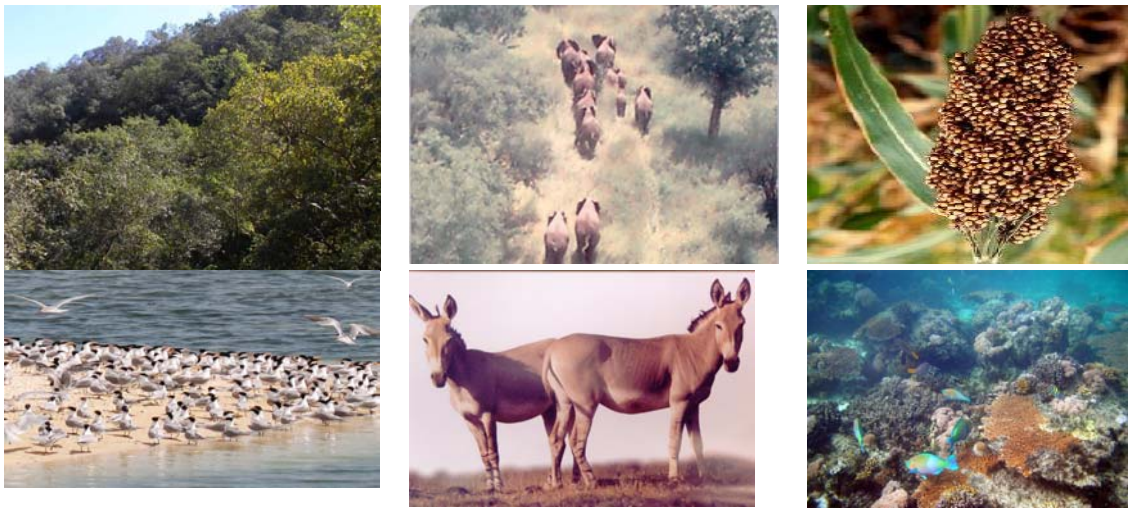
The State of Eritrea
Ministry of Land, Water and Environment
Department of Environment

The 4th National Report to the Convention on Biological Diversity



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ACRONYMS

AEAS	Association of Eritrean in Agricultural Sciences
AMFS	Applied Marine and Fisheries Science
APDD	Agricultural Promotion and Development Division
BSF	Belgium Survival Fund
CBD	Convention of Biological Diversity
CCA	Climate Change Adaptation
CDB	Convention on Biological Diversity
CIAT	International Center for Tropical Agriculture
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLIMA	Center for Legume in Mediterranean Agriculture
CMI	Coastal Marine and Island
CMS	Convention on the Conservation of Migratory Species of Wild Animals
COP	Country of Party
CTTC	Consultancy, Training and Testing Center
DANIDA	Danish International Development Aid
DoE	Department of Environment
DoL	Department of Land
EAE	Environmental Agency for the Environment
EAPGREN	Eastern Africa Plant Genetic Resources Network
ECMIB	Eritrean Costal Marine and Island Biodiversity
EEQ	Environmental Evaluation Questionnaire
EIA	Environmental Impact Assessment
ER-CWP	Eritrean Country Water Partnership
ER-SNRMF	Eritrean Sustainable Natural Resource Management Forum
EU	European Union
FAO	Food and Agriculture Organization
GEF	Global Environmental Facility
GIS	Geographical Information System
GHG	Green House Gas
GMO	Genetically Modified Organisms
GoSE	Government of State of Eritrea
HAC	Hamelmalo Agricultural College
IBA	Important Bird Areas
IFAD	International Fund for Agricultural Development
ICAM	Integrated Coastal Area Management
ICARDA	International Center for Agricultural Research in the Dry Area
ICIPE	International Center of Insect Physiology and Ecology
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICZMP	Integrated Coastal Zone Management Plan
IOSEA	Indian Ocean and South East Asia
IUCN	The World Conservation Union (formerly the International Union for Conservation of Nature and Natural Resources)
IPM	Integrated Pest Management
I-PRSP	Interim Poverty Reduction Strategy Paper

IRC	Impact Review Committee
IWRM	Integrated Water Resources Management
LWF	Lutheran World Federation
MIKE	Monitoring Illegal Killing of Elephants
MoA	Ministry of Agriculture
MoE	Ministry of Education
MoF	Ministry of Fishery
MoLWE	Ministry of Land Water and Environment
MoMR	Ministry of Marine Resources
MoT	Ministry of Tourism
MSY	Maximum Sustainable Yield
NAP	National Action Plan
NARI	National Agricultural Research Institute
NBSAP	National Biodiversity Strategy Action Plan
NCSA	National Capacity Needs Self Assessment
NEAPG	National Environmental Assessment Procedure and Guideline
NGO	Non Governmental Organization
NWFP	None Wood Forest Products
OECD-DAC	Organization for Economic Cooperation/Development Assistance Committee
PCRRDP	Post-Crisis Rural Rehabilitation Development Program
PGRU	Plant Genetic Resources Unit
PI-EIA	Post Investment Environmental Impact Assessment
RSD	Regulatory Services Department
RTI	Refugee Trust International
SFSA	Syngenta Foundation for Sustainable Agriculture
SLM	Sustainable Land Management
SoC	State of the Coast
TICD	Toker Integrated Community Development
TLU	Tropical Livestock Unit
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention on Combating Desertification
UNDP	United Nations Development Program
UNEP	United Nation Environmental Program
UNFCCC	United Nations Framework Convention of Climate Change
UNICEF	United Nations Children’s Fund
WCMC	World Conservation Monitoring Center
WIOMSA	Western Indian Ocean Marine Sciences Association
WWF	World Wide Fund for Nature and World Wildlife Fund

EXECUTIVE SUMMARY

Eritrea ratified the Convention on Biological Diversity (CBD) on 9 September 1995. Eritrea regularly submits its National Report to the CBD. The National Report summarizes measures that have been undertaken to implement the Convention and its objectives of conserving biological diversity, sustaining the use of its components, and sharing benefits fairly and equitably.

The Fourth National Report focuses on assessing the country's progress towards meeting the 2010 biodiversity target, present the current status and trends in biodiversity and actions taken to implement the convention.

The status, trend and threat of the country's biodiversity have been presented under three major biome/ecosystems, namely terrestrial, marine and agricultural.

Terrestrial biodiversity is the natural biological systems occupying the land area of Eritrea, excluding the marine systems and also the biodiversity associated with agricultural systems. There is a good deal of overlap between these systems, especially with regard to extensive rangeland and the coastal plains and islands of the Red Sea. The terrestrial biodiversity is classified under four major ecosystem types namely: forest ecosystem, wood land ecosystem, bush land/grassland ecosystem, barren land/ semi desert ecosystem.

Forest ecosystem contains three habitat type i.e. highland dense and disturbed forest (1001 km^2), reverine forest (1,865 km^2), and mangrove forest (74 km^2). There is no comprehensive study on the biodiversity of the forest ecosystem. However, some studies showed that the highland forest contains 98 woody plant species; approximately 20 major mammalian species; and 66 birds' species. The riverine forest is also contains about 25 woody plant species, 17 mammalian species and 91 Bird species. Likewise, the mangrove forest has 4 woody plant species, and 45 bird species.

The two extreme sides of the highland forest namely Rora Habab and Abehane-Soira, juniper forests are extremely disturbed and look unstable, while the forests in the middle of the Green Belt namely Mogo, Fagena, Sabur, Filfil, Fishoi and Mirara and some part of Mt Bizen are relatively stable. In theses areas, the vitality and integrity of the habitat as well as the regenerative capacity of the species are improving. Likewise, wild life species like *Felis pardus, Tragelaphus strepsiceros, Sylvicapra grimmia and Oreotragus oreotragus* and many bird species are reviving.

The main threats of the forest ecosystem are: excessive collection of firewood and construction wood; forest fire; over grazing/over browsing; expansion of settlements, villages and towns; recurrent droughts; invasive alien specie (*Opuntia ficus indica in the highland forest and Prosopis juliflora in the riverine forest*).

The country's woodland is estimated at about 14,074 Km^2 out of which 7082 km^2 (50%) is found in the western lowland. The woodland ecosystem contains: 47 woody plant species; 15 major mammalian species; and 87 Bird species. The woodlands in general and those located in the western lowlands in particular are subjected to heavy pressure as a result of

clearing for agricultural purposes, collection of fuel wood and also intensive grazing thus it is unstable. On the southern part of the central highlands, however, the *Acacia etbaica* dominated open woodlands are relatively stable due to increased awareness of the local communities in establishing and managing temporary and permanent enclosures and introducing wood saving stoves, and this situation is expected to continue.

The key threats to the woodland ecosystem are: excessive clearing of woodlands for agriculture especially in the south western part of the country; cutting of live trees for firewood, both for local consumption and to the major urban centers of the country; uncontrolled fire devastates a lot of woodland; excessive pollarding of multipurpose trees, such as *Balanites aegyptiaca*, *Faidherbia albida*, for dry season fodder; and recurrent droughts.

The bush land, grassland and wooded grassland habitats are found in most parts of the western lowland, and in some areas of the eastern coastal plains and foot of the escarpments of Eritrea with total area of 25,577 km^2 while that of the bush land is about 53, 824 km^2. These habitats cover 63 % of the total land area of the country. Study made in the Buri Peninsula which is part of this ecosystem showed that there are: 18 species of woody perennials; 16 major mammalian species; 66 bird species.

The most serious threats of these habitat are: uncontrolled fire devastates a lot of woodland and grasslands; expansion of villages and towns; expansion of agriculture; recurrent droughts; invasive alien species (*Prosopis juliflora*; *Corvus splendens*) ; illegal hunting of wildlife around Buri and Wengebo.

The barren land/semi desert ecosystem occurs in the eastern coastal plains and in some parts of the north western of Eritrea. The total area is estimated at about 47,301 km^2. The biodiversity of this ecosystem is very fragile. Study made in the northern coastal area of semi desert of Eritrea indicated that there are 86 drought and salt tolerant grass and shrub species. However, no information is available on to the availability of mammals and birds.

The major treats to biodiversity in this ecosystem are: **c**utting brushwood to build diversions and bunds for seasonal, spate floods that come from the uplands and to use it for small scale irrigation near some wadis are causing significant degradation to the *Acacia trees and other* bushy plants; invasion of the invasive alien species mainly *Prosopis juliflora* along the sides of the wadies (e.g. in Krora, Ila Tsaeda, Algen-Melit); desert locust and pesticide spray (This area is the main breeding ground of the desert locust); and excessive grazing and browsing by camels and goats.

Marine biodiversity in Eritrea represents a major part of the overall biodiversity of the country. The diversity of the Red Sea is a subset of that found in the Indo Pacific Region. A total of 1000 fishes and 220 species of hard corals have been recorded. In addition, Eritrea's coast is inhabited by possibly 5 marine turtles, 8 or more cetaceans and the dugong almost all of these species are of conservation concern globally. The Red Sea is the only major aquatic habitat in the country.

Eritrea's 3,300 km mainland and islands coast contain a mixture of semi-desert ecosystems and patches of mangroves. For many years, these ecosystems have remained

relatively unchanged, mainly due to the long war in the struggle for independence. Recent studies, however, indicate that threats to the mangrove habitats have caused changes in mangrove forest cover. While traditionally the main source of economic support has been limited agriculture in highland areas and artisanal fishing in scattered coastal areas, the primary economic development opportunities for Eritrea lie in its coastal, marine and island (CMI) areas.

The Eritrean Marine Biodiversity is classified into two major ecosystems namely the a***quatic ecosystem*** below the tide line and the ***mainland and Islands Shoreline ecosystem***. Within these ecosystems 5 main habitat types are identified, namely: Coral Reef, Sea grasses and sea weeds, Open sea/ Pelagic/, Mangrove and Sandy Shores/Beaches and Mudflats/.

The Eritrean marine ecosystems have been relatively well protected from aggressive exploitation because of the recurrent conflicts in the region. Understandably urban and industrial development along the coast has also been minimal. Assab and Massawa are the only two large population centers with a combined population of less than 200,000. Consequently the marine and coastal habitats of the Eritrean Red Sea are believed to be in pristine condition (Wilkinson, 2000).

The Eritrean Coastal Marine and Islands Biodiverstiy (ECMIB) project which was funded by GEF implemented by UNDP and executed by Ministry of Fisheries has contributed in laying conservation management ground by initiating the establishment of the baseline data of the CMI biodiversity, developing Integrated Costal Area Management (ICAM), identification of protected areas and developing their management plan; increase public awareness of CMI biodiversity value. It has also brought noticeable impact on the level of individual and institutional capacity to the Ministry of fisheries.

In Eritrea, about 80% of the population derives a large part of their subsistence income form agricultural activities (crop and livestock production). Agriculture is based on traditional systems with over 90% of production coming from rain-fed farming. The rain-fed crop/livestock production system entails extensive land use and is the main source of staple crops (cereal and pulses) and contributes to relatively high value food supplies of animal origin. The number and distribution of livestock has considerable impact on terrestrial biodiversity, through grazing pressure on vegetation and also by competition with other wild herbivores – these impacts influence almost 50% of the entire terrestrial area of the country.

Data compiled from different range of sources indicates that 20 varaities of sorghum, 8 for maize, 6 for barley, 5 for taff, 3 for pearl millet, 3 for finger millet, 3 for sesame and 2 for Niger (*Nihug*) seed have already been identified as indigenous crop diversity in Eritrea.

Crop Genetic diversity existing in Eritrea is presently subject to serious genetic erosion and irreversible losses mainly due to drought. At times famine forced farmers to eat their own seed in order to survive or sell seed as a food commodity. In addition, insect pests and diseases change in land use, introduction of high-yielding exotic crop varieties have been the major causes of loss of PGR in Eritrea. Agricultural biodiversity's function as source

of food, income and employment has been reduced; hence the vulnerability to food insecurity is apparent.

The pastures in the highlands are infertile and steep, hence fragile under continuous uncontrolled grazing regimes. The grazing area has been shrinking over the years because of over-grazing, extensive cultivation, improper utilization of water resources and deforestation. The removal of forest cover and constant grazing has depleted the resources of the browse layer. The pastures have no opportunity to recover because hungry animals are continuously searching for any edible plant that sprouts. The most palatable species of herbage and browse are decreasing in quantity and leaving space for less palatable species.

In the western lowlands the extensive and migratory system of animal husbandry allows the rangelands to recover, unlike in the highlands. However, if the present system of uncontrolled grazing continues with a larger animal population, the fate of the rangelands will be similar to that of the highlands.

In the eastern lowlands pastures are of low productivity and not in good condition in terms of ground cover, as grasslands and browse are limited within a vast desert. The pastures are overstocked mainly in the dry season. In many places the soils are severely degraded and have lost much of their water-holding capacity. The pastures are subject to sheet and gully erosion with the onset of and for the duration of the rains. Erosion has resulted in several areas in a significant loss of the topsoil generally, and poor seed set in the heavily grazed areas. This is a significant constraint to productivity in pasturelands, which consist almost entirely of annuals.

Eritrea has 1.9 million cattle, 4.7 million goats, 2.1 million sheep, 0.5 million donkeys, 9 thousand mules, 5 thousand horses and 0.32 million camels. The total numbers of livestock in Eritrea has fluctuated considerably through this century. The majority of livestock in Eritrea are indigenous stocks which have been selected for the prevailing eco-climatological conditions, and to a lesser extent for resistance to the major animal diseases present in the country. To date, the introduction of exotic breeds has been negligible, but the prevailing government policy of livestock improvement will rely heavily upon the introduction of exotic genetic material through artificial insemination, especially from Friesian stock for dairy production in the highlands.
In line with the requirement of Article 6, Eritrea has prepared and implemented the NBSAP as of year 2000. The NBSAP has three major objectives:

- Rehabilitation of degraded terrestrial ecosystems and their components through a combination of natural succession; protected area establishment and management; and sustainable use of terrestrial biodiversity resources,
- The coastal, marine and island biodiversity of Eritrea conserved and human activity managed to promote the sustainable development and optimal use of these resources,
- Agricultural biodiversity-resources conserved and sustainably utilized for food security, income generation and agriculture, whilst ensuring the socially-fair distribution of benefits arising from the use of national agricultural biodiversity resources.

The NBSAP has identified a total of 101 priority actions under 32 strategic elements that are categorized under 10 headings (themes).

Despite lack of coordination among sector institutions the achievement registered in implementing the NBSAP is considerable. Except one or two thematic areas all have been addressed partly or fully.

To integrate biodiversity conservation and sustainable use into relevant sectoral and cross-sectoral plans, programs and policies, the GoSE has taken several measures which enhance mainstreaming of biodiversity issues into agriculture, tourism, mine, water, marine, transport and education. The progress made towards implementing priority actions set in the NBSAP is satisfactory and that is mainly due to the integration of biodiversity and NBSAP priority areas into different sectors programs and plans.

Despite these progresses there are still many gaps that need be addressed, including:

- Low level of communication and follow up of the implementation of NBSAP,
- Limitation on human and institutional capacity: despite the effort made by the GoSE,
- Shortage of fund, and
- Lack of coordination between government institutions,

CHAPTER I. OVERVIEW OF BIODIVERSITY STATUS, TREND AND THREATS

1.1 Background

1.1.1 Introduction

Under the Convention of Biological Diversity, Eritrea like other countries, has committed itself to a number of specific obligations and opportunities for enhancement of biological diversity conservation and sustainable use within Eritrea. Amongst the specific obligations are:

- preparation of regular reports on measures taken for the implementation of provisions of the Convention (**Article 26**);
- identification of components of biological diversity important for its conservation and sustainable use (**Article 7**)
- Preparation of a national biodiversity strategy and action plan (**Article 6**).

These three obligations form part of a long-term commitment to activities, which conserve and promote sustainable use of biodiversity resources within member countries.

Eritrea submitted its First to Third National Reports on Implementation of Article 6 of the Convention of Biological Diversity (CBD) in December 1997, following a number of national workshops to discuss preparation of the reports. These reports summarised the overall objectives of Eritrea's evolving biodiversity policy, and reviewed the work being undertaken as part of implementation. They also provided brief overviews of current knowledge of Eritrea's biodiversity, the threats to this biodiversity, and measures taken to promote its conservation and sustainable use (DoE, 1997). However, previous National Reports were prepared using pre-prepared forms, whereas the Fourth National Report requires country parties a full narrative report that incorporates 4 chapters and 4 appendices namely:

Chapter-1	Overview of Biodiversity Status, Trend and Threats
Chapter-2	Current Status of National Biodiversity Strategy and Action Plan
Chapter-3	Sectoral and Cross-Sectoral Integration or Mainstreaming of Biodiversity Consideration
Chapter-4	Conclusion: Progress towards the 2010 Target and Implementation of the Strategic Plan

Appendix I –	Information Concerning Reporting Party and Preparation of National Report
Appendix II -	Further Sources of Information

1.1.2 Geographical Location and Climate

Eritrea is located in the Horn of Africa between 12^0 22′ and 18^0 02′ North and between 36^0 26′ and $43^0$13′ East serving as a bridge between the rest of Africa and the Middle East and the Gulf States. It is bordering with the Sudan in the west, Ethiopia in the south, Djibouti in the southeast and with the Red Sea in the east. Eritrea has a total land area of 124,300 km^2 with a coastline (mainland coastline) of 1900 km. along the important Red Sea oil and shipping route connecting the Mediterranean Sea with the Indian Ocean.

The Eritrean territorial waters are around 120,000 km^2, stretching out to the Red Sea Central Rift. There are around 390 islands in the Eritrean Red Sea zone, the prominent being the Dahlak Archipelago.

The country exhibits a varied topography, rainfall and climate with altitude that ranges from 60 meters below sea level to over 3,000 meters above sea level.

The climate of Eritrea ranges from hot and arid adjacent to the Red Sea to temperate in the highlands and sub-humid in isolated micro-catchments area of eastern escarpment. Most part of the country (70%) is classified as hot to very hot with mean annual temperature of more than 27^oC; about (25%) as warm to mild with a mean temperature of about 22 ^oC, and the remaining parts (5%) as cool with a mean annual temperature of less than 19 ^oC.

The total annual rainfall increases from the north to south and varies from less than 200 mm in the northwestern lowlands to more than 700 mm in the southwestern lowlands. Besides, the amount of rainfall also increases with altitude. While the coastal lowlands are very dry, some areas on the eastern escarpment get more than 1000 mm of rain. As to areas covered by the different rainfall regimes, about 50% of the country receives less than 300 mm, 40% between 300 and 600 mm and about 10% more than 600 mm of rain per annum (FAO 1994, Haile etal. 1998).

The agro ecological map (FAO 1997a) has six major agro ecological zones namely moist lowland, arid lowland, semi-desert, moist highland, arid highland and sub humid (Figure-1). The general characteristics of the agro ecological zones in terms of area, topography, altitude and climate are given in Table 1.

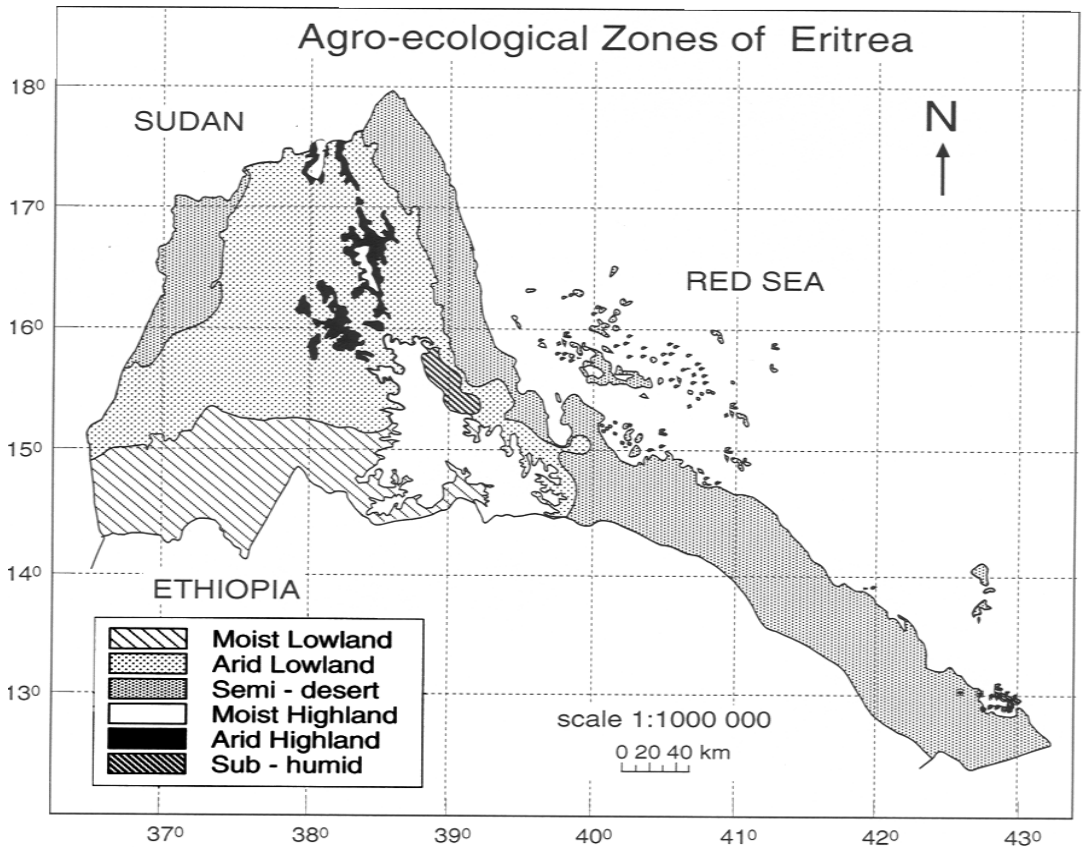

Figure:- 1. Agro ecological zones of Eritrea (FAO 1997)

Table 1 - Description of the six-agro ecological zones of Eritrea.

	agro ecological zone					
Characteristics	**sub-humid**	**arid highland**	**moist highland**	**moist lowland**	**arid lowland**	**semi-desert**
area (km^2)	1,006	3,143	9,302	20,363	43,115	48,772
Total area (%)	1	3	7	16	34	39
Slope (%)	8-100	2-100	2-30	2-30	0-30	0-30
Altitude (m a.s.l.)	600-2600	1600-2600	1600-3018	500-1600	400-1600	<100-1355
Rainfall (mm)	700-1100	200-500	500-700	500-800	200-500	<200
temperature (^oC)	16-27	15-21	15-21	21-28	21-29	24-32
PET (mm) [(1)]	1600-2000	1600-1800	1600-1800	1800-2000	1800-200	1800-2100
DLGP (days) [(1)]	60-210	0-30	60-110	50-90	0-30	0
MLGP (days) [(1)]	90-240	30-60	90-120	60-120	30-60	<30

Source: FAO (1997). PET is Potential Evapotranspiration, DLGP is Dependable Length of Growing Period, and MLGP is Median Length of Growing Period.

1.2 Overview of Eritrea's biodiversity

The biodiversity resources of Eritrea is not yet exhaustively studied and documented. Collection and documentation on natural resources was far better in the Italian times

(1889-1941), and up to independence (1991) there was limited attempt made to document biodiversity information in country. After independence, the Department of Environment of the Ministry of Land, Water and Environment and other line ministries have taken considerable effort on the conservation of biological diversity resources, despite the existing large shortfall in the number of personnel, institutions and financial resources, which would be required to fill this information gap.

The conservation status of most species at all the three levels (genetic, species, and ecosystem) is not known in detail. However; for the Terrestrial Biodiversity, at ecosystem level, has been partially studied and identified in a number of national land use classifications like Eco-geographical, agro-ecological, and vegetation cover classifications for Eritrea. These classifications capture the main regional ecological variations within the country but provide very little detailed information about the species diversity, which exists within these regions. In almost all cases, the level of ecological/biodiversity information about particular ecosystems and habitats (e.g. *Juniperus* forest, riverine forest, coral reefs, traditional farming systems) is incomplete.

In all cases there is a long time gap between information collected prior to 1960 and that collected since 1991 has created a major problem distinguishing between what has been recorded as historically present and what may actually be present today. A century ago Eritrea was endowed with all sorts of natural resources, which include fertile land, enough water resources, dense forests, various wild animals and birds. Thirty years of armed struggle, combined with the persistent drought and neglect have impacted on the natural resource of the country. Its rich natural resources have been denuded and are currently left with fragile ecosystems.

It has been recognized that a total of 126 mammal species, 577 species of Birds out of this around 320 are resident, of which about 50% have historical breeding records, around 195 are migrants and around 50 are recorded as breeding in Eritrea and the remaining are either vagrants or of unknown status. Eritrea also shares up to 13 species of Birds “endemics" with Ethiopia alone. A total of 90 reptiles and 19 amphibian species have been recorded for Eritrea. There are two possible endemic reptiles and one possible endemic amphibian. In the absence of a comprehensive national checklist, a number of site-specific checklists are included one list of almost 700 species indicates that considerable plant diversity may persist in human-altered landscapes.

The Eritrean coastal, marine and island zone is situated in the southern sector of the Red Sea, an almost enclosed, hot, saline body of water that harbors a flora and fauna derived from the Indo Pacific Ocean at some time in the last 10-20,000 years. The diversity of the Red Sea is a subset of that found in the Indo Pacific Region. A total of 1000 fishes and 38 genera of stony corals have been recorded. In addition, Eritrea’s coast is inhabited by possibly 5 marine turtles, 8 or more cetaceans and the dugong almost all of these species are of conservation concern globally.

Eritrea is recognized as a centre of origin and centre of diversity for a number of crops, notably the cereals: sorghum, wheat and barley. There is a rich diversity of crop landraces still available in Eritrea. Even though the inventory that has been made is not a complete one, 20 varaities of sorghum, 8 for maize, 6 for barley, 5 for taff, 3 for pearl millet, 3 for

finger millet, 3 for sesame and 2 for Niger (Nihug) seed have already been identified (DoE, 1999). Though not complete, a list of insect, weed and microbial pests was compiled by Ministry of Agriculture. A total of 52 major insect pests are reported to be found in Eritrea.

The level of knowledge of diversity of the lower taxa is weak as attempts made to compile checklists or to assess conservation status is little.

1.3 Biodiversity Status, Trends and Threat under different Biome/Ecosystems

According the Biodiversity Stocktaking Assessment Report (1998), the biodiversity of Eritrea is described under three core areas. These ares-

- The natural terrestrial habitats characteristic of the region,
- The diverse agro-ecosystems which have developed as a result of traditional agricultural activities in the region, and
- The coastal marine and island ecosystems of the Red Sea.

In this report, the three core areas were adopted in analyzing the status, trends and threat.

1.3.1 Terrestrial Biodiversity

Terrestrial biodiversity is the natural biological systems occupying the land area of Eritrea, excluding the marine systems and also the biodiversity associated with agricultural systems. There is a good deal of overlap between these systems, especially with regard to extensive rangeland and the coastal plains and islands of the Red Sea (DoE, 2000). For the purpose of this report, the terrestrial biodiversity is classified under four major ecosystem types namely: forest ecosystem, woodland ecosystem, bush land/grassland ecosystem, barren land/ semi desert ecosystem.

1.3.1.1 Forest Ecosystem

Forest ecosystem contains three habitat type i.e. highland dense and disturbed forest, reverine forest, and mangrove forest. By virtue of its location along the coastline between the water body and the land, there is always ambiguity in categorizing the mangrove forest as part of terrestrial ecosystem and the marine and coastal ecosystem. For the purpose of this report, however, the mangrove habitat is treated under the terrestrial ecosystem in order to avoid overlaps.

The dense and disturbed forest habitat: This habitat is located in the eastern escarpments of Eritrea encompassing 1001 km^2. The main part of this forest is called Semienawi and Debubawi Bahri or the Green Belt, although small highly disturbed patches of juniper groves are found at Abahane and Soira in the south and Rora Habab in the north (FAO, 1997).

There is no comprehensive study on the biodiversity of this habitat. According to Bein *et al* 2006, however, there are 98 woody plant species (Table-2). The species distribution is highly determined by altitude and other factors such as rainfall, temperature, soils, and aspects. At the highest section of the Green Belt (2,300-2,400m above sea level), the

vegetation is dominated by *Juniperus procera*, which in many locations forms almost pure stands with some *Acacia abyssinica*. At the periphery of the upper escarpment, the juniper forest is highly disturbed and degraded due to human encroachment from the adjacent villages. At lower altitude, the juniper forest is replaced by a mixed forest dominated by *Juniperus procera* and *Olea africana*. Going further down, the *Olea africana* becomes more and more dominant associated with *Acokanthera schimperi*, *Anogeissus leiocarpus*, *Combretum molle* etc. *Syzygium guineense* and *Mimusops kummel* are mainly found in the valley bottoms. At approximately 1100-1200m, a different set of species take over. These include: *Terminalia brownii, Vangueria madagascariensis, Boscia angustifolia, Entada abyssinica* and *Diospyros mespiliformis*. The under story includes species such as *Jasmium sp. Rosa abyssinica, Asparagus africanus* and a range of shrubs and climbers.

Table 2: Number of the major wild woody plant species found in the dense and disturbed forest of Semenawi and Debubawi Bahri

Family	**Number of Species**	**Family**	**Number of Species**
Anacardiaceae	5	Moraceae	2
Apocynaceae	2	Myricaceae	1
Asclepiadacea	1	Myrsinaceae	1
Balanitaceae	1	Myrtaceae	1
Barbeyaceae	1	Olacaceae	1
Bignoniaceae	2	Oleaceae	1
Bombacaceae	1	Palmae	1
Boraginaceae	4	Papilionoideae	4
Burseraceae	1	Phytolaccaceae	1
Caesalpinioideae	3	Polygalaceae	1
Capparidaceae	5	Rhamnaceae	5
Celastraceae	2	Rubiaceae	2
Combretaceae	5	Rutaceae	1
Compositae	1	Salvadoraceae	2
Cupressaceae	1	Santalaceae	1
Ebenaceae	3	Sapindaceae	2
Euphorbiaceae	3	Sapotaceae	2
Flacourtiaceae	2	Sterculiaceae	3
Loganiaceae	2	Tiliaceae	5
Meliaceae	1	Ulmaceae	1
Melianthaceae	1	Umbelliferae	2
Mimosoideae	10	Verbenaceae	1
TOTAL		**44**	**98**

Source: Modified Bein *et al*, 1996; MoA, 2000; Bein *et al*, 2006

Based on the study and observations (Zinner *et al*, 2000; Hagos Yohannes, 2006 personal observation), there are approximately 20 major mammalian species of 9 different families in the Green Belt areas (Table-3). Among others, the mammalian species include: *Papio hamadryas*, *Cercopithecus aethiops*, *Felis pardus*, *Potamochoerus percus*, *Phacochoerus aethiopicus*, *Tragelaphus scriptus*, *Tragelaphus strepsiceros*, *Sylvicapra grimmia*, *Oreotragus oreotragus* and *Madoqua saltiana*. Except *Papio hamadryas* (hamadrias

baboon), all the rest mammals are considered as highly endangered and thus require due conservation and follow up.

