GOVERNMENT OF THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

ETHIOPIA'S NATIONAL BIODIVERSYTY STARATEGY AND ACTION PLAN 2015-2020

ETHIOPIAN BIODIVERSITY INSTITUTE

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Addis Ababa, Ethiopia

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Foreword

Ethiopian is endowed with diverse ecological and biological resources. The country is known as one of the twelve primary centers for origin and diversity of plant genetic resources in the World, and is also rich in faunal diversity. Culturally, Ethiopia is extraordinarily rich with over 70 languages spoken by nations, nationalities and peoples of different ethnic origins. The diverse cultural practices and lifestyles and management by local communities are important factors for the development, maintenance and use of the rich biological resources.

Biodiversity plays vital and diverse roles in economic, ecological and social fabrics. For example, Arabica coffee, one of the indigenous species of Ethiopia, has been the backbone of the Country's economy. It has been noted that biodiversity and its ecosystem services are the bases for the sustainable development. It can be concluded that biodiversity is the basis for all ecosystem goods and services including providing food and clean water, regulating impacts of climate change, contributing to nutrient cycling and controlling the outbreak of diseases and pests. In general, biodiversity is a fundamental building block of sustainable development as it is critical for reducing poverty, creating sustainable livelihoods and helping communities adapt to climate change. Cognizant of this fact, biodiversity and healthy ecosystems are featured prominently in the goals and targets of the Sustainable Development 2030 Agenda.

However, attributed to different manmade and natural factors, Ethiopia has been experiencing an array of serious environmental challenges that eventually are leading to loss of biodiversity and ecosystem services. In order to reverse these, there is a need for better coordination and cooperation in the conservation of our natural resources in general and biodiversity in particular. Furthermore, promoting sustainable utilization of biodiversity and public awareness raising on biodiversity and its ecosystem services are key issues to be addressed at all levels. The Federal Democratic Republic of Ethiopia has developed and also began implementing a climate-resilient green economy strategy. One of the pillars of this green economy strategy is protecting and rehabilitating forests for their economic and ecosystem services, such as carbon stocks. We need to increase conservation of our natural resources and promote their sustainable utilization. As a result, national biodiversity and ecosystem services have to be studied, valued, conserved and sustainably utilized in a way that they could bring fair and equitable benefits to all Ethiopians.

This National Biodiversity Strategy and Action plan has been prepared to guide national efforts in the conservation, sustainable utilization and access and fair and equitable benefit sharing undertakings in the Country. It is important document that provides information on biodiversity resource bases and its values as well as ecosystem services. The document further provides information on the various threats to the country's biodiversity and ecosystem services, and analyzes institutional and legal frameworks that govern biodiversity resources of the country.

Finally, I urge all relevant federal and regional institutions and other stakeholders to positively contribute towards successful implementation of this National Biodiversity Strategy and Action Plan.

Dr. Shiferaw Teklemariam
Minister
Ministry of Environment Forest and Climate Change

Foreword

Ethiopia is an agrarian country and agriculture has been the leading sector in terms of contribution to the overall economic growth and development by supplying food for domestic consumption and raw materials for the domestic manufacturing industries and primary export commodities which constitute as high as 86% of the total foreign exchange earnings. The main export agricultural commodities include coffee, oilseeds and live animals. Ethiopia's coffee is organic as more than 90% of the nation's harvested coffee is organically produced. Arabica coffee which is originated from Ethiopia has excellent and unmatched flavor and aroma. In addition to live animal export, Ethiopia also offers a wide range of processed and semi-processed hides and skins to the world market. Some of the products such as Ethiopian highland sheepskin, which has gained international reputation for making gloves, are well-known for their quality and natural characteristics. In general, the agriculture sector accounts for 85% of employment, and supplies 70% of the raw material requirements of local industries.

It has to be noted that Ethiopia is one of the world's important centers of genetic diversity and often referred as a major Vavilovian gene center. The Country is known to be a center of origin and diversity for many cultivated crop plants that have been playing significant roles in the national economy. It is a primary gene center for field crops such as Niger seed, Teff and Ethiopian mustard and a secondary gene center for crops such as Durum wheat, Barley, Sorghum, Finger millet, Linseed, Sesame, Safflower, Faba bean, Field pea, Chickpea, Lentil, Cowpea, Fenugreek and Grass pea. The indigenous landraces of various crops, their wild relatives, and the wild and weedy species are all highly prized for their potential values as sources of important traits for crop improvement programs. Among the most important traits that are believed to exist in these landraces are disease and pest resistance, nutritional quality, resistance to drought and other stress.

The major challenge for agriculture is to ensure food security, adequate nutrition and stable livelihoods for all, now and in the future, by increasing food production while adopting sustainable and efficient agriculture, sustainable consumption of resources, and landscape-level planning to ensure the conservation of biodiversity.

Therefore, there is high need to assess the status and trends of agricultural biodiversity, the underlying causes of change; identify adaptive management techniques, practices and policies; build capacity, increase awareness and promote responsible action, and mainstream agricultural biodiversity into national plans and strategies with the aim of ensuring conservation and sustainable use of our biodiversity in general and agricultural biodiversity in particular.

Finally, I request all relevant federal and regional government institutions and non-governmental organizations to mainstream biodiversity into their plans and actions and also support the implementation of the National Biodiversity strategy and Action Plan.

Tefera Deribew
Minister
Ministry of Agriculture and Natural Resources

Foreword

Ethiopia is a country of great geographical and climatic diversity, which has given rise to many and varied ecological systems. Although much of the interior of Ethiopia is dominated by highland plateau, these are interrupted by deep gorges and twelve major valleys formed by large rivers and their tributaries. These landscape diversities have contributed to the rich biodiversity in Ethiopia. The country is not only rich in biodiversity but also known for having many endemic plants and animals. For example, out of the 6000 higher plants, about 10% are endemic to the Country. Our national economy and the livelihoods of our local communities are strongly dependent on this biodiversity and its ecosystem services. Land degradation, habitat conversion for different uses, habitat fragmentations and overutilization of natural resources are among the major causes for biodiversity loss.

Ethiopia is committed to the implementation of the Convention on Biological Diversity and therefore has put in place relevant institutions and domestic legislations for the conservation and sustainable utilization of its biological resources. Furthermore, the Country declared the green economy strategy called Climate-Resilient Green Economy (CRGE) based on pillars that include:

- improving crop and livestock production practices to increase food yields, hence food security and farmer income, while reducing greenhouse gas emissions, and
- protecting and re-habilitating forests for their economic and ecosystem services, such as carbon stocks

For Ethiopia, green growth is a necessity as well as an opportunity to be seized. It is an opportunity to realize Ethiopia's huge potential in renewable energy and a necessity so as to arrest agro-ecological degradation that threatens our rich biological resources.

Rehabilitation of degraded lands using the area exclosure approaches and watershed management activities are key areas where we have achieved significant results.

In order to mitigate or reverse land degradation, poor agricultural productivity and poverty nexus problems, the Ethiopian Sustainable Land Management Investment Framework has been issued by government in the year 2010, with the aim of providing a comprehensive framework under which all stakeholders and actors in Sustainable Land Management effectively collaborate. The ESIF underlines the

urgency of reversing the high level of land degradation through the promotion and up-scaling of proven SLM technologies and approaches through multi-sector partnership in which investments and development efforts of the large number of stakeholders including Bilateral and Multilateral development partners and the Government of Ethiopia are effectively harmonized and coordinated. We strongly believe that conservation, restoration and sustainable management of ecosystems are cost-effective and ensure conservation of biodiversity, continued ecosystem services and carbon dioxide sequestration.

This National Biodiversity Strategy and Action Plan was prepared following participatory process and the set of targets are expected to bring transformation in our biodiversity conservation and use endeavors. The Ethiopian government will continue allocating resources for implementing these targets. However, we are faced with challenges of limited financial resources and lack of human and infrastructure capacity and therefore, call upon our development partners, the GEF and other relevant stakeholders to support implementation of the Ethiopian Biodiversity Strategy and Action Plan 2015-2020. Ethiopia reiterates its firm commitment to continue implementing strategies and targets that promote our sustainable development and biodiversity conservation.

Finally, I encourage all stakeholders to positively contribute to the full and effective implementation of the Ethiopian Biodiversity Strategy and Action Plan.

Bileshi Getahun
Minister
Ministry of Livestock and Fisheries

Preface

Biodiversity is directly linked to the livelihoods and economic well-beings of most Ethiopians. It touches upon almost every aspect of livelihoods, including agricultural productivity, food security, building materials, human health and nutrition, culture, climate, water resources and aesthetic values for the Ethiopian people. Despite such high importance to the country and its people, Ethiopia's biodiversity and ecosystems are threatened by multiple factors. Habitat conversion and land degradation, over exploitation, agricultural expansions, invasive alien species and pollution remain the predominant threats. Displacement of farmers' varieties/landraces and local breeds by exotics and their crosses, and unregulated use of agro- chemicals are also among the major threats to our agro biodiversity and ecosystems. Moreover, interactions of multiple threats including climate change have been increasing pressures on biodiversity and ecosystems thereby leading to their further decline, degradation and eventual loss.

In light of the growing threats to and values of biodiversity and ecosystems to the country's economic development and environmental sustainability, the Ethiopian government is committed to the conservation and sustainable utilization of the country's unique biological resources for the benefit of present and future generations. Moreover, being a party to the CBD, Ethiopia has an obligation of developing a national strategy for conservation and sustainable use of its biodiversity and integrating conservation into relevant sectoral and cross-sectoral plans. The national Biodiversity strategy and Action Plan (NBSAP) was developed following participatory process in which all regional states and other relevant stakeholders participated. Based on the national stocktaking report, national capacities and priorities, draft national Biodiversity strategy and action plan was developed and evaluated by stakeholders at different levels including three consecutive national workshops. After incorporating the feedbacks, the NBSAP 2015- 2020 of Ethiopia comprising 18 national targets, 44 indicators and 58 actions has been produced and its implementation has officially started in January 2015 following the final approval at the National stakeholders workshop.

This NBSAP is built upon the achievements and lessons learned from implementation of the previous one. It is a testimony of Ethiopia's continued commitment towards fulfilling its international obligations. The document provides a comprehensive account of the country's biodiversity; indentifies threats to biodiversity. It sets out vision, mission, principles, strategic goals, national targets and their corresponding

indicators and actions, and outlines implementation arrangement. The targets and their corresponding actions of the strategic document take into consideration concerns of conservation and sustainable use of biodiversity and ecosystem services, and access and fair and equitable sharing of benefits arising from the use of our genetic resources. The strategy will be implemented in collaboration with different stakeholders. I would like to acknowledge significant contributions of the NBSAP National Project Coordinator and technical team members. I am grateful to all federal and regional institutions and other relevant stakeholders for their contributions to this NBSAP. The preparation of this NBSAP was supported by the global Environment facility (GEF) and the United Nations Environment Program (UNEP). I would like to express my thanks to UNEP- GEF for their financial and technical support. The continuous support and guidance of the convention on biological diversity (CBD) secretariat is highly appreciated.

Finally, I request all relevant federal and regional institutions and other relevant stakeholders to mainstream biodiversity into their plans, implement the targets as appropriate and report on the achievements.

Gemedo Dalle (PhD)
Director General
Ethiopian Biodiversity Institute

ACRONYMS

ABS	Access and Benefit Sharing
BMNP	Bale Mountains National Park
CBD	Convention on Biological Diversity
CHM	Clearing House Mechanism
CoP	Conference of Parties
CRGE	Climate Resilient Green Economy
CSA	Central Statistical Agency
EBI	Ethiopian Biodiversity Institute
EIAR	Ethiopian Institute of Agricultural Research
EIPO	Ethiopian Intellectual Property Office
EPA	Environmental Protection Authority
EWCA	Ethiopian Wildlife Conservation Authority
GEF	Global Environmental Facility
HoPR	House of People's Representatives
IGAD	Intergovernmental Authority on Development
IUCN	International Union for Conservation of Nature
PFM	Participatory Forest Management
RARIs	Regional Agricultural Research Institutions
RBUs	Regional Biodiversity Units
REDD	Reducing Emissions from Deforestation and Forest Degradation
SCBD	Secretariat of the Convention on Biological Diversity
SMNP	Semien Mountains National Park

Executive Summary

Ethiopia is a country of great geographic diversity, and macro- and micro-climatic variability. The altitudinal variation of the country ranges from 126 meters below sea level in the Danakil Depression in Afar region to the highest peak of 4,620 masl at Ras Dashen Mountain. The physio-geographic features of the country are composed of high and rugged mountains, flat-topped plateaus, deep gorges, incised river valleys and rolling plains. As a result, Ethiopia is endowed with 10 ecosystems, and 18 major and 49 minor agro-ecological zones that are inhabited by great diversity of animal, plant and microbial genetic resources that make the country one of the biodiversity hotspots of the world.

The higher plant species of Ethiopia is estimated to be 6000 of which 10% are considered endemic. There are 75 breeds of cattle, sheep, goat, camel (dromedary) equines and chickens, and six species of honey bees. The species of wild mammals, birds, reptiles, fishes, amphibians and arthropods that have so far been recorded in Ethiopia are 284, 861, 201, 200, 63 and 1,225, respectively. Of the wild faunal resources; 29 mammal, 18 bird, 10 reptile, 40 fish, 25 amphibian and seven arthropod species are endemic to the country. The country is also believed to harbour a wide diversity of microbial genetic resources.

Ecosystems and biological diversity contained within them have provisioning, supporting, regulatory and cultural services. In Ethiopia, biodiversity and ecosystem services are the bases for economic and social development. Agriculture is the primary sector of the economy contributing 40.2% to the GDP and about 74.1% of export earnings. Biodiversity is also a source of tourism, and is a major input supplier to the manufacturing sector.

Biodiversity and the ecosystems of the country are facing multitudes of interlinked pressures which include habitat conversion, unsustainable utilization, invasive alien species, climate change, replacement of farmers' varieties/breeds and pollution. These resulted in eventual fragmentation and degradation of natural habitats, disturbance of ecosystem functions and loss of biodiversity and ecosystem services.

To reverse this loss, and increase the contribution of biodiversity and ecosystem services to national development, ensuring conservation and promoting sustainable utilization of biodiversity, and access and fair and equitable sharing of benefits arising from the use of genetic resources is of the utmost importance. The Government of Ethiopia recognizes the importance of biodiversity and has put in place necessary institutional and legal frameworks that govern conservation, sustainable use and access to genetic resources and the fair and equitable sharing of benefit arising from their use. The country has ratified international and regional treaties including CBD, ITPGRFA, CITES, CMS, World Heritage, AEWA and acceded to the Nagoya Protocol.

Ethiopia prepared the first National Biodiversity Strategy and Action Plan (NBSAP) that was implemented in the period between 2005 and 2010. Following the termination of the first NBSAP, the country has prepared the present Strategic Plan 2015-2020.

The process leading up to the preparation of this revised NBSAP has involved broad participation of stakeholders from governments, local communities, academic institutions, civil society and NGOs in activities ranging from accessing the required information to participation in three national workshops organized to review the draft strategy and its components.

The Ethiopian NBSAP 2015–2020 document contains eight chapters. **Chapter 1** describes variable physio-geographic and climatic features of the country. These are the bases for varied ecosystems and agro-ecological zones that are inhabited by diverse animal, plant and microbial genetic resources. It also describes administrative setup, population and economy of the country. **Chapter 2** presents an overview of the resource base of the country, namely: the ecosystem, plant, animal, microbial and cultural diversity. It also describes the protected area systems and presents summary of major factors affecting the biodiversity resource base and ecosystems of the country. **Chapter 3** deals with values of biodiversity and ecosystem services. It presents values of agricultural biodiversity and forest and its

ecosystem services. The chapter also describes direct economic and indirect ecological values of the protected area systems. **Chapter 4** treats direct and indirect causes of biodiversity loss where habitat conversion, unsustainable utilization, invasive alien species, climate change, replacement of farmers' varieties and breeds, and pollution are identified as direct causes while demographic change, poverty, and lack of awareness and coordination are identified as indirect causes. **Chapter 5** outlines institutional and legal frameworks that govern conservation, sustainable utilization and access to genetic resources and associated community knowledge and fair and equitable sharing of benefits arising from their use. **Chapter 6** describes lessons from the previous NBSAP and process of preparation of the present NBSAP. **Chapter 7** provides vision, mission and guiding principles of the NBSAP 2015-2020 and outlines the National Biodiversity Targets of Ethiopia. Implementation arrangements for the revised NBSAP of Ethiopia are outlined in **Chapter 8**.

The vision of the present NBSAP is "By 2050, Ethiopia's biodiversity and ecosystems are conserved and sustainably utilized by all sectors providing food security and contributing to poverty eradication and improved quality of life of the Ethiopian people".

The mission of this NBSAP is "By 2020, awareness of the general public and policy makers on biodiversity and ecosystem services is raised, biodiversity and ecosystem services are valued, pressures on biodiversity and ecosystems are reduced, status of biodiversity and ecosystem service are improved and access to genetic resources and fair and equitable sharing of benefits arising from their use is ensured. To realize the vision and the mission, the goals of the global Strategic Plan 2011-2020 have been adopted and 18 national targets have been developed. The targets of the Ethiopia's National Biodiversity Strategy and Action Plan 2015-2020 are:

Target 1. By 2020, awareness of public and decision makers on the values of biodiversity and ecosystem services is raised, and the steps they can take to conserve and use them sustainably is improved

Target 2. By 2020, the existing biodiversity related laws, regulations and strategies, including those associated with incentives are reviewed and gaps are addressed

Target 3. By 2020, biodiversity values and ecosystem services are communicated and integrated into national and local development and poverty reduction strategies and plans

Target 4. By 2020, habitat conversion due to expansion of agricultural land is halved from the existing rate of about 10% per year

Target 5. By 2020, unsustainable utilization of biodiversity and ecosystem services are reduced

Target 6. By 2020, the area invaded by invasive species is reduced by 75% and measures are in place to regulate and monitor invasive species, including newly emerging ones

Target 7. By 2020, area coverage of ecologically representative and effectively managed PAs is increased from 14% to 20%

Target 8. By 2020, *ex situ* conservation of agro-biodiversity, wild plants, animals and microbes; with special emphasis on endemic, endangered, economically or ecologically important species and breeds is increased and standards of the existing *ex situ* conservation are improved

Target 9. By 2020, *in situ* conservation sites for important species and breeds are increased and the standards of the existing *in situ* conservation are improved

Target 10. By 2020, the contribution of biodiversity and ecosystem services, including climate change adaptation and mitigation, is improved through increasing forest cover from 15% to 20% of the country, increased designated total area of wetlands from 4.5% to 9.0% and doubling the area of restored degraded lands

Target 11. By 2020, the number of genetic materials accessed for research and development, and fair and equitable sharing of benefits arising from their use are increased by 24% and 39%, respectively

Target 12. By 2020, women's access to and control over biodiversity resources and ecosystem services are improved

Target 13. By 2018, benefits from biodiversity are increased through value addition to at least 12 agro-biodiversity species and products, and creating market linkages for five species of medicinal plants; taking into account the needs of women and local communities

Target 14. By 2020, stakeholders' integration, including the participation of local communities in biodiversity conservation and sustainable utilization, is strengthened

Target 15. By 2017, national biodiversity information system is strengthened, information dissemination strategy is devised and Clearing House Mechanism is updated

Target 16. By 2020, knowledge and innovations related to biodiversity values, ecosystem functioning, status and trends, and the consequences of its loss are generated, reviewed, compiled and applied

Target 17. By 2020, community knowledge, innovations and practices of local communities related to biodiversity are documented, subject to the national legislation, and relevant international obligations, and integrated into the national development strategies with the full and effective participation of local communities

Target 18. By 2020, mobilization of financial resources from internal and external sources required for effective implementation of the strategy is increased substantially

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CHAPTER ONE

1. INTRODUCTION

1.1. Physio-geographic and Climatic Features

Ethiopia is located in the horn of Africa, bordering Eritrea in the North, Djibouti and Somalia in the East, Kenya in the South, and Sudan and South Sudan in the West. The country stretches from 3°N of the equator to 15°N latitude and from 33°E to 48°E longitude, and has an area of 1,127,127 km^2.

Ethiopia is a country of great geographic diversity. Erosion, volcanic eruptions, tectonic movements and subsidence have occurred for centuries in the country and still continue to occur accentuating the unevenness of the surface. As a result, Ethiopia is subjected to wide altitudinal and physio-geographic variations. The altitudinal variation of the country ranges from 126 meters below sea level in the Danakil Depression in Afar region to the highest peak of 4,620 meters above sea level (masl) on Mount Ras Dashen. The physio-geographic features are composed of high and rugged mountains, flat-topped plateaus, deep gorges, incised river valleys and rolling plains. The Great Rift Valley runs from Northeast to Southwest of the country and separates the Western and Southeastern highlands. Extensive semi-arid lowlands in the East, South and West are extensions of these highlands. Due to these physio-geographic variations, the country has variable climatic conditions within the close distances.

Macro- and micro-climatic conditions of the country are highly variable. Rainfall distribution of the country is seasonal. The major rainy season is from June to September followed by short rainy season that occurs between February and April. The mean annual rainfall ranges from 500 mm to 2800 mm. Similarly, mean annual temperatures range from below 10 to above 30°C. Because of the combined effects of the above factors, the country is endowed with diverse ecosystems. It has 10 ecosystems, and 18 major and 49 minor agro-ecological zones that are inhabited by amazingly great diversity of plant, animal and microbial genetic resources.

1.2. Administrative Regions and Population

Ethiopia is comprised of nine regions and two city administrations (Figure 1). Over eighty distinct languages having about 200 dialects are spoken in the country, making Ethiopia one of bio-culturally rich countries. Amharic is the working language of the Federal Government. English is used in academic and research institutions.

Ethiopia harbours a population of over 87.9 million, and about 83% of the people live in rural areas. Ethiopia is the second most populous country in Africa, next to Nigeria. With an annual population growth rate of more than 2%, Ethiopia will have more than 136 million people by 2029 (CSA, 2014a).

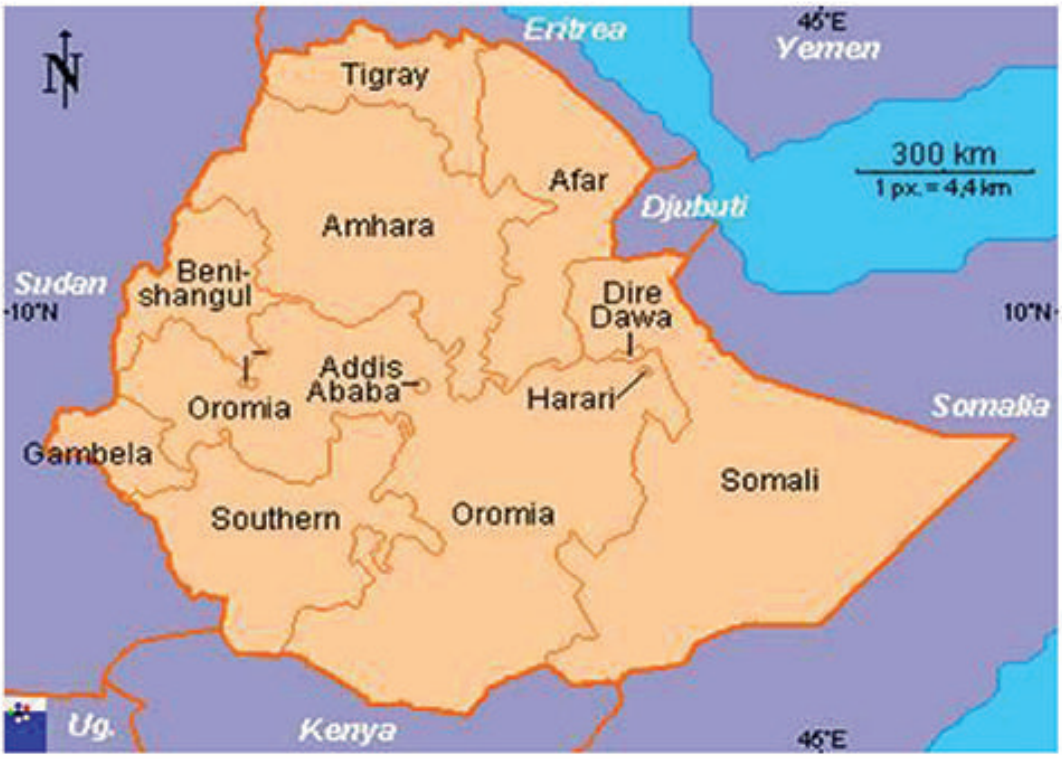

Fig. 1. Administrative setup of the Federal Democratic Republic of Ethiopia

1.3. Economy

Ethiopia's gross domestic product (GDP) has shown growth by 11% between 2010/2011 and 2013/2014. Agriculture is the primary sector of the economy contributing 40.2% to the GDP and accounted for approximately 74.1% of export. Contributions of service sectors and industry to the GDP for the same period were 46.2% and 14.3%, respectively. Ethiopia's GDP per capita was USD 631.5 in 2013/2014. Major export items included coffee, sesame, leather, flowers, gold and live animals. To support its growth, Ethiopia's foreign direct and other investment nets increased from around two billion USD in 2009/2010 to 3.8 billion USD in 2013/2014 (MoFED, 2014).

CHAPTER TWO

2. BIODIVERSITY RESOURCE BASE

2.1. Ecosystem Diversity

The diversity of ecosystems of Ethiopia has been described in a number of reports and has been indicated that Ethiopia has 10 distinct ecosystems (IBC, 2009). Classification of these ecosystems is based on vegetation types, which describe dominant plant species composition. These ecosystems are geographically located in different altitudes, and harbour unique and diverse biological resources.

