopia and how they affect the different types of biodiversity components, including the ecosystems are presented.

1.2. Overview of Ethiopia's Biodiversity

Ethiopia has a large natural and cultural diversity with a big range of climates which result from of its topography and latitiudinal position. The great plains of Ethiopia occur atop two massive highland plateaus, cloven into unequal halves by the Great Rift Valley. From the sweltering arid and semi-arid lands of the Ogaden in the Somali Region in the east, the lowlands bordering the Sudan in the west and Dalol in the Afar Region in the north, where Africa crashes into Arabia, the land sweeps up, rising through semi-arid lowlands and pockets of tropical jungle, montane forests, and reaching afro-alpine pastures on the slopes of the Simen, Bale, Ghugi and other mountain ranges. Many of these mountain ranges reach over 4000 masl, and are home to numerous endemic species of flora and fauna. There is a great variation in altitude ranging from 116 m below sea level in Dalol to 4620 m above sea level in Semien. The differences in altitude and latitude have resulted in a wide variation in climates (rainfall, humidity, temperature and exposure to wind).

These differences along with edaphic variations form the basis for the wide biodiversity of the country. Although much of the interior of Ethiopia is dominated by highland plateaus, these are interrupted by deep gorges draining into 12 major river valleys. The annual runoff of water from these river valleys amounts to about 122.19 billion cubic meters (m^3) a year of which 74 per cent goes into the rivers. Ethiopia's ecological diversity is mirrored by her cultural diversity. The fantastic diversity of cultures and ecology is further mirrored by the diversity of fauna and flora. As a result Ethiopia is a center of biological diversity with sizeable endemism.

When the Russian plant geneticist, N.I. Vavilov, came during one of his collection expeditions to Ethiopia and to neighboring countries in the 1920s, he was amazed. In Ethiopia, Eritrea and Somaliland he found so much genetic diversity that he included the area in the list of the few great centers of crop plant diversity

and called it the Abyssinian gene centre. Virtually the whole complex of seed crops from the South West Asian and Mediterranean centers of crop origin were found here. On wheat variation, Vavilov says that "Abyssinia occupies the first place" and on barley that there is "an exceptional diversity of forms" (http://www.grain.org/seedling/?id=374). Since these observations of Vavilov, impressive diversity in native crops such as teff, sorghum, millets and many grain legumes, oil crops, vegetables, spices and other species have also been found.

There are between 6500 and 7000 higher plant species, out of which about 12 per cent are endemic to Ethiopia (Tewolde Berhan, 1991). There are about 30 cattle, 14 sheep, 14 goat, 4 camel, 4 donkey, 2 horse, 2 mule, 5 chicken and 5 honey bee breeds/strains/populations in the country (IBC, 2004; Department of Animal Genetic Resources, unpublished). Ethiopia also has rich wild fauna including 284 mammal (29 endemic), 861 bird (18 endemic), 201 reptile (10 endemic), 188 fish (37 endemic), 63 amphibian (25 endemic) and 1,225 arthropod (7 endemic) recorded species. The actual numbers of invertebrate species is not known.

In general, as a result of a number of threats, the trend in the conservation status of Ethiopia's biodiversity is in decline. There are only a very few cases of improvement or stabilization of plant and animal populations.

The major threats to the biodiversity of the country are unsustainable utilization of natural resources (over-harvesting), deforestation, conversion of natural vegetation to farmland, forest fires, land degradation, habitat loss and fragmentation, extensive replacement of farmer's/local varieties/breeds by improved ones, invasive species, illegal trafficking of domestic and wild animals, poaching, wetland destruction and climate change. But all these are related to the root causes of poverty, which are lack of alternative viable livelihoods, increasing population pressure and inadequate awareness of the threats and possible solutions at all levels.

The IBC has been involved in the collection and conservation of the biological resources of the country. To date, the Institute has conserved 69,255 accessions in its cold rooms and field gene bank facilities, out of which 61,782 are plant and 1,268 are microbial accessions that are kept in the cold room, while 6,205 are plant accessions maintained in field gene banks. Table 1 presents the categories of germplasm holdings of the Institute while Figure 1 shows the temporal distribution of the *ex-situ* collection activities by categories.

Table 1: Germplasm holdings of the Ethiopian Institute of Biodiversity Conservation in Cold Rooms and Field Gene Banks

Germplasm categories	No. of genera/families	No. of accessions
Cold room (a)		
Cereals	9	45,873
Pulses	11	6,906
Industrial crops	5	501
Medicinal plants	24	239
Forage plants	43	658
Horticultural plants		1,501
Oil crops	7	5,928
Fiber plants		70
Wild plants used as food	4	18
Forestry	23	88
Sub total		61,782
Microbial*		1,268 (584**)
Subtotal	126	63,050
Field gene bank (b)		
Forage and pasture	35	104
Coffee	1	5,446
Spices	4	71
Root crops	6	301
Medicinal Plants	193	283
Subtotal	239	6,205
Grand Total (a + b)		69,255

*From the total microbial holdings, 14 fungal and 35 bacterial strains were isolated and identified by Ominlog pus (1) system while 85 extremophiles were identified by cloning and sequencing.

**584 bacteria accessions/samples have been submitted by other organizations and kept under agreement.

Source: IBC gene bank and Department of Microbiological genetic resource.

Figure 1 shows the number, categories and the trend of *ex-situ* germplasm acquisitions and conservation since the establishment of the Ethiopian gene bank. There is a declining trend in the acquisition of the major germplasm types since 1985. Particularly in the last four years there was almost insignificant collection. Field crops make up more than 94 per cent of the total holdings. However, despite the current fast rates of ecological change, a declining trend in biodiversity and the lack of frequent collection activities and rescue missions are serious threats to biological diversity and need to be addressed properly.

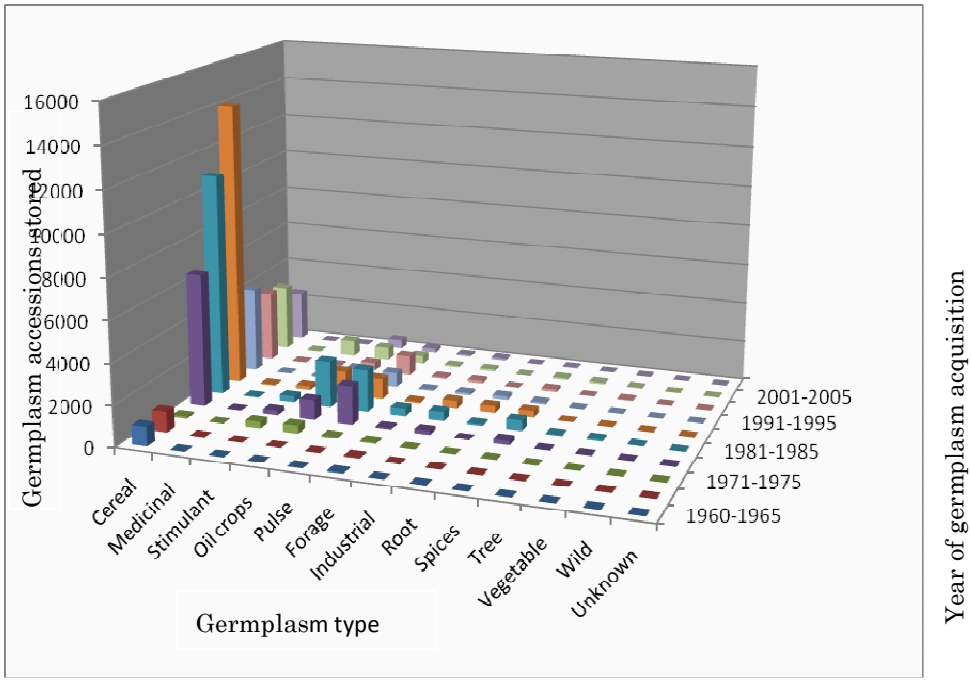

Figure 1: Plant genetic resources stored ex-situ at the Ethiopian gene bank indicating the germplasm type and the year of acquisition (note: collections of years 1960-1975 were obtained by donation from holdings of other international and local institutions)

1.3. Ecosystem Diversity

Using vegetation as the main distinguishing factor, there are 10 broadly recognized ecosystems in Ethiopia (Tesfaye *et al* 2003; Friis and Sebsebe 2001; Zerihun 1999; Sebsebe *et al* 1996; Anonymous 1992), which are briefly described below. A unique ecosystem is also represented by the Dallol depression which is one of the hottest places in the world. This place is where Ertale, an active volcano, is found and known to be inhabited by a unique biodiversity constituting of micro-organisms, plants and animals (Genene Tefera, pers. comm.).

An appropriate classification for agro-biodiversity is agro-ecosystems, which is based on agro-ecological zones. The agro-ecological zones of Ethiopia (AEZE) have been modified and mapped (MoARD, unpublished data) with the purpose of delineating homogenous resource units in terms of bio-physical conditions. Thus, a more refined recent classification has partitioned the country into 32 major agro-ecological zones unlike the 18 in a previous classification (MoA, 2000) as this can be a more appropriate framework for agro-biodiversity management. The system is intended to systematically identify and classify variations that help development strategies showing the opportunities in each agro-ecological zone. The map for major AEZE for which ground verification is currently underway is being developed through the superimposition of the thermal zones and moisture regimes occurring in the country.

1.3.1. Afroalpine and Subafroalpine Ecosystems

Ethiopia has the largest extent of afro-alpine and subafro-alpine habitats in Africa. These ecosystems are found on mountains between 3,200 and 4,620 masl, and are characterized by the most eye-catching giant herb, a lobelia (*Lobelia rhynchopetalum*), the evergreen tree heather (*Erica arborea*)[1] and shrubby and herbaceous everlasting flowers (*Helichrysum* spp.*)*. There is a rich grass and herb flora including endemic succulents belonging to the Crassulaceae. The endemic wild mammals in this ecosystem include Walia Ibex, Mountain Nyala, Starck's Hare, Ethiopian Wolf, Bale Monkey and Gelada Baboon. The Giant Mole Rat is also a characteristic species in southern areas of these ecosystems. Endemic birds found in these ecosystems include Spot-breasted Plover, Blue-winged Goose, Black-headed Siskin and Ankober Serin. Other important birds include Chough, Wattled Crane, Lammergeyer, and Golden Eagle.[2]

Many of the natural faunal and floral resources are threatened due to severe encroachment by human and domestic animals. The Ethiopian Wolf and Walia Ibex that are endemic to this ecosystem are the most threatened mammals.

1.3.2. Montane Grassland Ecosystems

The montane grassland ecosystems are distinguished from other types of ecosystem by their physiognomy, floristic composition and ecology. These ecosystems occur in the areas where human activity has been largest and most intense for several thousand years, and are found at altitudes between 1,500 and 3,200 masl. Characteristic species of the montane grassland ecosystems include species, including endemics, of the grasses *Pennisetum, Hyparrhenia, Cynodon, Eragrostis, Panicum, Cymbopogon, Chloris, Andropogon*, legumes, particularly *Trifolium*, sedges and rushes (Tewolde Berhan, 1988). Ground orchids make up an important component of the montane grassland biodiversity: 10 of the 45 species of *Habenaria* are endemic: Where soil conditions allow, woodland with an open single-layered canopy or with isolated trees occur. Characteristics species include *Acacia abyssinica, A. negrii, A. pilispina, Juniperus procera, Olea europaea* subsp. *cuspidata, Allophylus abyssinica, Celtis africana, Croton macrostachyus, Milletia ferruginea, Maesa lanceolata, Buddelja polystachya, Erythrina brucei, Myrsine africana, Calpurnia aurea, Dovyalis abyssinica, Draceana afromontanum*. Shrubby species such as *Acokanthera schimperi*, *Carissa edulis*, *Euclea schimperi, Rosa abyssinica* and *Maytenus arbutifolia* (Zerihun, 1988) are also found in this ecosystem.

These ecosystems are those used for the traditional mixed farming of Ethiopia and are densely inhabited by people. They are, therefore, highly disturbed. As a result, the mammalian wildlife resource is extremely poor, except

1 All scientific names of plants are according to the Flora of Ethiopia and Eritrea, 1989-2006.

2 Names of birds are according to Birds of Ethiopia and Eritrea, Ash and Atkins, 2009.

for Spotted Hyaena, and Golden Jackal. But there is a richer bird diversity including most of the 18 endemic species and others belonging to the Afrotropical Highlands Biome of 56 species, also found in the following ecosystems.

1.3.3. Dry Evergreen Montane Forest and Evergreen Scrub Ecosystems

Typical dry evergreen montane forests in Ethiopia are situated on highlands and mountains occurring at altitudinal ranges of 1,500 to 3,200 masl. The forests in this ecosystem have greatly diminished due to expansion of agriculture and other interference by people and domestic animals and have been replaced by bushland and scrub in most areas. Dry evergreen montane forest is multi-storeyed. The top storey consists of the taller trees known as "emergents" because they project above the lower layers. Below the emergents is a layer of shorter trees of various heights forming a more or less continuous canopy. Still lower is a stratum of short trees and large shrubs, much less dense than the second stratum. Finally, there is the lowest stratum of shrubs, suffrutescents, and herbs. Epiphytes, lianas and semi-parasites are common (Zerihun, 1999; Anonymous, 1992). This vegetation is characterized by *Olea europea* subsp. *cuspidata, Juniperus procera, Prunus africana, Celtis kraussiana, Euphorbia ampliphylla, Dracaena* spp. *Carissa edulis, Euclea divinorum, Rosa abyssinca, Mimusops kummel, Ekebergia capensis*, etc. There are mixed provenances of *J. procerea*, some of which can get very big while others remain small. In moister areas, this vegetation type includes *Podocarpus falcatus* and is associated with stands of highland Bamboo (*Arundinaria alpina*). The patches of grassland are rich in species including many legumes. The most important grass genera are *Hyparrhenia, Eragrostis, Panicum, Sporobolus* and *Pennisetum* while the most important herbaceous legumes are species of *Trifolium, Eriosema, Indigofera, Tephrosia* and *Crotalaria*. These include a large number of endemic species (Anonymous, 1992). Climbers include *Smilax aspera, Rubia cordifolia, Urera hypselodendron, Embelia schimperi, Jasminum abyssinicum,* various species in the Cucurbitaceae, and other families that often join this element of the vegetation.

Except for birds, the other wildlife species diversity and distribution in the dry evergreen montane forest is low presumably due to human interference. However, this type of vegetation could provide an ideal environment for elephant, buffalo and lion. The mammalian diversity that manages to survive includes Leopard, Menelik's Bushbuck, Warthog, Bohor Reedbuck, Olive Baboon, Grey Duiker, and Spotted Hyaena. These still manage to thrive hiding themselves in the dense remnant dry evergreen montane forest. The Highland Biome of 56 bird species occurs in this and the previous vegetation types and includes the endemics Harwood's Francolin, Blue-winged Goose, Spot-breasted Plover, Yellow-fronted Parrot, Prince Ruspoli's Turaco, Nechisar Nightjar, Abyssinian Catbird, Abyssinian Longclaw, Black-headed Siskin, Yellow-throated Seedeater and Ankober Serin. Other importat birds of these ecosystems are Black-winged

Lovebird, White-cheeked Turaco, Banded Barbet, Gold-mantled (Abyssinian) Woodpecker, Abyssinian Ground Thrush, African Hill Babler, Abyssinian Oriole, Sharpe's Starling, Slender-billed, Chestnut-winged Starling, Crowned Eagle and Narina's Trogon (EWNHS, 1996 & Ash & Atkins, 2009).

The dry evergreen montane forests are under severe pressure and threat of destruction caused by deforestation for wood products (especially fuel wood extraction), fire, encroaching agriculture and overgrazing.

1.3.4. Moist Montane Forest Ecosystems

The montane moist forest ecosystems comprise the high forests of the country and are found mostly on the southwestern plateau, with an altitudinal range between 800 to 2,500 masl. The southeastern plateau, on the southern portion of the Bale Mountains at an altitudinal range of between 1,450 to 2,700 masl also carries this ecosystem.

In terms of the woody plant diversity, more than 160 species from the southwestern plateau and 200 from the southeastern plateau forests are recorded. Where still standing, this forest vegetation is stratified into four different layers, namely, upper canopy, sub-canopy, shrub layer and the ground layer.

The upper canopy is occupied by the spectacular emergent trees of *Pouteria adolfi-friedericii*. *Podocarpus falcatus* is important in the mixed broad-leaved forests of the Bale Mountains. Other characteristic species in the canopy include *Olea capensis* subsp. *welwitschii* and subsp. *hochstetteri*, *Prunus africana*, *Albizia schimperiana*, *Milletia ferruginea* and *Celtis africana*. Others such as *Polyscias fulva*, *Schefflera volkensii, Trilepisium madagascariense*, *Schefflera abyssinica*, *Bersama abyssinica*, *Mimusops kummel* are also found. Sub-canopy species include, among others, *Croton macrostachyus*, *Cordia africana*, *Dracena steudneri*, *Syzygium guineense* subsp. *afromontanum*, *Sapium ellipticum*, *Ilex mitis*, *Erythrina brucei, Rothmannia urcelliformis* and the tree fern, *Cyathea manniana*. The shrub layer consists of species such as *Coffea arabica*, *Galiniera saxifraga*, *Teclea nobilis*, *Ocotea kenyensis*, *Clausena anisata*, *Maesa lanceolata* and *Maytenus* spp. Examples of woody climbers are *Urera hypselodendron*, *Landolphia owarensis*, *Embelia schimperi* and *Jasminum* spp. Epiphytes include many species of orchids, the endemic *Scadoxus nutans*, *Peperomia* spp., ferns and fern allies such as *Lycopodium*. The ground vegetation is mainly made up of herbaceous plants including species of *Acanthus*, *Justicia*, *Impatiens*, various species of Urticaceae and Zingiberaceae, some grass and sedge species.

Larger mammals living in this ecosystem include, among others, Lion, Leopard, Black leopard, Serval Cat, Black Common Jackal, Wild Dog, Wild Cat, Bush Pig, Giant Forest Hog, Warthog, Bushbuck, Colobus Monkey, Olive Baboon, Grey Duicker and several species of Bush Baby. Although a complete inventory is lacking some of the montane moist forest ecosystems are recognized to be important bird areas of Ethiopia (EWNHS, 1996). For example, the Bonga Forest contains more than 15 Afrotropical Highland biome species of birds, the Metu-

Gore-Tepi Forest contains more than 16, of which at least two are endemic, and the Tiro-Boter-Becho Forest has also more than 32 Afrotropical Highland biome species of birds (EWNHS, 1996).

The most striking change in the montane moist forest ecosystems is caused by human activities in the form of timber extraction, coffee and tea plantations, agricultural expansion, human settlement and fire hazards. As a result of the selective felling of trees for timber, few species are targeted and those that are of low commercial value are remaining with very few over-matured individuals of quality timber species.

1.3.5. *Acacia-Commiphora* Woodland Ecosystem

This ecosystem occurs between 900 and 1,900 masl and is characterized by drought resistant tree and shrub species with small leaves and which are usually deciduous. The characteristic woody species are *Acacia senegal, A. seyal, A. tortilis, Balanites aegyptiaca, Commiphora africana, C. boranensis, C. cilliata, C. monoica* and *C. serrulata*. The ground layer is rich in *Acalypha, Barleria, Aerva, Aloe* and grass species. The characteristic mammals include African Wild Ass and Grevy's Zebra, which are globally threatened. Dibatag, and Gerenuk, both long-necked antelopes, are some of the larger mammals that inhabit this ecosystem. The characteristic birds include Hunter's Sunbird, Shining Sunbird, Golden-breasted Bunting, Salvadori's Seedeater, Yellow-throated Seedeater, Ruppell's Weaver, White-headed Buffalo Weaver, Golden-breasted Starling, White-tailed Swallow and Stresemann's Bush Crow.

Most of the National parks of the country are found in this ecosystem. Extraction of fire wood and charcoal, expansion of agriculture and exotic and indigenous invasive species such as *Prosopis juliflora* and some Acacia species, as well as fire are the major threats to these ecosystems.

1.3.6. *Combretum-Terminalia* Woodland Ecosystem

This ecosystem occurs between 500 and 1,900 masl and is characterized by small to moderate-sized tree species with broad leaves, often deciduous, such as *Boswellia papyrifera, Anogeissus leiocarpa, Stereospermum kunthianum* and species of *Terminalia, Combretum* and *Lannea*. There are extensive stands of the lowland bamboo, *Oxytenanthera abyssinica* in the valleys. The vegetation in this ecosystem has developed under the influence of fire and many of the trees have thick corky bark while the herbs are generally geophytes. The most notable endemic mammal found in the ecosystem is Swaynes' Hartebeest. The characteristic birds include Fox Kestrel, Red-throated Serin, Red-billed Pytilia, Green-backed Eremomela, Bush Petronia and Black-rumped Waxbill.

Indiscriminate fire, settlement/resettlement of refugees and people from the highlands, overgrazing by domestic livestock and inappropriate agricultural investment practices are the major threats to this ecosystem.

1.3.7. Lowland Tropical Forest Ecosystem

This is a lowland semi-evergreen forest ecosystems restricted to the lowlands of the eastern Gambella Region in Abobo and Gog (Gok) districts, and adjacent areas in the Sudan. This forest occurs on well-drained sandy soils with an altitudinal range of 450 to 800 masl. The area has a mean annual temperature of 35 to 38°C and an annual rainfall range of 1,300 to 1,800 mm (Friis, 1992; Demel, 1999). The forest has more than 106 woody plant species including lianas (Anonymous, 2001). The characteristic species of this forest are *Baphia abyssinica* and *Tapura fischeri* (Chaffey 1979; Friis, 1992; Tesfaye *et al*, 2001). The common species in the upper canopy include *Celtis gomphophylla, Celtis toka, Lecaniodiscus fraxinifolius, Zanha golungensis*, *Trichilia prieureana, Alistonia boonei, Antiaris toxicaria, Malacantha alnifolia, Zanthoxylum lepreurii, Diospyros abyssinica*, *Milicia excelsa*, *Baphia abyssinica*, *Vepris dainellii* and *Celtis zenkeri*. The common species in the middle layer include *Acalyphla neptunica, Erythroxylum fischeri, Tapura fischeri, Ziziphus pubescens* and *Xylopia parviflora* (Chaffey 1979; Friis, 1992; Tesfaye *et al*, 2001). The common species in the shrub layer include *Whitfieldia elongata, Argomuellera macrophylla*, *Alchornea laxiflora, Mimulopsis solmsii, Oncoba spinosa, Oxyanthus speciosus, Rinorea ilicifolia* (Friis, 1992), *Chazaliella abrupta* (Tesfaye *et al*, 1997) and *Acalypha acrogyna* (Tesfaye *et al*, 2001). Lianas including *Hippocratea africana* and *H. pallens* are found in this ecosystem (Tesfaye *et al*, 2001).

Shifting cultivation through land clearing commonly performed through slash and burn has contributed a lot to the depletion of this forest. Recent development has brought in dam and road construction, various settlements and state farms along with extractions of fuel wood, all of which have contributed a lot towards the shrinkage of this unique forest ecosystem.

1.3.8. Desert and Semi-desert Scrubland Ecosystems

These ecosystems occur below 500 masl and are characterized by drought tolerant species of including woody *Acacia bricchettiana, A. stuhlmanii, A. walwalensis, Boswellia ogadensis, Commiphora longipedicellata, C. staphyleifolia, Hyphaene thebaica*, and the grasses *Dactyloctenium aegyptium, Panicum turgidum* as well as succulents including species of Euphorbiaceae and Aloaceae. The characteristic birds include Kori Bustard, Arabian Bustard, Blackheaded Plover, Temminck's Courser, Two-banded Courser, Tawny Pipit, Chestnut-bellied Sandgrouse, Lichstenstien's Sandgrouse, Singing Bush Lark and Masked Lark.

The desert and semi-desert scrubland ecosystems are threatened by grazing, bush encroachment and invasive exotic species, such as *Prosopis juliflora*. Wild ass, which is found in these ecosystems is critically endangered and has appeared in the 1996 IUCN list of threatened animals.

1.3.9. Wetland Ecosystems

Ethiopia possesses a great diversity of wetland ecosystems (swamps, marshes, flood plains, natural or artificial ponds, high mountain lakes and micro-dams). According to Hillman (1993), there are 77 wetlands in Ethiopia and Eritrea with a total coverage of 13,699 km² or 1.14 per cent of the total land area of the two countries. Wetlands are widely distributed in all climatic regions of Ethiopia and support a wealth of flora and fauna, including many endemic plant species and several of Ethiopia's endemic or near-endemic birds.

Typical characteristic species of wetland ecosystems include those of aquatic macrophytes including *Cyperus, Eleocharis, Scirpus, Echinochloa, Panicum, Alisma, Nymphaea, Typha, Paspalidium, Potamogeton, Wolffia, Aeschynomene, Phragmites, Urochloa, Veronica, Hydrocotyle, Polygonium*, and *Kyllinga*. Tree species include *Ficus sycomorus, Tamarindus indica, Celtis africana, Mimusops kummel, Syzygium guineense, Terminalia brownii, Acacia polyacantha, Kigelia abyssinica, Phoenix reclinata, Trichilia* spp., *Diospyros* spp. Some birds, for example, Spot-breasted Plover, Blue-winged Goose, Rouget's Rail, White-winged Flufftail, Wattled Crane, Corn Crake, Shoebill, Black-winged Pratincole, Great Snipe, and Lesser Flamingo in general favor, feed and/or breed in wetlands (Mengistu, 2000).

Wetland vegetation includes useful non-cultivated plants such as species of *Discorea, Erythrocarpus, Celtis tokka, Tamarindus indica, Echinochloa* spp., *Ficus sur, Carissa edulis, Cordia africana, Gardenia ternifolia, Citrus auriantifolia, Ipomea aquatica*, and *Nymphaea* that are used by people for food in the Baro-Akobo, Omo and Awash Valleys (Tesfaye *et al*., 1997; Bayafers 2000; Mitiku, 2001). Additionally they include species of plants used to treat people and their animals such as *Achyranthes aspera, Asparagus africanus, Acokanthera schimperi, Celosia trigyna*, etc.

Wetland ecosystems are basically assumed to be less important than any others irrespective of the many services they provide, and are regarded as free goods. Threats to these ecosystems include conversion to agricultural land, over utilization, pollution, unregulated management, siltation and construction of dams.

1.3.10. Aquatic Ecosystems

The Ethiopian aquatic ecosystems are found in many areas and include the major rivers and lakes that are of great national and international importance. The country is well known for its richness in its water potential. There are about 30 major lakes that are located in different climatic/ecological zones. These lakes are situated at altitudes ranging from below sea level in the Dallol depression up to 4,000 masl. The surface areas of the lakes vary considerably from less than 1 km² to over 3,600 km² and mean depths range from a few meters to over 260 meters. However, except for Lake Tana, the major lakes that are of economic importance are concentrated in the Great African Rift Valley that divides the western and northeastern plateau from that of the southeast.

Aquatic resources in these ecosystems include over 188 fish species of which 37 are endemic and many invertebrates. Lake Tana has the only remaining stock for Barbus flock after the demise of the same species in Lake Lanao in the Philippines. The Baro and Akobo rivers are also 'hotspots' for aquatic biodiversity. In the rivers and lakes, numerous species of planktonic and benthic fauna have been reported. Moreover, the aquatic ecosystems harbor over 200 species of phytoplankton, including many important blue-green algae such as Spirulina (*Arthrospira* spp.). These diverse aquatic habitats serve as feeding sites for a large number of resident and migrant birds. These ecosystems are used by many species of reptiles, including the Nile Crocodile. Hippopotamus is the only larger mammal species found in these ecosystems. Aquatic ecosystems are also rich in invertebrate diversity, much of which has still to be described and studied.

These ecosystems are highly influenced by various development activities. Land and water development, pollution, the introduction of exotic species, over exploitation of fish stocks, etc are some activities which have a negative influence on these ecosystems. In view of the increased threats posed to endemic fauna, the need for the protection and conservation of endemic aquatic invertebrates becomes particularly pressing (Seyoum, 2006). Direct human effects such as damming and diversion of rivers, channeling and building water distribution facilities; and indirect influences such as the removal of vegetation cover of drainage basins for agriculture, the expansion of urban, industrial, mining and similar activies have played a role in changing or even destroying these habitats, for example Lake Alemaya.

Conservation efforts directed to the aquatic ecosystems of Ethiopia are very limited. From the points of view of environmental protection and sustainable development, no significant work has been done.

1.4. Components of Biodiversity

1.4.1. Plant Diversity

1.4.1.1. Field crop diversity

Ethiopia is one of the major Vavilov centers of origin/diversity for many crops and their wild and weedy relatives. It is an important primary and secondary gene pool for many field crop species that are useful sources of germplasm for economic traits in general and sources of genes resistant to diseases and pests in particular. Ethiopia is a primary gene center for eleven field crops including noug (*Guizotia abyssinica*), teff (*Eragrostis tef*), the Ethiopian mustard (*Brassica carinata*) and enset (*Ensete ventricosa*). Field crops such as barley, sorghum, durum wheat, finger millet, faba bean, linseed, sesame, safflower, chickpea, lentil, cowpea, fenugreek and grass pea have a large genetic diversity in Ethiopia.

There has been an immense contribution of Ethiopian crop plant genetic resources (PGRs) to the world and useful genetic variations of global significance

have emanated from these genetic resources. Among numerous examples are the Barley Yellow Dwarf Virus (BYDV) resistance gene found in Ethiopia's barley, on which California's US $160 million per annum worth of barley production depends (Qualset, 1995). Sorghum is one of the most diverse crops distributed over a wide range of agro-ecological regions in the country (400 to 3000 masl) having intermediates as well as wild and weedy forms. The high lysine gene has also an Ethiopian origin traced to the local varieties called '*Wotet Begunche*' (milk in the mouth) worth $12 million annually in Canada. Teff collected from the Dessie area and hence called 'Dessie Teff' has been given Plant Breeders' Rights protection (similar to that of a patent) by the US Plant Variety Protection Act until 2016 in USA. Examples of Access and Benefit-sharing arrangements for the use of the endemic crop, teff and the endemic wild shrub, *Vernonia galamensis* subsp. *galamensis* var. *ethiopica*, are provided in box 1.

However, the Ethiopian plant genetic resouces have not yet contributed to the country's economic wealth to the extent that they should have done. The major reason for Ethiopian plant genetic resources not being effectively utilized in the past is twofold:

- One is the absence of adequate capacity to characterize and evaluate germplasm and identify novel genotypes to make them available for use; and
- The other is the lack of a system to review the existing information and identify aspects which could be useful in developing the resources.
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Figure 2: Teff (Eragrostis tef) (left), Vernonia galamensis, Asteraceae (right)

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Box 1: Implementation of Access and Benefit sharing in Ethiopia — The case of teff and vernonia

Teff

Ethiopia is the center of origin and diversity for teff (*Eragrostis tef* (Zucc.) Trotter) that is one of the most important food crops in the country. It accounts for about 22 per cent (more than 2 million ha) of the total cultivated acreage among the major cereals. It is grown as a cereal crop only in Ethiopia where it is ground into flour, fermented and then made into *injera* (a type of pancake and staple food of many Ethiopians). It originated in Ethiopia between 4000 and 1000 BC. Genetic evidence points to *E. pilosa* as the most likely wild ancestor **(**Ingram and Doyle, 2003).

It has adapted to environments ranging from drought stress to waterlogged soil conditions. Maximum teff production occurs at altitudes of 1800 to 2100 masl, growing season rainfall of 450 to 550 mm, and a temperature range of 10 to 27 °C.

Teff has an attractive nutrition profile, being high in dietary fiber, iron and calcium (National Research Council, 1996) as well as being high in protein (Seyfu, 1993). It is gluten free, so it is appropriate for people with celiac disease (cited in Chanyalew, 2007).

Demand for teff is increasing in some European countries mainly due to health reasons associated with gluten allergy. In April 2005, a Dutch company called Health and Performance Food International (HPFI) entered into an agreement with the Institute of Biodiversity Conservation (IBC) and the Ethiopian Agricultural Research Organization (EARO) to develop non-traditional teff-based food and beverage products, which are listed in the agreement. This agreement is a benefit-sharing arrangement.

Vernonia galamensis

Vernonia galamensis is a tall plant found in the natural flora of eastern Ethiopia: sometimes it is considered as a weed. The plant is a new industrial crop originating in Ethiopia which combines all the possible merits for the semiarid tropics and subtropics (Baye, 2000). The plant has shiny black seeds rich in oil. When pressed, the seeds release oil that offers a source of epoxy compounds. Applications of the oil that are being investigated include: a base for paints and pharmaceutical applications such as healing wounds, alleviating psoriasis and as a drug delivery system in the body (Baye and Gudeta, 2002). A preliminary survey was conducted to see the associated pests and diseases of *V. galamensis* subsp. *galamensis* var. *ethiopica* and design a breeding strategy in a multidisciplinary approach which will help to foster its improvement as a potential new industrial oilseed crop for Ethiopia (Baye and Gudeta, 2002).

Currently, epoxies are produced entirely from petrochemicals. It is believed that vernonia oil avoids the polluting volatile organic compounds associated with petrochemical epoxy sources, without sacrificing technical performance. A British company, Vernique Biotech, wanted to extract oil from the seeds of the plant to make a 'green epoxy'. In July 2006 the company entered into an agreement with IBC to access and develop the plant in return for a benefit sharing arrangement.