Table 3: Mammalian species found in the dense and disturbed forest of Semienawi and Debubawi Bahri

Family	Species Scientific Name	Common Name
Cercopithecidae	*Papio hamadryas*	Hamadryas Baboon
Cercopithecidae	*Cercopithecus aethiops*	Grivet Monkey
Canidae	*Canis aureus*	Common Jackal
Canidae	*Canis mesomelas*	Black-backed Jackal
Herpestidae	*Herpestes ichneumon*	Egyptian Mongoose
Hyaenidae	*Hyaena hyaena*	Striped Hyena
Hyaenidae	*Crocuta crocuta*	Spotted Hyena
Viverridae	*Genetta genetta*	Common Genet
Viverridae	*Genetta abyssinica*	Ethiopian Genet
Felidae	*Felis serval*	Serval cat
Felidae	*Felis caracal*	Caracal
Felidae	*Felis pardus*	Leopard
Procaviidae	*Procavia capensis*	Ethiopian Rock Hyrax
Suidae	*Potamochoerus percus*	Bush Pig
Suidae	*Phacochoerus aethiopicus*	Warthog
Bovidae	*Tragelaphus scriptus*	Bushbuck
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu
Bovidae	*Sylvicapra grimmia*	Common Duiker
Bovidae	*Oreotragus oreotragus*	Klipspringer
Bovidae	*Madoqua saltiana*	Salt Dikdik

Zinner *et al*, 2000; Hagos Yohannes, 2006 personal observation; Bein *et al*, 2006

The Green Belt is one of the important bird areas (IBA) of Eritrea. Birhane (2006) observed 66 species of birds in Mirara area out of which 56 residents, 6 palaearctic migrants, and 4 inner Africa migrants (Table-4). The palaearctic migrants include *Upupa epops, Falco tinnunculus, Motacilla flava, Lanius collaris, Lanius nubicus,* while the inner African migrants include *Coracias abyssynica* and *Cinnyricinclus leucogaster*.

Table 4: Types of birds and their corresponding number of species found in the dense and disturbed forest of the Semienawi and Debubawi Bahri

Type	Number of Species	Type	Number of Species
Herons	1	Wagtail	2
Raptors	7	Bulbuls	1
Francolins	1	Thrushes	2
Quails	2	Camaroptera	1
Dove pigeon	5	Timalies	1
Parrots	3	White eyes	1
Owls	1	Sun bird	2
Swifts	2	Shrikes	6

Bee-eater s & trogons	3	Corvids	1
Rool-hoope	2	Starling	2
Hornbils	2	Drongos	3
Wood pecker	1	Sparrows	2
Lark	1	Weavers	2
Mouse bird	1	Finch-like	2
Barbets	2	Bunting	1
Martins	1	Finches	2
Total		**32**	**66**

Source: Modified Zinner *et al*,2000; Berhane, 2006; Bein *et al*,2006

Abehane, Soira, and Rora Habab juniper forests are extremely disturbed and look unstable. In addition, the upper and lower peripheries of the greenbelt are highly encroached and are under pressure. However some parts of the Green Belt which are managed under permanent enclosures i.e. parts of Mogo, Fagena, Sabur, Filfil, Fishoi and Mirara with estimated area of 40,000 ha and Mt. Bizen about 15,000 ha are relatively stable. In these areas the vitality and integrity of the habitat as well as the regenerative capacity of the species are improving. Likewise, wild life species like *Felis pardus*, *Tragelaphus strepsiceros*, *Sylvicapra grimmia and Oreotragus oreotragus* and many bird species are reviving.

The dense and disturbed forest habitat plays a major role in the livelihood of the people living within and at the periphery of the forest. Among others, collecting wood for energy and construction, livestock grazing, farming on pocket areas can be mentioned. In addition, it is also serving as ecotourism.

The Riverine forest habitat: The reverine forests are found mainly in the western lowlands, alongside the Gash, Barka and Anseba intermittent rivers, encompassing a total area of 1,865 km^2 (FAO, 1997). This habitat supports extensive vegetation with variety species composition and diversity. There are about 25 woody plant species, such as *Hyphaene thebaica, Balanites aegyptiaca, Ziziphus spina-christi, Acacia nilotica, Acacia seyal, Tamarindus indica, Tamaryx aphylla* etc. There are also succulent plant species and grasses but not properly documented.

The riverine forest habitat contains 17 mammalian species, such as: *Gazella soemmerringi, Gazella dorcas, Phacochoerus aethiopicus and* 91 Bird species, such as: *Ardeotis arabs, Neophron percnopterus.*

The riverine forest is important for human well being. In addition to being the usual source of fuel wood, fodder and construction material, some species such as the *Hyphaene thebaica* provide edible nut (*Akat*) alcoholic beverage (*Duma),* fiber for making sacs and ropes; leaves used for making different artifacts like baskets, brooms, mats and fans. .

Like the other forests and woodlands of the country, the riverine forest is also suffered from deforestation for irrigated horticultural purposes. The need to reduce irrigation costs have induced commercial farmers to clear forests very close to the river banks, triggering a process of river bank erosion, thereby damaging the biological diversity and the

environment as a whole. Irrigated agriculture within the reverine forest has been increasing from 1997 to 2009. However, recently the Regional Administration has prepared directives that limit agricultural activities 700 meters away from ether side of the river banks. If these directives are put into practice and properly enforced, the destruction of the riverine forest will be reduced.
Invasive alien species mainly *Prosopis juliflora* is expanding very fast and thus continue to negatively affect the biodiversity of the riverine forest

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The mangrove habitat: This habitat is found as patches along the coast of the Red Sea, especially where some seasonal freshwater runoff occurs; very importantly also in low lying, poorly draining areas behind dune ridges which are flooded infrequently. However, the existing mangrove habitats are not as well developed as those found along the African Indian Ocean coastline (e.g. Kenya and Tanzania), attributed mainly for shortages of freshwater runoff from inland, and the generally high salinity of the Red Sea waters. The total area of the mangrove forest is bounded to only 380Km long or 74 km^2 (State of the Coast, 2007). Dense mangrove coverages in Eritrea are spotted near Assab bay, and in patches around Tio. Similar to the mainland distribution islands such Museri, Dissei, Norah, Harena, and Dergamman Kebir harbours dense coverage of mangrove strands. There are also some patches near Mersa Deresa and Mersa Mubarek in the north.

The salt and temperature tolerant *Avicenna marina* is the dominantly occuring species in most of the mangrove habitats in Eritrea. Other mangrove species that found along the coastline but confined to certain localities are *Rhizophora mucronata* and *Ceriops tagal*. A fourth species *Brughieria gymnorrhiza* is reported historically to occur along the Eritrean coast, but has yet to be recorded.

Despite a diverse faunal communities existing highly associated with mangroves, no complete faunal survey of the mangrove habitats has been undertaken, primarily because of the present low capacity for taxonomic identification of marine invertebrates in Eritrea. Birds are among terrestrial wildlife populations closely linked with mangrove habitats. Reports of to date surveys reveals that 45 bird species have been commonly seen in or close to mangrove habitats depending partly for feeding, roosting and/or breeding in their life. This includes inter-alia:

Within mangrove: *Pink-backed Pelican; Reef Heron; Goliath Heron; Purple Heron; Grey Heron; Little Egret; Greater Flamingo; Black Kite; Pale Chanting Goshawk; Osprey; Oystercatcher; Blackwinged Stilt; Crab Plover; Little-ringed Plover; Chestnut-backed Plover; Kentish Plover; Ringed Plover; Black-headed Plover; Kittlitz's Plover; Little Plover; Sanderling; Curlew Sandpiper; Common Snipe; Bar-tailed Godwit; Curlew; Whimbrel; Redshank; Common Sandpiper; Turnstone; Sacred Ibis; European spoonbill;* and *Mangrove Warbler*.

Close to mangrove: *Namaqua Dove; Pink-headed Dove; Olive Bee-eater; European Bee-eater; Cimmanon chested Bee-eater; Hoopoe; Palm Swift; (Red-chested) Swallow; Yellow Wagtail; Pied Wagtail; Graceful Prinia; Ruppell's Weaver;* and *Common Bulbu.*

In addition, the mangrove habitat hosts high densities of marine invertebrates (crustaceans, molluscs, etc.) as well as large concentrations of a wide range juvenile fish species for nursery and feeding services.

Mangroves play important role for coastal communities by providing wood and none wood benefits to human, including timber, fuel, fodder for camels and tannin. Besides mangroves are also crucial for harnessing coastal stabilization and maintaining ecosystem integrity within the broader coastal environment that includes: wildlife habitat provision, coastal protection, soil formation, organic material production, and nursery for many marine species. In addition, mangrove

A continued loss of mangrove has been witnessed in the past. Study conducted by the ECMIB Project (2005) showed a net loss of about 3.57 km^2 of mangrove forest between 1985 and 2000. The main cause for the loss has been concluded as: cutting by local communities for fuel and construction, over-browsing by camels; diminished inflows of fresh water due to reduced runoffs, and blockades resulted from uncoordinated road construction works reduced supply of nutrients, particularly nitrogen, iron and phosphorus (State of the Coast 2007). On the other hand noble initiatives are also underway campaigning in the Afforestation and rehabilitation of degrarded mangrove forests as demonstrated by the Manzanar Project in Masswa and Hirgigo Areas (Manzanra project).

Threats of the Forest Ecosystem

The main threats of the forest ecosystem are:-

- Un regulated expansion of agricultural land
- Excessive collection of firewood and construction wood,
- Forest fire,
- Over grazing/over browsing,
- Expansion of settlements, villages and towns,
- Recurrent droughts,
- Invasive alien specie (*Opuntia ficus indica in the highland forest and Prosopis juliflora in the riverine forest*)

Figure-2: Mangrove forests and their prop roots a secret for adapting anoxic soil conditions (ECMIB Project 2007

1.3.1.2 Woodland Ecosystem

The woodlands are scattered all over the country, although the dominant part is located in the low-lying areas. The total area of the woodlands is estimated at about 14,074 km^2 out of which 7082 km^2 (50%) is found in the western lowland (FAO, 1997). The woodlands vary from open to relatively closed canopies towards the vicinities of the rivers in the western lowlands

Status and Trend

Like in all ecosystems, no exhaustive biodiversity study conducted in the woodlands of the country. According to Bein *et al* 2006, however, there are about 47 woody plant species of

21 families in the woodlands (i.e. both open and dense woodland habitats) Table-5. These include *Acaia mellifera, A. oerfota, A. tortilis, A. asak, A. senegal* and *A.seyal*, but also with few associated species like *Adansonia digitata, Boscia angustifolia, Boscia senegalensis, Delonix elata, Cadaba rotundifolia, Capparis deciduas, Combretum fragrans, Dalbergia melanoxylon, Balanites aegyptiaca, Albizia amara* and *Boswellia papyrifera.*

Table 5: Number of the major plant species found in the woodlands of the Gash Setit - western lowland

Family	**Number of Species**	**Family**	**Number of Species**
Anacardiaceae	2	Hernandiaceae	1
Asclepiadacea	1	Meliaceae	1
Balanitaceae	1	Mimosoideae	12
Bignoniaceae	1	Palmae	1
Bombacaceae	1	Papilionoideae	2
Boraginaceae	1	Rhamnaceae	2
Burseraceae	2	Salvadoraceae	2
Caesalpinioideae	3	Tamaricaceae	1
Capparidaceae	6	Tiliaceae	2
Combretaceae	3	Verbenaceae	1
Ebenaceae	1		
Total		21	47

Source: Modified Bein *et al*, 1996; Ogbazgi *et al* 2006; MoA, 2000; Bein *et al*,2006

In the woodlands of the western lowland, there is a proposed protected area of the Gash-Setit mainly for the conservation the last remaining elephant populations of Eritrea. These elephants are probably the most northerly group of elephants in the African continent. In this proposed protected area, there are 15 major mammalian species (Table-6) and 87 Bird species such as: *Upupa epops, Nimida meleagris, Burhinus coronatus, Apus affinis, Coracias abyssinica Coracias caudat, Galerida cristata* etc…

Due to habitat destruction and indiscriminate hunting, particularly during the colonial era (1889-1991), most of the mammalian species are found rare and some important species such as buffalo, roan antelope, giraffe and lion have been confirmed as extinct.

Table 6: Mammalian species found in the Gash Setit Proposed Protected Area

Family	**Scientific name**	**Common Name**
Bovidae	*Madoqua saltiana*	Salt Dikdik
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu
Canidae	*Canis aureus*	Common Jackal
Canidae	*Canis mesomelas*	Black-backed Jackal
Canidae	*Vulpes pallida*	Sand Fox
Cercopithecidae	*Papio anubis*	Olive Baboon

Elephantidae	*Loxodonta Africana*	African Elephant
Felidae	*Felis caracal*	Caracal
Felidae	*Felis serval*	Serval Cat
Felidae	*Felis silvestris*	African Wild Cat
Hyaenidae	*Crocuta crocuta*	Spotted Hyena
Hyaenidae	*Hyaena hyaena*	Striped Hyena
Procaviidae	*Procavia capensis*	Ethiopian Rock Hyrax
Suidae	*Phacochoerus aethiopicus*	Warthog
	Lepus habessinicus	Abyssinian Hare

Zinner *et al*, 2000; Hagos Yohannes, 2006 personal observation

The woodlands play a vital role in the livelihood of the local communities by providing wood and none wood products and services. A study conducted to assess the contribution of none wood forest/woodland products (NWFP's) in the Gash Barka region of the western lowland of Eritrea (Ogbazgi *et a*l, 2006) showed that on average 14% of each household annual income is obtained from NWFP's. These none wood forest/woodland products include: wild fruits, gum & incense, fiber, toothbrush, traditional medicine, fodder etc. During the long dry season (7-9 months), the pastoral communities depend on the perennial multipurpose drought tolerant trees and shrubs as a source of fodder.

Apart from the contribution to livelihood, the woodlands are also important for ecosystem integrity. Among others, they provide habitats for different species of wild animals and micro-organisms, conserve soil and water, sequestrate carbon, and improve nutrient cycling and water quality.

The woodlands in general and those located in the western lowlands in particular are subjected to heavy pressure as a result of clearing for agricultural purposes, collection of fuel wood and also intensive grazing. Natural regeneration of the woodlands is affected seriously when grown trees that could be mother trees supplying seeds are cut down and young shoots or seedlings are eaten by grazing livestock. The decline of woody vegetation in the lowlands has a dramatic effect on the biological diversity and on the well being of the local people as well. Agricultural concessions for modern agricultural production in the western lowlands have been the major cause of destruction of the woodland resources. In addition, clearing of woodlands for resettlements and firewood collection have also contributed to biodiversity loss in these areas and this trend seems to continue unless proper land use planning for sustainable use of the resource is introduced. On the southern part of the central highlands, however, the *Acacia etbaica* dominated open woodlands are relatively stable due to increased awareness of the local communities in establishing and managing temporary and permanent enclosures and introducing wood saving stoves, and this situation is expected to continue.

Threats

The key threats to the woodland ecosystem are:

- Excessive clearing of woodlands for agriculture especially in the south western part of the country,
- Cutting of live trees for firewood, both for local consumption and to the major urban centers of the country,

- Uncontrolled fire devastates a lot of woodland,
- Excessive pollarding of multipurpose trees, such as *Balanites aegyptiaca*, *Faidherbia albida*, for dry season fodder, and
- Recurrent droughts.

1.3.1.3 Bush Land/Grassland Ecosystem

The bush land, grassland and wooded grassland habitats are found in most parts of the western lowland, and in some areas of the eastern coastal plains and foot of the escarpments of Eritrea. The total area of the grassland and wooded grassland is estimated at 25,577 km^2 while that of the bush land is about 53, 824 km^2. These habitats cover 63 % of the total land area of the country (FAO, 1997).

Status and Trend

Most parts of the northwestern lowlands grassland/wooded grassland habitat consists of *Acacia nubica*, *Capparis decidua*, *Balanites aegyptiaca*, *Boscia senegalensis* and a range of other arid and semi-arid species. *Calotropis procera* is usually present where the water table is near the surface. Pastoralists who followed traditional migration routes use this area. There is very little rain fed agricultural cultivation, as rainfall is too low and irregular. Groundwater has also high salinity. Fuel wood reserves could be extensive, but remote from potential markets. Therefore, the status of biological resources is relatively stable. However, new irrigation development project is under construction in the Kerkebet area, where this land use change could negatively affect the biodiversity of the area unless careful environmental assessment is conducted and management plan developed accordingly.

The vegetation of the coastal plains is, in general, sparse and forms only a thin, partial cover to the land. Much of the vegetation is similar in species composition and is dominated by species tolerant to drought, grazing pressure and salinity. There are however significant differences in plant community composition in response to local variations.

Although no recent complete floristic inventory has been undertaken in this habitat, the biodiversity stock taking assessment (DoE, 1999) showed that plant species, mostly of weedy species, such as *Echinochloa colona*, *Datura metel*, *Solanum* sp., *Aerva javonica* and *Heliotropium pterocarpum* found sparsely. Nearer to the shoreline, saline areas not used for cultivation are covered by patchy *Suaeda monoica*, with a ground layer of *Cenchrus ciliaris* grass and occasional *Trianthema crystallina*. *Cenchrus setigerus*, *Dactyloctenium scindicum* plus very occasional stunted *Acacia tortilis* trees, and is still under considerable grazing pressure. In the areas around Zula, Buri Peninsula and Wongobo, some of the natural vegetation have been cleared for agriculture and the uncultivated areas are also mostly degraded and heavily grazed.

The Buri peninsula is one of the proposed protected areas. The flora of this area is not exhaustively studied. However, there are 18 species of woody perennials so far identified clustered under 11 families, out of which 2 are endangered (Bein *et al*, 2006), Table-7.

Table 7: Number of the major woody plant species found in the Buri Peninsula proposed protected area

Family	Number of Species	Family	Number of Species
Asclepiadacea	1	Chenopodiaceae	1
Balanitaceae	1	Mimosoideae	6
Boraginaceae	1	Palmae	1
Burseraceae	1	Rhamnaceae	1
Caesalpinioideae	1	Verbenaceae	2
Capparidaceae	2		
Total		11	18

Source: 2000; Bein *et al*,2006

There are different species of wildlife in the Buri Peninsula proposed protected area. A recent survey indicates that some 100 African wild asses (*Equus africanus somaliensis*) live and breed in this area. This may be the viable population of this highly endangered species in Africa. Dorcas gazelle (*Gazella dorcas*) and Soemmerring's gazelle (*Gazella soemmerringi*) also use this area on a seasonal basis congregating in significant numbers on the Irrori and Wengebo plains during the wet season. It is many years since Oryx (*Oryx beisa*) have been seen in the Danakil area, and it is suspected that they were hunted during the liberation war. Ostrich (*Struthio camelus*) are still numerous in the Buri Peninsula, and are often found close to settlements.

In general, there are approximately 16 major mammalian species of 8 different families in the Buri Peninsula as indicated in Table-8.

Table 8: Mammalian species found in Buri Peninsula proposed protected area

Family	Scientific name	Common Name
Bovidae	*Madoqua saltiana*	Salt Dikdik
Bovidae	*Gazella soemmerringi*)	Soemmerring's Gazelle
Bovidae	*Gazella dorcas*	Dorcas Gazelle
Canidae	*Vulpes pallida*	Ruppll's Sand Fox
Canidae	*Canis aureus*	Common Jackal
Canidae	*Canis mesomelas*	Black-backed Jackal
Cercopithecidae	*Papio hamadryas*	Hamadryas Baboon
Equidae	*Equus aficanus*	African Wild Ass
Felidae	*Felis serval*	Serval Cat
Felidae	*Felis caracal*	Caracal
Felidae	*Felis sylvestris*	African Wild Cat
Hyaenidae	*Hyaena hyaena*	Striped Hyena
Hyaenidae	*Crocuta crocuta*	Spotted Hyena
Procaviidae	*Procavia capensis*	Ethiopian Rock Hyrax
Suidae	*Phacochoerus aethiopicus*	Warthog

Lepordae	*Lepus fagani*	Ethiopian Hare

Hagos Yohannes, 2006 personal observation

In the Buri Peninsula, there are about 66 bird species which include: *Struthio camelus* (Ostrich), *Ardeotis arabs (*Arabian bustard), *Rhodophoneus cruentus* (Rosy-patched bush shrike), *Merops orientalis* (Little green bee eater), *Anthreptes platarus metallicus* (Pygmy sun bird), *Trachyphonus margaritatus* (Yellow-breasted), *Pycnonotus barbatus*, (White-vented bulbul) etc. Most of these bird species are in a good condition and are stable while some of them like the Arabian bustard are getting rare and require special conservation attention.

Threats

The most serious bush land, grassland and wooded grassland habitats threats are:
- Uncontrolled fire devastates a lot of woodland and grasslands,
- Expansion of villages and towns,
- Expansion of agriculture,
- Recurrent droughts,
- Invasive alien specie (*Prosopis juliflora*; *Corvus splendens*),
- Illegal hunting of wildlife around Buri and Wengebo

1.3.1.4 Barren Land/ Semi desert Ecosystem

The barren land/semi desert ecosystem occurs in the eastern coastal plains and in some parts of the north western of Eritrea. The total area is estimated at about 47,301 km^2, (FAO, 1997).

Status and Trend

The climate in the semi desert area is so dry with very small and so erratic rainfall. Most of the land is bare and covered with sand duns. There is no recent comprehensive study conducted on the status of biological diversity in this particular ecosystem, but according to the biodiversity stocktaking assessment (DoE**,** 1999) there exist drought and salt tolerant grass species such as: *Panicum turgidum*, *Cenchrus ciliaris Cenchrus ciliata*, *Leptothrium senegalens and Aristida* sp., along with *Euphorbia granulata*. *Tribulus longipetalus*, *Indigofera anabaptista, Indigofera spinosa*, *Pavonia kotschyi*, and *Tephrosia* sp.

In the wadis, there are just a few *Acacia tortilis* subsp. *raddiana, A. ehrenbergiana, A.nubica, Cadaba rotundifolia, Commiphora abyssinica, Tamarix aphylla), Ziziphus spina christi , Salvadora persica* and *Delonix elata.* The number of species, which are found in the northern part of the semi desert area of the coastal plans, clustered under different families is stated in Table-9.

Table 9: Plant species (woody and none woody) found in the semi-desert area of the northern part of the coastal plains

Family	**Number of Species**	**Family**	**Number of Species**

Acanthaceae	1	Malvaceae	2
Aizoaceae	1	Mimosaceae	4
Amaranthaceae	2	Orobanchaceae	1
Asclepiadaceae	2	Papilionaceae	6
Asparagaceae	1	Plumbaginaceae	1
balanitaceae	1	Rhamnaceae	1
Boraginaceae	4	Rhizophoraceae	2
Burseraceae	1	Rubiaceae	1
Caesalpiniaceae	2	Salvadoraceae	2
Capparidaceae	4	Solanaceae	2
Chenopodiaceae	6	Tamaricaceae	1
Compositae	1	Verbenaceae	1
Cruciferae	1	Vitaceae	1
Euphorbiaceae	4	Zygophyllaceae	3
Cyperaceae	3	Typhaceae	1
Gramineae	23	-	-
Total		31	86

Source: Biodiversity Stocktaking Assessment (1998)

N.B: No study is available on availability and status of mammalian and bird species in the semi-desert areas.

Threats

- Cutting brushwood to build diversions and bunds for seasonal, spate floods that come from the uplands and to use it for small scale irrigation near some wadis are causing significant degradation to the *Acacia trees and other* bushy plants;
- Invasion of the invasive alien species mainly *Prosopis juliflora* along the sides of the wadies (e.g. in Krora, Ila Tsaeda, Algen-Melit);
- Desert locust and pesticide spray (This area is the main breeding ground of the desert locust)
- Excessive grazing and browsing by camels and goats

1.3.2 Marine Biodiversity

The coastline of the Eritrean runs for about 1,350 km, stretching from the coastal village of Ras Kasar near the Sudanese border in the north, to the village of Ras Dumera near Djibouti in the south (State of the Coast, 2007). In addition it contains more than 350 islands that form a shoreline of 1950Km.

The area of the Eritrean landmass is estimated about 124,000 km^2 and its territorial waters cover an area of about 55,000 km^2. Besides, the exclusive economic zone spans over 120,000 km^2, and watersheds linked to the coast are best estimated at 55,000 km^2. The continental shelf (down to a depth of about 200m) extends from the coast to a maximum

distance of 120 km east of Massawa, narrowing to about 20 km in the north and south of the country *(ECMIB Project GIS Unit, 2007).*

Biodiversity richness in the Red Sea is comparatively low compared to that of the larger Indo-Pacific region from which the Red Sea biota is largely derived. This is partly due to the short time evolution history (20,000 years) since the Red Sea was last dry; thus limited both the time for colonization from the Indian Ocean in one hand, and for *in situ* evolution of new species on the other. This fact is well reflected in the overall low levels of endemism in most taxa of faunas and floras in the Red Sea ecosystem. Nonetheless, the Eritrean marine and coastal environment is relatively rich in biodiversity that embraces an array of diversified ecosystems mainly: coral reefs, mangroves, sea grass beds, sandy and muddy flats, all important for fisheries activities offering a significant opportunity to boost the tourism industry as well. The inter-tidal and near-shore zones are also equally important supporting a diverse range of marine and terrestrial species with key ecological and economic importance.

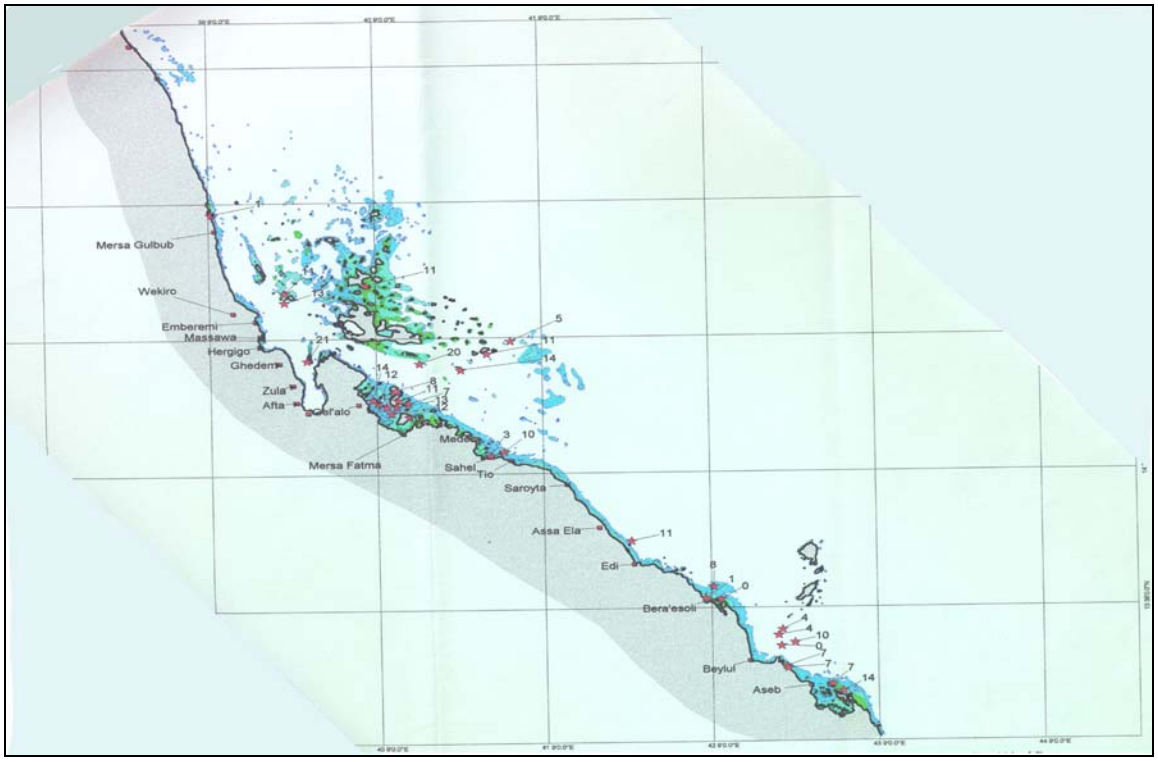


Figure-3: The Eritrean Red Sea Coastline (source: ECMIB project)

For purposes of compiling the 4th National Biodivetisity Report, the Eritrean Marine Biodiversity has been classified into two major ecosystem categories namely the a***quatic ecosystem*** below the lowest tide line, and the ***mainland and Islands Shoreline ecosystem*** area representing above the lowest tidal line**.** Within these ecosystems 5 main habitat types are identified and reviewd namely: Coral Reef, Sea grasses and sea weeds, Open sea, Mangrove and Sandy Shores/Beaches and Mudflats.

1.3.2.1 Aquatic Ecosystem:

The Red Sea waters and shoreline forms a range of marine habitats including coral reefs, seagrass beds, mangroves, salt marshes and saltflats (*sabkhas*) along the coastline. Each of these habitats is home to diversified species of pelagic, demersal and benthic fish species and marine invertebrates.

Coral Reef:

Coral reefs are common in the Eritrean waters, occurring as patches in relatively pristine conditions. Compilation of scientific previous surveys identified 154 species belonging to 38 genera of stony corals (Scleractinians), such as *Acropona, Astreopora, Ctenactis, Cycloceris* etc. Recent surveys however have updated the list upto 220 species with 5 new are in the process of identification (State of the Coast 2007). Widely distributed families include *Acropora, Echinopora, Favia, Favites, Fungia, Galaxea, Goniopora, Montipora, Platygyra, Porites, Stylophora, Tubipora, Xenia and Pocillopora.* In addition, it has been also observed Coral reef along the islands coastlines are in good conditions while reefs along the mainland coastline are less due to sedimentation caused by river runoffs and human effects.

Coral reefs support thousands of species including crustaceans, fishes, sponges, algae and mollusks, reef fisheries, ornamental fish collection and tourism thereby helping the economy of the coastal communities. Reefs protect coastlines against wave and storm surge, prevent erosion and contribute to the formation of sandy beach and sheltered harbors. Under the scope of the ECMIB Project status of corals in the islands around the port of Massawa area (Green Island, Risi-Midri and Tuwalet), Dissei-Madot, Duhul Bahut, Dahlak-Nora, Ingel-Assakri area, Shumaha, southern Dahlak, Durgham, Durghela and Sarad were assessed in 2005, and in some cases such as Green and Dissei-Madot island permanent coral monitoring transects has been established. It is reported that Dissei-Madote area possesses a well developed reef which extends for about 15km an areas also proposed for a Marine Protected Area. The aforementioned islands are also located in the same zoogeographical zones and exposed to the same level of exploitation, and are believed to encompass the same coral and fish diversity.

Major fish family that are found common in the coral ecosystems include:Acanthuridae (Surgeonfish), Chaetodontidae (Butterfly fish), Haemulidae (Grants/Sweetlips), Labridae (Wrasses), Lutjanidae (Snappers), Pomacanthidae (Angelfish), Pomancentreidae (Damselfish), Serranidae (Grouper), Siganidae (Rabbit fish), Morey Eel (Muraenidae), Trigger fish, Box fish, Scaridae (Parrotfish) etc.