Afroalpine and Subafroalpine Ecosystem

Afroalpine and Subafroalpine Ecosystem areas are found between mountain ranges of 3,200 and 4,620 masl. They include mountain slopes and tops of highest mountains such as Bale and Semien Mountains, and Menz-Guassa and Mount Guna. Some of the characteristic plant species of this ecosystem include *Alchemilla ellenbeckii, A. haumannii, Erica arborea, E. trimera, Euphorbia dumalis, Hagenia abyssinica, Hebenstreitia dentata, Hypericum revolutum, Knifofia foliosa, Lobelia rhynchopetalum, Philippia keniensis, Rosularia semiensis, Thymus schimperi, Festuca sp.*, and *Helichrysum sp.*

A number of wild animals including endemic species exist in this ecosystem. Unique mammals found in this ecosystem are Ethiopian Wolf (*Canis simensis*), Gelada Baboon (*Theropithecus gelada*), Walia Ibex (*Capra walie*), Mountain Nyala (*Tragelaphus buxtoni*), Abyssinian grass rat (*Arvicanthis abyssinicus*), Klipspriger (*Oreotragus oreotragus*), Golden Jackal (*Canis aureus*), Serval Cat (*Leptailurus serval*), Caracal (*Caracal caracal*), Ratel (*Mellivora capensis*), Yellow-spotted Rock Hyrax (*Heterohyrax bruceipo*), Anubis Baboon (*Papio anubis*), Crested Porcupine (*Hystrix cristata*) and Abyssinian Hare (*Lepus habessinicus*).

Some of the characteristic avian species of Afroalpine and Subafroalpine Ecosystem include Blue-winged Goose (*Cyanochen cyanopterus*), Wattle Ibis (*Bostrychia*

carunculata), Thick-billed Raven (*Corvus crassirostris*), White-collared Pigeon (*Columba albitorques*), and many other rare and common birds (IBC, 2005).

Status and trends

Afroalpine and Subafroalpine Ecosystem is under pressures from growing human and livestock populations of the surrounding areas and subsequent expansion of agricultural and grazing lands. Efforts are underway to improve the status of some areas of this ecosystem. For example, the Bale Mountain National Park (BMNP) is legalized, demarcated, and management and business plans are developed for effective and efficient management of the park. Other activities are also being conducted in BMNP and its surroundings to improve environmental management through ecosystem based approach.

Semien Mountain National Park (SMNP) has been re-demarcated by increasing the size of the Park. Furthermore, community managed protected Afroalpine and Subafroalpine Ecosystems such as Guassa and Abune Yosef are demarcated and legalized as parks. Surveillances of Mount Choke and Guna have been completed for subsequent designation as parks. Works are being conducted in other Afroalpine areas with emphasis on ecosystem and fauna research, monitoring and conservation, reducing the negative impact of the interactions between humans and the Afroalpine and Sub-Afroalpine wildlife, strengthening of traditional grassland management systems (in Menz), awareness raising campaigns to farmers, and feasibility studies in Wello in two national parks so as to assess their tourism potential. Activities aimed at alleviating poverty, developing and managing the environment and natural resources of the Park, through maintaining its world heritage status and by enhancing its income generation capacity for the local communities are also being conducted in Semien Mountain National Park. As a result of these interventions, a number of threatened and endemic mammals such as Walia Ibex (in SMNP) and the Ethiopian Wolf (in BMNPS and Guassa) are showing improvements over time.

Montane Grassland Ecosystem

Montane Grassland Ecosystem is found between 1,500 and 3,200 masl. It occurs on the uplands of Central, North and Western Shewa, Arsi, Bale and Borena highlands, Western and Eastern highlands of Harerge and Gojam, Southern and Northern highlands of Gonder and Wello; Eastern highlands of Tigray, and highlands of Sidama and Gamo Gofa. Trees and shrubs interspersed with grasses in this ecosystem include species such as *Acacia abyssinica, A. negrii, A. pilispina, Acokanthera schimperi, Allophylus abyssinica, Buddleja polystachya, Calpurnia aurea, Carissa spinarum, Celtis africana, Croton macrostachyus, Dovyalis abyssinica, Draceana afromontanum, Erythrina brucei, Euclea racemosa, Juniperus procera, Maesa lanceolata, Maytenus arbutifolia, Millettia ferruginea, Myrsine africana, Olea europaea* subsp. *cuspidata, Podocarpus falcatus,* and *Rosa abyssinica*. Characteristic grass genera of this ecosystem include Andropogon, Cymbopogon, Cynodon, Eragrostis, Hyparrhenia, Panicum and Pennisetum. The ecosystem is known to have high bird diversity, including the endemics.

Status and trends

Montane Grassland Ecosystem occurs in areas where human activities such as crop cultivation and livestock husbandry have been most intense for years. Livestock density is greater than the carrying capacity of the ecosystem. As a result, it has experienced a considerable habitat and land degradation. The main threats to this ecosystem emanate from agricultural expansion, overgrazing and over harvesting of selected species. Currently, in Tigray, Amhara, Oromia and Southern Nations, Nationalities and Peoples Regional State (SNNPRS), integrated soil and watershed management and area closure measures are being undertaken to rehabilitate the degraded areas.

Dry Evergreen Montane Forest and Evergreen Scrub Ecosystem

Dry Evergreen Montane Forest and Evergreen Scrub Ecosystem is situated between altitudinal ranges of 1,500 and 3,200 masl. It covers much of the highland areas and mountainous chains of Oromia (Shewa, Arsi, Bale, Borena and Harerge), Amhara

(Gojam, Wello and Gonder), Tigray (East and West Tigray) and SNNPRS (Sidama and Gamo Gofa).

Characteristic trees and shrubs of Dry Evergreen Montane Forest and Evergreen Scrub Ecosystem include *Carissa spinarum, Celtis africana, Ekebergia capensis, Euclea divinorum, Euphorbia ampliphylla, Juniperus procera, Mimusops kummel, Olea europaea* subsp. *cuspidata, Podocarpus falcatus, Prunus africana,* and *Rosa abyssinca.* In some moist areas, there are patches of highland bamboo (*Arundinaria alpine*). The common grass genera found in this ecosystem include Hyparrhenia, Eragrostis, Panicum, Sporobolus and Pennisetum.

Wild mammals found in this ecosystem include Mountain Nyala (*Tragelaphus buxtoni*), Leopard (*Panthera pardus*), Menelik's Bushbuck (*Tragelaphus scriptus*), Common Warthog (*Phacochoerus africanus*), Bohor Reedbuck (*Redunca redunca*), Olive Baboon (*Papio anubis*), Grey Duiker (*Sylvicapra grimmia*), and Spotted Hyena (*Crocuta crocuta*). Common bird species include Harwood's Francolin (*Francolinus harwoodi*), Blue-winged Goose (*Cyanochen cyanopterus*), Yellow-fronted Parrot (*Poicephalus flavifrons*), Prince Ruspoli's Turaco (*Tauraco ruspolii*), Nechisar Night Jar (*Caprimulgus solala*), Abyssinian Catbird (*Parophasma galinieri*), Abyssinian Long Claw (*Macronyx flavicollis*), Black-headed Siskin (*Spinus notata*), Yellow-throated Seedeater (*Serinus flavigula*) and Ankober Serin (*Carduelis ankoberensis*).

Status and trends

Dry Evergreen Montane Forests and Evergreen Scrub Ecosystem is under severe threat of habitat conversion caused by deforestation for wood products (especially for fuel wood), fire, agricultural expansion and overgrazing. However, the regional governments are taking various measures to improve the management status of this ecosystem. In Adaba Dodola 'woreda', Oromia, for example, state forests are given on concession and are administered by joint management of government and community through benefit sharing arrangements, carbon trade and other incentive measures. These interventions are aimed at increasing the participation and responsibilities of local communities in the management and conservation of natural

resources, mainly forests. Consequently, the status of vegetation and associated fauna are showing improvements in some areas.

Moist Montane Forest Ecosystem

Moist Montane Forest Ecosystem is found mostly on the Southwestern and Southeastern plateaus with altitudinal range between 800 and 2500 masl, and comprises the high forests of the country. Characteristic trees and shrubs found in this ecosystem include *Coffea arabica, Cordia africana, Croton macrostachyus, Erythrina brucei, Galiniera saxifraga, Ilex mitis, Maytenus harennensis, Pouteria adolfi-friederici, Rothmannia urcelliformis, Sapium ellipticum, Syzygium guineense* and *Teclea nobilis.*

The ground layer of Moist Montane Forest Ecosystem is mainly made up of herbaceous plants including species of Acanthus, Justicia, Piperoma, Impatiens, Urtica and several grass species. The epiphytes such as Canarina, Orchids, Scadoxus and fern plants such as Platycerium, Drynaria, and mosses are found in the wettest parts of this ecosystem. This ecosystem is known for its high level of endemicity. Harena forest, for example, is known for its high level of endemic plants such as *Solanecio harennensis*, and for intra-specific diversity in wild coffee.

The Montane Moist Forest Ecosystem is also home to a number of wild animals. Larger wild mammals living in this ecosystem include Lion (*Panthera leo*), Leopard (*Panthera pardus*), Serval Cat (*Leptailurus serval*), Common Jackal (*Canis aureus*), African Wild Dog (*Lycaon pictus*), Wild Cat (*Felis silvestris*), Bush Pig (*Potamochoerus larvatus*), Giant Forest Hog (*Hylochoerus meinertzhageni*), Common Warthog (*Phacochoerus africanus*), Bush Buck (*Tragelaphus scriptus*), Olive Baboon (*Papio anubis*), Grey Duicker (*Sylvicapra grimmia*), and several species of Bush Baby. Areas such as Bonga, Metu-Gore-Tepi and Tiro-Boter-Becho moist forests contain more than 15, 16 and 32 highland bird species, respectively.

Status and trends

Human activities such as timber extraction, commercial coffee and tea plantations, small-scale agriculture and grazing expansions and settlement are the major threats to Moist Montane Forest Ecosystem. The ecosystem is dominated by tree species with recalcitrant seeds. Because of this, it is susceptible to climate change.

Despite the above pressures, regional governments are taking various measures to manage and maintain the Moist Montane Forest Ecosystem. Some moist Montane forest vegetation are also given on concession for joint government and community management in which local communities are organized and encouraged to work and obtain benefits from non-timber forest products (NTFPs). Due to awareness raising activities conducted by Participatory Forest Management (PFM), people have willingly resettled out of the forest areas. Consequently, illegal timber cutting and wood collection have been minimized. Attributed to inadequate data, however, it is difficult to show trends of those forests representing this ecosystem.

Acacia-Commiphora Woodland Ecosystem

Acacia-Commiphora Woodland Ecosystem is found between 900 and 1,900 masl, and covers mainly parts of Southern, Eastern and the Rift Valley of Oromia, Afar, Harari, Somali, and Southern Nations and Nationalities and Peoples' (SNNP) regional states. The characteristic woody species of this ecosystem include *Acacia senegal, A. seyal, A. tortilis, A. mellifera, Boswellia microphylla, B. neglecta, Balanites aegyptiaca, Commiphora africana, C. myrrha, C. boranensis, C. cilliata, C. monoica* and *C. serrulata.* These species are characterized by either small deciduous or leathery persistent leaves. Species of Acalypha, Barleria, Aerva and Aloe are also common in Acacia-Commiphora Woodland Ecosystem.

Characteristic wild mammals such as Swayne's Hartebeest (*Alcelaphus buselaphus swynei*), Lesser Kudu (*Tragelaphus imberbis*), Greater Kudu (*Tragelaphus strepsiceros*), African Wild Ass (*Equus africanus*), Grevy's Zebra (*Equus grevyi*), Waterbuck (*Kobus ellipsiprymnus*), Serval Cat (*Leptailurus serval*), African Bush Elephant (*Loxodonta africana*), African Buffalo (*Syncerus caffer*), Dibatag

(*Ammodorcas clarkei*), Gerenuk (*Litocranius walleri)*, Gazelle species, Long-necked Antelopes and Oryx species, inhabit this ecosystem. Characteristic bird species include Ostrich (*Struthio camelus*), Hunter's Sunbird (*Chalcomitra hunteri*), Shining Sunbird (*Cinnyris habessinicus*), Golden-breasted Bunting (*Emberiza flaviventris*), Salvadori's Seed Eater (*Serinus xantholaemus*), Yellow-throated Seed Eater (Serinus flavigula), Ruppell's Weaver (*Ploseus galbula*), White-headed Buffalo Weaver (*Dinemellia dinemelli*), Golden-breasted Starling (*Lamprotornis regius*), White tailed Swallow (*Hirundo megaensis*) and Stresemann's Bush Crow (*Zavattariornis stresmanni*).

Status and trends

Expansion of large scale commercial agriculture for sugar cane, cotton and bio-fuel plantations are the major development activities taking place in Acacia-Commiphora Woodland Ecosystem. Introduction of crop cultivation into this ecosystem, especially in semi-arid rangelands, is a recent development contributing to land degradation and loss of biodiversity. Furthermore, intensive firewood collection and charcoal making, expansion of invasive alien species such as *Prosopis juliflora* and *Lanthana camara,* (especially in Eastern Ethiopia) have contributed to the loss of species diversity and habitat degradation of the ecosystem. Similarly, in the Borena lowlands the increase in both density and cover of indigenous woody plants has crossed the critical threshold and entered into the encroached condition. As the result; the ecosystem is deteriorating, leading to habitat loss that directly affects species diversity. However, measures are being taken to minimize or halt the invasion, especially that of Prosopis from rangelands. Efforts are also being made to designate some protected areas. Re-demarcation activities such as Awash and Abijata-Shalla National Parks are other activities that are being carried out to ensure effective management. The state of disturbance of these protected areas varies from low to moderate.

Combretum-Terminalia Woodland Ecosystem

Combretum-Terminalia Woodland Ecosystem occurs between 500 and 1,900 masl. It is found in different parts of all regions of the country. The vegetation in this ecosystem has developed under the influence of fire and many of the trees have thick corky barks. Characteristic trees and shrubs include *Anogeissus leiocarpa, Boswellia papyrifera, Combretum collinum, Lannea* spp., *Oxytenanthera abyssinica, Stereospermum kunthianum* and *Terminalia laxiflora* (IBC, 2005; 2012a). Herbaceous species of genus Justecia, Barleria, Eulophia, Chlorophytum, Hossolunda, and Ledeburia exist in this ecosystem. The grasses include species of Cymbopogon, Hyparrhenia, Echinochla, Sorghum and Pennisetum.

Wild mammals such as Swaynes' Hartebeest (*Alcelaphus buselaphus swynei*), Tiang (*Damaliscus korrigum*), Grant's gazelle (*Gazella granti*), Greater Kudu (*Tragelaphus strepsiceros*), and Lesser Kudu (*Tragelaphus imberbis*), Gerenuk (*Litocranius walleri*), Lion (*Panthera leo*), Leopard (*Panthera pardus*), Giraffe (*Giraffa camelopardalis*), African Bush Elephant (*Loxodonta africana*), African Buffalo (*Syncerus caffer*), Cheetah (*Acinonyx jubatus*) and Oryx species are found in this ecosystem. Characteristic bird species of this ecosystem include Fox Kestrel (*Falco alopex*), Ostrich (*Struthio camelus*), Red-pate Cisticola (*Cisticola ruficeps*), Green-backed Eremomela (*Eremomela canescens*), Bush Petronia (*Petronia dentata*), and Black-rumped Waxbill (*Estrilda troglodytes*).

Status and trends

Encroachment and expansion of small and large scale agriculture for crops such as sugar cane, cotton, sesame, rice and bio-fuel plantations are aggressively undertaken in the Combretum-Terminalia Woodland Ecosystem. Furthermore, overgrazing and shifting cultivation are deteriorating the ecosystem. Consequently, many wild animals (including Lion, Cheetah, Giraffe and Buffalo) and unique plants such as *Vitellaria paradoxa, Oxythanthera abyssinica*, and *Boswellia papyrifera* are under threat.

To address the threats, different efforts including plantation, implementation of PFM, awareness raising, demarcation and designation of protected areas such as Alatish, Qafta Shiraro, Anbessa Chaka and Gambella National Parks are being made in this ecosystem.

Lowland Tropical Forest Ecosystem

Lowland Tropical Forest Ecosystem is situated in the lowlands of the Eastern Gambella region in Abobo-Gog 'woreda', and adjacent areas of South Sudan border. Characteristic plant species of this ecosystem are *Baphia abyssinica* and *Tapura fischeri.* Other trees and shrubs of this ecosystem include *Alistonia boonei, Antiaris toxicaria, Celtis gomphophylla, C. toka, C.zenkeri, Diospyros abyssinica, Lecaniodiscus fraxinifolius, Malacantha alnifolia, Milicia excelsa, Trichilia prieureana, Vepris dainellii* and *Zanthoxylum lepreuri.*

Status and trends

Lowland Tropical Forest Ecosystem is facing pressure emanating from settlements and agricultural expansions. Furthermore, indiscriminate fire, shifting cultivation by land clearing which is commonly performed through slash and burn system have contributed to the shrinkage of this ecosystem. Consequently, many wild animals including large mammals such as antelopes are under threat. Conservation measures that have been taken include formulation of forest legislations, preparation of management plan, establishment of conservation areas and implementing PFM.

Desert and Semi-desert Scrubland Ecosystem

Desert and Semi-desert Scrubland Ecosystem is found in Northeastern, Eastern and Southern lowlands of Ethiopia. It occurs in the Afar Danakil Depression, Ogaden, around Lake Chew Bahir and Omo valley.

Desert and Semi-desert Scrubland Ecosystem hosts drought tolerant species including woody species such as *Acacia bricchettiana, A. stuhlmanii, A. walwalensis, Boswellia ogadensis, Commiphora longipedicellata, C. staphyleifolia, Hyphaene thebaica,* and other species of Boscia, Cadaba, Maerua, Grewia, Balanites and

Ziziphus. Grasses like *Dactyloctenium aegyptium* and *Panicum turgidum* as well as succulent plants such as Euphorbiaceae and Aloaceae are found in this ecosystem.

Wild mammals that are found in Desert and Semi-desert Scrubland Ecosystem include Soemmerring's Gazelle (*Gazella soemmerringii*), Greater Kudu (*Tragelaphus strepsiceros*), Lesser Kudu (*Tragelaphus imberbis*), Grant's Gazelle (*Gazella granti*), Gerenuk (*Litocranius walleri*), Lion (*Panthera leo*), Leopard (*Panthera pardus*), Cheetah (*Acinonyx jubatus*) and Oryx species. Characteristic bird species include Ostrich (*Struthio camelus*), Kori Bustard (*Ardeotis kori*), Arabian Bustard (*Ardeotis arabs*), Black-headed Plover (*Vanellus tectus*), Temminck's Courser (*Cursorius temminckii*), Two-banded Courser (*Smutsornis africanus*), Tawny Pipit (*Anthus campestris*), Chestnut-bellied Sand Grouse (*Pterocles exustus*), Lichstenstien's Sand Grouse (*Pterocles lichtensteinii*), Singing Bush Lark (*Mirafra cantillans*), and Masked Lark (*Spizocorys personata*).

Status and trends

Overgrazing, bush encroachment and invasive species such as *Prosopis juliflora* and *Acacia drepanolobium* in Eastern and Southern low lands of Ethiopia are among the factors threatening the Desert and Semi-desert Scrubland Ecosystem. Expansion of small and large scale agriculture such as palm tree, sugar cane and cotton are major activities taking place in this ecosystem. Furthermore, widespread firewood collection and charcoal making have contributed to the deterioration of this ecosystem.

Wetland Ecosystem

Wetland Ecosystem consists of areas of swamps, marshes, flood plains, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water depth of which at low tide does not exceed six meters (Ramsar, 1971). Wetlands deliver a wide range of ecosystem services that contribute to human well-being such as food, feed, construction materials, water supply, water purification, climate regulation,

flood regulation and eco-tourism. According to estimates by Forum for Environment (2009), Ethiopia has a wetland area of 22,600km^2.

Characteristic species of wetland ecosystem include aquatic macrophytes, common tree species such as *Acacia polyacantha, Celtis africana, Diospyros mespiliformis, Ficus sycomorus, Kigelia africana, Mimusops kummel, Phoenix reclinata, Syzygium guineense* and *Tamarindus indica*. Wild mammals such as Hippopotamus (*Hippopotamus amphibius*), Otter species and other vertebrates and invertebrates are common in this ecosystem. Bird species common to Wetland Ecosystem include Spot-breasted Plover (*Vanellus melanocephalus*), Blue-winged Goose (*Cyanochen cyanopterus*), Rouget's Rail (*Rougetius rougetii*), White-winged Flufftail (*Sarothrura ayresi*), Wattled Crane (*Bugeranus carunculatus*), Corn Crake (*Crex crex*), Shoebill (*Balaeniceps rex*), Black-winged Pratincole (*Glareola nordmanni*), Great Snipe (*Gallinago media*), and Lesser Flamingo (*Phoenicopterus minor*). This ecosystem is serving as feeding, breeding and brooding sites for a large number of resident and migrant birds.

Status and trends

Wetland Ecosystem is under pressure emanating from uncontrolled conversion of the ecosystem into agriculture (especially for rice production), over exploitation of wetland resources, deforestation, soil erosion and land degradation, siltation, settlement, climate change and pollution. The Fogera and Chefa wetlands in Amhara region are, for example, highly affected by excessive use of swamps and flood plains for cultivation of rice and other horticultural crops. Ethiopia had bad experiences regarding total loss of Lake Haramaya. Boye-Kito wetland that is found around the town of Jimma and Lake Chelelaka found in Bishoftu town have shrunk due to agricultural expansion and urbanization. Efforts are being made in some regions such as Oromia, Amhara and SNNPR to tackle these threats. To manage Wichi wetland found in Illuababor zone (Oromia region), for example, integrated watershed management, livelihood improvement, and family planning with the community are being conducted.

Aquatic Ecosystem

Ethiopian aquatic ecosystem includes rivers, reservoirs and lakes. This ecosystem harbours various species of mammals, birds, reptiles, amphibians, fishes and invertebrates. Several species of planktonic and benthic fauna have been reported from different rivers, lakes and reservoirs of the country. Moreover, many important microorganisms such as bacteria, fungi, algae and protozoa exist in aquatic ecosystems of Ethiopia. These aquatic habitats are also serving as feeding, breeding and brooding sites for a large number of resident and migrant birds, especially Lesser Flamingo (*Phoenicopterus minor*), Greater Flamingo (*Phoenicopterus roseus*), Duck and Pelican species.

Status and trends

In Ethiopia, Aquatic Ecosystem is highly affected by various anthropogenic activities such as pollution and over exploitation of fish stocks. Damming and diversion of rivers, channeling and building water distribution facilities, removal of riparian vegetation cover, mining and similar activities are playing destructive roles in changing this ecosystem. Invasive species such as Water hyacinth are becoming other threats to aquatic ecosystems of the country. Conservation efforts directed to the ecosystem are minimal, and rift valley lakes in particular are in great danger. The current trend around Lake Abijata, for example, shows that the lake could dry up in the near future. Relative importance of major direct threats by ecosystems is summarized in figure 2.

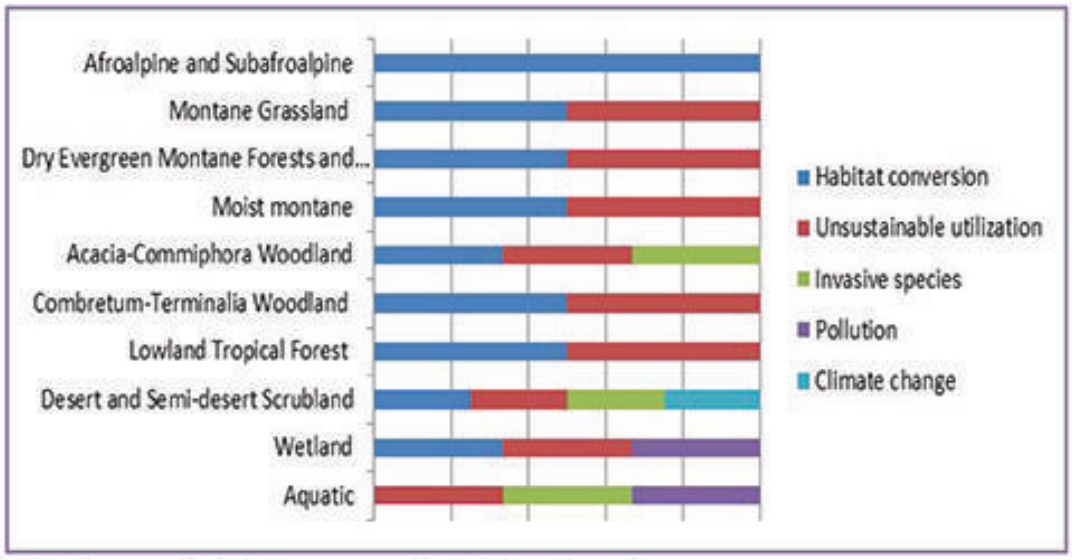

Fig. 2. Summary of relative importance of major direct threats by ecosystems

2.2. Plant Biodiversity

Higher plants of Ethiopia constitute about 6000 species of which 10% are considered to be endemic. Woody plants constitute about 1000 species (IBC, 2012a). The natural vegetation is classified into 12 major vegetation types (Friis *et al.*, 2010). Out of these, six are categorized as forest vegetation (IBC, 2012a). As the result of its diverse agro-ecologies, farming systems, socio-economic conditions and cultures; Ethiopia is endowed with diverse crop genetic resources. Thus, the country is one of the Vavilovian centers of origin and diversity for various crops (Vavilov, 1951).