Among other arrangements, for both the teff and vernonia agreements, the companies pay a mix of license fees, royalties and a share of profits to the Ethiopian Government over a ten year period from the time the agreement starts being implemented. The implementation of the agreement on teff, as judged from the first four years of performance, is below the expectation. Though there is expressed desire from the HPFI to move forward with the agreement, the only benefit shared to date is a few thousand Euros that had been paid upfront towards the beginning of the

implementation of the agreement. IBC has tried repeatedly to remind the company to be governed by the spirit of the agreement, but no action has so far been taken by the company. In a letter written in September 2008 IBC took the case to the witnesses of the agreement (The Embassy of the Netherlands in Ethiopia and the Director General of the Environmental Protection Authority of Ethiopia) to mediate on the matter.

In the case of vernonia a sizable amount of upfront payment was made but subsequent payments have not been made, partly because the company has reported that it has not yet gone into business. Part of the benefit to be shared is earmarked for work which is related to the development and conservation of the two crops within Ethiopia.

The major field crops grown in Ethiopia are classified in four groups: cereals, pulses, oil seeds, and industrial crops.

The widely cultivated cereal species are teff (*Eragrostis tef*), barley (*Hordeum vulgare*), Emmer and other wheat species (*Triticum* spp), sorghum (*Sorghum biocolor*), finger millet (*Eleusine coracana*), maize (*Zea mays*), rice (*Oryza sativa*), oat (*Avena sativa*.), and pearl millet (*Pennisetum glaucum*).

The major pulse species are faba bean (*Vicia faba*), field pea (*Pisum sativum*, including the endemic var. *abyssinicum*), chickpea (*Cicer arientinum*), lentil (*Lens culinaris*), haricot bean (*Phaseolus vulgaris*), grasspea (*Lathyrus sativus*), and fenugreek (*Trigonella foenum-graecum*). Additionally white lupin (*Lupinus albus*), soyabean (*Glycine max*), pigeon pea (*Cajanus cajan*), cowpea (*Vigna unguiculata*), jackbean (*Canavalia ensiformis*), hyacinth bean (*Lablab purpureus*), and mungbean (*Vigna radiata*) are produced by some farmers. Yeheb nut (*Cordeauxia edulis*) is also found in the bushlands of Somali Regional State.

The major oil seed species are *Brassica* spp., niger seed (*Guizotia abyssinica*), linseed (*Linum ustitatissimum*), sesame (*Sesamum indicum*), castor bean (*Ricinus communis*), safflower (*Carthamus tinctorius*), sunflower (*Helianthus annuus* L.), crambe (*Crambe abyssinica*) and groundnut (*Arachis hypogea* L.).

The widely cultivated industrial crop is cotton (*Gossypium barbadense* and *G. hirsutum).* Cotton also includes *G. arboreum* and *G. herbaceum* which are grown in home gardens and are locally important in traditional handicrafts.

The status of field crop diversity is currently declining at an alarming rate. The major threats to field crop diversity are the replacement of farmers' varieties by a few genetically uniform crop cultivars, invasive species, drought and climate change. The famine that persisted in some parts of Ethiopia in the 1980s forced farmers to utilize the seeds of their own varieties for food. Native barley and durum wheat are probably among the most threatened by new improved/introduced varieties and/or replacement by other crop species such as forage oats (*Avena sativa*) and bread wheat, which are expanding within the cereal growing highlands. Farmers' varieties of durum, emmer and 'bonde' wheat, maize, sorghum, 'Semereta' barley are being lost by the extensive introduction of improved varieties into the farming system. The threat is more on wheat followed by maize and pulses. Late maturing farmers' varieties are being eroded as a result of the shortening of the growing season due to the change in climate. These late maturing

varieties are also being threatened due to replacement by early maturing varieties in areas where there is shortage of rain. Local varieties of some pulses, such as cowpea, primitive or diploid wheats and barley (particularly six-row barley) are disappearing from production.

The status and trend of field crops diversity varies in different parts of the country. The Arsi-Bale areas of the Oromia region used to be believed to be rich in agro-biodiversity. However, their biodiversity was severely degraded in the 1960s and 1970s during the implementation of comprehensive development projects such as the Arsi Rural Development Unit (ARDU), the Chilalo Agricultural Development Unit (CADU), and the associated changes in polycultural farming systems into mono-cropping. All durum and other traditional wheat varieties in those areas disappeared from the farmers' fields. The central, southern and western parts of Ethiopia, which were relatively intact in terms of their agro-biodiversity, are now threatened due to conversion of farm lands into plantations. The central-west and extreme west of the country were renowned for their natural coffee and local root crops, such as Anchote (*Coccinia abyssinica*) in Wellega representing the diversity of traditional crop plants. This diversity is currently indiscriminately threatened by uniform varieties, for example local varieties of maize are being eroded as a result of hybrid and modern composite varieties. The other recent threat is the allocation of large areas to external investors for high external input farming, including flower farms and rice.

In the northern and eastern parts of the country the threats come from widespread land degradadation through deforestation, gullying and erosion of the fertile soil. The high population pressure has forced people to farm unsuitable areas resulting in a high rate of depletion of genetic resources. However, there are presently many mitigating measures being taken through the PASDEP (Plan for Accelerated Sustainable Development to End Poverty) program with notable successes in Tigray, Harargie and SNNP Regions. In many of these areas, farmers are restoring their agro-biodiversity and diversifying with perennial crops, particularly fruit trees.

With respect to protecting the crop diversity in the country, the Institute of Biodiversity Conservation (IBC) has been rescuing threatened genetic variants and has conserved more than 59,000 accessions of field crops *ex-situ* - see Table 1. In addition, the Institute has established community gene banks which have been serving in maintaining crop germplasm on-farm (*in-situ*) in various agro-ecologies of the country. Ethio-Organic Seed Action (EOSA), an NGO, has built on the experience of IBC and has promoted integrated conservation, use and management of agro-biodiversity and has worked on the restoration of barley and durum wheat with community participation, details of which are in box 2.

Box 2: Success story from the Ethio-Organic Seed Action (EOSA) project: Restoring diversity of local durum wheat varieties on-farm

Durum wheat is the most displaced local wheat variety mainly due to an intensive introduction of exotic bread and durum wheat. As a result of a serious threat to the

conservation and permanent evolution of the existing Ethiopian wheat genetic resources, progressive loss of associated farmer's knowledge, linked to the traditional management and uses of crops, were found. Furthermore, smallholder farmers had been losing control over their traditional production systems.

The objective of on-farm conservation and enhancement of local durum wheat genetic resources was to restore Ethiopian varieties of durum wheat into the country's highland areas. Thus, the issue of restoring and maintaining the replaced agro-biodiversity has been integrated into a new and participatory approach leading to a sustainable maintenance of diversity on-farm. It is now possible to restore the farmers' varieties of durum wheat including access for the industrial needs in the areas where displacement of the crop was more than 95 per cent in the 1980s. The successful approaches of this project include: agricultural biodiversity and social capital, marketing and raising awareness of the availability of the durum wheat locally. Based on a decentralized or eco-specific approach, a partnership established between researchers and local communities assisted in knowledge sharing and co-guidance in selection and multiplication/distribution of promising materials (Regassa *et al*., unpublished).

EOSA, in collaboration with Instituto Agronomico per l'Oltremare (IAO) and the Ethio-Italian Development Cooperation "Arsi and Bale Rural Development Project (ABRDP)" are supporting research and capacity building initiatives. The various steps adopted for the re-introduction of gene pools, and their on-farm selection across representative sets of locations are outlined.

- Farmers own varieties and selections of durum wheat obtained from the IBC were first characterized and enhanced.
- A bulk selection methodology on farmers' fields was used as *in-situ* plots and community seed bank evaluation sites.
- Newly selected types were multiplied and distributed over diverse locations.
- Various services like technical aid in agronomy, seed multiplication schemes, and enhanced management of seed banks were provided for farmers.
- Market and non-market emerging opportunities were explored at an early stage and evaluated as an incentive for extending cultivation, and consequently maintenance and exploitation of durum wheat diversity was achieved.

The importance of this initiative is to promote a community based management approach through linking traditional landrace improvement (on-farm) with formal variety selection, strengthening community-based seed networks (community seed banks) and developing market and non-market incentive for farmers.

Initially, multiplication of the gene bank materials and original farmers' varieties was accompanied by a preliminary evaluation of the different types of durum wheat composed of heterogeneous materials. Farmers were actively involved in identifying and selecting genotypes based on the traits they are in favor of and the different use-values of the products for food preparation. In the second phase, genotypes were recomposed into groups, following the guidance provided by the farmer, for further evaluation and adaptation response over locations. During this process, selection was more focused on traits for stress tolerance, stability and market value. The quality of durum wheat in the production of spaghetti was then given attention by some local industries who signed "grain acquisition agreements" with the farmers. This shows the necessity of landrace enhancement to be coupled with early analysis for stability characteristics and processing value in collaboration with different stakeholders.

Comparative biochemical analysis, was the next phase, and was carried out by EOSA for the population, using guiding markers for the gene bank durum wheat and the

nationally released durum wheat varieties (Metakovsky *et al*., 1991). The result showed that the process of on-farm improvement of the farmers' varieties and the reintroduced gene bank durum wheat (carried out over different years by EOSA) led to obtaining distinct enhanced types (Figure 3) which uniformly represented a single and unique biotype over sites.

On the other hand, the released materials represented more of genetic uniformity. All the types display a typical "Ethiopian" pattern of gliadin and present newly found alleles at the different Gli loci which is in net contrast with the result shown by varieties released from the formal research program, which exhibit a typical "European" type of gliadin spectra showing that foreign material was extensively and almost exclusively used. The result of this study reveals that the approach followed is successful where on-farm diversity has been restored. On the other hand, the uniqueness and the novelty of the materials are encouraging the farmers to use and conserve the reintroduced resources due to non-market and market incentives.

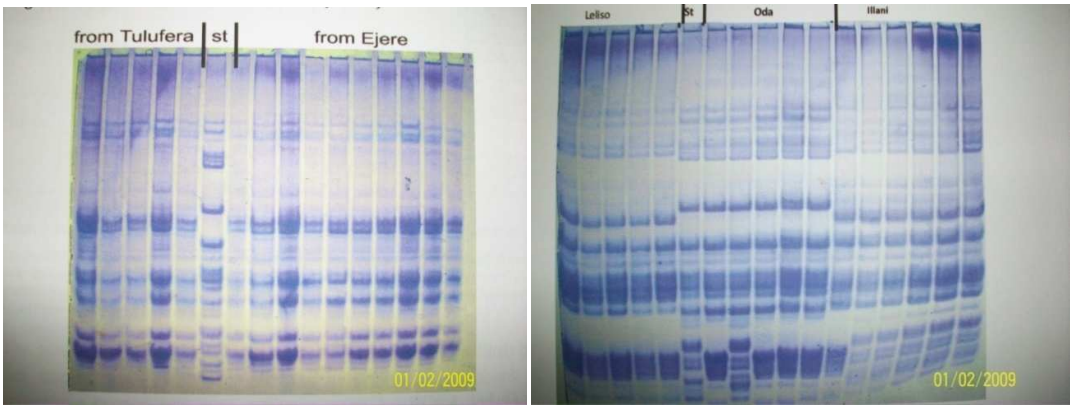


Figure 3: Gliadin pattern of EOSA population PS-1 grown in two different sites (left), Gliadin pattern of three Ethiopian released varieties. St: standard cv. Icaro

Source: EOSA, Unpublished

An example of good practice for studying the indigenous knowledge of the Konso People in cultivating field crops under bench terracing, agro-forestry and intercropping techniques is presented in box 3. A success story on ecological agriculture with smallholder farmers in a mountainous environment in Tigray Region is described in box 4.

Box 3: Konso's indigenous knowledge in terrace building, agro-forestry and intercropping as a way of conserving land races through sustainable utilization

The Konso district is found in the Southern Nations, Nationalities and People's Region (SNNPR). The population density is about 90 persons/km^2. About 80 per cent of the total area of the district is terraced. The farmers of Konso are well known for their special terrace building, which is one of the best locally available techniques for soil and water conservation. In addition, the Konsos people / farmers are well known for their crop diversification to minimize risk, mixed cropping, multi-storey cropping and tree plantation. As a result, the Konso people have controlled land degradation even in hilly and mountainous areas. Each terrace has been in place for more than 50 years. All Konso people participate in terrace building. Konso's terracing and agro-forestry and

other agricultural practices have made a significant contribution towards biodiversity conservation.

Considering the difficult agro-ecological conditions which prevail in Konso, it is remarkable how many people can be fed from a rather limited area when appropriate farming methods are applied. The ancient terraces and other constructions, as well as the simple but efficient irrigation methods, are the salient features of Konso agriculture which allow an optimal use of water throughout the year. The intercropping of various crops and tree species together with the cultivation practices seem to be important factors in food and fodder security as well as in soil conservation. The diversity of crop species and the genetic diversity within many of the crop species make Konso an important area for germplasm conservation.

The terraces are planted with sorghum intercropped with a range of species including trees such as *Moringa stenopetala* (the cabbage tree), *Terminalia browni*, and *Cordia africana* which is grown for timber, The terraces are also intercropped with shrubs such as pigeon pea, coffee and khat (*Catha edulis*) and annuals including sunflower, maize, millet, chickpea, various beans, cotton and cassava. They are fertilized with wastes from the villages, including partially burned plant residues mixed with animal dung. The cultivation of the cabbage tree as well as of certain tuber crops is almost entirely confined to the Konso highlands. These species may have good potential in other similar areas where rainfall is limited and a small number of crops are grown.

The most striking feature of Konso agriculture is the high number of plant species used and the way they are intercropped. Hallpike (1970) has reported the use of 80 wild plant species and trees for food, animal fodder, medicine, building material, magico-rituals and miscellaneous.

The Konso people have already been held up as a model for others to follow. The FAO has awarded them in recognition of their agricultural system and recommends their agricultural system as an example for farming peoples elsewhere in Ethiopia. The exemplary Konsos have been taken to other areas of the country to share their experience in dryland agriculture. The whole Konso village together with its terracing is now due for designation as a UNESCO World Heritage Site.

Box 4: Success story from the Tigray Project of Institute for Sustainable Development (ISD): Ecological agriculture with smallholder farmers in a mountainous environment

The Institute for Sustainable Development (ISD) is a non-profit-making non-governmental organization that promotes environment friendly practices. ISD launched a Project in Tigray Region in collaboration with Bureau of Agriculture and Rural Development (BoARD) and the respective districts. The main activities of the Tigray Project are: training and follow-up on compost making and use; water and soil conservation activities; restricting free range grazing and feeding animals from cut grass and branches of woody plants; making community ponds and river diversions to catch and hold water for use in the dry season; promoting and encouraging innovator farmers in water harvesting, bee keeping and use of bio-pesticides based on indigenous knowledge; supporting women-headed and elderly families (they are the poorest of the poor) through supplying seeds of spices and training in making fruit and forage tree nurseries; training unemployed girls who complete formal schooling to equip them with skills for earning an income; experience sharing through cross-visits; and supporting the use of new and easy technologies such as treadle pumps. The Tigray Project started in 4 local communities in the central, eastern and southern parts of the Region. The

experience is now expanding fast in all the crop cultivating parts of Ethiopia, particularly the use of environmental bylaws and the making and use of compost. A brief account of a success story of compost application is provided below.

The Impact of Compost on Crop Yields

The major concerns and reasons for ISD to promote compost are:

1) To avoid the financial risk of farmers who take chemical fertilizers on credit,

2) Overall soil fertility is more important than just the amounts of the two major nutrients, N and P, supplied by urea and DAP,

3) To promote farmers varieties, which respond to organic fertilizers more efficiently than improved varieties,

4) Increased use of chemical fertilizers could lead to eutrophication of lakes, which could affect the biodiversity therein.

The soils of the project areas are generally poor due to land degradation and erratic rainfall. Between 2000 and 2006, yield data for 11 crops were collected from over 900 plots in farmers' fields and analyzed statistically. The average of the grain and straw yields for each treatment for seven cereal crops is shown in Figure 4. The compost generally doubled the grain yield when compared to each respective check. The application of compost also increased straw yield compared to the check, but not to the same extent as it increased grain yield. The use of compost also gave higher yields than the use of chemical fertilizer, though differences in the yields from compost and from chemical fertilizer were not as great as the differences between the use of compost and the check. The residual effect of compost in maintaining soil fertility for two or more years was soon observed and appreciated by the farmers. They are thus able to rotate the application of compost on their cultivated land and do not need to make enough to apply to all their cultivated land each year. The reduction of difficult weeds, such as Ethiopian wild oats *Avena vaviloviana*, and improved resistance to pests, such as teff shoot fly, has also been noted by the farmers.

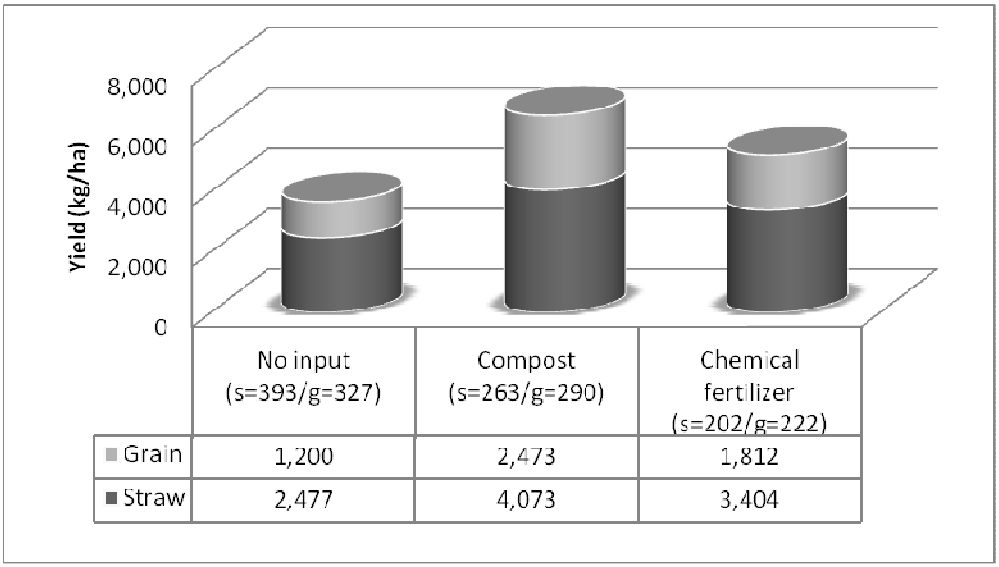


Figure 4: Average grain and straw yields (kg/ha) for 7 cereal crops, based on averages for each crop between 2000 and 2006 inclusive

(s = number of observations for straw yield; g= number of observations for grain yield

Source: Edwards, Sue, Arefayne Asmelash, Hailu Araya and Tewolde Berhan Gebre Egziabher, 2007.)

1.4.1.2 Forest plant diversity

The forest resources of the country are grouped in 5 categories, namely, natural closed forests, woodlands, bushlands, plantations and on-farm trees. The current area coverage of each category is not available. It is often reported that about 35 per cent of the landmass of Ethiopia was once covered with closed forests, but this Figure is based on a study of the possible climatic climax vegetation types of the country which was included in reports by FAO. Historical records and archeological studies indicate that the forest cover has been much lower since prehistoric times. The revised estimate of the closed forest cover of Ethiopia is less than 3.5 per cent (Anonymous, 2004). The total number of woody species of Ethiopia is estimated to be 1017, out of which 29 tree species, 93 shrub species and 2 liana species are endemic. These species represent 104 families and 387 genera (Taye *et al*., 2003). A new tree species, *Acacia fumosa,* has been identified from the Ethiopian Somali Region.

Since 2005, six *ex-situ* conservation field gene-banks in three regions have been established based on the priority species for conservation. These are: Gareno-Gorotta (Goba district), Lepis (Arsi Negelle Woreda), Shashemane botanical garden (Shashemene Woreda), Regin (Asosa District) and Adeda (Mandura woreda) in the Benshangul-Gumuz Region, and Kona Giorgis (Farta Woreda) in the Amhara Region. Endangered woody species in these field gene-banks include *Hagenia abyssinica, Podocarpus falcatus, Juniperus procera, Olea europaea* subsp. *cuspidata, Prunus africana, Cordia africana, Milletia ferruginea, Calpurnia aurea, Acacia abyssinica, Acacia albida,* various *Ficus* spp. and one pioneer species, *Croton macrostachys*. Although *Oxytenanthera abyssinica* is the main species targeted to be conserved in the Asosa and Mandura *ex-situ* sites, other economically and socially important species such as *Zizipus spina-christi* and *Piliostigma thonningii* have been included. In addition, a collective *ex-situ* conservation site has been established at Adulala, in Liben Chiquala Woreda, East Shewa Zone of the Oromia Region. Species in this site include: *Cordia africana, Ficus vasta, Hagenia abyssinica, Acacia senegal, A. albida, A. seyal, Calpurnia aurea* and *Olea europaea* subsp. *cuspidata.*

Based on data from the forest inventory and other sources, priority species were identified, and a strategy was developed for the conservation of the forest genetic resources of the country. Taking into account the very alarming degradation of these resources, IBC and a Forest Genetic Resources Conservation Project funded by GTZ jointly started the *in-situ* conservation of the priority species. *In-situ* conservation sites were established in Mandura for *Oxytenanthera abyssinica* in Benshangul-Gumuz, Bonga for *Hagenia abyssinica* and Masha for highland bamboo, *Arundinaria alpina,* in the in SNNP, while Sigmo-Setema was set up for *Podocarpus falcatus* Tiro-Boto-Becho for *Pouteria adolfi-friedericii* and Bishan Gari for *Ficus ovata* in Oromia Regions. Though the *in-situ* sites are

established for the conservation of the target species mentioned above, the whole ecosystem is conserved. Reports from the monitoring and evaluation activities show that these conservation sites are very susceptible to human and livestock encroachment, and hence becoming severely degraded. This calls for urgent and rational measures by the concerned bodies and other stakeholders in order to develop and implement proper management plans for these *in-situ* conservation sites.

Ethiopian forests provide several products and ecosystem services. The major products are logs (timber), fuel wood, poles, food (such as fruits, nuts, pods, leaves, honey, and coffee), fodder, tannin, spices/condiments, medicinal plants, resin, fiber, oils, gum, incense/olibanum etc. These products are economically important for forest dwelling households and communities as well as the nation. Forest foods are known to bridge difficult times when normal food is in short supply. The non-wood forest products such as coffee, frankincense, gum arabic, myrrh and honey are earn hard currency as export products, and are also used locally to generate income and in traditional foods and medicine.

The services of forests are environmental and socio-cultural. They also provide habitats for several fauna and flora, as described under the ecosystems diversity. The major environmental functions of forests are ecosystem stability, particularly in times of climate change, climate amelioration (shade, soil improvement, etc.), soil and water conservation, and carbon sink. The major socio-cultural values of forests are in maintaining traditional lifestyles (building and furnishing houses), providing important secondary forest products, aesthetic, for ritual/religious practices and other ceremonies.

The Ethiopian forests are repositories and gene pools for several domesticated and/or important wild plants and wild relatives of domesticated crops as well as wild animals and microbes. For example, *Coffea arabica* (stimulant shrub), *Phytolacca dodecandra* (medicinal shrub), *Aframomum corrorima* (spice herb), *Prunus africana* (medicinal timber tree) and *Hagenia abyssinica* (medicinal timber tree) are some of the important plant species still found in the natural forests of the country. The success story of forest coffee from Bale region is presented in Box 5.

Box 5: Success story of a specialty market and co-management of Bale Wild coffee

Coffea arabica is one of the important crops in Ethiopia. The gene pool of this plant exists in the wild (primary natural forest), semi-wild (managed forest), cultivated (backyards and gardens) and mixed farming or designated farms (plantations). The wild coffee is the dominant component of the Harena natural forest of Bale. This forest is among the top priority natural forests of the country that is well known for its large area coverage (>190, 000 ha) and species diversity. Two districts border the Harena Forest and thus the dominant livelihood of the community is strongly related to forest products. Sale of wild coffee provides 90 per cent of the annual family income of the people living in the forest. Although traditional beehives are common, beekeeping is the second source of household income.

Among the major challenges to the coffee production are human encroachment on the forest and damage to regenerating coffee plants. Lack of access to motor roads and

market infrastructures forces farmers to sell their produce at very low prices. Lack of market information, poor control over the marketing mechanisms, poor quality of products resulting from poor handling, complicated traders chains, weak service cooperatives, price fluctuation and adulteration are additional market related problems. This has served as a disincentive to conserve the forest and the wild coffee associated with it. The complex nature of problems demands a holistic and systematic approach (rather than a single commodity based strategy) for wise, sustainable use, and conservation of this resource. This is in line with the current Ethiopian "Plan for Accelerated and Sustained Development to End Poverty (PASDEP)". Any threat to the natural forest is a threat to the coffee gene pool and other valuable plant species. Therefore maintaining the wild and semi-wild coffee entails conserving the forest. The major threatening factors are deforestation caused by timber harvesting, conversion to farmland, human settlement and unregulated harvesting.

Figure 5: A picture showing coffee in the Harenna natural forest in south Ethiopia (photo: EOSA)

A project with the overall objective of improving the local capacity for integrated and sustainable forest coffee resource management and use was initiated by Ethio-Organic Seed Action. Among the approaches to improve the situations are: sound resource use strategy; proper resource use rights; ensuring sustainable incentives for communities through benefits from natural resources (market and non-market benefits); and adding value to the resources. The components of these approaches include: creating the feeling of ownership and the sense of common goods among all involved; creation of associations like the "Natural Forest Coffee Producer and Marketing Cooperatives"; and creation of specialty market (preliminary lab assessment of samples per locality have shown specific characters).

Partners promoting the initiative included farming communities harvesting coffee from Harena natural forest, Arsi-Bale Rural Development Project, Slow Food Foundation for Biodiversity, S.A Bagersh (an Ethiopian Private Company for processing and exporting coffee), Caffe Speciali Certifcati/CSC (a group of Italian roasters and coffee traders), local district administration, agricultural cooperatives and natural resource offices for policy implementation, regulation and extension services, and Ethio-Organic Seed Action.

The community participatory approach for conservation and use of natural forest coffee was accepted by all involved stakeholders, thereby strengthening the co-management of the natural forest and the wild coffee. Storage and marketing facilities were established. In addition the tremendous community motivation has achieved improvement in the quality of the harvested coffee. This has led to the increase in the price of coffee sold by the individual farmers/cooperatives, which has in turn led to strengthening the collective management of the natural forest and the coffee.

Overall, forest diversity and area is declining. However, there are some positive developments that have contributed to rehabilitation of biodiversity, particularly in the form of area closures in the woodlands and bushlands (for example, see Figure 7). The moist evergreen forests in south and south-western Ethiopia and the *Commiphora-Terminalia* woodlands in western and northern-western Ethiopia are being destroyed to make for commercial agricultural investment. Leasing forest land for investment in high external input plantation agriculture is the government's number one priority, but it does not require payment for the lost resources and anyone who gets the right to develop the land also has the right to use the resource without any payment. Under the pretext of establishing modern farms, some investors have cleared forests/woodlands, sold firewood, charcoal and timber for construction without making any investments. After the investors make money from the sale of forest/wood products, they cultivate the land for one or two seasons and then abandon the area. This has become a very serious threat to the forest biodiversity mainly in primary forest/woodland areas of the south, southwest and western parts of the country.

Land leasing agreements need to eliminate such loopholes which end up in unfairly enriching 'smart investors' at the expense of the local people and their biodiversity. If the agreements are not able to eliminate this trend, rather than the objective the lease is intended for, which is promoting agricultural development that can contribute to the overall growth of the nation, they will continue to damage the environment. The leasing agreement should particularly include the payment for the resource on the land and penalties for those who quit without adequate justification before the time stipulated in the agreement.

In south western Ethiopia, the moist evergreen montane forests are severely degraded, affecting the associated biodiversity. Box 6 describes the irresponsible conversion of the Gemadro forest to coffee plantations in the SNNPR. Wetlands are converted to small and big farms such as tea plantations. Riverine forest/vegetation is under heavy exploitation along the Awash river in Afar area (north eastern Ethiopia). The woodlands providing gums and resins are also under serious threat, particularly from the possibility of Jatropha plantations for biofuel. In general, deforestation is rampant and some commercially important tree species like *Cordia africana, Juniperus procera, Hagenia abyssinica, Podocarpus falcatus, Olea europaea* subsp. *cuspidata, Pouteria alitissima, P. adolfi-fridericii, Prunus africana, Acacia tortilis, A. nilotica* and *Vitellaria paradoxa* are severely threatened. Both highland (*Arundinaria alpina*) and lowland Bamboo (*Oxytenanthera abyssinca*) species are threatened. Table 2 shows the land use land

cover (LULC) change in Gemadro area and Table 3 shows summary of LULC in four districts where Bale Mountain National Park is located. Figure 8 presents a map depicting the change in vegetation cover in one of the districts, Dollo Mena.

Table 2 and Figure 6a & 6b show rapid land use/land cover changes on Gemadro forest between 1973 and 2005. This is just one example of irresponsible and irrational use of the dwindling primary forests of Ethiopia.

Table 2: The extent of land cover changes around the Gemadro coffee plantation project area

Year	*Dense closed forest*	*Disturbed closed forest*	*Open forest*	*Agriculture /tree mosaic*	*Agriculture*	*Exposed /cultivated*	*Cloud block*
1973	4,389	414	784	75			
1987	2,461	481	2,430	267	22		
2001	861	942	2,368	368	1,034	88	
2005	914	956	691	1,883	814	52	349

Source: (Bedru, 2007)

Box 6: Should primary forests give way to coffee plantations? The case of Gemadro

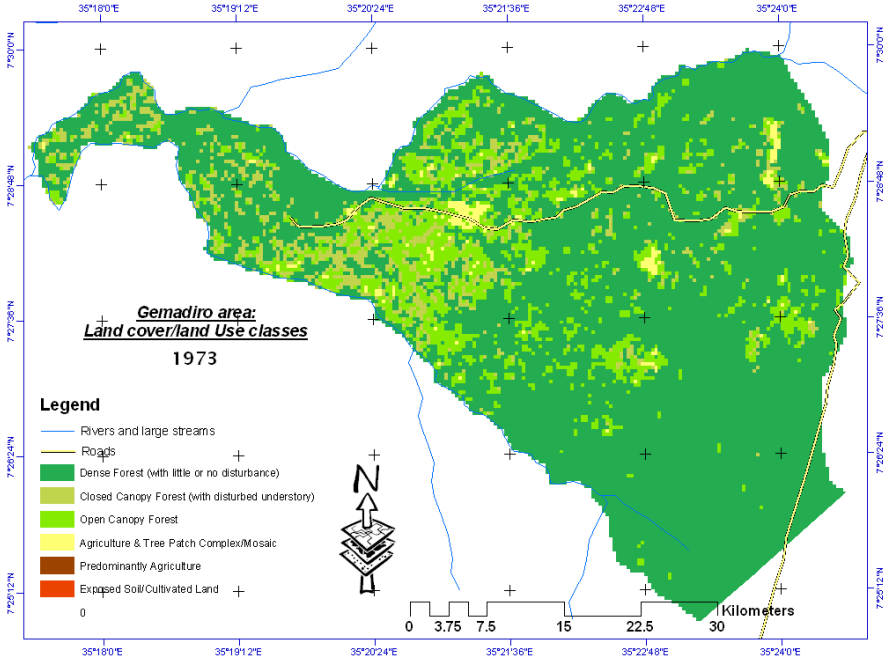
The Gemadro Forest in Andrecha District (district) of Sheka zone in SNNPR is threatened because of large coffee plantation and influx of smallholder settlers. Except the high altitude areas dominated by bamboo, about 50 per cent of the forest was converted to coffee plantation since 1987. The land cover/land use assessment in Gemadro has shown extensive decline in canopy coverage and two types of land cover change patterns are observed (Bedru, 2007):

1. Land cover change caused by local farmers: This land cover change is largely driven by increase in population, which is manifested through farmland extension, accompanied by proportional decrease in forest cover and quality. The proportion of deforestation to secondary regeneration is increasing.

2. Investment induced land cover change: Agricultural investment entails high level of land management and changes in natural resources use. Between 2001 and 2005 alone, a quarter of the total area of Gemadro was severely deforested and converted to coffee plantation. If this trend continues unabated, the remaining intact forest of Gemadro (50 per cent) will be severely endangered.