Treats to Coral Habitat

In most cases the corals are away from human influence and hence relatively unaffected except those in near the bigger urban centers of Massawa and Assab. Those major threats include:

- Rapid coastal development and fishing infrastructures;
- Tourism;

- Oil exploration (in the future);
- Sedimentation from land reclamation;
- Population increase;
- Destructive fishing activities (trawling in Shallow waters)
- Solid waste disposal and sewage from septic tanks;
- Occassional oil spills
- Effluents from desalination plants
- Dust from industrial activities (cement)
- Curios collections (shells,corals)
- Climate change

In addition corals are also threatened by natural factors such as crown of thorns (starfish), sea urchins or drupella infestation, or from human induced impacts such as bleacing related to global climate change; massive bleaching observed in the Nora islands in the 1998 global warming.

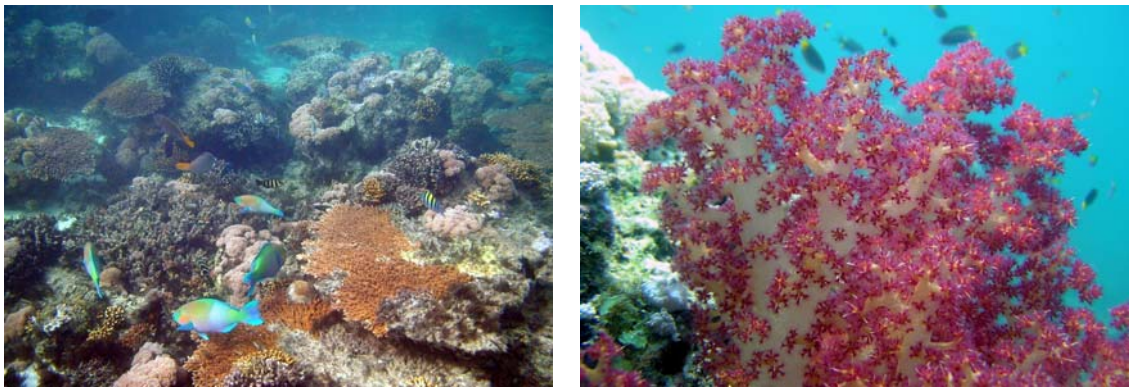


Figure-4: Diverse species of stony and soft Corals in the the Dahlak Archipelago (Source: ECMIB Project)

Sea Grasses and Sea Weeds:
As part of the overall marine Biodiversity inventory, ECMIB's surveys were also inclusive for sea grass biodiversity. Out of the 60 species existing worldwide the 10 are present in the Eritrean waters: *Thalassia hemprichii, Halophila ovalis, Halophila stipulacea, Enhalus acoroides, Cymodocea rotundata, Halodule uninervis, Syringodium isoetifolium, and Thalassodendron ciliatum and other unidentified species.* The Southern Eritrean marine zone is characterized by more extensive soft bottomed continental shelves and higher rate of water influx from the Indian Ocean as compared to the Central region. These combined with other physico-chemical and ecological factors results in increasing sea grass abundance southwards. Due to limitations in survey methodologies however (confined only to sub-tidal and inter-tidal zones), their vertical distributions is not well known.

Sea weeds on the other hand also constitute important part the diversified Eritrea's coastal marine and Island Biodiversity elements. In most of the assessments carried out sofar all the three major groups of Thallophyta are well represented along the Eritrean coastline. Out of the the 26 common sea weed species identified, 9 are Chlorophyta (Green algae), 12 Phaeophyta (Brown algae) and 9 Rhodophyta (Red algae). Spatial distribution is not uniform. Sorgassum and Turbinaria are the most dominat in the southern part of

Gurgussum, Dehil, Baradu, Tio, Sahil, Harasan, Morah and Mersa fatma. Likewise padina gymnaspora and turf algae are abundant in most areas, whereas caulerpa *lintellifera* more frequent in the southern Red Sea.

Fig5. Sea Weed (Enhalus acoroides) (left) and Sea Grass (right) (Source: Ministery of Fisheries 1997)

Table -10: Seaweed species recorded from the Eritrean Red Sea Zone (Source: Ministery of Fisheries 1997)

Chlorophyta (green algae) 9 spp.	**Pheaophyta (brown algae) 12 spp.**	**Rhopdophyta (red algae/coralline algae) 9 spp.**
Bryopsidophyceae	Phaeophyaceae	Rhodophyaceae
Caulerpa racemosa	*Cystoseira myrica*	*Corallina geonfera*
Caulerpa selago	*Cystoseira trinodis*	*Gelidiella* sp.
Caulerpa serrulata	*Dictyota bartayresii*	*Gracilaria crassa*
Caulerpa taxifolia	*Dictyota ceylanica*	*Gracilaria edulis*
Halimeda macroloba	*Dictyota* sp.	*Gracilaria millardeti*
Halimeda renschii	*Padina gymnospora*	*Gracilaria* sp.
Cladophorophyceae	*Sargassum aquifolium*	*Polymeria* sp.
Chaetomorpha sp.	*Sargassum polycystum*	*Soliera robusta*
Valonia fastigiata	*Sargassum spathulaefolium*	*Spyridia filamenta*
Ulvophyceae	*Sargassum turneri*	
Ulva reticulate	*Turbinaria conoides*	
	Turbinaria ornata	

Threats to Sea grasses and Sea weeds:

- Changes in water quality (pollution)
- Building Coastal infrastructure
- Disturbing sea bottoms by trawlings

Fisheries:

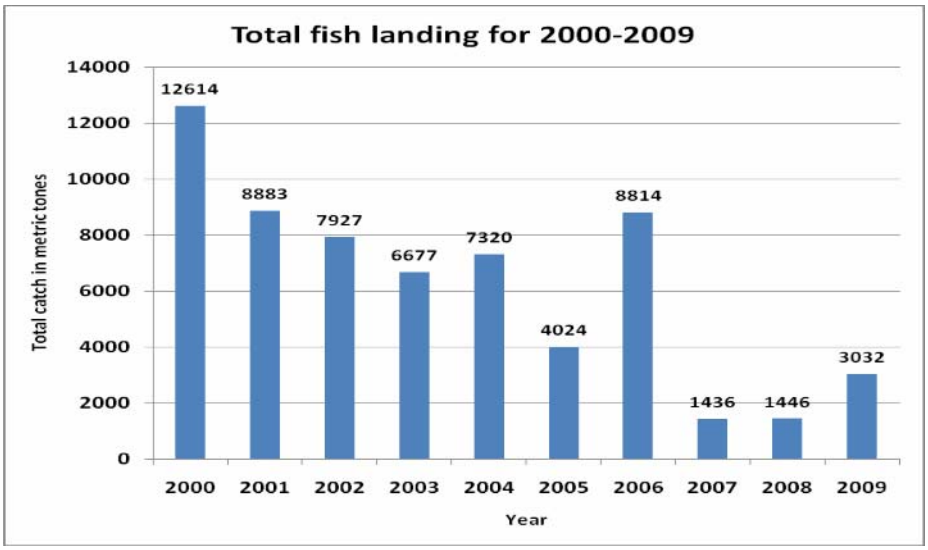
The Eritrean Red Sea is generally recognized as being highly favourable for the development of artisanal fisheries. Important coral reef areas, extensive surface of soft bottom, numerous shelters of the Dahlak archipelago plateau and extensive mangrove mud

flats and sea grass/weed habitats harbor diversified commercially important fisheries resources including: hard bottom demersal and reef fishes, ornamental fishes, soft bottom demersal fishes and shrimps, large pelagic, small pelagics such as sardines, sharks, and shell fishes, and other invertebrates.

It is reported that Over 1000 species of fish *(http://www.fao.org/fishery/countrysector/FI-CP_ER/en)* exist in the Eritrean waters. No comprehensive quantitatuive surveys of the resources have been carried out except few exploratory surveys for specific stocks between the mid 1950s and the late 1990's. The Maximum Sustainable Yield (MSY) of the Eritrean marine fish resources has been estimated in the range between 79,500 - 36,000MT (State of the Coast 2007).

Fisheries in Eritrea started to develop in the 1970s, and because of the expansion of fish meal production had reached to the level 20,000MT/annum, but later collapsed to 250MT/annum in the 1980-1990 during the Ethiopian colonization. The sector has however been revitalized since independence (1993) with significant portion of its catch coming form the industrial fisheries. For the reason that industrial trawling is mostly carried out by licensed foreign vessels that operates intermittently, catch has been significantly dwindled in the years 2007-2009.

Figure 6: Total Fish catch in Metric tones for the period (2000-2009) from the Eritrean Marine waters: (Source Ministry of Marine resources 2010)



Major catch species are represented by species: sardine (*Harangula punchata*) and anchovy (*Thrissocles balaena/Amentum heterolobium*) lizard fishes, thredin bream, grunts, mackerels jack fishes, baraccuda, demersal fishincluding Red Snappers Lutjanidae**:** *groupers* (Serranidae);

Figure 6: Coastal communities heavily dependent on artisanal fishemen for their livelihood (source: ECMIB Project)

Threats to Fish Biodiversity:

At present, there is no significant threat to the overall fish diversity along the Eritrean coastline, but the following potential threats can have indirect negative impacts:

- Coral habitat destruction from artisanal fishermen and dive tourists anchoring and diving;
- Poorly regulated commercial fishing, and illegal fishing from neighboring countries;
- over collecting of rare/endemic ornamental fish for the aquarium trade and for specialised markets (e.g. shark fin); and
- Future oil and gas production.

Sea Turtles

Eritrea's mainland coastline, together with bigger and numerous smaller offshore islands, provides important feeding and breeding habitats for the five turtle species, and nesting grounds for green, hawksbills and olive ridley. Five of the sea turtle species existing in the Eritrean Red Sea include: Hawksbill (*Eretmochelys imbricata)*, Green turtle (*Chelonia mydas)* Leatherback (*Dermochelys coriacea)*, Olive-Ridley (*Lepidochelys olivacea)* and Loggerhead turtles (*Caretta caretta) (*Hillman, 1997). As per the IUCN category, the three species (green, Olive ridley and Loggerhead) have been categorized as endangered, and the remaining two as critically endangered. Since the early 2004 several conservation and management initiatives focused on assessing information concerning turtle feeding and nesting habitats, and levels of natural and anthropogenic threat have been underway.

Eritrea generally harbors extensive sea grass beds and coral reefs that can support considerable numbers of turtles (marine.turtles@eritrearedsea.org) for nesting feeding and nesting purposes. Of the three species known to nest in Eritrea, the Hawksbill and Green turtles are the most common. But in 2005 Olive Ridley has been spotted to nest at the Ras Terma Beach in 2005 (a first nesting record in the whole Red Sea). For Hawksbill, the main nesting season is during the Northeast Monsoon winds (*Azieb*) in the season from Decmeber to May and has been recorded in more than 120 islands the most important being: Mojeidi, Aucan, Dhul, Kuff, Entaentor, Entaasnu, Urukia, Ras Fatuma and Dissie. At the same time records are also available from Berasole, Ras terma Gahro and Deleme

on the mainland (State of the Coast, 2007). Despite common nesting also for green turtle, less data is available.

Research, Monitoring and awareness are underway as part of the conservation programmes but significant role in turtle protection through community involvement is the ultimate choice. Turtle tagging to determine turtle movements and inter-nesting frequency and re-migration intervals has been introduced and has been carried out for about 150 turtles. On the other side, tags have been recovered between 1992 and 2006 from nesting females tagged mainly in Oman. (ECMIB Project 2007)

Threats to Sea Turtles

Sea turtles are threatened by variety of man-induced factors, including:

- Incidental catch in commercial trawlers
- Destruction or loss of nesting habitats
- Entanglement in fishing nets/gears coincinding with the nesting season of turtles.
- Each Poaching
- Predating of Eggs and Hatchlings
- Turtle harvest for meat, eggs, shells and skin
- Land-based activities and pollution

A ten-year (1994-2004) trawling data collected by the Ministry of Fisheries indicates all the 5 species are threatened from incidental catch. A total of 3342 sea turtles has been incidentally caught in the ten-year period out of which 1819 are Green turtle, 133 hawksbill, 30 Loggerhaed, 3 Olive-ridley and 39 Leatherback, the rest (1128) unidentified. The statistics also shows from the total number of turtles caught, 690 were dead and 2462 alive.

Figure-7: Green Turtle (Chelonia midas) laying eggs (source SoC, 2007)

Dolphins, Whales and Dugongs

Different literatures and reports and surveys from realized between 1998 and 2007 revelas, the following have been identified out of the cetaceans likely to exit in the Red Sea,:

- Bryde's whale or Tropical whale (*Balaenoptera edeni*),
- Sperm whale (*Physeter catodon*),
- Short-finned Pilot whale (*Globicephala macrorhynchus*),
- False Killer whale (*Pseudorca crassidens*),
- Common dolphin (*Delphinus delphis*),
- Spinner dolphin (*Stenella longirostris*),
- Bottle-nosed dolphin (*Tursiops truncatus*),
- Humpbacked dolphin (*Sousa plumbea*),
- Dugong (sea cow) *(Dugon dugong).*

The Common dolphin, Spinner dolphin, Bottle-nosed dolphin and Indo-Pacific Hump-backed dolphin are the most frequently seen in the Eritrean Red Sea.Some fishing communities consume the meat of dolphins when they are caught incidentally and die in their nets. In addition, the skin is used for producing oil which is used as a medicine.

The dugong (*Dugon dugong*) belongs to a monotypic genus of the order sirenia. Other surviving members of the sirenia are the three species of manatee (*Trichechus sp*.). Dugongs are very shy and difficult to see. Their presence is signaled mostly when they are stranded in fishermen nets or skeletons are found on the coast as seen on the islands of Norah, Adasi, Mojeidi and Entvedul or along the shore of Eritrea in Ingel, Arean or north of Massawa.

Figure-8: Dugong and Dolphins in the Eritrean Red Sea

Sea Birds and Shore Birds:

Large populations of birds estimated more than 73 specied reside either temporarly or permanently on the shores and the shallow waters of the Eritrean Red Sea. Birds appear to be concentrated in large number on the exposed intertidal zone and on the shallow area of the open sea. The most characteristic feature of this habitat type are the large number of invertebrates that become visible during low tides, the small fishes in the shallow water and the school of large and small fishes and planktons on the open sea. These rich sources of food on the varying habitats of the Eritrean Red Sea attract large number of birds, such as waders, herons, gulls, terns, boobies and other species.

The large number of islands on the Eritrean waters also provides critical habitat for a large number of seabirds' colony on summer. The open sand above the intertidal zone is suitable breeding site for terns and other birds such as the lesser-crested, white-cheeked and the crab plover. The various vegetation type provide excellent breeding habitat for bridled terns, sooty gull, herons and pelicans. The coral cliff and coral out crop is also suitable nesting site for sooty falcon and green backed heron. Some of the important breeding population also includes the White-eyed Gull *Larus leucophthalmus*, the Crab Plover *Dromas ardeola*, Brown Noddy *Anous stolidus*, White-cheeked Tern *Sterna repressa* and Sooty Falcon *Falco concolor.*

Based on the two year (2005-2007) detailed surveys carried out, the entire Eritrean Red Sea may support 250,000 breeding seabirds in summer. Many of the islands visited are an area of ornithological importance where a number of migratory and breeding seabirds and shorebirds occur. Islands such as Umal Bager, Delgus, Omel Assela and, Gurna on Assab Bay; Harbi, Sayal and Haycock on the offshore of Ras Terma or Near Hanish islands; Fanadir island near Barasole; Abeilat, Cod Ali and Sadla close to Edi; Seil, Estam Aghe, Crulli on Anfile Bay (Tio), Umm en Nayim, Laksu, Galdina, Rakh Howth, Umm Nammus on Hawakil Bay; Sheik el Abu, Mojeidi, Aucan, Museri, Entaasnu, Entaentor, Isratu, Awali Hutub, Abu Sherayu, Sarad, Dur Ghella, Dahret, Dohul Bahut and Madot on Dahlak Archiopelago support diversified and large number of breeding seabird populations (Status of Breeding Birdsy report, 2007).

The Southern coast from Marsa Fatuma to Tio, the coast around Barasole, islands such as R. Fatuma, Handa, Museri, Eastern side of Dahlak Kebir, Dhu Ladhiya, Nora, Harat, Dissie and Sheik Seid are also potentially very important sites serving as primary feeding, wintering ground and migratory stopover for thousands of seabirds and shorebirds such as terns, gulls, boobies flamingos, spoonbills, herons, smaller plovers and sandpiper and the Crab plover (ECMIB Project 2007).

Figure-9: Caspian Turns (Sterna caspia) and Western Reef Heron on nest (Egretta gularis)

Threats to Breeding Birds

Potential threat to breeding sea birds on the islands comes from local and foreign sea cucumber fishermen and tourists:

- Permanent large and small camps on many islands; egg collection, habitat destruction (wood collection) and garbage dumping are the main destructive features practiced by the fishermen

- Additional disturbance especially to breeding terns comes from tourists who swim, snorkel and rest on the beaches; islands such as Madot, Dahret and Umm Nammus are intensively visited by tourists, thus access should be denied during the breeding season mainly from May to August.

Table 12: Bird species recorded from the Eritrean islands (Source: Ministry of Fisheries 1997)

LAND BIRDS		**SEA BIRDS**	
Resident		**Resident**	
Bustard, Arabian	*Ardeotis arabs*	Booby, Brown	*Sula leucogaster*
Houbara Bustard (???)	*Chlamydotis undulata*	Booby, Masked	*Sula dactylatra*
Crow, Pied	*Corvus albus*	Gull, Slender-billed	*Larus genel*
Dove, African Collared	*Streptopelia roseogrisea*	Gull, Sooty	*Larus hemprichii*
Dove, Namaqua	*Oena capensis*	Gull, White-eyed	*Larus leucophthalmus*
Lark, Black-crowned Finch	*Eremopterix nigriceps*	Noddy, Brown	*Anous stolidus*
Lark, Crested	*Galerida cristata*	Pelican, Pink-backed	*Pelecanus rufescens*
Lark, Hoopoe	*Alaemon alaudipes*	Tern, Bridled	*Sterna anaethetus*
Osprey	*Pandion haliaetus*	Tern, Black	*Chlidonias niger*
Pigeon, Feral	*Columba sp.*	Tern, Caspian	*Sterna caspia*
Raven, Brown-necked	*Corvus ruficollis*	Tern, Commom	*Sterna hirundo*
Redstart, Black	*Phoenicurus ochruros*	Tern, Lesser Crested	*Sterna bengalensis*
Robin, Black Bush	*Cercotrichas podobe*	Tern, Whitecheeked	*Sterna repressa*
Sandgrouse, Spotted	*Pterocles senegallus*	Tropic Bird, Red-billed	*Phaethon aethereus*
Shrike, Great Grey	*Lanius excubitor*	**Palaearctic migrant**	
Warbler, Mangrove reed	*Acrocephalus baeticatus*	Booby, Red-footed	*Sula sula*
Wheatear, Desert	*Oenanthe deserti*	Gull, Black-backed	*Larus marinus*
White Eye, White Breasted	*Zosterops abyssinica*	Gull, Lesser Black-backed	*Larus tuscus*
Intra-African migrant		Pelican, White	*Pelecanus onocrotalus*
Falcon, Sooty	*Falco concolor*	**SHORE BIRDS**	
Stork, Abdim's	*Ciconia abdimii*	**Resident**	
Palaearctic migrant		Heron, Goliath	*Ardea goliath*
Bee-eater, European	*Merops aplaster*	Heron, Green-backed	*Butorides striatus*
Courser, Cream-coloured	*Cursorius cursor*	Heron, Reef	*Egretta gularis*
Crake, Spotted	*Porzana porzana*	Plover, Crab	*Dromas ardeola*
Cuckoo	*Cuculus canorus*	Plover, Kentish	*Charadrius alexandrinus*
Doves, Turtle	*Streptopelia turtur*	Spoonbill	*Platalea leucorodia*
Falcon, Pregrine	*Falco peregrinus*	**Intra-African migrant**	
Flycatcher, Spotted	*Muscicapa striata*	Flamingo, Greater	*Phoenicopterus ruber*
Hoopoe	*Upupa epops*	Flamingo, Lesser	*Phoenicopterus minor*
Kite, Black	*Milvus milvus*	Snipe, Great	*Gallinago media*
Martin	*?*	**Palaearctic migrant**	
Nightjar, European	*Caprimulgus europaeus*	Dunlin	*Calidris alpina*
Oriole, Golden	*Oriolus oriolus*	Godwit, Bar-tailed	*Limosa limosa*

Pipit	*Anthus sp.*	Oystercatcher	*Haematopus ostralegus*
Quail	*Coturnix coturnix*	Plover, Little Ringed	*Charadrius dubiu*
Redstart	*Phoenicurus phoenicurus*	Plover, Ringed	*Charadrius hiaticula*
Roller, European	*Coracias garrulus*	Redshank	*Tringa totanus*
Sand grouse, Spotted	*Pterocles senegallus*	Sanderling	*Calidris alba*
Shrike, Red-backed	*Lanius collurio*	Sandpiper, Common	*Actitis hypoleucos*
Shrike, Woodchat	*Lanius senator*	Sandpiper Terek	*Xenus cinereus*
Swallow	*Hirundo rustica*	Turnstone, Ruddy	*Arenaria interpres*
Wagtail, Grey	*Motacilla cinerea*	Whimbrel	*Numenius phaeopus*
Wagtail, White	*Motacilla alba*		
Wagtail, Yellow	*Motacilla flava*		
Warbler (grey/yellow spp.)	*?*		
Warbler, Mangrove reed	*Acrocephalus baeticatus*		
Wheatear, Isabeline	*Oenanthe isabellina*		
Introduced species			
Crow, Indian House	*Corvus splendens*		
? Hawk	*?*		

1.3.2.2 Mainland and Islands Shoreline Ecosystem

As mentioned in the previous chapters, the Eritrean Red Sea shoreline extends over 3,300 km, whereby the 1350 km runs over the mainland coastline, and the 1950km over the islands shoreline.

Sandy Shores/Beaches and Mudflats:

A cross section of almost any stretch of coastline in Eritrea reveals a number of different shoreline habitats. These include the sand beach itself, the edge of the water at low or high tide, the exposed mud or sands at low tide, and the shallow water offshore. The sand beach provides a source of detritus - pieces of dead or dying organisms that are washed ashore by the tide. The edge of the water provides small swimming organisms, plankton and larvae. The exposed mud and sand bottom provides a medium to be probed by birds with long bills for worms, crustaceans and other invertebrates. In addition, although not part of the shoreline, the shallow water contains small fish, crustaceans and invertebrates. These areas are therefore important feeding habitat for many bird species, especially shorebirds and seabirds. Some of this habitat, especially the relatively isolated northern Eritrean coast and the uninhabited islands, are important breeding areas for some species, such as Crab Plover. (These beaches also provide important turtle nesting habitat). Several areas of exposed flat shoreline including the Dahlak outer eastern islands that serve as an important resting ground for passing migrant birds have been prioritised for increased protection, to enhance biodiversity conservation. On the other hand, much remains to document other faunal and floral species living in the areas but requiring extensive taxonomical knowledge on benhic organism mainly invertebrtaes and microbials.

Figure-10: Sandy shores and mud-flats

Treats to Sandy Shores/Beaches and Mudflats

The main threats to this habitat are:

- Pollution,
- Land use change,
- Sea- level rise,
- Land reclamation and uncoordinated development.

1.3.3 Agricultural Biodiversity

In accordance to the of decision III/11 of the Conference of the Parties to the Convention on Biological Diversity, agricultural biodiversity is a broad term that includes all components of biological diversity of relevance to food and agriculture, and all components of biological diversity that constitute the agro-ecosystem: the variety and variability of animals, plants and micro-organisms, at the genetic, species and ecosystem levels, which are necessary to sustain key functions of the agro-ecosystem, its structure and processes.

In line with this broader definition, the NBSAP for Eritrea has defined agricultural biodiversity as the variability among living organisms associated with agriculture: these include plants (utilised as food/feed, industrial, spices, medicinal, etc.), the wild relatives of these plants, animals, weeds and microbial. The diversity exists between species and within species in a given ecosystem.

Ideally a full assessment of the status and trend of agro biodiversity would require a full assessment of a) Eritrea's plant genetic resources, including pasture and rangeland species, genetic resources of trees that are an integral part of farming systems; b) Animal genetic resources, including insect genetic resources; c) Microbial and fungal genetic resources, d) components of agricultural biodiversity that provide ecological services and e) Socio-economic and cultural issues related to biodiversity. However, insufficient information has restricted this national report to focus more on PGR and animal genetic resources.

In Eritrea, about 80% of the population derives a large part of their subsistence income form agricultural activities (crop and livestock production). Agriculture is based on traditional systems with over 90% of production coming from rainfed farming. The rain-

fed crop/livestock production system entails extensive land use and is the main source of staple crops (cereal and pulses) and contributes to relatively high value food supplies of animal origin. In the last 18 years the total annually cultivated land for rain-fed agriculture varies between 321,000 ha and 540,000 ha. There are currently about 68,000 ha under irrigation which represents about 10% of the estimated potential. The staple crops are sorghum, pearl millet, maize, wheat, barley, *taff* (Eragrostis tef) and finger millet. Fruits and vegetables are grown in small-scale irrigation plots. Commercial agriculture operates in concessional areas but accounts for less than 10% of agricultural output.

In Eritrea, traditional farming represents centuries of accumulated experience and skills of peasants who often sustained yields under adverse farming conditions using locally available resources. The foundation for Eritrean farming is comprised of the traditional crops and landraces which farmers have adapted over centuries of selection and use to meet dynamic and changing needs. Farmers are instrumental in conserving germplasm as they control the bulk of the country's genetic resources. Peasant farmers retain some seed stock for security unless circumstances dictate otherwise.

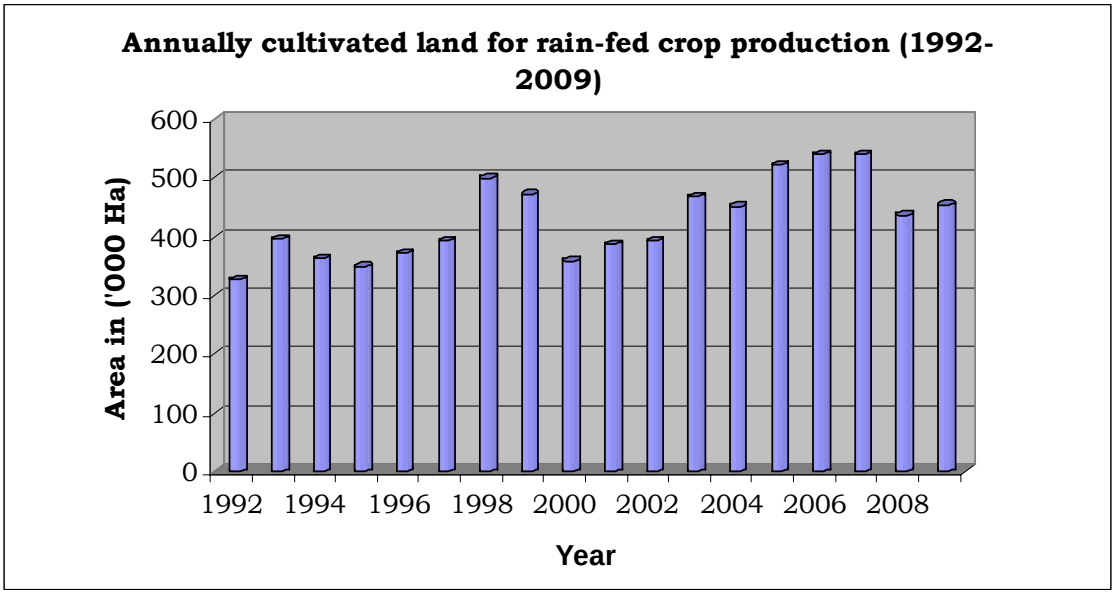


Figure-11:
Source: Ministry of Agriculture

1.3.3.1 Diversity of Individual Crop Species

Eritrea is recognized as a centre of origin and centre of diversity for a number of crops, notably the cereals: sorghum, wheat, barley, pearl millet, taff, and finger millet. There is a rich diversity of crop landraces still available in Eritrea. A full inventory of the local land races for all crop types in Eritrea is not yet complete. However, data compiled from different range of sources indicates that 20 varaities of sorghum, 8 for maize, 6 for barley,

5 for taff, 3 for pearl millet, 3 for finger millet, 3 for sesame and 2 for Niger (*Nihug*) seed have already been identified as indigenous crop diversity in Eritrea (DoE, 1999). Though not complete, a list of insect, weed and microbial pests was compiled by Ministry of Agriculture. A total of 36 major insect pests, 16 pests of stored product and 32 crop diseases are reported to be found in Eritrea. In addition, a total of 81 weed plants/species common to Eritrea are recorded from field observation and survey (Negassi, 1999). Crop diversity is Eritrean farmer's best defense against poverty and threats of climate variation, diseases and pests. Diversity has increased options for improved livelihoods including spreading of risks in the face of failure of certain crops.

Cereal Crops Diversity Status and Trend

Cereal crops cover about 90 percent of the total annually cultivated land of the country. The most significant cereal crops genetic diversity for food and agriculture are: sorghum (*Sorghum bicolor*) ; barley (*Hordeum vulgare*); wheat (*Triticum drum*); maize (*Zea mays*); taff (*Eragrostis tef); p*earl millet (*Pennisetum typoides);* finger millet (*Eleusine caracona*), *hanfets* (Mixture of barley and wheat). These crops are also the staples that feed the nation. On the average, sorghum accounts for 46% of total cropped area, compared with just, 12 % for pear millet, 10% for barley, 6.5% for Taff, 5.3% for finger millet, 4.7 % for maize, and 4.5% for wheat (MoA, 2010).

Farmer's interview during NARI's germplasm collection revealed that most cereal landraces are at risk mainly due to serious genetic erosion and irreversible losses. Some sorghum, pearl millet, wheat and barley varieties are replaced by exotic and developed varieties.

Sorghum

Data shows that the proportion of land covered by sorghum is steadily increasing in the last 13 years. In 2000 the total land planted with sorghum was about 151,000 ha which was accounted for 46 % of the total area under cereal crops. In 2009, the coverage of this crop has increased to 239,442 ha and it accounts to 59.4% of the total land under cereal crops. This is mainly attributed to the higher local demand for cereal crops particularly sorghum and its higher price for farmers. Shortage of labour and low selling price for sesame has also contributed to the conversion of most sesame land to sorghum fields. This has resulted in inappropriate reliance on monoculture by disturbing the cropping pattern of sorghum-sesame-cotton in the western lowlands which has a negative impact on productivity.

In general, the situation of genetic diversity of sorghum in the western lowland appears good, except some varaties like Alclamoy appears to be restricted to near the borders of Sudan. Recently improved varieties are introduced by NARI but the local variety, *Higeri* remain largely dominant.

Barley:

Barley (*Hordeum vulgare*) since its introduction, distinct landraces have developed in the Ethiopian and Eritrean highlands, which are unique to the region and possess a number of useful resistance genes and tolerance to harsh conditions. Highland farmers grow barley as the main first crop, followed by sorghum, maize, taff, and wheat in a decreasing amount. Barley is grown in the highland mainly as an insurance against drought, it is important in different traditional food staffs/dishes and as fodder. Barley is adapted to a wider type of soils and can be grown in almost any soil type. It is one of the crops that tolerates adverse climatic conditions and is early maturing, so farmers can harvest it before the rain ceases and the soil dries. It has wide adaptability and provides fodder for livestock.
Although most local landraces show relatively low productivity, they have some useful characteristics for breeding including tolerance of marginal growing conditions, resistance to barley shoot fly, aphids and frost, vigorous seedling establishment and quick grain filling capacity (Gebre *et al*, 1991).

During the 1997 exploration/collection programme of barley crop varaities, it was noted that in general farmers grow 2-3 early-maturing cultivars; while the late-maturing types are now rarely found. Varaities like the six-row *Quinto* and the naked barley *Demhay* are almost entirely confined to the relatively high rainfall areas (DoE, 1999).