2.2.1. Cultivated plants and their wild relatives

Field crops

Tef, sorghum, wheat, barley and maize are the major cereals grown in the country. Significant genetic diversity exists in tef (*Eragrostis tef*) which enables it to be adapted to various agro-ecological conditions. Many wild Eragrostis species including E*ragrsostis aethiopica*, *E. bicolor*, *E. cilianensis*, *E. curvula*, *E. minor*, *E.papposa* and *E. exicana* which are believed to be close relatives or progenitors of the cultivated tef exist in Ethiopia (Endashaw Bekele, 1978). Four morphological farmers' varieties of *Sorghum bicolor* (*bicolor, guinea, caudate* and *durra*) are grown and adapted to

different agro-ecological conditions in Ethiopia. Many of the intermediate forms as well as several of the wild and weedy forms such as S. *arundinaceum* and *S. aethiopicum* are also found in the country. Similarly, wide variations exist for wheat and barley germplasm and they are known for agronomically important traits including adaptation to abiotic and biotic stresses such as drought and disease resistance. In addition, farmers' varieties have greater performance in terms of biomass production and yield under marginal conditions (Zemede Asfaw, 2000; Worku Denbel and Ayele Badebo, 2012; Dejene Kassahun, 2014). The genus Hordeum contains about 32 species and within the species *Hordeum vulgare,* there are endemic varieties that evolved in Ethiopia and have not been reported from elsewhere. The presence of high level of variation in morphology and phenology among barley farmers' varieties grown by smallholder farmers is reported. Wide variation exists also for tetraploid wheat (*Triticum turgidum* subsp. *durum, T. turgidum* subsp. abyssinicum, *T. dicoccum, T. polonicum* and *T. compactum*) and the hexaploid wheat (*Triticum aestivum*). There are also wild/weedy tetraploid oat species (*Avena abyssinica* and *A. vaviloviana)* which are endemic to Ethiopia. *A. Abyssinia* is cultivated in northern Ethiopia and is also a weed on the arable lands, particularly in barley fields. Similarly, *Oryza barthii* and *O. longistaminata* are the wild relatives of rice that are found in the western plains and around Lake Tana, respectively.

Ethiopia is a center of diversity for many pulse crops and the presence of high diversity in various traits is reported for faba bean, chickpea, lentil, grass pea, cowpea and field pea. A unique subspecies of field pea known as *Pisum sativum* subsp. *abyssinicum* has evolved in Ethiopia and wild and primitive forms of field pea are also known to exist in the higher elevations of the country. *Lathyrus pratensis* and *L. sphaericus* which are wild relatives of grass pea are found in upland grasslands of the country. *Lablab purpureus* subsp. unciatus, the wild and sometimes cultivated sub species of *Lablab purpureus,* and *Vigna vexillata;* a relative of cowpea, are found in many parts of the country. *Lens ervoides*, the wild relative of lentil, is found in

north and central Ethiopia and *Cicer cuneatum*, the wild relative of chickpea, is found in Northern Ethiopia.

Ethiopian mustard (*Brassica carinata*), noug (*Guizotia abyssinica*), sesame (*Sesamum indicum*) and linseed (*Linum usitatisimum*) are oil seed crops for which Ethiopia is considered as a center of origin or diversity. Six Brassica species (*B. campestris, B. carinata, B. integrifolia, B. juncea, B. nigra* and *B. oleracea*) are cultivated in Ethiopia.

Although there are no completely wild species of Brassica, there exist weedy forms in the highland areas of the country. Similarly, *Guizotia* has a wild relative (*G. scabra*) that often grows in the same fields with cultivated *G. abyssinica. Sesamum indicum* is also found in wild state. Other species such as S. *latifolium, Linumholstii, L. keniense*, L. *strictum* and L. *trigynum* var. *sieberi* are among the reported wild relatives of Sesamum and Linum that grow in Ethiopia.

Similarly, there are indigenous cultivated and wild species of cotton. *Gossypium herbacium* var. *acerifolium* is believed to be domesticated in Ethiopia. The indigenous cultivated species *G. arboreum* and *G. herbaceum* are grown in home gardens and are important in traditional handicrafts. *G. anomalum* subsp. senarense, *G. somalense, G. bricchettii* and *G. benadirense* are wild relatives of cotton found in the country (Engels and Hawkes, 1991; IBC, 2012b).

There are also neglected/underutilized crops which are not widely grown by farmers in Ethiopia. These include Finger millet (*Eleusine coracana*), Pearl millet (*Pennisetum glaucum*), Emmer wheat (*Triticum dicoccum*), Pigeon pea (*Cajanascajan*), Hyacinth bean (*Lablab purpureus*), Fenugreek (*Trigonella foenum-graecum*), Lupin (*Lupinus albus*) and Yam (*Dioscorea sp.*).

Status and trends

Attributed to different factors, the number of farmers' varieties maintained by farmers is decreasing over time. In Tigray region, for example, farmers' varieties of wheat ('Shehan', 'Gerey' and 'Gomad'), barley ('Demhay' and 'Gunaza') and sorghum ('Gedalit') are among the varieties reported to have been lost due to climate change

and replacement by high yielding ones. Durum wheat is a seriously threatened crop from loss of diversity on farmers' fields.

Climate change and the threats it poses to the resilience of agricultural sector call for a better understanding of the potential of farmers' varieties to provide adaptation options to the prevailing climatic conditions (Deressa T. *et al.*, 2009; Conway and Schipper, 2011; Dejene Kassahun, 2014). Rare occurrence of durum wheat farmers' varieties during the main growing season is reported by EOSA (2007) from its survey in selected zones (West Shewa, Sidama and Arsi). The main reason for this is displacement by bread wheat varieties which took place gradually over a period of three decades. Studies on sorghum in Northeastern Ethiopia have also shown that some important farmers' varieties have disappeared either locally or regionally in 30 years' time, and many other farmers' varieties have become marginalized (Hailemichael Shewayrga *et al.*, 2008).

The factors affecting the state of field crop genetic resources include displacement of farmers' varieties by improved ones, shift to market oriented crop production, diseases and pests, frequent drought, and unreliable rainfall. The later affects not only farmers' varieties but also improved ones.

Most of the crop wild relatives are found growing as weeds on marginal fields, traditionally managed agricultural lands and in disturbed habitats such as roadsides. The natural populations of many species of crop wild relatives are increasingly at risk. They are threatened primarily by habitat loss, degradation and fragmentation. Climate change is posing significant impacts on species distributions through reducing suitable habitat and increasing the rate of habitat fragmentation.

In order to conserve and promote sustainable utilization, Ethiopian Biodiversity Institute (EBI) has conserved different field crops in cold room. The majority of plant species conserved in the genebank are field crops. To promote on-farm conservation activities, over 12 community seed banks have been established, out of these eight are in good status. The community seed banks obtain technical support from EBI and Ethio-organic Seed Action (EOSA) to strengthen their capacity and ensure the

continued cultivation of farmers' varieties. Recently, additional five on-farm conservation sites are being established in the SNNPRS. The community seed banks are intended to enhance the access to diverse crop genetic resources. In addition, Ethiopian Biodiversity Institute is now part of a global initiative called the Seeds for Needs that was initiated with Bioversity International. The initiative aims at understanding the potential of genetic diversity to adapt to climate change and to be reintroduced in production systems (Gotor *et al.*, 2014).

Horticultural crops

Horticultural plant species grown in Ethiopia include root and tuber crops, fruits and vegetables, stimulant and beverage, and herbs and spices. The most important root and tuber crops of Ethiopia are enset (*Ensete venricosum),* anchote (*Coccinia abyssinica*), Ethiopian potato (*Plectranthus edulis*) and yams (*Dioscorea spp.*).

Anchote, enset and Ethiopian potato are found both in cultivated and wild states. There is tremendous variation among enset varieties in morphological characters, disease resistance, product quality and use value. In Ethiopia, the genus Plectranthus has 32 species. Among these, *P. garckeanus* is endemic to the country. Out of the ten species of *Coccinia* that are found in Ethiopia, only *C. abyssinica* is cultivated for human consumption. Other root crops that occur in the country include taro (*Colocasia esculenta*), tannia (*Xanthosoma saqitiffolium*), cassava *(Manihot esculenta*), potato *(Solanum tuberosum*) and sweet potato (*Ipomoea batatas*). Potato and sweet potato have limited intra-specific diversity while taro and tannia are naturalized and diversified.

About 38 fruit plant species are cultivated in Ethiopia. Among these, pineapple (*Ananas comosus*), papaya (*Carica papaya*), sweet orange (*Citrus sinensis*), mango (*Mangifera indica*), banana (*Musa paradisca*) and avocado (*Persea americana*) are naturalized to the Ethiopian agro-ecologies and have many varieties (IBC, 2012b).

Widely cultivated vegetable species include pepper, garlic, shallot, tomato, cabbage, carrot, beetroot, pumpkin and okra. Okra (*Abelmoschus esculentus)* is believed to be domesticated in Ethiopia and has high diversity and its wild relative, *A. ficulneus,* is

found in western Ethiopia. Cabbage tree (*Moringa stenopetala*) is another important vegetable indigenous to Ethiopia with multiple values such as food, feed, medicine and shade.

The most important stimulant and beverage species that are found in Ethiopia are coffee (*Coffea arabica),* chat (*Catha edulis*), tea (*Camellia chinensis)* and shiny-leaf buckthorn *(Rhamnus prinoides)*. Arabica coffee in Ethiopia has enormous phenotypic diversity in both quantitative and qualitative characters. There is an extremely high variability in disease and pest resistance, liquoring quality, caffeine content and other traits. Reports (Engels and Hawkes, 1991; IBC, 2012b) indicate that Ethiopia is either a center of origin or diversity for spices like Ethiopian cardamom *(Aframomum corrorima*), long pepper *(Piper longum),* black cumin (*Nigella sativa*), cumin/bishop's weed (*Carum copticum*), coriander (*Coriandrum sativum*), thyme (*Thymus schimperi*) and fenugreek *(Trigonella foenum-graecum*).

Status and trends

In Ethiopia, major threats to horticultural plant species are drought, pests, disease, replacement by food grains and deforestation. Deforestation mainly affects wild coffee and spices. The gene pool of *Coffea arabica* is highly endangered by increasing settlement and land-use pressure on the montane rainforests. Enset is experiencing loss of its populations and diversity caused by family size increment and land shortage that forces the household to consume it at early stages (Abraham Shumbulo *et al.*, 2012). Imported varieties of horticultural crops are also becoming threats to farmers' varieties. Local mango variety in Wellega, for example, has been replaced by mango from Pakistan which is highly susceptible to white skin disease.

Ethiopian Biodiversity Institute has established a number of field genebanks in agro-ecologically representative parts of the country to conserve and promote sustainable utilization of horticultural crops. Currently, over 6,200 accessions of coffee, spices, and root and tuber crops are conserved in these field genebanks.

2.2.2. Wild plants

Forest genetic resources

Ethiopia has 12.3 million hectares of forests comprising of natural and planted forests, woodland, with a coverage of about 15% of the country. There are also huge areas that are covered by wooded grasslands. Apart from the natural and the planted forests, the forest genetic resources of the country include trees outside natural forests, which are mainly found in traditional agro-forestry system. Planted forests constitute over 972,000ha (Million Bekele, 2011). The area coverage of trees and shrubs that are found on farm lands is not clearly known.

The Ethiopian forests and woodlands are depositories and gene pools for several domesticated and/or important wild plants and wild relatives of domesticated plants. Species richness varied across forests, depending on environmental factors characterizing the forests. Woodlands and shrub lands of Ethiopia comprise of different vegetation types with diverse tree and shrub species.

Status and trends

Forest resources of Ethiopia are seriously threatened by deforestation, habitat destruction and subsequent decline in regeneration, expansion of exotic and invasive species, agricultural expansion, forest fires and deforestation for farming and/or settlement. The most important threats to forest genetic diversity are results of deforestation and forest fragmentation. A total of 103 tree and shrub species are considered as endangered species in the IUCN red list (Annex I).

Illegal logging, firewood collection, overgrazing and invasive species are threats to forests throughout the country. Land use change including commercial farming and population pressure are other threats to forest and rangeland plants. In Benshangul Gumuz region, for example, forest and other vegetation cover is reported to have declined from 80 to 50%. As a result, *Boswellia papyrifera* and *Oxytenanthera abyssinica* (Yekola Bamboo) are among the highly threatened species in the region (MoFED, 2011; IBC, 2012a,d).

In order to conserve and promote sustainable utilization of forest and rangeland plant genetic resources, a total of 2000 accessions of 260 forest species are conserved at genebanks of Ethiopian Biodiversity Institute (EBI). Forests are also being conserved in Protected Areas (PAs), National Forest Priority Areas (NFPA), and other *in situ* conservation sites such as area closures, church forests, sacred forests and community forests. Because of the increasing human and livestock pressures on the resource base, and lack of sustainable management; however, the status of PAs, including National Forest Priority Areas (NFPAs) are deteriorating. In response, the forests in Yayu, Kafa and Sheka have been designated as Biosphere reserves by UNESCO and fifteen *in situ* sites have been established by EBI in Benshangul Gumuz, SNNP and Oromia regions.

Regional governments are taking various measures to improve the management status of some forests and rangeland plants in their respective regions. In Amhara region, for example, area closure is playing an important role in increasing the natural bush land coverage of the region. In Oromia region, forests are given on concession to be administered by joint management of regional government and community through benefit sharing arrangements, carbon trade and other incentive measures. In order to increase the roles and responsibilities of local communities in the management and conservation of their natural resources; mainly forests, local communities around the forests are organized into associations and engaged in other income generating Non-timber Forest Products (NTFPs) activities.

Medicinal plants

Medicinal plants have significant roles in traditional health care delivery system in Ethiopia, where more than 70% of human and 90% of livestock populations depend on traditional medicine. Of the total medicinal plant species, 2.7% are endemic to Ethiopia; and most are found in the wild (IBC, 2005). The extent of species diversity and variability has been described and documented for some localities. From the total of 230 medicinal plant species identified from an assessment made in Mana Angetu 'woreda', Southeastern Ethiopia, for example, 78.70, 11.74 and 9.57% are

used as human medicines, livestock medicines, and for treating both human and livestock ailments, respectively (Ermias Lulekal, 2008). Similarly, 74 veterinary medicinal plant species that were distributed among 64 genera and 37 families were recorded in Bale Mountains National Park (BMNP) and adjacent areas (Haile Yineger *et al.*, 2007).

Status and trends

Majority of the medicinal plants utilized in Ethiopia are harvested from the wild. Therefore, most of the threats to the forest and rangeland plants are also threats to medicinal plants. These include environmental degradation, agricultural expansion, loss of forests and woodlands, fire and cultivation of marginal lands. Moreover, uprooting and unsustainable utilization are the major threats to medicinal plants in Ethiopia. Traditional medicines such as *Taverniera abyssinica* is critically endangered due to overuse. Species such as *Hagenia abyssinica* and *Prunus africana* which are also harvested for non-medicinal values such as timber, fuel wood and other purposes are subjected to multiple pressures. Some efforts have been made to conserve and promote sustainable utilization of medicinal plants in the country. For example, EBI has established *ex situ* conservation sites in representative areas of the country, including Wondo Genet and Bale-Goba medicinal plants field gene banks.

Rangeland and forage genetic resources

There is a wide range of forage resources that are adapted to different ecosystems in the country. Ethiopia is known to be a centre of diversity for a number of important forage species in the genera *Trifolium, Vigna,* and *Dolichos*, which are herbaceous legumes, among others. Out of the 26 indigenous species of Trifolium, eight are endemic to Ethiopia. Major forage species of the country include *Stylosanthes fruticosa*, *Neonotonia wightii*, and species of Alysicarpus, Indigofera, Tephrosia, Acacia, Erythrina, Pennisetum, Rhynchosia, Trifolium, Medicago, Brachiaria, and Crotalaria. There are 159 genera with 569 species of grasses, 108 genera with 358 species of legumes and 179 species of trees used by domestic animals. Attributed to

various factors, however, many of these palatable species are highly threatened (IBC, 2009).

Status and trends

Overgrazing and/or browsing, drought, invasive species and conversion of grazing lands to crop lands are the main threats to forage species. Invasion by non-palatable indigenous species such as *Acacia mellifera*, *A. nubica*, and other invasive alien species such as *Prosopis juliflora* and *Parthenium hysterophorus* and overgrazing have resulted in the loss of high quality and palatable plants in the rangelands. According to data and information obtained from bureaus of agriculture of Afar region, *P. juliflora* alone covers about 51,000 ha of rangelands of the region. Similarly, most of the grass and bush lands in the lowland areas of Oromia region are invaded by *P. juliflora*. In Amhara region, expansion of farmlands is reported to be a major threat to its rangelands and forage genetic resources.

Activities such as clearing invasive species, selecting and multiplying productive forage species adaptable to specific area, testing indigenous tree species suitable for feed, banning open grazing and enclosing rangelands are undertaken to ease the pressure on rangelands and forage resources of the country.

Edible wild plant genetic resources

Edible wild plants (EWPs) have supplementary, seasonal and emergency roles in the communities in Ethiopia. Some EWPs such as *Berchemia discolor, Carissa spinarium, Amaranthus graecizans, Amorphophallus gallaensis, Dovyalis abyssinica* and *Mimusops kummel*are also used as a source of income. A review documented by Ermias Lulekal *et al.* (2011) indicated that 413 species of EWPs representing 224 genera and 77 families have been identified so far. Among these, Fabaceae is the most diverse family represented by 35 species of EWPs.

Status and trends

In Ethiopia, studies conducted on EWPs cover only about 5% of the country. Hence, the state of EWPs in Ethiopia is not well known. The contribution of EWPs and

associated community knowledge to food security is neglected. Factors that threaten forest resources are also the threats to EWPs and their natural ecosystems, resulting in a decrease in the diversity of EWPs from time to time.

2.3. Animal Biodiversity

2.3.1. Farm animal genetic resources

Ethiopia has served as a gateway to domestic animals from Asia to Africa and the country's diverse ecology favored the diversification of these resources. In terms of livestock population, Ethiopia stands first in Africa and 10th in the world. The most common farm animals of the country are categorized into mammals, avian and honeybees. Cattle, sheep, goats, camels, donkeys, horses and mules are the major farm animals that lie under the mammalian category. Under the avian category are chicken, ostrich and turkey. However, the latter two avian species are not widely used in the country.

According to EBI (2014) and IBC (2012c) the number of breeds of cattle, sheep, goat, camel (dromedary), donkey, horse, mule and chickens identified so far are 28, 9, 8, 7, 6, 8, 2, and 7; respectively (Annex II). As a result of breed characterization and identification works being conducted in the country, the number of breeds of cattle, sheep, goats, camel, horse, and chicken shows some variations from former reports (IBC, 2004). There are five geographical races of honeybees (*Apis mellifera monticola, A. m. jemenitica, A. m. bandasii, A. m. scutellata* and *A. m. woyi-gambela*) which are economically important in the country. Other than these races of honeybees, there are bee species called stingless bees (meliponini) or 'Tazima nib', which make special honey.

Although majority of the Ethiopian livestock are indigenous breeds, some exotic cattle, sheep, goats and chicken breeds have been introduced by different institutions in the last four decades. The number of breeds of cattle, sheep, goat and chicken imported so far are 7, 7, 3, and 14, respectively (IBC, 2004, 2012c).

Out of the exotics; Holstein-Friesians and Jersey cattle, and their crosses with different indigenous breeds are the majority (IBC, 2012c). Crossbreeds used under medium input production system are those produced from crossings between exotic sires and five indigenous dam breeds, namely: Borena, Horro, Fogera, Arsi and Begait.

Similarly there are several exotic poultry breeds and their crosses in the country. The current blood level composition of indigenous, hybrids and pure exotics of poultry is 96.83%, 2.37% and 0.80%, respectively (CSA, 2014b). Thus; several layer, broiler and dual-purpose exotic chicken breeds and hybrids are being used by small and large-scale commercial producers in urban and peri-urban areas. In addition, some of their crosses with indigenous chicken are used by rural smallholders for egg and meat production.

Status and trends

Population of domestic animals of the rural sedentary areas of country (excluding three mobile pastoralist zones of Afar and six zones of Somali regions) is estimated at 55.03 million cattle, 27.35 million sheep, 28.16 million goats, 1.1 million camels, 51.35 million chickens, 1.96 million horses, 0.36 million mules and 6.95 million donkeys (CSA, 2014b). Trends in livestock population over the last six years are presented in Figures 3 and 4.

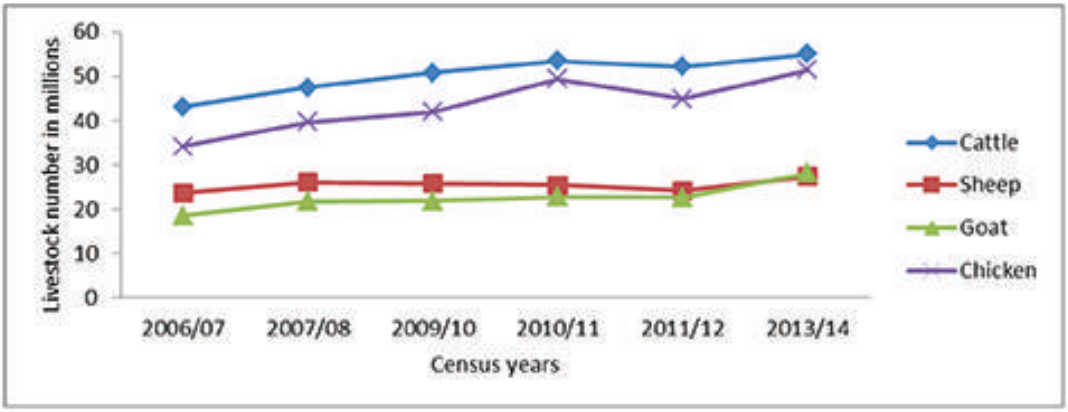

Fig. 3. Change in population size of cattle, sheep, goats and chicken

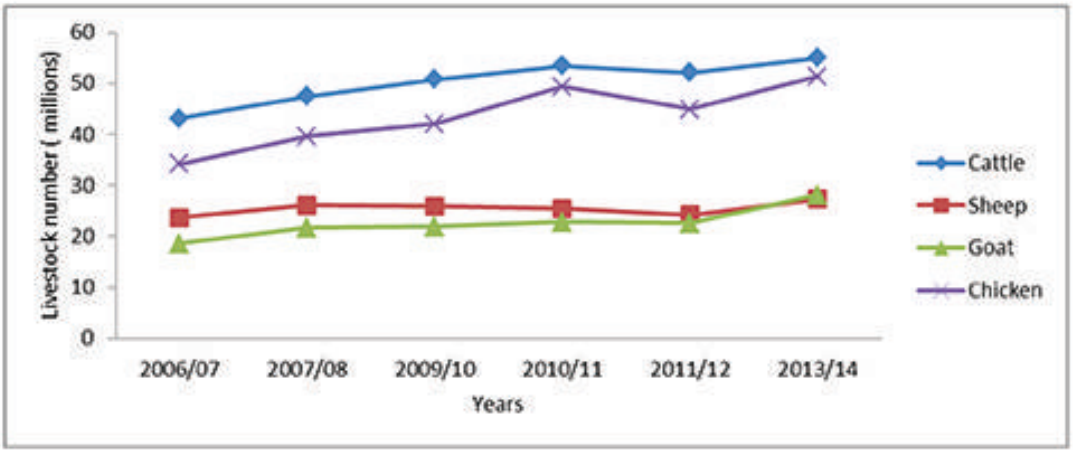

Fig. 4. Change in population size of horses, donkeys, mules and camels

Though increase in population size doesn't necessarily show the status of the domestic animal diversity in the country, given that the majority of the livestock populations are indigenous breeds, it appears that the resource is thriving well (CSA, 2014b).

Identification and characterization activities conducted on livestock resources of Ethiopia are not exhaustive. As a result, there is no complete and up-to-date breed level data for most of the breeds, and this makes determination of the status and trends difficult. There are, however, some indigenous breeds which are known to be found at different threat levels. Sheko (the only taurine breed in East Africa) and Fogera cattle appear to be highly threatened as a result of interbreeding with other local breeds and changes in the production systems. In addition; Begait, Irob, Ogaden, Afar and Borena cattle breeds; Sinnar donkey, and Afar, Menz and Gumuz sheep breeds are also facing various degrees of threats.

Ever increasing demand for export (both legal and illegal) market of cattle, goats, sheep and camels seems to threaten the resources since the size and selection of export animals does not commensurate the off-take rate or the traditional breeding systems. This can be demonstrated by the large proportion of young and breeding animals supplied to the market (IBC, 2009).

Some activities are underway to conserve domestic animal diversity. To promote conservation and sustainable utilization of local breeds, ranches have been established in different parts of the country for Begait, Borena, Horro and Fogera cattle breeds. Furthermore, semen from Fogera, Begait, Sheko and Irob indigenous cattle breeds has been collected and cryo-conserved. Sheko, Irob Begait, Afar and Begaria cattle; Afar sheep, and Black Head Somali sheep; Woito-Guji and Abergele goat; Kundudo horse breeds as well as Mandura chicken breeds have been conserved *in situ*.

In Ethiopia, major causes of threat to the farm animal genetic resources are feed shortage, overgrazing, encroachment by invasive species and expansion of crop cultivation into both grazing lands in the highlands and marginal areas in the lowlands. Additional threats emanate from crossbreeding, interbreeding, diseases and parasites, shortage of quality drinking water and poor housing. Particularly, the gene pool of indigenous chicken breeds is under pressure from replacement by pure exotics and their hybrids (IBC, 2012c,d).

Due to diverse climatic conditions and rich and diverse flora, Ethiopia has large number of honeybee colonies. Ethiopia possesses over 10 million bee colonies. Out of these, about five to seven and half million are estimated to be hived while the remaining exist in the wild (CSA, 2009). There are also three types of beekeeping systems in Ethiopia, namely: traditional, transitional and modern systems. However, more than 95% of bee-keepers use traditional system (IBC, 2012c). Major threats to honeybees are vegetation loss, diseases and pests, predators, and pesticide and herbicides (IBC; 2004, 2005, 2012d).

2.3.2. Wild animal genetic resources

Ethiopia encompasses a broad range of ecosystems with great varieties of habitats contributing to the occurrence of high faunal diversity. Data and information on the diversity of wild fauna as a whole is not yet complete. According to the existing data, the Ethiopian wild fauna is comprised of 284 mammal, 861 bird, 201 reptile, 200 fish, 63 amphibian and 1,225 arthropod (out of which 324 butterfly) species. Of these

faunal resources, 29 mammal, 18 bird, 10 reptile, 40 fish, 25 amphibians and seven arthropods species are endemic to the country (USAID, 2008; IBC, 2009; Redeat Habteselassie, 2012). The variety of species and great proportion of endemicity within the group, especially in the highlands is the result of the isolation of the highland areas of the country from other highlands within and outside the country by the surrounding lowlands (IBC, 2005).