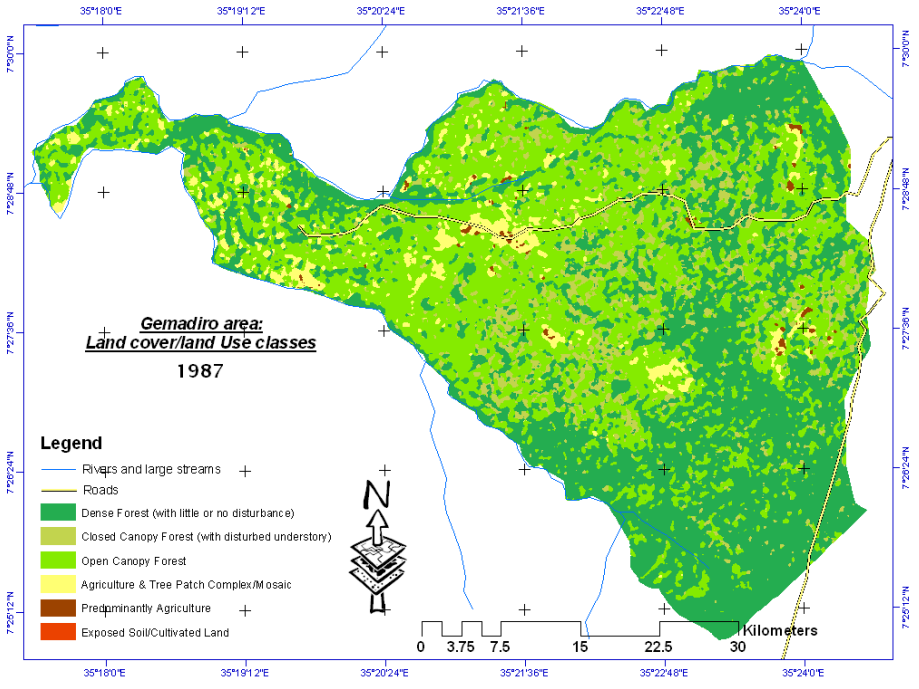
Authorities in regions where participatory forest management (PFM) schemes have been implemented have reported that the forests (e.g. Chilmo, Adaba-Doddola, Belete-Gera and Bonga) are showing improvements. The Oromia Forest Agency has indicated that an area of 34,000 ha of forest under PFM (which has a livelihood diversification component) has shown 15 per cent improvement in vegetation cover compared to an unmanaged adjacent area which has shown 16 per cent reduction in vegetation cover. On the other hand, some Ethiopian scholars

argue that PFM was successful in Asia (Nepal and India) but has failed in Africa (Ethiopia, Kenya and Tanzania), because Africa primary forests were distributed to



forest communities without adequate monitoring whereas Nepal and India distributed the forests with strong monitoring.

Figure 6a: Spatial representation of land cover classes around Gemadro in 1973 (top) and 1987 (bottom). (Source: Bedru, 2007)



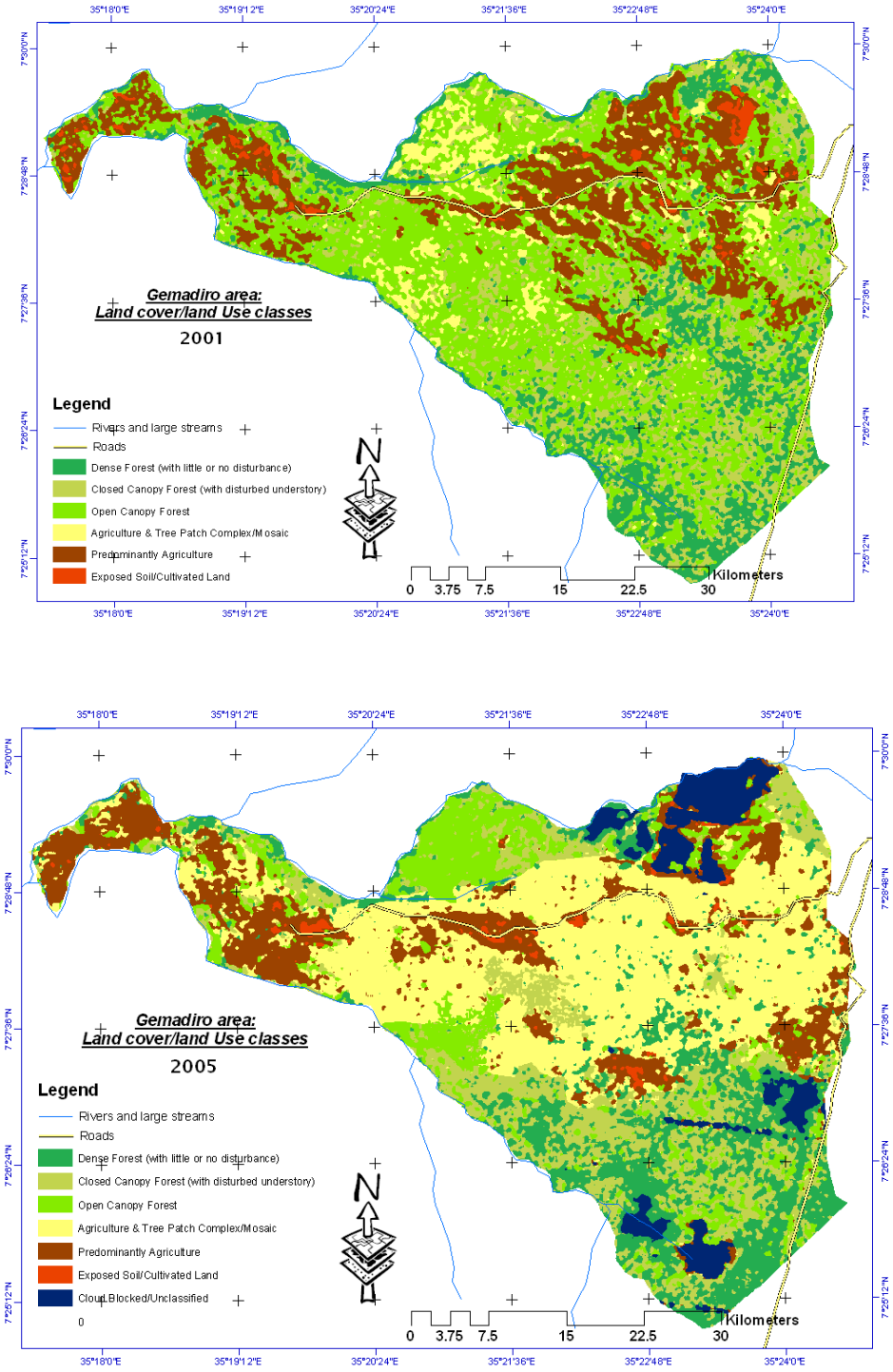


Figure 6b: Spatial representation of land cover classes around Gemadro in 2001 (top) and 2005 (bottom). (Source: Bedru, 2007)

Improvements to woodlands, and their associated grass and herb cover, have been seen where areas have been enclosed to prevent free range grazing by livestock. An example is shown in Figure 7.

Figure 7: Adjacent enclosed (left) and open (right) sites on the road from Ziway to Shashemene. The area was closed by Wondo Genet College of Forestry and Natural Resources. (Photo: Adugna Abdi)

The last examples is taken from Bale Mountains National Park where FARM Africa and SOS Sahel have monitored the land use and land cover change since 1986. The data are given in Table 3 and Figure 8.

Table 3:. Summary of land use and land cover (LULC) changes in four districts of Bale Mountain National Park

LULC conversion types	LULC% conversion in each districts			
	Dallo Mena	Harena Buluk	Goba	Nansabo
Forest to annual crops	5	6	7	17
Woodland to mixed woodland and cropland	5	NA	NA	NA
Woodland to cropland	NA	1	28.5	NA
Wooded grassland to cropland	NA	3.4	NA	NA
Woodland to plantation	NA	NA	1	NA
Bushed grassland to cropland	NA	NA	28	NA
Bushed grassland to plantation	NA	NA	1	NA
Mixed woodland and grassland to cropland	NA	NA	NA	9

NA = Not applicable. Source: Farm Africa and SOS Sahel, 2008.

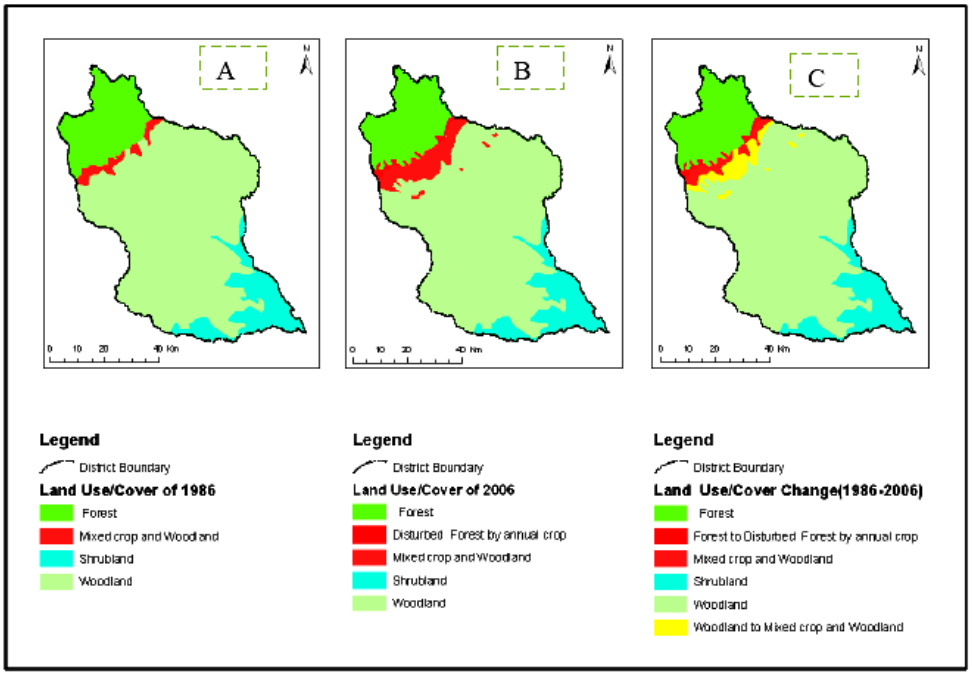


Figure 8: Land use/cover maps of Dollo-Mena district for 1986 (A) and 2006 (B) and land use and land cover change between 1986 and 2006 (C) (Source: Farm Africa and SOS Sahel, 2008).

The major threats to forest plant species are fire hazard, deforestation for various purposes including converting forest areas to agricultural land, grassland, and settlements.

1.4.1.3. Horticultural plant diversity

The major horticultural plant species grown in Ethiopia are categorized in five groups: root and tuber crops, fruits and nuts, stimulant and beverage species, herbs and spices, and wild-edible species. The most important root and tuber crops, which are native to Ethiopia are anchote (*Coccinia abyssinica*), enset (*Ensete venricosum),* yams (*Dioscorea spp*.), and "Oromo dinich" (*Coleus edulis*). The major exotic root and tuber crops include taro (*Colocasia esculenta*), tannia (*Xanthosoma saqitiffolium*), yam (*Dioscorea alata*), Cassava *(Manihot esculenta*), potato *(Solanum tuberosum*), and sweet potato (*Ipomoea batatas*). Some of the exotic crops, such as taro and tannia, are naturalized and diverse. The most important stimulant and beverage species are coffee (*Coffea arabica),* tea (*Camellia chinensis),*gesho *(Rhamnus prinoides)* and khat *(Catha edulis).* There are about 40 tropical, sub-tropical and temperate fruit crop species grown in Ethiopia. The number of wild-edible species recorded so far is 233. There are about 30 herb and spice species that are commonly grown and used in Ethiopia.

The major threats to horticultural plant species are severe and prolonged drought, pests (vertebrate and invertebrate) and disease, replacement by food grains, deforestation (affecting wild-edible fruits), frost and hail storms.

1.4.1.4. Medicinal plant diversity

At least 80 per cent of the Ethiopian people depend on traditional medicine for their health care (Dawit and Ahadu, 1993), and more than 95 per cent of traditional medicinal preparations in Ethiopia are made from plant origin (Dawit, 1986). There are about 887 plant species recorded as having medicinal uses for people. The majority of the medicinal plants are herbs, followed by shrubs and trees (see Table 4). Twenty four (2.7 per cent) of the medicinal plant species are endemic to Ethiopia, and most are found in the wild (Table 5). Therefore, the threats and trends for medicinal plants are similar to those for the forest plant species. A case study showing the commendable work of a traditional healer to conserve the medicinal plant diversity is presented in box 7.

Table 4: Distribution of the medicinal plants by their growth forms

Growth habit	No. of species	Percent
Herbs	271	30.5
Shrubs	168	19.0
Trees	110	12.4
Climbers	74	8.3
Reed	2	0.2
Unidentified	262	29.6

Source: Tesema *et al*., 2003

Table 5: Distribution of medicinal plants by their state of existence

State of existence	No. of species	Percent
Wild	357	40.2
Cultivated	89	10
Weed	52	5.9
Undetermined	389	43.9

Source: Tesema *et al*., 2003

Box 7: A Case study of a traditional healer as an individual contribution to *ex situ* conservation of biodiversity

Herbalist Abebech Shiferaw is owner and manager of "Deshet Traditional Herbal Medicine Treatment Center". The Center is conducting conservation of medicinal plants and giving treatments to patients using traditional practices. The center is conserving the medicinal plants in a field gene bank (a 4 ha garden) and traditional seed store. In the field gene bank, some 600 species of herbs, shrubs, grasses and trees having medicinal value and a total of 1,400 samples collected from all over the country are conserved (Figure 9). In addition, edible horticultural crops such as potato and cabbage are also planted mixed with the medicinal plants. They are served to patients demanding nutritional supplements. About 50 seed samples of tree species, some of which are highly threatened, and 112 samples of teff, sorghum, barley and wheat are kept in the seed store.

Figure 9: Partial view of the medicinal plants garden (left) and partial view of traditional seed store of Deshet Traditional Herbal Medicine Center (right) (Photo: Adugna Abdi)

The seeds are monitored for viability every 3 to 5 years. Thirteen seed samples which the center calls 'vitamin *Etse-tehadso*' are also kept under ground. According to the Herbalist, restoration of medicinal plants has been undertaken in some areas of the country where these genetic resources have been lost from the localities. In addition to the conservation activities, the Center is providing traditional medicines and health care in the Center and its branch in Addis Ababa.

The Herbalist states that about 23 medicinal plant species have become extinct from the country because of the absence of proper conservation and sustainable utilization. The Center identified the following major problems and constraints of medicinal plants:

- Severe erosion and extinction of indigenous knowledge;

- Lack of capacity of government institution responsible to look after the resources;
- Lack of due consideration to the resource and traditional medicines;
- Absence of an organization to integrate and coordinate the efforts of traditional healers and their healing practices;
- Absence of due respect for indigenous traditional healers (or herbalists);
- Lack of inclusion of traditional medication in government institutional structure.

Besides the conservation and traditional healing endeavors, the Center organizes workshops and trainings in relation to traditional medication. The center recommends the following sites/regions as priority areas for the conservation of medicinal plants. There is need for urgent action.

- Abay river catchment
- The Kesem-lowland-woodland areas including Afar and Somali regions;
- South Omo – the Omo river catchment, and around Jinka
- Gonder and Eastern Gojam (Zege) areas
- Benishangul-Gumuz and Gambella areas

The Herbalist believes that restoration of the medicinal plants to their natural habitat is important since the curing ability is more effective when they are collected from their natural habitats rather than plants collected from areas where they have been taken. The center has plans to restore these resources to their natural agro-ecologies but this plan has had shortfalls of financial and other capacities. There is also a plan to establish a college in this field in collaboration with other stakeholders.

1.4.1.5. Pasture and forage plant diversity

There is a wide range of pasture and forage resources adapted to different ecosystems in the country. Production of the Flora of Ethiopia and Eritrea and other studies show that there 159 genera with 569 species of grasses (Phillips, 1995), 108 genera with 358 species of legumes (Thulin, 1989) and 179 species of trees used by domestic animals for browse have so far been recorded in Ethiopia (Anonymous 2005; Getahun *et al*., 2003). Ethiopia is known to be a centre of diversity for a number of important forage herbaceous legumes species in the genera *Trifolium, Vigna,* and *Dolichos*, among others. But many of these palatable species are highly threatened.

Vegetation cover in pastoral grazing areas is changing from grassland to bushlands. High quality and palatable plants are being degraded in the rangelands as a result of overgrazing and invasion by non-palatable indigenous such as *Acacia mellifera* and *A. nubica* and alien species, particularly *Prosopis juliflora* and *Parthenium hysterophorus*. Area closures in Afar and Tigray regions and establishment of biodiversity conservation gardens in the Somali region have resulted in regeneration of desirable forage and browse species that were lost from the rangelands. The Somali Region established a herbarium to characterize and document forage plant species of its rangelands, such as *Cordeauxia edulis*.

Farmers at Fogera Plain are focusing on expansion of farmlands for rice cultivation instead of maintaining and scaling up the old tradition of cattle husbandry as a result of which, the forage species of the plain are being threatened.

In general, the major threats to pasture and forage plants is overgrazing and/or over browsing and conversion of pasture land to crop land. As most of the pasture and forage plant species are found in the wild, their threats and trends are similar to those of the forests. The threats on the forage and pasture genetic resources are thereby a threat on the domestic and wild animal genetic resources and other components of the natural resources.

1.4.2. Animal Diversity

1.4.2.1. Domestic animal diversity

Ethiopia has served as a gateway to domestic animals from Asia to Africa and its diverse ecology favored diversification of these resources. In terms of livestock population, Ethiopia stands first in Africa and 10th in the world in livestock population. The domestic animal population of the country is estimated to be 47.5 million cattle, 26.1 million sheep, 21.7 million goat, 1 million camel, 39.6 million chickens, 1.8 million horses, 0.4 million mules and 5.6 million donkeys (CSA, 2009). The trends in population size of these livestock over the last five years are presented in Figure 10a and 10b. The change in population size has shown an increase in all cases. Though increase in population size doesn't necessarily show the state of the animal diversity, given that more than 99 per cent of the livestock population (excepting poultry) are indigenous breeds, it appears that the resource is well.

At present there are about 30 cattle, 14 sheep, 14 goat, 4 camel, 4 donkey, 2 horse, 2 mule, 5 chicken and 5 honey bee breeds / strains / populations. It is reported by Somali Region Pastoral and Agropastoral Research Institute (SORPARI) that there are two humped camel breeds and a feral horse population in the region. There is also another feral horse population in the eastern part of Oromia region. However, the status and trend of most of the breeds is not known and needs to be studied: some are considered to be threatened. At the moment Sheko cattle, the only taurine breed in East Africa, appears to be highly threatened as a result of interbreeding with the local zebu breed and due to the change in the system of production (box 8). The Fogera, Begayit, Irob, Ogaden, Afar and Borena cattle breeds, Sinnar donkey breed, and Afar sheep breed are also facing various degrees of threat.

The major threats to the livestock genetic resources include feed shortage as a result of degradation of rangelands and other grazing areas, overgrazing and overstocking; invasion of rangelands by unpalatable weeds and shrubs; expansion of crop cultivation; illegal trafficking, inbreeding and interbreeding; and Trypanosomiasis. The major threats to indigenous chicken are replacement by exotic breeds, diseases and predation while the major threats to honeybees are agro-chemicals (pesticides/herbicides), diseases, pests and predators.

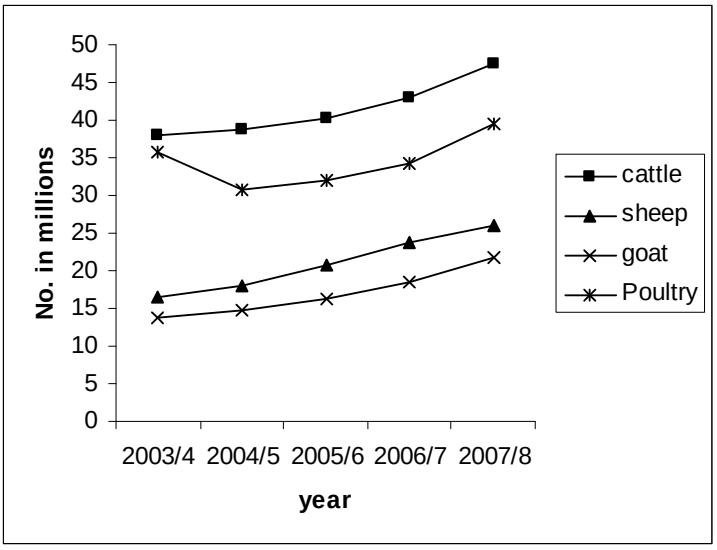


Figure 10a: Change in population size of the cattle, sheep, goat and poultry in the period 2003/2004 to 2007/2008. (Drawn based on CSA, 2009)

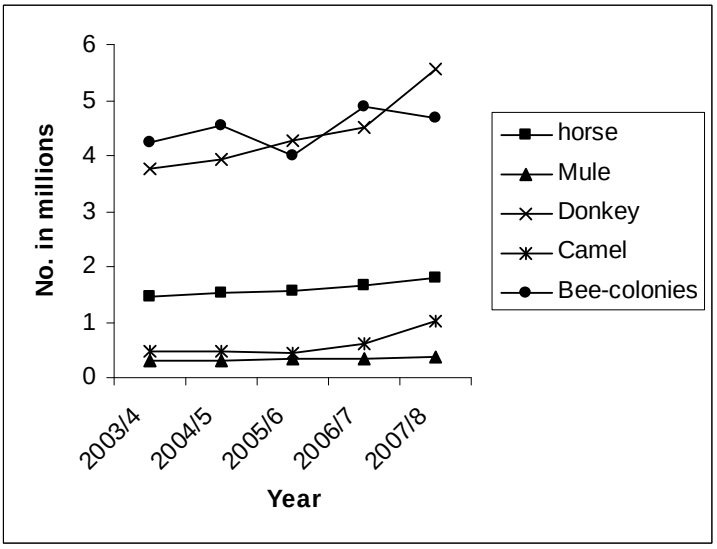


Figure 10b: Change in population size of horse, mule, donkey, camel and bee-colonies in the period 2003/2004 to 2007/2008. (Drawn based on CSA, 2009)

Box 8: The Sheko cattle—An endangered breed of Ethiopia

The Sheko/Goda breed is the only remaining representative of the brachyceros type (humpless shorthorn breed of cattle) in Eastern Africa. It is characterized by its prominent eye, folded type of eyelid, glossy-red hair coat and blocky appearance. Moreover, the majority of them are polled while the rest have stumpy or curved type of floating horn and are characterized by having horizontally-oriented broad and short ears, broad muzzles, and reduced type of cervico-thoracic humps. The breed is trypano-tolerant and a better milk producer compared to other indigenous breeds. It has also a good reputation for its traction performance. Its distribution lies approximately between 5^0 12' and 36^0 18' N latitude and 34^0 30' and $36^0$12' E longitude.

Currently as a result of changes in production system and interbreeding with Zebu animals, the breed is under severe threat of extinction. The recent estimate of the population is around 4,000 (Takele, 2005) against 31,000 and 18,307 reported by FAO in 1999 and 2001, respectively. The production system in the area was forest based where animals graze at the fringes and in the natural forest. Due to its polledness and other qualities the breed was highly suitable for foraging in the forest where animals need to be able to move through a thick vegetation. Currently, heavy deforestation of the area has taken place and coffee and crop farming has expanded.

The type of tending management has changed from free roaming to tethering. Due to their polledness the animals are tied on the neck but the rope snaps frequently because cattle have the ability to pull stronger by the neck than by their horns. As a result communities keeping these animals find it expensive to keep replacing snapped ropes. The owners have to pay compensation for the damage the animals incur on crops and property of other farmers when they are free and in the absence of their owners. Consequently, farmers are selling their Sheko cattle. In addition, there is a shortage of Sheko bulls, and Sheko cows are usually mated with the Zebu breed. All these factors have contributed to the drastic reduction of the Sheko cattle population. The most worrying aspect of the situation is that there currently is no conservation program for these animals.

Figure 11: A Sheko cow

Some indigenous domestic animals (e.g. Sheko and Ogaden cattle) are interbreeding with other breeds and are losing their unique features. In addition, drought, desertification and abandoning of irrigated areas due to salinity are affecting the pastoralists and possibly the animal genetic resources. Cross-breeding of Menz sheep with Awasi exotic breed is likely to dilute the indigenous Menz sheep breed. Boran cattle breed is also subject to dilution as a result of cross-breeding and replacement by other breeds during restocking after drought. Introduction of new breeds to a new area is also resulting in the appearance of diseases which were not recorded before. Gumboro is a disease of poultry which is being seen in Ethiopia only recently.

As a result of increased market demand, the number of cattle, goat, sheep and camel being exported legally and illegally seems to threaten the resources since the size and selection of export animals is not commensurate the off-take rate or the traditional breeding systems. This can be verified by the large proportion of young and breeding animals supplied to the market. Conservation of the domestic animal diversity is also not getting the attention it deserves.

Fogera cattle breed is interbreeding with other cattle breeds, consequently the pure line is declining. Ranches were established in Chagni, Metekel and Angasa for this breed with major objectives of breed improvement and retaining the pure lines. A ranch was also established for Washera sheep in north western Ethiopia (Amhara region).

The national artificial insemination coverage for cattle is 1 per cent. Exotic or cross-breed bulls, chicken and sheep are also distributed to some parts of the country. Except for poultry the level of current introduction is low, in addition that for cattle is mainly restricted to urban areas. However with the aggressive extension program to increase the artificial insemination service and due to more focus on certain exotic breeds and areas, there is a serious threat of dilution to some local animal populations.

1.4.2.2. Terrestrial wild animal diversity

Ethiopia is endowed with diverse wild animal species, some of which are endemic to the country. There are 284 recorded species of mammals (Afework Bekele, pers. comm.), 861 species of birds, 201 species of reptiles (over 87 snakes, 101 lizards and 13 species of tortoises and turtles), 188 species of fish, 324 butterflies and 63 species of amphibians. Table 6 summarizes the major wild animal species and their conservation status. The literature giving records of the total number of wild animals shows variations in numbers. Especially the literature on birds varies from one author to another. The most commonly cited number is that there are 861 species of birds in the country. However, a recently published book on the birds of Ethiopia and Eritrea (Ash and Atkins, 2009) brings the number of birds of Ethiopia down to 837 species. The number of endemic and near-endemic (shared with Eritrea) is reported to be 18 and 14, respectively. Another web based information source (Lepage, 2009) raises the number to 954. The discrepancy is mainly the result of recent taxonomic revisions using molecular genetics with a number of subspecies raised to the rank of species.

There is a huge knowledge gap on other components of the fauna owing to the absence of systematic surveys, especially for the arthropods (other insects in general) where high diversity and endemism is expected from the array of diverse ecosystems in the country.

The trend in the status of the terrestrial wild animal biodiversity is variable. In general, there is a decline in most populations, mainly due to loss of habitats. Figure 12 shows the drastic decline in populations of 5 wild mammal species of Awash National Park. Though time series data is not available, ostrich and critically endangered species such as Swayne's Hartebeest and Grevy's Zebra are

believed to be locally extinct from the Park. The population sizes of ostrich and Soemmering gazelle have decreased drastically in the nearby Yangudi-Rasa National Park, while wild ass is highly threatened in the same park. Wild ass is also found but very rarely seen in Mille-Serdo Wildlife Reserve around Umdurur in Afar Region. Endemic bird species such as Yellow-throated Seedeater in Awash Park and Roujet's Rail in Bale Mountains National Park (BMNP) are highly threatened.

Table 6: Number of species, endemic species and endangered species (for mammals and birds only) of major non-domesticated animal groups of Ethiopia

Wild animal group	No. of Species	Endemic species	Critically endangered	Endangered	Vulnerable
Mammals	284	29	5	8	27
Birds	861	18	3	6	12
Reptiles	201	10	-	-	-
Amphibians	63	25	-	-	-
Arthropods	1,225	7	-	-	-
Fishes	188	37	-	-	-

Source: Mohammed *et al*., 2003; Anonymous, 2005; Claire *et al*., 2009 ; Abebe Amha, pers. comm.; Afework Bekele, pers. comm.

The status of a recently discovered monkey *Chlorocebus djamdjamensis* (previously known as *Cercopithecus aethiops djamdjamensis*), which is endemic to Ethiopia and found in Bale mountain is unknown. Migration of wild animals from Dolo Odo area of Somali region (around the boarder with Kenya), which is triggered by increased hunting threat is reported as a factor seriously affecting the wildlife resource of the country in general and of that area in particular. Previously the Somali clan in that area didn't have a culture of hunting wild animals. This is a recent negative development which has a very serious consequence on the wildlife biodiversity. Bale Mountains National Park (BMNP) is recognized as a biodiversity hotspot.

However, there are some positive developments particularly on some endemic wild fauna that were recognized as endangered. The IUCN (2009) up-listed Sidamo Lark to the category of critically endangered from its previous conservation status (Box 9).

The case of some endemic mammals that showed dramatic boost in population size in Semien Mountains National Park (SMNP) is presented in Figure 13 and as a success story in Box 10. The endemic Ethiopian Wolf (*Canis simensis*) and Mountain Nyala (*Traglaphus buxtoni*) which are flagship species have also showed remarkable increase in Bale Mountains National Park as compared to their

populations in earlier years. The adult and sub-adult population of the Ethiopian Wolf from Bale Mountains National Park (BMNP) showed a positive trend in population size from 150 in 1991 to 300 in 2008, but then fell to about 200 in 2009 (Figure 14) due to an outbreak of rabbis. The interventions of the Ethiopian Wolf Conservation Project and the major threats to the Ethiopian Wolf are described in Box 11. In BMNP, Mountain Nyala has stabilized at a population size of arounbd 1,200 animals in recent years while the elephant population in Babille sanctuary has stabilized at about 324 from less than 60 some 10 years ago. Figure 15 shows the progressively positive trend in the populations of the endemic Swayne's Hartebeest in Senkelle Sanctuary though its habitat is gradually shrinking from human settlement and agricultural expansion.

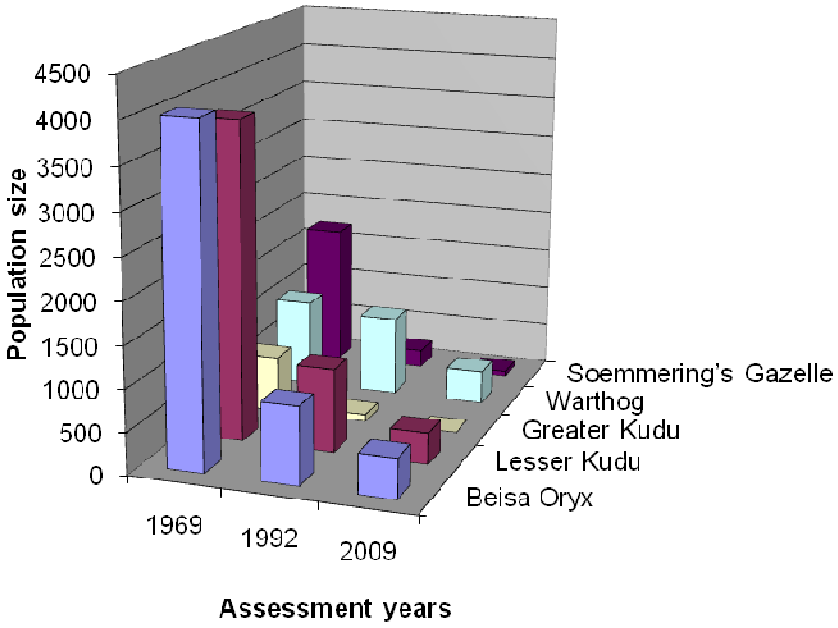


Figure 12: Declining population trend of some wild mammals of Awash National Park. Data source: Awash National Park office

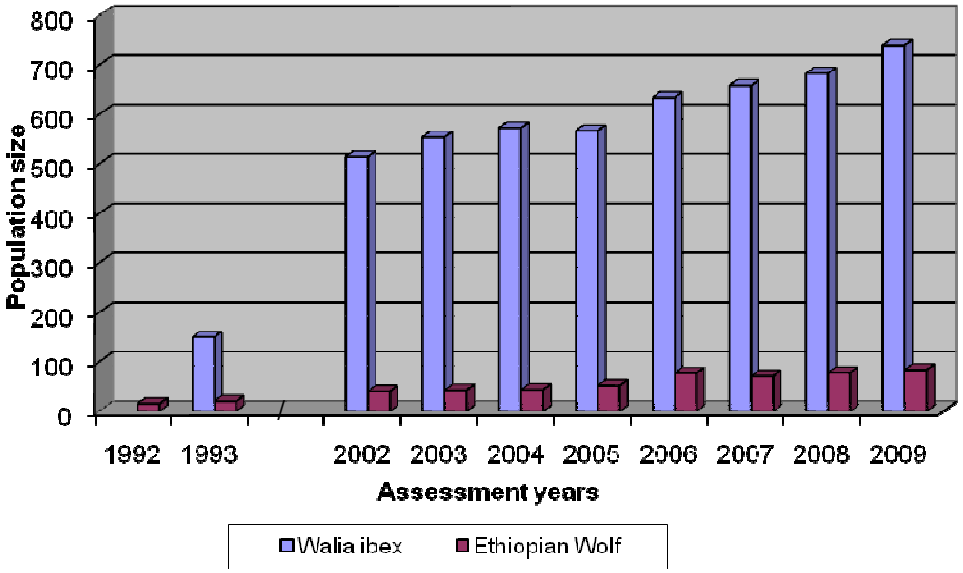


Figure 13: Changes in population sizes of the Ethiopian Wolf and Walia Ibex in Simen Mountains National Park (Source: Simen Mountains National Park)

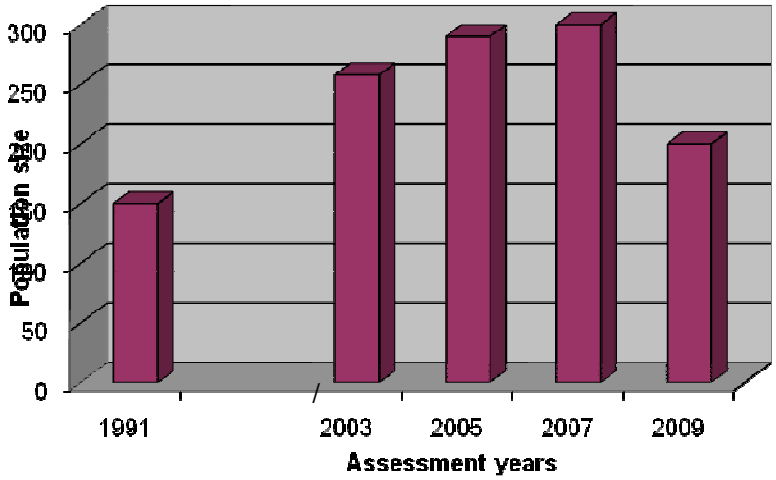


Figure 14: Changes in population size of the Ethiopian Wolf (Canis simensis) in Bale Mountains National Park (Drawn from Annual reports of EWCP)

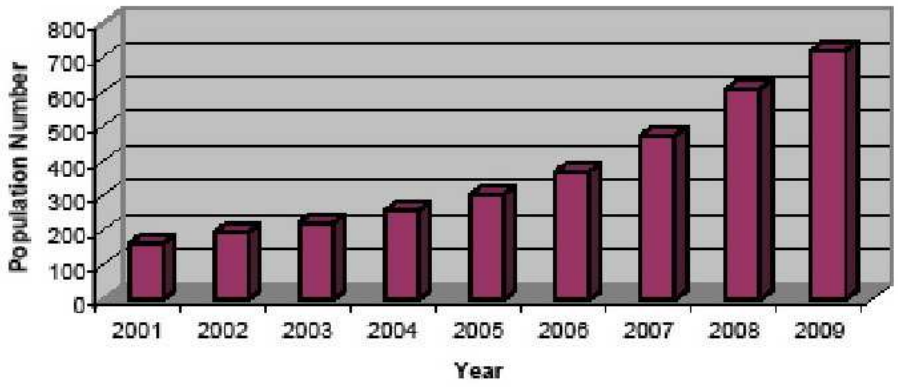


Figure 15: Progressive positive trend in the populations of the endemic Swayne's Hartebeest in Senkelle Sanctuary (Source: EWCA)

Box 9: Sidamo Lark up-listed to critically endangered (IUCN 2009)

The Sidamo Lark, *Heteromirafra sidamoensis,* is confined to the Liben Plain, a small plateau with a core of grassland east of Negele town in the Borana Zone of Oromiya Region in southern Ethiopia. It was listed as endangered (globally threatened) due to its tiny range and agricultural expansion in the plain (Anonymous, 2007). Its habitat at 1,450m is herbaceous steppe dotted with acacias or open wooded savanna or very dense herb layer, which is described as 'seasonally lush grass of herbaceous steppe' (Collar & Stuart, 1985; Érard, 1975). The Sidamo Lark occupies an exceptionally small range (about 40 km²). The total male population of the species does not exceed 250 individuals (Spottiswoode *et al*. 2009). The species has now been up-listed to critically endangered status because of the degradation of the grasslands, very low population size and the single location the species is found in (Spottiswoode *et al*. 2009). The authors argue that it may soon cause mainland Africa's first modern bird extinction. Urgent intervention, mainly habitat restoration, is needed to assure its continued existence.