Finger Millet:
Finger millet (*Eleusine coracana*) grows mostly in the central highlands and parts of the south-western lowlands on sandy and sandy loam soils. The area planted to finger millet is likely to decline as agriculture becomes more mechanized and intensive and there is considerable risk of rapid genetic erosion.

Wheat
Among the major food crops in Eritrea, wheat is perhaps the most endangered to genetic erosion from past and current introduction of exotic varieties such as recently introduced *Wedenill* variety. Presently, landraces varaities like *tsellim cerau, russo, felasi* and *manna keih*, *guandie* are much less frequent than in the past and are likely to disappear unless carefully managed.

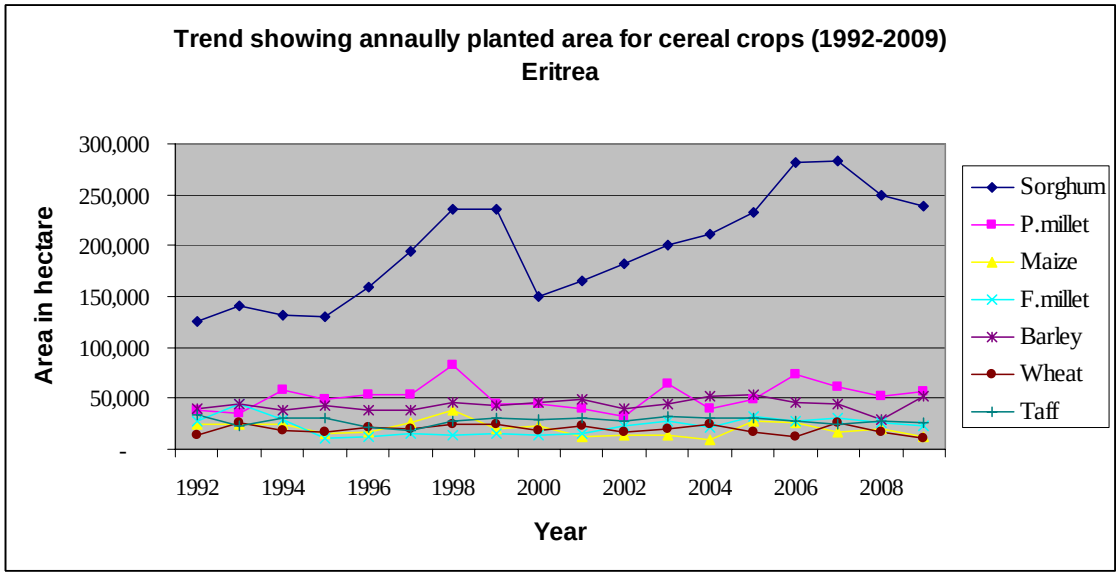


Figure-12:

Oil Crops

Oil crops cover about 5.5 % of the total annually cultivated lands. The most significant oil crops grown in the country are sesame (*Sesamum indicum*); ground nut (*Arachis hypogaea*), castor (*Ricinus communis*.). Oilseed crops are dominated by sesame (80%) with groundnuts and linseed comprising 9% and 6% respectively of the total area annually utilized for oil crops.

Oil seeds are genetically declining. Area planted with Niger seed is almost to nil. In 5 years germplasm collection (2004-2008) only 2 pieces of lands were identified to be planted with Niger seed. Recently farmers were forced to plant introduced groundnut seed. This has resulted to an increase of groundnut coverage in relation to the dominant oil seed crop sesame (NARI, 2010- expert communication).

In general the proportion of land planted with oil crops is decreasing. In 1996, oil crops used to cover about 8% of the total cultivated land has dropped to 1.3 % in 2009, mainly due to a significant reduction of area planted by sesame.

The area planted out to linseed and *nihug* is thought to be declining, primarily due to the shortage of accessible land for growing basic food crops and the ease of availability of alternative imported corn oils.

Pulses

Pulses cover about 4.5 % of the total annually cultivated lands (MoA 2006). Faba beans *(Vicia faba);* check pea (*Cicer arietinum*); field pea (*Pisum sativum*), grass pea (*Lathyras sativum*); cow pea (*Vigna ugunuculata*); fenugreek (*Triganella foenum- graecum)*; linseed (*Linum usitatissium),* lentil (*Lens culinaris*), common bean (*Phaseolus vulgaris*) are the most common land races found in Eritrea . Chickpea (*Cicer arietenum*), faba bean (*Vicia faba*), and field pea (*Pisum sativum*) are the three most important crop legumes by area. All three were introduced into the Horn of Africa many hundreds or thousands of years

ago and Eritrea is now part of a secondary centre of diversity. The Plant Gene Bank of NARI holds around 71, 260 and 40 local landrace accessions for each of these species respectively (NARI, 2009). Among the pulses, the distribution of crop species is more even, with an average of the total crop being 35% chickpea, 22% field pea, 21 % of faba bean, and 22% others.

Zoba Debub and Zoba Maekel are the two major pulse producing regions in the country. Recent data shows that area covered by pulses is steadily decreaing since 2003. This declining trend is more significant in Maekel region. The cultivated area of chick pea, the major legume food crop sown by the farmers, is decreasing in certain areas due to heavy root rot attack problem. In some occasions and some villages of Zoba Debub region farmers were depending on chickpea seed from market and/or from Ministry of Agriculture.

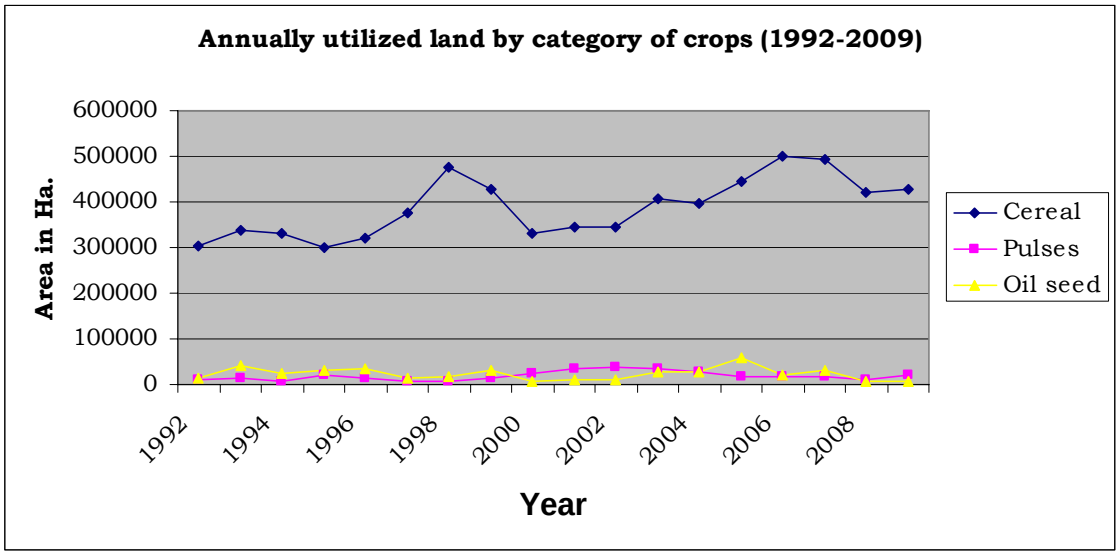


Figure-13:

Fruits and Vegetables

The amount of information available on the diversity of fruits and vegetable crop species is very limited. Vegetable crop species so far identified to be grown in Eritrea are: potato (*Solanum tuberasun*), onion (*Allium cepa*), garlic (*Allium sativum*), okra (*Abelmoschus esculentus*), tomato (*Lycopersicon lycopersicum*), pumpkin (*Cucurbita pepo*) watermelon (*Citrullus lanatus*), melon (*Cucumis melo),* hot pepper (*Capsicum frutescens*), mustard (*Brassica carinata*), eggplant (*Solanum melongena*), cabbage (*Brassica oleracea*), beetroot (*Beta vulgaris*), *melokia* (*Corchorus trilocularis*), *jirijir* and Swiss chard.

Among fruits: banana (*Musa spp*); orange (*Citrus sinensis*); lemon (*Citrus limon*), grapefruit (*Citrus paradisi*), mandarin (*Citrus reticulata*), apple (*Malus pumila*), mango (*Mangifera indica*), papaya (*Carica papaya*), guava (*Psidium guajava*), date Palm (*Phoenix dactylifera*), grape vine (*Vitis vinifera*), and coffee (*Coffea Arabica*) are

identified to be grown in Eritrea. Presently the vegetable and fruit coveage is about 17,519 ha.

1.3.3.2 Wild Food Products

Eritrean farmers have also managed in traditional way a variety of wild species and habitats which benefit the sustainability of both agricultural and natural ecosystems. In many parts of Eritrea, the collection of wild-growing natural products is an important part of the overall household economy. For example, *beles*, the fruit of the introduced cactus, *Opuntia ficus-indica* provides food and income for a considerable number of people in the highlands every summer. Ogbazghi & Bein (2006) provided a list of 110 tree species, parts of which have been used as food by local inhabitants and by animals in Zoba Gash Barka. Of these 110 species, 30 produce edible fruits and 7 of them also used as sources of vegetable for rural community of Gash Barka Region. The most important sources of wild-food trees grown naturally are listed in Table-13.

Table 13 - Important wild food tree species in Eritrea

Scientific Name			
Adansonia digitata	Cordia Africana	Ficus vasta	Sclerocarya birrea
Balanites aegyptiaca	Cordia monoica	Grewia ferruginea	Syzygium guineense
Boscia angustifolia	Diospiros mespiliformis	Grewia flavescens	Tamarindus indica
Boscia senegalensi	Dobera glabra	Grewia tenax	Teclea nobilis
Capparis deciduas	Euclea schimperi	Grewia villosa	Ximenia Americana
Capparis tomentosa	Ficus carica	Hyphaene thebaica	Ziziphus spina Christi
Carissa edulis	Ficus glumosa	Mimusops kummel	
Combretum aculeatum	Ficus sp.	Opuntia ficus-indica	

Source- Ogbazghi & Bein (2006) - Assessment of Non-Wood Forest Products and their Role in the Livelihoods of Rural Communities in the Gash-Barka Region, Eritrea

Reason for Decline of Wild Plant Species and their Habitat:

As part of the natural vegetation cover of the country the wild species and their habitat are declining in diversity, distribution and abundance. In most cases of wild fruit and seed collection, there is little or no "management" of the wild species specifically to enhance production. Therefore they are under serious threat. There are several reasons contributing to the decline of the wild species and their products. These are: Drought, shortage of community forest guards, lack of proper land use system, communal use of forest resources and lack of ownership, lack of awareness of the local community, lack of forest law and conservation norms, land clearing for agriculture and resettlement, excessive cutting of trees and shrubs for firewood for local consumption and sale of wood in urban settlements.

***Ex-situ* Conservation:-**

There is no complete inventory of the local landraces for all crops. Currently, the *ex-situ* conservation of Plant Genetic Resources is undertaken at the MOA Plant Genetic Research

Unit for Eritrea (PGRU-ER) within the National Research Institute of the MOA. Since independence, PGRU-ER has collected and documented around 4287 accessions of cereal, legume, oil crops, forage, fiber crops and medicinal plant. Since 1999 the collection and documentation has been increased by 160 percent. The number of crop accession in the National Plant Gene Bank as of December 2009 is summarized in Table-14.

Table-14: Number of crop accessions in the National Plant Gene Bank

Crop Species	Number of Accessions		% increased	Crop Species	Number of Accessions		% increased
	2000	2009			2000	2009	
Cereals				**Pulses**			
Sorghum	417	534	28	Faba bean	29	260	797
Barley	253	856	238	Chickpea	51	71	39
Wheat	249	1093	339	Field pea	27	40	48
Maize	137	193	41	Cow pea	17	27	59
Pearl millet	116	200	72	Lentil	9	20	122
Finger millet	71	120	69	Grass pea	40	57	43
Taff	67	105	57	Fenugreek	22	24	9
Total	**1310**	**3101**	**137**	Phaseolus sp.	9		
Oil seeds				Common bean		119	
Sesame	51	62	22	**Total**	**204**	**618**	**203**
Groundnut	31	41	32	**Others**			
Linseed	30	32	7	Wild sesame	1	2	100
Cotton	8	11	38	Wild sorghum	4	4	0
Niger	3	7	133	Garden cress	3		
Mustard	2	14	600	Okra	1	7	600
Sunflower	2	2	0	Vegetables and fruit		33	
Total	**127**	**169**	**33**	Medicinal plants		27	
				Forage		326	
				Total	**9**		**4333**
				Grand Total	**1207**	**4287**	**160**

1.3.3.3 Rangeland Resources

Rangeland in Eritrea is estimated at 6 million hectares or 49% of the total land mass of the country and approximately 75% of the total population depends on livestock and livestock production (FAO, 1994). 5% of the total population is pastoralists, with another 25% classified as practicing agro-pastoralism. Almost all farming households own some livestock and many upland farmers move livestock to the lowlands in combined herds for grazing. The rangelands get less than 400 mm/year of rainfall and cover most of the Eastern and western lowlands. They are dominated by various grasses (mostly annual), herbs and small browse species of Acacia. The natural grassland is constrained by

overgrazing during dry season and under grazing during wet season due to poor grazing land management.

About 60% of the livestock of all types are kept in the lowlands within the pastoral and agro-pastoral livestock production systems while the remaining 40% are kept within the cereal-livestock production system in the highlands (FAO, 1994). Cereal straw is an important component of animal feed that supplements grazing. There is shortage of arable as well as grazing land. In the highlands there are special communal grazing areas with seasonal closure called *hizaati* around the villages.

Pasture and Forage Plant Diversity

In terms of the forage and pasture resources not much research has been done, means most of the information documented is really not derived from systematic research activity, but is based on general assessment and surveys and some from development projects. However, it should be borne in mind that the initial potential for increasing the total feed resource is by optimizing the natural production of the specific ecological zones.

Livestock are sustained by grazing the natural pasture comprising mostly fast maturing species, and various shrubs and trees like *Acacia albida, Acacia seyal, Balanites aegyptiaca, Acacia senegal, Terminalia brownii, Acacia mellifera, Capparis decidua, Acacia tortilis, Acacia asak, Diospyros abyssinica, Acacia nilotica, Ziziphus spina-christi and Albizia lebbeck* are also available during and shortly after the rainy season. Annual rainfall is the main factor influencing the availability of feed on the pastures. According to FAO (1995) the production of feed, in dry matter (DM) terms (kg/ha), under different rainfall regimes (mm/year) and the relative animal carrying capacity (ha/Tropical Livestock Unit), have been estimated as follows (Table-15).

Table 15: Estimated DM production and carrying capacity

Rainfall (mm)	**Total Above Ground DM Production (kg/ha)**	**Carrying Capacity (ha/TLU)**
100	n.a.	over 20
200	450	17
300	675	10
400	900	7
500	1,125	6
600	1,130	4

The amount and quality of native pasture available to livestock varies with altitude, rainfall, soil and cropping intensity. Depending on the climate, different types of pasture grow in different agro-ecological zones of Eritrea. A close relationship exists between pasture and climate as a consequence of plant evolvement and adaptation over long periods of time. Because of this interaction dominant natural pasture groups have become associated with a particular climate. The status of the different rangelands is discussed below.

Central Highlands:

Natural grasses of the central highlands include species of *Pennisetum clandestinum , Chloris gayana, Digitaria abyssinica, Digitaria scalarum, Setaria sphacelata, Cenchrus ciliaris, Cenchrus mitis, Eragrostis cilianensis, Eragrostis superba, Andropogon* spp., *Bromus pectinatus, Dactyloctenium aegypticum, Hyparrhenia hirta, Brachiaria semiundulata, Heteropogon contortus, Melinis repens, Avena fatua, Eleusine indica, Cynodon dactylon, Denebra retroflexa, Echinochloa colona, Themeda triandra* and *Sporobolus natalensis* (GOSE, 1998a). The pastures in the highlands are infertile and steep, hence fragile under continuous uncontrolled grazing regimes. The grazing area has been shrinking over the years because of over-grazing, extensive cultivation, improper utilization of water resources and deforestation. The removal of forest cover and constant grazing has depleted the resources of the browse layer. The pastures have no opportunity to recover because hungry animals are continuously searching for any edible plant that sprouts. Attempts to allow regeneration by closing land to grazing have shown promising results and are becoming models for recovery. However, generally because of the above-mentioned reasons the most palatable species of herbage and browse are decreasing in quantity and leaving space for less palatable species. If the present trend of deterioration persists for much longer, it may not only destroy the palatable species completely but it could also change the land to bare soil and initiate the process of desertification.

A number of exotic annual and perennial high potential grasses such as oats (*Avena sativa*) Sudan grass (*Sorghum sudanese*) Rhodes grass (*Chloris gayana*) and elephant grass (*Pennisetum purpureum*) as well as legumes have only been introduced quite recently to Eritrea and are now being evaluated in adaptation studies. Preliminary trial results on several of these forages at Halhale Research Station are very promising. As an example, elephant grass (*Pennisetum purpureum*) yielded 25$\pm$6 tons dry matter/ha/year in ten cuttings.

The central-highland is also home for enormous number of pasture legume species, though most of the species are in very critical genetic threat

Western Lowlands

The dominant grasses observed are species such as *Andropogon dummeri, Digitaria diagonalis, Setaria sphacelata, Chloris virigata, Eragrostis cylindriflora, Eragrostis cilianensis, Eragrostis superba, Cyndon nlemfuensis, Aristida adscensionis, Dactyloctenium aegyptium, Elytrophorus spicatus, Aristida funiculata, Eragrostis macilenta, Eragrostis tremula, Cenchrus biflorus, Enteropogon macrostachyus Cyperus rotundus* and *Aristida mutabilis.* In the wetter southern part of the western lowlands, there appears to be no damage to the rangelands, except in those areas adjacent to population centres. The intensity of grazing increases in the drier northern part of the lowlands, where the grass becomes relatively scarcer. The extensive and migratory system of animal husbandry allows the rangelands to recover, unlike in the highlands. Significant efforts have been made by the Gash Barka branch office of the MoA to domesticate the grass species *Abertata* (*Urochloa trichopus)*However, if the present system of uncontrolled grazing continues with a larger animal population, the fate of the rangelands will be similar to that of the highlands. The vegetation of this agro-climatic zone presents a

picture of great complexity, comprising a wide variety of vegetation types, which may be called semi-arid tropical.

Eastern Lowlands:

Grasses, which occur naturally, include species of *Cynodon* spp., *Cenchrus prieuri, Eragrostis cilianesis, Aristida mutabilis, Eragrostis cylindriflora, Eragrostis superba, Elytrophorus spicatus, Panicum triticeum, Paspalidium gemminatum, Sporobolus spicatus, Cyperus rotundus,* and *Aristida adscensionis.* This region is arid, having annual temperatures varying from 28-38 ^{0}C with little seasonal variation. Pastures are of low productivity and not in good condition in terms of ground cover, as grasslands and browse are limited within a vast desert. The pastures are overstocked mainly in the dry season. In many places the soils are severely degraded and have lost much of their water-holding capacity. The pastures are subject to sheet and gully erosion with the onset of and for the duration of the rains. Erosion has resulted in several areas in a significant shallowing of the topsoil generally, and poor seed set in the heavily grazed areas. This is a significant constraint to productivity in pasturelands, which consist almost entirely of annuals.

In general, currently key pastoral land near major water resources is being converted to agricultural use. The concentration of animals in the remaining localities is likely to destroy the productive capacity of rangeland in those areas (MoA,2001).

1.3.3.4 Livestock Diversity

Livestock are an important part of the Eritrean agricultural sector, through their contribution to diet as meat and dairy products, and also to crop production as draught animals (both oxen and camels); they are thus an important part of Eritrea's total agro-biodiversity. In addition, the number and distribution of livestock has considerable impact on terrestrial biodiversity, through grazing pressure on vegetation and also by competition with other wild herbivores – these impacts influence almost 50% of the entire terrestrial area of the country.

No recent census on livestock population has been conducted. According the 1997 survey of the Ministry of Agriculture, however, Eritrea has 1.9 million cattle, 4.7 million goats, 2.1 million sheep, 0.5 million donkeys, 9 thousand mules, 5 thousand horses and 0.32 million camels. The total numbers of livestock in Eritrea has fluctuated considerably through this century. As shown in Figure 14 the dominant trend for livestock population has been one of slow build-up in numbers from 1930-1973, followed by a considerable decline during the struggle for independence, after which numbers have begun to build up once more reaching a total of over 7 million animals or 2.7million TLUs by 1994 (DoE,1999) . No census in recent years but the present numbers is the highest they have ever been, with the exception of cattle. A shift in numbers away from shoats to cattle would probably have a major beneficial impact on rangeland biodiversity but this will not be easily achieved whilst water supply and rangeland condition remain limiting factors on productivity. The seasonal distribution of livestock is complex, involving movements from the highlands to both the eastern and western lowlands and also extensive movements around the lowlands.

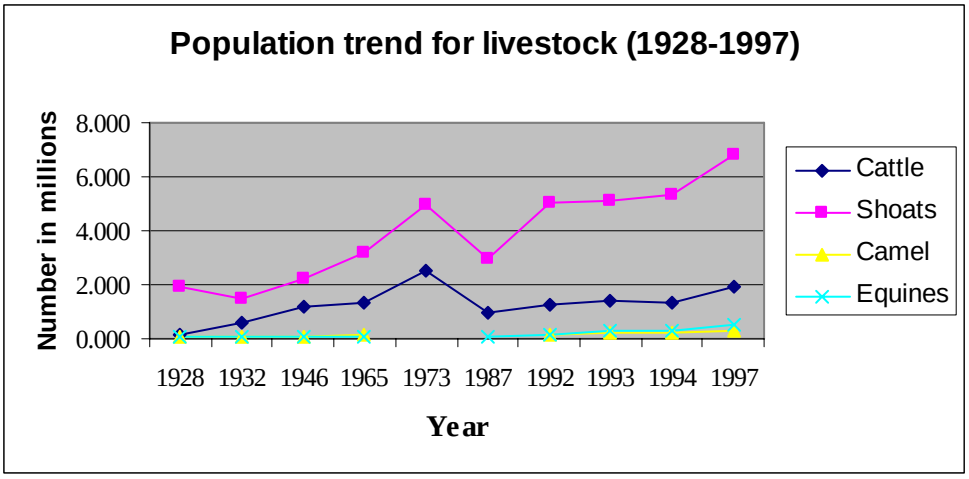


Figure-14:
Source – DoE, 1999 stocktaking assessment.

The majority of livestock in Eritrea are indigenous stock which has been selected for the prevailing eco-climatological conditions, and to a lesser extent for resistance to the major animal diseases present in the country. To date, the introduction of exotic breeds has been negligible, but the prevailing government policy of livestock improvement will rely heavily upon the introduction of exotic genetic material through artificial insemination, especially from Friesian stock for dairy production in the highlands. Some European dairy cattle have been introduced since the nineteenth century by Italian settlers; some 6,000 to 8,000 cows, basically composed of pure exotic Friesian and some cross breeds, owned by 800 to 1,000 commercial farmers are concentrated in urban and peri-urban zones of Asmara (Kayouli *et al*, 2006).

The actual numbers of introduced stock, the low levels of interbreeding and the poor performance of cross-bred stock indicate that there will be little loss of indigenous livestock breeds over the next 10 years (STA, 2000). Breeding programs based on indigenous breeds should ensure the continued survival of all existing breeds if they continue to meet the requirements of farmers and pastoralists.

Buffalo:

A total of 65 Buffalos were imported from Italy for the first time at the end of 2009, of which 38 are Heifers, 22 pregnant Cows and 5 Bulls. During the last 3 months, 2 adult cows died because of heart-water disease and out of the 21 calves that are born, 2 died. Presently, the total number of buffalos is 82. Buffalo milk is directly sold to the Mendefera milk cooling center in Debub Zone.

Cattle:

No characterization work has been done for proper breed identification except some effort made by MoA in 1998 on physical characterization. According to farmers description

there are four indigenous breeds of cattle found in Eritrea; these are the *Barka (Bigait), Arado, Arabo* (*Bahria*) and the *Afar.* Except one all are humped and belong to the *Bos indicus* species. The *Afar* breed is found mainly in Denkalia and along the southern Red Sea coast, where they are moved to take advantage of seasonal pasture. The *Arabo* is found mostly in the eastern lowlands north of Massawa, whilst the *Arado* is found throughout the highlands, but also moving seasonally down into the eastern lowlands. The availability of grazing is now so limited in the highlands that these seasonal movements are an essential part of the production cycle for the highland populations, with all animals except draught oxen, milking cows and sick animals making the seasonal movement. The fourth breed, the *Barka*, is found throughout the western lowlands; this breed has recently been found to have considerable potential for stock improvement through breeding, especially for milk yield, which can be 10-12 litres/day with good management, even under the difficult conditions which prevail through much of the region. Historically, the *Barka* cattle have been moved across the borders into both Sudan and Ethiopia to take advantage of seasonal grazing pasture. Recently, this movement has been restricted and has led to increased grazing pressure in the Gash-Barka region, and also a tendency for pastoralists to switch away from cattle to sheep and goats, which are less dependent upon seasonal grazing. In general The Barka breed is at risk due to interbreeding and moving to Ethiopia and the Sudan.

Small Ruminants Diversity:

Even though Eritrea's total ruminant population is much smaller than its neighboring states, the country is endowed with over 25 breed types. These are genetic resources Eritrea is yet to exploit and systematically develop, with breeds and meat products oriented towards specific markets

Goats:

In Eritrea, there are four main breed of goat. The *Afar* is a small goat not fully differentiated from the other breeds, but found only in Denkalia - the southern Red Sea coast. In north of Massawa, the *Bahira* breed is more common, whilst in the north of the country the Rora, a large goat with long pendulous ears, is the most common. In the western lowlands, the fourth variety, known as *Barka* or *Shukria*, is found - this breed is used more for dairy milk production than the other breeds and may yield up to 1.5 litres/day.

Sheep:

The geographical distribution of sheep breeds is similar to that described for goats and cattle. Most of the sheep in Eritrea are mutton type, although they are milked for rural household consumption. There are four main breeds. The *Rashaida* is a fat-rumped breed used by the Rashaida pastoralists who move along the Red Sea coast, especially north of Massawa. The *Hamele* is a large, thin-tailed breed found in the north. The *Shimegana* is a smaller, fat-tailed breed found mostly in the southern highlands along with a few mixed exotic animals, whilst in the western lowlands the main breed is the *Barka (Stock Taking Assessment report, 1999).* Recently there is controlled and uncontrolled export of sheep

and in some areas of Gash Barka a new breed, *Gerg* is introduced from the Sudan which might affect the diversity of the indigenous breed.

Camels and Equines:

There is little regional variation in the camel and equine stock in Eritrea; although the local populations have different names, there is little evidence of significant genetic variation for either of these species. Camels found in Eritrea are dromedary type (single humped) and are found in the lowlands although some are being introduced in the highlands.

Poultry

Little or no work has been done so far on the identification and characterization of indigenous poultry. Scavenging village poultry are a feature of highland farming systems, but there is little local experience with them in the lowlands. Lowland villages have poor supply of feedstuffs suited to scavenging birds. With most village poultry, broodiness also constrains the number of eggs produced. Early chick mortality in highland village systems is commonly about 50% from predation, malnutrition, and climatic stress, and is probably higher in lowland villages. In recent years there has been significant increase in commercial poultry production by introducing exotic breeds like Bovan White Leghorn and Fayoumi birds for both broiler and egg production.

Honeybees:

There are thought to be two wild sub-species of honeybee present in Eritrea, *Apis mellifera mentcosa* and *A. m. yemenitica*. Currently there are 25,000 bee colonies in traditional and 10,500 bee colonies that are kept in modern beehives, mostly in the southern highlands and the eastern escarpment, with around 1,000 modern hives closer to Asmara. A traditional hive might yield between 15-20kg/yr of honey, whilst a modern hive might produce 30-35kg/yr. Little is known about the rest of the pollinator community in Eritrea or the role that honeybees and wild pollinators play in enhancing crop productivity through cross-pollination. This is an area which should be given some serious attention.

Importance of Livestock

Livestock in Eritrea play an important role both at the national and household levels as per the evidence of past records on their performance, including export trade. The household economies of both the agro-pastoralist and pastoralists are highly dependent on incomes and services from livestock and any destabilization of its ecosystem and/or genetic resources will result into their further impoverishment. At the household level, livestock are the sources of cash income, protein food of high biotic value, and as a source of capital formation and life insurance. They contribute to crop production by supplying manure as fertilizer and draft animals for land preparation and transport of farm products as well as people. Small stocks particularly sold at times difficulty to buy food, and at other times to meet the cash requirements of the family. Thus, any change in their performance creates an imbalance of the rural household economy although it is already declining sharply.

Livestock contribute also to the national economy and in particular to the balance of trade. Climate changes that affect the livestock system negatively will result into serious impacts on the socio-economics of the rural populations and that of the country

1.3.3.5 Threats of Agricultural Biodiversity and its Underlying Causes

Agricultural biodiversity is directly under threat from declining soil productivity, drought, change in land use, change in cropping pattern, replacement by improved seed, diseases and pest. Loss of these land races would decrease the stock of genetic material available to plant breeders both within and outside Eritrea. This would have international as well as national consequences as Eritrea believed to be one of the origins of several of the world's cultivated crops.

Declining soil productivity:- Most of the decline in productivity of agricultural soils of Eritrea is a combined effect of physical loss (soil erosion), lowering of organic matter, degradation of soil physical property, organic matter depletion and reduce moisture availability. Unless this trend is not reversed declining soil productivity will remain a threat to agricultural biodiversity.

Drought: Drought in Eritrea is the major limiting factor of crop production and also a cause of genetic erosion. The statistical data of the annual rainfall registered in the last 50 years shows a great decline in amount and an increase in the variability of rainfall distribution. This has decreased the frequency of local varaities of many plant species which need most precipitation to mature; increasingly, many varaities are confined to limited geographical areas. In some cases, certain strains of the crops have probably already disappeared.

Change in Land Use: Though the extent of the threat is limited changes in land use, such as urbanisation around major and smaller towns, road and dam constructions are expanding and occupying agricultural lands. These changes may lead to the loss of locally adapted varaities if careful attention is not paid to land-use planning and ensuring that farmers who lost land to other development projects are adequately compensated with similar land suited to their cropping patterns.

Change of Habitat (Change in Cropping Pattern): Though the majority of farmers in the highlands still practices small scale farming and maintain the traditional cropping pattern, the recent trend of introducing mechanized farming and improved cultural practices, including using improved seeds particularly in suitable areas (major plains like Hazemo, Tsilema, Shimegana etc) is one of the main drive for the losses of indigenous crops and landraces.

Introduction of exotic crop and varieties: It is unclear to what extent the introduction of exotic varieties has lead to the loss of particular local varieties. Until now no comprehensive assessment or survey conducted. However, study by NARI has shows that:

- Recently sorghum areas are replaced by exotic varieties (PP290, ICSV210, Masha, IS29415, 89MW5056, 89MW5003, ICSV111IN, IESV92029) and

other local variety (*Zengada*). Some areas of pearl millet landraces are replaced by exotic variety (ICMV221) and developed variety (*Hagaz*). Great areas of wheat landraces are replaced by introduced varieties (Kenya, Australia Canada, HAR – 1865 and Pavon 76). Limited barley areas are also replaced by developed variety (*Shishay)*,

- Farmers prefer loos panicle varieties, Zengada etc which are resistant to birds attacked and this kick out some local varieties from cultivation.

- Low area cover of faba bean due to lack of drought tolerant varieties.

Pest and disease**:** the frequent eruption of large-scale migratory pest outbreaks (locust, army worm every 2-3 years, which can destroy entire crops, leads to the loss of seed stocks for the next generation. Common insects (stack borer, beetles, grasshoppers, cutworms, aphids, etc); diseases (net blotch, rusts, root rot, etc.) can lead to the loss of local varaities which are not specifically adapted to those pests and diseases. Invasive weed species like: striga hermonthica (purple witch weed), orobanche minor (broomrape), convolvulus arvensis (creeping jenny) and cyperus rotundus (purple nutsedge). The majority of the serious weed species in Eritrea are introduced species which have "followed" their preferred crops. These pests in general reduce agricultural productivity rather than representing direct threat to indigenous biodiversity (Negassi,1999).