McKee (2007) described a number of charismatic flagship species of mammals in Ethiopia, most notably the Gelada (an endemic genus and the world's only grazing primate), the Mountain Nyala, the Ethiopian Wolf and the Walia Ibex (the later species confined to areas in the Simien Mountains). There are also remnant populations of Elephant (an estimated 850, including 150 of *Loxodonta africana orleansi*), Lions (an estimated 1,000) and large ungulates. Spotted hyenas are abundant. There is at least one or two isolated populations of black rhino (IUCN, 2007 cited in USAID, 2008), but it is widely believed that this species might have gone extict.

Ethiopia has also a rich avifauna which is about 40% of Africa's total. Out of 861 species of birds, at least 596 are resident and 224 are regular seasonal migrants, including 176 from the Palearctic; a further 13 are shared with Eritrea. A remarkable 69 Important Bird Areas (IBAs) were defined by the Ethiopian Wildlife and Natural History Society. These areas cover 47,757 km^2, equivalent to at least 4.3% of the land area of the country (Bird Life International, 2001). The major IBAs of Ethiopia are presented in figure 5 and their list is attached as Annex III.

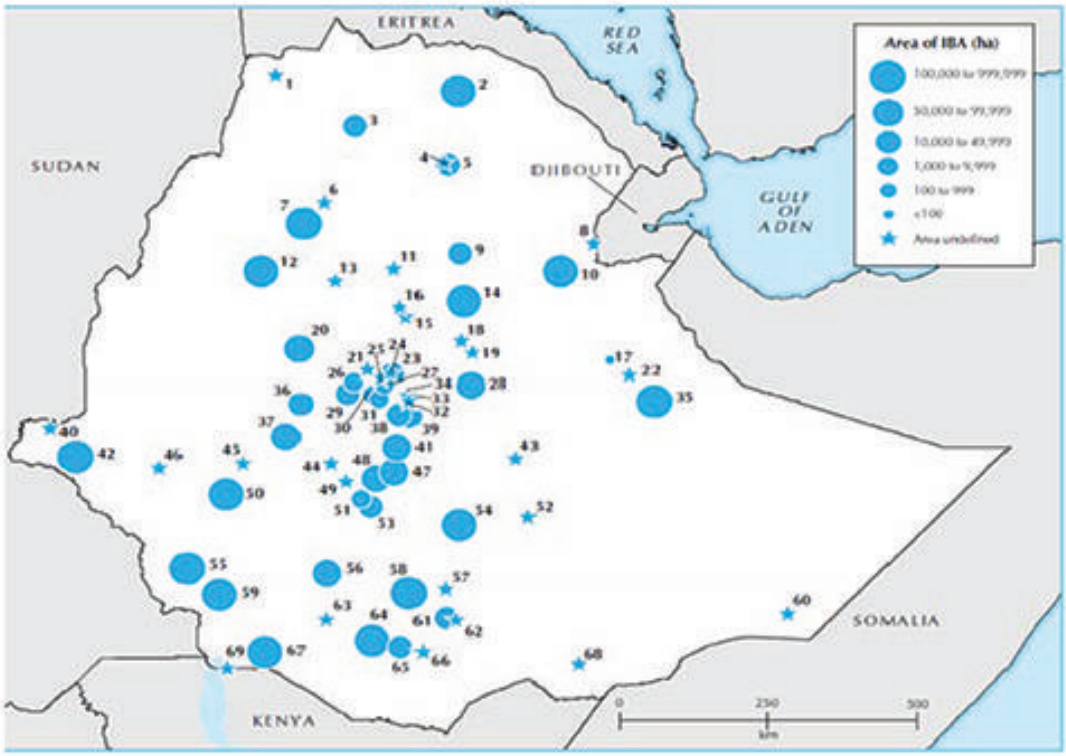

Fig. 5. Important Birds Areas of Ethiopia (Birdlife International, 2001)

Insects are dominant in aquatic and forest ecosystems, and occupy all conceivable habitats. However, arthropod fauna of Ethiopia including insects is poorly known. Similarly, data and information on amphibians of the country is very poor. A study on the Amphibian species composition of Lake Tana sub basin indicated that the sub basin comprises 17 species of amphibians belonging to nine genera and five families, with three endemic species. Thirty five species of reptiles belonging to three orders, 11 families and 25 genera have so far been recorded in the sub basin, out of which two are endemic (Seyoum Mengistu *et al.*, 2005).

There are about 30 major lakes, six major river basins and over 70 wetlands that are located in different parts of the country. The number of fish, benthic and aquatic insects and zooplankton species identified from the aquatic and wetland ecosystems so far is 200, 91, and 141, respectively (Abebe Getahun and Eshete Dejene, 2012; Redeat Habteselassie, 2012).

The major threats to aquatic and wetland animals are habitat degradation, over-harvesting, unbalanced water utilization, change in water flow (flow modification), siltation, mining, draining of wetlands for other land use and pollution. These activities might cause extinction of fish and some other aquatic biota that could not tolerate those pressures (Abebe Getahun and Eshete Dejene, 2012). The fish diversity in Lake Abijata, for example, is highly threatened by the increasing water extraction, high siltation and change in habitat. Lake Awassa is also highly polluted by municipal waste and a nearby hospital waste disposal, threatening the biodiversity therein. As a result of these threats, the populations of tilapia from lakes Awassa and Ziway, and Nile perch from Lake Chamo are exhibiting signs of over exploitation (FAO, 2005; Assefa Mitike, 2014). The hitherto efforts for the conservation of the aquatic ecosystems are very limited.

Status and trends

Information on the status and trends of wild fauna as whole is limited. According to the International Union for the Conservation of Nature's (IUCN, 2008) red list, Ethiopia has five critically endangered, 27 endangered, and 47 vulnerable species of wild animals.

Of the total 284 mammalian species, those that require urgent conservation action include Walia Ibex (*Capra walie*), Gelada Baboon (*Theropithecus gelada*), Mountain Nyala (*Tragelaphus buxtoni*), Ethiopian Wolf (*Canis simensis*) and Starck's Hare (*Lepus starcki).* Some of these endangered species have very restricted distribution, including Walia Ibex, which is the most endangered mammalian species in the world (IBC, 2005, 2009). All wild mammals which occur in Ethiopia and rated as critically endangered (CR), endangered (EN) or vulnerable (VU) in the 2004 IUCN Red List of threatened animals are presented in Annex IV.

Assessments on the status of birds in Ethiopia indicated that 31 bird species of the country are facing various levels of threats. Five of these, namely: *Sarothrura ayresii*, *Tauraco ruspolii*, *Heteromirafra sidamoensis*, *Serinus flavigula* and *Serinus ankoberensis* are critically endangered, 12 species such as *Aythya nyroca*, *Aquila*

clanga, *A. heliaca*, *Falco naumanni* and *Francolinus harwoodi* are endangered, and 14 species such as Prince Ruspoli's Turaco, Greater Spotted Eagle, Lesser Kestrel, Yellow throated Serin, Nechisar Nightjar and Wattled Crane are vulnerable to extinction. Various migratory birds considered as endangered at the international level also visit about fifty sites in Ethiopia every year. Moreover, parts or all of the three Endemic Bird Areas (EBAs) lie within Ethiopia. These are the Jubba and Shabelle valleys EBA, the South Ethiopian highlands EBA and the central Ethiopian highlands EBA (BirdLife International, 2001).

According to IUCN (2008), the number of threatened species (critically endangered, endangered and vulnerable) of reptiles, amphibians, fishes, mollusks and other invertebrates are 1, 9, 2, 3, and 11; respectively. Among the reptiles, python has been critically endangered in the Lake Tana sub basin due to habitat fragmentation and loss, and partly due to persecution by humans. Three species of reptiles, namely: the Nile crocodile, Water snake and Nile monitor that are found in the sub basin are rated as vulnerable (Seyoum Mengistu *et al.*, 2005). Some herps are facing high pressure and there is a possibility of extinction due to habitat destruction (Largen and Spawls, 2006).

In order to conserve the wildlife genetic resources, Ethiopia has established different types of protected areas (PAs). These are national and regional parks, sanctuaries, reserves, rescue centres, controlled hunting areas, botanical gardens, national forest priority areas and biosphere reserves. There are also other types of PAs which include lands protected by belief systems, forest and plant scientific research projects.

At present, the size of the PAs is estimated at 14% of the country's area. Several PAs such as such as Alatish, Omo, Maze and Chebera Churchura have been gazetted at regional levels (Young, 2012) while seven national parks have been gazetted at federal level.

All the important ecosystems in the country are not represented in the existing PAs. This is a major drawback for conservation of threatened endemic and unique

species. Even the areas dedicated for wildlife protection are faced with many problems such as limited institutional, legal and financial capacities; population growth, deforestation, invasive species and open access to resources, conversion of natural habitat to agricultural lands and overgrazing by large livestock population (USAID/Africa, 2008; EWCA, 2009). Different PA systems of Ethiopia are presented in Table 1 and figure 6.

Table 1. Protected area systems of Ethiopia

Types of protected area systems	Total (No.)
National parks	21
Wildlife sanctuaries	2
Wildlife reserves	3
Controlled hunting areas	20
Community conservation areas	6
Wild life rescue centers	2
Community managed ecotourism and hunting areas	2
Open hunting areas	6
Commercial ranches	3
Botanical gardens and herbariums	2
Biosphere reserves	4
National priority forest areas	80
Municipal parks	3
Land occupied by research centers, governmental institutions	36

Source: Young (2012)

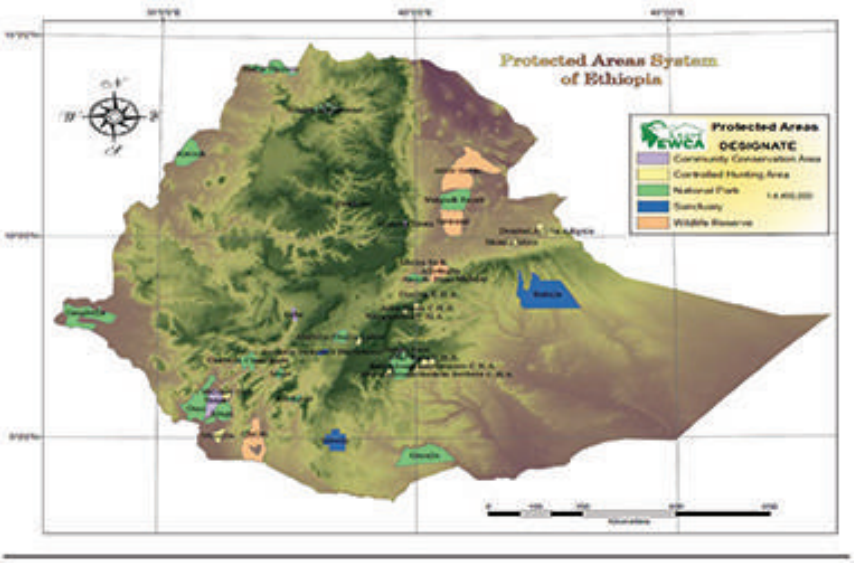

Fig. 6. Distribution of PA types in Ethiopia (Vreugdenhil *et al.*, 2012)

2.4. Microbial Biodiversity

Ethiopia is believed to harbour a wide diversity of microbial resources which, however, are hardly explored, collected, identified, characterized and conserved. Among the little known are those that are used in the fermentation processes in traditional foods and beverages, diseases control, biological pest control, soil fertility, reduction of post-harvest losses, improving human and animal health, improving environmental safety, reduction of wastes and/or its bioconversion into useful products. Researches on microbes have been going on for the last four decades. They have been mainly driven to generate data on some outstanding agricultural and health problems and initiated with the aim of identifying and characterizing microbes with academic goals.

Considerable numbers of microbes have been identified by institutions working in the sector. Even though there exist limited data on the number of collections held by the stakeholder institutions, EBI has identified and conserved 550 species of bacteria, fungi and microalgae in its genebank.

Status and trends

Data on the level of threats to microbial genetic resources of the country is lacking. However, all factors affecting ecosystems, and plant and animal biodiversity are believed to affect directly or indirectly the microbial genetic resource base of the country. Therefore, collecting, identifying and conserving the microbial genetic resources of the country will be a forthcoming major task.

2.5. Cultural Diversity

Ethiopia is a country of cultural mosaic. There exist over 80 different ethnic groups, languages, and dialects, which are associated with the existence of inter- and intra-ethnic cultural diversity. Associated with these diverse cultures, the country owns diverse community knowledge and innovations including that of conservation and use of biodiversity. Most of the rural communities depend on community knowledge and innovations for agricultural production. The farming communities and herders in

Ethiopia have maintained diversified crops, livestock and associated biodiversity through their community knowledge and innovations.

Farmers, herders, fishermen and wild food gatherers have diverse customary laws, which have been used or contributed to the conservation and sustainable use of natural resources of the country. Rangeland and other natural resources management strategies of the 'Gada' system amongst the Oromo people, particularly Borena, the 'Gereb' herding and grazing arrangements between the Afar pastoralists and the Tigrayan farmers, the 'Qero' system traditional grassland management systems used by Menz people in the Amhara region, and Konso cultural landscape management and the 'Kobo' system of Sheka forest management in SNNPRS are the most common traditional institutions involved in biodiversity conservation and sustainable utilization. This, to a large extent, reflects the correlation between biological and cultural diversities.

Status and trends

Community knowledge associated with the use of biodiversity particularly knowledge of traditional medicine is eroding due to various factors. Genetic erosion of plant and animal species, weak integration of traditional knowledge with modern science, neglecting/undermining indigenous knowledge and practices are some of the major factors leading to less application of cultural practices related to biodiversity conservation and sustainable use.

Furthermore, traditional institutions are weakened or undermined particularly by younger generations and development agencies. Attempts are being made to study and document community knowledge, particularly those related to traditional medicine and food, and edible wild plants (EWPs). In Ethiopia, efforts are underway to reverse the declining use of indigenous knowledge and cultural practices.

CHAPTER THREE

3. VALUES OF BIODIVERSITY AND ECOSYSTEM SERVICES

Ecosystems and the biological diversity contained within them provide provisioning (food fresh water, fuel wood, fiber, bio-chemicals, and genetic resources), supporting (soil formation, nutrient cycling, primary production), regulating (climate regulation, disease regulation, water regulation, purification and pollination) and cultural (spiritual, religious, recreation, eco-tourism, esthetic, inspirational, educational, and cultural heritage) services that are essential to the economic prosperity and other aspects of human welfare. However, data and information on the monetary values of biodiversity and ecosystem services are scanty in Ethiopia. Therefore, information provided in this chapter on values of ecosystem services and biodiversity of Ethiopia is very limited.

3.1. Values of Agricultural Diversity

3.1.1. Crop genetic resources

Crops have vital roles in agricultural production as a driver for economic growth and food security. Five major cereals (tef, wheat, maize, sorghum and barley) contribute 29% to the agricultural GDP, 14% to the total GDP and 64% to the calories consumed (ESSP, 2011). Pulses contribute 9.3% to the total grain production and are sources of income for smallholder farmers, as a higher-value crop than cereals and as a low-cost source of protein that accounts for approximately 15% of protein intake. Pulses have significant role in Ethiopia's economy generating an export earning of USD 129 million per annum (MoFED, 2010). Earnings from coffee contribute 4-5% to the GDP, about 20% to the government revenue and 60% to the total foreign exchange. Ethiopia is also one of the major producers of natural gums. In the year 2009/10, for example, the country earned USD 12.68 million from the export of gums and incense (MoFED, 2010). Revenue obtained from various agricultural products exported in 2009/10 is summarized in figure 7 and economic value of Ethiopian coffee genetic resources is presented in Table 2.

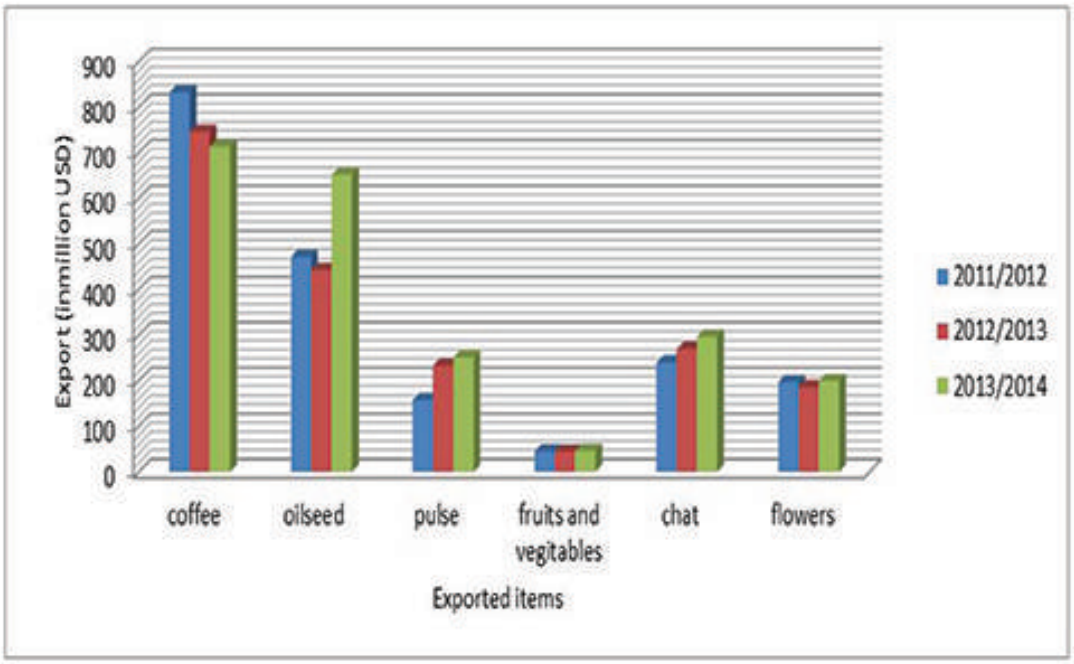

Fig. 7. Values of some agro-biodiversity in 2011-2013

Though the values of genetic diversity are widely recognized, monetary valuation has been made only for few of these resources. Another important gap is the contribution of genetic diversity for adaptation to climate change. Adaptation costs will be high and the value of genetic diversity to adapt agricultural sector to changing environmental conditions could be very significant (MoFED, 2011).

Contribution of the wild coffee genetic resources for the world coffee industry in breeding programmes for disease resistance, low caffeine contents and increased yields is estimated to lie in ranges between 0.5 and 1.5 million USD/year. In the coming 30 years, this value would go up as high as USD 1.45 billion (Hein and Gatzweiler, 2006; Gatzweiler *et al.*, 2007).

Table 2. Economic value of Ethiopian coffee genetic resources

Purposes	Net present value (in million USD) at discount rate of:	
	5%	10%
Disease resistance	617	169
•Coffee berry disease	60	11
•Meloidogyne sp.	232	65
•Coffee rust	323	94
Decaffeinated coffee	576	175
Yield increases	266	75
Total value	1458	420

Source: Gatzweiler, *et al.* (2007)

3.1.2. Farm animal genetic resources

Livestock play important roles in providing food, household income, draught, farmyard manure and fuel, ecological and social functions. In addition, livestock serve as sources of commodities for export such as live animals, meat and meat products, hides and skins, and honey and bees wax to earn foreign exchange. About 80% of Ethiopian farmers use animal traction to plough their fields.

According to MoFED (2009), the contribution of livestock to the GDP, excluding ploughing services is 25%. If the value of their ploughing services is included, however, their contribution to the GDP will rise up to 45% (IGAD, 2011), increasing the overall role of agriculture to the national GDP. Livestock have also socio-economic values in different cultures serving as insurance to mitigate risks and as indicators of social status. In the last two decades, hides and skins provided on average 90% of official livestock sector exports, whereas live animals and meat provided 6% and 4%, respectively. At present, the total value of livestock and their products stands at about 20% of all national exports (IGAD, 2011, IBC 2012c). In 2008/2009, household expenditure on livestock products was estimated at 1.086 billion USD, and the livestock sector exports contributed to earn more than 229 million USD (IGAD, 2011). The economic contribution of livestock and fish sector exports in the year 2011 is summarized in Table 3.

In Ethiopia, about one in 10 smallholders keep bees. National annual production of honey is estimated at 43,800 tones (CSA, 2014b). The total annual catches of fish from lakes and reservoirs have production potentials of about 50,000 tonnes/year.

However, only about 15,000 tonnes are being produced (FAO, 2005). Contribution of these resources to foreign earning is presented in Table 3. High populations of crocodiles are found in protected areas in most of their distribution ranges, in addition to Arbaminch Crocodile Ranch, and generate 1,605,000 USD per annum (Seyoum Mengistu *et al.*, 2005). There is also one newly established private crocodile farm located near Lake Chamo. Many insects are of great use to mankind since they are the primary agents of pollination and in most communities they occupy intermediate positions along the food chain (IBC, 2005).

Table 3. Proportion of livestock sector export in 2011

Livestock products	Annual value (in million USD)	Proportion (%)
Live animals	14.97	13.4
Meat and meat products	72.72	63
Hides and skins	23.2	20
Honey	2.3	2
Beeswax	1.5	1.4
Fish	0.22	0.19
Total	114.91	100

Source: Custom and Revenue Authority (2011)

3.2. Forest and its Ecosystem Services

Forest resources of Ethiopia have been contributing to economic, ecological and social benefits at national and local levels. Their biodiversity play vital and diverse roles in ensuring food security, and sustainable livelihoods for millions of households throughout Ethiopia. Forests contribute an estimated 4% to the GDP through the production of honey, forest coffee, and timber. Recent estimates indicate that about 26-30% of the total coffee production of the country originates from wild and semi-managed coffee forests. The value of wild coffee is estimated at 130 million USD/annum (Mulugeta Lemenih, 2009). Ecosystem services provided by the forest biodiversity include provisioning, regulating, supporting and cultural services. The economic, ecological and social value of some forests is estimated to be about 6.282 trillion USD/annum (Tables 4, 5 and 6).

Other NTFPs such as forages from forest largely serve as the feed sources of livestock in the country. Fodder driving from forests provides 10% and 60% of the livestock feed in the wet and dry season, respectively.

Table 4. Gross annual values of major non-wood forest products of Ethiopia

Types of product	Estimated annual turnover value ('000 USD)
Wild coffee	130,590
Gums and incense	3,700,
Honey and beeswax	86,510
Herbal medicine	216,367
Ecotourism	15,400
Bamboo	10,556
Spices	2,700
Civet	183
Total	462,306

Source: Mulugeta Lemenih (2009)

Similarly, many edible wild plants have supplementary, seasonal and the only source of food for a significant number of rural populations during times of critical food shortage. In Benshangul Gumuz region, for example, edible wild plants contribute 30 to 40% to food security in normal and at times of food shortage. Services provided by other ecosystems of the country are described in the respective sections (Chapter 2). However, monetary values of these services have not thus far been quantified.

Table 5. Annual production of wood products and their respective values

Product type	Production (1000 m^3)	Value ('000 USD)
Sawn wood	60	15, 167
Wood based panels	10	2,617
Industrial round wood	2459	38,251
Fuel wood	84134.6	420,673
Round wood, poles, posts, construction wood	84,532	1,047,999
Wood pulp	9	7,470
Other fiber pulp	9.4	2,350
Total	171,214	1,519,360

Source: Mulugeta Lemenih (2009)

Table 6. Estimates of annual economic values of some forest ecosystem services

No.	Forest service type	Values of Ethiopia's forest Ecosystems (in million USD)
1	Climate regulation	892
2	Water regulation	24
3	Water supply	32
4	Erosion control and sediment retention	980
5	Soil formation	40
6	Genetic resources	164
7	Recreation	448
8	Cultural	8
9	Nutrient recycling	3,670,000
	Total	6,280,000

Source: Adapted from Forum for Environent (2009)

3.3. Wildlife and Ecosystem Services in Protected Areas

Protected areas have both direct and indirect values. Direct values include generating foreign currency, recreation, tourism and employment. In terms of ecosystem services, protected areas play pivotal roles in providing ecological functions such as watershed protection, soil stabilization and erosion control, provision of clean water and associated filtration and storage functions, climate stabilization and carbon sequestration. These benefits contribute indirectly to the national economy. The annual economic value of PAs that are managed under Ethiopian Wildlife Conservation Authority (EWCA) is estimated at 1.5 billion USD (Table 7).

Table 7. Estimates of values of different services of PAs in EWCA managed areas

Services type	Values (in million USD)
Biodiversity	112
Watershed	432
Carbon sequestration	938
Total	1,482

Sources: Adapted from EWCA (2009)

3.4. Microbial Genetic Resources

Microbes have both direct and indirect economic values. However, data on values of microbial genetic resources in Ethiopia is limited. Microbes play pivotal roles in

preparation of traditional foods and local drinks both in the rural and urban areas of the country. Traditional foods such as Injera, Kocho, Bulla and Cheese, and local drinks such as Tella, Tej, Borde, Cheka and Areke are the means of livelihood and sources of income for millions of rural and urban communities of the country. In many part of the country, several species of mushroom are considered as delicious food, and currently small scale mushroom farming is emerging in urban areas benefiting thousands of low income households with economic contribution. With growth of agro-industries such as dairy, beverage, food and ethanol production, and health sector, contribution of microbial genetic resources to national economy is increasing over time.

Pulses are one of the most important crops that have significant values in the national and local economy. Yields of pulse crops depend on available soil nitrogen fixing microbes. Similarly, roles of microbes in biochemical processes that contribute to improved plant nutrient availability such as mineralization, phosphate solubilization, siderophores production, plant growth regulation and induced resistance have been reported for different farming systems, including Ethiopian coffee (*Coffea arabica*) and traditional agro-forestry system (Diriba Muleta, 2007).