As a means of minimizing conflict of interest between parks and the surrounding communities, provision of employment opportunities to members of the local communities, for example, employment of scouts, through waiving educational criteria for recruitment is a positive means of enlisting communal support for conservation efforts.

Box 10: Population size of three endemic mammals boosted in Simen Mountains National Park

The Simen Mountains National Park is found in north Gondar Administrative Zone of the Amhara National Regional State in northwestern Ethiopia. It was established in 1966 and gazetted in 1969 for the protection of mainly *Capra walie* (Figure15). The Park was later designated as world heritage site in 1978, making it the only natural heritage site in Ethiopia at the time. It now covers an area of 412 km² of the Simen Mountains watershed. Most of the park is mountainous, with elevations ranging from 1900 to 4430 masl. Agriculture is the dominant land use in the area. Endemic species, such as *Capra walie*, the Ethiopian wolf (*Canis simensis)*, and the gelada baboon (*Theropithecus gelada)* are flagship species for this area.

Walia Ibex

Simen Mountains National Park is home to world's only wild population of Walia Ibex. It was believed that Walia was formerly widespread over the Simen Mountains. It was seriously threatened and included in IUCN Red List as critically endangered in the mid 1990s. Most remaining Walia are currently found within the boundaries of the Simen Mountains National Park, mainly along 25 km of the northern escarpment between Adarmaz and Chenek camps. There are also four sub-populations outside the National Park. In 2004, the population stood at around 500, a slight increase over earlier estimates of 200-250 animals in 1994-1996. The population has been showing signs of increment over the past decade reaching 740 in 2009 (Figure 13). The Walia Ibex is the most charismatic animal species of Ethiopia, its image being used as an emblem by many government and non-government conservation institutions. Recently, positive interventions are being implemented, such as the Integrated Conservation and Development Project (funded by the Austrian Government) in collaboration with the Parks Authority of the Regional government. This has resulted in considerable improvements. Having survived two decades of war, the main threat to this species at present is habitat destruction caused by human encroachment, which is reducing its natural habitat. There are over 30,000 inhabitants in and around the National Park. A few Walias occasionally move to the south-east of their natural range to feed on cultivated crops at places where there is cultivation of barley and other crops on the steep gradients. This leads to conflict between local farmers and park authorities.

The Ethiopian Wolf

The Ethiopian Wolf (*Canis simensis)* is endemic to the Ethiopian highlands that lie above the tree line at about 3200 masl. There are no recent records of the species at altitudes below 3000 masl, although specimens were collected at 2500 masl from Gojam and North-Western Shewa at the beginning of the century (Yalden *et al* 1980). The species was first described from the Simen Mountains in 1835. There had been a continuous decline in the population size of the Ethiopian wolf until the last decade when gradual increase was recorded from 15 in 1992 to 84 in 2009 (Figure 13). More than half of the population of this species lives in the Bale Mountains. The Ethiopian Wolf is listed as endangered in the IUCN Red List, and has full official protection under Ethiopia's Wildlife Conservation Regulation of 1974.

Gelada baboon

Theropithecus gelada (Figure 17 on the right) is restricted to high grassland and escarpments in the deep gorges of the central Ethiopian plateau, in Tigray, north Gondar, north Wello, and north Shewa between 1800 to 4400 masl. The Blue Nile Gorge and the upper Wabe Shebelle valley (east of the Bale massif) mark the western and south-eastern boundaries of the range, respectively. There are possibly three subspecies: *Theropithecus gelada* ssp *gelada* and *T. gelada* ssp *obscurus* that occur in the north of Gondar, in Tigray, in north Wello, in north Shewa, and west of the Rift Valley, while an undescribed subspecies is found along the Wabi-Shebelle river in the Arsi massif.

Gelada are usually shot as vermin, and have been tapped as laboratory animals in the past. For example 1,200 animals were exported to the USA between 1966 and 1973. In the past, adult numbers may have been reduced as a result of selective shooting for their furry skin to make ceremonial costumes used by the Oromo people. It is listed as 'vulnerable' under the African Convention and in Appendix II of the Convention on International Trade in Endangered Species (CITES). Simen Mountains National Park is the only area of Gelada habitat which is formerly protected. Their number has reached 15,000 in 2009 from an earlier recorded number of 5,000.

Though dramatic improvements have been achieved, drought and encroachment by

the local people still remain as challenges facing the endemic mammals and the vegetation of Simen Mountains National Park.

In its 33rd session (Seville, Spain, 22 to 30 June, 2009), the World Heritage Committee (WHC) examined the state of conservation of the Simen Mountains National Park. It acknowledged the positive actions being taken by Ethiopia, as a State Party, in addressing the corrective measures recommended by the Committee in its previous sessions. It further requested for the implementation of the remaining recommended corrective actions, such as urgently re-gazette the newly established boundaries and start implementing the strategy to address the grazing pressure and the Alternative Livelihoods Development Project. The Committee has requested Ethiopia to submit a detailed report on the state of the National Park so that the WHC would re-examine its decision of retaining the Park on the List of World Heritages in Danger.

Figure 16: Herds of Walia ibex freely grazing in the Lobelia ryncopethalum-Festuca grass-community in Simen Mountains National Park (photo: Taye B. Ayele, 2009)

Figure 17: Ethiopian Wolf (left), Alfa male Gelada Baboon (right). (photo: Taye B. Ayele, 2009)

BOX 11: The Ethiopian Wolf Conservation Project

The Ethiopian Wolf Conservation Project (EWCP), established in 1995, has been building the capacity of the staff of the Bale Mountain National Park (BMNP) and assisting in the conservation of the Ethiopian Wolf. BMNP is one of the few important areas where the Ethiopian Wolf is found. Awareness creation in the community and other stakeholders, supply of veterinary services to control the most important disease (rabies) transmitted from domestic dogs, monitoring and research work are among the major activities of the project. The project is particularly working on protecting the endemic wolf populations against rabies infestation through dog vaccination and promotion of rational dog husbandry with the local communities. Since 1998, the project has vaccinated over 40,000 dogs in order to minimize the degree of rabies transmission to the wolves.

According to the project, the severe threats to the Ethiopian Wolf are:

- Habitat loss and fragmentation, caused primarily by expansion of subsistence and commercial agriculture, grazing pressure, burning of the habitats by pastoralists, the growth of urban centers and economic development such as mineral extraction; and
- The transmission of rabies from domestic dogs.

Increase in wolf number was observed in the period 2005 to 2007 (Figure 14) but the 2008 to2009 census has shown a sharp decrease as a result of high mortality from a rabies outbreak. During the census at least 30 wolves were found dead. Other risks include: road traffic accidents; revenge killings by people following livestock predation; intentional killings due to political instability or delinquency; inbreeding and problems associated with dogs such as hybridization; direct harassment or fighting; and competition for resources. The hybridization could lead to loss of genetic purity and inbreeding could lead to breed depression. Two hybrid wolves have been identified which were of opposite sex adding to the danger of dilution of the wolf diversity. The other deadly impact on the Bale Mountains' wolf population size is the progressive decrease of the home range for the wolves. They have been forced to be restricted to a very small area at the top of the mountain chain above 3000 masl due to ecological degradation. As a result of the narrowing of their territory, there is severe competition for resources among packs.

The major threats to terrestrial wild animals are habitat loss and degradation, illegal trafficking, poaching and climate change.

1.4.2.3. Aquatic wild animal diversity

There are about 30 major lakes, 12 major river basins and over 70 wetlands that are located in different ecological zones of Ethiopia. There are 188 fish species, 91 benthic and aquatic insects and 141 zooplankton species recorded so far in Ethiopia (Mohammed *et al*., 2003).

Wetland biodiversity is getting lost as the wetlands are being converted to farmlands. To mention a few examples: Fogera marsh has been converted to rice field; Sululta marsh is distributed to investors; ELFORA PLC has converted Chefa wetland in South Wello to farmland. Lake Tana is loaded with silt because the vegetation of the surrounding catchments are destroyed and farmed, and the wetlands are converted to rice paddy. Fogera wetlands were known for their rich biodiversity. They had been sheltering the rare flamingoes and cranes, which are

now moving to Abay valley. Lake Abijata has narrowed about 5 km from its previous size (Figure 18). Lake Haiq had sedges around its edges but, at present, the sedges have been destroyed. The sedges were important habitat for fishes and wetland birds. About two decades ago the surroundings of Green Lake, a crater lake in the Debre-Zeit area, were covered with bushes. Currently, the bush has been cleared and siltation is a serious problem. Lakes of Alemaya and Adele have dried up and are no more in existence.

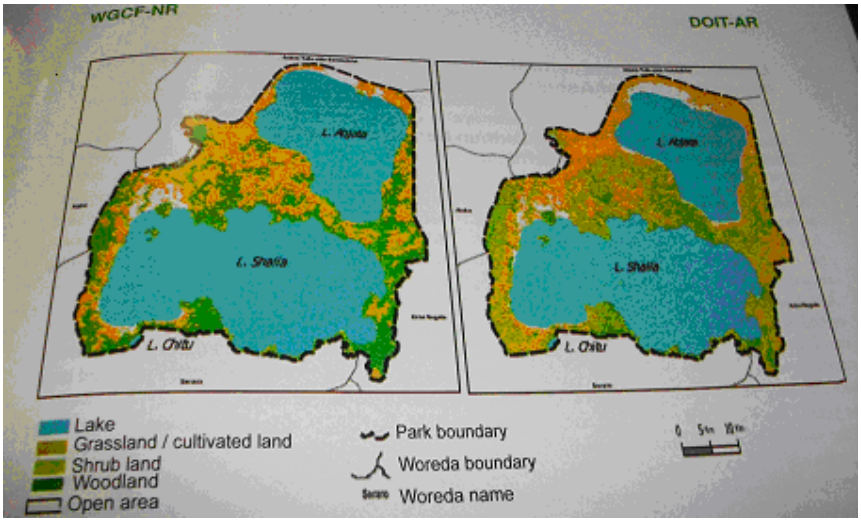


Figure 18: Changes in land use and water area of Lake Abijata and Shalla. (Source: Girma et al, 2009)

All lakes with fish populations are now being over harvested. Estimating the exploitable potential yield of existing fish stocks is the top priority work, as the status of the fish stock should be known in order to decide the amount of fish yield that can be gained annually in a sustainable way without endangering the fish biodiversity.

The case of Lake Awassa is used to assess the situation of the fish biodiversity in the country, as there is a time series data of more than 20 years for the lake. The fishery activities around Lake Awassa showed tremendous increase during the last 20 years (Figure 19). The number of fishermen increased from less than 20 in the early 1980s to over 100 in the 1990s and to a current number of about 100. These fishermen are legally registered, However, there are quite a large number of unregistered fishermen. Similarly, fishing efforts have shown significant increase during the last two decades. For example, during the early 1980s, the fish catch, which had been below 200 nets per day, increased from 400 to 700 nets per day during the early 1990s and eventually leaped to over 1,000 nets per day in the late 1990s. Currently, the catch ranges between 1,000 and 1,500 nets per day.

Total fish landings have increased for some years and have started to oscillate between 600 and 700 tons/year (Figure 19), although efforts to increase fishing have persisted until now. This is an indication of over-fishing, in particular concerning the heavily fished tilapia stock. Two decades ago, the catch per net of

tilapia was about 25 to 30 fish per net, but currently, it rarely exceeds 5 fish per net. Hence, tilapia is the most endangered stock from the increased fishing efforts. Lake Awassa is also highly polluted by city waste and a nearby hospital, threatening the biodiversity within the lake. Therefore releaving part of the fishing pressure on this particular stock is urgently required (Review report on Lake Awassa, unpublished). It is obvious that fish resources would decrease and in due course the catch of fish would also start to drop with the increasing fishing efforts. The consequence on the fish biodiversity would also be quite immense.

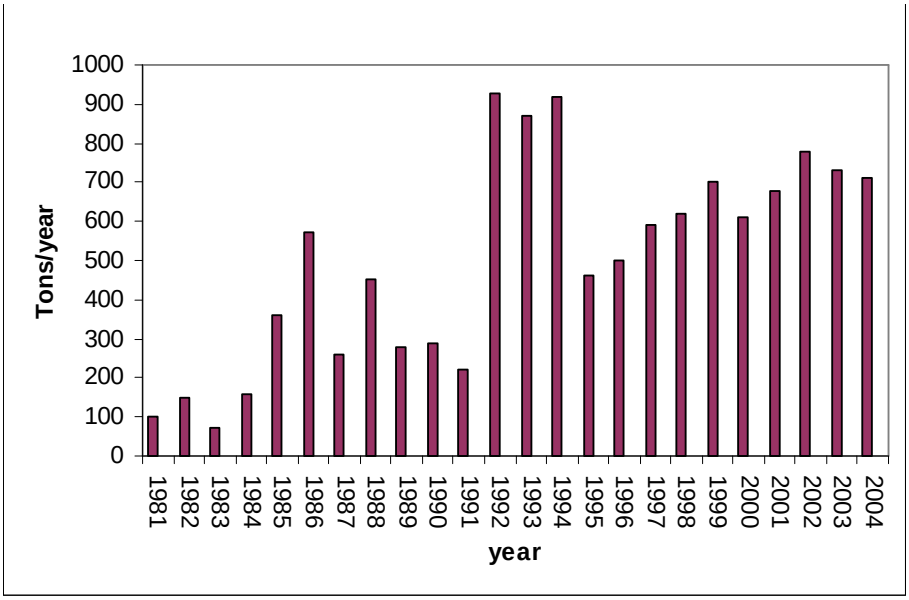


Figure 19: Total fish landings (tons/year) from Lake Awassa between 1981 and 2004 (Source: Yosef Wolde Giorgis and Elias Badebo, Unpublished)

Cat fish is becoming more dominant than tilapia in areas where tilapia used to be highly dominant, for example in Lake Ziway. The fish diversity in Abijata is highly threatened by the demands on the water that should flow into it, high siltation and change in habitat with the change in water chemistry and substrate. The substrate has changed from sandy to sandy clay and clay soil.

The major threats to aquatic and wetland wild animal biodiversity are habitat loss and degradation, siltation as a result of catchment degradation, over-harvesting, unbalanced water utilization, change in water flow (flow modification), silt mining, draining of wetlands for other land uses, and pollution.

1.4.3. Microbial Diversity

Ethiopia's heterogeneous environmental conditions are favorable for diverse micro-organisms. Ethiopia is rich in traditional microbial fermentation and preservation of foods and beverages (Ashenafi, 2002). These valuable microbial genetic resources have not been sufficiently studied, documented, and conserved. Micro-organisms are of great value to mankind because they benefit agriculture, industry, medicine, and the environment in various ways. The number of genera and species recorded

so far are shown in Table 7. An important work in the identification of extremophiles from the live volcano of Ertale in Afar region has been accomplished by IBC with international collaborators. These groups of micro-organisms have a high potential for scientific research and industrial use.

Table 7: The number of genera and species recorded so far for the various groups of micro-organisms in Ethiopia*

Group of micro-organisms	Genera	Species	Strain/isolate
Algae	97	248	
Bacteria	61	89	214
Fungi	35	45	
Protozoa	8	20	
Viruses		44	
Total	201	446	214

*These include work done by of other researchers in addition to that of IBC.
Source: Zeleke *et al*. 2003; Anonymous, 2005.

1.5. Other Activities of IBC

Ethiopia together with the Eastern and Central African countries of Burundi, Djibouti, Eritrea, Kenya, Madagascar, Rwanda, Sudan, Uganda, has formed a network known as the Eastern African Plant Genetic Resources Network (EAPGREN). This network attempts to conserve and sustainably utilize plant genetic resources within the member countries. As a continuation of previous work, Ethiopia has taken part in its second implementation phase of five years under three main outputs.

The first output includes activities such as conservation, collection, characterization and evaluation, base-broadening and genetic diversity/erosion studies of the plant genetic resources. The second output will focus on the development of a legal framework through internalizing global instruments and creating awareness on PGR coordination. On the other hand capacity building efforts through long and short term training, improvement of infrastructure and establishing sensitization education system are the third output.

Based on the Global Plan of Action (GPA) for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture (PGRFA), FAO has developed a proposal for establishing a National Information Sharing Mechanism (NISHM). For this purpose a project agreement has been signed between FAO and IBC to establish this info-sharing mechanism in Ethiopia. The project is important in that it enhances world-wide information management

and exchange on plant genetic resources for food and agriculture. It integrates efforts of stakeholders in national genetic resources activities and facilitates building strong linkages between stakeholders and international organizations to increase sharing of information and identifying opportunities for collaborative activities to realize national food security. Moreover, it is a key platform for information sharing, scientific exchange, technology transfer, research collaboration, and for the determination and sharing of responsibilities for activities such as collecting, conservation, distribution, evaluation, and genetic enhancement.

Ethiopia is a party to the regional Research Program on Sustainable Use of Dryland Biodiversity (RPSUD) which includes two Eastern African countries, Kenya and Tanzania, with technical and financial backup from Sweden. The consortium is a unique integrated pioneer program, addressing critical issues on resource management and use. The program together with other players has made notable contributions to research and the building of a critical mass of high level manpower in the sub-region.

IBC is the focal government institution regarding these issues in Ethiopia. In addition to capacity building, several studies have been successfully accomplished under the RPSUD. Some of these are:

- A study on the role of dryland wild plants used for food in Ethiopia.
- A study on the role of dryland tourism and ecotourism for livelihood support and development in Ethiopia.
- Study on use of wild plants for minor and non-wood products in Ethiopia.
- The influences of sectoral policies, legislation and institutional governance systems on natural resources management in drylands: experiences from Ethiopia.
- Study on the role of dryland wild animals used in supporting food security in Ethiopia.
- Assessment of local products of aromatic plants, oil crops, spices and condiments from the drylands of Ethiopia – A step towards promotion of their sustainable production and management systems.
- Synthesizing and compiling the fragmented information on aromatic plants, gums and resins done so far: A step towards developing a database and guideline for effective participatory resource management in drylands of Ethiopia.

Currently, restructuring of RPSUD's programs into a sub-regional scientific network trust "The Dryland Biodiversity Network for Eastern Africa (DBNEA)" is underway. This restructuring arose from a review of RPSUD's structure and management against the growing challenges facing the sub-region's dryland areas.

1.6. Threats to Biodiversity

The summary of the importance of the major threats to selected groups of biodiversity components is presented in Table 8. The driving factors of the threats to biodiversity are grouped in six categories of impediments as shown below.

1.6.1. Political Impediments

Conserving biodiversity requires strong political commitment and an understanding of the value of natural resources. It appears that the latter is lacking. As a result inadequate consideration is being given to conservation in the development agenda. Implementation of policies falls short from what the policies are intended for. Projects and investments are either oriented to short term development goals and, even when they consider biodiversity conservation, they are poorly implemented. For example, wild coffee in forests has been given the attention of regional and local administrators. But the vegetation associated with the wild coffee is not given the due consideration it deserves. In some areas, particularly in areas where protected areas are cross-regional, conflicts are creating a serious threat to the management and enforcement of regulations that have been developed for the effective functioning of the protected areas.

Table 8: The importance of major threats to selected groups of biodiversity components

Major threats	Biodiversity component					
	Field and horticultural crops	Medicinal and forage plant species	Domestic animals	Forest plant species	Wild animals	Aquatic and wetland life
Replacement of local varieties and breeds	XXX	X	XXX	XX	0	X
Land degradation	XXX	XX	XX	XX	XX	XX
Invasive species	XXX	XX	XX	XX	X	XX
Illegal trafficking and poaching	0	0	XX	X	XXX	0
Unsustainable utilization of natural resources (BD)	X	XXX	XX	XXX	XXX	XXX
Habitat loss and degradation	XX	XX	0	XXX	XXX	XXX
Water flow modification, unbalanced water utilization and drainage	XX	XX	X	X	XX	XXX
Pollution	X	X	X	X	X	XXX
Siltation	X	0	0	0	0	XXX
Climate change	XXX	XXX	XX	XX	XX	XXX
Fire hazard	0	XX	0	XXX	XXX	0
Population pressure	XX	X	XX	XXX	XX	XX

0= no impact to insignificant impact, X= least impact, XX= medium impact, XXX= high impact

1.6.2. Institutional Impediments

The integration of biodiversity conservation into the activities of various institutions is an important area in the successful implementation of biodiversity conservation and their sustainable use. At present, activities are institutionally oriented rather than being nationally focused. There is a lack of coordination and integration among relevant organizations at federal and regional levels. Moreover, there is a lack of proper implementation and monitoring mechanisms both in specific cases and in the overall assessment of the status of biodiversity conservation and their sustainable use. For example, Participatory Forest Management, which has been found to be effective in biodiversity conservation in Asian countries, has not been found to be as effective as it had been planned in Ethiopia. This is because of the lack of adequate monitoring following the distribution of primary forests to communities. Due to weakness in enforcing the law on those people who trespass the boundaries of protected areas and inflict damage to the vegetation and the wildlife therein, it has not been possible to implement the planned and effective patrolling mechanisms in protected and gazetted areas. The police and the judiciary are not effectively enforcing the legal

provisions related to biodiversity conservation. Area closures are showing promising results in terms of rehabilitation and restoration of the vegetation diversity. However, the lack of a responsible body to administer the law upon completion of projects that had been supporting conservation activities is resulting in some damage.

Most of the institutions involved in biodiversity conservation, research and development lack the capacity to effectively discharge their responsibilities. In some cases, there is lack of clarity on the mandate on biodiversity issues and incidences of contradiction or misunderstanding among government institutions is not uncommon. One important impediment on the conservation and use of biodiversity is the absence of an institution which is directly responsible for the management of the biodiversity resources in the various regional states of the country.

The wetland biodiversity is facing an alarming threat. There is no institution which is responsible for and guides the conservation and sustainable use of the wetlands and their resources. This could be because of the fact that Ethiopia is not a signatory to the Ramsar Convention on wetlands. As a result different organizations follow contradicting policies towards managing and conserving wetlands. Organizations working on agricultural extension encourage draining wetlands and turning them into agricultural lands while those working on conservation of natural resources advocate maintenance of the wetlands and genetic resource associated with them. There is overall a very poor understanding of the vital ecosystem services which wetlands provide, including regulating water flows and ameliorating local climates.

1.6.3. Socio-economic and Cultural impediments

The socioeconomic and cultural impediments can be seen in relation to the economic and cultural status of the society as a whole. These factors are mutually exclusive and there is always a link between different categories of impediments.

In this case, absence of schemes for benefit sharing in most parks can be taken ahead of others for causing negative repercussions due to minimizing the sense of ownership with the local communities. Furthermore, this lack of benefit sharing schemes has to some extent produced negative attitudes towards natural resources, particularly to wildlife. There are a number of ways through which the local communities around such areas express their feelings towards the natural resource conservation. These include poaching, for instance where Buffalo have not been seen in Alatish National Park for the last two years, and deliberate fire setting for agricultural expansion.

Many of the challenges related to socio-economic and cultural situations arise directly or indirectly from the increase of population size and the prevailing poverty so that the main interest of the local people in biological resources is for survival. This creates its own pressure on various forest and agricultural products and services. Particularly, increase in human population around parks has caused

a significant impact on the biodiversity, due to expansion of cultivation and free range grazing. This has also led to deforestation and land degradation.

On the other hand, there seems to be no balance between resources exploitation, conservation and sustainable utilization that could lead to halting the habitat destruction. Poverty, food insufficiency and insecurity contribute much to habitat loss and fragmentation as a result of deforestation and cultivation. These also apply for the loss of breeding sites for birds, fish, amphibians, snakes and other key stone species. For example, the conversion of the Fogera wetland to paddy rice cultivation has been considered a threat to the Fogera cattle breed and the other wetland flora and fauna in the area. This has greatly increased the negative impacts, particularly on Fogera cattle, by decreasing the availability of fodder. There is evidence of the cattle changing their feeding habitats to less nutritive and less palatable fodder species, as a kind of coping mechanism, while on the other hand there is the loss of native forage species diversity.

Population pressure observed in different parts of the country also impacts negatively on biological diversity through other mechanisms. Improper agricultural practices, for instance, occur under constraints such as the saturation of good agricultural lands under population pressure which leads settlers to cultivate too shallow or steeply sloping lands, plough fallow land before it recovers its fertility, or attempts to obtain multiple crops by irrigating land which is not suitable for irrigation. Resettlement (whether legal or illegal) from highlands to lowlands exerts high pressure on the woodland biodiversity. The resettlement of about 80,000 people from middle altitudes of Amhara region to the lowlands of Armachiho, Dawa, Quara, and Metema can be taken as an example. Resettlement, including refugees in wildlife corridors, has been a common practice in the country.

Firewood and charcoal production and lack of alternative energy sources is continuously posing a challenge to the natural woody vegetation, forests and woodlands, of the country. Expansion of small-scale wood-work enterprises for the youth in the many expanding urban areas of the country severely depletes the indigenous tree species such as *Cordia africana.* This leads to over-cutting of vegetation to obtain timber, fuel-wood and other products at a pace exceeding the rate of natural re-growth.

Genetic erosion due to extensive introduction of genetically uniform and improved varieties has resulted in mono-cropping and has been the major threat to the local crop landraces/farmers' varieties. Market-oriented and cash crop cultivation has ignored farmers' varieties and the traditional as well as changing needs of local communities. Crop species with small populations, taxa or genotypes with restricted distributions have been observed to be most at risk, particularly from the change in socioeconomic and agricultural status of the people.

Social, economic and cultural aspects of the community in most parts of the country have also negatively influenced the aquatic habitat. Over exploitation of fauna and flora from aquatic and wetland ecosystems (fish, papyrus, reeds and other vegetation) which is being observed in most lakes has caused depletion of

these resources. Pollution and/or degradation of feeder rivers, which are important for fish spawning, have been adding to the serious damage of this habitat. In addition, siltation has been occurring largely as a result of degradation of catchments and sand mining in wetlands and lake fringes in many parts of the country.

1.6.4. Policy and Law-related Impediments

Several biodiversity resources are susceptible to encroachment because of the lack of clear ownership. The wetlands, water bodies and some forest areas that are hosting several flora and fauna species are severely degraded. The uncontrolled and over exploitation of fish and wood resources in lakes and fragmented forest and woodland areas respectively demonstrate the lack of clear ownership of the resources.

Because of the lack of clear policy and law on investment, several intact natural forests have been cleared and changed into other land use types. Illegal timber extraction is increasing in the west and south-west of the country from forests with threatened indigenous tree species, such as *Pouteria altissima, P. adolphi-friedericii, Cordia africana, Hagenia abyssinica, Juniperus procera* and *Podocarpus falcatus*. In addition, illegal charcoal production characterizes these areas. In the eastern part of the country, where woodlands are being converted into castor-oil (*Ricinus communis*) and *Jatropha* plantations, tree and shrub species are subject to charcoal production and are illegally exported to the middle-east. This implies that the investment policy is inappropriate and doesn't have provisions for biodiversity conservation. Illegal wildlife trade and export is being carried out in and through border towns. Trafficking of cheetah, lion and elephant puppies via Somalia is among several similar instances of this activity. Conversion of natural forest areas into large scale tea and coffee plantations, mining, excavation, road construction and expansion in environmentally sensitive areas are among factors contributing towards resources degradation., These activities are out-comes of the lack of law enforcement and implementation of laws and regulations.

Though Ethiopia has a land use policy, it lacks a land use plan, which is a pre-requisite for all development activities. The main problem that impedes the achievement of poverty alleviation, food self-sufficiency and food security is the lack of land use planning, which has a direct link with biodiversity resources. Steep slopes being used for crop cultivation and other inappropriate land use types, rather than setting them aside for natural resource conservation areas is also a problem. These agricultural practices aggravate the degradation and genetic erosion of the biodiversity resources. The other gap in policy and law enforcement is illustrated through the illegal trade of the Begayt cattle breed to Sudan and Eritrea. Through this illegal border trade, especially cows with their calves, which are key in maintaining pure breeds, the indigenous cattle gene-pool of the country is becoming degraded.

There are many stakeholders that have an interest on the biodiversity of Ethiopia. For these to be effective, conservation efforts must be integrated and coordinated across many sectors of society. The policies and programs of key Federal Ministries (Agriculture and Rural Development, Finance and Economic Development, Ethiopian Science and Technology) and Regional Bureaus addressing agriculture, livestock, forestry, wildlife, and fisheries among those crucial for the conservation and sustainable utilization of biological diversity. But, partly because of the lack of integration of the existing sectoral and cross-sectoral policies, the anticipated conservation and sustainable use of biological resources has not yet been achieved.

The wetlands of the country are also among the susceptible areas to encroachment for the illegal supply of their resources for human needs. These areas, hosting important flora and fauna resources, are degrading because of several factors. One of the factors is lack of clear direction/policy on wetlands and the existence of policies that promote unwise use of wetlands. Wetlands are not adequately addressed in the National Conservation Strategy.

Investment on the other hand has been expanded, if not all in all, but to a large extent at the expense of biodiversity. It is possible to consider practical cases where biodiversity-inclusive impact assessments had not been put in place to mitigate damage to forests. There have also been clearing of natural vegetation for investment without conducting and implementing environmental impact assessments. The implementation of the bio-fuel initiative has been one of the major threats to biodiversity in Ethiopia where vast natural vegetation areas have been cleared and converted to a monoculture of *Jatropha* in Welayta zone of the SNNPR and of Castor (*Ricinus communis)* in Babille, Oromia region. Inappropriate investments in natural forest, for example, the taking over of 400,000 ha of bamboo land by a foreign company in Benishangul-Gumuz region; the taking over of vast vegetated area for the development of *Vernonia galamensis* by a British company in Oromia region, and several unwise investment activities in the area of the Rift Valley lakes have caused over-exploitation and pollution of lakes and wetlands.