Threat for Poultry:

The inadequate supplies of feedstuffs, including locally produced feed and imported premixes of vitamins/minerals, are a major constraint on commercial and semi-commercial systems, and this is unlikely to change in the foreseeable future. Coordination of service provision at the village level is difficult logistically, particularly in terms of disease control. Government vaccination programs have hitherto been restricted to commercial and semi-commercial systems, with no service (apart from disease surveillance) offered to traditional poultry systems. Newcastle disease, fowl cholera, infectious laryngotracheitis and fowl pox, cause increasingly high loss rates. Whilst opinion on the impact of avian influenza vary widely, the consensus of epidemiologists seems to be that it will not have a catastrophic impact on village poultry production in countries like Eritrea. However, the implications for the human population could be severe.

The indirect drivers (root causes) of the agricultural biodiversity loss are 1) Demand for more food production 2) Agricultural and Sectoral Development Programs that pursues economic growth, food security and raise productivity through intensive agriculture, introduction of increase number of high input agriculture (improved varieties) and change in farming methods; 3) Absence of effective land use policy and weakness on land use planning. It is just in 2008; Eritrea has drafted the national land use policy which is still waiting for endorsement. 4) Population increase.

With so little exotic stock present in the country and livestock populations still increasing, there is little threat to the genetic diversity of the livestock breeds in Eritrea. However, this situation may change over the next 10-20 years and, at present, very little is known about the genetics of these indigenous breeds.

CHAPTER II CURRENT STATUS OF NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN

2.1 Overview of National Biodiversity Strategy and Action Plan

Eritrea, being a party to the convention and looking into its history, where there was a complete neglect and mismanagement to its natural resources in general and to biodiversity resources in particular, it has prepared the NBSAP in 2000. The preparation of the action plan was a continuation of the government's commitment towards the conservation and sustainable use of biological diversity resources.

The overall goal of the Eritrean National Biodiversity Strategy and Action Plan is as follows:

> "The overall biodiversity of Eritrea restored, conserved and managed so that it provides environmental services and natural resources that contribute to sustainable and socially-**f**air national economic development".

The NBSAP process has been undertaken mainly within three core areas: Terrestrial, Marine and Agricultural biodiversity and set three major objectives of each core area which provides a key linkage between the overall goal and the strategic elements that guide the activities to be undertaken by different sectors. The three major objectives are:

- Rehabilitation of degraded terrestrial ecosystems and their components through a combination of natural succession; protected area establishment and managem**e**nt; and sustainable use of terrestrial biodiversity resources,
- The coastal, marine and island biodiversity of Eritrea conserved and human activity managed to promote the sustainable development and optimal use of these resources,
- Agricultural biodiversity-resources conserved and sustainably utilized for food security, income generation and agriculture, whilst ensuring the socially-fair distribution of benefits arising from the use of national agricultural biodiversity resources.

The NBSAP has identified a total of 101 priority actions under 32 strategic elements that are categorized under 10 headings (themes). Table -16 presents the summary of the strategic elemements by thematic area and by biodiversity. The action plan has set 2010as a target to successfully complete all priority actions to achieve the intended major objectives.

Table-16: Bodiversity strategic elements included in NBSAP by thematic area

	Strategic Elements		
Thematic area	**Terrestrial**	**Marine Biodiversity**	**Agricultural Biodiversity**
Integrated management	• Improve integration of biodiversity into integrated land management	• Develop a comprehensive, integrated and participatory management framework for the conservation, management and sustainable development of Eritrea's coastal, marine and island biodiversity	• Inclusion of agricultural biodiversity criteria in the zoning of potential agricultural land
Sustainable use of natural resources	• Reduce pressure on plants in natural habitat through promotion of alternative fuels • Increase production of wood-fuel from 'converted habitat' • Promote the economic benefits to be derived from non-destructive utilization of trees, etc. in natural habitat.	• Formulate an integrated CMI development and zoning plan	• Improve documentation of the distribution and status of agricultural biodiversity resources
Alien invasive species	• Increase capacity for the control of alien invasive species within Eritrea	• Protect the coastal, marine and island environment from alien invasive species	• Improve knowledge and control of alien species within agricultural ecosystem
Pollution management	• Increase protection of biodiversity resources from pollution	• Identify, monitor and control potential sources of pollution within CMI areas	• Reduce impact of industrial pollution on agricultural system
In-situ conservation (protected areas)	• Formalize the process for establishing protected areas system appropriate for the current and future Eritrean conditions by establishing a working group of MoA, MoF, and MLWE (and others) to harmonize policy/legislation on protected areas	• Develop and implement a participatory program for conservation and management of key CMI areas and for habitats and species of special concern outside of these areas	• Increase conservation of agricultural biodiversity within on-farm system
Ex-situ Conservation	• Increase biodiversity benefits from *ex-situ* conservation facilities	• -------	• Increase conservation of agricultural biodiversity within ex-situ systems
Taxonomic knowledge	• Increase biodiversity benefits arising from improved taxonomic knowledge	• Increase national capacity for CMI taxonomic data acquisition	• Increase taxonomic knowledge of biodiversity within agro-

			ecosystem
Information acquisition and storage	• Increase biodiversity benefits arising from improved use of biodiversity information	• Establish a comprehensive GIS database on CMI biodiversity and related cross-cutting information	• Increase use of knowledge about biodiversity within agro-ecosystems
Public awareness and education	• Improve the documentation and dissemination of information on the conservation and sustainable use of biodiversity	• Increase national capacity to undertake CMI biodiversity assessment and monitoring through education and training • Increase public awareness of CMI biodiversity values	• Increase knowledge of benefits arising from biodiversity within agro-ecosystem
Legal and institutional structure (capacity-building	----------	• Improve legislative arrangements and coordination for the protection and sustainable use of CMI biodiversity and enhance institutional capacity to implement legislation	• Increase protection of agricultural biodiversity within agro-ecosystem
Institutions (capacity building)	• Increase representations of biodiversity issues in relevant sectoral legislation, and increase institutional and technical capacity to promote conservation and sustainable use of terrestrial biodiversity	----------	----------

Terrestrial Biodiversity - 12 strategic elements with 42 priority actions; Marine Biodiversity - 10 strategic elements with 31 priority actions; Agricultural Biodiversity – 10 strategic elements with 28 priority actions

2.2. Review the Implementation of National Biodiversity Strategy and Action Plan

2.2.1 Terrestrial Biodiversity

Objective 1 - Rehabilitation of degraded terrestrial ecosystems and their components through a combination of natural succession; protected area establishment and management; and sustainable use of terrestrial biodiversity resource		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(1) Integrated management ***Strategy 1.1*** Improve integration of biodiversity into integrated land management	1) Improved land classification and zonation by completion of national land capability classification. Contribute to ***Article 8*** of ***CBD*** by promoting the regulation, development of biological resources in sustainable way.	• DoL of the MoLWE has initiated this task by completing the land use and land cover mapping for the two highly populated regions (Debub and Maekel) and with intensive land use for agriculture. For those two regions Agricultural lands are classified into three broader categories: high, medium and low potential agricultural lands. In terms of land size it is about 9 % of the country land size. Project was **funded** jointly by UNDP and the GoSE.
	2) Integrated watershed development by expansion MoA/Danida programs to other watersheds Contribute to ***Article 10*** of ***CBD*** by adopting integrated watershed strategy to restore and/or improve biological diversity.	• DANIDA program was terminated in 2002. Instead the DANIDA Integrated Watershed Development concept has been expanded as an integral part of the *Warsay Ykealo* National Development campaign by focusing on soil and water conservation, aforestation, natural regeneration through the establishment of enclosures, agricultural land husbandry, which was launched in 2002. Project is funded from Government treasury.
	3) Integrated management of reverine forest through implementation of management plan produced by MRF project Contribute to ***Article 10*** of ***CBD***	• No significant progress made on the implementation of the management plan, although some efforts are made to reduce deforestation of the reverine forest by promulgating and enforcing the forestry and wildlife conservation and development proclamation No 155/2006 Domestic **funding** is used to employ forest guards and inspectors.
	4) Completion and implementation of NAP for combating desertification In line with **Decision I/8; III/13** that encourage the CoP to	• The preparation of National Action Plan to combat desertification and mitigate its impact has been successfully completed in January,2002 • To speed up the implementation of NAP, Twenty bankable project profiles have been developed.

	the CBD to explore the ways in which it can cooperate with the Conference of the Parties to the Convention to Combat Desertification to the extent that their mandates are complementary.	• To mainstream NAP into the national development framework and budgetary processes, Consultation have been undertaken and entry points were identified. **Funding** - The NAP development process and publishing the document was funded by DANIDA. The bankable Project Profile development and mainstreaming process were completed using grant fund Global Mechanism ,

Objective 1 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(2) Sustainable use of natural resources ***Strategy 2.1*** Reduction of pressure on plants in natural habitat through promotion of alternative fuels	1) Implementation of wood-fuel substitution projects. Contribute to ***Article 8 & 10*** of ***CBD*** – support in-situ conservation and sustainable use of forest resources.	• There is Progress on wood fuel substitution with special emphasis on kerosene, LPG and rural electrification coverage since 2000. Quntified data not available.
	2) Increased use of improved traditional stoves Contribute to ***Article 8 & 10*** of ***CBD*** – support in-situ conservation and sustainable use of forest resources.	• The rate of the introduction of improved traditional stove is increasing every year. Between 2000 and 2008 the number of improved stoves increased from 44,000 to 100,000 (56%). Project is funded from Government treasury.
	3) Increased use of cotton briquettes Contribute to ***Article 8 & 10*** of ***CBD*** – support in-situ conservation and sustainable use of forest resources.	• This action is not implemented – The factory that used to produce cotton briquettes is destroyed during the 1998-2000 war.
Strategy 2.2 Increase production of wood-fuel from 'converted habitat'	4) National tree planting campaign Contribute to ***Article 8(f)*** by rehabilitating and restoring degraded ecosystem.	• National tree planting campaign was started in 1998 and then continued being as an integral part of the *Warsay-Yikealo* development campaign. To date, a total of 32,000 ha of new plantation (more than 80 million seedlings) have been established. Program is funded from Government treasury.
	5) Afforestation via summer school program Contribute to ***Article 8(f) and 13(a)*** by rehabilitating and restoring degraded ecosystem and promoting and encouraging the understanding of students about	• Since 1994 Eritrean students have been participating in an afforestation and soil conservation campaign during summer vacation, in the whole country, which is organized by the Ministry of Education and the Ministry of Agriculture. Since 1994 a total of 6800 ha of degraded land have been rehabilitated by planting and replanting trees and construction of soil and water conservation physical structures.

	conservation of biodiversity.	Program is funded from Government treasury.
	6) Encouraging trees and farming system (tree cultivation and management – community forestry) Contribute to ***Article 10 of CBD***	• Since 2000, the government has focused on strengthening community forestry program. To encourage tree planting on community land the Forestry and Wildlife Proclamation No 155/2006 has incorporated provision that encourage tree planting on community marginal land. This has secured tree tenure for individuals and communities who have planted and maintained trees at individual plots within a community owned land. Within last three years tree tenure for individuals have been piloted in Serejeka sub zoba of Zoba Maekel by individual households. In additions a number of schools have made green their compounds under the community forestry program through the participation of school children between 2000 and 2009. • On the other hand, however, no progress has been made in integrating trees in the farming system, agro-forestry on croplands, due to tenure problem. Funding - Domestic (government treasure), Local NGOs like Toker Integrated Community Development (TICD) and International NGOs like Refugee Trust International (RTI), Lutheran World Federation (LWF).
Strategy 2.3 Promotion of the economic benefits to be derived from non-destructive utilization of trees, etc. in natural habitat	7) Survey of traditional plant medicinal use; potential for commercial production Contribute to ***Article 7, 12 and 13 of CBD*** by identifying components of biological diversity, promoting and encouraging research and training and understanding of the importance of biodiversity which contribute for conservation and sustainable use of biodiversity.	• There is no well designed and implemented comprehensive survey on traditional plant medicine use and potential use for commercial production. However, a handbook on traditional medicine entitled *Let's Treat our Illness using Traditional Medicine* (*Tigringa* –local language) has been public by two professionals from MoA, namely Mr. Asmerom Kidane and Mr. Mohammed Ali Osman. Funding – Not known
	8) Sustainable use of Doum palm Contribute to ***Article 10 of CBD*** – Support sustainable use of biological diversity.	• A Management Plan for the reverine forests of the western lowland of Eritrea has been prepared and endorsed in 2000[1]. Among others the major actions proposed in the management plan for sustainable use of reverine forest resources including Doum palms are: 1. Establishment of enclosure of Doum Palm scrab; 2. Planting with indigenous species on a gaps of the reverine area; 3. Control *Prosopis juliflora*, invasive alien species 4. Use of Doum Palm leaves for making artifacts

[1] MoA and SOS Sahel International (Uk), 2000. Management Plan for the reverine forest of the western lowlands of Eritrea. London

		The implementation of the management plan in its entirety was not initiated; however there are some relevant actions that have taken place since the development of NBSAP. These are: ▪ Establishment of 580 ha of reverine forest enclosure; ▪ A total of about 4 session of training for about 430 women and men on the sustainable use of Doum palm leaves for different artifacts (like baskets, fan, mat, ropes etc) have been given between 2000 to 2009. ▪ A total of about 1200 ha of *Prosopis juliflora* (invasive alien species) uprooted in area such as Engerne on the Barka river, Aligider and Haikota along Gash River and Forto Sawa along Sawa River. Despite this effort the expansion of this species has been reported to be expanding at an alarming rate. Funding – Partly from Government treasury and partly from Gash Barka Livestock and Agricultural Development Project funded by IFAD and BSF
	9) Sustainable use of Gum Arabic and resin production from *Boswellia papyrifera* trees Contribute to ***Article 10 of CBD*** – Support sustainable use of biological diversity.	• There is no management plan in place to promote sustainable use of Gum Arabic (from *Acacia senegal*) and resin production (from *Boswellia papyrifera)* trees. However, MoA has conducted on the job training for Gum and resin tapers focused on gum and resin production techniques that would support the sustainable use of the product. Collection of Gum Arabic and frank incense is done every year. As reported by MoA between 2003-2008 a total of about 1773 ton of Gum Arabic and 124 ton of frank incense are collected, however, Forest Resources Assessment Report of 2010 has concluded that the use of this biological resources is not sustainable. The collection is private program while support services are funded by government.
	10) Survey of distribution and regeneration of *Boswellia papyrifera* Contribute to ***Article 7, 12 and 13 of CBD*** by identifying components of biological diversity, promoting and encouraging research and training and understanding of the importance of biodiversity which contribute for conservation and sustainable use of biodiversity.	• The distribution and regeneration of *Boswellia papyrifera study was conducted in Anseba, Gash Barka and Debub regions of Eritrea (Ogbazgi, 2001). The study showed that the distribution of Boswellia papyrifera has decreased over the years. The past and presented distribution of the species is mapped.* • *The study also showed there is poor regeneration*
	11) Increased honey production through promotion of use of new hives Contribute to ***Article 10 (b&c) & 11 of CBD***	• Since 2000 the MoA has established 4 queen rearing centers in Southern Zone (Mendefera and Segeneiti) and Central Zone (Toker and Merhano) and 1000 bee colonies to 1000 farmers have been produced and distributed. This is mainly to solve the shortage of bee swarms in the country. Currently there are 25,000 bee colonies in traditional and 10,500 bee colonies that are kept in modern beehives, mostly in the

		southern highlands and the eastern escarpment. Funding - Domestic (government treasure) and International NGOs like Refugee Trust International (RTI) and Self Help International.

Objective 1 –Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(3) Alien invasive species **Strategy 3.1** Increase capacity for the control of alien invasive species within Eritrea	1) Survey distribution and spread of selected alien invasive species and their economic/social benefits Contribute to ***Article 8(h) and 17*** of ***CBD*** by providing information to control and/or eradication of alien species which threaten ecosystem, habitat and species; and to parties of this convention to exchange information relevant to conservation and sustainable use of biological diversity respectively.	• The actual survey is not yet conducted. However, the Department of Environment has initiated the work by conducting an assessment on methodologies and capacity needs to evaluate and mitigate specific threats due to alien invasive species to components of biodiversity in 2004, by hiring Consultancy, Training and Testing Center (CTTC) from the University of Asmara[2].
	2) Collection of information on control methods of known and potential invasive and exotic species Contribute to ***Article 8(h) and 17*** of ***CBD.***	• Not achieved
	3) The human resources of quarantine and services at points of entry are to be strengthened and improved. All imported varieties of crops to be quarantined at MoA Research Station before release to farmers Contribute to ***Article 8(h)*** of ***CBD*** by providing strengthening national capacity to control alien species which threaten ecosystem, habitat and species.	• Regulatory Services Department (RSD) of the Ministry of Agriculture which is officially established in 2003 has the responsibility to undertake quarantine activities. Since 2003, RSD has strengthened the existing quarantine stations at Asmara Airport, Massawa and Assab seaports by providing equipments such as microscopes, refrigerators, computers, etc. which worth about 34,762 USD. One additional quarantine station is also established at Tessenei, a town near the boarder of Sudan to effectively quarantine crop, livestock and their products. A total of about 4 trainings/workshops for about 104 staff were conducted to strengthen the human resources capacity of RSD. • National Agricultural Research Institute has been routinely engaged in testing of imported crops prior to releasing to farmers.

[2] UoA, 2004. Assessment of methodologies to evaluate and mitigate specific treats to components to biodiversity. Asmara-Eritrea

		• Plant quarantine proclamation No 156/2006 enacted in 2006. This proclamation has provisions, among others, to appoint plant quarantine officers (Article-6), establish and strengthen quarantine stations (Article-16) Funding - Domestic (government treasure) and FAO

Objective 1 –Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(4) Pollution management ***Strategy 4.1*** Increase protection of biodiversity resources from pollution a	1) Survey of hazardous chemicals used in Eritrea Contribute to ***Article 7(c) and t***his action is also inline with the Rotterdam convention on Hazardous chemical and pesticides which is also adopted by CBD decision V/5 and Eritrea is signatory.	• Regulatory services Department of the MoA in collaboration with other relevant national institutions have conducted an inventory of hazardous chemicals in 2007. As per this inventory 246 tons of hazardous chemicals were registered in 294 stores all over the country in 2007. By this action the locations, type and amount of hazardous chemicals found in the country have been well documented and found to be a good ground for future action. Funding - FAO and Domestic (government treasure)
	2) Develop control procedures for hazardous chemicals used in Eritrea Contribute to ***Article 8(l) and*** also inline with the Rotterdam convention on Hazardous chemical and pesticides.	• Regulations for importation, handling, use, storage, and disposal of pesticides have been enacted in 2006 under Legal Notice No 114/2006. In this Legal Notice, 85 types of pesticides are included as a national list of pesticides allowed for use. • As a continuation to the development of legal and regulatory framework in line with the regulatory framework RSD of MoA with financial and technical support from FAO has initiated a project to safeguard the obsolete and hazardous chemicals that are found in 9 different locations and categorized as high risk. • RSD of the MoA in collaboration with FAO is in the process of preparing a project proposal with estimated budget of 2.5 million Euro aiming at o Safeguard the remaining 285 hazardous chemical storage sites as well as disposing of all obsolete chemicals. o Develop a safe pesticide management system o Develop integrated pest management (IPM) • DoE has drafted regulation and submitted to Minstry of Justice that serves as regulatory framework on the importation of chemicals. • The project proposal will be submitted to GEF for funding.

Objective 1 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(5) In-situ conservation (protected areas) ***Strategy 5.1*** Formalization of the process for establishing protected areas system appropriate for the current and future Eritrean conditions by establishing a working group of MoA, MoF, and MLWE (and others) to harmonize policy/legislation on protected areas	1) Preservation of the flora and fauna through identification, survey and boarder demarcation of representative protected area(s) in the Central and Northern Highlands. Contribute to ***Article 8*** in-situ conservation with main emphasis of sub articles a, d and f.	• No progress has been made in implementing this action since the preparation of NBSAP. • Low level of awareness on the importance of protected area, insufficient technical and institutional capacity, shortage of fund and weak coordination among MoA, Zoba and MoLWE are the major obstacles hindering the implementation of the action
	2) Identification, survey and demarcation of protected areas in Semienawi and Debubawi Bahri Contribute to ***Article 8*** in-situ conservation with main emphasis of sub articles a, d and f.	• 40% of the proposed protected areas (40,000 ha) in Semienawi and Debubawi Bahri has been under permanent enclosure but not yet demarcated and officially gazetted as protected area. Protection of the area is carried out by forest guards and forestry and wildlife inspectors employed by the government. Funding – Government Treasury
	3) Identification, survey and boarder demarcation of representative protected area (s) from the Western Lowlands (e.g. North Setit River: Elephant preserve; Greater Kudu, *Tragelaphus strepsiceros*; Duiker, *Cephalophus sp.;* Warthog, *Phacochaeros aethiopicus*) Contribute to ***Article 8*** in-situ conservation with main emphasis of sub articles a, d and f.	• Boarder identification, survey using GPS and demarcation using existing natural features has been completed in 2009 between Gash river and Setit River to protect the Elephant population along with other wild fauna and flora. The total demarcated area for the reserve is estimated at about 44,000 hectares but not yet officially gazetted Funding – Government Treasury
	4) Identification, survey and boarder demarcation of representative protected area (s) from the Eastern Lowlands (e.g. North Eastern Denkalia (Buri peninsula): Ostrich, *Struthio sp.* Soemmering's gazelle, *Gazella soemmeringii;* Dorcas gazelle, *G. dorcas*; Wild ass, *Equus equus*) Contribute to ***Article 8*** in-situ conservation with main emphasis of sub articles a, d and f.	Preliminary identification of representative protected area within the eastern lowland to protect the stated species has been prepared prior to the preparation of NBSAP. The ICZMP which is developed as an integral part of the Eritrean Costal Marine and Island Biodiversity (EMCIB) project in 2008 has identified Buri Peninsula as one of the priority areas for protection. The total area of Buri peninsula is about 2500 km^2. MoLWE alogwith the MoA, is in the process of securing fund and developing project proposal for establishment and management of the Buri peninsula protected area. Funding - Eritrean Costal Marine and Island Biodiversity project has been funded by GEF and GoSE.

	5) Identification, survey and boarder demarcation of representative protected area(s) from the Red Sea Coastal Zone (e.g. Islands proposed for national parks: Sciumma; Black Assarca; Dissei) Contribute to ***Article***	
	6) Improved biodiversity benefits associated with closures; increased monitoring of established closures ; establishment of new closures Contribute to ***Article 7*** identification and monitoring of process and activities which have adverse impact on biodiversity; ***Article 8*** - in-situ conservation by rehabilitating and restoring degraded ecosystem and encouraging the equitable sharing of biological resources; ***Article 10*** - protect and encourage customary use of biological resources; **Article 11**-introducing incentive measures.	• Since 2000 more than 12,000ha new closures have been established (it increases from 192,734 ha in 2000 to more than 205,000ha in 2008). • In the enclosed areas a management system has been developed that provides benefits to local communities living adjacent to the enclosures such as collection of grass through cut and carry system, collection of dried wood for fuel, erecting bee hives for bee production. One successful site that can be mentioned as an example is the Monguda enclosure (about 560 ha) located within the central highland. Continuous monitoring is undertaken by MoA, local government and local community, to make sure community benefits are secured with out jeopardizing the vitality, regeneration capacity and sustainability of the biological resources within enclosures. As part of the monitoring a specific biodiversity assessment has been done at Menguda enclosure site by Mr. Redazghi in 2009 and the assessment confirm that there are total of 14 mammals, 103 birds and 181 plant species. Funding – by The GoSE
	7) Increased documentation of trans-boundary species in Eritrea and increased collaboration with appropriate international agencies through exchange of information on migratory species between relevant in-country and international organizations Contribute to ***Article 8 and 17***	• RSD of the MoA is a focal point for CITES and has frequent communications as needed with the secretariat of CITES and parties of the convention pertinent to movements of Flora and Founa for international trade. • Eritrea is closely monitoring the illegal killing of Elephants and share the information with a project of CITES on Monitoring Illegal Killing of Elephants (MIKE) based in Nirobi, Kenya. • Eritrea is also participating in the regional project for mainstreaming the migratory soaring birds into the production sectors of 11 countries which are located along the Red Sea and Rift Valley migratory birds flyway. Funding - The regional project of Migratory Soaring Birds is funded by GEF and regional projects on monitoring of illegal killing of elephants by EU.

Objective 1 –Cont…

Thematic Area	Priority actions and their contribution to implementation of CBD articles	Progress of Actions implementation & Sources of Funding
(6) Ex-situ Conservation **Strategy 6.1** Increase biodiversity benefits from *ex-situ* conservation facilities	1) Preparation of feasibility study for the establishment of Zoological and Botanical Gardens, Natural History Museum; Aquarium Contribute to ***Article 9(a)*** and ***12 (b)*** of ***CBD***	A comprehensive feasibility study not done. However, Department of Environment has conducted a capacity need assessment of the **Betgiorgis zoo** to serve as zoological garden and that of **Asmara's Martyrs Park** to serve as botanical garden in 2004 by assigning Consultancy, Training and Testing Center (CTTC) of the University of Asmara. The report[3] has concluded that those two sites could serve as capable *ex-situ* conservation sites provided that significant improvement and upgrading is made on the existing institutional set up, human and financial resources and equipment and facilities.

Objective 1 –Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(7) Taxonomic knowledge **Strategy 7.1** Increase biodiversity benefits arising from improved taxonomic knowledge	1) Establish herbarium and zoological collections. Undertake training activities to improve capacities of taxonomic knowledge of relevant institutions Contribute to ***Article 9 and*** of ***CBD*** by establishing and maintaining facilities for Ex-situ	• No action has been taken to establish National Herbarium, but there are some plant collections in the Biology Department, Institute of Technology Mai-Nefhi (about 3000 vascular plant collections) and some plant collections in the Ministry of Agriculture(400 vascular plant). • Likewise, no progress has been made in establishing National Zoological Museum, but there are two national museums that contain archeological, biological, cultural and military collections, in Asmara and Massawa. In the Asmara museum, there are 28 staffed mammals, 33 stuffed birds, and 3 reptiles While in the Masawa museum, there are150 specimens of fish, mollusks, crustaceans and corals. • Capacity needs assessment for herbarium and zoological collections was made by the Department of Environment in 2004, by hiring Consultancy, Training and Testing Center (CTTC) from the University of Asmara[4]. However, little has been done to establish new or strengthening the existing ones Funding - Domestic (government treasure)
	2) Conduct inventories on all aspects of (terrestrial) biodiversity	No comprehensive inventory has been conducted on all aspects of terrestrial biodiversity since the preparation of NBSAP.

[3] DoE, 2004. Assessment of capacity for in-situ and ex-situ conservation and sustainable use of biodiversity in Eritrea (2004)
[4] UoA, 2004. Assessment of methodologies to evaluate and mitigate specific treats to components to biodiversity. Asmara-Eritrea

	Contribute to ***Article 7*** of ***CBD by*** supporting the implementation of the identification and monitoring of biodiversity resources.	
	3) Increased participation in regional taxonomic networks (e.g. BIO-NET/EAFRINET, ICIPE) Contribute to ***Article 17*** (Exchange of information) of ***CBD***	

Objective 1 –Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(8) Information acquisition and storage **Strategy 8.1** Increase biodiversity benefits arising from improved use of biodiversity information	1) Compilation of baseline data surveys, using GIS tools on Important habitats, species and resource uses Contribute to ***Article 7 and*** of ***CBD.***	Action not done
	2) Participate actively in the acquisition and exchange of biodiversity information with relevant organizations (such as BIO-NET/EAFRINET, ICIPE) Contribute to ***Article 17*** of ***CBD***	Action not done
	3) Periodical preparation of biodiversity state of environment reports (3-4 years) Contribute to ***Article 7*** of ***CBD***	Action not Done

Objective 1 –Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(9) Public awareness and education **Strategy 10.1**	1) Integration of environmental education in general and biodiversity in particular in the national educational system.	• Environmental education is highly integrated into elementary, middle and high school curriculums. With support of Department of Education, Ministry of Agriculture and Ministry of Marine Resources, the Ministry of Education, Department of Curriculum has integrated environmental issues in school text books and teaching material,

Improve documentation and dissemination of information on the conservation and sustainable use of biodiversity resources.	Contribute to ***Article 6*** **(b)** of **13** ***CBD***	particularly in the fields of science, social science. In 2009, Ministry of Education with financial support from the Government of Japan and technical support from UNICEF has prepared 6 teachers manual "Environmental guidelines for teachers". Of these 4 of them address biodiversity. These are:- 1) Green Club Manual for elementary schools 2) A manual for environmental education within social studies 3) A manual for environmental education within English; 4) A manual for environmental education within science; 4) Food garden and mini forest a manual for elementary school. • In addition Ministry of Education in coordination with a number of other sectors is in the process of establishing a Children Educational and Research Center. The project is under construction.
	2) Increase use of the media to disseminate and promote conservation and use biodiversity resources. Contribute to ***Article 13 CBD***	• National media have radio and television programs related to environment – to mention some of the programs: a) We and our environment; b) youth forum c) environmental education d) agriculture and development; e) Agriculture and vegetable production and f) Eritrea and its resources. These programs have in one or another way promote the conservation and use of biodiversity. • The national news paper "Hadas Eritrea" regularly publishes different article and interviews related to agriculture, forest resources, wildlife conservation and sustainable use.
	3) Use of relevant government institutions and NGOs in the dissemination of information for the conservation and sustainable use of biological diversity. Contribute to ***Article 13 CBD***	
	4) Preparation of newsletters, etc., to promote the conservation and sustainable use of biodiversity resources. Contribute to ***Article 13 CBD***	

Objective 1 –Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(10) Legal and Institutional structure	5) Capacity building of institutional resources to meet the needs of decentralization policy of the government	**Short term Training** - Between 2001 and 2009 a total of 2054 people from all zobas have been trained by MoA Human Resources Development Division in wide range of

(capacity building) **Strategy 10.1** Increase representations of biodiversity issues in relevant sectoral legislation, and increase institutional and technical capacity to promote conservation and sustainable use of terrestrial biodiversity	Contribute to ***CBD by*** raising the implementation capacity of Cop obligations stated in ***Article 6, 7, 8, 9, 10 and 12***	fields of agricultural, forest, livestock, rangeland, bee keeping, crop protection, horticulture etc. **Post Graduate** – Between 2000 and 2007 – a total of 84 people have got post graduate training from MoA in areas highly related to the conservation and sustainable use of agricultural and terrestrial biodiversity. **Technicains** – Sawa School of agricultural technology has trained a total of 1055 youth in three years (2007-2009) in the fields of plant science, animal scinces, soil and water conservation and forestry and wild life. In addition – Hamelamlo college of agriculture have produced thousands of graduates who have directly or indirectly supporting the conservation of biological diversity and strengthen the regional governments.
	6) Completion of Environmental Proclamation; provision of biodiversity information to other sectors preparing legislation ; regulations; guidelines Contribute to ***Article 6*** **(b)** of **8(k)** ***CBD***	Action not done.
	7) Preparation of regulations for managing and administering Protected Area System (National Parks, Nature Reserve, etc.) Contribute to ***Article 8(k)*** of ***CBD***	• This action is ***not implemented as it was planned***. The proposed regulation for managing and administrating protected area system under this NBSAP emphasize the centralization of all categories of terrestrial and marine protected area under one institution. However, sectoral ministries such as the Ministry of Marine Resources and the Ministry of Agriculture promulgated proclamations with provisions to establish,, and manage protected areas in the marine and terrestrial ecosystem respectively. For example, the Forestry and Wildlife Conservation and Development Proclamation No 155/2006 Articles 16 and 17 empowers the Ministry of Agriculture to establish and manage protected areas i.e national parks, nature reserves etc under terrestrial settings. Similarly, The Fisheries Proclamation, No 104/1998 article 13 empowers the institution to establish and mange protected areas under their jurisdiction. Funding - EU and domestic funds for the preparation of forestry and wildlife proclamation.
	8) Drafting of biodiversity legislation	***No progress has been made in re-drafting the intended revised biodiversity legislation***. The first Biodiversity Legislation draft has been prepared in 1996. The NBSAP has

	Contribute to ***Article 8(k)*** of ***CBD***	identified the redrafting of the proclamation as an important step to remove the overlaps of functions and responsibilities of different sectors on biodiversity issues.