CHAPTER FOUR

4. CAUSES AND CONSEQUENCES OF BIODIVERSITY LOSS

4.1. Direct Causes and Consequences

4.1.1. Habitat conversion

Conversion of natural forests, grazing lands, woodlands, and wetlands into agricultural land and settlement are some of the threats to biodiversity of Ethiopia. In some areas, land use change resulted in the loss of nearly all species of fauna and flora on-site and led to increasing fragmentation of the remaining ecosystems. As a result of 15% expansion of agricultural land in years 2005-2010, significant portions of high forests, woodlands, rangelands and wetlands have been converted into commercial agricultural farming such as tea, rice, sugarcane, bio-fuel plants and coffee plantations. In order to achieve targets set for the growth of agriculture sector for years 2010 through 2030, land expansion of 3.9% per annum is required. Under "business as usual" scenario, this will continue to affect ecosystems and biodiversity of the country, especially of the high forest and woodland areas (MoFED, 2011).

Attributed to high population growth, demand for arable land by small scale farmers has also increased from time to time. As the result, the gene pool of *Coffea arabica* is, for example, highly endangered by increasing human encroachment and land-use change. Furthermore, ever increasing human encroachment into Bale Mountains, Awash, Semien Mountains, and Abijata Shalla National Parks is affecting the ecosystems of these parks. The negative impacts of land use change in these PAs include degradation and shrinkage of natural ecosystems, loss of biodiversity and ecosystem services.

4.1.2. Unsustainable utilization

Unsustainable utilization (overgrazing/browsing, harvesting, hunting) of biological resources is a major threat to biodiversity and ecosystem services in Ethiopia. For example, unregulated and uncontrolled fishing, along with other factors such as soil

erosion and unsustainable utilization of water resources for developments, has threatened Labeobarbus fish in Lake Tana. Similarly, over harvesting has threatened timber tree species such as *Hagenia abyssinica* and medicinal plants species such as *Taverniera abyssinica*. Overgrazing/browsing by livestock in many ecosystems, including rangelands has also contributed to the degradation (increased erosion, decreased quality and productivity of range resources, reduction or elimination of the natural regeneration of woody species and highly palatable forage species) of rangelands and forest ecosystems. The consequence of these impacts includes ecological disturbance, loss of species and ecosystem services; thereby affecting livelihoods of the local communities. Furthermore, over pumping or drainage of water from lakes and wetlands has resulted in loss of habitats and species as is the case for Lake Haramaya. The increase in population in Harar town and in the lake watershed raised high demand for municipal water supply. Besides, farmers in the watershed of the lake were pumping water mainly to irrigate commercial crops such as chat (*Catha edulis*). These resulted in eventual disappearance of the lake, severely affecting the local communities whose livelihoods were based on the lake resources (Brook Lemma, 2011).

4.1.3. Invasive species

Invasive species cause biodiversity loss by competing with native species for feed and habitat and altering the physical environment in ways that exclude native species. About 35 alien and indigenous invasive species have been identified in Ethiopia. These species are negatively affecting agricultural lands, rangelands, national parks, water ways, lakes, rivers, power dams, road sides and urban green spaces with huge economic as well as social consequences on national economy and local livelihoods. Furthermore, invasive species have been threatening local biodiversity and ecosystem services.

Invasive alien species

Major invasive alien species documented in Ethiopia include mesquites (*Prosopis juliflora*), parthenium weed (*Parthenium hysterophorus*), water hyacinth (*Eichornia crassipes*) and lantana weed (*Lantana camara).* Recent survey reports identified other invasive alien species such as *Cryptostegia grandiflora, Parkinsonia aculeata, Mimosa diplorotricha* and *Nicotiana glauca (*Rezene Fessehaie *et al.*, 2012*).*

Prosopis juliflora has been aggressively invading rangelands in many parts of the country particularly the Middle and Upper Awash Valley, Western and Eastern Harerge zones, and Afar and Somali regions. It is replacing more nutritive browsing vegetation, reducing the overall biodiversity of the areas; reducing the carrying capacities of rangelands, increasing incidence of crop pests and causing health problems (damaging eyes and hooves) of both domestic and wild animals, eventually leading to deaths. Information from the Agricultural bureau of the Afar region indicated that the total coverage of *P. juliflora* on agricultural lands and rangelands was 87,198ha in 2012.

Parthenium hysterophorus is spreading rapidly in many rangeland areas and farmlands of Afar, Somali, Oromia, Amhara and Gambella regions, causing enormous reduction in forage production. Yield losses due to Parthenium weed in sorghum reached 46-97%, depending on the location and year. Manual control of Parthenium by farmers resulted in developing skin allergies, itching, fever, and asthma in some of the farmers who involved in such weed control practices. Annual social cost of Parthenium weed in Ethiopia was estimated to be about 4,365,057 USD (Rezene Fessehaie *et al.*, 2012; IBC, 2012d).

Eichornia crassipes is also becoming a serious threat in the Awash basin (Wonji and Koka reservoir areas) and Lake Tana. It obstructs irrigation, affecting productivity and biodiversity of the aquatic ecosystems. At Wonji Shewa Sugar Estate, impact assessment of water hyacinth infested areas of 116.4ha of irrigation water reservoirs, secondary and tertiary irrigation water supplies, and border and central drains revealed that the weed inflicted excess loss that is estimated in ranges from

393,660 to 2,945,160m^3 of water, restricting water flow, thereby incurring significant management cost (Rezene Fessehaie *et al.*, 2012).

Invasive species such as *Argemone mexicana*, *Lantana camara*, *Cryptostigma grandifolia* and *Mimosa sp.* have caused severe damage by reducing crop and forage yields, displacing indigenous species and aiding the spread of crop pests.

Carmine cochineal (*Dactylopius coccus costa*), an insect that was introduced into the country in 2001 for production of cochineal dye (Tesfaye Belay and Zimmermann, 2006), has been causing heavy damage on cactus species (*Opuntia ficus-indica*) in Tigray, northern Ethiopia.

Indigenous woody encroachers

Encroachment of indigenous woody species has been among the major threats to the livelihoods of pastoralists, biodiversity and ecosystem services. Some of the major woody encroachers in Ethiopia include *Acacia drepanolobium, A. oerfota, A. mellifera* and *Commiphora africana*. These woody encroachers have been decreasing grasses and grazing lands resulting in lack of forage resources. Furthermore, encroachment of these woody plants have been causing lower herbaceous biomass, altering soil carbon and nitrogen pools, and contributing to loss of desirable forage species (Gemedo Dalle *et al.*, 2006).

4.1.4. Climate change

Over the last decades, temperature in Ethiopia increased at about 0.2°C per decade. The increase in minimum temperatures is more pronounced with roughly 0.4°C per decade. Precipitation, on the other hand, remained fairly stable over the last 50 years when averaged over the country. However, the spatial and temporal variability of precipitation is high (Keller, 2009).

Climate change has caused adverse ecological, economic and social impacts in the country. One of the impacts is reduction in the length of growing seasons that has resulted in the loss of many long duration varieties. Moreover, it has made large marginal agricultural areas out of production. Information obtained from the Bureau

of Agriculture of Benshangul Gumuz region indicates that Kuncho, an improved variety of tef, is affected by late rain. Climate change also alters the underlying agro-ecosystems through elevated temperatures and CO_2 levels, leading to changes in crops pests and disease activities and population levels. Additionally, climactic variables influence the spread of vector-borne diseases through determining the distribution and growth rate of vectors and shortening the life cycle (Holly and David, 2001).

The vast genetic resources of the country and the presence of well adapted varieties are invaluable sources of adaptive traits that are important for sustainable agricultural production and adaptation to new climatic conditions. The Seeds for Needs approach implemented by EBI and other research institutions in Ethiopia in collaboration with Bioversity International clearly showed the potential of genetic diversity to provide options to adapt to climate change (Engels and Hawkes, 1991; Dejene Kassahun, 2014).

Climate change also causes shortage of livestock feeds, disease outbreak, change in disease distribution and shrinkage of rangelands. Furthermore, it causes desertification, forest fire, high evapo-transpiration, and drought. For example, prolonged drought that occurred for consecutive years in Borena zone of Oromia and Somali regions has, reportedly, resulted in loss of animals, especially cattle. During this time, rangelands were degraded and there were shortages of water and feed. In some places, climate change favored bush encroachment such as *Acacia drepanolobium* to invade the rangelands. Other effects of climate change include loss of traditional institutions and associated knowledge/practices.

4.1.5. Replacement of farmers' varieties and breeds

Agricultural biodiversity provides essential raw materials for improving the productivity and quality of crops, livestock, fish and other resources. However, due to high attention to the improved varieties many farmers' varieties /breeds of both plants and animals have been replaced. According to the information from the Bureau of Agriculture of Tigray region, farmers' varieties of wheat (locally called

"Shehan", "Gerey" and "Gomad"), barley ("Demhay" and "Gunaza") and sorghum ("Gedalit") have been locally lost due to various factors, including wider use of improved varieties. EOSA (2007) reported that about 77% of durum wheat has been replaced by improved varieties in Eastern Shewa, mainly due to displacement by bread wheat varieties which took place gradually in a time of three decades.

Sheko cattle breed is among threatened local breeds, resulting from interbreeding with the local zebu breed and changes in the production system (IBC, 2009). Similarly, chicken genetic resources of the country are highly affected by replacement by exotics and their crosses. Generally, loss of agricultural biodiversity results in loss of ecological, economic, nutritional and cultural benefits, and increases vulnerability to climate change and food insecurity.

4.1.6. Pollution

Improper management of solid and liquid wastes is one of the main causes of environmental pollution and degradation in many places. Many of these places lack solid and liquid waste disposal regulations and proper disposal facilities, including for harmful wastes. Such wastes may be infectious, toxic or radioactive. Poor waste management poses a great challenge to the biodiversity, due to the potential of the waste to pollute water, land, air and vegetation. Potential effects of pollutants on ecosystems and its biodiversity include changes in the abundance of species, loss of species, modification of habitats, reduction in soil, water and air quality, and changes to the stability and resilience of ecosystems. In rural areas, irrigation, run-off from farming activities containing insecticides, fertilizers and herbicides that have been applied to crops are affecting aquatic and wetland organisms. Excessive draining of nitrogen and phosphorous from agricultural fields to fresh water systems has caused excessive plant and algae growth due to eutrophication that leads to depletion of oxygen as well as to other environmental problems, which in turn will cause loss of species.

Major causes of pollution to aquatic and wetland ecosystems in Ethiopia are large and small scale factories which have unregulated waste disposal. They are causing

major damage to the nearby aquatic and wetland ecosystems through deposition of heavy metals as is the case in Akaki River, and Abasamuel and Koka reservoirs. Major large-scale human activities producing dangerous pollutants in Ethiopia include garages, petrol stations, tanneries, slaughter houses, market centres, breweries; textile, chemical, tobacco, thread and garment, and paint factories; hospitals, oil and flour mills, metal works and car washing.

4.2. Indirect Causes

4.2.1. Demographic change

Population growth is directly correlated with increase in resource consumption. Uncontrolled population growth puts undue pressures on all natural resources of the country. At present, Ethiopia's population has reached to 87.9 million. The population has increased over the last three decades, from 42.6 million in 1984 to 53.5 million in 1994 and 73.8 million in 2007, and is expected to reach 136 million by 2029 (CSA and ICF International, 2011; CSA, 2014). The population increase causes expansion and intensification of land use, over utilization of biological resources, exploitation of marginal lands and the weakening of traditional resource-management systems. As the result, it is putting undue pressures on all ecosystems and biodiversity of the country.

4.2.2. Poverty

Poverty, particularly in situations where people depend directly upon consumption of biodiversity or other natural resources for survival, is one of the causes of biodiversity losses. Poverty prevents people and nations from assuming long-term economic and environmental attitudes. There exists a vicious circle of poverty, resource degradation and further impoverishment in Ethiopia. Poor farmers, fishermen, pastoralists and other users extract whatever they can from the environment to support their families. According to t data from CSA (2014a), the national poverty head count indices and inequality has reached 26% (MoFED, 2014), this together with high unemployment rate of 17.4% in cities (CSA, 2014c), are creating huge pressure on the country's biodiversity and ecosystem services.

4.2.3. Low level of awareness and lack of coordination

Contribution of biodiversity and ecosystem services to the national economy and sustainable development are undervalued due to low level of awareness. Decision makers and local communities often take actions that negatively affect biodiversity and ecosystem services. Lack of relevant and timely information to the public and decision makers is another factor for loss of biodiversity and unsustainable utilization of resources. Biodiversity and ecosystem services are not well mainstreamed into the formal education system and other relevant sectors. Community knowledge on biodiversity, its cultural practices in the management of biodiversity and ecosystems are not well promoted and applied.

There are several stakeholders (institutions, researchers, policy makers and public) working on biodiversity conservation and sustainable utilization. However, further strengthening of coordination of the stakeholders is required for the effective conservation and sustainable utilization of biodiversity and ecosystems. Summary of threats to Ethiopia's biodiversity and their root causes are presented in Table 8.

Table 8. Threats to Ethiopia's biodiversity and their root causes

Threats	Root causes	Consequences	Gaps/Barriers
Habitat conversion	•increasing human population, agricultural expansion, and settlement	•deforestation •loss of species •ecological disturbances •loss of ecosystem services	•lack of adequate capacity, commitment, organizational set-up and incentives to implement land use policy properly
Unsustainable utilization: •over- exploitation	Due to rising human population: •increasing demand for wood products such as firewood, charcoal and harvesting for construction materials, and for NTFPs such as medicines, spices and stimulants •hunting/harvesting of various animals from aquatic and terrestrial environments for food, medicine, cosmetics and other purposes •limited alternative livelihoods •poverty	•ecological disturbances •loss of species •loss of ecosystem services	•lack of sustainable use regulation and monitoring systems •lack of alternative livelihood and energy sources
•overgrazing/ browsing	•increasing livestock number	•regeneration affected •loss of species •ecosystem disturbances •loss of ecological services	•lack of proper management of grazing lands •weakening of traditional resources management systems/institutions
Replacement of farmers' varieties/ breeds	•higher demand for food to feed growing population •lower yields from farmers' varieties/breeds	•loss of farmers' varieties/breeds	•agricultural policy promoting the use of improved varieties •lack of incentive for maintaining farmers' varieties/breeds
Invasive species	•lack of proper management and/or quarantine system	•loss of species and ecosystem services •health problems •loss of agricultural production •food insecurity	•lack of monitoring of the implementation strategy on the status and trends of invasive species •lack of capacity and resources to control invasive species
Climate change	•emission of greenhouse gases •deforestation and unsustainable land use systems	•natural calamities (drought, floods, frost, etc.) •decline in production and productivity, disease outbreak and loss of species	•low level of climate change mitigation mechanisms •lack of awareness
Pollution	•improper use of agro-chemicals •unregulated discharge of pollutants	•ecological disturbances •loss of species •loss of ecological services	•poor implementation of environmental regulations •poor wetland management •poor waste management systems

CHAPTER FIVE

5. INSTITUTIONAL AND LEGAL FRAMEWORKS

5.1. Institutional Frameworks

Ethiopia has taken a number of fundamental measures on biodiversity conservation and promotion of sustainable utilization including putting in place domestic legislations and upgrading the former Plant Genetic Resources Centre to Ethiopian Biodiversity Institute so that it can deal with plant, animal and microbial biodiversity and their respective ecosystems as well as associated community knowledge. The country has been working towards integrated implementation of the three objectives of the Convention on Biological Diversity (CBD) and to that effect, mandated the Ethiopian Biodiversity Institute to coordinate and implement these objectives in consultation with all relevant stakeholders including regional states.

Major actors in biodiversity and ecosystem services related activities include Ministry of Agriculture and Natural Resources, Ministry of Livestock and Fisheries, Ethiopian Institute of Agricultural Research, Ethiopian Wildlife Conservation Authority, Ministry of Environment, Forest and Climate Change (the then EPA), Higher Learning Institutions, Ministry of Culture and Tourism, Regional Bureaus of Agriculture, and Environment and Forest as well as Forest and Wildlife, and Pastoral Agencies of the regions. The activities of these are financed by the budgets allocated from the federal and regional governments. Besides, there are several international, regional and local NGOs that are involved in biodiversity related activities in Ethiopia.

5.2. Legal Frameworks

Ethiopia is 54th signatory to the CBD and ratified the convention in 1994 (Negarit Gazetta, 98/1994). Ethiopia is also signatory to multilateral biodiversity related agreements and conventions such as CITES, CMS, World Heritage and AEWA.

The following are major legal frameworks that govern the conservation, sustainable use and access to genetic resources and the fair and equitable sharing of benefits

arising from utilization of the genetic resources and associated community knowledge in Ethiopia.

Constitution of the Federal Democratic Republic of Ethiopia

The Constitution is the supreme law of all laws (Negarit Gazetta, 1/1995). Constitution of the Federal Democratic Republic of Ethiopia has integrated environmental laws which address conservation and sustainable development. The environmental rights provided under the Constitution require that human, animal and environmental health of the country be protected.

Ethiopian Climate Resilient Green Economy Strategy (2011)

As set forth in the Growth and Transformation Plan, reaching the planned middle income status before 2025 will require Ethiopia to boost its agricultural productivity, strengthening the industrial base, and fostering export growth. Ethiopia is also aware of the important role that developing countries play in fighting climate change, and has consequently taken on a constructive role in international climate negotiations. Ethiopia's ambition to become a "green economy front-runner" is an expression of its potential for and belief in a sustainable model of growth. If Ethiopia were to pursue a conventional economic development path to achieve its ambitious targets, the resulting negative environmental impacts of, *inter alia*, greenhouse gas emission would follow the patterns observed all around the globe. Therefore, Ethiopia has devised a strategy for Climate Resilient Green Economy (CRGE) that will allow a green growth path and fosters development and sustainability. The CRGE initiative follows a sectoral approach, and as part of the strategy, the government has selected four initiatives, namely: exploiting the vast hydropower potential; large-scale promotion of advanced rural cooking technologies; efficiency improvements to the livestock value chain; and Reducing Emissions from Deforestation and Forest Degradation (REDD) as the best chances of promoting growth immediately, capturing large abatement potentials, and attracting climate finance for their implementation.

Growth and Transformation Plan (2010)

The Growth and Transformation Plan (GTP) is based on a previous plan, namely, a Plan for Accelerated and Sustained Development to End Poverty (PASDEP), the guiding plan for 2005/06-2009/10 strategic framework and was built up on Sustainable Development and Poverty Reduction Programme (SDPRP). GTP is a five year plan (2010/11-2014/15) and is directed towards achieving Ethiopia's long term vision and sustaining the rapid and broad based economic growth anchored on the experiences that has been drawn from implementing development policies and strategies and undertaking policy measures for the challenges that has been surfaced in the course of implementation. The overriding development agenda of GTP is to sustain rapid and broad-based growth path witnessed during the past several years and eventually end poverty.

Ethiopia's strategy for sustaining the rapid and broad-based growth path hinges on seven pillars, namely: sustaining faster and equitable economic growth, maintaining agriculture as a major source of economic growth, creating favorable conditions for the industry to play key role in the economy, enhancing expansion and quality of infrastructure development, enhancing expansion and quality of social development, building capacity and deepen good governance, and promoting women and youth empowerment and equitable benefit. The objectives and activities of GTP are, *inter alia,* linked to environmental issues in Ethiopia National legal frameworks.

National Economic Development Strategy (1993)

The guiding strategy under the National Economic Development is known as the Agricultural Development led-Industrialization (ADLI). This strategy further developed into sectoral strategies that include agriculture, industry, mining, population growth, technological progress, and economic and social infrastructure.

The Conservation Strategy of Ethiopia (1997)

The Conservation Strategy of Ethiopia (CSE), approved by the Council of Ministers in 1996, provides a comprehensive and rational approach to environmental

management in a very broad sense, covering national and regional strategies, sectoral and cross sectoral policies, action plans and programmes as well as providing the basis for development of appropriate institutional and legal frameworks for the implementation. It also deals with providing a strategic framework for integrating environmental planning into a new and existing policies and projects. It mainly recognizes the importance of incorporating environmental factors into development activities from the beginning so that planners may take into account environmental protection as an essential component of economic, social and cultural development.

Environmental Policy (1997)

The Environmental Policy of Ethiopia has an overall goal to improve the health and quality of the life of all Ethiopians, and promote sustainable social and economic development by adopting environmental management principles. The policy includes important requirements for environmental impact assessment (EIA) such as recognition of the need for EIA to address social, socio-economic, political and cultural impacts, in addition to physical and biological impacts; incorporation of impact containment measures within the design process, and for mitigation measures and contingency plans to be incorporated within environmental impact statements; creation of a legal framework for the EIA process, including a coordinated institutional framework for the execution and approval of EIAs and environmental audits; development of detailed technical sectoral guidelines for EIA and environmental auditing; and EIA and auditing capacity and capabilities within the Ministry of Environment, Forest and Climate Change (the then EPA), sectoral ministries and agencies, as well as in the regions.

Proclamation on Environmental Impact Assessment (No. 299/2002)

This proclamation makes Environmental Impact Assessment (EIA) mandatory for specified categories of activities undertaken either by the public or private sectors. The EIA must be prepared by the proponent, and reviewed by either the Ministry of Environment, Forest and Climate Change or regional bureaus/agencies, depending

on the situation. The EIA guidelines put the projects into three categories, namely: projects that may have significant environmental impacts and therefore require detailed field investigation and a full EIA Schedule, projects whose type, scale or other relevant characteristics have potential to cause some significant environmental impacts but are not likely to warrant full environmental impact study and those projects which generally do not require environmental analysis because they have negligible or minimal direct disturbance on the environment.

Proclamation on Environmental Pollution Control (No. 300/2002)

This proclamation provides the basis for the development of relevant environmental standards and to make violation of these standards a punishable act based on the polluter pays principle. Environmental Inspectors are to be assigned by the Ministry of Environment, Forest and Climate Change (the then EPA) or regional environment offices and thresholds have been set for industrial, agricultural and domestic wastes (EPA, 2003).

Industrial Pollution Regulation (No. 159/2008)

The Council of Ministers approved Regulation No. 159/2008 to prevent industrial pollution in accordance with Article 20 of the Environmental Pollution Control Proclamation No. 300/2002. The Regulation provides a gestation period of five years for existing industries during which they are expected to reduce the strength of their effluents to lie within the industrial standards (EPA, 2003).

Rural Land Administration and Use (Proclamation No. 456/2005)

This law defines the state ownership of rural land and the tenure rights of the land occupant including rights to 'property produced on his land', rights of inter-generational tenure transfer, and rights to exchange land and limited leasing rights. Provisions are made for the registration and certification of tenure rights. The rural land administration and land use laws are being implemented by the regional states.

Development, Conservation and Utilization of Wildlife (Proclamation No. 541/2007)

The major objectives of the Proclamation are to conserve, manage, develop and properly utilize the wildlife resources of Ethiopia; to create conditions necessary for discharging government obligations assumed under regional and international treaties regarding conservation, development, and utilization of wildlife, and to promote wildlife-based tourism and to encourage private investment.

National Policy on Biodiversity Conservation and Research (1998)

The National Biodiversity Conservation and Research Policy (1998) provides guidelines for conservation, development and sustainable use of biodiversity. The policy objectives are ensuring that genetic resources and essential ecosystems of the country are conserved, developed and sustainably used, asserting national sovereignty over genetic resources, enriching the country's biological resources through restoration, integrating biodiversity conservation with sectoral and cross-sectoral strategies and programmes, recognizing and protecting community knowledge, ensuring that the local communities share benefits arising from the use of genetic resources and community knowledge and promoting regional and international cooperation.

Access to Genetic Resources and Community Knowledge, and Community Rights Proclamation (No. 482/2006) and Regulation (169/2009)

After ratifying the Convention on Biological Diversity (CBD) and International Treaty on Plant Genetic Resources for Food and Agriculture, as well as adopting international model laws and guidelines, Ethiopia has issued Access to Genetic Resources and Community Knowledge, and Community Rights Proclamation (No. 482/2006) and Regulation (169/2009). The country has also acceded to the Nagoya Protocol, which is aimed at promoting the fair and equitable sharing of the benefits arising from the utilization of the genetic resources.

Plant Breeders Right (Proclamation No. 481/2006)

Plant Breeders Right was one of the significant developments for the conservation and sustainable utilization of the country's plant genetic resources. The proclamation deals, *inter alia*, with the protection of their community knowledge that is relevant to the plant genetic resources, obtaining an equitable share of benefits from the use of plant genetic resources, exchanging and selling farm-saved seed or propagating material of the farmers' varieties; as well as the new plant varieties protecting under breeders' rights, and to collectively save, use, multiply and process farm-saved seed of protected varieties.

Ethiopian Water Resources Management Policy (1998)

Ethiopian Water Resources Management Policy document outlines several policy objectives of which conserving, protecting and enhancing water resources and the overall aquatic environment on sustainable basis are considered as the major ones.

A water Supply and Sanitation Master Plan framework was completed in 2003, which, among other aspects reviewed the targets of the Water Sector Development Programme and developed strategies for prioritization based on analysis of opportunities and constraints in physical, financial and institutional aspects.

Federal Forest Proclamation (Legislation 542/2007)

The government of Ethiopia has put in place forest development, conservation and utilization Proclamation. The objective of the Proclamation is to meet public demand in forest products and foster the contribution of forests in enhancing the economy of the country through conservation and development of forest resources. Provisions of the Proclamation are designed, among others, to encourage the development of forests by individuals, organizations and government and the designation of protected forests and productive forests to be administered in accordance with laws to be enacted for each. The Proclamation further provides for growing native tree species and their utilization as well as identifying useful exotic species and growing seedlings of such trees for wide dissemination.

Regional Forest Legislations

Regional states have issued their own provisions to fill existing gaps in forestry sector. In Oromia, Proclamation that establishes Forest and Wildlife Enterprise was issued in 2009. This proclamation is geared towards conservation, production and sustainable utilization of forest and wildlife of the region. Similar legal provisions have been issued by other regions such as SNNPRS, Benshangul Gumuz and Amhara.

Fisheries Development and Utilization (Proclamation No.315/2003)

The objectives of Fisheries Development and Utilization Proclamation are to conserve fish biodiversity and its environment as well as to prevent and control over exploitation of the fisheries resource, to increase supply of safe and good quality fish and to ensure a sustainable contribution of the fisheries towards the food security and to expand aquaculture.