The existing laws are very general and not easy to implement. One of the reasons for the failure to implement the laws is the absence of specific legislations (regulations, guidelines, and directives). Therefore, developing such legislations should be a matter of urgency.

1.6.5. Natural Impediments

The degradation of natural resources in general and deforestation in particular, have resulted in land degradation, soil erosion and ecosystem deterioration. These coupled with other factors have led to exacerbating the impacts of recurrent drought, erratic and insufficient rainfall, leading to desertification, now recognised as the result of climate change (increase in temperature, shortening of rainy season). These in turn affect local crop varieties (crops are being pushed up on the

mountains beyond 2000 masl and pushed up into the short cropping season at the expense of other biodiversity resources.

1.7. Implications of Changes in Biodiversity Status on Human Well-being

The impacts of the major threats described under section 1.6 on biodiversity status are undoubtedly immense. If these threats are not adequately addressed and reversed, the biodiversity of the country will unquestionably deteriorate with huge adverse implications for the environment, in general, and on human well-being, in particular. The livelihoods of the majority of the Ethiopian people directly or indirectly depend on the biological resources of the country. Using the agro-biodiversity alone employs more than 84 per cent of the Ethiopian population. These same people depend on forests and woodlands of the country *inter alia* for fuel energy, construction wood, medicine, (wild) food and other kinds of income generation. If the threats are unabated, ecosystem services such as regulating the hydrological cycle, soil erosion control, carbon sink, environmental amelioration, habitat for varieties of life, clean water and fresh air provision, crop pollination, nutrient recycling, ritual and cultural practices and aesthetic values would be certainly at stake. The end result of these would be the suffering of all the people from hunger, malnutrition and diseases. The relationship of biodiversity and poverty can be like that of an egg and chicken, where one supports the other.

Ethiopia is the sole gene pool for globally important crops such as *Coffee arabica* and *Eragrostis tef*, and a center of diversity for field crops such as barley, sorghum and durum wheat. The loss and degradation of these crops have grave implications not only for Ethiopia, but also for the world at large.

Ethiopia has a tremendous but yet partially untapped tourism potential including religious and historical heritage sites, unique natural beauty and wildlife. The latter two are profoundly dependent on biodiversity, the loss of which could detrimentally affect them.

The importance of biodiversity and ecosystem services are not well-understood by a large number of people at all levels, particularly policy makers in Ethiopia. The focal point institute (IBC) to the CBD should embark on valuation of these precious resources together with the relevant and capable stakeholders in order to enhance understanding and lift biodiversity concerns up in the development agenda.

2. Review of the Implementation of Ethiopia's National Biodiversity Strategy and Action Plan (NBSAP)

2.1. The NBSAP Preparation Process

Ethiopia has taken a number of measures to address the loss of biological diversity, environmental degradation, impact of climate change and the associated problems that arise from their combined effects. Some of the measures taken include the issuance of the Environmental, Biodiversity, Wildlife, Forest and related sectoral and cross-sectoral National Conservation strategies, policies and proclamations.

In addition to the Convention on Biological Diversity (CBD), the country has also ratified various international environmental agreements, which have direct or indirect implications for the sustainable utilization of biodiversity and other components. These include the Convention on Migratory Species (CMS), Convention on International Trade in Endangered Species (CITES), African-Eurasian Water-bird Agreement (AEWA), International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), United Nations Convention to Combat Desertification (UNCCD), and United Nation Framework Convention on Climate Change (UNFCCC). The Ramsar Convention is not yet adopted but the proposal for adoption is finalized and awaiting approval from law-makers.

After the ratification of the CBD, the government of Ethiopia took a commendable measure by promoting the former Plant Genetic Resources Center to the Institute of Biodiversity Conservation and Research (IBCR), at present Institute of Biodiversity Conservation (IBC), with expanded mandates to collect, characterize, conserve and promote sustainable utilization of the biological resources of the country, including animal and microbial genetic resources.

Article 6 of the CBD demands the preparation of National Biodiversity Strategy and Action Plans (NBSAP) by each of the signatory parties. As a party to the Convention, Ethiopia prepared its NBSAP document that was published in 2007. The NBSAP comprises a framework and plan of action for the conservation and sustainable use of the country's biological diversity and the equitable sharing of benefits from its use. The NBSAP project was supported by GEF-UNDP and a nation-wide planning team prepared working documents in 14 thematic areas. Finally, national and international consultants turned the working documents into a strategy and action plans. The document defines the current status of, pressures on, options for, and priority actions to ensure the conservation, sustainable use, and equitable sharing of benefits accrued from the use of the biological diversity of Ethiopia.

The NBSAP serves as a roadmap to enhance the contribution of biodiversity to overall development. It provides the basis for analyses of the status of biodiversity and the environment at large, the root causes of biodiversity loss and the adverse consequences upon social and economic developments. These consequences are presented both in terms of impacts on ecosystems and vulnerability of human populations to droughts, floods, diseases, pests, etc. The NBSAP brings out the multi-dimensional challenges and opportunities that biodiversity conservation provides not only to citizens of Ethiopia but to the world community at large.

Familiarization and distribution of the NBSAP was made at a workshop with stakeholders from federal and national regional states. During the finalization of the document, it was hoped that the NBSAP would inspire all stakeholders in their endeavors for conservation and sustainable utilization of biodiversity. Nonetheless, grass-root level familiarization, training and follow up on whether the stakeholder institutions were using the document as a roadmap were not done by the focal point institute, the IBC.

2.2. Goal and Strategic Objectives of the NBSAP

2.2.1. Goal

The overall goal of the Ethiopia's National Biodiversity Strategy and Action Plan is "Effective systems are established that ensure the conservation and sustainable use of Ethiopia's biodiversity, that provide for the equitable sharing of the costs and benefits arising therefrom, and that contribute to the well-being and security of the nation".

2.2.2. Strategic Objectives

The NBSAP identified four Strategic Priorities:

Representative examples of Ethiopia's remaining ecosystems are conserved through a network of effectively managed protected areas.

By 2020, all remaining natural ecosystems outside of the protected areas to be under sustainable use management.

The costs and benefits on biodiversity conservation are equitably shared through a range of public, private, community and NGO partnerships for Protected Area management and for sustainable use and marketing of biodiversity.

The rich agro-bio diversity of Ethiopia is effectively conserved through a mix of *in situ* and *ex situ* programs.

Twenty three specific objectives were set to achieve the goal and the strategic objectives. The NBSAP identified outcomes, activities, targets and actions as well as indicators for each of the strategic objectives (Table 9).

2.3. Progress towards the Implementation of the NBSAP

The NBSAP outlines a series of policy approaches and strategic plans effective from its date of publication that lead to useful outcomes over 10 to 15 years. The NBSAP is, therefore, a vital strategic document that should guide biodiversity and its ecosystem conservation, sustainable utilization and development. Nonetheless, to date the use made of the document as a guide book to undertake development, research and conservation activities is minimal. IBC, the focal point institution, failed to undertake follow-up work in coordination with the other stakeholders for monitoring the implementation of the NBSAP. However, various institutions at federal, national and regional levels are, in one way or another, engaged in certain biodiversity related projects and activities, which could be translated into the NBSAP.

The progress made in mainstreaming biodiversity can to some extent be attributed to the NBSAP. The NBSAP familiarization workshop has influenced some of the national regional states (particularly Southern Nations, Nationalities and Peoples and Tigray), to take the crucial step of assigning experts to oversee the conservation of biodiversity. Recently the IBC conducted training on the status and strategies and techniques of biodiversity conservation for the experts at zonal and special districts level in SNNPR upon the request of the Regional Bureau of Agriculture and Rural Development. During the present data gathering mission for this report, the experts of the Environment Protection and Land Administration and Land Use Authority of Tigray Region expressed the need for similar training and orientation on the NBSAP.

The overall assessment is that the implementation of the NBSAP has not been formally coordinated. However, it has been used as an important source of information regarding the activities and priorities of certain stakeholders in the sector, ranging from government departments to NGOs. Some priority areas identified in the NBSAP continue to receive attention from various stakeholders.

In some instances, the activities of the NBSAP are being absorbed in an *ad-hoc* manner rather than being a foundation document that guides priority activities and resources allocation. As a result, there is often insufficient budget allocated to activities that fall in the NBSAP. Some of the challenges that may be affecting the effective incorporation of the NBSAP into planning processes are described below:

- There is inadequate communication between the focal point institution and key stakeholders at federal and regional levels, as well as with NGO's, communities and the private sector;
- There is no binding provision or legal obligation for stakeholders to consider the NBSAP in their planning;
- There is no formal system for monitoring and reporting progress on NBSAP implementation, and lack of positive attitude towards sharing

information and data on key indicator species and ecosystem and other biodiversity issues in general; and

- There is no funding mechanism or trust for implementing the NBSAP.

However, generally, there is some positive progress that could fit into certain actions of the NBSAP as highlighted below (Table 9).

2.4. Highlights of Progress on Expansion of Protected Areas

Ethiopia has established several protected areas including 14 National Parks, 4 Sanctuaries and 18 Controlled Hunting areas during the last 40 years. A total area of 213,464 km^2 of the country's land is dedicated to wildlife conservation (EWCA, unpublished data; PADPA, unpublished data).

Five National Parks (Alatish, Denqoro-Chaka, Maze, Chebera-Churchura, Kafta-Sheraro) have been established recently by the National Regional States of Amhara, SNNP and Tigray Regions. Alatish, Denqoro-Chaka, Maze, Chebera-Churchura National Parks are benefiting from better management, especially in terms of law enforcement. The CBD's 2010 Targets stipulates that Ethiopia is expected to leave 12 per cent of its total land area aside to protect various ecosystems that would thereby protect and conserve the declining population of vegetation and wildlife in the country.

Current figures show that a total of 19.05 per cent of the country's land is protected, the majority of which is Controlled Hunting Areas. However, most of these protected areas do not have legal status, and are inadequately protected. Even some of the gazetted parks, such as the Awash National Park, are facing problems that could potentially deteriorate them.

One of the shortcomings of the NBSAP is that it doesn't propose comprehensive targets for the number, distribution, total size, and number of those that should have legal status and proper law enforcement under the expected expansion of protected areas. There are encouraging efforts being made by some Regional Wildlife Authorities and Regional Bureaus of Agriculture to expand the number of local protected areas. The expansion of the boundary of Simen Mountains National Park from 179 km^2 to over 400 km^2 is a notable example of these efforts. Abay Valley National Park is one of the potential candidates expected to be protected in the coming few years in Amhara National Regional State. However, it is difficult to claim that these efforts are the result of the implementation of the NBSAP.

2.5. Some Areas of Consideration during Revising the NBSAP

The threats to biodiversity are the decline of plant and animal species diversity. Some of these species are in the Red List of IUCN's threatened species. The NBSAP has upto now failed to pinpoint mechanisms that could reduce these threats to the identified species and thereby downlist them to improved categories in the IUCN's Red List.

Lack of funding is an fundamental obstacle in implementing the actions recommended in the NBSAP.

The prime goals indicated in the PASDEP are for the Ethiopian government to achieve food sufficiency and poverty alleviation. It is important that these goals are achieved in a sustainable way and without undue pressure on the environment and biodiversity. This requires adequate funding for organizations involved in the conservation and sustainable utilization of biodiversity and the maintenance of the environment. These organizations are the IBC, EWCA, EPA, MoARD, universities, EIAR and Bureaus working on biodiversity conservation in regional states.

Because biodiversity conservation is an international agenda and the impacts of investment on biodiversity are long-term, the Ethiopian government could find it difficult to bear all the necessary costs. Therefore soliciting external funding is an area that deserves due consideration. Ethiopian institutions working on biodiversity conservation have not been able to obtain adequate funds from external sources. Despite the rich biodiversity in the country and the alarming threats they are currently facing, Ethiopia is one of the least beneficiaries from donors such as GEF and other funding sources.

Empowering the capacity of institutions on developing saleable project proposals and concept papers is mandatory. In addition soliciting funds should be one of the main issues that should be considered in the revision of the NBSAP.

The expansion of universities and the inclusion of biodiversity related courses especially at post graduate level and the addressing of thematic areas related to biodiversity in graduate research are expected to improve the data collection. This will also increase the availability of information on indicators of changes in ecosystems and knowledge about the biodiversity resources in the country. However, experience until now shows that most of the graduate research outcomes are not being communicated effectively and not being optimally used. Therefore, designing ways of improved communication and easy access to the information and research findings should be put explicitly.

Valuation of the biodiversity resources would help in making policy decisions about biodiversity conservation and the sustainable use of the resources. The NBSAP should include ways in which adequate information can be generated through valuation.

The IBC has collected over 60,000 accessions of farmers' varieties (landraces), seeds of horticultural crops and tree species. The NBSAP lacks clear directions on the range of genetic resouces, number of farmers' varieties, and species that are required to be collected and characterized during the IBC's life span.

The establishment of a duplicate genebank is of paramount importance for conserving the germplasm collected over the years. This would serve as a guarantee in case of unexpected disaster to the existing gene-bank. However, actions for establishing a duplicate gene-bank have not been accommodated in the NBSAP. Therefore, this provision should be incorporated in the forthcoming NBSAP.

The task of conserving and sustainable utilization of the vast biodiversity needs to be carried out through integrated action by the various stakeholders, rather than by a single institution. Revision of the NBSAP should address the issue of mapping and integrating all stakeholders.

Biodiversity conservation needs the commitment and involvement of all stakeholders. Conservation of priority biodiversity within a specific ecosystem or in different ecosystems requires high-level vision, strategy and action plans. Coordinating such tasks requires the full support of all government sectoral ministries, federal government institutions, regional administrations, bureaus, departments, district offices, NGOs, CBOs, the private sector, international funding institutions (particularly GEF), and government and non-government co-financers. This is important to adhere to an ecosystem approach recommended by the CBD. The CBD defines the ecosystem approach as:

> "a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Application of the ecosystem approach will help to reach a balance of the three objectives of the Convention: conservation; sustainable use; and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources".

The NBSAP hasn't included the application of the ecosystem approach through multi-stakeholder integration, as a tool for the implementation of all the priority actions listed to meet the strategy and its objectives. Therefore such an important issue of structuring and integrating stakeholders should be considered in the future revision of the NBSAP.

Table 9: NBSAP specific objectives, actions, performance indicators and implementation status.

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
Protected Areas (PA) Conservation 1. Objective: A reclassification plan is completed for development of a PA network that contains viable, representative examples of the full range of remaining ecosystems.	1.1. Prepare an updated forest/ecosystem cover map of Ethiopia including inland water ecosystem that identified and delineates all remaining non-agricultural areas.	1-2	Forest/ecosystem cover map published	**EWCO, EWDCD**, IBC, EPA, **MoARD**, EMA, Regions, EARO	Forest/ecosystem cover map not published
	1.2. Conduct a gap analysis by digitally super-imposing the best ecosystem map with a map of all PAs & reserves and the new forest cover type map — to identify gaps in PA coverage.	2	Gap analysis published	**EWCO, EWDCD**, IBC, EPA, **MoARD**, EMA, **Regions**, EARO	Gap analysis not identified
	1.3. Identify candidate areas for declassification, classification and reclassification and conduct field verification and biodiversity surveys and obtain local stakeholder inputs. Include special emphasis on conservation of wild relatives of agricultural crops.	2-3	List of candidate sites	**EWCO, EWDCD**, IBC, EPA, **MoARD**, EMA, **Regions**, EARO	Candidate sites not identified
			Reports on field verification, biodiversity surveys and stakeholder meetings	**IBC, EWCO**, EWDCD, EPA, **MoARD**, Regions, EARO, CBO	Biodiversity surveys and stakeholder meetings have not been undertaken

Sector / Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
	1.4. Finalize a reclassification plan that identifies the most suitable status and form of management for all remaining natural areas — all areas should be targeted for either a specified category of PA or for some form of sustainable use/management area.	3	Reclassification Plan published	**IBC, EWCO**, EWDCD, EPA, MoARD, Regions, EARO, CBO	The Plan has not been done
2. Objective: Effective management of the modified PA network is achieved through public / private/ NGO/ CBO partnerships and ensure equitable sharing of costs and benefits.	2.1. Conduct a national, regional and a desk study review of lessons learned and best practices for effective PA management with an emphasis on innovative forms of public, private, NGO, CBO management partnerships.	1	Review/lessons learned and best practices published	**EWCO**, EWDCD, IBC, EPA, MoARD, ESTC, Regions, EARO, CBO	Partially accomplished (e.g. Simen Mountains National Park)
	2.2. Develop a 10 year PA Network Management Plan implementing the Reclassification Plan and for bringing the PA under effective management through innovative partnerships (identify need for policy and legislative reform).	1-3	10-yr PA Network Management Plan published	**EWCO**, EWDCD, ETC, EPA, IBC, MoARD, MoFED	Network Management Plan not prepared
	2.3. Develop new management partnerships, test them in the field and improve them through the use of M&E systems developed for use in adaptive management approaches.	2-5	Document on M&E strategy, guidelines and partnerships established	**EWCO**, EWDCD, ETC, EPA, IBC, MoFED, MoARD, NGO, CBO	Not accomplished

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
			Document describing M&E system	**EWCO**, EWDCD, ETC, EPA, IBC, MoARD, NGO, CBO	Document not prepared
			M&E periodic reports	**EWCO**, EWDCD, ETC, EPA, IBC, MoARD, NGO, CBO	Periodic report on M&E not prepared
	2.4. Conduct capacity building program for PA management partners	2-3 & 6-7	Capacity building plan	**HLI**, Universities, MoCB, MoE, EWCO, IBC, EPA, MoARD	Plan not prepared
			Reports on training conducted	**HLI**, Universities, MoE, EWCO, IBC, EPA, MoARD	Training not conducted
			Assessment of training effectiveness	MoCB	Not accomplished

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
	2.5. Revisit existing trans-boundary wildlife agreements (Eritrea/Sudan) for the establishment of Peace Parks for wildlife protection, managing invasive alien species and benefit sharing.	3-7	One new trans-boundary Peace Park established	**EWCO**, EWDCD, EPA, IBC, ETC, Regions	Partial progress on establishment of new PA
	2.6. Conduct a major five year review of the effectiveness of PA management and revise the PA Network Management Plan including control of invasive alien species.	5	Five year review published	**EWCO**, EWDCD, ETC, EPA, IBC, MoARD, NGO, CBO	Not accomplished
	2.7. Complete the establishment of effective PA management partnerships! systems for the entire PA network including mountain biodiversity	5-10	Annual M&E reports	**EWCO**, EWDCD, ETC, EPA, IBC, MoARD, NGO, CBO	Partnership not established
			10-yr review report	**EWCO**, EWDCD, ETC, EPA, IBC, MoARD, NGO, CBO	Review report not accomplished

Sector / Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
Sustainable Use 3. Objective: Effective, integrated sustainable use natural resource management systems are developed at pilot sites using innovative public / CBO / private / NGO partnerships in accordance with the Reclassification Plan.	3.1 Conduct a national, regional and a desk study review of lessons learned and best practices for the sustainable use/ management of natural forests, ranges, wildlife (including birds) and fisheries in ecosystems similar to Ethiopia's and with an emphasis on innovative forms of public / CBO / private / NGO management partnerships.	1	Review published	**IBC**, EWCO, EWDCD, Universities, EARO, Regions	Not accomplished
	3.2 Mobilize funding, resources, project design, development and implementation for a set of pilot projects to develop sustainable management systems for both intact and degraded natural ecosystems outside of PA in accordance with the Reclassification Plan. Build upon indigenous knowledge and traditional systems	2-5	Project design documents approved and funded	**IBC**, EWCO, EWDCD, Universities, EARO, NGO, CBO, Private sector, Regions	Few Project proposals prepared, but not funded
	3.3 Develop M&E systems for resource managers and for government oversight for monitoring the ecological, social (equitable sharing of costs and benefits) and economic aspects and use results in the development of adaptive management approaches.	2-4	M&E manual	**IBC**, EWCO, EWDCD, Universities, EARO, NGO,CBO, Private sector, Regions	Manual not prepared

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
	3.4 Develop natural resource-based enterprises that maximize revenues and incentives for community and private sector natural resources (NR) partners.	2-5	M&E reports	**IBC**, EWCO, EWDCD, Universities, EARO, NGO, CBO, Private sector, Regions	Reports not prepared
	3.5 Develop sustainable funding mechanisms for natural resource management (NRM) whereby part of the revenues are reinvested in the management costs	2-5	M&E system reports detail enterprises developed, revenue generated, people employed, etc.	**EPA**, MoFED, IBC, NGO, CBO, Private sector, Regions	Enterprises not developed
	3.6 Strengthen mechanism for sectoral co-ordination and collaboration in development of integrated NRM	2-5	Account books of CBO/ Private sector/ NGO management partners	**EPA**, MoFED, IBC, NGO, CBO, Private sector, Regions	Not accomplished
			M&E system documents roles and support from the sectoral agencies	**EPA**, MoFED, IBC,NGO, CBO, Private sector, Regions, MoARD, Parliament	M&E system documents not prepared

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
4. Objective: Sustainable management systems are replicated, adapted and applied to all remaining natural areas outside of PA.	4.1 Conduct a major review of the sustainable use and management systems/ trials/ pilot projects and develop a 10 year strategy for bringing all remaining natural resources	5	Five year. review published	**IBC**, EPA, MoARD, Regions	Strategy not prepared
	4.2 Undertake a major training program to build the capacity of government (mostly regional to district), NGO, CBO and private institutions to assist new communities to build their own capacities for adapting the sustainable NRM systems developed under Objective 3.	5- 7 & 10 - 11	Training reports. Assessment of training effectiveness	MoCB	Training was given to selected communities in SNNPR, but this was not done as part of this action and effectiveness was not assessed by MOCB
	4.3 Mobilize resources to replicate and adapt the sustainable management systems to all remaining natural areas outside the PA and complete this program by yr 15	5-15	Project design documents and funding approved	**MoARD**, MoFED, Parliament, Regions	No project was designed on replication of sustainable management system
			Annual Project reports	**MoARD**, EPA	Not accomplished

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
Policy 5. Objective: Appropriate policies and plans are adopted that promote the conservation and sustainable use of biodiversity and integrate biodiversity conservation measures into sectoral plans and programs	5.1. Adopt NBSAP	1-3	NBSAP document and contents known and understood by planners in all sectors of the economy	**IBC**, MoARD, MoFED	Familiarized to stakeholders but not to planners
	5.2. Integrate biodiversity conservation into Agricultural, Wildlife and Forestry policies at National and Regional levels	1-5	Draft agricultural, forestry, and wildlife policies approved	**MoARD**, IBC, EARO	Wildlife Regulation developed and approved; Forest policy approved
	5.3. Formulate and approve land use policy	1-5	Nation-wide land use policy formulated and approved	**MoARD**, Regions	There is Land Use Policy, but Land Use Planning has not been formulated.
	5.4. Promote co-ordination between institutions (e.g. workshops, seminars, etc.)	1-3	Efforts made to institutionalize the NBSAP at all levels; workshops held; capacity built.	**IBC**, EPA, REPA, MoARD	Insignificant effort was made to institutionalize NBSAP
	5.5. Revisit CSE/RCSs to strengthen the biodiversity component	1-5	Program to revisit CSE/RCSs set in motion; workshops held	**IBC**, EPA, REPA, MoARD	No workshop was held

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
Legislation 6. Objective: An effective legal framework for the implementation of the CBD, related conventions, and national policies are developed.	6.1 Review all relevant existing legislation in Ethiopia against the obligations under the CBD, related conventions and national concerns	1-5	Existing relevant legislation reviewed to address both national concerns and international obligations	**EPA**, IBC	Reviewing of legislation in relation to the CBD was not made.
	6.2 Ensure that the relevant draft laws currently under review embody conservation measures including those suggested for adoption by the CBD and other related conventions	1-5	Draft laws (Federal/Regional) under preparation to effectively address biodiversity concerns.	**IBC**, EPA, MoARD, Parliament	No draft laws prepared
	6.3 Ensure, as far as possible, that reforms in the forestry sector are integrated with reforms in the wildlife sector and the new forestry laws are also framed fully within the context of the CBD and other International Conventions such as CITIES	1-5	Integrate laws/programs that impact on biodiversity	**IBC**, MoARD	Not accomplished

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
	6.4 Develop access and benefit sharing legislation as a matter of priority to comply, among other concerns, with Article 15 (genetic resources), Article 16 (technology) and Article 19 (handling of biotechnology and distribution of benefits)	3-7	Biodiversity access legislation enacted	**IBC**, EPA	ABC legislation is developed, but it is being rather toothless and the benefits obtained so far is almost nill
	6.5 Develop guidelines/regulatory measures with regard to biosafety relating to the development use, transport and import of genetically modified organisms (GMOs)	3-7	Regulation/guidelines that address management of GMOs formulated	**EPA**, ESTC, IBC	Biosafety proclamation is formulated and recently approved
	6.6 Legislate benefit sharing incentives	3-7	Regulations that guide benefit sharing enacted	**EPA**, ESTC, IBC, MoARD, Regions	No regulation guiding benefit sharing enacted
7. Objective: Enforcement of biodiversity-related laws enhanced	7.1. Enhance capacity for law enforcement related to conservation	1-3	Training programs for law enforcement officers put in place; and trainings effected	**IBC**, Customs, EPA, MoARD	Training on concepts of biodiversity and genetic material transfer was given to law enforcement officers

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
	7.2. Promote enabling environment for civil society to challenge government in conservation related issues	3-5	NGO/CBO advocacy activities for upholding conservation laws impact on biodiversity	**IBC**, NGOs, CBOs, MoJ, MoCB, Universities	Few NGOs are actively undertaking advocacy works
	7.3. Comply with International Conventions related to biodiversity management	1-5	Guidelines/regulations providing for fulfillment of international agreements put in place	**EPA**, IBC, EARO	Not accomplished
Identification and Monitoring 8. Objective: Information base on the biodiversity of Ethiopia expanded and improved	8.1. Strengthen the capacity of the existing National Herbarium and the Natural History Museum (Addis Ababa University) (flora and fauna)	1-5	The National Herbarium and the Natural History Museum at Addis Ababa University strengthen both in manpower and infrastructure	**AAU**, IBC, EARO, MoARD	There was initiation of strengthening the National Herbarium and National Museum of AAU. But this has slacked due to shortage of funds.

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
	8.2. Promote the establishment of herbaria and zoological museums in all universities and relevant institutions	1-7	Nuclei for the establishment of herbaria and zoological museums in at least two universities (in addition to AAU) be established	**IBC**, MoE, Regional universities	No promotion and initiation made
	8.3. Promote the establishment of microbial and aquatic culture collections	1-7	Enrich the microbial and aquatic culture collections; capacity built for the same	**IBC**, EARO, AAU, AHRI	Few attempts made but given the huge diversity and daunting task very little progress has been made.
	8.4. Strengthen the existing computerized database at IBC and other institutions	3-5	Capacity of the establishment in human resources, staff training and computers doubled	**IBC**, HLI, Regions	Staff obtained short-term training abroad at different times and number of computers is doubled

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
	8.5. Identify national/regional conservation priorities	3-7	National 'hot spots', threatened ecosystems and species identified	**IBC**, EPA, MoARD, CSA, Regional Institutions	Threatened ecosystems and species identified in some regions but not at national level.
	8.6. Create National Red List of threatened species (flora and fauna)	1-5	National Red Data listing of threatened species produced	**IBC**, AAU, MoARD, National and International (IUCN) NGOs	This has not been produced.
	8.7. Enhance and/or strengthen existing information sharing mechanism	2-7	Workshops, special training provided	IBC	Workshops on information sharing mechanism were held
	8.8. Establish mechanisms for sharing biodiversity information, including relevant traditional knowledge	2-7	Regular distribution of information on biodiversity (bulletins, newsletters, etc), including information on relevant traditional knowledge	**IBC**, MoARD	The information sharing on biodiversity has been improved especially on electronic alerts and web pages. Some effort has also been made on production of leaflets and brochure, etc

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
	8.9. Promote taxonomic activities including integrating taxonomic capacity building activities into thematic and cross-cutting programs	1-5	Workshops/training programs for taxonomic capacity held; tertiary education in taxonomy strengthened	**IBC**, AAU, MoARD, Universities	Not accomplished
9. Objective: Develop and institutionalize systems to monitor key elements of biodiversity	9.1. Develop and institutionalize resource monitoring	2-7	Biological resource monitoring institutionalized	**IBC**, MoRAD, EPA	Not accomplished
	9.2. Develop capacity to regularly monitor the state of Ethiopia's environment	2-7	Regular production of 'State of the Environment Report' institutionalized	**EPA**, REPA	So far two Environmental reports have been produced. Lack of capacity at lower level is limiting annual publication of the report
Ex-situ Conservation 10. Objective: Contribution of ex-	10.1. Develop national legislation and guidelines on *ex-situ* conservation	3-5	Guidelines on *ex-situ* conservation developed and laws enacted	**IBC**, EARO, EPA, Parliament, Regions	Draft guidelines have been developed but not finalized and published

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
situ biodiversity conservation programs strengthened.	10.2. Compile directory of conservation initiatives	1-5	Directory of institutions/ organizations engaged in biodiversity conservation compiled. Copies made available to relevant institutions	**IBC**, Regions	Not accomplished
	10.3. Identify and prioritize *ex-situ* conservation measures	3-7	Information on Ethiopia's genetic resources compiled and the information made available to appropriate bodies and institutions	**IBC**, EARO, Regions	Information on crop, forest and animal genetic resources have been compiled but except the animal resources information the others have not been made available
	10.4. Strengthen capacity and scope	3-7	Available fund for *ex-situ* conservation at least doubled	**IBC**, Regions	Has not been realized

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
	10.5. Establish microbial and aquatic resources culture collections	3-7	Enrich existing microbial and aquatic culture collections	**IBC**, EARO, Universities, EPA, Regions	This has been done to some level by IBC
	10.6. Promote integration among institutions	3-5	Regular meetings/ consultations carried out	**IBC**, EARO, EPA	One of the serious shortcomings of the implementers of the NBSAP
Incentive Measures 11. Objective: An integrated system of incentives and disincentives is created at the national, regional and local levels to encourage the conservation and sustainable use of biodiversity	11.1. Legislation and guidelines to introduce a system of direct and indirect incentives to promote the conservation and sustainable use of biodiversity	3-10	Direct and indirect incentives identified and publicized	**IBC**, MoARD, Regions, MoFED	Not accomplished
	11.2. Legislation and guidelines to introduce a system of disincentives to discourage unsustainable utilization and practices which deplete biodiversity	3-10	Disincentives identified and publicized	**IBC**, MoARD, MoFED, Regions	no identification work on incentives and disincentives

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
12. Objective: Identify "Perverse" incentives and minimize their impacts on biodiversity	12.1. Carry out a comprehensive review of GoE programs and policies, identify "perverse" incentives, suggest measures to ameliorate their impacts and use rights and benefit sharing systems	3-7	All relevant policies and amended	**IBC**, MoARD	The impacts of "perverse" incentives on biodiversity are increasing from time to time. But the effort to minimize their impacts is very weak.
Capacity building in research and training 13. Objective: Research	13.1 Program to strengthen current biodiversity research on conservation biology, ethno-biology, etc.	3-10	Special funds established	**IBC**, MoFED	No Biodiversity Fund established
	13.2 Identify gaps and priorities for research	3-5	Workshops organized to identify gaps	**IBC**, MoARD, MoE	Not accomplished
	13.3 Establish legally binding regulations on biodiversity research	3-7	All important research undertakings in biodiversity regulated	**IBC**, MoARD, Regions	Not accomplished

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
strengthened on the conservation and sustainable use of biodiversity, particularly on indigenous species under threat.	13.4 Conduct participatory research in order to establish the knowledge base on biodiversity	3-10	Results of research undertaken in a participatory manner by local communities of which outputs and participation of local communities (farming and/or pastoral) are documented and published	**IBC**, EARO, MoARD, Regions	Inventory of medicinal plants in some parts of the country was done and posters were prepared and draft of the report has been prepared
14. Objective: Human and infrastructure capacity in biodiversity conservation and management	14.1. Assess biodiversity related training needs	1-3	Biodiversity training needs assessed	**IBC**, MoARD, Universities, Regions	Strategic Plan and Management of IBC has identified training needs of the same
	14.2. Design opportunities for international linkages	2-5	Workshop/training programs carried out	**IBC**, MoARD, MoE	Not accomplished

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
	14.3. Strengthen existing degree (BA) programs in biodiversity and conservation biology	2-7	At least one program in each of the country's universities strengthened to address biodiversity concerns	**AAU**, AUA, IBC, MoE	Many universities have started including biodiversity issues in their curricula
	14.4. Create diploma course for PA Managers	3-7	Diploma programs established	**MoE**, IBC, Universities	Not accomplished
	14.5. Promote postgraduate programs	3-7	'Twinning arrangements' with universities abroad for the purpose established	**AAU**, AUA, IBC, MoE, IBC, EPA, NGO'S	Being exercised by few universities
	14.6. Initiate training programs with NGOs	3-7	Joint training programs with 'umbrella NGOs' established	**MoE**, IBC, Regions, Universities	Gender mainstreaming in biodiversity conservation training workshop
	14.7. Integrate biodiversity concerns in training curricula of rural development and extension staff, particularly in the field of agriculture, forestry and fisheries	3-10	Biodiversity concerns addressed in curricula	**MoE**, IBC, MoARD, Regions, Universities	Partially accomplished