2.2.2 Marine Biodiversity

Objective 2 - The coastal, marine and island biodiversity of Eritrea conserved and human activity managed to promote the sustainable development and optimal use of these resources		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions Implementation & Sources of Funding**
(1) Integrated management ***Strategy 1.1*** Develop a comprehensive, integrated and participatory management framework for the conservation, management and sustainable development of Eritrea's coastal, marine and island biodiversity	1) Implement and strengthen the existing GEF/GoSE Biodiversity Project 'Coordination, Planning and Implementation Committee (CMI Committee)' Contribute to most articles of the convention particularly ***Article 6, 8,9,10, 12, 13 &14*** of ***CBD***.	• GEF/GoSE CMI Biodiversity project office has been successfully re-strengthen, CMI Committee established and effective management and implementation of the CMI biodiversity project started in 2005 and project completed in 2007 (Treminal report 2007). Project was **funded** jointly by GEF/UNDP and the GoSE.

Objective 2 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(2) Sustainable use of natural resources ***Strategy 2.1*** Formulate an integrated CMI development and zoning plan	1) Establish a baseline of CMI biodiversity and initiate monitoring programs Contribute to ***Article 7*** of ***CBD***	• A baseline data biodiversity resources set of 90% of the Eritrea Red Sea collected and entered into a Marine Resources Database and monitoring programs had been established in areas selected as hot spots for protection by CMI biodiversity project which was implemented between 2004 and 2007 (MoF 2010). • Monitoring sites established for coral reefs, birds, mangroves, seagrass/algae and turtles. the status of the species can be considered at least as stable (MoF, 2010) Project was **funded** jointly by GEF/UNDP and the GoSE.
	2) Undertake sector specific/cross-sectoral analysis of the ~~impacts and management implications of key~~ development activities on CMI biodiversity	• Integrated Coastal Area Management (ICAM) guidance for implementation was produced by CMI biodiversity project in 2007. The document has Identified Integrated Coastal Area Management policy elements and directives common to all sectors; and

	Contribute to ***Article 6(b)*** of ***CBD***	developed sector specific development guidelines and guidance. The document has gone through a very long consultative process with all relevant stakeholders/ sector institutions. Project was **funded** jointly by GEF/UNDP and the GoSE.
	3) Formulate an integrated CMI development and zoning plan. Incorporating CMI-specific EIA guidelines Contribute to ***Article 6 &10*** of ***CBD***	• Integrated Coastal Area Management Plan has been produced as one of the key CMI biodiversity project output, but not incorporating CMI specific EIA guidelines Project was **funded** jointly by GEF/UNDP and the GoSE.

Objective 2 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(3) Alien invasive species ***Strategy 3.1*** Protection of the coastal, marine and island environment from alien invasive species	1) Establish a database of known CMI invasive species Contribute to ***Article 7*** of ***CBD***	• A centralized database for invasive species of known CMI environment is **not yet established**. However, Department of Environment has identified and listed invasive alien species in CMI environment in its study entitled "***Assessment of methodologies to evaluate and mitigate specific threats to components of biodiversity***" of 2004. The identified species are: Tilapia spp (Fish spp.), Corvus splendens (bird spp.), *Prosopies juliflora* (plant spp.) Project was **funded** jointly by GEF/UNDP and the GoSE.
	2) Establish policies for safeguarding against alien invasive species, including licensing, screening, monitoring and containment procedures Contribute to ***Article 6(b)*** of ***CBD***	• No progress on this particular action. Only EIA guideline developed by DoE which is not very elaborative only applicable to evaluate and screened projects before clearance for implementation.
	3) Establish an eradication and containment program for known and potentially harmful alien invasive species. Contribute to ***Article 8(h)*** of ***CBD***	• No progress on the implementation of this action.

Objective 2 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(4) Pollution Management	1) Monitoring of critical pollutants which impact on marine	• MoF has established an environmental monitoring Unit in 2006 with a small

	and coastal environment Contribute to ***Article 7*** of ***CBD***	laboratory that follows up the level of certain pollutants in the coastal area by measuring nutrient level, PH, temperature and salinity. Project was **funded** jointly by GEF/UNDP and the GoSE.
Strategy 4.1 Identify, monitor and control potential sources of pollution within CMI areas	2) Install and maintain reception facilities for crude oil wash at Massawa and Assab. Contribute to ***Article 8(d)*** of ***CBD***	• This action is fully achieved. The Ministry of Marine Resources installed garbage collection facilities in all the fishing ports – Massawa, Ge'lalo, Tio, Edi and Assab. Year of Implementation - 1995 • The Eritrea Ports Rehabilitation Project has completed reception of liquid and solid wastes from ships, oil spill combating equipment and improving safety standards of the two ports as part of its environmental component for at port of Massawa and Asseb.
	3) Establish and implement oil pollution contingency plan Contribute to ***Article 10(a & b)*** of ***CBD***	• No contingency plan prepared
	4) Install receptacles at all fishing centers in which fishermen can dispose of used engine oils Contribute to ***Article 8(d)*** of ***CBD***	• Action done see progress for activity 2 for pollution management
	5) Issue a norm for the construction of septic tanks for all present and future coastal buildings Contribute to ***Article 10(a&b)*** of ***CBD***	• Not yet developed.

Objective 2 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(5) In-situ conservation (i.e. protected areas ***Strategy 5.1*** Develop and implement a participatory program for conservation and management of key CMI	1) Identify and delineate protected areas for the conservation of CMI biodiversity Contribute to ***Article 8*** of ***CBD***	• CMI Biodiversity Project has identified and delineated two islands 1) Sheik Said (Green Island) (0.12 km^2) as National park; 2) Dissei-Madot (Dissei - 6.4 km^2; Madot 0.04 km^2) as protected area, for the conservation of CMI Biodiversity. Project was **funded** jointly by GEF/UNDP and the GoSE.
	2) Establish protected area management plans and monitoring programs Contribute to ***Article 8*** of ***CBD***	• Sheikh Said/Green Island National Park and the Dissei-Madot Protected Area Management and monitoring plans were prepared and all technical and legal documents are forwarded to Ministry of Justice.

areas and for habitats and species of special concern outside of these areas		
	3) Prepare a species conservation network and action plans for the protection of endangered endemic, migratory and/or indicator species, including marine turtles and mammals, migratory birds and sharks Contribute to ***Article 17*** of ***CBD***	• Memorandum of understanding is signed with Indian Ocean and South East Asia (IOSEA) on marine turtle and dugong conservation. • Networking has been established with convention on migratory species of wild animals (CMS) focusing on Shark.

Objective 2 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(7) Taxonomic knowledge ***Strategy 7.1*** Increase national capacity for CMI taxonomic data acquisition	4) Develop national expertise in CMI taxonomy through training. Contribute to ***Article 12(a)*** of ***CBD***	• No organized taxonomy training given to national experts. However, ECMIB project experts in marine biology have gained significant experience on identification of known Eritrean marine plant and animal species through on the job training. • College of Marine Science and Technology teaches courses on systematic taxonomy which will familiarize students with the taxonomy and nomenclature of marine organisms (both flora and fauna). Students are taught about the species concept, classification (which includes collection, preservation and identification), nomenclature (code of nomenclature and ranking), and the operative principles of nomenclature. Project was **funded** jointly by GEF/UNDP and the GoSE.
	5) Establish a curated reference collection of CMI biodiversity and improve library acquisitions of key reference literature Contribute to ***Article 9*** of ***CBD***	• This action is not done.
	6) Co-opt international expertise to assist in short-term CMI taxonomic profiling initiatives Contribute to ***Article 12(a)*** of ***CBD***	• This action is not done.

Objective 2 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**

(8) Information acquisition and storage ***Strategy 8.1*** Establish a comprehensive GIS database on CMI biodiversity and related cross-cutting information	1) Upgrade the MoF, CMI biodiversity database Contribute to ***Article 7*** of ***CBD***	• The CMI Biodiversity database was created through the CMI biodiversity project and that information was used in all CMI planning and management activities of the MoF. The project has also set up the systems for managing this valuable resource, particularly its database on a GIS platform. Project was **funded** jointly by GEF/UNDP and the GoSE.
	2) Establish a meta-database of relevant CMI database and update the MoF CMI database, including data from ongoing and planned baseline and monitoring data acquisition imitative Contribute to ***Article 7*** of ***CBD***	• MoF is updating its database but the completion of Eritrean CMI Biodiversity project has made the monitoring work difficult which is important to update the database The activity is financed from the Government treasury.
	3) Establish data exchange linkages and forums at national, regional and international levels Contribute to ***Article 17*** of ***CBD***	• Data sets of CMI Biodiversity are not linked with other sector database for effective information sharing and CMI management. Data collected from 100% of the coast and 85% of the islands stored (database) and analyzed. It will be available for use by all relevant stakeholders once the linkage established. • Marine biodiversity data exchange linkage is just started (2009) at regional level with Western Indian Ocean Marine Sciences Association (WIOMSA) Project was **funded** jointly by GEF/UNDP and the GoSE.

Objective 2 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(9) Public awareness and education ***Strategy 9.1*** Increase national capacity to undertake CMI biodiversity assessment and monitoring through education and training	1) Undertake a national training needs assessment for CMI biodiversity-related activities Contribute to ***Article 6*** of ***CBD***	• An assessment of capacity needs and priorities on biodiversity monitoring including taxonomy was carried out by Consultancy, Training and Testing Center (CTTC) of the University of Asmara in 2004. The objective of the assessment was to facilitate the planning of targeted capacity development in CMI Taxonomy. The study concluded that a total of 45 taxonomists in the field of plant taxonomy (1), physiologist (12), vertebrate systematist (1), ornithologist (4), fish taxonomist (6) and invertebrate systematist (18) are needed for the Ministry of Fishery. Project was **funded** jointly by GEF/UNDP and the GoSE.
	2) Identify trainees and suitable training courses and agencies (where possible, training should be conducted *in-situ)*	• The "assessment of capacity needs and priorities on biodiversity monitoring including taxonomy" report has identified institutions involved, assesses capacity need and training courses in taxonomic works and biodiversity monitoring activities.

	Contribute to ***Article 6*** of ***CBD***	• More than 30 marine biologists and other experts were trained on 1) socio economic survey of the coastal community; 2) CMI habitat and species survey; 3) geo referencing survey techniques prior and during the CMI Biodiversity project operation. The activity is financed from the Government treasury.
Strategy 9.2 Increase public awareness of CMI biodiversity values	3) Develop suitable CMI biodiversity awareness supporting materials and establish a national campaign and network for community-based CMI biodiversity awareness Contribute to ***Article 13*** of ***CBD***	• MoF through its CMI biodiversity project has developed a website www.eritrearedsea.org starting mid 2007 that posts CMI information on Eritrea and made widely CMI Biodiversity information available. In addition there was a regularly published newsletter (every 3 month) named *Dagurnai*. *Dagurnia* is an Afar[5] word meaning "let's conserve" and its web site is "dagurnai@yahoo.com". The action is implemented but it needs to be reinvigorated. • The ECMIB project had a number of awareness campaigns targeting decision makers, soldiers, and students focusing mainly on topics related to marine and coastal resources conservation efforts, ICAM policy, Pollution in Massawa and Conservation of turtle and birds between 2004 and 2007. The project also utilized different events like Fenkil the liberation of Massawa, youth festival (Sawa festival), the international day of Mirine Turtle, and Expo festival (every year event) to increase public awareness of CMI biodiversity values. • Two marine clubs one for turtle in Assab and the other for birds in Massawa so that students have forum and opportunity to organize information sharing and contest programs. Project was **funded** jointly by GEF/UNDP and the GoSE.
	4) .Incorporate CMI biodiversity awareness programs into the national curriculum Contribute to ***Article 13*** of ***CBD***	• The marine environment conservation aspects had been included in the elementary school curricula. CMI Biodiversity project was involved during the effort made by ministry of education to integrate environmental education into elementary school curriculum. The action is implemented but it needs to be reinvigorated • College of Marine Science and Technology has been open in 2005 and currently offering four degree and five diploma programs under 4 departments. These departments are: 1) Department of Applied Marine and Fisheries Science (AMFiS); 2) Department of Aquaculture; 3) Department of Marine Biotechnology; and 4) Department of Marine Engineering (ME). Project was **funded** jointly by GEF/UNDP and the GoSE.

[5] Afar is one the nine nationalities in Eiritrea

		Establishing the college and running it by the GoSE
	5) Develop a suitable mechanism for routine dissemination of CMI biodiversity information at both technical and non-technical levels. Contribute to ***Article 13 & 17*** of ***CBD***	• In 2007 CMI Biodiversity project has launched a website "www.eritreareadsea.org" that facilitates the dissemination of biodiversity information and support in raising awareness at all levels for sustainable management and development of the resources. • CMI biodiversity Project has established numerous national, regional and international contacts and connections for example with Egypt, South Africa, Australia; PERSGA, IOSEA; WCMC, IUCN,WWF, Bird Life International; etc to routine exchange of biodiversity information. This contact has produced a flow of books (1200) and electronic documents (1500) Project was **funded** jointly by GEF/UNDP and the GoSE.
	6) Encourage community based involvement in CMI biodiversity assessments and monitoring (i.e. increase community 'stewardship' of CMI biodiversity). Contribute to ***Article 7*** of ***CBD***	• This action is not done.
	7) Develop plans for a national marine aquarium and CMI educational facility. Contribute to ***Article 13*** of ***CBD***	• This action is not done.

Objective 2 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(10) Legal and institutional structure (capacity building)	1) Preparation and coordination of laws/regulations for Integrated Coastal Zone Management Contribute to ***Article 8(k)*** of ***CBD***	• In 2007 MoF has drafted 1.) Integrated Coastal Area Management (ICAM) Proclamations; 2) A Proclamation to Establish Coastal Area Authority; 3) a National Coastal Policy Project was **funded** jointly by GEF/UNDP and the GoSE.
Strategy 10.1 Improve legislative arrangements and coordination for the protection and sustainable	2) Preparation and coordination of laws/regulations for CMI protected areas Contribute to ***Article 8(b&k)*** of ***CBD***	• The draft Integrated Coastal Area Management (ICAM) Proclamations (Thematic area 10- Action 1) has included a provision in Article 12 for the Creation of Protected Areas with in CMI. Project was **funded** jointly by GEF/UNDP and the GoSE.

use of CMI biodiversity and enhance institutional capacity to implement legislation	3) Identification of capacity needs for effective enforcement of CMI-related laws/regulations Contribute to ***Article 8*** of ***CBD***	• This action is not done

2.2.3 Agricultural Biodiversity

Objective 3 - Agricultural biodiversity-resources conserved and sustainably utilized for food security, income generation and agriculture, whilst ensuring the socially-fair distribution of benefits arising from the use of national agricultural biodiversity resources		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(1) Integrated management ***Strategy 1.1*** Inclusion of agricultural biodiversity criteria in the zoning of potential agricultural land	1) Identification of zones of high landrace (crop and livestock) diversity and incorporation zones into national land use classification Contribute to ***Article 12*** of ***CBD***	• A comprehensive study to identify zone of high landrace diversity is not done. However, to support this activity the Plant Genetic Resources Unit (PGRU) at National Agricultural Research Institute (NARI) has identified 200 samples of sorghum from different agro ecological zones and characterized at phenotypic and molecular level. Many studies have indicated Central Highland as zone of high landrace diversity and for that reason DoL has prepared land use and land cover mapping for the two regions of the central highland. • Identification of high landrace crop diversity for the central highland has been conducted by NARI. Funding - Sorghum identification and characterization funded by International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). - Identification of high landraces – funded by the Go SE

Objective 3 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(2) Sustainable use of natural resources ***Strategy 2.1*** Improve documentation of the distribution and status of agricultural biodiversity resources	1) Promote the conservation, enhancement, production, utilization and marketing of high value/ industrial indigenous crops and livestock for income generation and economic development Contribute to ***Article 12*** of ***CBD***	▪ *Ex situ* conservation of cotton, sesame, forage crops, Niger seed, okra and others by collecting from different areas . ▪ Distribution of germplasm for breeding purpose. Project was funded by the GoSE
	2) Produce and distribute to farmers improved varieties of indigenous landrace (crops and livestock) materials.	• In the last 10 years NARI with support from ICARDA, DANIDA and Syngenta Foundation for Sustainable Agriculture (SFSA) had produced and distributed

	Contribute to ***Article 12*** of ***CBD***	improved varieties of barley and pearl millet to farmers. Despite the efforts made, the coverage is extremely limited and need to be expanded. Funding – ICARDA, DANIDA and SFSA and GoSE
	3) Improving crop management practices that enhance soil moisture retention of agricultural land. Contribute to ***Article 12*** of ***CBD***	• Conservation Agriculture: NARI as joint program with TCP/FAO had conducted a 2 year pilot program (2003-2005) on conservation agriculture focused both in the highland and lowland. Though the research project is phased after 2 years, MoA/NARI had continued to undertake the work mainly by training farmers and conducting pilot program. Introduction of different farming implements, identifying cover crop legumes, Identifying appropriate technology are the major activities undertaken under this program. Presently research is underway on conservation agriculture and fertilizer rate by NARI. Funding – FAO and GoSE
	4) Improvement of rangeland quality through temporary closures, enhancement of perennial grazing cover, increased forage/fodder crops. Contribute to ***Article 12*** of ***CBD***	• Between 2000 and 2009 a total of 50,000 ha of rangeland is assigned to be under permanent enclosure in sub-regions *Maimine* and *Goluj*, while additional 100,000 ha is under temporary enclosures (this data mainly represent Gash Barka and Debub Regions). • Seed of indigenous grass forage multiplied and distributed to farmers between 2000-2009 Funding – Government budget
	5) Increase honey and wax production by establishing queen (bee) rearing centers and expansion of bee colonies. Contribute to ***Article 12*** of ***CBD***	• The Ministry of Agriculture has established 4 Queen Bee Rearing Centers in the Southern and Central regions namely, Mendefera, Segeneiti, Toker and Merhano. In the four centers, 1000 bee colonies have been produced and distributed to 1000 farmers in the last eight years. Currently there are 25,000 bee colonies in traditional and 10,500 bee colonies that are kept in modern beehives and an average of 275,660 kg of honey is harvested annually both from modern and traditional beehives. Funding - GoSE, DANIDA, Self Help International (International NGO); Toker Integrated Community Development (TICD) – Llocal NGO

Objective 3 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(3) Alien species	1) Design a monitoring program to identify changes in crop and forage diversity at farm level and establish baseline data for the program	• A comprehensive program that establish crop and forage diversity baseline data at farm level and a design of monitoring program **is not done**. However, some inventory activities on indigenous pasture legume (forage) diversity have been undertaken by NARI and Center for Legume in Mediterranean Agriculture (CLIMA) in 2004. A

Strategy 3.1 Improve knowledge and control of alien species within agricultural ecosystem	Contribute to ***Article 7(a)*** of ***CBD***	report on the subject is available at NARI. Project was **funded** jointly by GoSE and CLIMA
	2) Increase surveillance and quarantine activities at 'points of entry' for live biological materials Contribute to ***Article 8(h)*** of ***CBD***	• In 2003, the MoA prepared and distributed a guideline on phytosanitary and zoosanitary on the importation of plant materials, live animals and genetic materials. • In 2006 Plant quarantine proclamation No 156/2006 enacted. Based on these regulatory instruments, continuous surveillance and quarantine activities are implemented by the MoA at all points of entry. This action has been contributing to conservation of crop and livestock species by effectively excluding or kept to a minimum damaging alien pests, diseases and invasive species from entering Eritrea Project was **funded** jointly by GoSE and FAO.
	3) increase survey and documentation of agricultural and livestock pests Contribute to ***Article 7(c) & 8(h)*** of ***CBD***	▪ A nation wide survey on agricultural pests has been undertaken and documented by RSD in collaboration with APDD, NARI and Collage of Agriculture, in 2003. In addition, specific surveys: 1) on citrus pests mainly whitefly, citrus leaf miner and cottony cushion scale was conducted in citrus growing areas (Alla, Maihabar, Durfo, Ghinda, Keren, Hagaz, Elabered and Hamelmalo) in 2008. Report is available at RSD – Plant Health Division; 2) on desert locust, armyworm quelia quelia etc. are conducted almost every year by APDD ▪ Surveys were also conducted for ticks and pathogenic diseases in livestock (NARI 1997 reports) Project was **funded** jointly by GoSE and FOA

Objective 3 – Cont…

Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(4) Pollution management ***Strategy 4.1*** Reduce impact of industrial pollution on agricultural system	1) Use of environmental assessment procedures for new projects and monitoring of potential impacts of industry on agricultural biodiversity Contribute to ***Article 10*** of ***CBD***	• In recent years the use of Environmental Impact Assessment Procedures and Guidelines (NEAPG) developed by Ministry of Land, Water and Environment (1999) for new projects is increasing. Fore example: 1) Between 2007 and 2009 EIA has been conducted on the mining industry of Bisha (Nevson) and GoSE) by Nevson strictly following NEAPG and internationally accepted EIA guidelines for mining industry. 2) There is an ongoing EIA in the Zara Gold Mining Project of Sub Sehara Mining

		Company using EIAPG and internationally accepted EIA guidelines for mining industry. 3) Between 2004 and 2009 The RSD of Ministry of Agriculture and Zoba Administrations has conducted environmental monitoring (Post Investment Environmental Impact Assessment- PI-EIA) on major parastatal irrigated agricultural farms in order to undertake and recommend remedial measures for existing and potential negative environmental impacts. To mention some of the EIA related to Agricultural Biodiversity: a) PI-EIA on Sawa and Afhimbol agro industry along the lower Barka River Basin - in 2004 b) PI-EIA on Gash-Setit and Barka Commercial Agricultural Farms which located along the lower Gash River Basin - in 2009 c) PI- EIA for the Livestock Vaccine Production Project at Villago-Asmara by a team of experts from the Department of Environment, RSD, and Asmara Municipality, d) PI-EIA of new diversion project funded by IFAD at Keih Kor, Debub region – in 2009. Funding: EIA where commissioned by 1) NEVSON Mining Company, 2) Sub Sehara Mining Company, 3) IFAD with Government of the State of Eritrea

Objective 3 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(5) In Situ Conservation ***Strategy 5.1*** Increase conservation of agricultural biodiversity within on-farm system	1) Implementation of existing plans for *in-situ* conservation of landraces (crops and livestock) Contribute to ***Article 8*** of ***CBD***	▪ **No progress** has been made in establishing on-farm conservation of landraces in organized manner. Still traditional way of in-situ conservation of landraces by individual farmers is continuing and monitored by MoA. • In 2009 proposal and concept paper to implement *in situ* conservation of landraces is prepared and it waiting for funding.
	2) Develop a system of effective incentives for farmers to maintain divers landraces (funding, training, input ~~supply, etc.~~) Contribute to ***Article 8*** of ***CBD***	▪ **No Progress**. There is no well organized incentive system in place except the usual extension service and training program focused on crop landraces conservation given by MoA. • Recently a project proposals was prepared that will support farmers to establish community based seed banks, provide training and supply required facilities.

	3) Develop and adopt complementary conservation strategy and methods (*in-situ* and *ex-situ* – contracting farmers to grow threatened landraces; multiply threatened landraces in research station Contribute to ***Article 8*** of ***CBD***	▪ **No progress** has been made to achieve conservation of threatened landraces with well developed strategy. No organized or systematic efforts made on seed multiplication of threatened landraces by farmers and/or research station. ▪ To enhance the *ex-situ* conservation capacity of NARI Gen Bank, 12 freezers has been purchased and installed. Freezers were purchased by EAPGREN (Eastern Africa Plant Genetic Resources Network)

Objective 3 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(6) Ex-Situ Conservation ***Strategy 6.1*** Increase conservation of agricultural biodiversity within ex-situ systems	1) Increase representation of indigenous landrace material in ex-situ collections through: (a) in country collection; (b) representation of material from international collections Contribute to ***Article 9*** of ***CBD***	• The National Agricultural Research Institute had collected more than 3000 samples of cereals, legumes, forage, oil crops, fiber crops, medicinal plants and vegetables and represented in the gene bank through in-country collection from 2000-2008. • In addition, more than 100 samples of forage species, common beans and groundnuts acquired to the gene bank through donation (donated by CIAT and CLIMA) from 2000-2008. Funding:- CLIMA, CIAT and GoSE
	2) Combating drought as an agent of genetic erosion through selection and improvement of drought tolerant/ resistant varieties from local landraces. Contribute to ***Article 9*** of ***CBD***	• NARI has developed in its research stations improved varieties of barley *(Shishay)* and pearl millet *(Hagaz)* tolerant/resistant to drought from local landraces. • In addition, NARI has introduced and adapted drought tolerant/resistant exotic varieties of pearl millet, sorghum and wheat in the country to support the national food security strategy. Funding:- ICARDA, DANIDA, ICRISAT, SFSA and GoSE
	3) Promote conservation of threatened species in the form of frozen semen and embryos Contribute to ***Article 9*** of ***CBD***	▪ **No action has been taken** to conserve threatened species in the form of frozen semen and embryos. NARI should assume this responsibility and start establishing facilities that identify and conserve threatened species.

Objective 3 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**

(7) Taxonomic knowledge ***Strategy 7.1*** Increase taxonomic knowledge of biodiversity within agro-ecosystem	1) Survey and document the distribution of indigenous landraces and their wild relatives Contribute to ***Article 7*** of ***CBD***	• Survey and collection of germplasm distribution of landraces and their wild relatives is conducted and documented for limited areas of the country. Funding:- CLIMA and GoSE
	2) Conduct survey of soil biota associated with different crops and livestock, especially indigenous landraces Contribute to ***Article 7*** of ***CBD***	• No progress on this action
	3) Increase knowledge of biodiversity of agro-ecosystem Contribute to ***Article 7*** of ***CBD***	• To improve the taxonomic knowledge and skill base a number of training and workshops were organized and conducted to staffs from MoA and farmers in the last 10 Years. Funding – GoSE with support from EAPGREN
	4) Conduct general insect, pest, diseases and weeds survey in all agro-ecological zones. General fruit and vegetable insect pests survey on the major growing areas of Eritrea Contribute to ***Article 7*** of ***CBD***	• See progress stated under Alien Species, strategy 3.1 action no 3. Several general insect, pest, diseases and weeds surveys conducted during growing season on field and horticultural crops (NARI report 2005, 2006, and 2007). Funding – Government of the State of Eritrea
	5) Study and identification of races of fungi on sorghum (leaf blight, anthracnose and rust) Contribute to ***Article 7*** of ***CBD***	• **No progress** has been made towards this action.

Objective 3 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(8) Information acquisition and storage ***Strategy 8.1*** Increase use of knowledge about biodiversity within agro-ecosystem	1) Conduct surveys to document farmers/agro-pastoralists and pastoralists knowledge of use of biodiversity production techniques Contribute to ***Article 7*** of ***CBD***	• Comprehensive survey on traditional knowledge and practice focusing on agro pastoralist and pastoralist production system is **not yet conducted**. However, sporadic survey and documentations related to traditional knowledge on conservation and use of biodiversity have been made by MoA such as: a) The Afar people's knowledge, attitude and practices towards conserving trees and wildlife surveyed and documented in 2001; b) The contribution of non wood forest products to the livelihood of the local communities of the Gash Barka region has been studied and documented in 2004; c) A nation wide survey on traditional rangeland management in conjunction with wildlife has been conducted and documented by MoA in 2000.

		Funding:- GoSE; Dry Land Coordination Group (DCG-- Norway); Regional Land Management - SIDA
	2) Study biodiversity system of crops and livestock in all agro-ecological zones Contribute to ***Article 7*** of ***CBD***	NO INFORMATION
	3) Map rangeland quality in relation to livestock density and seasonal patterns of use Contribute to ***Article 7*** of ***CBD***	▪ Activity is underway in Gash Barka region Funding – GoSE and IFAD
	4) Develop and strengthen early warning system for sustainable management Contribute to ***Article 7 and 13*** of ***CBD***	• The early warning system is still weak. The effort made is limited. • During the development of the action plan there was small unit on early warning under the Planning and Statistics Division of MoA which mainly focusing on NFIS and collection and dissemination of information for drought preparedness and mitigation plan. In 2007, this unit was transformed to be Strategic Information System. The intention was to covering additional areas on natural resources, socio-economics and by strengthening the GIS system within the MoA. Funding – GoSE and FAO
	5) Develop a national system for agricultural biodiversity information collection, dissemination and exchange Contribute to ***Article 6*** of ***CBD***	• **No progress** has been made towards this action.

Objective 3 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(9) Public awareness and education ***Strategy 9.1*** Increase knowledge of benefits arising from biodiversity within agro-ecosystem	1) Create awareness at scientific, policy and community level on the importance of agricultural biodiversity conservation and use through the national media, bulletins and incorporate in teaching mate Contribute to ***Article 13*** of ***CBD***	▪ Since 2000 – Radio Programs ▪ Television program Funding: Government of the State of Eritrea and EAPGREN

Objective 3 – Cont…		
Thematic Area	**Priority actions and their contribution to implementation of CBD articles**	**Progress of Actions implementation & Sources of Funding**
(10) Legal and institutional structure (capacity building) ***Strategy 9.1*** Increase protection of agricultural biodiversity within agro-ecosystem	1) Make assessment studies on how agricultural biodiversity resources, including local knowledge and practices, are be protected and sustainable used through the legal means Contribute to ***Article 8 (k)*** of ***CBD***	This action is not fully achieved. However, there are progresses on drafting policy and some legal documents. 1) New seed policy which was drafted and disseminated in 2002. This policy has great contribution on protection and sustainable use of agricultural biodiversity. 2) Accordingly, the new seed law was redrafted in 2005. Still not promulgated. 3) Plant Quarantine law is enacted in 2006 4) Pesticide legal notice issued in 2006 Funding: GoSE, EU and DANIDA

CHAPTER III SECTORAL AND CROSS-SECTORAL INTEGRATION OR MAINSTREAMING OF BIODIVERSITY CONSIDERATION

This section will describe the county's efforts to integrate biodiversity conservation and sustainable use into relevant sectoral and cross-sectoral plans, programs and policies as required by Article 6 (b) of the convention.

At independence, Eritrea found itself with serious environmental problems. These included land and pasture degradation, deforestation, low quality of water for drinking and increasing deterioration of the urban environment. The government has taken several policies, legal and institutional measures to effectively address conservation of natural resources and biodiversity while reinvigorating economic growth. The Government adopted macro policy document in 1994 that provides direction for the country's national economic growth strategy, established a Ministry of Land, Water and Environment, potentially providing for a more integrated approach to Eritrea's environmental problems. In 1994, a comprehensive land reform, which is hoped to improved land husbandry and better environmental conservation, was proclaimed. A comprehensive national environmental management plan has been adopted in 1995 and is being implemented. National environmental assessment procedures and guidelines are in place (1999). Poverty Reduction Strategy paper has been prepared in 2004. The national biodiversity stock taking assessment has been prepared in 1999 and there exist a national biodiversity strategy and action plan. A 6 year program supported by Global Environmental Facility (GEF) to protect marine biodiversity has been completed. The National Action Plan to combat desertification and mitigate the effect of drought was prepared and it is under implementation. Sector policies, strategies and programs have been reviewed to integrate environmental issues and other national priorities.

3.1 Integration into Sectoral Policies, Strategies and Programs

3.1.1 Agriculture Sector

Agriculture Sector Policy: The Ministry of Agriculture of the State of Eritrea is committed to integrate aspects of biodiversity conservation into agricultural sector policy, strategies, plans and legally binding instruments. The Agriculture Sector Policy aims to promote equal opportunities, market liberalization and support services to the private sector, especially to small holders and small to medium-scale commercial farmers. Specific objectives of the policy are to:

- Rehabilitate and maintain the natural resource base (including biodiversity resources) for agriculture;
- Promote rational exploitation and proper management of natural resources (including biodiversity resources);
- Stimulate private investment in agriculture to boost production;
- Boost employment and income levels in rural areas;
- Realize food security;

- Increase foreign exchange earnings; and
- Increase the supply of all agricultural products to agro-industries.