National Aquaculture Development Strategy of Ethiopia (2009)

The overall objective of National Aquaculture Development Strategy of Ethiopia is to define a regulatory framework and build a strong basis for the development of aquaculture in the country. The strategy seeks to integrate the aquaculture industry into the agricultural sector and to facilitate development of viable aquaculture plans. It also aims to provide a framework in which the aquaculture industry can be developed in an economically, socially and environmentally sustainable manner. Aquaculture development is to be targeted as an activity to ensure food security, alleviate poverty of rural farmers and to provide fish for domestic consumption and industry.

Proclamation on Biosafety (No. 655/2009)

The objective of this Proclamation is to protect human and animal health, biological diversity and in general the environment, local communities and the country at large by preventing or at least managing down to levels of insignificance the adverse effects of modified organisms.

Nagoya Protocol on Access to Genetic Resources and Fair and Equitable Sharing of Benefits Arising from Utilization of the Genetic Resources

Ethiopia has acceded to the Nagoya Protocol, and this will eventually enhance implementation of the domestic proclamation on Access to Genetic Resources and Community Knowledge and Community Rights (482/1998) by creating conducive conditions for cooperation between parties. At present, EBI has formulated Code of Conduct to accessing genetic resources and community knowledge and benefit sharing, a further move to effective use of the Protocol.

Re-establishment and Restructuring of Ethiopian Biodiversity Institute

In 2013, Council of Ministers of the Federal Democratic Republic of Ethiopia issued a regulation for the re-establishment of the Ethiopian Biodiversity Institute, the former Institute of Biodiversity Conservation (Regulation No. 291/2013). According to the Regulation, the objective of the Institute is to ensure that the country's biodiversity and the associated community knowledge are properly conserved and sustainably utilized, and its communities get fair and equitable share of benefits arising from their utilization. One of the steps taken by EBI to effectively implement its mandate of conservation, sustainable utilization and access to genetic resources and the fair and equitable sharing of benefits arising from their use is restructuring of its technical wing into Directorates. These are Crop and Horticulture Biodiversity, Forest and Rangeland Plants Biodiversity, Animal Biodiversity, Microbial Biodiversity and Access and Benefit Sharing Directorates. Moreover, the Institute has signed memorandum of understandings with different national and international universities working on biodiversity and international institutions such as ICARDA that will make the signatories work together in research and development of biodiversity related themes.

Establishment of Regional Biodiversity Units and Centres

To ensure effective conservation and sustainable utilization of biodiversity, and access to genetic resources and the fair and equitable sharing of benefits arising from their use at the grass root levels; regional biodiversity units have been

established in nine regions and Dire Dawa City Council. Furthermore, the Institute has established seven biodiversity centres in representative bio-geographical regions of the country.

Establishment of Ministry of Environment, Forest and Climate Change

Establishment of Ministry of Environment and Forest has been proclaimed to amend the proclamation on the definition of powers and duties of the executive organs of the Federal Democratic Republic of Ethiopia (Proc. No. 803/2013). The Proclamation transfers rights and obligations of the Environmental Protection Authority re-established under Proclamation No.295/2005 and powers and duties of Ministry of Agriculture that are related to forestry to the Ministry.

CHAPTER SIX

6. LESSONS FROM PREVIOUS NBSAP AND PROCESS OF REVISING

6.1. Lessons from Previous NBSAP

The first Ethiopian National Biodiversity Strategy and Action Plan (IBC, 2005) was devised to serve as a roadmap to enhance the contribution of biodiversity to overall development of the country. It outlined the status of biodiversity and the environment at large. It also pointed out the root causes of biodiversity loss and their impacts. Review of its implementation status indicated that some of the planned activities such as afforestaion, collection of germplasm, area closure, provisions of policy and legislations, and raising public awareness at federal, regional and local levels; particularly, in the areas of PAs have been implemented, though not satisfactory.

It is understood that the actions planned to be implemented within the time frame were too many to be achieved. Moreover, most of these actions were planned with the expectation of funds from external sources. Furthermore, the strategic document did not put in place any mechanism or a system that would realize timely mobilization of expected resources from both internal and external sources. The document also lacked clarity on the mechanism of coordination of the implementation. Lack of agreed upon binding instruments, lack of monitoring and evaluation as well the absence of reporting mechanisms and low efforts on awareness raising at federal, regional and local levels were other factors that have contributed to low level of implementation.

The planning process of the current NBSAP takes into account lessons from the previous exercises and considers those priority issues identified by the stakeholders as critically important. Selection of targets from the priority issues was based on their alignment with the top government priorities so that the actions of corresponding targets can easily be mainstreamed into the forthcoming five years federal and regional plans. Although external funding is required for the effective implementation of the NBSAP, the current strategy has not entirely been based on

the assumptions that the planned actions would be implemented by the external funding. Therefore, most of the activities are planned to be mainstreamed into government activities.

Actions outlined within the current NBSAP have been discussed with the stakeholders at three consecutive national workshops. Lead institutions have agreed on the actions they would be responsible for the implementation. Legally binding instruments, monitoring and evaluation as well as reporting mechanisms will be in place for the follow up of the implementation. Moreover, separate financial resources mobilization strategy will be devised to facilitate the implementation. It has been agreed that the Focal Institute will take full responsibility lead to coordinate the implementation and mainstreaming of the NBSAP at all political and grass root levels.

6.2. The Process of Revising NBSAP

The developments of NBSAPs are provisions of Article VI of the Convention on Biological Diversity (CBD), and the need for its revision was based on Decision X/2 of Conference of the Parties (CoP) at Nagoya in October 2010. The agreement referred to as Strategic Plan 2011-2020. The Plan calls for effective implementation of the Convention through strategic approach comprising of a shared vision, mission, goals and Aichi Biodiversity Targets.

Based on the above, Ethiopia requested the Secretariat of the CBD (SCBD) to commence preparation of the NBSAP. The preparation phase included nomination of the National Coordinator and building the capacity of the Coordinator through participating in consecutive regional capacity building workshops that were conducted between 2012 and 2014. Similarly, other requirements from the implementing agency (UNEP), project funding mechanism (GEF) and the government of Ethiopia (MoFED) were fulfilled.

Parallel to the above, the Focal Institute organized an *ad hoc* Expert Group to develop Annual Work Plans (AWP) for the NBSAP preparation period. Similarly, National Project Steering committee (NPSC) that oversees overall activities of the

NBSAP and a Technical Team (TT) that would be involved in stocktaking and synthesizing stocktaking report, drafting national targets, developing the actions, the action plan and devising implementation arrangements to the NBSAP were established. Accordingly, the NPSC members from 10 critical stakeholder institutions conducted their first meeting on 22nd June 2012 and approved the AWP, and institutional and technical composition of the TT members.

Twenty four TT members were nominated from seven stakeholder institutions. Before launching the NBSAP preparation, the TT members were trained on the NBSAP revision processes. After the training, the TT members were divided into three groups and conducted stocktaking at federal and regional levels. Then, the TT compiled group reports into a national stocktaking report and prepared draft National Biodiversity Strategy. The draft National Biodiversity Strategy which contained 16 targets was presented at the First National Stakeholders Workshop held between 26 and 28 June 2013. Afterwards, the TT incorporated the feedbacks and proposed targets, indicators and actions for the draft National Biodiversity Strategy and presented it at the Second National Stakeholders Workshop held between 7 and 9 March 2014. Then, the TT finalized the draft document by incorporating comments and proposed the implementation period, implementation agencies and implementation arrangements. The final draft NBSAP was then presented at the Third National Stakeholders Workshop held between 26 and 28 December 2014. After incorporating the feedbacks, the NBSAP containing 18 targets, 44 indicators and 58 actions was produced. Finally, the Strategic document was endorsed by the government and submitted to the SCBD.

CHAPTER SEVEN

7. NATIONAL BIODIVERSITY STRATEGY

7.1. Vision

By 2050, Ethiopia's biodiversity and ecosystems are conserved and sustainably utilized by all sectors providing food security and contributing to poverty eradication and improved quality of life of the Ethiopian people.

7.2. Mission

By 2020, awareness of general public and policy makers on biodiversity and ecosystem services is raised, biodiversity and ecosystem services are valued, pressures on biodiversity and ecosystems are reduced, status of biodiversity and ecosystem services are improved, and access to genetic resources and fair and equitable sharing of benefits arising from their use is ensured.

7.3. Principles

The following are basic principles underlying Ethiopia's 2015-2020 NBSAP.

- We work hard to live in harmony with nature
- We acknowledge and respect the culture, values, innovations, practices and knowledge of local communities
- We remain alert to control the spread and introduction of invasive species
- We pay due attention to gender equity in our endeavors of conservation and sustainable utilization of our biodiversity
- We adapt to and mitigate climate change through proper conservation, development and utilization of our biodiversity
- We acknowledge active participation of local communities for effective conservation and sustainable utilization of our biodiversity, and access to genetic resources and the fair and equitable sharing of benefits arising from their use
- We strive for enhancing contribution of biodiversity to food security and poverty eradication
- We promote research-based biodiversity conservation

7.4. National Biodiversity Targets

Development of Ethiopia's National Biodiversity Targets and Actions has been based on the analysis of the existing situations of the country such as level of threats, government priorities, existing capacity, lessons from the hitherto implementation experiences on the three pillars of the CBD, and associated global provisions of the Strategic Plan 2011-2020. Accordingly, Ethiopia has developed the following 18 National Biodiversity Targets that would be implemented between 2015 and 2020. These are outlined under the five Strategic Goals of the Global Strategic Plan for Biodiversity 2011-2020. Indicators, actions, implementation period and implementing agencies of the Ethiopian Biodiversity Targets are presented in Table 9. The relationships of the Targets to the Aichi Biodiversity Targets have been presented in Table 10. Strategic Goals and Aichi 2011-2020 Biodiversity Targets are presented in Annex V.

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society

Target 1. By 2020, awareness of public and decision makers on the values of biodiversity and ecosystem services is raised, and the steps they can take to conserve and use them sustainably is improved

Technical rationale

In Ethiopia, local communities and most decision makers have limited knowledge and awareness on biodiversity and ecosystem services. Therefore, policy makers are occupied with poverty reduction and development issues that may have short term gains, but will harm biodiversity in the long term. Similarly, some of the investment activities may have adverse effect on biodiversity. Ethiopia has been undertaking various actions in areas related to education and public awareness on biodiversity conservation and sustainable utilization. Further efforts are, however, required to increase overall awareness of communities, policy makers, development partners and private sectors on the importance of biodiversity and ecosystem services. Therefore, there is a high need to raise awareness at different levels in order to bring

positive changes and to create more commitment of government for effective implementation of the three objectives of the Convention on Biological Diversity.

Implementation strategy

A strategy for the implementation of this target relies mainly on, use of mass media (radio, TV, print), biodiversity forums at selected schools, universities and community, visits to target groups to selected protected areas (PAs), and organizing events to local communities to exchange experiences and share information, including organizing National Biodiversity Days and workshops.

Milestones

- By 2015, national baseline data will be collected and comprehensive national strategies to promote awareness of general public and policy makers on the values of biodiversity and ecosystem services are prepared and adopted
- By 2015, public awareness campaigns on biodiversity and ecosystem services, and the steps people can take to protect them are initiated
- By 2016, relevant educational curricula have been revised and implemented
- By 2016, awareness raising is integrated into the extension and adult education
- By 2020, level of awareness is evaluated, and level of improvement is reported

Target 2. By 2020, the existing biodiversity related laws, regulations and strategies, including those associated with incentives are reviewed and gaps are addressed

Technical rationale

Lack of harmonization of laws, regulations and strategies, perverse incentives and absence of regulations and guidelines in some areas of biodiversity have resulted in loss of the same. Therefore, there is a need to review and fill the gaps of the existing laws, regulations and strategies, and formulate new ones, as appropriate. Moreover, there is a need for capacity building that will enable the enforcement of the existing legal frameworks.

Implementation strategy

Strategy for the implementation of this target will be based on identifying and filling the gaps in the existing laws, regulations and strategies, including those associated with the incentives. The need for harmonization of the Proclamation on Access to Genetic Resources and Community Knowledge and Community Right and the corresponding Regulation with the Nagoya Protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their use is one of the activities for the implantation of this target. There is also a need to reduce/eliminate perverse incentives that cause loss of biodiversity and encourage the positive ones. Mainstreaming of the revised and/or formulated laws, regulations and strategies is another crucially important part of the strategy for the realization of this target.

Milestones

- By 2015, laws, regulations, guidelines and strategies related to biodiversity conservation, sustainable utilization, and access to genetic resources and fair and equitable sharing of benefits arising from their use are reviewed and gaps are identified
- By 2017, drafted/harmonized laws, regulations and strategies are approved
- By 2020, capacity for the enforcement of laws, regulations and strategies related to biodiversity conservation, use, development and sharing of benefits accrued from their use is strengthened
- By 2020, approved laws, regulations and strategies are mainstreamed and implemented

Target 3. By 2020, biodiversity values and ecosystem services are communicated and integrated into national and local development and poverty reduction strategies and plans

Technical rationale

Like in many other developing countries, the importance of biodiversity, especially of ecosystem services are not widely reflected in decision making processes in Ethiopia,

resulting from the absence of reliable and comprehensive data on economic and non-economic values of biodiversity and the ecosystem services it underpins. Therefore, the objective of this target is to ensure the diverse values of biodiversity and opportunities derived from its conservation and sustainable use are recognized and reflected in all relevant public and private decision-making processes such as national and local development and poverty reduction strategies.

Implementation strategy

Ensuring the recognition of diverse values of biodiversity and opportunities derived from its conservation and sustainable use, and making them reflected in all relevant public and private decision-making processes such as the national and local development and poverty reduction strategies and planning requires, *inter alia*, capacity building. Therefore, implementation of this target will start with reviewing the outcomes of biodiversity and ecosystem services valuation studies that have so far been conducted in the country as well as the outcomes from other relevant targets of the this NBSAP. This will be followed by devising a strategy for communicating and integrating the contributions of biodiversity and ecosystem services into national and local development and poverty reduction strategies.

Milestones

- By 2015, results of the hitherto studies on valuation of biodiversity and ecosystem services are reviewed
- By 2020, values of biodiversity and ecosystem services are communicated and integrated into local and national development and poverty reduction strategies and plans

Strategic Goal B: Reduce the direct pressures on biodiversity and promote its sustainable use

Target 4. By 2020, habitat conversion due to expansion of agricultural land is halved from the existing rate of about 10% per year

Technical rationale

Habitat conversion is one of the major factors of biodiversity loss in Ethiopia. Rising demands for food and other agricultural products, among others, have resulted in clearing of natural habitats for agricultural lands; and economic, demographic and social pressures are likely to put further pressure on habitats. Therefore, there is an urgent need to decrease the rate of such expansion into forest and other ecosystems. Projections indicate, for example, that unless appropriate measures are in place to change the traditional development path, an area of 9 million ha might be deforested for agriculture between 2010 and 2030. Over the same period, annual fuel wood consumption will rise by 65%, leading to additional forest degradation to generate more than 22 million tonnes of woody biomass. Moreover, both federal and regional government policies and laws are silent regarding wetland protection. As a result, many ecosystems such as wetlands and high forests have been converted to farmlands, and there is an urgent need to prevent the loss of these ecosystems.

Implementation strategy

Habitat loss can be addressed through conservation of currently viable ecosystems and restoration of degraded ones. Though restoration activities can restore many of the attributes of primary ecosystems, they cannot be reversed to their original states in the short to medium term. So, the emphasis of this target is preventing the loss of high-biodiversity value habitats such as primary forests and wetlands and rehabilitation of degraded ecosystems. Reduction in the rate of loss and degradation of natural habitats can be achieved by adopting technologies and innovations that increase productivities of small holder farmers. This will help in increasing yields of crops per unit input, which will eventually result in a decrease in requirements for

new agricultural lands. The other scheme is creating alternative livelihoods for local communities to reduce pressure on the ecosystems.

Milestones

- By 2020, technologies and innovations for increasing productivity of smallholder farmers and pastoralists are adopted
- By 2020, provisions of alternative livelihoods, including jobs and alternative energy sources and use of energy efficient technologies for local communities are improved

Target 5. By 2020, unsustainable utilization of biodiversity and ecosystem services are reduced

Technical rationale

Unsustainable utilization of biological resources is one of the major threats to biodiversity in Ethiopia; contributing to degradation of rangelands, forest ecosystems, wetlands and aquatic ecosystems. Therefore, sustainable land and water resource management is required to achieve biodiversity conservation and sustainable utilization.

Implementation strategy

Ecosystem based approaches of resources management are required to conserve and sustainably utilize biodiversity and ecosystems. To achieve this target, sustainable management of resources such as participatory forest management, sustainable rangeland and aquatic ecosystems management practices need to be adopted. These require development and implementation of regulations and guidelines to control open access over resources on grazing lands, aquatic, wetland and community forests.

Milestones

- By 2017, regulation and guidelines to promote sustainable utilization of resources on grazing lands, aquatic, wetland and other communal lands are developed and implemented

- By 2020, sustainable utilization of wetlands, aquatic ecosystems, forests and rangelands plants is improved
- By 2020 aquaculture and afforestation practices are expanded, use of non-wood forest products is promoted

Target 6. By 2020, the area invaded by invasive species is reduced by 75% and measures are in place to regulate and monitor invasive species, including newly emerging ones

Technical rationale

Invasive species are threats to biodiversity and ecosystem services. Invasive species are spreading rapidly into farm lands, aquatic ecosystems and rangelands of Ethiopia, causing loss of biodiversity, reductions in crop, fish and forage yields. They are displacing indigenous species of natural ecosystems. Though the extent of these damages has not been well documented, they are threatening food security, livelihoods, and human and animal health. Hence, they need to be controlled and eventually eradicated.

Implementation strategy

Different species are identified as invasive in different regions of Ethiopia. It is necessary to prioritize control and eradication measures on those species with the greatest impact on biodiversity. Therefore, it is important to revise the existing strategies to address problems of invasive species effectively. When taking actions to meet this target, it is worth considering the experiences of some projects which contributed in the development and implementation of control measures on some invasive species. It is also crucial to put in place measures to regulate and monitor invasive species, including newly emerging ones.

Milestones

- By 2016, status, trends and impacts of major invasive species are reviewed and control strategies are revised

- By 2020, revised control strategies on major invasive species is are implemented
- By 2018, measures to regulate and monitor invasive species, including newly emerging ones are in place and implemented
- By 2020, area covered by the invasive species is reduced by 75%

Strategic Goal C: Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

Target 7. By 2020, area coverage of ecologically representative and effectively managed PAs is increased from 14% to 20%

Technical rationale

Well governed and effectively managed protected areas (PAs) are proven methods for safeguarding both habitats and populations of species and for delivering important ecosystem services. About 14% of the country's area is designated as PAs. However, most the PAs do not have legal status, and are inadequately protected and this is more pronounced on wetlands and water bodies. There is a need to increase the coverage of PAs, with due attention to their ecosystem representation as well as effectiveness in terms of management. Lack of law enforcement, facility and infrastructure, absence of networks between PAs and wildlife corridors, poor coordination, and weak capacity and low awareness at different levels are some of the problems that need to be addressed in this target. Economic valuation on PAs is another issue that needs to be addressed to realize the target.

Implementation strategy

To implement this target, some of the selected PAs will require re-demarcation and development of new management plans. Furthermore, there is a need to establish new PAs. The PAs have to be managed in close collaboration with local communities recognizing their rights. These communities should be empowered to fully engage in governing and managing the PAs and should share fair and equitable benefits arising from their use. Carrying-out economic valuation on selected PAs is also important to

give greater visibility amongst policy makers and integrate benefits from PAs into poverty alleviation and development plans so as to ensure sustainability.

Milestones

- By 2017, eleven PAs are re-demarcated and management plans are developed
- By 2020, additional ecologically representative PAs are established
- By 2020, economic valuation for seven PAs is conducted
- By 2020, benefits from PAs are integrated into poverty alleviation and overall national development plans

Target 8. By 2020, *ex situ* conservation of agro-biodiversity, wild plants, animals and microbes; with special emphasis on endemic, endangered, economically or ecologically important species and breeds is increased and standards of the existing *ex situ* conservation are improved

Technical rationale

The diversity of crops and their wild relatives, animals, forest and rangeland plants and microbial genetic resources have been contributing to national economy and local livelihood improvements of Ethiopian communities. However, they are declining due to direct and indirect pressures. In the face of climate change and outbreaks of emerging diseases and pests, conserving these resources provides future food security options for the country. The *ex situ* conservation activities are inadequate and encountering different management problems. Thus, strengthening the *ex situ* conservation of agro-biodiversity, forest and range land plants, animals and microbes; with special emphasis on endemic, endangered and economically or ecologically important species and breeds is the emphasis of the target.

Implementation strategy

Assessment of conservation status of agro-biodiversity, forest and range land plants, animals and microbes are the major activities required to implement this target. Subsequently, collections of priority germplasm, herbarium and animal specimen

need to be strengthened. Moreover, the status of conservation of the existing *ex situ* conservation sites, with full participation of local communities has to be improved.

Milestones

- By 2017, conservation priorities are identified and set for species, with special emphasis on species that are endemic, endangered, and/or of economic or ecological importance
- By 2019, Natural History Museum and National Herbarium are established
- By 2020, ex situ collections are increased and status of the existing sites are improved
- By 2020, number of Botanical Gardens are increased

Target 9. By 2020, *in situ* conservation sites for important species and breeds are increased and the standards of the existing *in situ* conservation are improved

Technical rationale

The diversity of crops and their wild relatives, animals, forest and rangeland plants and microbial genetic resources have been contributing to national economy and local livelihood improvements of the communities. However, they are declining due to direct and indirect pressures. In the face of climate change and outbreaks of emerging diseases and pests, conserving these resources provides future food security options for the country. The *in situ* conservation activities are inadequate and encountering different management problems. Thus, strengthening the *in situ* conservation of agro-biodiversity, forest and range land plants, animals and microbes; with special emphasis on endemic, endangered and economically or ecologically important species and breeds is the emphasis of the target.

Implementation strategy

Actions required to implement this target are assessing crops and their wild relatives, animals, forest and rangeland plants and microbial genetic resources followed by identification and prioritization of potential *in situ* sites. Moreover, gaps

in the existing *in situ* sites are identified. Then, new *in situ* sites are established and status of the existing ones is improved, with full participation of local communities.

Milestones

- By 2017, crops and their wild relatives, forest and rangeland plants, animal and microbial genetic resources are assessed, and in situ conservation priorities are set
- By 2020, in situ conservation sites are increased and management plans are developed

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services

Target 10. By 2020, the contribution of biodiversity and ecosystem services, including climate change adaptation and mitigation, is improved through increasing forest cover from 15% to 20% of the country, increased designated total area of wetlands from 4.5% to 9.0% and doubling the area of restored degraded lands

Technical rationale

Conservation, restoration and sustainable utilization of forests and rangeland plants, woodlands, wetlands and other ecosystems are the means to sequester carbon dioxide and reduce the effect of greenhouse gases. Therefore, maintaining these ecosystems helps to ensure the continuation of carbon sequestration as well as many other ecosystem services. Restored ecosystems can have improved resilience and can contribute to climate change adaptation and generate additional benefits for the people, in particular local communities.

Implementation strategy

There are already huge efforts in Ethiopia for forest ecosystem restoration through area closures and massive tree plantings. Increasing forest cover, designation of wetlands and restoration of degraded areas are the major activities required to realize this target. Participatory Forest Management, which is underway in different

parts of the country, will be strengthened through 2020. Moreover, climate change mitigation activities such as REDD+ and CRGE strategy will be widely implemented.

Milestones

- By 2020, the national area under forest cover and designated wetlands is raised to 20 % and 9%, and restored degraded area is doubled
- By 2020, incentives for the local communities through carbon trade from high forests, woodlands and traditional agro-forestry are generated

Target 11. By 2020, the number of genetic materials accessed for research and development, and fair and equitable sharing of benefits arising from their use are increased by 24% and 39%, respectively

Technical rationale

The concept of Access to Genetic Resources and Fair and Equitable-sharing of Benefits arising from their use (ABS) emerged during the negotiations on the Convention on Biological Diversity in Rio de Janairo, 1992. Due to limited capacity and lack of effective enforcement and follow-up mechanisms on the ABS, the government of Ethiopia and the local communities have not been adequately benefited from access to their genetic resources. This has contributed to the degradation of the country's biodiversity. Therefore, concerted efforts are required to maximize benefits from access to potential genetic materials.

Implementation strategy

Implementation of this target will require identification of potential genetic resources for access (bio-prospecting), market promotion, capacity building, awareness raising on ABS at various levels, implementing the Nagoya Protocol and accommodating its principles into the national laws to ensure fair and equitable sharing of benefits arising from the use of genetic resources.

Milestones

- By 2020, genetic materials accessed for research and development, and fair and equitable sharing of benefits arising from their use are increased by 24% and 39%, respectively
- By 2020, number of bio-prospected species and associated community knowledge are increased by 167%

Target 12. By 2020, women's access to and control over biodiversity resources and ecosystem services are improved

Technical rationale

The government of Ethiopia doesn't discriminate citizens on the basis of gender, but in practice gender imbalance exists in areas of biodiversity conservation and sustainable use. Biodiversity conservation cannot be sustained without the involvement of different sectors of the societies. Women are the primary conservers and promoters of biodiversity. However, they don't have equal rights with their men counterparts in using what they have conserved. There is also lack of clear guideline that helps to mainstream gender into biodiversity conservation and management.

Implementation strategy

Recognizing and supporting gender equality, and focusing on women and their contribution to conservation and sustainable use of biodiversity are the main activities required to ensure women's access to and control over biodiversity resources of the country. This will, *inter alia*, require establishing and strengthening of networks to promote gender mainstreaming within biodiversity conservation and sustainable use. Therefore, preparation of regulations and guidelines, and their implementation to promote awareness and involvement of women in all biodiversity programmes and projects are the major activities that will help to realize this target.