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
	14.8. Identify the needs required in infrastructure development	2-5	Identify the needs required in infrastructure development including Laboratory, software, hardware, and equipment needs in centers of excellence on various biological resources identified.	**IBC**, MoARD, EARO, EPA, HLI, Regions	There are attempts but not exhaustive and organized
Public education and awareness 15. Objective: A comprehensive strategy for public education and awareness developed.	15.1. Develop public education awareness strategy	1-5	Workshops held public media utilized	**IBC**, MoE, Mol, MoARD	Though strategy is not developed awareness raising workshops were conducted & a few colleges and universities revised curricula
16. Objective: Awareness	16.1. Develop enhance the status of biodiversity in curricula (all levels)	3-7	School curricula revised	**MoE**, IBC, Regions	Not accomplished

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
increased, using the formal education system, about the need for biodiversity conservation.	16.2. Develop relevant course material	3-10	A method system of gradual introduction of specific local concerns in school programs	**MoE**, IBC, Regions	Not accomplished
	16.3. Promote/Encourage partnerships in curricula development	3-7	Regional level consultations in local curriculum development carried out on pilot basis in at least 10% of the county's woredas	**MoE**, IBC, Regions	accomplished at some scale
	16.4. Develop interpretative facilities	3-7	Interpretative facilities established in all PAs	**MoE**, IBC, Regions, MoARD	Not accomplished
17. Objective: Use informal channels to increase awareness about biodiversity and the need for its conservation.	17.1. Promote informal and adult education programs including traditional channels and focused campaigns	3-10	Radio programs, public discussions, pamphlets/ brochures produced and distributed	**MoE**, MoI, IBC, MoARD, Regions	Environmental clubs have been established in various schools

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
	17.2. Document local knowledge	3-10	Local knowledge documentation institutionalized and documents produced by each Regional State	**IBC**, MoARD, Regions	Not accomplished
	17.3. Encourage growth of membership groups in biodiversity conservation	3-10	Associations and other membership groups established in each Regional state	**IBC**, MoARD, Regions	Not accomplished
	17.4 Develop locally relevant resource materials including field guides	3-10	Field guides for common plants and animal groups produced and widely distributed and used	**MoE**, IBC, Regions	Not accomplished
Environmental Impact Assessment 18. Objective: EIA	18.1. Finalize rules and guidelines for IEE/EIA under the draft act	1-3	Rules and regulations finalized.	**EPA**, REPA, MoARD	Rules & regulations finalized

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
procedures for projects, programs, and policies institutionalized and strengthened	18.2. Strengthen capacity of EPA staff to evaluate EIA	1-5	Training of personnel, both at Federal and Regional levels carried out	**EPA**, REPA, MoARD	EIA training offered for regional and federal EPA staff
	18.3. Encourage effective public participation in EIA process	1-5	The public advantage of the EIA process/outcome well publicized	**EPA**, REPA, MoARD	Not accomplished
	18.4. Expand the Standard Environmental Assessment (SEA) concept	1-5	Same as above	**EPA**, REPA, MoARD	Not accomplished
	18.5. Review National Environmental Quality Systems (NEQS) for specific ecosystems	3-10	NEQS for threatened ecosystems reviewed.	**EPA**, REPA, MoARD	Not accomplished
Access Issues 19. Objective: Policies and laws to regulate access to genetic resources developed and equitable sharing of benefits between	19.1. Collect baseline data on current practices of access of genetic resources	3-5	Base-line data collected	**IBC**, MoARD, EARO	Not accomplished
	19.2. Prepare existing legal/institutional profile	3-5	Existing institutional/legal profile compiled	**IBC**, MoARD, EARO	Not accomplished
	19.3. Develop action plan	3-7	Action plan prepared	**IBC**, MoARD, Regions	Not accomplished

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
resource owners and users promoted.	19.4. Develop legislation to support national policy based on a regional approach	3-7	Legislation put in place	**IBC**, MoARD, Regions	An access and benefit sharing legislation is put in place
Exchange of information 20. Objective: Information management systems on the biodiversity of Ethiopia: Clearing House Mechanism strengthened	20.1. Strengthen the national clearing house on biodiversity information	3-7	Strengthen the capacity of the national clearing house at IBC both in infrastructure and human resource	**IBC**, EPA, MoARD	The capacity of national clearing house mechanism is strengthened, at least in human resource.
	20.2. Exchange information with outside institutions and communities	3-7	Information exchange mechanism devised and used	**IBC**, EPA, MoARD	Information is shared with selected outside communities
	20.3. Enhance institutional capacity to manage information	3-7	Workshops/training programs managed	**IBC**, EPA, MoARD, ESTC, CSA	Trainings were given to some staff working on information management

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
Financial resources 21. Objective: National funding mechanisms developed for support of priority biodiversity conservation and management programs.	21.1. Reassess national spending priorities vis-à-vis biodiversity conservation	1-3	The contribution of conservation to well being of the nation is assessed and national budget reviewed to address biodiversity management	**MoARD**, MoFED, IBC	Not accomplished
	21.2. Assign budget to address NBSAP priorities	3-5	Budget use prioritized	MoARD, MoFED, **IBC**	No budget assignment for NBSAP priorities
	21.3. Establish task force to generate funding	3-5	Taskforce established and made operational	MoARD, MoFED, **IBC**, EPA	No task force established to generate funding
22. Objective: Increased bi-lateral and multi-lateral funding mobilized for biodiversity programs.	22.1. Establish group of aid agencies/donors for biodiversity conservation in Ethiopia	3-7	Interest in Ethiopia's Biodiversity inculcated among international donors and visible actions taken by the same	**IBC**, EPA, MoARD, MoFED	Not established

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
	22.2. Co-ordinate donor interest/ activities to maximize conservation efforts	3-7	Same as above	**IBC**, EPA, MoARD, MoFED	Not accomplished
	22.3. Strengthen capacity to develop GEF proposals	1-5	Training/workshops in proposal writing given to IBC/EPA personnel	**EPA**, IBC, MoARD,	Very little attempts made, impact is very small
	22.4. Strengthen Ethiopia's "voice" CBD-COP	1-5	GEF requirements understood/ appreciated by planning	MoFED, **EPA**, IBC, MoARD	Accomplished to some extent
Biotechnology Capacity and Technology Transfer	23.1. Establish/strengthen public agencies to address intellectual property concern within a framework of national legislation and use them as a basis for international negotiations	3-7	Institution strengthened to address intellectual property rights	**ESTC**, IBC, EARO, MoARD, EPA	Some of the institutions have strengthened their capacity in addressing IPR
23. Objective, Biotechnology capacity built and biotechnology transfer enhanced	23.2. Legislate /Institutionalize biodiversity prospecting and biotechnology development	3-5	One department established at IBC Law enacted	**ESTC**, IBC, EARO, MoARD, EPA	Department established but poorly staffed, and law not enacted

Sector/Specific Objective	*Actions*	*Time Frame (yrs)*	*Performance Indicators*	*Indication of institutions (Lead institutions in bold)*	*Implementation Status*
	23.3. Build biotechnological capability/capacity primarily through national/ regional/international Cupertino	3-7	Agreements entered into and put in action	**ESTC**, IBC, EARO, MoARD, EPA, Regions	A Biotechnology Center has been established by EIAR (EARO), but collaboration not started yet.
	23.4. Establish legal and institutional regimes to exert and enforce sovereignty over biodiversity resources to leverage technology transfer	3-7	Biodiversity and biotechnology needs linked to technology transfer	**IBC**, EARO, ESTC, MoARD, Regions	Ongoing restructuring at IBC

3. Sectoral and Cross-sectoral Integration (Mainstreaming) of Biodiversity

3.1. Purpose

This chapter is aimed at addressing biodiversity conservation and its sustainable use, based on plans, programs, policies, activities and achievements of the relevant sectoral and cross-sectoral institutions in Ethiopia. It describes the processes and measures taken by stakeholders at different levels to implement biodiversity conservation and the sustainable use of biodiversity. The relationship of biodiversity conservation and its sustainable use with other international agreements and conventions is also explained in this chapter. The contribution of biodiversity in ecosystem services, products, wellbeing of the communities and national economic development is addressed. The extent to which biodiversity-inclusive Environmental Impact Assessment (EIA) is being used as a tool to monitor and minimize the negative impacts of development projects on biodiversity is shown.

3.2. Sectoral and Cross-sectoral Strategies, Programs and Related Conventions

3.2.1. Sectors Related to Biodiversity Issues

In addition to the sectors that directly deal with biodiversity and environmental issues, there are many others that are supposed to do this. However these sectors have failed to integrate biodiversity considerations into their strategies and programs. These sectors include health, mining, investment, tourism, trade and industry. Although these sectors are considered to be key stakeholders and actors in mainstreaming biodiversity issues, their achievements have been inadequate.

On the other hand some of the research and educational institutions are striving to accommodate biodiversity issues in their programs. In the higher learning institutions, biodiversity related aspects are being addressed through designing full courses or incorporating the issue as chapter(s) of courses. For instance, in Bahir Dar University, courses on fisheries, wetlands and wildlife are being offered to students at postgraduate level. Mekelle University has designed courses on crop diversity conservation that incorporate the introduction of international conventions and treaties like the Convention on Biological Diversity (CBD). A course on plant ecology with a chapter dealing with biodiversity, and forestry that is being provided in Mekelle University is an expression of the importance being given to biodiversity issues by this University.

Addis Ababa University (AAU) offers graduate courses on biodiversity management, conservation, and other subjects for botany, drylands biodiversity and zoology. The courses in AAU include streams on mammology, biogeography, ichthiology, invertebrate zoology, systematics, principles of taxonomy, animal ecology, food webs, limnology, and plant propagation. There had been a prgoram on drylands biodiversity since 1997. However, the program ceased to be provided after December 2007 following the termination of support from SIDA/SAREC for the Research Program on Sustainable Use of Dryland Biodiversity (RPSUD) program coordinated from Nairobi.

Hawassa University offers graduate courses on wildlife genetic resources and rangeland biodiversity. The rangeland biodiversity course has been adopted by Bale-Robe/Meda-Wolabu University. There is a plan to establish a graduate program dealing with biodiversity conservation in Wondo Genet College of Forestry and Natural Resources (WGCFNR).

In addition to the inclusion in the academic curricula, some graduate research studies are focusing on aspects of biodiversity, such as studies on invasive species, characterization of genetic resources, assessment and identification of the biodiversity and use of farmers' varieties in crop improvement. Review and use of information generated from graduate research work is important because it can serve as a source of basic knowledge on the biodiversity of the country. A shortcoming of these graduate studies is that the students do not usually give feedback to the institutions (parks, development organizations, communities) that have hosted or are the subject of their research work. To overcome this, higher learning institutions need to work towards communicating the findings from their graduate research programs to stakeholders.

Some universities are involved in research on the maintenance of farmers' varieties. The maintenance of over 3000 accessions of sorghum farmers' varieties and the establishment of a small nucleus herd of Ogaden cattle by Haramaya University are indicators of efforts being made in the higher learning educational sector to address biodiversity conservation. Research staff of Mekelle University and Hawassa University also collect and characterize farmers' varieties of various crops in their respective regions.

At primary and secondary school levels there are efforts to incorporate environment / biodiversity conservation concepts in the educational curricula and in the activities of nature and environmental clubs.

However, with the exception of Tigray Region and SNNPR, biodiversity mainstreaming in sectoral government organizations is lacking in the other regions. This has contributed to inadequate consideration of the issues in the structural set up, overall strategy and action plans of the sectors in these Regions.

The IBC has prepared several publications, workshops, seminars and trainings aimed at raising awareness about biodiversity conservation. An awareness raising workshop on biodiversity conservation and sustainable use was organized for the House of Peoples Representatives and members of the Rural

Development Standing Committee of the Parliament. Specific trainings on forest genetic resources conservation and sustainable utilization were also provided to higher officials in key political decision-making positions, TVET colleges, Wondo Genet Forest Resource College students, a number of high schools, District (Woreda) Agricultural and Rural Development Office experts, technicians and development agents and rural communities living within the vicinity of *in-situ* and *ex-situ* conservation sites. Local communities residing in the surrounding rural areas of the *ex-situ* conservation sites of Gareno-Gorotta, Lepis, Debre Tabor and Mandura participated in such awareness raising workshop. Representatives from the Agriculture and Rural Development Office, Regional Administration, Police and Legislative bodies of the Districts also attended the workshop.

3.2.2. Other Strategies and Programs Integrating Biodiversity

The government of Ethiopia has issued proclamations on:

- Access to Genetic Resources and Community Knowledge, and Community Rights (Proclamation No. 482/2006) and;
- Plant Breeders' Right (Proclamation No. 481/2006).

These are highly relevant to the conservation and sustainable utilization of biodiversity. The Ministry of Agriculture and Rural Development (MoARD) is one of the governmental organizations whose national strategies and programs need to integrate biodiversity. The needs assessment for the Millennium Development Goals (MDGs) (MoARD, 2005) and programs such as the Plan for Accelerated and Sustainable Development to Eradicate Poverty (PASDEP) have incorporated biodiversity within the cross-sectoral environmental focus. Through the millennium tree planting scheme, some 1.6 billion seedlings were planted within 2 years and 76 per cent of these have survived. As a result large areas of land have been rehabilitated. The rehabilitation work is very important to balance the forest clearing for plantations of tea, coffee and bio-fuel crops and other agricultural activities. In addition, MoARD plans to scale-up Participatory Forest Management (PFM) in 4 administrative regions: Afar, Somali, Benshangul-Gumuz and Gambella. Although adequate enforcing mechanisms are lacking, the environmental policy developed by EPA includes EIA for all investments.

3.2.3. Other Biodiversity Related Conventions

The majority of stakeholders are not aware of the various conventions that are related to CBD. Even when the knowledge and aware is there, strategies and plans relating biodiversity conservation with the conventions is minimal. The Environmental Protection Authority (EPA) is the focal point of the country for the United Nations Convention to Combat Desertification (UNCCD), while the National Metereological Agency (NMA) is the focal point for the United Nations Framework Convention for Climate Change (UNFCCC) (EPA, 2008).

The NMA has developed a "Climate Change National Adaptation Program of Action (NAPA) for Ethiopia" and projects and activities included in the Program

have a direct bearing on biodiversity conservation and sustainable use, particularly in arid and semi-arid areas of the country.

Both EPA and NMA have made available most of the conventions related to the CBD on their respective websites with the objective of raising awareness.

The Institute of Biodiversity Conservation (IBC) works towards achieving the objectives of the various conventions and treaties by incorporating them in its Strategic Planning and Management (SPM) as well as on an *ad hoc* basis. The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and the Global Diversity Trust are some of the conventions in which IBC is engaged.

The Ethiopian Wildlife Conservation Authority (EWCA), which is the focal point for CITES, has carried out some activities to control illegal items being sold in souvenir shops and on managing the captive civet cat farms.

The stakeholders believe that the various conventions related to biodiversity need to be implemented in an integrated manner.

On the other hand, there has recently been good progress made by the government towards ratification of other conventions. Among these, the ratification of the Conventions on Migratory Species (CMS) and African-Eurasian Waterbird Agreement (AEWA) are indications of commitment of the government to biodiversity conservation and sustainable utilization. In addition to governmental institutions mentioned above, there are a few local NGOs involved in biodiversity conservation. Among them are the Ethiopian Wildlife and Natural History Society (EWNHS), Forum for Environment (FfE), Ethio-wetlands and Natural Resources Association, Wildlife Conservation and Development (WildCod), Ethio-Organic Seed Action (EOSA), Institute for Sustainable Development (ISD), Movement for Ecological Learning and Community Action (MELCA-Mahiber), and Wildlife for Sustainable Development (WSD). International NGOs such Born Free and Frankfurt Zoological Society (FZS) are also actively working on the conservation of wildlife in particular and protected areas in general.

3.2.4. Mainstreaming Processes, Mechanisms and Measures to Incorporate Biodiversity Issues

3.2.4.1. Organizational and structural set up

For the effective conservation and sustainable utilization of biodiversity, an effective organizational and structural set up needs to be put in place. This is not the case in most sectoral and cross-sectoral institutions of the country. In governmental organizations, besides the education sector, biodiversity issues are being handled as a minor component and at times on an *ad hoc* basis. There are no activities that directly address biodiversity issues in a sustained manner in most of these institutions. For example, there are no formal systems to protect and conserve the Sidamo Lark, an endemic bird, which is currently critically endangered (see Box 9). Relevant governmental institutions such as the Ethiopian

Wildlife Conservation Authority and Institute of Biodiversity Conservation, which have a national mandate to deal with biodiversity threats, had been unaware of the problem about the Sidamo Lark. They were not involved in finding solutions to preserve this unique species. Instead, an *ad hoc* task force was formed at zonal level to develop an action plan to take the necessary measures to save the bird with the help of local and expatriate researchers coordinated by EWNHS.

However, there are initiatives in some regions to mainstream biodiversity directly or indirectly. Tigray and SNNP Regional States could be mentioned in this regard. In Tigray Region, there is one biodiversity expert and a post for an additional expert at the regional level has been created. In SNNPR, the structure for natural resource management and environmental protection (that accommodates biodiversity) stretches from regional to district levels, and there are biodiversity experts at all levels. In SNNPR regional level experts are assigned on the basis of biodiversity components. There is a biodiversity program launched by the Organization for Relief and Development of the Amhara Region (ORDA) in five districts in the highlands and lowlands of south and north Gonder zones, respectively. Additionaly, capacity building endeavors are underway to boost the efficiency of all districts with particular focus on North Gonder Zone.

The research strategy of Amhara Region Agricultural Research Institute (ARARI) is mainly production oriented. However, genetic selection with the objective of improving indigenous cattle and sheep breeds is also being undertaken. In addition, a project on crop improvement to study local sorghum varieties has been completed.

3.3. Participatory Biodiversity Management

As part of the community-based conservation of natural resources, initiatives to establish and manage protected areas are currently underway throughout the country. In Addis Ababa, 709 hectares of land has been allotted for a botanical garden where some 250 species of plants are identified through an inventory of the existing vegetation. In SNNPR around Mechisho area in Dara district, 30 hectares of land has been designated for a community park and forest rehabilitation. Similarly, in Bahr Dar, a Millennium City Park near the outlet of Abay River (Blue Nile) from Lake Tana to Tiss Abay Falls has been delineated. This Millennium City Park covers about 4000 hectares of land of which 54 per cent is found within the city boundary. Rapid assessment of the area has identified a huge diversity of fauna and flora. This is believed to have potential for socio-economic and ecotourism development with the local communities. This will also lead to the conservation, rehabilitation and recreational aspects of biodiversity being developed.

There are some attempts being made to involve the local communities in the protection of the parks in the different parks of the country. Awareness creation, livelihood diversification, and creation of employment opportunities for the surrounding communities within the parks are some of the strategies being used to

involve the communities. Requirements for recruiting park scouts used to be quite high, particularly in terms of education level. However, this requirement is currently being waived to give better opportunities for the surrounding communities to compete in the recruitment process.

Support to enable local communities to produce items for sale (e.g. souvenirs) is also being implemented. Parks are assigning sociologists who are community experts in order to raise the awareness of the local communities and enable them to contribute towards the conservation of the parks. Shortage of grazing land outside park areas, particularly during dry seasons; the decline of the populations of medicinal plants outside park areas while being relatively abundant in the parks; and illegal hunting (poaching) by people who sell bush meat are serious threats to parks. Alleviating these threats requires more work to involve and engage the communities in the conservation activities. Bale Mountain National Park (BMNP) has developed a management plan through a participatory process by involving the communities.

Outreach programs provided by the Haramaya University are designed to involve Farmers Research Groups (FRG) in a participatory approach and provide full packages of technologies that are evaluated by the Group. This has created an opportunity to address natural resources conservation, use of farmers' varieties and planting of indigenous tree species. The FRGs are directly involved in selecting varieties, which creates a platform for the farmers' varieties to be considered. There is an annual farmers' day organized by the University where farmers, breeders and other stakeholders discuss biodiversity conservation issues and seek solutions for the way-forward.

There is participatory resource management in West Arsi and Bale zones in central and south Ethiopia co-ordinated by the Bale Eco-region Sustainable Management Program (BESMP). One of the objectives of the Program is the introduction of participatory resource management including biodiversity resource conservation and providing socio-economic benefits to the rural communities. The Program is currently implementing management of natural resources in 14 districts (10 in Bale and 4 in West Arsi zone) covering an area of 22,000 km^2 (Farm-Africa/SOS Sahel Ethiopia, 2007). The Program focuses on the following program outputs:

- Development of an eco-region plan;
- Functional and sustainable natural resource participatory management and conservation systems;
- Sustainable financing mechanisms;
- Improved/appropriate legal policy and regulatory frameworks in order to lobby for policy changes and develop policy briefs;
- Government and community institutional capacity built; and
- Diversification of natural resources based livelihoods.

Wondo-Genet College of Forestry and Natural Resources (WGCFNR), in collaboration with the Swedish University of Agricultural Science (SLU) and Center for International Forestry Research (CIFOR) is engaged in a new research program, known as Development Oriented Interdisciplinary Thematic Action Research (DOITAR). Within this DOITAR, the college with its partners, the communities and other stakeholders have been following a multi/interdisciplinary approach towards achieving its objectives, whereby scientific and local knowledge are combined to identify entry points for improving livelihoods, through natural resource related interventions. The DOITAR has been conducted in three pilot areas, namely: Wondo Genet catchments, Lake Langano and the Shashemene Forest Industry Enterprise. In these pilot areas, baseline surveys were initially conducted in consultation with the local communities. Researchers from various relevant disciplines were involved in the analysis of livelihood data. In this research intervention strategies were identified on the basis of the nature of the problems facing the area and communities. Twenty projects were carried out based on developing interdisciplinary thematic action plans concerned with increasing food production, income and health, and through engaging the local communities in the utilization and management of forests and woodlands. More than 50 researchers from WGCFNR and other faculties of Hawassa University with different professional backgrounds were involved in these projects. Local community members and other sectoral offices were also involved at the various stages of the research process which extended from the identification of priority problems to evaluation of the selected technologies in the field.

Although it is difficult to assess the full impact of these interventions within the period of four years (from 2004 to 2008), several achievements at various levels have been identified (Motuma *et al*., 2009). Some of the achievements are that farmers gained experience and skills from training sessions, field tours, and through working with researchers. Some farmers were also able to improve their productivity and obtain more food and income. The Shashemane Forest Industry Enterprise has confirmed that its relationship with the community in the Ashoka area has improved as a result of the activities of the DOITAR. This was achieved by working towards reducing the dependence of the local community on the forest through the creation of various alternative means of getting a livelihood. These experiences are believed to have contributed positively by complimenting the teaching-learning process.

The Relief Society of Tigray (REST) has been undertaking programs on the establishment of plantations of indigenous trees: it has planted over 150,000,000 seedlings of 55 species since 1993. Environmental rehabilitation programs in the region have facilitated the regeneration of trees and shrubs through area closures that have resulted from the rich soil seed banks. Gully rehabilitation has been carried out in some parts of both Tigray and the Amhara Regions. These activities are related with gender mainstreaming and family planning in North Gondar to help minimize population pressure on biodiversity resources. In both Amhara and

Tigray Regions, area closures are widely practiced for soil and water conservation and regeneration of natural vegetation.

Community participation in forest conservation in the Humbo woreda, Wolayta Zone of the SNNPR, has recently been linked to the carbon market, where the community has been awarded for their efforts that contributes to Carbon Sequestration. The livelihood diversification initiatives in these areas are currently active in managing and conserving forest resources and the production of non-timber forest products (e.g. honey and spices). Community managed forest areas such as Chilimo, Adaba-Doddola and Belete Gera in Oromiya Regional State are showing improvements in this regard.

The Productive Safety Net Program (PSNP) has been carried out in many parts of Ethiopia. It is common especially in food insecure areas of Tigray, Amhara, SNNP and Oromia Regions. The Program has focused on selected households over several years and has contributed towards the mainstreaming of biodiversity conservation to the grass-roots level. The impacts and effectiveness of the Program are important both in bringing alternative livelihoods to the food insecure families as well as in improving degraded lands and the associated biodiversity through the various soil and water conservation and related land management interventions. In Tigray, all healthy adults in food-insecure communities provide 40 days a year of free work to carry out public works. This has resulted in thousands of kilometers of terraces being built on degraded land with improved vegetation cover on a large total area. This has contributed to a reduction of soil erosion by about 60 percent. In Western Hararge, soil and water conservation activities were conducted on a watershed area that had been abandoned after people were resettled to other areas. This watershed area has brought significant rehabilitation to the ecosystem of the area.

3.4. Traditional Practices and Indigenous Knowledge

Conservation that capitalizes on indigenous knowledge through community participation has gained precedence in most parts of Ethiopia (MoARD, 2000; EPA, 1997). For example, the Konso people's land management practice in Southern Ethiopia is considered to be a model in traditional environmental management and rehabilitation efforts for the world (Engels and Goettsch, 1991). In recognition of the contribution of the traditional natural resource management of the Konso people, the UNFAO on its 50th Anniversary awarded this community a special prize (http://www.wiserearth.org/event/view). Such an award is a positive recognition of valuing traditional practices of the communities to manage the natural resources of the country.

Guassa area is located in the Central Highlands of Ethiopia, and has a total area of 111 km^2: its altitude ranges from 3200 to 3700 masl. The area is characterized as rugged, with plateau, gorges and river valleys. The area harbors

22.6 per cent of the endemic mammals and 48.3 per cent of the endemic birds of Ethiopia. The Guassa area has been managed by the Menz community as a common property resource for centuries and it represents an interesting model of community led natural resource management regime that has operated in a very fragile ecosystem. However, as the human population of the region continues to increase, it is important to ensure that the community continues to utilize the natural resources sustainably. This will require the empowerment of the community. Currently the Afro-alpine Ecosystem Conservation Project of the Frankfurt Zoological Society is working with the Menz community to strength this age-old conservation system.

There are remarkable efforts being made by various environmental and biodiversity advocacy groups in different corners of the country. The Movement for Ecological Learning and Community Action (MELCA-Mahiber) and the Institute for Sustainable Development (ISD) focus on cultural biodiversity (combining the concepts of culture and biodiversity in the context of traditional knowledge). Activities of Kembata and Tembaro farmers in establishing area closures, the traditional forest utilization rule of the Sheka people and the Gedeo Agroforestry conservation activities are important initiatives and heritages that are exemplary in south Ethiopia. ISD applies this principle in supporting the environment clubs in 23 of the secondary/high schools, at least one from each Region of the country, to re-establish their relationships with their local communities and their traditional knowledge and practices through a program called 'back to roots'.

The Christensen Fund is organizing and coordinating the conservation of the indigenous knowledge (IK) and culture about natural resources and the environment in Sidama, Konso and Dorze areas. The Association for Research and Conservation of Culture, Indigenous Knowledge and Cultural landscape (ARCCIKCL) has established 64 community organizations in the SNNPR. These community organizations are intended to rationally conserve indigenous knowledge (IK), farmers' crop varieties, livestock and other biological resources in their respective geographical areas. In Bonga, the ARCCIKCL has conducted mapping of the area in collaboration with other NGOs. The ARCCIKCL has also prepared a map of the Konso area and submitted it to UNESCO. Based on this, the UN has assigned ICOMOS and International Union for Conservation of Nature and Natural Resources (IUCN) to verify the map on the ground and upon which, the whole Konso area is to be recognized as a world heritage site (Dr. Metasebia Bekele, pers. comm.). Additionally, there are researchers attempting to identify traditional practices of farmers which can help to improve productivity of indigenous animals.

3.5. Case Studies and Success Stories

There are a number of institutions that are undertaking activities towards conserving biodiversity and are worth sharing their experiences. The Institute of Sustainable Development (ISD) is conducting a large scale study on composting to

increase crop yields particularly on farmers' crop varieties (Edwards *et al*, 2007). This study's findings indicate that the increase in yield amounts to two to three folds when using compost rather than using unfertilized checks. The findings also shows compost is better than chemical fertilizer because the yield increase can be maintained in subsequent years and works better when used with the farmers' varieties (details are presented in Box 4).

A study on the seed system impact and farmers' income and crop biodiversity was conducted in the dryland of Southern Tigray with the aim of describing the effect of improved seeds on the existing seed system. This study showed the decrease in the diversity of the local crop varieties as a result of the introduction of high yielding improved/exotic varieties (Kiros *et al,* 2009). Five cultivars of sorghum, one cultivar of teff and four cultivars of maize have been lost and others are on the verge of being lost from the farming system of the area. This is due to the late maturity and susceptibility to moisture stresses of some of the local varieties. This was verified by studies that showed early maturing sorghum varieties from the informal seed system that out-performed and could substituted the local late maturing types. The fact that traits with higher yield, good food or culinary quality, and ability to perform best under high moisture conditions are considered to be most favored, has led to the local varieties' to be subjected to genetic erosion. In addition to taking the yielding ability and earliness traits as the only criteria for selection, emphasis needs to be given on the utility, market quality and other traits of the products.

Collection of farmers' varieties and characterization were carried out by the Tigray Agricultural Research Institute and Mekelle University. Wheat (*berihu, arkbi, anji*) wheat/barley mixture *(hanfets*), barley (*abatgebs*), teff (*key teff, netch teff, sergegna teff*), sorghum (*wefey, shilkut, degalit, wedi aker, leiqua*), linseed, safflower, sesame and noug farmers' varieties were included in this scheme. The aim of this collection is ensure that the resources are well managed and their characteristics identified for future uses. Mekelle University has launched an ongoing project entitled "Seed Safety through Diversity" where 2 Ph.D. and 1 M.Sc. students are carrying out their research work. In addition, research on area closures and indigenous tree species propagation are being conducted by Mekelle University. Another project entitled "Trees for Farmers" has distributed 10 seedlings of indigenous tree species to each farmer at the household level with follow-up activities to assess survival rates. Research on Jatropha's allelopathic effect, invasiveness and maximization of its oil yield has also been conducted by Mekelle University.

Based on a study conducted to determine forest carrying capacity in Adaba-Dodola Participatory Forest Management (PFM) project, the net income of forest user groups and non-forest user groups is found to be 7,360 birr/year/hh and 4,820 birr/year/hh, respectively. This shows, the current income of the forest user group is equivalent to 1.5 times the income of the non-forest user households (Tsegaye *et*

al 2007). Such data helps in assessing the value of the services of the biodiversity resources and in involving the communities.

3.6. Awareness Creation

Major biodiversity mainstreaming activities include awareness creation/raising through workshops at federal and regional levels and the use of the media. On top of that, capacity building to implement mainstreaming has been done in some areas as well. Awareness creation/raising activities primarily focusing on schools have been carried out in some parks of the different Regions. It is believed that awareness created in schools is likely to reach all the community, since students communicate what they have gained to their family. In Gewane (Afar) area, Yangudi-Rasa National Park raised awareness within the military, since it was reported that military personnel assigned close to protected wildlife areas were involved in illegal hunting for bush meat and cutting trees for fire wood. The awareness creation in the community has resulted in reduction of occurrence of wild fire. In Babille local mass media has been used in changing attitude of the population to the extent that they prevent their fellows from damaging biodiversity. In other corners of the country, awareness raising activities have been conducted on the impact of bush encroachment on the rangeland vegetation for the local communities residing within the vicinity of the Borena rangelands.

Training of personnel working at the zonal level with the intention of the knowledge being passed on to the communities and schools has been started in the SNNPR. The Ethiopian Wolf Conservation Program uses schools, social and sport events to raise awareness on the conservation problems of the species. Awareness raising has also been done in relation to fish conservation and utilization by using the mass media, field visits and training on food technology but the activity was limited in scale due to lack of capacity. In Addis Ababa awareness raising workshops have been organized on environment and biodiversity issues in all ten sub-cities. It is too early to evaluate the impact of these worskshops. Afar Pastoralist Development Association (a local NGO) has done a lot to raise awareness about pastoral development, conservation of natural resources and agro-biodiversity, as a result of which, award winning individuals have emerged at national level.

The IBC has organized a training workshop for members of the House of Representatives with the ultimate objective of influencing their decision on the environment in general and biodiversity in particular. The Annual International Biodiversity Day is also one event IBC is using to create and raise awareness among the public and stakeholders.

Farmer's field school program, organized by EOSA, has increased the exchange of information and experience among farming communities, researchers and development practitioners with regard to crop variety improvement (Genene, 2006; Regassa *et al*., 2009). With EOSA playing a leading role, experiences have been gained in optimizing collaboration and task division between farming

communities and public institutions to scale up the Farmer Field School approach using a (TOT) training of the trainers scheme. EOSA promoted integrated conservation, use and management of agrobiodiversity, with a guiding principle of "Conservation Through Use" that involves community groups, government institutions, researchers, other NGOs and industry. This program is aimed at promoting and increasing small-scale farmers' ability to manage their resource base, establish community-based seed networks, linking farmers with industry, creating local markets and promoting organic production (Regassa, *et al*., 2009).