Forest and wildlife Policy (Draft 2005): The Forestry and wildlife sub-sector, which falls under the Ministry of Agriculture, is the main body concerned with the conservation and management of forests and wildlife resources of the country. Draft forestry and wildlife policy, as a section of the comprehensive agriculture sector policy, has been prepared through intensive consultative process involving all stakeholders in 2005.This document stipulates many aspects of biodiversity issues such as:- enhancing forest regeneration by reducing overgrazing; ameliorating the conflict between agriculture and forests; securing forest tenure rights; promoting afforestation and community participation in forest management; providing incentives in maintaining forests on critical areas; developing programs to reduce forest fires; promoting none wood forest products; establishing and developing protected areas; institutional improvement; and developing conservation education and law enforcement mechanisms.

forestry and wildlife conservation and development proclamation: Based on the above policy objectives, the Government has promulgated the forestry and wildlife conservation and development proclamation No 155/2006.This Proclamation, in association with the regulations for the issuance forestry permits (Legal Notice 111/2006) and regulations for the issuance of wildlife permits (Legal Notice 112/2006) provides the framework for the conservation and development of forests and wildlife resources of the country.

Eight Articles from the proclamation have particular relevance to conservation and sustainable use of biological diversity resources. These articles:

- Mandates the Ministry of Agriculture to properly implement the Proclamation (Article-4) and to establish and manage protected areas for the conservation of biodiversity, sites of special scientific interest or preservation of landscapes (Article-16 & 17);
- Secures tree tenure to a person who plants trees on any land which that person has a legal right to use (Article-23)
- Provide legal rights to individuals or communities to use a specified land area, for the creation or management of woodlots' (Article 24)
- Prohibits unauthorized hunting, catching, transporting of wildlife or parts or products (Article-25)
- prohibits unauthorized exploitation, transporting and processing of wood and none wood forest products for commercial purposes, cutting live trees for domestic use and clearing land for agriculture and other purposes (Article-21)
- Prohibits the importation of exotic trees and wildlife and their products without getting permits. It requires verifying that the exotic species is not invasive and does not affect the conservation and sustainable management of the indigenous species and ecosystem.

In accordance with the proclamation, the National Forest and Wildlife Inspection Division has been established under the Regulatory Service Department of the Ministry of Agriculture. This division currently employed 143 forest and wildlife inspectors distributed in the 6 regions. A series of awareness raising workshops have also been

conducted at all levels to sensitize the rules and regulations pertinent to the conservation and sustainable utilization of forest and wildlife resources.

Plant Quarantine Proclamation: In addition to the Forestry and Wildlife Conservation and Development Proclamation, Plant Quarantine Proclamation No 156/2006 has also been enacted in order to prevent the introduction and spread of pests through the importation of plants and plant products; take appropriate measures for the control of introduced pests; and prevent the presence of pests in plants and plant products during exportation. This proclamation sets requirement for importation like import permit, phytosanitary certificate and made responsible plant quarantine officer to inspect the imported items.

The Plant Health Division in the Regulatory Services Department of the Ministry of Agriculture is assigned to follow up the implementation of this proclamation. Since its promulgation, the RSD has been working to strengthen the quarantine stations at Asmara airport, as well as Masawa and Assab sea ports. One new quarantine station at Tessenei (land port) near the border of Sudan has also been established.

Agricultural Development Program (2008-2010): Aside from the policy and regulatory frameworks, the Ministry of Agriculture has developed a comprehensive development program (2008-2010) through consultative process conducted in the six administrative regions of the country. In this program, biodiversity considerations such as: enhancing natural regeneration through establishment of enclosures, afforestation and reforestation, strengthening regulatory activities like plant and animal quarantine etc. are well addresses under the natural resources, regulation and enforcement sections.

As monitoring and evaluation process, annual meetings are being organized at national and regional levels. In addition, May 15 every year is designated as *National Forestry and Wildlife Conservation and Development Day*, to evaluate the status and trends of forest and wildlife resources of the country and discuss ways forward. Every year in this occasion, more than 200 people including high level government officials, regional administrators, students, religious leaders, subject matter specialists, civil societies and local communities participate. Selected individual farmers, communities, schools, churches, mosques are awarded based on their contribution to forest and wildlife conservation and development. In addition, one out of the six administrative regions gets the highest award of the year i.e. *Shilmat- Dma* (Baobab-Award).

Post-Crisis Rural Recovery and Development Program (2007-2012):- The program is funded by IFAD and GEF and it has been implemented in Zoba Debub and Zoba Gash Barka since 2009. The project is targeted the improvement of smallholders productivity and to achieve this objective the project identified three major components. These are:

- Capacity building and institutional strengthening,
- Natural Resources Management,
- Livestock and agricultural development.

The Natural Resources Management component recognizes the natural resources in both the highland and lowland areas in which the programme will be implemented are severely degraded by a combination of overgrazing, human population pressure, deforestation, and poor farming practices. The conflict with Ethiopia and its aftermath, and the prolonged drought of 2000-2002 have exacerbated the situation.

The programme has included concerted efforts to redress the environmental problems in the programme area. Programme activities target improved natural resource management, rehabilitation of degraded areas, improved agricultural and livestock production practices, and support of policies and strategies that will encourage community protection of natural resources.

Given that Eritrea is predominantly semi-arid, falls within one of Africa's biodiversity hotspots, and is being adversely affected by climate change, this program will address priority areas related to the Convention on Biological Diversity, the UN Framework Convention on Climate Change (UNFCCC) and the UNCCD priority areas of Sustainable Land Management (SLM). In relation to CBD the project will mainstream biodiversity in production landscapes, sectors and build capacity on access and benefit sharing. In addressing UNFCCC, it will support activities that reduce GHG emissions from land use, land use change and forestry and support pilot and demonstration projects for adaptation to climate change. In addition, it is designed to promote sustainable management and use of forest resources.

The livestock and Agricultural Development Component is designed to promote sustainable livestock and agricultural development. Most of the activities under these sub components are to assist the project area community in alleviating poverty and improve food security by promoting the conservation and sustainable use of agricultural, livestock and rangeland biodiversity and minimizing the adverse impacts of loss or deterioration of biological diversity resources on human well being.

3.1.2 Marine and Coastal Sector

The marine and coastal sector is covered by two proclamations and thirteen Legal Notices (Regulations), all promulgated in 1998 and 2003, and these are:

- The Fisheries Proclamation: Proclamation No. 104/1998,
- The Fishery Product Proclamation No. 105/1998,
- The Foreign Fishing Vessel Regulation: Legal Notice No. 38/1998,
- The National Fishing Vessel Regulation: Legal Notice No. 39/1998,
- The Fishery Product Regulation: Legal Notice No. 40/1998,
- The Fishery Product Hazard Analysis Critical Control Points Regulation: Legal Notice No. 41/1998,
- The Potable Water Regulation: Legal Notice No. 42/1998,
- The Aquaculture Products Regulation: Legal Notice No. 64/2003,
- The Additives Regulations: Legal Notice No. 65/2003,
- The Heavy Metals Regulations: Legal Notice No. 66/2003,
- The Factory Vessel Regulations: Legal Notice No. 67/2003,

- Potable Water Regulations in Fishery Product Activities: Legal Notice No. 68/2003,
- The Fishery Product Importation and Exportation Regulations: Legal Notice No. 69/2003,
- Regulations issued to amend the Foreign Fishing Vessels Regulations (Legal Notice No. 38/1998): Legal Notice No. 70/2003,
- Regulations issued to amend the Fishery Product Regulations (Legal Notice No. 40/1998): Legal Notice N*o. 71/2003.*

These laws and regulations provide comprehensive coverage about the development and management of the marine sector in Eritrea and contain a numbers of Articles relevant to the protection, conservation and sustainable use of marine biological diversity, including the establishment of marine protected areas.

The fisheries proclamation No. 104/1998 provides a strong legal basis for sustainable utilization of the fisheries resources and broadens the responsibility of the Ministry of Fisheries to all aquatic and coastal resources. The proclamation outlined the need for the establishment of Fishery Advisory Council (Article 6) with its duties and composition which could serve as a plat form for effective integration and coordination of cross-sectoral issues, particularly on coastal area.

The Ministry of fisheries is bound to ensure proper conservation and management of the marine resources (Proc.104/98 Art.8 (1)). The Ministry is particularly bound to ensure that the marine resources are not endangered by exploitation (Proc.104/98 Art.8(1-a)).The Proclamation further provides the Ministry with the power of declaring closed seasons and closed areas; prohibited fishing methods and gear and specification of gear that may be used (including the mesh size of the net); the species, sizes and other characteristics of fish and other aquatic organisms that it is permitted or prohibited to catch; and schemes for the limitations of entry into all or any specified fisheries (Proc. 104/98 Art.9(2)). Before declaring a protected area the Minister may consult the occupiers of adjoining land, the authorities responsible for other use of the area, the appropriate local government councils and the Fisheries Advisory Council (a council set to assist the management development of fisheries). A declaration of a protected area may prohibit or restrict fishing; dredging or taking any sand or gravel; or otherwise destroy or disturb the natural habitat with in such area (Proc.104/98 Art. 13).

The Ministry of fisheries is further provided to participate in environmental protection issues through the powers vested on it to license fishing vessels and reserving areas for Eritrean citizens and national vessels (Proc.104/98 Art. 18 & 49). It can also set conditions to: the type and method of fishing or related activities authorized; the areas within which such fishing or related activity is authorized; the target species and amount of fish or other aquatic organisms authorized to be taken, including any restrictions on them; the period during which fishing or a related activity is authorized; and measures to facilitate enforcement of this Proclamation (Proc.104/98 Art.12). This further strengthens the Ministry's role on conservation and sustainable use of marine biodiversity.

3.1.3 Transport Sector

Biodiversity is also integrated into the Eritrean port management by developing and enforcing regulatory measures in the national port management system (Port Regulations Legal Notice No. 46/2000). This regulation empowers the Department of Marine Transport under the Ministry of Transport and Communications to govern certain part of the Eritrean Marine and Coastal area, particularly area set within the boundary of Assab and Massawa ports. In line with regulations and close coordination with department of environment, Department of Marine Authority takes precaution measure to protect the port from any kind of damage or pollution, refuse the storage of certain goods which are not convenient for handling and dangerous to person, property or the environment and regulate discharging of a marine pollutant.

3.1.4 Mines Sector

***Petroleum Policies and legal Issues*:-** Petroleum operations of the country lie under the jurisdiction of the Ministry of Energy and Mines. The Minister is authorized to direct the implementation of proclamations, and has the power of controlling the operations. Environmental protection measures are treated as part of the whole operation. Article 2 (10) of Proclamation No.108/2000 includes 'environmental protection' in the context of 'petroleum operations'. Unlike legislations of other sectors environmental damage has been defined explicitly in under Article 2 of Legal Notice No. 45/2000 as: '*inter alia*, soil erosion, removal of vegetation, destruction of wildlife and marine organisms, pollution of ground water, pollution on surface water, land or sea contamination, air pollution, bush fire, disruption to natural drainage and damage to archaeological, paleontological and cultural sites.' These legislations also apply to the search, exploration and exploitation of sea-beds and the subsoil (Art. 3(3)).

The petroleum Legal Notice provides detailed provisions on environmental protection. Like the mine operations it applies the principles of EIA at two stages in seismographic survey and exploration stage. The EIAs has to include; fuel storage & handling; use of explosives; camps & staging area; liquid & solid waste disposal; cultural & historical sites; selection of drilling sites; terrain stabilization; protection of fresh water horizons; blowout prevention plan; flaring during completion & testing of gas & oil wells; well abandonment; rig dismantling & site completion; reclamation for abandonment; and noise control (Art. 11 (6) Legal Notice). Moreover these proclamations make a general reference to three international standards of environmental protection. All activities shall be in accordance with the 'accepted international petroleum industry standards and practices'; it must be reasonable; and must protect anthropological, archaeological and historical objects and site (Art.14 & 17 of Proclamation, and Art. 2 & 11(4) of Legal Notice).

Eritrea is considered to be potentially rich in mineral resources, even though it has a short history of mining activities. At present, foreign companies and local private

investors are engaged in exploring and developing infrastructure to exploit the mineral resources of the country. To eliminate or minimize the adverse effects upon the environment and biological diversity resources of the country, the mineral resources proclamation No. 68/1995 and Regulation of Mining Operation (Legal Notice 19/1995) have been issued with articles that oblige applicant to present environmental impact assessment report. Department of Mine has a mine division whose function is to ensure that mines and quarries are conducted their operation in environmentally safe way.

3.1.5 Tourism Sector

The **National Tourism Development Plan (2000-2020)** has presented the tourism development policy and strategy and the wider aspect of tourism development plan. The Tourism Development Policy and Strategy for Eritrea has given policy directives to address potential impact on environment including biological diversity of tourism. Those directives that strictly linked to biodiversity include:

- Emphasizes the need to develop tourism in a manner that encourages conservation and enhancement of the natural environment, especially protection of scenic areas, watersheds, ecosystems, biodiversity, and expansion of forests and wildlife populations;
- Encourage the involvement of local communities in conservation programs that have linkage with the development and management of tourism;
- Emphasizes development of tourism in a sustainable manner. This means *inter alia* conserving the natural archaeological/historic, cultural resources of tourism, maintaining and improving the environmental quality of tourism areas and sharing of the benefits of tourism as widely as possible through out the society;
- Emphasizes the need of suitably designed and environmentally appropriate good quality tourist facilities, service and infrastructure that serve the needs of quality tourism and do not result in environmental problem;
- Recognizes the need to ensure the effective management of tourism based on cooperation between the public and private sector and coordination among central, regional, municipal and local governments. Develop effective organizational structures legal and other institutional arrangements, controlling socio-economic and environmental impacts and monitoring all aspects of the progress of tourism.

The National Tourism Development Plan (2000-2020) has identified the most important environmental protection measures that will be integrated into the tourism planning development and management process in Eritrea, These are:

- Not to overdevelop or overuse sites, that is, not to exceed their carrying capacity for tourism development or visitor use;
- To use properly designed infrastructure systems of water supply, electric power, waste management and drainage for tourist facilities. Especially important in Eritrea is provision of adequate waste management systems of sewage and solid waste disposal to prevent pollution problems. If these systems are not already available in the area, then self contained and non-polluting systems must be installed for the tourism development;

- To develop adequate road and other transportation systems, with emphasis on use of non-polluting public transport systems. Electric shuttle buses, for example, can be used in resorts and parks. Proper maintenance of tourist vehicles is important to prevent air pollution as well as promote safety;
- To apply environmentally suitable land use site planning principles, development standards and architectural, landscaping and engineering design in tourism areas. Controls of advertising signs and under grounding of utility lines are important in maintaining an attractive environment;
- To provide open space, parks and generous landscaping in tourism areas and resorts;
- To carefully manage visitor flows at tourist attraction features. At fragile sites, the number of visitors may need to be limited or completely prohibited at certain times such as the breeding season of some animals;
- In natural areas, to prohibit tourists from cutting trees in camping and trekking areas or from collecting rare plant and animal species, and control disturbance of wildlife. Hunting should be prohibited or allowed only under carefully controlled conditions so that the animal populations are maintained at sustainable levels appropriate to their habitats.

Specifically in marine environments along the coast and around the offshore islands, the development plan has identified the following measures:

- Prohibit the collection of live shells, corals, turtles and their eggs and control other marine organisms such as ornamental fish;
- Prohibit divers to use gloves, touch the coral formations or walk or stand on coral formations;
- Prohibit dropping boat anchors onto coral formations and provide proper mooring buoys for boats in diving areas;
- Prohibit cleaning boat bilges or other types of oil or wastewater spillage into protected marine areas;
- Prohibit disposing of any type of solid waste material such as garbage from boats or on beaches where the boats may stop over. Such material must be carried to the port of return and properly disposed on land;
- Design marinas and piers so that they do not create erosion or disposition problems along shorelines, such as requiring that piers be on pilings that allow free flow of water under the pier;
- Prohibit dumping of solid waste from hotels and restaurants on the beach or on in the water, and ensure that solid waste is properly collected and disposed;
- Clean the beaches in tourism resort areas regularly.

3.1.6 Water Sector

Eritrea, in line with its international commitments to develop integrated water resources management (IWRM) and efficiency plans by 2005 has completed the development of IWRM plan in 2009. This management plan is intended to promote the co-ordination, development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without

compromising the sustainability of vital ecosystems. To integrate the IWRM principle the 2004 national water policy was reviewed in 2007 and it recognizes drainage basin as the basic unit of planning. Specifically the draft water policy:

- emphasize to incorporate environmental conservation and protection requirements as integral parts of water resources management;
- Encourage that Environment Impact Assessment and protection requirements serve as part of the major criteria in all development projects including water resources development projects;
- Promote coordination of activities of the various regulatory bodies and development organizations in-order to ensure more effective and timely environmental protection;
- Emphasize the need to develop guidelines for the close integration of water and land-use managements.

3.1.7 Education Sector

Environmental education is highly integrated into elementary, middle and high school curriculums. Department of Curriculum of the Ministry of Education with support of Ministry of Agriculture and Ministry of Marine Resources has integrated environmental issues including biodiversity in school text books and teaching material, particularly in the fields of science and social sciences. In 2009, Ministry of Education, with financial support from the Government of Japan and technical support from UNICEF has prepared 6 teachers manual "Environmental guidelines for teachers". Of these 4 of them addresses biodiversity. These are:- 1) Green club manual for elementary schools 2) A manual for environmental education within social studies 3) A manual for environmental education within English; 4) A manual for environmental education within science; 4) Food garden and mini forest a manual for elementary school. In addition Ministry of Education in coordination with a number of sectors is in the process of establishing a Children Educational and Research Center.

Hamelamlo Agricultural College: Hamelmalo Agricultural College (HAC) was established in 2005 and merged with the College of Agriculture, University of Asmara in 2006. HAC currently offers Diploma and Degree programs namely 1)Agricultural Engineering 2) Land Resources and Environment 3) Agricultural Economics 4) Agricultural Extension 5) Crop protection 6) Crop production 7) Horticulture 8) Animal Science and 9) Veterinary Science.

College of Marine Science and Technology: College of Marine Science and Technology has been open in 2005 and currently offering four degree and five diploma programs under 4 departments. These departments are: 1) Department of Applied Marine and Fisheries Science (AMFiS); 2) Department of Aquaculture; 3) Department of Marine Biotechnology; and 4) Department of Marine Engineering (ME). This higher education program has significant contribution on the conservation and sustainable use of biological diversity.

Institute of Science and Technology Mai Nefhi Department of Biology: The department is providing in four biodiversity related cources: 1) Animal zoology and

plant ecology; 2) Biodiversity and conservation; 3) Morphology and taxonomy of flowering plants; and 4) invertebrate and verabrate zoology

Summer Student Campaign:- Since 1994, Eritrean students throughout the country have participated in reforestation and soil-conservation campaigns during *Kremti* (June-July) during their summer vacations. One of the main objectives of implementing the program is to cultivate responsible citizen who will participate in protecting and conserving the natural environment by engaging into the actual conservation work which simultaneously raise awareness and promote practical education. This program is usually organized jointly by the MoE and the MoA. On average more than 18,000 students participated every year in the summer student campaign.

3.2 Integration into National Policies, Strategies and Action Plans

3.2.1 Macro policy

The micro policy document was adopted in 1994 and provides a background for the country's national economic growth strategy and states the guiding principles for human centered, efficient, sustainable and equitable development. This policy document clearly states the need for environmental impact assessments to determine the potential environmental consequences of major investment decisions. It recognizes the negative impacts of some traditional farming practices on crop productivity, as well as progressive environmental degradation attributed to increasing demands for fuel wool, and inadequate soil and water conservation measures. In addition it states that the commitment required from the government to allocate financial resources to promote the rehabilitation, conservation, development and proper exploitation of natural resources.

3.2.2 Poverty Reduction Strategy Paper

The 2004 Interim Poverty Reduction Strategy Paper (I-PRSP) provides an overview of the nature of poverty in Eritrea, and states the Government's commitment to poverty reduction. Of the various economic development strategies and action proposed those directly related to the conservation and sustainable utilization of biodiversity include: 1) Increasing water availability: The strategy is to harness the seasonal water flows and direct them to ***where they are needed***, through catchments rehabilitation, rainwater harvesting through construction of embankments, canals, lining of watercourses and introducing modern methods that enhance on-farm water use efficiency; 2) Increasing farm productivity by introducing modern farming techniques and management methods, primarily farm inputs, wide spread use of improved pest control, reducing post harvest losses and developing and disseminating more drought resistant, faster-maturing seed varieties. In addition soil conservation measures to improve soil fertility and construction of check dams, planting / afforestation to protect and restore the rural environment were identified as appropriate action relevant to reduce poverty by conserving biodiversity and the natural environment; 3) Promoting production of high value crops; 4) Expanding land under cultivation by bringing under cultivation vast tracts of fertile land so as to enable farmers to intensify and diversify their agricultural

production systems; and 5) Modernizing and expanding livestock and dairy production by realizing the good potential for increasing earnings from production of livestock (goats, sheep, cattle, camels, pigs and poultry).

3.2.3 National Environmental Management Plan

The national environmental plan for Eritrea was adopted in 1995, and is the basis for action in environmental management and conservation. The guiding principle outlined in the plan include the:

- Recognition of the strategic importance of a good management of renewable terrestrial, coastal and marine resources and maintaining environmental quality as part of the national economic growth and development;
- Importance of developing strategies for integrated and multiple uses of natural resources while ensuring local involvement and equity in environmental management; and
- The need to balance broad-scale management (e.g., national and regional environmental legislation, and economic incentives and disincentives) with targeted management (e.g., establishment of protected area and rehabilitation of heavily degraded ecosystem).

3.2.4 Land Tenure Proclamation (1994)

This new land policy is aimed at eliminating periodic redistribution, curtailing land disputes, increasing duration of the land rights and enhancing exclusivity and transferability rights. These measures are hoped to provide land cultivators with more secure land rights, which ultimately will contribute in boosting long-term investment, improved land husbandry and better environmental conservation. The new land law will permit the classification and allocation of land on a more rational and scientific basis, avoiding fragmentation, and ensuring the establishment of appropriately-sized reserves for woodlots, grazing, and communal, housing and urban facilities.

3.2.5 Draft land use policy

The land use policy was drafted in 2007 with the aim (goal) of facilitating land use that sustain and promote economic growth while guiding the development of land to produce a healthful, efficient and aesthetically pleasing environment by conserving natural resources and encouraging development partners that protects natural resources. The new policy has set the following objective which all has direct contribution to the conservation and sustainable use of biodiversity:

- To relate the use of land to its potential and sustainability for development,
- To preserve the ability of freshwater and wetlands to perform their valuable natural functions through conservation and protection,
- To preserve and enhance fauna and flora diversity and stability through habitat protection and enhancement, and prevention or mitigation of adverse impacts of land use changes,
- To preserve and protect coastal resources, which contribute to the economic development and improve quality of life of the people,

- To preserve areas of heritage significance, and
- To avoid conflicts that may arise between different land use interests.

The policy has expressed the governments perception of the direction to be taken on major issues related to a) agricultural land use; b) rangeland; c) forest land; d) urban and built up land use; e) coastal land; f) water bodies, g) conservation area; h) wetland; i) Heritage sites; j) mineral areas; and k) barren land.

3.3 Synergy between the Environmental Conventions (UNCCD, UNCBD, UNFCCC)

3.3.1 Preparation of National Action program (NAP)

In pursuant to Article 5 of the convention to UNCCD, Eritrea in 2002, have prepared a national action program (NAP) that identifies factors contributing to desertification and practical measures necessary to combat it and mitigate the effect of drought. NAP has given particular attention to preventive measures. The actions under NAP have entailed both policy and institutional measures to facilitate the establishment of an enabling environment at the national level for sustainable resource use, as well as local level development activities to preserve and/or restore the resource base and improve livelihood security of the affected populations. In relation to biodiversity conservation and sustainable use NAP has:

- Identifies key concerns and threats to flora and fauna;
- Emphasized the need for creation of protected area system (*in situ* conservation) and identified four priority areas for conservation of biodiversity (The Semenawi Bahri, North of the river setit, reverine habitat along the Gash and Barka Rivers and the Buri Peninsula);
- Proposed actions that make effective enough the traditional practices and customary laws in conserving and sustainable use of the natural flora and fauna of Eritrea;
- Recommend actions that strengthen the ex-situ conservation capacity of the nation on biodiversity resources;
- Identify actions related to laws that promote the conservation and sustainable use of biodiversity;
- Identify ways to establish international cooperation with international organizations with respect to technical assistance, scientific research and financial support; and
- Identify actions required to improve, conserve and use sustainably the agricultural, livestock, rangeland and forest resources of the country.

To **speed up the implementation of the National Action Plan** (NAP) Eritrea has developed 20 project profiles that are priority area for immediate action. These profiles are documented in an elaborative format that could make them favorably considered by financial institutions, donors, etc. Out of these 20 projects 16 of them will directly contribute to the implementation of CDB articles while at the same time addressing land degradation and/or impact of climate change issues. These are:

- Mapping and land classification for resources assessment,

- Application of land tenure system and introduction of community land use planning in pilot areas,
- Assistance to farmers for in-situ conservation of indigenous crops and landraces,
- Soil and soil moisture assessment at watershed scale using remote sensing and GIS,
- Community awareness raising,
- Dissemination of improved traditional wood stoves,
- Promotion of renewable energy technologies for rural community benefits (solar photovoltaic promotion project),
- Establishment of gazetted protected area,
- Fuel wood plantation for sustainable supply of biomass fuel,
- Natural forest and woodland conservation and management,
- Development of agro forestry/ farm forestry,
- Identification of useful grasses and forbs of Eritrea,
- Reviewing and revising existing customary (traditional) law on the management & utilization of communal grazing lands,
- Comparative analysis of livestock *versus* crop production,
- Establishment of shelterbelts in areas prone to dust storm,
- Establishing local land degradation committees.

3.3.2 National Capacity Needs Self Assessment

Ministry of Land Water and Environment with financial and technical support from GEF and UNEP completed a National Capacity Needs Self Assessment (NCSA) through a country driven consultative process. The Project has identified gaps and priority needs, opportunities for synergistic cross cutting and strategy and action plan for capacity building in the country at various levels, to help implement global environmental conventions, mainly focused on UNCBD, UNCCD and UNFCCC. The action plan has identified eight synergetic capacity building intervention areas.
(MoLWE, 2007)

3.3.3 National Biosafety Framework

The Cartagena protocol on Biosafety to the Convention on Biological Diversity entered into force for Eritrea on 8th of June 2005. Eritrea has initiated the implementation of Cartagena protocol on Biosafety by conducting a survey on the status of biotechnology (practice and policy) in the country and developing of a National Biosafety Framework with financial support from GEF/UNEP. The framework includes four sets of guidelines for: 1) Handling requests/permits for authorization; 2) Risk assessment of genetically modified organisms (GMOs); 3) Public awareness and participation in biotechnology/biosafety; and 4) Protection of confidential business information (CBI).

Eritrea is practicing the traditional biotechnology and has not yet reached the level of using modern biotechnology. The practice is restricted only in fermentation, brewing and animal breeding. University of Asmara used to practice tissue culture for research

purpose. The National Agricultural Research Institute is also in the process of a tissue culture laboratory. Biotechnology and biosafety being new the public awareness on the extent and nature of risk associated with genetically modified organisms (GMOs) is low. No policy specifically tailored to address biotechnology as well as biosafety matters that arise in the context of the adoption and/or application of biosafety (MoLWE, 2007).

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3.4 Extent of Biodiversity Considerations in EIA of Development Projects and Others

The Ministry of Land Water and Environment being responsible for the implementation of the national environmental policies and strategies has developed the National Environmental Impact Assessment Procedures and Guidelines in 1999. This document lays out the general principles, approaches and instruments to fulfill the obligations required to maintain a safe and healthy environment and through the application of its procedures determine the potential negative environmental consequences of all development projects. Moreover, the NEAPG is a tool for integrating environmental issues into a planning process. The NEAPG document contains a set of procedures such as the screening and categorizing projects. Based on their type, size, location, and mode of operation projects are categorize in one of the following categories:-

- Small scale projects having minimal impact on environment (Category C),
- Big or large projects with clear potential impact but having cost-effective mitigation measures to minimize these impacts , (Category B),and
- Large-scale projects having major impacts on the environment are expected to pass through a full-fledged impact assessment (Category A).

For category-A projects the project owner is obliged to conduct full-fledged environmental impact assessment and management plan that minimize the impact to acceptable limit. The environmental impact assessment and the environmental management plan is reviewed by an impact review committee (IRC) from relevant ministries such as: the Ministry of Land Water and Environment (Chair), Ministry of Agriculture, Ministry of National Development, Ministry of Energy and Mines, Ministry of Health, Ministry of Public Works, Ministry of Labor and Human Welfare, National Museum, etc. For category B projects, however, only environmental evaluation process is required.

Despite all these effort the use of NEAPG during the palnning and development of national project is very limited mainly due to lack of coordination between government institutions, low level of awareness about NEAPG at all level, shortage of fund and skilled human power in the area of EIA. Since the adoption of this document, very few projects are checked against the environmental impact assessment procedures and guidelines and granted environmental clearance. A case in point is the success story of the BISHA Mining Project in the western lowland of Eritrea, where an intensive social and environmental impact assessment has been conducted and management plan developed and reviewed by IRC.

To integrate environmental issues in sectoral development programs and activities targeting the coastal, marine and island environment, Ministry of Fishery has circulated Environmental Evaluation Questionnaire (EEQ) for those considered category B projects as per NEAPG.

3.5 Contribution of Mainstreaming into Implementation of NBSAP and Existing Biodiversity Trend

During the preparation of this 4th national report it was possible to notice that the level of communication and follow up on the implementation of NBSAP was not reached to a level it is required to accomplish the planned actions. However, the progress made towards implementing priority actions set in the NBSAP is satisfactory and that is mainly due to the integration of biodiversity and NBSAP priority areas into different sectors programs and plans. Fore example, the efforts made to mainstream biodiversity and environmental education into the educational curriculum, the student summer campaign, awareness raising programs, the Warsay Yikealo Development campaign has significantly contributed to attitude change at all levels that positively contributed to the achievements of NBSAP and the existing status and trend of biodiversity particularly in the central highlands.