Milestones

- By 2015, baseline data on the level of Women's access to and control over biodiversity resources and ecosystem services are generated

- By 2020, national gender mainstreaming guideline on biodiversity resources and ecosystem services are developed and implemented
- By 2020, the level of improvement of women's access and control over biodiversity resources and ecosystem services is evaluated

Target 13. By 2018, benefits from biodiversity are increased through value addition to at least 12 agro-biodiversity species and products, and creating market linkages for five species of medicinal plants; taking into account the needs of women and local communities

Technical rationale

Smallholders and pastoralists are custodians of biodiversity. Nevertheless, biodiversity is in danger of disappearing. Finding niche markets for selected species and their products is one possible way of ensuring the survival of biodiversity and enabling people who conserve them to earn more. These can be achieved through searching local, national and international markets and enhancing information on the marketing channels to increase the value of genetic resources. Although value addition and finding niche markets have been initiated for some agro-biodiversity, most communities have not yet been benefited. Thus, value addition and finding niche markets will be strengthened.

Implementation strategy

Implementation of this target will require identification of selected species, focusing on farmers' varieties, breeds and non-timber forest products (NTFPs) with high market potential and those that are of a priority for conservation. Improving production, processing, value addition, product certification and searching for niche markets are the most important activities pursued to achieve the target.

Milestones

- By 2018, value additions are conducted for at least 12 agro-biodiversity species and their products, and their value chains are studied

- By 2020, niche markets for the value added and five species of medicinal plant genetic resources are created

Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building

Target 14. By 2020, stakeholders' integration, including the participation of local communities in biodiversity conservation and sustainable utilization, is strengthened

Technical rationale

Stakeholders working in the areas of biodiversity conservation and sustainable utilization in Ethiopia lack integration and collaboration in their activities. Apart from sporadic consultation at project/programme initiation phases, many stakeholders working in the same area also lack interest to fully engage local communities. These, together with the poor institutional set ups, make efforts inefficient and uncoordinated in the sector. As the result, their efforts have been unsuccessful in reducing the loss of biodiversity and ecosystem services.

Implementation strategy

There are many actors including government institutions, NGOs, business communities and individuals who are making efforts towards conservation, sustainable utilization of biodiversity and climate change mitigation. Implementation of this target needs to integrate activities and collaborations of all the stakeholders. Moreover, making local communities to fully participate in the community-based management plans and implementation activities will have more impact to achieve the target. Establishing and strengthening Biodiversity Units of regions, including Dire Dawa City Council and Biodiversity Centers at representative bio-geographical regions of the country are required to materialize this target.

Milestones

- By 2015, National Biodiversity Council and National Biodiversity Technical Committee are in place

- By 2020, 10 Biodiversity Units at different regions and seven Centres at representative bio-geographical regions of the country are established and strengthened

Target 15. By 2017, national biodiversity information system is strengthened, information dissemination strategy is devised and Clearing House Mechanism is updated

Technical rationale

Weak information exchange mechanisms and strategies among the stakeholders are affecting the effectiveness of conservation and sustainable utilization of biodiversity in Ethiopia. Thus, strengthening information exchange mechanisms including information dissemination and updating of the Clearing House Mechanism (CHM) are the means to implement this target.

Implementation strategy

Stakeholders' involvement throughout the process of designing, planning and implementation of NBSAP is essential to ensure that the plans would be effectively communicated and implemented. Thus; creating national data base devising networking strategies, updating the CHM and establishing ABS Clearing House Mechanism (ABS-CHM) are the key activities to strengthen information exchange.

Milestones

- By 2015, CHM is updated and ABS-CHM is established
- By 2017, national biodiversity database is in place
- By 2018, information networking strategies are devised

Target 16. By 2020, knowledge and innovations related to biodiversity values, ecosystem functioning, status and trends, and the consequences of its loss are generated, reviewed, compiled and applied

Technical rationale

In Ethiopia, there is no sufficient information on values of biodiversity and ecosystem services. The status, trends and consequences of biodiversity loss are also not well studied. Therefore, there is high need to compile the exiting information and generate new knowledge in order to identify status, tends, threats and determine values, and set priorities for conservation and sustainable utilization. Full implementation of this target will also contribute to the achievements of the other targets outlined in the Strategic Plan 2015-2020. Effective implementation of the target will also strengthen the policy-science integration through information access.

Implementation strategy

Implementation of this target requires generation and compilation of knowledge related to ecosystem functioning, status and trends, and causes and consequences of loss of biodiversity as well as values of biodiversity and ecosystem services. It also requires integration of the knowledge into biodiversity conservation and sustainable utilization strategies. Therefore, more investment on research is critical for the full implementation of the target.

Milestones

- By 2020, valuation studies on at least two forest and rangeland ecosystems and 11 species/breeds/varieties are conducted
- By 2020, information on status, trends and threats of biodiversity, ecosystem functioning and services, and ABS related issues are generated and applied for further research and development

Target 17. By 2020, community knowledge, innovations and practices of local communities related to biodiversity are documented, subject to the national legislation, and relevant international obligations, and integrated into the national development strategies with the full and effective participation of local communities

Technical rationale

Ethiopia is a country with more than 84 ethnic groups. These ethnic groups inhabit in different agro-ecological zones and their interaction with diversified biophysical environments resulted in diverse community knowledge related to biodiversity. Nevertheless, community knowledge has not been well documented and used in conservation and sustainable utilization of biodiversity. Moreover, the knowledge has not been integrated into national development and poverty alleviation strategies. Therefore, further efforts are required to document knowledge, innovations and practices of local communities. There is also a need to integrate and apply the knowledge into national development strategies, with the full participation of local communities.

Implementation strategy

In Ethiopia, documented community knowledge, innovations and practice, relevant to conservation and sustainable utilization of biodiversity are scarce and fragmented. Therefore, implementation of this target will start with reviewing the existing documents, and recording the undocumented ones. Devising a strategy for communicating and integrating the knowledge, innovations and practices of local communities into the national and local development and poverty alleviation strategies is another activity required to implement this target.

Milestones

- By 2018, existing knowledge, innovations and practices of local communities relevant to biodiversity and ecosystem services are reviewed, documented and communicated

- By 2020, knowledge, innovations and practices of local communities relevant to conservation and sustainable utilization of biodiversity are communicated, and integrated into national and local development and poverty alleviation strategies

Target 18. By 2020, mobilization of financial resources from internal and external sources required for effective implementation of the strategy is increased substantially

Technical rationale

One of the major obstacles for the implementation of the previous NBSAP was limitation in financial resources. The government of Ethiopia is highly committed to support biodiversity conservation and sustainable utilization endavours. In light of multiple challenges biodiversity and ecosystems are facing, however, the financial resources from the government alone cannot support full implementation of the current Strategic Plan. Therefore, mobilization of substantial amount of internal and external funds is critically required to effectively implement the Strategic Plan 2015-2020.

Implementation strategy

Effective implementation of the current NBSAP requires full support and cooperation of the stakeholders and the government of Ethiopia. Moreover, it requires substantial financing both from national and international sources. Therefore, the focal institute should develop financial resources mobilization strategy.

Milestones

- By 2015, Competent project proposals for seeking funds are developed
- By 2015, financial resources mobilization strategy is in place

Table 9. Strategic goals, targets, actions, implementing agencies and period of implementation

Ethiopian targets by goals	Indicators	Actions	Implementing Agency		Implementation period
			Lead[1a]	Collaborators[2a]	
Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society					
1. By 2020, awareness of public and decision makers on the values of biodiversity and ecosystem services is raised, and the steps they can take to conserve and use them sustainably is improved	• Percentage of the public and decision makers aware of biodiversity and ecosystem services • Percentage of decision makers addressing the sustainability agenda • Percentage of the public participating in caring biodiversity and environment	1.1. Conduct national baseline survey on the level of awareness of public and decision makers on biodiversity	EBI	CSA, RBUs, MoANR, MoLF	2015
		1.2. Conduct awareness raising activities on biodiversity for public and decision makers	EBI	RBUs, EBF, EWNHS, Media, EWCA, MoANR, MoLF, HoPR, concerned NGOs	2015-2020
		1.3. Revise educational curricula relevant to biodiversity	MoE	EBI, HLIs, regional bureaus of education including Addis Ababa and Dire Dawa City Councils, EWCA, MoANR, MoEFCC, MoLF	2015-2020
		1.4. Start implementation of the revised educational curricula	MoE	HLIs, regional bureaus of education including Addis Ababa, Dire Dawa City Councils	2016
		1.5. Make awareness creation part of the extension and adult education programmes	MoANR	MoE, MoH, MoLF, EBI, MoEFCC, BoANR/ Pastoral/Agropastoral Bureaus	2016
		1.6. Evaluate the level of awareness of public and decision makers on biodiversity	EBI	CSA, RBUs, MoANR, MoLF	2020

[1] **Lead agency**: The institute mandated to carryout actions stated under the respective targets of this NBSAP Therefore, it is the agency that takes major responsibility to execute the actions and coordinates others

[2] **Collaborating agency:** The institute that works in close coordination with lead agency to execute the specified actions, as per condition specified under binding instrument (to be prepared as separate document)

[a]- some of the acronyms standing for lead and collaborating agencies are defined at the end of this Table (Table 9)

Table 9. Strategic goals, targets, actions, ...

Ethiopian targets by goals	Indicators	Actions	Implementing Agency		Implementation period
			Lead	Collaborators	
2. By 2020, the existing biodiversity related laws, regulations and strategies, including those associated with incentives are reviewed and gaps are addressed	•Number of revised laws, regulations and strategies •Number of identified incentives that reward positive contributions and addressed perverse incentives •Number of mainstreamed laws, regulations and strategies •Number of capacity built stakeholder institutions	2.1. Review laws, regulations and strategies related to biodiversity, including those associated with incentives	EBI	MoANR, MoLF, MoEFCC, EIPO, EWCA, Investment Agency, EBF, MoJ	2015
		2.2. Draft/harmonize laws, regulations and strategies related to biodiversity	EBI	HoPR, MoANR, MoLF, ATA, MoEFCC, EIPO, EWCA, Investment Agency, EBF, MoJ, Council of Ministers, regional governments, MoI	2016-2017
		2.3. Approve and mainstream laws, regulations and strategies	EBI	MoANR, MoLF, MoEFCC, MoFPDA, BoANR/ Pastoral/Agropastoral Bureaus, BoEFCC, EIPO, EWCA, Investment Agency, EBF, ATA	2017-2020
		2.4. Build capacity on the implementation of the existing biodiversity related laws, regulations and strategies	EBI	MoEFCC, MoJ, EIPO, EWCA, MoANR, MoLF	2020
3. By 2020, biodiversity values and ecosystem services are communicated and integrated into national and local development and poverty reduction strategies and plans	•Strategies integrating values of biodiversity and ecosystem services	3.1. Review studies on valuation of biodiversity and ecosystem services	EBI	MoANR, MoLF, MoEFCC, EWCA, HLIs, EIPO	2016
		3.2. Communicate and integrate values of biodiversity and ecosystem services into local and national development and poverty reduction strategies and plans	NPC	MoANR, MoLF, HoPR, MoEFCC, EBI, EWCA	2016-2020

Table 9. Strategic goals, targets, actions, ...

Ethiopian targets by goals	Indicators	Actions	Implementing Agency		Implementation period
			Lead	Collaborators	
Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use					
4. By 2020, habitat conversion due to expansion of agricultural land is halved from the existing rate of about 10% per year	•Rate of annual conversion of habitats into agricultural land	4.1. Create alternative jobs for local communities	MoI	MoANR, MoLF, MoCT, MoT, MoMPNG, MoYS, regional governments	2015-2020
		4.2. Increase alternative energy sources and use of energy efficient technologies	MoWIE	MoANR, MoLF, MoT, MoI, MoMPNG, MoST, regional governments, concerned NGOs	2015-2020
		4.3. Adopt technologies and innovations for increased productivity of smallholder farmers and pastoralists	MoANR	MoLF, EIAR, RARIs, EBI, RBUs, MoST, MoFPDA, BoANR/Pastoral/ Agropastoral Bureaus/ Agencies, NAIC, HLIs dealing with livestock, fisheries and agriculture, ATA	2015-2020
5. By 2020, unsustainable utilization of biodiversity and ecosystem services are reduced	•Number of ecosystems and species/breeds managed sustainably •Number of ecosystems restored	5.1. Develop and implement regulations and guidelines to control open access to grazing lands, aquatic ecosystems, wetlands and other communal lands	MoEFCC	EBI, MoANR, MoLF, MoEFCC, EBF, MoWIE, HoPR, concerned NGOs, RBUs, BoANR/Pastoral/ Agropastoral/ Livestock and Fisheries Bureaus/Agencies, BoEFCC, Forest Enterprises, Oromia Pastoral Commission	2015-2017
		5.2. Improve productivities of forage, grazing and rangelands	MoLF	EIAR, RARI, MoFPDA, BoANR/Pastoral/ Agro-pastoral/ Livestock and Fisheries Bureaus/Agencies, HLIs	2015-2020
		5.3. Ensure sustainable use of natural fish stock, applying ecosystem based management, and expanding aquaculture	MoLF	EBI, MoANR, MoEFCC, RBUs, EWCA, EIAR, MoWIE, BoANR, BoEFCC, HLIs, RARI, Bureaus/Agencies of Livestock and Fisheries	2015-2020
		5.4. Promote afforestation and use of non-wood forest products	MoEFCC	MoANR, MoLF, EBF, concerned NGOs, MoFPDA, BoANR/Pastoral/Agropastoral/ Bureaus, BoEFCC, Forest Enterprises, Bureaus/Agencies of Livestock and Fisheries	2015-2020

Table 9. Strategic goals, targets, actions, ...

Ethiopian targets by goals	Indicators	Actions	Implementing Agency		Implementation period
			Lead	Collaborators	
6. By 2020, the area invaded by invasive species is reduced by 75% and measures are in place to regulate and monitor invasive species, including newly emerging ones	•Area cleared from invasive species and properly managed •Trends in expansion of invasive species •Measures for monitoring invasive species	6.1. Conduct studies on the status, trends and impacts of major invasive species (prosopis, parthenium weed, water hyacinth, lantana weed, Cochineal insect and others), and revise their control strategy	EBI	MoEFCC, MoANR, MoLF, HUs, MoFPDA, BoANR/Pastoral/Agropastoral/ Livestock and Fisheries Bureaus/Agencies, BoEFCC	2016
		6.2. Implement the revised strategies to control major invasive species	EBI	EIAR, MoEFCC, MoANR, MoLF, MoFPDA, RBUs, BoANR/Pastoral/ Agropastoral/Livestock and Fisheries Bureaus/Agencies, BoEFCC, RARI, regional governments, Dire Dawa City Council	2016-2020
		6.3. Put in place and implement measures to regulate and monitor invasive species, including newly emerging ones	EBI	EIAR, MoEFCC, MoANR, MoLF, MoFPDA, RBUs, BoANR/Pastoral/ Agropastoral/ Livestock and Fisheries Bureaus/Agencies, BoEFCC, RARI, regional governments, Dire Dawa City Council	2018-2020
Strategic Goal C: Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity					
7. By 2020, area coverage of ecologically representative and effectively managed PAs is increased from 14% to 20%	•Percent increase in area coverage of ecologically representative PAs •Percentage of properly managed PAs	7.1. Identify gaps in the level of representativeness of the existing PAs	EWCA	EBI, MoEFCC, MoANR, MoLF, concerned NGOs, Oromia Forest and Wildlife Enterprise, Bureaus of Wildlife and Tourism of regions, RBUs where PAs are located	2015
		7.2. Establish ecologically representative PAs	EWCA	EBI, MoEFCC, MoANR, MoLF, Oromia Forest and Wildlife Enterprise, Bureaus of Wildlife and Tourism of Amhara, SNNPR, Gambella, Benshangul Gumuz, Somali, Tigray, Dire Dawa City Council, RBUs	2016-2020
		7.3. Re-demarcate 11 of the PAs and develop management plans for seven PAs	EWCA	EBI, MoEFCC, MoANR, MoLF, Oromia Forest and Wildlife Enterprise, Bureaus of Wildlife and Tourism of regions where PAs are located, RBUs	2015-2017
		7.4. Conduct economic valuation for seven PAs	EWCA	EBI, MoEFCC, HUs, Ethiopian Economic Association	2015-2020

Table 9. Strategic goals, targets, actions, ...

Ethiopian targets by goals	Indicators	Actions	Implementing Agency		Implementation period
			Lead	Collaborators	
8. By 2020, *ex situ* conservation of agro-biodiversity, wild plants, animals and microbes; with special emphasis on endemic, endangered, economically or ecologically important species and breeds is increased and standards of the existing *ex situ* conservation are improved	•Number of ecologically representative *ex situ* conservation sites •Number of species/breeds under *ex situ* conservation •Number of *ex situ* conservation sites to which standard conservation practices have been developed •A Natural History Museum and Herbarium established •Number of botanical gardens	8.1. Identify threatened species of agro-biodiversity, wild plants, animals and microbial genetic resources, and set priority for collection and conservation	EBI	RBUs, HLIs, EIAR, RARIs	2015-2017
		8.2. Establish Natural History Museum and National Herbarium	EBI	AAU, EWCA	2017-2019
		8.3. Increase *ex situ* collections of species/breeds/ strains and accessions/straws from: •62 species to 99 species (76,521 to 80,571 accessions) of field and horticultural crops •714 species to 1,214 species (1,704 to 4,746 accession) for forests and rangeland plants •Five breeds/species to eight breeds/species (32,600 straws to 132,600 straws) for domestic and wild animals •550 to 1000 species/strains of microbes	EBI	RBUs, EIAR, RARIs, HLIs	2015-2020
		8.4. Increase the number of botanical gardens from three to 10 sites	EBI	HLIs, RBUs, BoEFCC, BoANR/Pastoral/ Agropastoral Bureaus	2015-2020
		8.5. Identify gaps in and improve the standards of *ex situ* conservation	EBI	EWCA, HLIs, RBUs, EIAR, RARIs	2015-2020
9. By 2020, *in situ* conservation sites for important species and breeds are increased and the standards of the existing *in situ* conservation are improved	•Number of *in situ* conservation sites •Number of species/breeds under *in situ* conservation •Number of *in situ* conservation sites to which standard conservation practices have been developed	9.1 Identify threatened species and sites/ecosystems and set priority for *in situ* conservation	EBI	RBUs, EWCA, MoEFCC, MoANR, MoLF, HLIs	2015-2017
		9.2. Increase the number of *in situ* conservation from: •14/19 to 24/69 species/varieties of field and horticultural crops •600 to 1000 species for forest and rangeland plants •15 to 36 breeds/species of animals	EBI	EWCA, MoANR, MoLF, MoFPDA, MoEFCC, RBUs, BoANR, Pastoral/Agropastoral/ Livestock and Fisheries Bureaus/Agencies, BoEFCC, concerned NGOs	2015-2020
		9.3. Develop management plans for *in situ* conservation sites	EBI	EWCA, MoANR, MoLF, MoEFCC, RBUs, BoANR/Pastoral/ Agropastoral Bureaus/Agencies, BoEFCC, concerned NGOs	2016-2020

Table 9. Strategic goals, targets, actions, ...

Ethiopian targets by goals	Indicators	Actions	Implementing Agency		Implementation period
			Lead	Collaborators	
Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services					
10. By 2020, the contribution of biodiversity and ecosystem services, including climate change adaptation and mitigation, is improved through increasing forest cover from 15% to 20% of the country, increased designated total area of wetlands from 4.5% to 9.0% and doubling the area of restored degraded lands	• Percent increase in forest cover • Percent increase in designated wetlands • Percent increase in restored degraded areas	10.1. Increase forest cover from 15% to 20% through afforestation and re-forestation	MoEFCC	MoANR, EBI, RBUs, BoANR, BoEFCC, Forest and Wildlife Enterprises, concerned NGOs	2015-2020
		10.2. Double area of designated wetlands	MoEFCC	MoANR, MoLF, EBI, RBUs, EWCA, BoANR, Bureaus/Agencies of Livestock and Fisheries, BoEFCC, Forest and Wildlife Enterprises, concerned NGOs	2015-2020
		10.3. Increase restored area of degraded land from 10 to 20 million hectares	MoANR	MoEFCC, MoLF, EBI, RBUs, BoANR, MoFPDA, Bureaus/Agencies Livestock Fisheries, BoEFCC, Forest Enterprises, concerned NGOs	2015-2020
		10.4. Generate incentives for the local communities through carbon trade from high forests, woodlands and traditional agro-forestry	MoEFCC	MoANR, RBUs, EWCA, BoANR, BoEFCC, Forest and Wildlife Enterprises, concerned NGOs	2015-2020
11. By 2020, the number of genetic materials accessed for research and development, and fair and equitable sharing of benefits arising from their use are increased by 24% and 39%, respectively	• Number of genetic materials accessed for research and development • Number of genetic materials accessed for fair and equitable benefit sharing	11.1. Build material and human capacity for bio-prospecting and negotiation	EBI	MoANR, MoLF, MoFED, HLIs, EIAR, MoEFCC	2015-2020
		11.2. Promote and increase the number of genetic materials for research and development from 163,834 to 203,926 accessions and bio-prospected species for access and fair and equitable benefit sharing from their use from 13 to 18 species	EBI	MoANR, MoLF, EIAR, RARIs, HLIs, EIPO, Media, MoJ, RBUs	2015-2020
		11.3. Control unauthorized movement of genetic resources	EBI	Customs and Revenue Authority, Civil Aviation, National Post Office, DHL, RBUs, MoND, Police, National Interpol Coordination Office	2015-2020

Table 9. Strategic goals, targets, actions, ...

Ethiopian targets by goals	Indicators	Actions	Implementing Agency		Implementation period
			Lead	Collaborators	
12. By 2020, women's access to and control over biodiversity resources and ecosystem services are improved	•Percent increase in women's access to and control over biodiversity resources and ecosystem services •National gender mainstreaming guideline	12.1. Generate baseline data on the level of women's access to and control over biodiversity resources and ecosystem services	EBI	CSA, MoANR, MoLF, MoWCA, RBUs	2015
		12.2. Develop and implement national gender mainstreaming guideline on biodiversity resources and ecosystem services	EBI	MoANR, MoLF, MoWCA, MoEFCC, concerned NGOs	2016-2020
		12.3. Evaluate the level of improvement of women's access and control over biodiversity resources and ecosystem services	MoWCA	EBI, MoANR, MoLF, MoEFCC, CSA, RBUs	2020
13. By 2018, benefits from biodiversity are increased through value addition to at least 12 agro-biodiversity species and products, and creating market linkages for five species of medicinal plants; taking into account the needs of women and local communities	•Number of value added products •Number of newly established market links	13.1. Conduct value addition activities for at least 12 agro-biodiversity species and products (tef, enset, wheat, coffee, sesame, haricot bean, black cumin, barley, soya bean, chick pea, meat and milk), including studying their value chains, taking into account geographic origins	MoANR	Ethiopian Standards Authority, MoI, EBI, MoLF, MDTI, ECXA, Cooperative Agency, private sector, BoANR, Bureaus/Agencies of Livestock and Fisheries ATA, concerned NGOs, cooperatives/associations EIAR, RARIs, HLIs	2015-2018
		13.2. Create linkage to potential niche markets for the value added agro-biodiversity species and products and five species of medicinal plants (*Hibiscus sabdariffa, Moringa stenopetala, Withania somnifera, Embelia schimperi and Podocarpus falcatus*)	MoANR	EBI, MoLF, Ethiopian Standards Authority, MoI, Cooperative Agency, BoANR, Bureaus/Agencies of Livestock and Fisheries private sector, MDTI, ECXA, ATA, cooperatives/association, MoFA	2015-2020

Table 9. Strategic goals, targets, actions, ...

Ethiopian targets by goals	Indicators	Actions	Implementing Agency		Implementation period
			Lead	Collaborators	
Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building					
14. By 2020, stakeholders' integration, including the participation of local communities in biodiversity conservation and sustainable utilization, is strengthened	• Level of local communities and stockholders participation • Level of NBSAP implementation	14.1. Put in place National Biodiversity Council and National Biodiversity Technical Committee	EBI	HoPR, MoANR, MoLF, MoEFCC, EWCA, EIAR, MoFED, MoE	2015
		14.2. Establish and strengthen 10 Biodiversity Units at regions and seven Centers at representative bio-geographical areas	EBI	MoANR, MoLF, MoEFCC, regional governments, Dire Dawa City Council	2015-2020
15. By 2017, national biodiversity information system is strengthened, information dissemination strategy is devised and Clearing House Mechanism is updated	• Status of National Biodiversity Database • Status of CHM and ABS-CHM	15.1. Update Clearing House Mechanism (CHM) and establish ABS-CHM	EBI	MoANR, MoLF, MoEFCC, EWCA, EIPO, HLIs, EIAR, RARI, BoANR/Pastoral/ Agro-pastoral Bureaus, Bureaus/Agencies of Livestock and Fisheries, BoEFCC, concerned NGOs	2015
		15.2. Establish and strengthen national biodiversity database and dissemination strategy	EBI	MoANR, MoEFCC, MoLF, EWCA, EIPO, HLIs, EIAR, RARI, concerned NGOs BoANR/Pastoral/Agro-pastoral Bureaus, BoEFCC, Bureaus/Agencies of Livestock and Fisheries	2017
		15.3. Devise information networking strategies	EBI	MoANR, MoEFCC, MoLF, EWCA, EIPO, HLIs, EIAR, RARI, CBOs, concerned NGOs	2015-2018
16. By 2020, knowledge and innovations related to biodiversity values, ecosystem functioning, status and trends, and the consequences of its loss are generated, reviewed, compiled and applied	• Number of compiled knowledge and innovations on biodiversity • Number of generated knowledge and innovations on biodiversity • Number of knowledge and innovations applied in biodiversity conservation and sustainable use	16.1. Conduct research on status, trends and threats of biodiversity and ABS related issues	EBI	EIAR, RARIs, MoST, HLIs, EWCA, RBUs, EIPO	2015-2020
		16.2. Apply generated knowledge and innovations for development and further research	NPC	EBI, MoFED, EIAR, HLIs, MoEFCC, MoANR, MoLF, EWCA, MoWIE, MoMPNG, MoI, HoPR	2016-2020
		16.3. Conduct valuation studies on at least six species/varieties of field and horticultural crops, five breeds/species of animals and two forest and rangeland ecosystems	EBI	MoEFCC, MoFED, MoANR, MoLF, EWCA, Economic Society of Ethiopia, HLIs, concerned NGOs	2016-2020

Table 9. Strategic goals, targets, actions, ...