3.7. The Use of Incentives

In a number of areas incentives have been used to promote biodiversity conservation. There is an attempt by local administrations to compensate the surrounding communities for loss of crops and life by elephant and other wild animals around the Babille Elephant Sanctuary. The radio-collar elephant tagging system in Babille Elephant Sanctuary has created a system by which farmers will be warned when elephants are approaching their farm and this has drastically reduced the conflict between the elephant population and the surrounding communities.

The recruitment of scouts from the surrounding community by Parks Administration (as described above) is one good incentive for the local people. As a way of raising the interest of the communities to conserve the forest biodiversity in the Bale highland, market development for the forest coffee through a specialty market and collective action has increased the income from coffee.

The Environment Protection Bureau of the Addis Ababa City Administration is involving communities of wood collectors to create alternative livelihood strategies. The aim is to protect Green Areas and biodiversity of the city. These include: 1) organizing them to produce energy saving stoves for sale which contributes to the efficiency and reduction of fuel wood use; 2) to use part of the wood harvested by the Addis Ababa fuel wood project, in return for compliance not to encroach in the forest; and 3) training of about 15,000 wood collectors in handicrafts, with support of ILO, so that they can create their own income generating activities.

Wondo Genet College of Forestry and Natural Resources (WGCFNR) engaged local communities in utilization and management of forest and woodlands through which household food security, income and the conservation of the natural resources have improved. This also led to a decrease in maternal morbidity and mortality in the area through improving the living conditions for the women.

3.8. Ecosystem Services

Pastoral areas have species adapted to harsh climatic conditions that are important in feed and food security.

The case of Bale Mountains National Park is a vivid indication for the importance of biodiversity, in providing ecosystem services and for overall development and human wellbeing. The Bale Mountain massive is a source for some 40 tributary rivers which flow into the main rivers of the Wabe Shebelle, Genale, Web and others. These rivers are the sources of water for about 12 million people in eastern and south eastern Ethiopia, parts of Somalia and Kenya, and for hydroelectric power and large scale irrigation in southeastern Ethiopia. A point worth mentioning here is the contribution of the giant mole rat which is found in the area. Among its other roles in the ecosystem, the mole rat facilitates rain water percolation into the ground as a result of the large number of holes it digs in to the soil. This plays an important role in sustaining the large number of springs in the area. On top of this, the whole catchment area, being very rich in biodiversity, is the basis for ecosystem stability and home for a number of endemic flora and fauna species of the country. The carbon sequestration benefits and the high potential for ecotourism are important services with high potential for economic development through carbon-trading and tourist attraction. There is an on-going negotiation for benefits and creation of carbon neutral areas. Organic coffee and other agricultural products from this area are a source of foreign currency.

Conserving wild animals and vegetation in parks and other protected areas would encourage a thriving tourism which creates jobs. The tourism industry promotes employment opportunities by way of tourist guides, horse renting, souvenir/artifact/handicraft sale and local food industry. This, in turn, creates an incentive for the local people to protect the conservation areas.

With regard to on-farm conservation, the co-existence and co-evolution of the wild, weedy and wild-weedy relatives with the cultivated ancestors create opportunities for the continuous introgression of new traits. This contributes for enhancement of local crop varieties from the economic and agronomic points of view.

3.9. Biodiversity Inclusive Impact Assessment

The Environmental Protection Authority (EPA), based on the cross-sectoral Environmental Policy of the country, has developed a law on Environmental Impact Assessment (EIA) that has been passed by the parliament. In the legislation it is stipulated that without authorization from EPA or from the relevant regional environmental agency, no person shall commence implementation of any project that requires environmental impact assessment (Federal Democratic Republic of Ethiopia, 2002). Implementation of EIA in development projects is under way and its familiarization has been done. However, effective follow-up was not done because of limitations in the capacity of EPA to involve the public and other interested and affected parties. Additionally there is no monitoring activity and audit reporting to make sure that the mainstreaming is effective or not.

In the EIA legislation, though it is implied in the definition of the term impact that biodiversity needs to be considered, it is not clearly put that the assessments should be biodiversity-inclusive impact assessments.

The proclamation requires an EIA process for any planned development project or public policy which is likely to have a negative impact on the environment, and recognizes the fact that activities in other economic sectors can have significant negative impacts on natural resources in particular and the environment in general. There are sector specific laws and regulations into which EIA should be integrated.

The Rural Land Administration and Use Proclamation recognizes the right of investors to obtain and use rural land, provided that priority is given to farmers and pastoralists. Once land has been allocated, the proclamation obliges landholders to sustainably use and manage the property. Similar proclamations are issued, accordingly, by regional states stipulating that the development plan submitted by investors seeking land must not lead to the degradation of the land or surrounding environment.

The Fishery legislation seeks to ensure sustainable use of the fish resources in the country and stipulates that federal and regional organs should ensure that development programs and projects will not have a negative impact on the fish resources of a basin. The proclamation contains important provisions that support EIA relevant to the sustainable utilization of fishery resources. However, it does not specifically require fishery developers to submit an EIA report to environmental agencies.

The Wildlife Proclamation, while asserting that wildlife based tourism should not endanger the ecological integrity of the protected areas, which is a positive measure, fails to subject the granting of permits for development of wildlife tourism infrastructures such as hotels, lodges and other facilities in protected areas to the EIA process.

The Water sector of the natural resources has a Water Resources Proclamation and a Water Resources Regulation. The proclamation states that the water resources of the country are duly conserved for the highest social and economic benefits of the country and prohibits the release of any waste into water bodies that endangers the lives of humans, animals or plants. It also prohibits the clearing of trees or vegetation and the construction of residential houses along the banks of water bodies. The regulation stipulates that a water use permit will not be issued if the plans entail the creation of pollution or harmful effects to the water resources and the environment. Like some of the other proclamations, the water resources proclamation and regulation fails to make EIA a mandatory requirement for the issuance of water use and development permits.

The law on Community Rights and Access to Genetic Resources and Traditional Knowledge (Proclamation 482/2006) states that access to genetic resources is carried out without causing harm to the environment and may be denied if the planned use may cause an undesirable impact on the environment, an

ecosystem, human health or the cultural values of local communities (Mellese and Mesfin, 2008). This also fails to require applicants wishing access to the genetic resources to conduct a formal EIA process.

3.10. Conclusion

There is a good start with regard to mainstreaming biodiversity. As a result of some of the measures, some changes have been observed in the status and trends of some of the biodiversity resources. Based on the awareness raising activities, a relatively positive attitude is being achieved at all levels, though it is neither adequate nor exhaustive. For instance, the degree of encroachment by people and livestock in some parks (e.g. in Yangudi-Rasa and Babille National Parks) has reduced. Positive progress in some areas is observed particularly in participatory resources management. Introduction of new livelihood options (livelihood diversification), increase in production for consumption and market, conservation and sustainable utilization are some of the changes. Indigenous knowledge, cultural landscapes and some ecosystems are conserved in certain areas. The conservation of forest coffee, agro-biodiversity and forest resources are among the positive achievements. However, it is rational to admit that what is achieved to date is far from what needs to be done given the magnitude of the problem.

Use of positive incentives has contributed to the increase of the elephant population in Babille, which in turn contributes to the tourism development in the area and income generation for the local community. This signifies the role of positive incentives in the conservation of biological resources, which should be applied in other areas. As observed in some higher learning institutions, governmental and non-governmental organizations (NGOs), incorporation of biodiversity concerns in the academic curricula, development strategies and research programs have assisted the overall efforts towards the conservation and sustainable utilization of biodiversity. However, a large number of current development projects are posing threats to the country's biological resources. It appears that EIA is often lacking and, when it exists, in most cases it does not include biodiversity impact assessment.

As compared to the vast diversity of the biological resources, the measures taken towards the implementation of the National Biodiversity Strategy and Action Plan (NBSAP) with regard to mainstreaming are far below expectations. So, urgent additional measures are required to bridge the wide gap.

4. Conclusions: Progress towards the 2010 Targets and Implementation of the Strategic Plan

4.1. Progress towards 2010 Targets

The Conference of the Parties adopted the Strategic Plan for the CBD in decision VI/26. In its mission statement, the Parties committed themselves to a more effective and coherent implementation of the CBD, to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national levels as a contribution to poverty alleviation and to the benefit of all life on earth. This target was subsequently endorsed by the World Summit on Sustainable Development. The subsequent COP adopted a framework to facilitate the assessment of progress towards the 2010 targets in decision VII/30. This is a flexible framework within which each party could set national targets and indicators.

Nonetheless, the Focal Point Institution (FPI) - the Institute of Biodiversity Conservation (IBC) did not publicize the 2010 targets to the relevant stakeholders. Surprisingly, the IBC itself did not integrate the targets in either its strategic plan or the annual plan of action. However, some of the targets were circuitously addressed in its Strategic Plan and Management (SPM). In general, Ethiopia did not adapt the 2010 targets to its condition and did not prepare a roadmap to achieve the 2010 biodiversity targets.

In order to tackle this chapter, the reporting team translated the works of various institutions at federal and national regional levels including some NGOs in to the 2010 targets (Table 10). There is some positive progress that could fit into certain 2010 targets as highlighted in Chapter 1 of this report.

4.2. Ethiopia's Progress towards the Implementation of Goals and Objectives of the Strategic Plan

As a signatory to the CBD, Ethiopia is obliged to implement and fulfill all the commitments to conserve its biodiversity through sustainable utilization in a way that ensures equitable sharing of benefits that arise from genetics resources. Given the present high rate of biodiversity loss at national and global level, implementing the commitments stated in the CBD and other related international agreements is not a matter of choice: it is becoming a matter of survival and a mandatory issue.

The country has taken positive steps such as upgrading the previous Plant Genetic Resources Center to the level of the Institute of Biodiversity Conservation (IBC) with wider responsibilities, re-establishing the Ethiopian Wildlife Conservation Authority, having higher learning institutes deal with issues of biodiversity in one way or another, and the establishment of wildlife authorities in the Regions. Issuance of a National Policy on Biodiversity Conservation and Research, preparation of NBSAP and setting priority actions for biodiversity conservation are measures that would enable the goals and objectives of the CBD's Strategic Plan to be achieved.

However, Ethiopia's implementation of the goals and objectives of the Strategic Plan is far behind expectations. Table 9 shows some of the efforts made towards achieving the Strategic Plan. The major obstacles have been lack of funding, lack of integration, inadequate mainstreaming of the objectives of CBD by relevant stakeholders, inadequate awareness by the local communities on their rights under Article 8(j) of the CBD, and lack of consultation with local communities on the use of traditional knowledge and other indigenous practices as they relate to biodiversity.

4.3. Summary of Goals, Targets and Indicators

Table 10: Provisional framework of goals, targets and indicators to assess progress towards the 2010 Biodiversity Targets

Goals and targets	Relevant indicators	Progress of Ethiopia
Protect the components of biodiversity		
Goal 1. Promote the conservation of the biological diversity of ecosystems, habitats and biomes		
Target 1.1: At least 10% of each of the world's ecological regions effectively conserved.	Coverage of protected areas Trends in extent of selected biomes, ecosystems and habitats Trends in abundance and distribution of selected species	The current total coverage of Protected areas is 19.05% but these are not effectively conserved No indicators developed yet, but the overall trend is negative Positive increasing trend is observed for the population size of some tree species under closure area schemes (see section 1.4.1.2 of this report) and five endemic mammals (section 1.5.2)
Target 1.2: Areas of particular importance to biodiversity protected	Trends in extent of selected biomes, ecosystems and habitats Trends in abundance and distribution of selected species Coverage of protected areas	Not all areas of particular importance to biodiversity are protected but Simen Mountains and Bale Mountains National Parks are in a better position than before Positive increasing trend is observed for the population of five endemic mammals (section 1.5.2)
Goal 2. Promote the conservation of species diversity		
Target 2.1: Restore, maintain, or reduce the decline of populations of species of selected taxonomic groups.	Trends in abundance and distribution of selected species Change in status of threatened species	The overall trend is negative but some signs of improvement are seen Ethiopia did not develop an official list of threatened species (except for higher endemic plants based on the Flora of Ethiopia and Eritrea), and criteria and indicators to monitor trends.

Goals and targets	Relevant indicators	Progress of Ethiopia
Target 2.2: Status of threatened species improved.	Change in status of threatened species Trends in abundance and distribution of selected species Coverage of protected areas	Refer to 2.1 above See 1.1 above
Goal 3. Promote the conservation of genetic diversity		
Target 3.1: Genetic diversity of crops, livestock, and of harvested species of trees, fish and wildlife and other valuable species conserved, and associated indigenous and local knowledge maintained.	Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socio-economic importance Trends in abundance and distribution of selected species	Genetic diversity of only few species studied. Indicators for monitoring genetic diversity have not yet been developed
Promote sustainable use		
Goal 4. Promote sustainable use and consumption		
Target 4.1: Biodiversity-based products derived from sources that are sustainably managed, and production areas managed consistent with the conservation of biodiversity.	Area of forest, agricultural and aquaculture ecosystems under sustainable management Trends in abundance and distribution of selected species, Marine trophic index, Nitrogen deposition, Water quality in aquatic ecosystems	1.2 million ha. natural forest and 75,827 ha plantations are under sustainable forest management in Oromiya National State. In addition, 5 natural forests are under PFM. Natural regeneration of some threatened tree species are improving
Target 4.2. Unsustainable consumption, of biological resources, or that impacts upon biodiversity, reduced.	Ecological footprint and related concepts	No ecological indicator developed

Goals and targets	Relevant indicators	Progress of Ethiopia
Target 4.3: No species of wild flora or fauna endangered by international trade.	Change in status of threatened species	Refer to 2.1 above
Address threats to biodiversity		
Goal 5. Pressures from habitat loss, land use change and degradation, and unsustainable water use, reduced.		
Target 5.1. Rate of loss and degradation of natural habitats decreased.	Trends in extent of selected biomes, ecosystems and habitats Trends in abundance and distribution of selected species Marine trophic index	Refer to 1.1 above
Goal 6. Control threats from invasive alien species		
Target 6.1. Pathways for major potential alien invasive species controlled.	Trends in invasive alien species	Worsening; invasive alien species are expanding
Target 6. 2. Management plans in place for major alien species that threaten ecosystems, habitats or species.	Trends in invasive alien species	Management plan prepared for Water hyacinth, Prosopis and Parthenium; the implementation is on-going but too early to report on the trend
Goal 7. Address challenges to biodiversity from climate change, and pollution		
Target 7.1. Maintain and enhance resilience of the components of biodiversity to adapt to climate change.	Connectivity/fragmentation of ecosystems	

Goals and targets	Relevant indicators	Progress of Ethiopia
Target 7.2. Reduce pollution and its impacts on biodiversity.	Nitrogen deposition Water quality in aquatic ecosystems	
Maintain goods and services from biodiversity to support human well-being		
Goal 8. Maintain capacity of ecosystems to deliver goods and services and support livelihoods		
Target 8.1. Capacity of ecosystems to deliver goods and services maintained.	Water quality in aquatic ecosystems Marine trophic index Incidence of Human-induced ecosystem failure	Chemical and biological limnology of some lakes have been changed negatively (e.g., Lake Tana, Lake Abijata-Shalla, Lake Awassa)
Target 8.2. Biological resources that support sustainable livelihoods, local food security and health care, especially of poor people maintained.	Health and well-being of communities who depend directly on local ecosystem goods and services	Net income of forest user groups was 1.5 times higher than that of the non-forest user households in Adaba-Dodola forest (refer to section 3.5). This has a direct impact on the health and well-being of communities
Protect traditional knowledge, innovations and practices		
Goal 9 Maintain socio-cultural diversity of indigenous and local communities		
Target 9.1. Protect traditional knowledge, innovations and practices.	Status and trends of linguistic diversity and numbers of speakers of indigenous languages	Survey on-going to document traditional knowledge, innovations and practices. Farmers' right law enacted

Goals and targets	Relevant indicators	Progress of Ethiopia
Target 9.2. Protect the rights of indigenous and local communities over their traditional knowledge, innovations and practices, including their rights to benefit-sharing.	Indicator to be developed	As above
Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources		
Goal 10. Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources		
Target 10.1. All access to genetic resources is in line with the Convention on Biological Diversity and its relevant provisions.	Indicator to be developed	See below (target 10.2)
Target 10.2. Benefits arising from the commercial and other utilization of genetic resources shared in a fair and equitable way with the countries providing such resources in line with the Convention on Biological Diversity and its relevant provisions	Indicator to be developed	In April 2005 a Dutch company called Health and Performance Food International (HPFI) entered into benefit-sharing agreement on *Eragrostis tef* with Ethiopia to develop non-traditional teff based food and beverage products. A British company – Vernique entered into agreement with Ethiopia to access and develop *Vernonia galamensis* in return for a benefit sharing arrangement in 2006 Both companies failed to fully discharge their obligations except for nominal upfront payments
Ensure provision of adequate resources		
Goal 11: Parties have improved financial, human, scientific, technical and technological capacity to implement the Convention		

Goals and targets	Relevant indicators	Progress of Ethiopia
Target 11.1. New and additional financial resources are transferred to developing country Parties, to allow for the effective implementation of their commitments under the Convention, in accordance with Article 20.	Official development assistance provided in support of the Convention	Insignificant financial support received from GEF
Target 11.2. Technology is transferred to developing country Parties, to allow for the effective implementation of their commitments under the Convention, in accordance with its Article 20, paragraph 4.	Indicator to be developed	

Table 11: Goals and objectives of the Strategic Plan and provisional indicators for assessing progress

Strategic goals and objectives	*Possible indicators*	*Ethiopia's progress*
Goal 1: The Convention is fulfilling its leadership role in international biodiversity issues.		
1.1 The Convention is setting the global biodiversity agenda.	CBD provisions, COP decisions and 2010 target reflected in work plans of major international forums	The three objectives of CBD are well reflected in the Ethiopia's NBSAP
1.2 The Convention is promoting cooperation between all relevant international instruments and processes to enhance policy coherence.		At national level a detailed study and assessment was made to synergize Multilateral Environmental Agreements so as to realize coherence of the policy and avoiding duplicating effort. This includes, CBD, CCD, CFFF and others.
1.3 Other international processes are actively supporting implementation of the Convention, in a manner consistent with their respective frameworks.		No information
1.4 The Cartagena Protocol on Biosafety is widely implemented.		A large campaign is being made for the implementation of Biosafety in Ethiopia. National and international forums attended and run for better implementation of biosafety.

Strategic goals and objectives	*Possible indicators*	*Ethiopia's progress*
1.5 Biodiversity concerns are being integrated into relevant sectoral or cross-sectoral plans, programs and policies at the regional and global levels.	Possible indicator to be developed: Number of regional/global plans, programs and policies which specifically address the integration of biodiversity concerns into relevant sectoral or cross-sectoral plans, programs and policies Application of planning tools such as strategic environmental assessment to assess the degree to which biodiversity concerns are being integrated Biodiversity integrated into the criteria of multilateral donors and regional development banks	Some sectoral or cross-sectoral plans, programs and policies have incorporated biodiversity concerns (see Chapter 3)
1.6 Parties are collaborating at the regional and sub regional levels to implement the Convention.	Possible indicator to be developed: Number of Parties that are part of (sub-) regional biodiversity-related agreements	Ethiopia is a member for the East African Plant Genetic Resource Network. This network provides information on plant genetic resource, collection & conservation and capacitates member countries. Efforts have been made to establish trans-boundary peace parks with Sudan
Goal 2: Parties have improved financial, human, scientific, technical, and technological capacity to implement the Convention.		
2.1 All Parties have adequate capacity for implementation of priority actions in national biodiversity strategy and action plans.		Adequate capacity is not yet built for the implementation of priority actions in NBSAP.

Strategic goals and objectives	*Possible indicators*	*Ethiopia's progress*
2.2 Developing country Parties, in particular the least developed and the Small Island Developing States amongst them, and other Parties with economies in transition, have sufficient resources available to implement the three objectives of the Convention.	Official development assistance provided in support of the Convention (OECD-DAC Statistics Committee)	As one of the least developed countries, Ethiopia doesn't have sufficient resources to fully implement the three objectives of the convention
2.3 Developing country Parties, in particular the least developed and the small island developing States amongst them, and other Parties with economies in transition, have increased resources and technology transfer available to implement the Cartagena Protocol on Biosafety.		The implementation of the Cartagena protocol on biosafety is not fully operational in Ethiopia. The Biosafety Law was issued recently.
2.4 All Parties have adequate capacity to implement the Cartagena Protocol on Biosafety.		Though full assessment was not done in this particular case, there is somehow minimal capacity in uncoordinated manner.
2.5 Technical and scientific cooperation is making a significant contribution to building capacity.	Indicator to be developed consistent with VII/30	Refer to objective 2.3
Goal 3: National biodiversity strategies and action plans and the integration of biodiversity concerns into relevant sectors serve as an effective framework for the implementation of the objectives of the Convention.		
3.1 Every Party has effective national strategies, plans and programs in place to provide a national framework for implementing the three objectives of the Convention and to set clear national priorities.	Number of Parties with national biodiversity strategies	The Ethiopia's NBSAP was published in 2007. The leading agency (focal point for CBD) for Ethiopia, IBC, developed its strategic plan and management in relation to biodiversity and its given mandate. However, the National Biodiversity Framework was not developed.

Strategic goals and objectives	*Possible indicators*	*Ethiopia's progress*
3.2 Every Party to the Cartagena Protocol on Biosafety has a regulatory framework in place and functioning to implement the Protocol.		Ethiopia has a national Biosafety Framework, based on this framework, Biosafety Law was issued. Six directives guiding the implementation of the protocol and the National Biosafety Law have been prepared and submitted to Environmental Council for approval.
3.3 Biodiversity concerns are being integrated into relevant national sectoral and cross-sectoral plans, programs and policies.	To be developed Percentage of Parties with relevant national sectoral and cross-sectoral plans, programs and policies in which biodiversity concerns are integrated	Environmental issues in general and biodiversity concerns in particular are addressed in the "Plan for Accelerated Sustainable Development to End Poverty" (PASDEP) and in some other relevant sectoral and cross-sectoral plans, programs
3.4 The priorities in national biodiversity strategies and action plans are being actively implemented, as a means to achieve national implementation of the Convention, and as a significant contribution towards the global biodiversity agenda.	To be developed Number of national biodiversity strategies and action plans that are being actively implemented	Refer to objective 2.1
Goal 4: There is a better understanding of the importance of biodiversity and of the Convention, and this has led to broader engagement across society in implementation.		
4.1 All Parties are implementing a communication, education, and public awareness strategy and promoting public participation in support of the Convention.	Possible indicator to be developed: Number of Parties implementing a communication, education and public awareness strategy and promoting public participation Percentage of public awareness programs/projects about the importance	Although NBSAP has incorporated public awareness and participation, it has not been fully implemented. However, a lot of work have been done by various relevant institutions.

Strategic goals and objectives	*Possible indicators*	*Ethiopia's progress*
	of biodiversity Percentage of Parties with biodiversity on their public school curricula	
4.2 Every Party to the Cartagena Protocol on Biosafety is promoting and facilitating public awareness, education and participation in support of the Protocol.		Resource materials for communication, education and awareness creation, have been prepared. In addition, refer to objective 1.4.
4.3 Indigenous and local communities are effectively involved in implementation and in the processes of the Convention, at national, regional and international levels.	To be developed by the Ad Hoc Open-ended Working Group on Article 8(j)	Local communities are involved in the implementation of the CBD in various ways. For example in community-based *in-situ* conservation, in community field gene bank activities and also in community based closure area management activities. Local communities were also involved in delineation of few protected areas
4.4 Key actors and stakeholders, including the private sector, are engaged in partnership to implement the Convention and are integrating biodiversity concerns into their relevant sectoral and cross-sectoral plans, program and policies.	To be developed Indicator targeting private sector engagement, e.g. Voluntary type 2 partnerships in support of the implementation of the Convention	Stakeholders such as NGOs, Civic societies and the private sector are involved to some extent in implementation of the CBD (see chapter III)

4.4. Conclusion

4.4.1 Overall Assessment of the Implementation of the Convention

Ethiopia has taken a number of fundamental measures after the ratification of the Convention on Biological Diversity (CBD). The upgrading of the former Plant Genetic Resources Center to the Institute of Biodiversity Conservation (IBC) to accommodate forest, animal and microbial genetic resources was the first step. Following its reestablishment, the IBC developed and issued a National Policy on the Conservation and Research of biological resources. As per the provision in Article 6 of the CBD, the country developed and published the Ethiopian Biodiversity Strategy and Action Plans (NBSAP) in 2007. The Access and Benefit Sharing, and the Biosafety Proclamations were enacted recently. Furthermore, a few sectoral and cross-sectoral stakeholders have integrated biodiversity concerns in their policies, strategies and laws.

Notwithstanding the above mentioned crucial achievements, efforts made to implement the Convention were very limited in scope and size. Consequently, the impact that such fragmented efforts had in the conservation and sustainable use of biodiversity and the fair and equitable sharing of benefits have been very low. The following are the basic impediments:

- Ethiopia has so far received only nominal funding to implement projects that address the objectives of the convention;
- Stakeholder institutions, communities and individuals were not well-informed on, and they were not involved in developing country positions for, the global processes and negotiations under the Convention;
- The Strategic Plan of the CBD and the 2010 targets were not known to the majority of the stakeholders;
- The Focal Point Institution, IBC, failed to coordinate and monitor the implementation of the NBSAP. There has been inadequate communication with key stakeholders at the federal and national regional state levels, as well as with NGO's, communities and the private sector;
- There is no binding provision or legal obligation for stakeholders to consider the NBSAP in their planning;
- There is no formal system for monitoring and reporting progress on implementing the NBSAP; and
- There is no funding mechanism or trust fund for implementing the NBSAP.

Despite the shortcomings, there is some positive progress made in the implementation of the Convention as listed below:

- Improvements have been observed in the conservation status and trends of some endemic mammal species;
- There has been a slight increase in the number and size of protected areas;
- Field gene banks of endangered forest, medicinal, and forage and pasture plant species have been established and are expanding;
- Area closures to restrict animal grazing, particularly in northern Ethiopia, has resulted in the restoration of some plants and animals that had disappeared from the localities;
- The Ethiopian 3rd Millennium initiative resulted in the planting of over 1.6 billion tree seedlings in degraded areas and areas designated for Millennium Parks in many localities; and
- Ecosystem rehabilitation has taken place in participatory forest management areas.

In general, however, the threats and challenges facing the biological resources of Ethiopia are intensifying with serious negative impacts on the efforts to conserve and sustainably utilize biodiversity.

4.4.2 Lessons learnt

The importance of biodiversity conservation and ecosystem services are not well-understood by a large number of people at all levels, particularly at the level of policy makers in Ethiopia. The focal point Institute of the CBD should embark on economic valuation of these precious resources together with the relevant and capable stakeholders in order to enhance understanding and lift up biodiversity concerns in the development agenda. The key stakeholders should be well-informed on the global processes and negotiations, and they should be involved in developing country positions to be presented in various fora organized by the CBD Secretariat.

Although the NBSAP is a vital strategic document that should guide the conservation and sustainable utilization of biodiversity, stakeholders did not use it as a national guidebook in their planning. However, it is believed that NBSAP familiarization workshops have influenced some of the national regional states (e.g. Southern Nations, Nationalities and Peoples (SNNP), and Tigray Regions) to take the crucial step of assigning experts to oversee the conservation of biodiversity.

The dramatic boost in the population size of the endemics, including Walia Ibex, Ethiopian Wolf and Gelada Baboon in Simen Mountains National Park in northern Ethiopia is a very encouraging and successful example of actions taken to conserve endangered species. On the other hand, the ostrich, Swayne's Hartebeest (endemic) and Grevy's Zebra are believed to have disappeared from Awash National Park in central Ethiopia.

4.4.3 Future priorities and capacity-building needs for the implementation of the Convention

The Institute of Biodiversity Conservation has conserved over 69,000 accessions of plant species in cold rooms and field gene bank facilities. However, there is only one gene bank where germplasm is kept in cold chambers. Therefore, the establishment of at least one more duplicate gene bank is indispensable as a security in case of any possible failures in the functioning of the existing gene bank. The molecular genetic diversity of the majority of the holdings of the IBC has not been studied. The molecular laboratory of the Institute should, therefore, be upgraded with appropriate new equipment to characterize the collections and to elucidate their genetic diversity. Moreover, emphasis should be given to the biological components which have not yet been given attention, such as aquatic and soil invertebrates. The number of protected areas and their percent coverage of the country are high in number but none of them are effectively protected. Furthermore, the majority are designated as Controlled Hunting Areas. The first step should be to ensure their legal status and implement effective law enforcement to protect them from further deterioration. In addition, the number of National Parks should increase with the necessary legal protection. The following additional actions are recommended:

- Developing the capacity of stakeholder institutions to write project proposals that can attract funding;
- Strengthening partnerships with all the relevant stakeholders;
- Developing capacity to enforce biodiversity related strategies and laws;
- Raising the awareness of the relevant staff in all stakeholder institutions on the global processes, negotiations and work programs on the CBD;
- Revising Ethiopia's National Biodiversity Strategy and Action Plan (NBSAP) in light of the present recommendations (see chapter 2); and
- Providing training on biodiversity conservation and orientation in order to implement the NBSAP.

4.4.4 Actions for consideration at regional and global levels

An emphasis should be given by the CBD to the Program of Work on biodiversity and climate change, as recommended in the National Adaptation Plan of Action (NAPA) and Technological Need Assessment (TNA).

4.4.5 Goals and objectives that may be included in a future strategic plan of the CBD

- Program to support National Biodiversity Assessment (NBA), which could be used as an input for Global Biodiversity Assessment (GBA)

- Capacity/skill development in the global negotiations for access and benefit sharing
- The creation of a Global Arbitration Mechanism (GAM) to mediate between parties having disputes over agreed terms of access and benefit sharing

In conclusion, the analysis presented in this report is based on information collected from key stakeholders and is believed to represent the overall state of biodiversity conservation and sustainable utilization.

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Appendices

Appendix 1: Information concerning reporting Party and preparation of national report

A. Reporting Party

Contracting Party	Ethiopia
NATIONAL FOCAL POINT	
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SUBMISSION	
Signature of officer responsible for submitting national report	
Date of submission	

B. Process of preparation of national report

In accordance with Article 26 of the Convention on Biological Diversity (CBD) and Decision VIII/14 of the Conference of Parties (COP), the Institute of Biodiversity Conservation (IBC), together with other stakeholders has prepared Ethiopia's Fourth National Report on Implementation of the CBD. The report which is prepared following the guidelines for the 4th national report contains five parts namely: Status, Trends and Threats on Biodiversity; the National Biodiversity Strategy and Action Plan (NBSAP) implementation; Biodiversity integration in to other sectors; the conclusion regarding progress towards the 2010 targets and the strategic plan of the convention, and appendices.

The report was prepared in the period between May and August, 2009. A team of researchers was formed in IBC of which some have participated in a training workshop, organized by CBD Secretariat, for least developed countries on preparation of the 4th CBD country report. At the beginning the team was joined by representatives of three stakeholder institutions namely: Environmental Protection Authority (EPA), Ethiopian Wildlife Conservation Authority (EWCA) and Ethiopian Institute of Agricultural Research (EIAR). Representatives of EWCA (Ato Arega Mekonnen and Ato Lakew Berhanu) participated in field data collection and provision of information in their organization but were not available for the writing up because of other engagements. A representative of EIAR (Dr Adugna Wakjira) was not available for either the fieldwork or the writing up, though he participated in initial planning meetings.

Team Members who participated throughout:

1. Dr Taye Bekele (IBC, Chairperson of the team)
2. Ato Berhanu Tekalign (EPA)
3. Ato Berihun Gebre Medhin (IBC)
4. Ato Adugna Abdi (IBC)
5. Dr Alishum Ahmed (IBC)
6. Dr Solomon Abegaz (IBC, Secretary)

Ato Abiyot Birhanu, Head of Information and Documentation Service of IBC, has coordinated the whole process of the project.

The committee has communicated with 113 experts associated with more than 45 major stakeholders in the different parts of the country to gather information on their activities with regard to biodiversity conservation, and has reviewed relevant publications. Information from the stakeholders was collected through discussions guided by a check list of issues which are relevant to the report. These include information about the status trend and threats of

biodiversity, implementation of NBSAP and integration and mainstreaming of biodiversity.

Collected information was summarized, checked for consistency and validity by the team to be included in the report. Due to lack of data (particularly time series data) it was not possible to develop indicators on the state of the various biodiversity components. In a few cases where data are available various figures were developed to serve as indicators. Cases where achievements worth recording are available or where threats are serious or activities are exemplary have been selected and presented as case studies or as success stories.

A stakeholders' workshop to review the first draft of the report was organized on the 6th and 7th of August, 2009. Relevant inputs from the stakeholders who participated in the workshop were incorporated into the report and an improved draft was prepared. In addition a team of senior researcher's from Institute of Biodiversity Conservation has reviewed the improved draft and contributed to the preparation of the final draft.

The report has limitations in terms of coverage and accuracy. Due to time constraint it was not possible to communicate with a sizeable portion of the stakeholders. Additionally there is no system for monitoring biodiversity at the national level. Therefore it is obvious that the report is far from exhaustive and some of the facts may not have the required accuracy. However, the stakeholders were sampled in such a way that most of the major stakeholders are included and the report shows a picture for the whole country.