Ethiopian targets by goals	Indicators	Actions	Implementing Agency		Implementation period
			Lead	Collaborators	
17. By 2020, community knowledge, innovations and practices of local communities related to biodiversity are documented, subject to the national legislation, and relevant international obligations, and integrated into the national development strategies with the full and effective participation of local communities	•Number of documented community knowledge, innovations and practices •Number of community knowledge, innovations and practices integrated into local and national development strategies	17.1. Review, document and communicate existing knowledge, innovations and practices of local communities relevant to biodiversity	EBI	EBF, HLIs, RBUs, EIPO, concerned NGOs, MoCT	2016-2018
		17.2. Integrate knowledge, innovations and practices of local communities relevant to biodiversity into national and local development strategies	NPC	EBI, MoFED, EBF, HLIs, MoI, EIPO, RBUs	2017-2020
18. By 2020, mobilization of financial resources from internal and external sources required for effective implementation of the strategy is increased substantially	•Amount of funds secured •The level of implementation of NBSAP	18.1. Develop competent projects for seeking funds	EBI	EWCA, MoEFCC, MoANR, MoLF, HLIs, EWNHS, RBUs	2015-2020
		18.2. Put in place financial resources mobilization strategy	EBI	MoANR, MoLF, MoE, EWCA, MoEFCC, MoFED	2016

* **BoANR** (Bureau of Agriculture and Natural Resources), **BoEFCC** (Bureau of Environment, Forest and Climate Change), **EWCA** (Ethiopian Wildlife Conservation Authority), **EWNHS** (Ethiopian Wildlife and Natural History Society), **EWNRA** (Ethio-wetlands and Natural Resources Association), **MoANR** (Ministry of Agriculture and Natural Resources), **MoCT** (Ministry of Culture and Tourism), **MoND** (Ministry of National Defense), **MoE** (Ministry of Education), **MoEFCC** (Ministry of Environment, Forest and Climate Change), **MoFPDA** (Ministry of Federal and Pastoralist Development Affairs), **MoFA** (Ministry of Foreign Affairs), **MoFED** (Ministry of Finance and Economic Development), **MoH** (Ministry of Health), **MoI** (Ministry of Industry), **MoJ** (Ministry of Justice), **MoLF** (Ministry of Livestock and Fisheries), **MoMFNG** (Ministry of Mines, Petroleum and Natural Gas), **MoST** (Ministry of Science and Technology), **MoT** (Ministry of Trade), **MoWCA** (Ministry of Women and Children's Affairs), **MoWIE** (Ministry of Water, Irrigation and Electricity), **MoYS** (Ministry of Youth and Sport), **NPC** (National Planning Commission)

Table 10. Relationships between Ethiopia's National Biodiversity Targets and Aichi Targets

Ethiopia's National Biodiversity Targets by Strategic Goals	Aichi Targets (No.)
Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society	
Target 1. By 2020, awareness of public and decision makers on the values of biodiversity and ecosystem services is raised, and the steps they can take to conserve and use them sustainably is improved	1,2,4,19
Target 2. By 2020, the existing biodiversity related laws, regulations and strategies, including those associated with incentives are reviewed and gaps are addressed	3
Target 3. By 2020, biodiversity values and ecosystem services are communicated and integrated into national and local development and poverty reduction strategies and plans	1,2,19
Goal B: Reduce the direct pressures on biodiversity and promote sustainable use	
Target 4. By 2020, habitat conversion due to expansion of agricultural land is halved from the existing rate of about 10% per year	5,7
Target 5. By 2020, unsustainable utilization of biodiversity and ecosystem services are reduced	6,7,8
Target 6. By 2020, the area invaded by invasive species is reduced by 75% and measures are in place to regulate and monitor invasive species, including newly emerging ones	9
Goal C: Improve the status of biodiversity by safeguarding ecosystems, species and Genetic diversity	
Target 7. By 2020, area coverage of ecologically representative and effectively managed PAs is increased from 14% to 20%	11
Target 8. By 2020, *ex situ* conservation of agro-biodiversity, wild plants, animals and microbes; with special emphasis on endemic, endangered, economically or ecologically important species and breeds is increased and standards of the existing *ex situ* conservation are improved	12,13
Target 9. By 2020, *in situ* conservation sites for important species and breeds are increased and the standards of the existing *in situ* conservation are improved	12,13
Goal D: Enhance the benefits to all from biodiversity and ecosystem services	
Target 10. By 2020, the contribution of biodiversity and ecosystem services, including climate change adaptation and mitigation, is improved through increasing forest cover from 15% to 20% of the country, increased designated total area of wetlands from 4.5% to 9.0% and doubling the area of restored degraded lands	12,14,15
Target 11. By 2020, the number of genetic materials accessed for research and development, and fair and equitable sharing of benefits arising from their use are increased by 24% and 39%, respectively	16
Target 12. By 2020, women's access to and control over biodiversity resources and ecosystem services are improved	14
Target 13. By 2018, benefits from biodiversity are increased through value addition to at least 12 agrobiodiversity species and products, and creating market linkages for five species of medicinal plants; taking into account the needs of women and local communities	16,19

Table 10. Relationships between Ethiopia's, ...

Ethiopia's National Biodiversity Targets by Strategic Goals	Aichi Targets (No.)
Goal E: Enhance implementation through participatory planning, knowledge management and capacity building	
Target 14. By 2020, stakeholders' integration, including the participation of local communities in biodiversity conservation and sustainable utilization, is strengthened	14,18
Target 15. By 2017, national biodiversity information system is strengthened, information dissemination strategy is devised and Clearing House Mechanism is updated	2,18,19
Target 16. By 2020, knowledge and innovations related to biodiversity values, ecosystem functioning, status and trends, and the consequences of its loss are generated, reviewed, compiled and applied	19
Target 17. By 2020, community knowledge, innovations and practices of local communities related to biodiversity are documented, subject to the national legislation, and relevant international obligations, and integrated into the national development strategies with the full and effective participation of local communities	18,19
Target 18. By 2020, mobilization of financial resources from internal and external sources required for effective implementation of the strategy is increased substantially	20

CHAPTER EIGHT

8. IMPLEMENTATION ARRANGEMENTS

8.1. Coordination

The Ethiopian Biodiversity Institute is responsible for the conservation and sustainable utilization of biodiversity, and ensuring access to genetic resources and the fair and equitable sharing of benefits arising from their use. It is also the Focal Institute to the Convention on Biological Diversity (CBD). Therefore, the Institute will take the overall responsibility of coordinating the implementation of the Strategic Plan 2015-2020. The Focal Institute will facilitate the establishment of National Biodiversity Technical Committee and National Biodiversity Council. It will also organize biannual National Biodiversity Technical Committee as well as annual stakeholders and National Biodiversity Technical Committee meetings. The Institute will also formulate binding instrument that should be agreed upon by the concerned lead and collaborating institutions.

National Biodiversity Technical Committee

National Biodiversity Technical Committee (NBTC) is a technical wing that shall follow up the implementation of the NBSAP. It is composed of heads of RBUs of all regional states including Dire Dawa City Council, a representative from each implementing lead agency, and a representative from EBF, IPBES, National Chamber of Commerce, local and international NGOs and Ministry of Information Communication.

The Chairperson of the NBTC will be the Deputy Director General of the Coordinating Institute, and the vice chairperson and the secretary will be elected by the Technical Committee from its members. The NBTC shall convene its meeting every six months a year, in first weeks of January and July.

The major task of the NBTC is evaluating progresses of implementation of the NBSAP. Its other tasks include approving various formats and strategies such as communication, education and public awareness and financial resources mobilization strategies; monitoring and evaluation, and reporting formats as well as detailed tasks outlined for the actions of the Strategic Plan. Moreover, the NBTC is responsible to carry-out other activities that may be advised by the National Biodiversity Council.

The findings on the progress of implementation reported from both NBTC meetings will be presented to the annual National stakeholders' workshop and National Biodiversity Council by the chairperson of the NBTC. Upon the call by its chairperson, the NBTC may convene urgent meeting/meetings, as the case may be, in addition to their planned biannual meetings.

National Biodiversity Council

National Biodiversity Council (NBC) is the highest body that oversees the implementation of the NBSAP, and provides strategic direction. Members of the NBC will be representatives from HoPRs, EBI, MoANR, MoLF, MoEFCC, EWCA, MoE, MoWCA, MoFED, and MoST. Local and international NGOs, and National Chamber of Commerce will be represented by one member each.

The chairperson of the NBC will be the Minister of Ministrty of Environment, Forest and Climate Change and the vice Chairperson will be a person from the appropriate Standing Committee of the House of the People's Representatives of the Federal Democratic Republic of Ethiopia. The secretary of the committee will be the Director General of the Ethiopian Biodiversity Institute.

The NBC shall meet once a year, immediately after the stakeholders' workshop. Based on the summary of the findings from both NBTC meetings and annual stakeholder workshop, the NBC will provide strategic directions to the NBTC, including revisiting the

plan, if necessary. Upon the call through its chairperson, the NBC may convene an urgent meeting/ meetings in addition to its annual meeting.

8.2. Resource Mobilization

Most of the actions set in the NBSAP are planned in a way that they can be mainstreamed into different sectoral and cross-sectoral plans, and will be implemented with government budgets allocated to the sectors. To effectively accomplish the actions and targets outlined in the NBSAP, however, substantial support from both internal and external funding sources is required.

To secure these funds, a separate portfolio of funding strategy will be developed by the Focal Institute. The strategy will also contain the disbursement component to release funds secured from different sources for the implementing agencies. The funding strategy will serve as the operational national standing document for funding mechanism for the implementation period of 2015 through 2020.

8.3. Plans for Clearing House Mechanism

One of the most important drawbacks of the previous NBSAP of Ethiopia was lack of responsible national coordinating system that resulted in weak information exchange. The Clearing House Mechanism (CHM), which was established by the SCBD worldwide for the purposes of availing information to interested parties, is one of the crucial tools to fill such gaps and this should be supported by networking national stakeholders and ABS-CHM that shall be established at the beginning of the implementation period. In addition to updating the CHM, establishment of information networks need to be expanded through regions and institutions.

8.4. Monitoring and Evaluation

Monitoring and evaluation shall be conducted by a group of experts from different disciplines set by NBTC and its outcomes shall be reported to NBTC, stakeholders and

the NBC in a step by step manner, based on the agreed upon format and work plan. Monitoring and evaluation formats will be formulated by the Focal Institute.

8.5. Reporting

The RBUs and lead agencies are required to submit their respective implementation progress reports to the focal institute on quarterly basis. These reports will be compiled and presented to the NBTC at its biannual meetings by the Focal Institute. The NBTC meetings will be conducted in January and July. In the case of July meeting, the findings of both NBTC meetings will be synthesized and presented to annual stakeholders workshop that will be conducted a week later from the July NBTC meeting. The outcome of both NBTC meetings and national stakeholders' workshop will be synthesized and submitted to coordinating Institute, and then will be presented to National Biodiversity Council (NBC) by Director General of the coordinating Institute. The outcomes of the meetings and strategic directions of the NBC will be communicated to the respective stakeholders through coordinating Institute. In addition, the annual progress report and the outcomes of the implementation will be communicated to the concerned international bodies such as the SCBD by the coordinating Institute.

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ANNEXES

Annex I. The red list of endemic trees and shrubs of Ethiopia

No.	Name of the Species	Status	Distribution in Ethiopian Floristic Region (s)*
1	*Acacia bricchettiana*	CR	HA
2	*Acacia negrii*	VU	GD, WU, GJ, HA, SD
3	*Acacia prasinata*	CR	AF, SU
4	*Acalypha marissima*	CR	WG
5	*Acanthus sennii*	NT	GD, GJ, WG, SU, HA, AR, BA, KF, GG, SD
6	*Argyrolobium schimperianum*	EN	TU, GD, GJ, SU
7	*Barleria longissima*	CR	SD
8	*Becium formosum*	VU	BA
9	*Blepharis cuspidate*	CR	SD
10	*Blepharispermum obovatum*	CR	BA
11	*Boswellia ogadensis*	CR	HA
12	*Boswellia pirottae*	VU	GD, GJ, WU, SU, KF
13	*Cadaba divericata*	VU	SD, HA
14	*Cladostigma nigistiae*	EN	SD
15	*Commiphora monoica*	CR	BA
16	*Crotalaria agatiflora*	NT	SU, HA, IL, AR, GG
17	*Crotalaria exaltata*	EN	SU, BA, KF, SD
18	*Crotalaria intonsa*	VU	GD, SU, KF, SD
19	*Crotalaria rosenii*	NT	SU, AR, BA, KF, SD
20	*Crotalaria sacculata*	CR	SD
21	*Cussonia ostinii*	NT	WU, GD, GJ, WG, IL, AR, KF, GG
22	*Delosperma abyssinica*	CR	TU
23	*Delosperma schimperi*	EN	TU, WU
24	*Dombeya kefaensis*	EN	KF
25	*Dombeya longebracteolata*	VU	KF, GG, SD
26	*Echinops ellenbeckii*	EN	SU, AR, HA
27	*Erythrina burana*	VU	HA, BA?
28	*Erythrococca uniflora*	EN	SD
29	*Euphorbia burger*	CR	HA
30	*Euphorbia dalettiensis*	EN	SD, HA
31	*Euphorbia doloensis*	CR	SD
32	*Euphorbia ellenbeckii*	EN	SD
33	*Erythrophysa septentrionalis*	EN	HA
34	*Euphorbia baleensis*	CR	BA
35	*Euphorbia betulicortex*	CR	SD
36	*Euphorbia fissispina*	EN	SD
37	*Euphorbia makallensis*	CR	TU
38	*Euphorbia nigrispinioides*	VU	SU, HA?

No.	Name of the Species	Status	Distribution in Ethiopian Floristic Region (s)*
39	*Euphorbia ogadenensis*	CR	BA, HA
40	*Euphorbia somalensis*	CR	HA
41	*Euphorbia tetracantha*	CR	BA
42	*Euphorbia uniglans*	EN	SD
43	*Euryops pinifolius*	VU	WU, GJ, SU
44	*Hildebrandtia aloysii*	VU	HA, BA
45	*Hildebrandtia diredawaensis*	EN	HA
46	*Hybanthus puberulus*	CR	SD
47	*Ficus ruspolii*	VU	SD, KF
48	*Helichrysum elephantium*	VU	BA, GG, SD
49	*Helichrysum horridum*	EN	GD, SD
50	*Hybanthus puberulus*	CR	SD
51	*Hypericum gnidiifolium*	VU	TU, SU
52	*Indigofera curvirostrata*	CR	SD
53	*Indigofera ellebenbeckii*	CR	HA
54	*Hibiscus boranensis*	VU	SD
55	*Indigofera kelleri*	CR	HA
56	*Indigofera rothii*	EN	SU, HA
57	*Inula arbuscula*	CR	GD
58	*Inula confertiflora*	NT	WU, SU, HA, BA, AR
59	*Kanahia carlsbergiana*	EN	AR, BA
60	*Lantana kisi*	EN	TU
61	*Lindenbergia awashensis*	EN	AF, SU
62	*Maerua boranensis*	CR	SD
63	*Maytenus addat*	NT	SU, AR, SD, GG
64	*Kirkia burger*	VU	SD, BA, HA
65	*Kleinia gypsophila*	CR	HA
66	*Kleinia negrii*	EN	WU, HA, SD
67	*Kotschya recurvifolia*	VU	BA, HA, KF, SD
68	*Maytenus cortii*	CR	GD
69	*Maytenus harenensis*	CR	BA
70	*Monadenium shebeliensis*	CR	HA
71	*Moringa rivae* subsp. *longisiliqua*	VU	SD, BA, HA
72	*Phyllanthus dewildiorum*	EN	WG, KF
73	*Phyllanthus limmuensis*	VU	GD, GJ, WG, IL, KF
74	*Polyscias farinose*	VU	TU, GD, GJ, SU, KF
75	*Polysphaeria aethiopica*	EN	SD, BA
76	*Otostegia tomentosa* subsp. *steudneri*	VU	GD, WU
77	*Phyllanthus borenensis*	CR	SD
78	*Pseudoblepharispermum bremeri*	CR	HA

Annex I. The red list of, ...

No.	Name of the Species	Status	Distribution in Ethiopian Floristic Region (s)*
79	*Rhynchosia erlangeri*	EN	HA
80	*Rhynchosia splendens*	CR	GD
81	*Rinorea friisii*	EN	IL, KF
82	*Rubus aethiopicus*	EN	SU, GD
83	*Rubus erlangeri*	EN	BA, SD
84	*Sparmannia macrocarpa*	NT	GD, GJ, WU, SU, AR, WG, KF, GG, HA
85	*Stomatanthes meyeri*	CR	KF
86	*Tacazzea venosa*	EN	TU, GD, GJ
87	*Taverniera abyssinica*	CR	TU, SU
88	*Ruellia boranica*	EN	SD
89	*Satureja unguentaria*	EN	GD
90	*Sesbania melanocaulis*	EN	KF, WG
91	*Tephrosia dichroocarpa*	EN	TU, GD, GJ
92	*Terminalia hararensis*	DD	BA, HA
93	*Terminalia hecistocarpa*	DD	BA
94	*Tragia abortive*	VU	GG
95	*Tragia negeliensis*	VU	SD, BA
96	*Verbascum arbusculum*	CR	SU
97	*Wellstedia filtuensis*	CR	SD
98	*Wendlandia arabica subsp. aethipica*	EN	SU
99	*Verbascum arbusculum*	CR	SU
100	*Vernonia cylindrical*	VU	TU, GD, GJ, WG
101	*Vernonia dalettiensis*	CR	HA
102	*Vernonia tewoldei*	EN	KF, BA
103	*Vernonia thulinii*	CR	WG

*Distribution in Ethiopian Floeristic Region(s): BA (Bale), GD (Gonder), GG (Gamo Gofa), GJ (Gojam), HA (Harerge), IL (Iluababor), KF (Kafa), SD (Sidamo), SU (Shewa), TU (Tigray), WG (Walesa) and WU (Well).

Source: Jose L., Ensermu Kelbessa and Sebsebe Demissew (2005)

Annex II. Indigenous and exotic breeds' diversity in each farm animal species of Ethiopia

Species	Breeds names and number			
	Indigenous breed names	No	Exotic	No
Cattle	Arsi, Begait, Ogaden, Borena, Goffa, Arado, Nuer, Gurage, Jidu, Karayu, Afar, Harar, Horro, Simada, Fogera, Mursi, Raya-Azebo, Adwa, Jem-Jem, Sheko, Ambo, Jijiga, Bale, Hammer, Medenece, Irob, Abergelle and Begaria	28	Holstein-Friesian, Jersey, Brown Swiss, Hereford, Brahman, Angus and Simmental	7
Sheep	Simien, Short-fat-tailed, Washera, Horro, Arsi-Bale, Bonga, Afar, Black head Somali, Gumuz	9	Awassi, Hampshire, Blue-demain, Merino, Romney, Corriedale and Dorper	7
Goat	Arsi-Bale, Gumuz, Keffa, Woyto-Guji, Abergelle, Afar, Highland Goats and the Somali Goats.	8	Anglo-Nubian, Toggenberg and Boer goats	3
Camel	Jijiga, Geleb, Shinile, Amibara, Mile, Hur and Liben	7	---	
Donkey	Abyssinian, Afar, Haraghe, Omo/Hamer, Ogaden and Sinnar	6	---	
Horse	Abyssinia, Bale (pony), Borena, Horro, Keffa-Sheka (giant), Kundudo, Ogaden/Aware/Wilwal and Selale/Oromo	8	---	
Mule	Sinnar and Wollo	2	---	
Chicken	Horro, Jarso, Tililli/Mandura, Tepi/Sheko, Konso and Cheffe,Farta	7	Rhode Island Red, White Leghorn, Lawman Brown, Cobb-500, Fayoumi, Bovans Brown, Arob Acre, Bubcocks, Potcheftsroom Koekoek, Dominant Brown D102, Lahhman Silver, Hubbard Classic, Hubbard JV and ISA Brown	14

Source: (IBC, 2012c; 2004)

Annex III. List of Ethiopian Important Bird Areas in Priority Order for Conservation

Site Code	Site Name	Region
016	Bale Mts. Nat. Park	4
011	Awash Nat. Park	4,2
059	Simen Mts. Nat.Park	3
007	Ankober/Debre Sina Escarpment	3
064	Yabello Sanctuary	4
040	Guassa (Menz)	3
055	Nechisar Nat. Park	7
002	Abijatta-Shalla Lakes Nat. Park	4
008	Arero Forest	4
012	Awash Valley	2
037	Genale River	4
052	Metu-Gore Tepi Forests	4
003	Aba Samuel Wetlands	4
044	Koka Dam/Gelila Lake	4
013	Awi Zone	3
015	Bahir Dar Lake-Tana	3
021	Bogol Manyo	5
035	Gambella Nat. Park	12
049	Mankubsa-Welenso Forest	4
061	Sululta Plains	4
062	Tiro Boter-Becho Forest	4
070	Chilimo Forest	4
073	Senkelle Sanctuary	4
024	Chelekleka Swamp	4
006	Anferera Forest	4
023	Boyo Wetland	7
027	Dawa- Wachille	4
031	Denkoro Forest	3
036	Gefersa Reservoir	14
042	Jemma/Jara Valleys	3
048	W/Shebelle River/Warder	5
051	Menagesha Forest	4
053	Mid-Abbay River Basin	3
025	Chew Bahir Lake	7
032	Entoto Natural Park	14
033	Fincha'a-Chomen Swamps	4
046	Langano Lake	4
047	Liben Plain-Neghelle Woodlands	4
066	Yegof Forest	3
017	Baro River	12

038	Green Lake	4
005	Aliyu Amba/Dulecha	3,2
028	Desa'a Forest	1
029	Dilu Meda (Tefki)	4
034	Fogera plains	3
060	Sof Omar	4
066	Yangudi Rassa Park	2
072	Jibat Forest	4
009	Ashenge Lake	1
064	Turkana Lake/Omo Delta	7
001	Lake Abbe	2
018	Berga Floodplains	4
039	Gudo Plains	4
043	Koffe Swamp	4
054	Mugo Highlands	7
070	Zuqualla Mt.	4
010	Lake Awassa	7
004	Alemaya/Adele Lakes	4
014	Babille Elephant Sanctuary	4
019	Bishoftu Lake	4
020	Bisidimo	4
022	Bonga Forest	7
026	Choke Mountains	3
045	Konso-Segen Valley	7
056	Mago Nat. Park	7
057	Omo National Park	7
061	Shiek Hussien	4
069	Zeway Lake	4
041	Hugumburda/Grat Kahsu Forest	1
058	Shire Lowlands	1
050	Melka Wakena	4
068	Yerer Forest	4
030	Dindin Arba Gugu Forest	4

Annex IV. Wild mammals of Ethiopia rated as critically endangered, endangered or vulnerable

Critically Endangered	Endangered	Vulnerable
African Wild Ass (*Equus africanus*)	Grevy's Zebra (*Equus grevyi*)	African Elephant (*Loxodonta africana*).
Bilen Gerbil (*Gerbillus bilensis*)*	Mountain Nyala (*Tragelaphus buxtoni*)*	Ammodile (Gerbil Family) (*Ammodillus imbellis*)
Black Rhinoceros (*Diceros bicornis*)	Nubian Ibex (*Capra nubiana*)	Bailey's Shrew (*Crocidura baileyi*)*
Ethiopian Wolf (Simien Jackal) (*Canis simensis*)*	Wild Dog (*Lycaon pictus*	Bale Shrew (*Crocidura bottegoides*) *
Guramba Shrew (*Crocidura phaeura*)*		Beira Antelope (*Dorcatragus megalotis*)
Harenna Shrew (*Crocidura harenna*)*		Cheetah (*Acinonyx jubatus*)
MacMillan's Shrew (*Crocidura macmillani*) *		Dibatag (*Ammodorcas clarkei*)
Walia Ibex (*Capra walie*) *		Dorcas Gazelle(*Gazella dorcas*)
		Glass's Shrew(*Crocidura glassi*) *
		Large-eared Free-tailed Bat(*Otomops martiensseni*)
		Lesser Horseshoe Bat(*Rhinolophus hipposideros*)
		Lion(*Panthera leo*)
		Moorland Shrew(*Crocidura lucina*) *
		Morris's Bat(*Myotis morrisi*)
		Mouse-tailed Bat Species(*Rhinopoma macinnesi*)
		Natal Free-tailed Bat(*Mormopterus acetabulosus*)
		Nikolaus's Mouse(*Megadendromus nikolausi*) *
		Patrizi's Trident Leaf-nosed Bat(*Asellia patrizii*)
		Red-fronted Gazelle(*Gazella rufifrons*)
		Rupp's Mouse(*Myomys ruppi*)*
		Scott's Mouse-eared Bat(*Myotis scotti*)
		Soemmerring's Gazelle(*Gazella soemmerringii*)
		Speke's Gazelle(*Gazella spekei*)
		Spotted-necked Otter(*Lutra maculicollis*)
		Stripe-backed Mouse(*Muriculus imberbis* *

* Endemic to Ethiopia; Source: IUCN (2004)

Annex V. Strategic Goals and Aichi 2011-2020 Biodiversity Targets

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society

Target 1
By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

Target
By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.

Target 3
By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.

Target 4
By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use

Target 5
By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.

Target 6
By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.

Target 7
By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

Target 8
By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to

ecosystem function and biodiversity.

Target 9
By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

Target 10
By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

Target 11
By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

Target 12
By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

Target 13
By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services

Target 14
By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

Target 15
By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

Target 16
By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.

Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building

Target 17
By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.

Target 18
By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.

Target 19
By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.

Target 20
By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.