Appendix 2.Further sources of information

Access and Benefit Sharing (ABS) Policy.

Animal Genetic Resources National Report to FAO.

Biosafety/biotechnology policy.

Breeders' Right and Indigenous Knowledge.

Capacity Self Assessment thematic profiles for the CBD, UNCCD and UNFCCC.

Draft project document on protected areas,

Draft proposal on capacity building in agricultural biotechnology for improved productivity and livelihoods in Ethiopia.

Ethiopia: Environmental Outlook

Genetic Resources Policy Initiative (GRPI) document.

Global Strategy for Plant Conservation reports

Millennium Development Goals reports

National Biodiversity Strategy and Action Plan (NBSAP)

National report and project proposal on invasive alien species.

Second National Report on the implementation of the CBD to the COP

Stocktaking documents used for the preparation of the National Biodiversity Strategy and Action Plan

Synergy document (to create synergy and implement the three conventions CBD, UNFCCC, UNCCD).

Terminal reports of the "Farmer-based on-farm *in situ* conservation of crop diversity in Ethiopia".

The Proceedings of the National Awareness Workshop on Biosafety.

Appendix 3: Progress towards Targets of the Global Strategy for Plant Conservation and the Program of Work on Protected Areas

A. Progress towards Targets of the Global Strategy for Plant Conservation

This appendix provides an overview of the progress towards goals and objectives of the Global Strategy for Plant Conservation. It describes the 16 targets that were adopted by decision VI/9 for which some progress has been made based on the status and trends of plant diversity. Five requirements are addressed as per the guideline: national targets established (global targets adopted), incorporation of targets into relevant strategies, plans and programs; actions taken to achieve the target, obstacles encountered, and needs and future priorities identified.

Table A3.1. Progress towards Targets of the Global Strategy for Plant Conservation

Targets	*Ethiopia's progress towards targets*
Target 1. A widely accessible working list of known plant species, as a step towards a complete world flora	The Flora of Ethiopia and Eritrea in 8 volumes was completed in 2009. The work was based on an exhaustive assessment estimated to include about 6500 species of higher plants with 10-12% endemism.
Target 2: A preliminary assessment of the conservation status of all known plant species, at national, regional and international levels	A list of endemic species compiled and threat status made. The distribution and status of most of the forest plant species is assessed.
Target 3: Development of models with protocols for plant conservation and sustainable use, based on research and practical experience	Established the germplasm maintenance and gene bank management system and procedures based on practical experience. Protocols at the national level for different activities are: Acquisition (including collecting, introduction and exchange of germ plasm) Regeneration Characterization Storage and maintenance Documentation Health of germplasm Germplasm distribution Phyto-sanitary certification

Targets	*Ethiopia's progress towards targets*
Target 4: At least 10 per cent of each of the world's ecological regions effectively conserved	The current total coverage of Protected areas is 19.05% but these are not effectively conserved
Target 5: Protection of 50 per cent of the most important areas for plant diversity assured	In terms of protection of plants, the Bale Mountains National Park area, which is one of the world's biodiversity hotspot areas, and the Simen Mountains National Park are relatively better protected. These may account for up to 1% of the most important areas for plant diversity in the country
Target 6: At least 30 per cent of production lands managed consistent with the conservation of plant diversity	Current expansion of the production lands has become serious threat to plant diversity. Production system in Ethiopia is not operated based on planned land use.
Target 7: 60 per cent of the world's threatened species conserved in situ.	*Prunus africana* which is in the IUCN red list and annex II of CITES is currently being conserved *in-situ* in association with *Podocarpus falcatus*. The number of all the threatened plant species in Ethiopia as listed in the IUCN Red List is not well known.
Target 8: 60 per cent of threatened plant species in accessible *ex situ* collections, preferably in the country of origin, and 10 per cent of them included in recovery and restoration programs	Ethiopia did not develop list of threatened plant species. However, seeds of about 125 plant species are stored in cold rooms and field gene banks.
Target 9: 70 per cent of the genetic diversity of crops and other major socio-economically valuable plant species conserved, and associated indigenous and local knowledge maintained	The genetic diversity was not exhaustively assessed. However, the Ethiopian gene bank has collected and conserved *ex-situ* over 69,000 accessions of about 125 plant species and some associated indigenous knowledge
Target 10: Management plans in place for at least 100 major alien species that threaten plants, plant communities and associated habitats and ecosystems	Management plans produced only for *Prosopis juliflora*, Water hyacinth and *Parthenium hysterophorus*.
Target 11: No species of wild flora endangered by international trade	Not known
Target 12: 30 percent of plant-based products derived from sources that are sustainably managed	"The Ethiopian Home Gardens: Potentiation of Practices and Produce, *In Situ* Conservation of Biodiversity Project" has selected and identified the following plant-based products: Ye-Masha nech mar (Masha white honey)

Targets	*Ethiopia's progress towards targets*
	Ye-Mareqo berbere (Mareko Long chilli) Ye-Amaro mitmita (Amaro Short chilli) Ye-Basketo kororima (Basketo malaguetta) Ye-Kefa (Bonga) timiz (Bonga Long black pepper) Ye-Gurage Koseret and besobila (Gurage Lippia and basil) Ye-Dawro, Kambata, Bambe-zinjibil (3 local gingers) Ye Dendi Nech Shinkurt (Dendi garlic) Ye-Habesha Qey shinkurt (Habesha shallots) Ye-Limu Bunna (Limu coffee) Ye-Amaro bunna (Amaro coffee) Ye-Asosa Mango (Asosa mango) Ye-Gojjam bicha mar (Gojjam yellow honey) Ye-Tigray nech mar (Atsbi– Wukro) Tigray white honey Ye-Harer Sanga (Harar beef) (beef product) Ye-Kucha qibe (Kucha butter) Ye-Ankober qibat ihil (Ankober oil seeds) Ye-Gidole Qey shinkurt (Gidole Shallots) Ye-Amaro Baro shinkurt (Amaro chives) Ye-Arsi-Negele areke (Arsi Negel Areke) Ye-Wello Ades (Wello Myrtle) Ye Ada na Becho Tef (Ada and becho tef) Ye-Tegulet Gesho (Tegulet Gesho) Ye-Harer bicha bunna (Harer Amber coffee) (Ye buna Kello) Ye-Mokoy tiringo (Mokoy citron) Ye-Kambata muz (Kambata Banana) Ye-Bale Tej (Mead from Bale)
Target 13: The decline of plant resources, and associated indigenous and local knowledge innovations and practices that support sustainable livelihoods, local food security and health care, halted.	There is some progress towards the achievement of the target, however much is to be done to avert the declining trend.

Targets	*Ethiopia's progress towards targets*
Target 14: The importance of plant diversity and the need for its conservation incorporated into communication, education and public awareness programs.	There is awareness creation program in various ways though very insignificant to meet the target.
Target 15: The number of trained people working with appropriate facilities in plant conservation increased, according to national needs, to achieve the targets of this Strategy.	Insufficient achievement
Target 16: Networks for plant conservation activities established or strengthened at national, regional and international	Not at the national level, however, regionally, the East African Plant Genetic Resources Network (EAPGREN) has currently established network with the Ethiopian gene bank, and at International level Center for Genetic Resources Netherlands (CGN) also has some link.
(2) National targets (including global targets adopted),	
List of national targets	The national targets established (global targets adopted) are based on the rural development and food security sector. This include: Environmental Sustainability Watershed based natural resources management for sustainable development and environment and for reversing degradation of environmental resources Rural infrastructure
Incorporation of targets into relevant strategies, plans and programs	Ensuring integration of environment in the implementation of: Rural development and food security programs Biodiversity conservation programs Forest resources management programs Wildlife utilization and conservation programs Proper land use and soil conservation programs Water resources management for irrigation programs Rural energy programs Rural road program
Actions taken (Interventions) to achieve the target	

Targets	*Ethiopia's progress towards targets*
Environmental Sustainability Ensuring integration of environment in the implementation of rural development and food security programs	
Establishing environmental laws and development of guide lines and standards Review of environmental assessment (EA) documents for small-scale projects Awareness rising through training and workshops Institutional capacity building through training Purchase of office and lab equipment	Slow progress towards the target
Auditing and evaluating environmental performance of large scale projects Construction of office building Review of environmental assessment (EA) documents (large scale and small-scale projects) Identifying and availing best available technologies Environmental research partnership Environmental Information management: establish and maintain common platform for the exchange of environmental information	Not implemented
Watershed based natural resources management for sustainable development and environment and for reversing degradation of environmental resources Biodiversity conservation programs	
Promote ecosystem approach to conserve in and out side protected areas Integrate local community knowledge, skills and practices into conservation research, planning and management,	Not implemented

Targets	*Ethiopia's progress towards targets*
Establish *ex-situ* conservation: Field gene bank Seed gene bank Establish *in-situ* conservation and community gene bank,	Some achievements have been made
Building duplicate gene bank Renovate the existing gene bank, Develop market and non-market incentive for landraces, (indigenous products), including gender specific incentives and reward schemes to promote biodiversity	Not implemented in both cases
Public education and awareness creation about biodiversity through mass media (radio, TV, Publications), Set-up well equipped laboratory to enhance identification, classification and characterization and *ex-situ* conservation of farm animal genetic resources, Select and train farmer conservators to curate and manage community gene bank, Institutional capacity building through training	There is some progress, however very insignificant in all the anticipated intervention measure.
(b) Forest resources management programs	
Survey and map to show the extent and spatial distribution of the natural (undisturbed) forest as well as to determine its capacity and implement a sustainable management plan in order to meet the national requirement for lumber, fuel wood and other forest products, Promote and strengthen reforestation to rehabilitate degraded lands and at the same time to contribute towards fulfilling the requirements for fuel wood, construction wood, fodder and income generating products, Promote and strengthen agro-forestry practice to improve soil fertility and then to increase the productivity of land, and to supplement fuel wood,	Only little progress towards achievements

Targets	*Ethiopia's progress towards targets*
fodder requirements and fruits, Institutional capacity building through training,	
(c) Wildlife utilization and conservation programs	
Strengthening existing wildlife farms and establishment of new ones, Assist and promote establishment of wild life ranches, Promote and strengthen live export of wild life, Promote and strengthen wild life based tourism, Establishment of trans boundary protected areas, Protected area management plan development, Establishment of community conservation areas, Promote public conservation education and awareness creation, Infrastructure development of wild life conservation areas, Institutional capacity building through training	Some progress has been recorded
(d) Proper land use and soil conservation programs	
Establish natural resources data base including agro-climate, land-use/land cover, land suitability, etc. to facilitate preparation of development and investment plans Identify agricultural potentials and measure constraints in each agro-ecological zones or sub-zones of the country on the basis of socio-economic and biophysical conditions, Promote the practice of proper land use management, i.e. using the right land use types suitable to the given type of biophysical conditions of the land and applying management practices according to its requirement for sustainable use, through training and demonstration, Support to speed up the process of	Only in some very limited cases

Targets	*Ethiopia's progress towards targets*
issuing rural land user-right certificate in all regions, which is expected to enhance land holding security Survey and map to determine the extent of degrade lands that need treatment vis-à-vis the areas that had been treated in the recent past, Strengthens soil and water conservation (both physical and biological practice) to retain rain water where it is needed, to protect soil from erosion, to avoid erosion associated hazards and to reverse land degradation, Institutional capacity building through training	
(e) Water resources management for irrigation programs	
Promote and strengthen small-scale irrigation, Promote and strengthen medium and large-scale irrigation, Promote and strengthen water harvesting (for 7, 700, 00NP & LOHHs), Promote mini-drip irrigation method, Promote low cost manual, mechanical and electrical water lifting, Promote family drip kit, Enhance farmers capacity, Institutional capacity building	General progress seen to some extent
Rural Infrastructure (f) Rural energy	
Develop and promote alternate sources energy Technologies Biogas schemes Wind energy: wind mill pumps Wind energy: small wind generators Hydraulic ram pump Introduce and promote fuel saving	Insignificant achievement

Targets	*Ethiopia's progress towards targets*
devices-stoves,	
(g) Rural road	
Promote and strength community feeder road construction,	Encouraging progress
Obstacles	
List of obstacles encountered;	The major obstacles are: Political impediments Institutional impediments Information-based impediments Socio-economic impediments Policy & legal based impediments Natural impediments For details refer to section 1.7
Future priorities identified	
Needs and future priorities identified	The Ethiopian MDG for Rural Development and Food Security Sector identified the following: Provision of enhanced input increase in livestock and crop production and productivity, Moisture conservation and utilization, credit, training, income generating activities, market information Attain food security both at households and at national levels Safety-net and resettlement programs

B. Progress towards Targets of the Program of Work on Protected Areas (PAs)

Protected areas in Ethiopia include National Parks, Wildlife Sanctuaries, Wildlife Reserves, and Controlled Hunting Areas. Analysis of the number and size of PAs of Ethiopia before and after the development of the NBSAP, reveals that 37 PAs that cover 17.86 per cent of the land mass of the country were established before, while only a few National Parks that comprises 1.19 per cent emerged later. The total coverage of Protected Areas is 19.05 per cent. Unspecified number and area of "Millennium Parks" are also designated for the "Ethiopian Millennium 2000", which began two years ago. The total number of seedlings of indigenous and exotic species of trees planted during the past three years in line with the motto of "Two Trees for the 2000" and "Three Trees for the 3rd Millennium" per head is estimated

to be about 1.6 billion. The total area of degraded land covered by native and exotic tree species during the Millennium Initiative is estimated to be over 500,000 ha which would be additional resources that would bring positive impact on the conservation areas of the country.

Habitat fragmentation is one of the problems that are considered as a threat to biodiversity, hampering the dispersal, home range and reproductive behaviors of plants and animals. Protected areas in Ethiopia are facing a continual fragmentation from human pressures such as settlement, grazing, and agricultural expansion. Efforts to connect fragmented habitats and ecosystems are uncommon, excepting to the case at Simen Mountains National Park where Parks Administration, Development and Protection Authority and the Park's Office in collaboration with International Conservation Organizations are working to resettle illegal settlers to neighboring villages around Arquaziye area. This will help wildlife to move freely between the mountain ranges. The regional government is highly committed in supporting the resettlement project both financially and by offering the necessary administrative support. Expansion of wildlife corridor has also been made in the Park.

Ethiopia has four new and one old National Parks which qualify to be Transboundary Peace Parks (TBPA). The Gambella National Park in the west, Alatish National Park in the northwest, Kafta-Sheraro National Park in the north, and Geralle National Park in the Somali national reginal state are parks at frontiers that borders south Sudan, northeast Sudan, Eritrea and Kenya, respectively. Realizing the potentials, the Ethiopian Wildlife Conservation Authority (EWCA) has started communicating with the World Conservation Society representative at Boma (South Sudan), on the possibility of establishing TBPA joining the Gambella National Park and the Boma Conservation Area and on how to strengthen the cooperation and upgrading the two National Parks to the level of TBPA. There is similar initiation between wildlife conservation institutions of Ethiopia and Sudan on the establishment of Alatish – Dindir National Parks.

The initiative taken up to include Alatish National Park as Biosphere Reserve by the UNESCO-MAB-Ethiopian representative is also another encouraging step for expansion of protected areas in the country. As stated in Chapter two, overall status of protected areas in Ethiopia is not good and current reality is not encouraging. Most National Parks are under serious anthropogenic and natural pressures. There are exceptions where few dedicated conservation as well as development partners of international NGOs are engaged in improving management of National Parks. A full fledged Management Plan is prepared for Bale Mountains National Park, in which detailed recommendations are formulated concerning the implementation of protection activities in a 10 year perspective. Preparation of detailed management plan is also undergoing for Simen Mountains National Park by FZS and Austrian Development Cooperation. Management plan is also prepared for Alatish National Park. Generally, the over all stride in achieving the 2010 Target of protected area network is very little.

Table A3.2. Ethiopia's Progress towards Targets of the Program of Work on Protected Areas

Goal	*Target*	*Implementation status*
1.1. To establish and strengthen national and regional systems of protected areas integrated into a global network as a contribution to globally agreed goals.	By 2010, terrestrially 3/ and 2012 in the marine area, a global network of comprehensive, representative and effectively managed national and regional protected area system is established as a contribution to (i) the goal of the Strategic Plan of the Convention and the World Summit on Sustainable Development of achieving a significant reduction in the rate of biodiversity loss by 2010; (ii) the Millennium Development Goals – particularly goal 7 on ensuring environmental sustainability; and (iii) the Global Strategy for Plant Conservation	The number and size of PAs before and after the development of the NBSAP, reveals that 36 PAs that cover 17.86% of the land mass of the country were established before, while only five National Parks that comprise 1.19% have been emerged after NBSAP. The total coverage of Protected Areas is 19.05%. Unspecified number and area of "Millennium Parks" are also designated with the coming of the "New Ethiopian Millennium", 1.6 billion Seedlings of indigenous and exotic species of trees planted during the past three years under the motto "Two Trees for 2000" and "Three Trees for the 3rd Millennium".
1.2. To integrate protected areas into broader land- and seascapes and sectors so as to maintain ecological structure and function.	By 2015, all protected areas and protected area systems are integrated into the wider land- and seascape, and relevant sectors, by applying the ecosystem approach and taking into account ecological connectivity 5/ and the concept, where appropriate, of ecological networks.	Resettlement of illegal settlers at Arquaziye, Simen Mountains National Park, to neighboring villages by the wildlife authority (PADEP) and the Park's Office
1.3. To establish and strengthen regional networks,	Establish and strengthen by 2010/2012 6/ transboundary protected areas, other forms of	EWCA communicating with the World Conservation Society representative at Boma (South Sudan), on establishment of

3/ Terrestrial includes inland water ecosystems.

5/ The concept of connectivity may not be applicable to all Parties.

6/ References to marine protected area networks to be consistent with the target in the WSSD plan of implementation.

Goal	*Target*	*Implementation status*
transboundary protected areas (TBPAs) and collaboration between neighboring protected areas across national boundaries.	collaboration between neighboring protected areas across national boundaries and regional networks, to enhance the conservation and sustainable use of biological diversity, implementing the ecosystem approach, and improving international cooperation	TBPA joining the Gambella National Park and the Boma Conservation Area Initiation between EWCA and the relevant authiorty of Sudan on the establishment of Alatish – Dindir National Parks. The initiative to include Alatish National Park as Biosphere Reserve
1.4. To substantially improve site-based protected area planning and management.	All protected areas to have effective management in existence by 2012, using participatory and science-based site planning processes that incorporate clear biodiversity objectives, targets, management strategies and monitoring programs, drawing upon existing methodologies and a long-term management plan with active stakeholder involvement	A full-fledged Management Plan prepared for Bale Mountains National Park, detailed recommendations are formulated concerning the implementation of protection activities in a 10- years perspective Preparation of detailed management plan undergoing for Simen Mountains National Park by FZS, Austrian Development Cooperation Management plan prepared for Alatish National Park
1.5. To prevent and mitigate the negative impacts of key threats to protected areas.	By 2008, effective mechanisms for identifying and preventing, and/or mitigating the negative impacts of key threats to protected areas are in place.	Research on selected invasive species on going, Database on ecosystem indicator species started. Environmental Impact Assessment Policy enacted to prevent, limit or compensate negative impacts on environment in general.

Goal	*Target*	*Implementation status*
2.1. To promote equity and benefit-sharing.	Establish by 2008 mechanisms for the equitable sharing of both costs and benefits arising from the establishment and management of protected areas	Measures taken by institutions to help local people around PAs include Strategy of allocating 85% of revenues accrued from film making and controlled hunting to regional government treasuries through which annual budget development infrastructures such as school, health centers, etc is allocated. Establishing of unions of different groups that offer services to tourists and earn additional income from tourism Creation of alternative livelihood (carpentry, masonry, weaving) to people around PAs.
2.2. To enhance and secure involvement of indigenous and local communities and relevant stakeholders.	Full and effective participation by 2008, of indigenous and local communities, in full respect of their rights and recognition of their responsibilities, consistent with national law and applicable international obligations, and the participation of relevant stakeholders, in the management of existing, and the establishment and management of new, protected areas	Creating enabling environment for involvement of people in delineation of Park boundaries Provision of basic infrastructure such as schools, roads, health centers, etc
3.1. To provide an enabling policy, institutional and socio-economic environment for protected areas.	By 2008 review and revise policies as appropriate, including use of social and economic valuation and incentives, to provide a supportive enabling environment for more effective establishment and management of protected areas and protected areas systems.	Proclamation for re-establishment of EWCA Proclamation for establishment of PADPA Proclamation for establishment of regional Parks

Goal	*Target*	*Implementation status*
3.2. To build capacity for the planning, establishment and management of protected areas .	By 2010, comprehensive capacity-building programs and initiatives are implemented to develop knowledge and skills at individual, community and institutional levels, and raise professional standards	Limited effort made to build the capacity of protected area professionals Short-term trainings to scouts at National Parks and Sanctuaries
3.3. To develop, apply and transfer appropriate technologies for protected areas.	By 2010 the development, validation, and transfer of appropriate technologies and innovative approaches for the effective management of protected areas is substantially improved, taking into account decisions of the Conference of the Parties on technology transfer and cooperation.	Introduction of exotic horticultural fruits to people living near PAs representing highlands. Provision of seedlings of economically important tree species as a means to reduce illegal tree felling and obtaining additional income. Provision of improved breeds of cattle and sheep Introduction of new technology of plough tools Provision of access for solar energy

Goal	*Target*	*Implementation status*
3.4. To ensure financial sustainability of protected areas and national and regional systems of protected areas.	By 2008, sufficient financial, technical and other resources to meet the costs to effectively implement and manage national and regional systems of protected areas are secured, including both from national and international sources, particularly to support the needs of developing countries and countries with economies in transition and small island developing States.	EPA has been working as the focal point of GEF- but fund allocated for biodiversity conservation and research is insignificant No strategy is devised to secure financial sustainability from government treasury, other than the annually allocated regular and capital budget. Ministry of Science & Technology announce for a very small research grant on annual basis. The RPSUD was a source of grant for research undertakings but quit the program as of December 2007 IPGRI (now Bioversity International) has been funding IBC for research activities, *in-situ* and *ex-situ* on conservation of plant genetic resources.
3.5. To strengthen communication, education and public awareness.	By 2008 public awareness, understanding and appreciation of the importance and benefits of protected areas is significantly increased	Awareness on PAs' significance, challenges and solutions aired on Radio Programs Lectures on PAs, biodiversity conservation and related courses at different Universities, TVET Colleges, … PAs have been serving as sites, where higher learning institutions bring their students to demonstrate practical aspect of the courses given www.ibc-org has been very active in posting different issues of biodiversity, PAs and reaching its subscribed members. Leaflets and brochures prepared Panel discussions held on events of "Biodiversity Day"

Goal	*Target*	*Implementation status*
4.1. To develop and adopt minimum standards and best practices for national and regional protected area systems.	By 2008, standards, criteria, and best practices for planning, selecting, establishing, managing and governance of national and regional systems of protected areas are developed and adopted.	Most PAs in Ethiopia, even those reputed to have better management, don't fulfill the least standard expected. No standard and criteria dveloped or adopted.
4.2. To evaluate and improve the effectiveness of protected areas management.	By 2010, frameworks for monitoring, evaluating and reporting protected areas management effectiveness at sites, national and regional systems, and transboundary protected area levels adopted and implemented by Parties	One of the shortcomings of PAs Management in Ethiopia is absence of standard way of evaluating efficiency of the performance of their management.
4.3. To assess and monitor protected area status and trends.	By 2010, national and regional systems are established to enable effective monitoring of protected-area coverage, status and trends at national, regional and global scales, and to assist in evaluating progress in meeting global biodiversity targets	There are some assessment and monitoring activities being carried out in most of the National Parks and sanctuaries. However, there are no standard ways of assessing the status and trend of the ecosystem in general and data management is the biggest problem.
4.4 To ensure that scientific knowledge contributes to the establishment and effectiveness of protected areas and protected area systems.	Scientific knowledge relevant to protected areas is further developed as a contribution to their establishment, effectiveness, and management	Many post graduate studies are being carried out in protected areas. The scientific findings generated would have positive implication for future management of the conservation sites.

Annexes

Annex 1. List of some important plant genetic resources of the Ethiopian Center of Origin/Diversity

Anchote (*Coccinia abyssinica*)
Barley (*Hordeum vulgare*)
Cabbage tree (*Moringa stenopetala*)
Caster bean (*Ricinus communis*)
Chat (*Catha edulis*)
Chick pea (*Cicer arietinum*)
Coffee (*Coffea arabica*)
Cowpea (*Vigna unguiculata*)
Durum Wheat (*Triticum durum*)
Enset (*Ensete ventricosum*)
Faba bean (*Vicia faba*)
Field pea (*Pisum sativum*)
Finger millet (*Eleusine coracana*)
Gesho (*Rhamnus prinoides*)
Gomenzer (*Brassica carinata*)
Kosso (*Hagenia abyssinica*)
Lentil (*Lens culinaris*)
Noug (*Guizotia abyssinica*)
Okra (*Abelmoschus esculentus*)
Oromo potato (*Plectranthus edulis*)
Pearl millet (*Pennisetum glaucum*)
Suf (*Carthamus tinctorius*)
Seasme (*Sesamum indicum*)
Sorghum (*Sorghum bicolor*)
Teff (*Eragrostis tef*)
Yams (*Dioscorea* spp.)

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Annex 2: Size, distribution and description of protected areas of Ethiopia

Name of National Park	*Year of Establish ment*	*Area km²*	*Key species*	*No. of Species Recorded*		*Topography & Climate*	*Major Habitat Types*	*Unique Physical Features*	*Distance from A.A (km) and Location*
				Mammals	*Birds*				
Awash	1966	756	Beisa Oryx, Lesser Kudu, Waterbuck, Somme ring's Gazelle, Hamadryas & Anubis Baboon	81	>460	750-2007masl alt. range, major areas lie on 1000m asl plains, Semi-arid,	Open Grass land, Bushland, woodland, riverine forest, Doum palm forest	Waterfall, Hotsprings, Doum palm forest, Fantale crater	180, Afar & Oromia RS
Simen Mountains	1966	412	Walia Ibex, Abyssinian Wolf, Gelada Baboon	21	180	Part of Northwestern Massifs at an average elevation of 3300masl, Cold-very cold moist mountains	Afro-alpine, Sub-afro-alpine, Montane forest.	Mt. Ras-Dashen, Ethiopia's highest peak, 4543masl	875, Amhara RS
Omo	1966	4,068	Common Eland, A. Buffalo, Elephant, Cheetah, Lion, Giraffe, Topi, Brazza's Monkey	75	325	500-1100masl alt. range, and Semi-arid Savannah,	Open Grass land, Bushland, Woodland, Riverine forest, Doum palm forest	Omo and Mui Rivers,	870, Southern NNPRS
Abijata-Shalla Lakes	1975	887	White Pelican, Greater and Lesser Flamingoes, African Fish Eagle	76	439	1540-2075 masl alt. range, Larger proportion of the park area (59.9%) is covered by lakes, Semi-arid	Acacia woodland and aquatic habitat, covered by three lakes and associated wetlands	Abijata , Shala (the deepest in Africa) and Chitu lakes, l hot springs bubbling around Lake Shala.	215, Oromia RS

Name of National Park	*Year of Establish ment*	*Area km²*	*Key species*	*No. of Species Recorded*		*Topography & Climate*	*Major Habitat Types*	*Unique Physical Features*	*Distance from A.A (km) and Location*
				Mammals	*Birds*				
Bale Mountains	1969	2,471	Mountain Nyala, Minelik's Bushbuck, Abyssinian Wolf, Bohor Reedbuck, Bale Monkey	77	260	Part of Southeastern Massifs rising to a height of >400masl, Cold-very old moist mountains	Afro-alpine, Sub-afro-alpine, Montane forest.	Mt. Batu, Sante Plateau (the largest Afro-alpine habitat in Africa) and Harena Forest	400 Oromia RS
Gambella	1974	5,061	Nile Lechwe, A. Buffalo, Elephant, White Eared Cob, Roan Antelope	41	154	Humid lowland Altitude ranging 395-2300 m asl.	Woodlands, Forests, Marshy grasslands, extensive wetland areas	largest low laying wetland in the country including 4 big rivers	800 kms Gambella RS
Nechisar	1967	514	Burch ell's Zebra, Greater and Lesser Kudu, Swayne's hartebeest, Grant's Gazelle, Nile Crocodile	84	342	1108-1650 masl. Hot t-warm humid zone	Open Grassland, Savannah Woodland, Ground water forest. aquatic habitat marshy areas	Lake Abaya & Chamo, Nechisar Plain, Riftvalley escarpment, Nearby 40 springs	500 kms SPNNRS
Yangudi - Rassa	1976	4,731	African Wild Ass, Soemmoring's Gazelle, Gravey's Zebra	36	230	Arid Lowland Altitude ranging 400-1459 masl.	Open grassland, dwarf shrub	Vast open grassland plain, Awash river, Several archeological sites	420 kms Afar RS

Name of National Park	*Year of Establish ment*	*Area km²*	*Key species*	*No. of Species Recorded*		*Topography & Climate*	*Major Habitat Types*	*Unique Physical Features*	*Distance from A.A (km) and Location*
				Mammals	*Birds*				
Mago	1975	2,162	African Buffalo, Burch ell's Zebra, Hippopotamus, Gerenuk, Greater and Lesser Kudu, B. Oryx, Topi	81	257	Arid Lowland Altitude ranging 450-2528 masl.	Savannah grassland, savannah bush	Omo river	785 kms SPNNRS
Maze	2005	210	Swayne's hartebeest, Oribi, Guereza, Lion	33	138	900 – 1500 masl	Combretum-Terminalia woodland		SNNPR
Chebera-Churchura	2005	1,215	Buffalo, Elephants	37					SNNPR
Alatish	2006	2,665	Elephant,	48	180	Hot –warm sub moist plains. Altitude ranges 500-900 masl.	Bush land, scrub land, woodland, riverine vegetation and bamboo forest	Dinder/Haym a and Gelegu rivers with many tributaries & representing the Sudan-Guinea Savanna Biome	Amhara RS
Geraille	2005	3,858	Beisa Oryx. Grant's Gazelle	27			Acacia woodland, open grassland, Riverine vegetation	Dawa River	Beisa Oryx, Grant's Gazelle, Somali

Name of National Park	*Year of Establish ment*	*Area km²*	*Key species*	*No. of Species Recorded*		*Topography & Climate*	*Major Habitat Types*	*Unique Physical Features*	*Distance from A.A (km) and Location*
				Mammals	*Birds*				
Kafta-Sheraro	2007	5,000	Elephant, Roan Antelope, Greater kudu	37	163		Bush land, scrub land, woodland, riverine vegetation and bamboo forest	Tekeze River, Surrounding High Lands	1100, Elephant, Roan Antelope, Greater kudu, D. Crane, Tigray
Denqoro-Chaka	2007	47	Menelik,s Bushbuck ??	?	?	Part of Northwestern Massifs at an average elevation of 3300masl, Cold-very cold moist mountains	Sub-afro-alpine, Montane forest		Denqoro-Chaka
Abay Valley	2005	400	Nile crocodile	?	?	??	Riverine vegetation	Nile River & its falls	550, Bahir Dar
Total area		34,457							
% of parks in protected areas		3.07							
Babille Elephant S	1970	6,982	Elephant, endemic subspecies Loxodonta africana orleansi	22	-	Upper kola, alt ranging from1000-1788masl	woodland	-	550, b/n Oromiya and Somali regions
Sinkille Hartebeest S.	1976	54	Swayne's hartebeest, Bohor reedbuck, Oribi, Greater kudu	37	91	Woina dega Alt range 2020-2120masl	Savanna(grass land)	-	

Name of National Park	*Year of Establish ment*	*Area km²*	*Key species*	*No. of Species Recorded*		*Topography & Climate*	*Major Habitat Types*	*Unique Physical Features*	*Distance from A.A (km) and Location*
				Mammals	*Birds*				
Yabello Wildlife S.	-	2,496	Stresmanns Bushcrow, White-tailed Swallow, Swayne's hartebeest	43	194	Upper kolla	Savanna	Genale(juba) river	Oromiya region
Total area		9,532							
% of sanctuaries		0.85							
% of protected areas		3.92							

Annex 3

Table A3.3 Size, distribution and description of Controlled Hunting Areas (CHA) under concession & concessionaries in Ethiopia

No	Name of CHA	Year of	Area (km^2)	Key species	Number of species		Topography and climate	Major habitat types	Unique physical features	Distance From AA, and Location
					Mammals	Birds				
1	Afdem-Gewane		5,932	Soemmering's Gazelle, Dorcas						
2	Akobo		5,049							
3	Arsi		10,876							
4	Awash West		9,136	Oryx, Some. Gazelle						
5	Bale		9,663							
6	Borana		45,366							
7	Boyo Swamp		-							
8	Chercher & Arba Guggu		3,045							
9	Dabus Valley		2,127							
10	Erer-Gota		2,386							
11	Jikau		3,375							
12	Lower Wabe Shebelle		23,788							
13	Mizan-Teferi		-							
14	Murle		4,172							
15	Maze		-							
16	Omo West		4,561							
17	Segen		-							
18	Tedo		2,347							
Total			131,823							
% of Protected areas			11.77							

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