CHAPTER IV CONCLUSIONS: PROGRESS TOWARDS THE 2010 TARGET AND IMPLEMENTATION OF THE STRATEGIC PLAN

4.1. Progress towards the 2010 Targets

Table-17: Progress towards the 2010 Targets

Goals and Targets	Relevant Indicators
Protect the components of biodiversity	
Goal 1. Promote the conservation of the biological diversity of ecosystems, habitats and biomes	
Target 1.1: At least 10% of each of the world's ecological regions effectively conserved. Target 1.2: Areas of particular importance to biodiversity protected	• Coverage of protected areas • Trends in extent of selected biomes, ecosystems and habitats • Trends in abundance and distribution of selected species

Progress towards 2010 target

To date there are no formally protected areas in Eritrea. However, a total of 27 areas are identified and proposed for protection all over the country (FAO, 1997). Priority is given to areas, namely Semienawi Bahri, Buri Peninsula, Riverine forest, Gash-Setit Elephant Sanctuary and Dahlak's Iselands. From the total area of forest types (35,637 km^2), 17.6% (6456km^2) is identified as being priority areas for biodiversity conservation in terms of protected areas and expected to be gazetted.

i. Semienawi Bahri (Green Belt) 1001 Km ^{2}: to protect Eritrea's last remnant of evergreen montane forest. The upper and lower peripheries of the greenbelt are highly encroached and are under pressure. However, a total of about 415 Km ^{2} of the Green Belt which is managed under permanent enclosures are relatively stable. In these areas the vitality and integrity of the habitat as well as the regenerative capacity of the species are improving. Likewise, wild life species like *Felis pardus*, *Tragelaphus strepsiceros, Sylvicapra grimmia and Oreotragus oreotragus* and many bird species are reviving,

ii. Buri Peninsula Proposed Protected Area 2500 Km ^{2}: The area is particularly important in protecting African wild ass (*Equus africanus somaliensis*), Dorcas gazelle (*Gazella dorcas*), Soemmerring's gazelle (*Gazella soemmerringi*) and Ostrich (*Struthio camelus*) living and breeding in this area. All those mentioned important species are stable while the Ostrich is believed to be increasing (personal Comm. Hagos Yohannes),

iii. Gash-Setit Proposed Protected area (elephant sanctuary) 443 Km ^{2}. Its objective is to protect Eritrea's remaining elephant population. Compared to the 1996 count, the present population is reported to be increasing (MoA count 2003 and Community Information),

iv. Riverine forest: 1,865 km^2 (FAO, 1997). Highly suffered from deforestation for irrigated horticultural purposes. In 2009, Regional Administration has prepared directives that limit agricultural activities 700 meters away from ether side of the river banks. Doum palm (Hyphaene tebiaica) is the most important reverine forest

which is believed to be declining in abundance,.

v. Dahlaks Islands (640 Km ^{2}): A priority of Marine and Coastal Biodiversity. Soemmerring's gazelle (*Gazella soemmerringi*) is the only mammal speices on the Iseland and their number has been constantly increasing except in periods of extreme drought,

vi. Sheikh Said/Green Island National Park (0.12 km^2) and the Dissei-Madot Protected Area (6.4 km^2) have been identified as protected area, for the conservation of CMI Biodiversity. Management and monitoring plans were prepared and all technical and legal documents are forwarded to Ministry of Justice.

Since 2000 more than 120 Km ^{2} of new permanent enclosures have been established and this brought the total enclosure areas to 2050 Km ^{2} which is 1.65% of the total land mass of the country.

The Eritrean marine ecosystems have been relatively well protected from aggressive exploitation by the recurrent conflicts in the region. Understandably urban and industrial development along the coast has also been minimal. Assab and Massawa are the only two large population centers with a combined population of less than 200,000. Consequently the marine and coastal habitats of the Eritrean Red Sea are believed to be in pristine condition (Wilkinson, 2000).

Goal 2. Promote the conservation of species diversity

Target 2.1: Restore, maintain, or reduce the decline of populations of species of selected taxonomic groups. Target 2.2: Status of threatened species improved.	• Trends in abundance and distribution of selected species • Change in status of threatened species • Coverage of protected areas

Progress towards 2010 target

Eritrea has taken steps such as promulgating and effectively implementing the forest and wildlife conservation and development law, increase the area of enclosures, conducting various surveys and data collection on Marine biodiversity in view of supporting the CMI planning and management activities to promote the conservation of species diversity. This has been shown by the increase in number of the following selected (important) species.

- **African Wild Ass** (*Equus africanus*) – critically endangered species at global level,
- **African Elephant (***Loxodonta Africana) – endangered at the national level,*
- **Greater Kudu** (*Tragellaphus strepciceros)* - this beautiful antelope species had reached the threshold of extinction in 1991. However, after independence, it has been recovering constantly and, at present, it is slowly building up its population in the Semenawi Bahri. Endangered at national level,
- **Leopard** (*Panthera pardus*): The Leopard has been reported to disappear from Semenawi Bahri during the independence struggle. Since 1991, its presence in the area has become conspicuous especially after the area is proposed for protected area and it is under permanent enclosure. Comprehensive study needed to precisely determine the extent and status of the species. Endangered at national level,
- ***Sea Turtle***, **Dugong dugon** and **Sharks** are reported to be stable in their status and trend.

In general there is no complete list of endangered or threatened plant species in Eritrea to measure changes in status; the most recent discussion and/or lists were presented by the Eritrean Agency for the Environment (EAE-1995) and DoE (1999, 2000) but they require revisions.

Goal 2. Promote the conservation of genetic diversity	
Target 3.1: Genetic diversity of crops, livestock, and of harvested species of trees, fish and wildlife and other valuable species conserved, and associated indigenous and local knowledge maintained.	• Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socioeconomic importance • *Biodiversity used in food and medicine (indicator under development)* • Trends in abundance and distribution of selected species

Progress towards 2010 target

- Crop Diversity: - There is no systematic assessment of plant genetic erosion in the country. However, recent NARI's germplasm collection revealed that most cereal landraces are at risk mainly due to drought, insect pests and diseases, war, and the introduction of high-yielding exotic crop varieties. The frequency of those landraces of plant species like Maize, Long maturing Sorghum varieties, Faba bean varieties, finger millet and Taff varieties that need more precipitation to mature have declined in Arial extent and their frequency.

- Animal Diversity – No baseline data and monitoring program exist to establish the trend in livestock genetic diversity. However, the improved vet services, watering points, rangeland improvements have contributed significantly in maintaining the existing livestock diversity and distribution despite the recurrent droughts.

- To avoid over-exploitation of an area and minimize sensitive habitat damages, Ministry of Fishery has established a Licensing, Permit, Monitoring, Control and Surveillance unit which actively follow up the fishing operation. It also zoned the territorial waters of Eritrea in to three fishing zones so as to disperse trawlers all over the available fishing grounds and extended the closed season for fishing from three to four months (July – October).

- Based on the results of the GEF/PRIF surveys, the northern Eritrean Red Sea sector, especially the outer eastern islands and Museri, is considered to be the most diverse, especially with regard to coral reef fish species

Promote sustainable use	
Goal 4. Promote sustainable use and consumption	
Target 4.1: Biodiversity-based products derived from sources that are sustainably managed, and production areas managed consistent with the conservation of biodiversity. Target 4.2. Unsustainable consumption, of biological resources, or that impact	• Marine trophic index • Nitrogen deposition • Water quality in aquatic ecosystems • Trends in abundance and distribution of selected species • Ecological footprint and related concepts

upon biodiversity, reduced. Target 4.3: No species of wild flora or fauna endangered by international trade.	• Change in status of threatened species

Progress towards 2010 target

Since 2000 the Government of the State of Eritrea has issued a number of policies, proclamations, legal notices and management plans that promote the sustainable use and consumption of biodiversity resources (terrestrial, Marine and Agricultural). Refer Chapter 3 section 3.1 and 3.2

Sustainable Use of Non Wood Forest Products: Government of the State of Eritrea in partnership with IFAD, and some local and international NGO's like RTI/Vita is implementing a reforestation program, promotion of energy saving traditional stoves and training and awareness program that promotes the sustainable use forest resources. The implementation of NBSAP have contributed on sensitizing and bringing attitude change on policy and decision makers at regional and national level in particular and the community in general on sustainable use of the Doum palm forest and on the importance of reverine forest conservation and sustainable use. Despite the effort the sustainable use of NWFP is not yet attained.

The **Collection of Gum Arabic and frank incense** is described in Chapter 2 – Terrestrial Biodiversity, Thematic Area 2 and Strategy 2.3. Despite its low level of harvest of these biodiversity based products, the resource has faced significant challenge from unsustainable utilization.

Honey production has increasing approximately from 100,000 kg/year in 2000 to about 275,660 kg/ year in 2009. This particular activity reflects the availability of bee forage and sustainable utilization of forest resources by introducing environmentally friendly farming activities.

Fishery Resources: No comprehensive quantitative surveys of the resources and the productivity of the Eritrean Red Sea have been carried out. Several attempts have been made to estimate the maximum sustainable yield (MSY) of the Eritrean marine fish resources. These estimates fluctuate between a high of 79,500 and a low of 36,000 tones per year. Presently the quantity taken is much less than the estimated sustainable yields

Fish diversity in the Eritrean Red Sea represents a potential economic resource for Eritrea, both in terms of commercial fisheries and also from dive tourism. Eritrean coral reef fish diversity is greater than that of Israel, Egypt, and other "competitors" for dive tourism, but overall coral species diversity is lower (SoC, 2007). Overall, the fishery sector has considerable commercial potential in Eritrea and it is likely that there will be a considerable increase in fishery off take in the next few years.

Agriculture and Livestock: - The government of the State of Eritrea has developed and implemented National projects focused on livestock and agricultural development through a conservation-based approach, driven by the communities and technically supported by government institutions. Fore example

The Post-Crisis Rural Rehabilitation Development Program (PCRRDP is promoting forage production through the provision of improved seeds/planting materials, technical training in forage production, and promotion of fodder crop as part of crop rotation; improvement of range management through reseeding; support to voluntary livestock exclusion areas; and expansion of livestock watering points through the construction of *hafirs*. Over 57 000 ha would be developed under forage production and range improvement programme; about 12,000 ha will be put under Voluntary Livestock Exclusion Areas; while 110 hafirs will be constructed.

For sustainable agricultural development there are programs focused on promotion of simple, improved and affordable technologies including elements of soil and water conservation practices, use of improved seeds, promotion of better production practices and reduction of post-harvest losses. The programme will support over 150 000 ha of which between 25 000 – 35 000 ha of new rain-fed areas will be developed. This and similar programs are mainly focused on promotion of sustainable use of agricultural resources.

Currently, there are no fauna and flora species threatened by international trade in Eritrea.

Address threats to biodiversity	
Goal 5. Pressures from habitat loss, land use change and degradation, and unsustainable water use, reduced	
Target 5.1. Rate of loss and degradation of natural habitats decreased.	• Trends in extent of selected biomes, ecosystems and habitats • Trends in abundance and distribution of selected species • Marine trophic index
Progress towards 2010 target No record or data generated from monitoring programs that enable this report to quantify and assess the rate of loss of natural habitats. Nonetheless, actions such as enhanced hiring of forest and wildlife guards, exclusion of concession land users from the Semenawi Bahri and the 700 meters exclusion of farming from reverine forest which have been taken by the Government of the State of Eritrea have shown positive signs on the reduction of the rate of loss and degradation of natural habitats.	
Goal 6. Control threats from invasive alien species	
Target 6.1. Pathways for major potential alien invasive species controlled. Target 6. 2. Management plans in place for major alien species that threaten ecosystems, habitats or species.	• Trends in invasive alien species • Trends in invasive alien species
Progress towards 2010 target Despite the GoSE's effort to control Invasive alien species, still are one of the main threats to biodiversity. The production of charcoal by cutting indigenous live trees is strictly prohibited in Eritrea; however there is regional regulation that allows charcoal producers to use *Prosopis juliflora* for charcoal production which in turn support the control of the expansion of this alien species. In addition, there is a much localized effort to uproot	

this alien invasive species.

Plant quarantine proclamation No 156/2006 enacted in 2006. This proclamation has provisions to establish and strengthen quarantine stations. Since 2003, Regulatory Service Department of the MoA has strengthened the existing quarantine stations at Asmara Airport, Massawa and Assab seaports and established one additional quarantine station at Tessenei, a town near the boarder of Sudan to effectively quarantine crop, livestock and their products.

In 2003, the MoA has prepared and distributed a guideline on phytosanitary and zoosanitary on the importation of plant materials, live animals and genetic materials.

Goal 7. Address challenges to biodiversity from climate change, and pollution

Target 7.1. Maintain and enhance resilience of the components of biodiversity to adapt to climate change.	• Connectivity/fragmentation of ecosystems
Target 7.2. Reduce pollution and its impacts on biodiversity.	• Nitrogen deposition • Water quality in aquatic ecosystems

Progress towards 2010 target

The Government of the State of Eritrea has developed Poverty Reduction Strategy, Food Security Strategy, Environment Management Plan, Integrated Water Resources Management Action Plan, National Action Plan to combat desertification and mitigate the impact of drought (Ref Chapter 3- section 3.2 &3.3) and implementing priority action based on those strategies and plans. Those priority actions are believed to be adequate to effectively prevent and mitigate climate change impacts on biodiversity. In all cases water harvesting, soil and water conservation, groundwater recharge, climate change awareness, research on drought resistant crops, rangeland improvement, natural resources conservation etc are priority areas where the government is fully engaged to reduce poverty and ensure food security while mitigating the effect of climate variability, drought and climate extreme events.

A national assessment of the vulnerability of Eritrea's major economic sectors including forest, agricultural and marine and coastal biodiversity resources to climate change have been finalized in 2005/2006. The national adaptation programs of action to mitigate the adverse effects of climate change have been developed.

A Climate Change Adaptation (CCA) Food Security Project is currently under implementation in arid areas of north-western Eritrea using funding from GEF, UNDP and GoSE. The project is designed to enhance the productivity of rangeland resources and introduce sustainable land management that will improve the adaptation capacity and resilience of the resources and the community.

In line with the national food security and poverty reduction strategy, the GoSE has constructed more than 200 small to medium dams that support small scale irrigation, serve as livestock watering point and to recharge groundwater. It has become a norm to undertake upstream catchment treatment works like physical soil and water conservation structures constructions, tree planting and putting catchments under protection in order to reduce the rate of soil sedimentation.

Marine resources - Refer Chapter 2 – Marine Biodiversity, Thematic Area 4 and Strategy 4.1 regarding effort made to reduce marine environment pollution in line with the NBSAP.

In addition the GoSE has implemented project targeting the conservation and management of marine and coastal biodiversity which also has direct implication on climate change adaptation. These are: a) Eritrea Coastal Marine Islands Biodiversity Project (ECMIB) b) Manzanar Project: Mangrove planting initiative; c) Formulation of Integrated Coastal Area Management (ICAM) d) establishing marine protected area even though not yet gazetted; e) Strengthening research programs of climate change in the Eritrean coastal environment through ECMIB project; and coastal people awareness program.

The government of the State of Eritrea has conducted a survey of hazardous chemicals and developed controlling procedures for hazardous chemicals used in Eritrea – Refer Chapter 2 – Terrestrial Biodiversity, Thematic Area 4 and Strategy 4.1 for detailed action and progress made.

The government of Eritrea has effectively implemented the plastic bag "*Festal*" banning regulation and regular environmental cleaning campaign through out the country. Its implementation has been rigorously followed up by the respective local administrative offices.

Maintain goods and services from biodiversity to support human well-being

Goal 8. Maintain capacity of ecosystems to deliver goods and services and support livelihoods

Target 8.1. Capacity of ecosystems to deliver goods and services maintained.	• *Biodiversity used in food and medicine (indicator under development)* • Water quality in aquatic ecosystems • Marine trophic index • Incidence of Human-induced ecosystem failure
Target 8.2. Biological resources that support sustainable livelihoods, local food security and health care, especially of poor people maintained.	• Health and well-being of communities who depend directly on local ecosystem goods and services • *Biodiversity used in food and medicine*

Progress towards 2010 target

Proper valuation of ecosystem goods and services is not yet done.

The GoSE has fully recognized the absence of market for goods and services gained from biodiversity resources. This absence of market has become incentive to over-exploit and degrade biological resources and their diversity because it is cheap or free for them to do so and because they do not have to pay the costs associated with the damage their activities cause. To reverse this situation and increase the capacity of ecosystem to deliver goods and services, the GoSE has issues and try to implement a new land tenure which provides secure and transferable property right over land and biological resources which are used to be considered local common pool resources. This is further supported by Forest and Wildlife Conservation and Development Proclamation (155/2006) which provides tree tenure and sustainable community forest and natural resources management,

Expansions of temporary closure are commonly practiced in the highlands and escarpments and allow villagers to cut and carry grass for livestock feeding. This practice is found to improve ecosystem integrity while providing goods and services for community (e.g Menguda valley community managed enclosure),

In Eritrea the NWFP still continue to provide goods and services to local community. For example the contribution of the NWFP accounts for about 14% of the total annual household income in Gash Barka Region (Ogbazghi and Bein et al. 2006). These services vary from animal fodder to fruits and medicine. During periods of drought, the vegetation serves as a source of emergency food for humans, livestock and wildlife,

Agricultural Biodiversity goods and services: all agricultural policies, strategies and programs have been directed towards improving the household and national food security by enhancing the productivity and production of agricultural land,

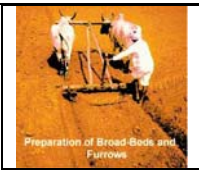
The GoSE with Financial support from GEF and UNDP is implementing Sustainable Land Management (SLM) pilot projects which inter alia develop systems of incentives and penalties at community, regional and sub regional level to further the adoption of SLM practices.

Protect traditional knowledge, innovations and practices

Goal 9 Maintain socio-cultural diversity of indigenous and local communities

Target 9.1. Protect traditional knowledge, innovations and practices.	• Status and trends of linguistic diversity and numbers of speakers of indigenous languages
Target 9.2. Protect the rights of indigenous and local communities over their traditional knowledge, innovations and practices, including their rights to benefit-sharing.	• *Additional indicators to be developed*

Progress towards 2010 target



Enhancing traditional Knowledge: A number of government programs provide special emphasis on building on, and enhancing, their traditional knowledge about their local land resources. For example the community based land use planning approach practiced under the catchments and landscape management project of PCRRDP, the SLM pilot project and the protection and enhancement of the eastern lowland spate irrigation project by IFAD. The first two projects are expected to enhance the traditional knowledge of local communities by providing them with the skills to: (i) assess the degradation status of their local ecosystem resources; (ii) determine the consequences of this degradation for them; and (iii) identify locally appropriate SLM options for tackling low and declining land productivity. In case of the spate irrigation traditional practice is maintained while improvement is made upgrading communities capacity in diverting the seasonal floods.

Local Level Forum- The GoSE is promoting the establishment of local level forums and partnership among researchers, extension workers and farmers that protect traditional knowledge and practices of indigenous and local communities relevant to conservation and sustainable use of biological diversity in agriculture. In 2004, Eritrean Sustainable Natural Resource Management Forum (ER-SNRMF) established to improve local and traditional capacity on sustainable land use through organizing training, workshops, study tours, exchange visits, establishing an information center, and facilitating a forum for information exchange including regional. In 2003 an Eritrean Country Water Partnership (ER-CWP) has been established and it is actively serving as a platform in creating alliance between sector institutions and

community for good governance of the nation's water resources to wards Integrated Water Resources Management.

Identification and documentation of indigenous knowledge: Starting 2001 NARI of the MoA is undertaking a research on integrated watershed management by focusing on a resources survey on the identification of indigenous knowledge related to integrated watershed management,

The GoSE with Financial support from GEF and UNDP is implementing a Sustainable Land Management (SLM) pilot project which will inter alia establishes knowledge management networks, document SLM best practices and lessons learned and finally disseminate good traditional practices in a form of replication.

Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources	
Goal 10. Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources	
Target 10.1. All access to genetic resources is in line with the Convention on Biological Diversity and its relevant provisions. Target 10.2. Benefits arising from the commercial and other utilization of genetic resources shared in a fair and equitable way with the countries providing such resources in line with the Convention on Biological Diversity and its relevant provisions	*Indicator to be developed* *Indicator to be developed*
Progress towards 2010 target Eritrea is not yet establishing mechanisms and frameworks for promoting fair and equitable sharing of the benefits arising out of the utilization of the genetic resources.	

Ensure provision of adequate resources	
Goal 11: Parties have improved financial, human, scientific, technical and technological capacity to implement the Convention	
Target 11.1. New and additional financial resources are transferred to developing country Parties, to allow for the effective implementation of their commitments under the Convention, in accordance with Article 20. Target 11.2. Technology is transferred to developing country Parties, to allow for the effective implementation of their commitments under the Convention, in accordance with its Article 20, paragraph 4.	• Official development assistance provided in support of the Convention
Progress towards 2010 target	

Eritrea is from the recipient end of the Official Development Assistances. So far GEF and UNDP are the two main organizations supporting Eritrea in implementing its commitment on the CBD.

4.2. Progress towards the Goals and Objectives of the Strategic Plan of the Convention

Table-18: Progress towards the Goals and Objectives of the Strategic Plan of the Convention

Strategic goals and objectives	Possible indicators
Goal 1: The Convention is fulfilling its leadership role in international biodiversity issues.	
1.1 The Convention is setting the global biodiversity agenda. 1.2 The Convention is promoting cooperation between all relevant international instruments and processes to enhance policy coherence. 1.3 Other international processes are actively supporting implementation of the Convention, in a manner consistent with their respective frameworks. 1.4 The Cartagena Protocol on Biosafety is widely implemented. 1.5 Biodiversity concerns are being integrated into relevant sectoral or cross-sectoral plans, programmes and policies at the regional and global levels. 1.6 Parties are collaborating at the regional and subregional levels to implement the Convention.	CBD provisions, COP decisions and 2010 target reflected in work plans of major international forums
Progress towards the goals and objectives of the Strategic plan 1.1 Eritrea believes that the global biodiversity issue is properly addressed at the convention level and the Countries NBSAP is believed to have contributed in setting national biodiversity agendas in line with CBD. 1.2 At National level – A very important workshop on the creation of synergy between the three environmental conventions (CBD,UNCCD UNFCCC) has been convened and a strategy for synergy was designed and endorsed by major stakeholders. Refer chapter 3, section 3.3 for detailed actions taken to synergize biodiversity into the respective conventions. 1.3 No information 1.4 Eritrea is fully implementing the Protocol. Refer to chapter 3, section 3.3.3 on the status of the implementation of the Protocol. (Focal Institution should revise this response in line with the information provided in national reports requested under the protocol) 1.5 Refer chapter 3 1.6 Eritrea is fully collaborating at regional and sub regional levels to implement the Convention	

Goal 2: Parties have improved financial, human, scientific, technical, and technological capacity to implement the Convention.	
2.1 All Parties have adequate capacity for implementation of priority actions in national biodiversity strategy and action plans. 2.2 Developing country Parties, in particular the least developed and the small island developing States amongst them, and other Parties with economies in transition, have sufficient resources available to implement the three objectives of the Convention. 2.3 Developing country Parties, in particular the least developed and the small island developing States amongst them, and other Parties with economies in transition, have increased resources and technology transfer available to implement the Cartagena Protocol on Biosafety. 2.4 All Parties have adequate capacity to implement the Cartagena Protocol on Biosafety. 2.5 Technical and scientific cooperation is making a significant contribution to building capacity.	Official development assistance provided in support of the Convention (OECD-DAC Statistics Committee) *Indicator to be developed consistent with VII/30*
<u>Progress towards the goals and objectives of the Strategic plan</u> 2.1 One of the major constraint encountered the implementation of the NBSAP is in adequate institutional and human capcity. See details in chapter 2. The national capacity needs self assessment for global environmental management in Eritrea has assessed the systemic and institutional capcity constraints for the implementation of Multi-lateral environmental agreements. The report can be accessed from DoE; 2.2 As one of the least developed countries, Eritrea is constrained by lack of financial resources to implement the three objectives of the Convention; 2.3 Biosafety being a new science and the implementation of the convention at an infant stage technology transfer has not been initiated; 2.4 Insufficient capacity to implement the Cartagena Protocol on Biosafety both at systemic and institutional levels. (Focal Institution should revise this response in line with the information provided in national reports requested under the protocol); 2.5 Even though the technical and financial support made by GEF and UNDP particularly related to marine biodiversity has contributed to improve the national capacity, there is still a huge capacity gap that need to be addressed in order to successfully implement the convention.	

Goal 3: National biodiversity strategies and action plans and the integration of biodiversity concerns into relevant sectors serve as an effective framework for the implementation of the objectives of the Convention.	

3.1 Every Party has effective national strategies, plans and programmes in place to provide a national framework for implementing the three objectives of the Convention and to set clear national priorities. 3.2 Every Party to the Cartagena Protocol on Biosafety has a regulatory framework in place and functioning to implement the Protocol. 3.3 Biodiversity concerns are being integrated into relevant national sectoral and cross-sectoral plans, programmes and policies. 3.4 The priorities in national biodiversity strategies and action plans are being actively implemented, as a means to achieve national implementation of the Convention, and as a significant contribution towards the global biodiversity agenda.	Number of Parties with national biodiversity strategies *To be developed* *Percentage of Parties with relevant national sectoral and cross-sectoral plans, programmes and policies in which biodiversity concerns are integrated* *To be developed* *Number of national biodiversity strategies and action plans that are being actively implemented*
<u>Progress towards the goals and objectives of the Strategic plan</u> 3.1 Eritrea has developed a National Biodiversity Strategies and Action Plan in line with article 6 of the convention. NBSAP is believed to provide a national framework for implanting the three objectives of the conventions. It also important to revise and update the plan; 3.2 Eritrea has designated DoE as a national focal point to be responsible on its behalf for liaison with the Secretariat. Eritrea is in the process of putting in place the National Biosafety Framework. Four set of guidelines have been prepared but all are awaiting for approval and endorsement. See Chapter 3, section 3.3.3 for list of guidelines. (Focal Institution should revise this response in line with the information provided in national reports requested under the protocol); 3.3 See Chapter 3 – relevant sectors and how biodiversity integrated into sectoral and cross sectoral policies, plans and programs for conservation and sustainable use of biodiversity resources is described in detail; 3.4 NBSAP is under implementation – See Chapter 2 on its progress, contribution to implementation of Articles of CBD which are designed to address the global biodiversity agenda.	

Goal 4: There is a better understanding of the importance of biodiversity and of the Convention, and this has led to broader engagement across society in implementation.	
4.1 All Parties are implementing a communication, education, and public awareness strategy and promoting public participation in support of the Convention.	*Possible indicator to be developed:* *Number of Parties implementing a communication, education and public awareness strategy and promoting public participation*

4.2 Every Party to the Cartagena Protocol on Biosafety is promoting and facilitating public awareness, education and participation in support of the Protocol.	*Percentage of public awareness programmes/projects about the importance of biodiversity* *Percentage of Parties with biodiversity on their public school curricula*
4.3 Indigenous and local communities are effectively involved in implementation and in the processes of the Convention, at national, regional and international levels.	*To be developed by the Ad Hoc Open-ended Working Group on Article 8(j)*
4.4 Key actors and stakeholders, including the private sector, are engaged in partnership to implement the Convention and are integrating biodiversity concerns into their relevant sectoral and cross-sectoral plans, programmes and policies.	*To be developed* *Indicator targeting private sector engagement, e.g. Voluntary type 2 partnerships in support of the implementation of the Convention*

Progress towards the goals and objectives of the Strategic plan

4.1 Eritrea has included a number of strategies on public awareness and education as part of it's NBSAP. The strategy was implemented public awareness and education priority activities through the relevant sector institutions and NGO. Biodiversity is mainstreamed into school curriculum. Progress on this area is satisfactory. Refer Chapter 2, thematic area 9 for the three major biodiversity components of Eritrea;

4.2 Consultation, analysis and training have been conducted to promote public awareness and broader participation during the preparation of the National Biosafety Framework. A paper on "*The role of biotechnology in promoting agricultural production and attaining food security*" has been presented at the workshop of the association of Eritrean in agricultural sciences (AEAS). (Focal Institution should revise this response in line with the information provided in national reports requested under the protocol);

4.3 Conservation and sustainable use of biodiversity is always implemented by making the local community at center. Enclosure site identification and implementation, protection of wildlife in general and endangered species in particular, village level water resources management, protection and management of catchments are always implemented with effective participation of local communities. The GoSE has encouraged the application of community by-laws and beliefs that enhance the conservation of biodiversity;

4.4 Refer Chapter 3 - for sectoral and cros sectoral plans integration of biodiversity concern.

4.3. Conclusions

4.3.1. Assessment of the Implementation of the Convention

Eritrea approved the Convention on Biological Diversity (CBD) on 21st March 1996. Thereafter, Eritrea has taken significant measures in the conservation and sustainable use of biodiversity. Eritrea also believes that it has made considerable effort to implement the three objectives of the convention and towards achieving the CBD's 2010 target and the strategic plan of the Convention. This was made by designing the NBSAP as an integral part of the national sectoral plans and programs which would be monitored and followed up by the respective sector institution as part of their institutional mandates.

With in the terrestrial biodiversity the expansion of permanent enclosures jointly with the introduction and expansion of improved traditional stoves has contributed significantly in improving the vitality and integrity of the habitat as well as the regenerative capacity of the forest resources of Semenawi Bahri (Green Belt Area) and the revival of wildlife species like *Felis pardus*, *Tragelaphus strepsiceros*, *Sylvicapra grimmia* and *Oreotragus oreotragus* and many bird.

The Eritrean Coastal Marine and Islands Biodiverstiy (ECMIB) project which was funded by GEF implemented by UNDP and executed by Ministry of Fisheries has contributed by initiating the establishment of the baseline data of the CMI biodiversity, developing Integrated Costal Area Management (ICAM), identification of protected areas and developing their management plan; increase public awareness of CMI biodiversity value. It has also brought noticeable impact on the level of individual and institutional capacity to the Ministry of fisheries. The substantial amount of work with communities including socio-economic surveys, awareness raising programmes, the sharing of information has also contributed for current status trend of Eritrea's Marine biodiversity which is believed to be still in good condition.

High awareness and sensitization of policy and decision makers was made on the importance of reverine forest conservation and sustainable use. The Number of trainings and sensitization workshops conducted during the preparation of the management plan and effort made to implement the NBSAP have contributed significantly in sensitizing and bringing attitude change on policy and decision makers at regional and national level in particular and the community in general on sustainable use of the Doum palm forest and on the importance of reverine forest conservation and sustainable use.

Despite these progresses there are still many gaps that need be addressed, including:

- Shortage of fund to develop project proposals attractive for funding and implement and monitor already on going programs related to the conservation and sustainable use of biological diversity;
- Low level of communication and follow up of the implementation of NBSAP;
- Limitation on human and institutional capacity: despite the effort made by the GoSE to strengthen its institution, there is still significant gap in human and institutional capacity compared the tasks the nation has to undertake in in-situ conservation, ex-

situ conservation, research and training which contribute to conservation and sustainable use of biological diversity, prevent and control alien invasive species and other measures that promote the conservation and sustainable use of biological diversity. There is also in sufficient capacity to develop project proposal attractive for external funding;

- Absence of policy and legal frameworks and management instruments on the fair and equitable sharing of benefits arising out of the utilization of genetic resources;
- Lack of coordination between government institutions: The major obstacle for extensive use of the NEAPG are lack of coordination between government institutions, low level of awareness about NEAPG at all level, shortage of fund and skilled human power in the area of EIA. Due to these facts not all development projects pass through the EIA procedures and guidelines outlined in national NEAPG document;
- Ministry of Fisheries should develop a project proposal with a project objective of eradication and containment of potentially harmful **alien invasive species** followed by soliciting fund for action.

4.3.2. Lessons learned

- There is no one single institution that practically assumes the responsible to follow up the implementation of the NBSAP and there is no monitor and reporting mechanism in place to measure the progress made in achieving targets of the planned priority activities. In such situations the most effective way of addressing biological diversity issues is found to mainstream the NBSAP priority actions into the relevant sector institutions programs through a continuous consultation and provision of sensitization and awareness programs;

- One of the important good lessen learned and need to be sustained and replicated as biodiversity information sharing and raising awareness is the successful effort made by ECMIB project of Ministry of Fisheries on the development of suitable CMI biodiversity awareness supporting material like development of web sites to post CMI information and publishing regular newsletters. This effort has to be continue regarding to marine biodiversity and replicated to agricultural and terrestrial biodiversity;

- More importantly, the NBSAP has to be revised and updated by addressing the barriers encounter during its implementation and incorporating the lesson learned.

4.3.3 Future Priorities and Capacity Building Needs

- In 2007 the National Capacity Needs Self-Assessment (NCSA) for the implementation of MEAs has identified gaps and priority needs, opportunities for synergistic cross cutting and strategy and action plan for capacity building in the country at various levels, to help implement global environmental conventions, mainly focused on UNCBD, UNCCD and UNFCCC. Those priorities need particularly activities identified for CBD need to be implemented;

- Establish strong taxonomic institutions and provide training to improve the taxonomic knowledge of relevant institutions. In the mean time it is highly recommended to upgrade the teaching herbarium in the department of biology to serve as national herbarium;

- Strengthen institutional capacity and provide training to Ministry of Fisheries and relevant organization on ICAM so that its implementation would be hastened;

- Strengthen country's marine and coastal environmental monitoring capacity by establishing a full fledged laboratory that would be operational in the Coastal city of Massawa that caters to inter-setoral needs of environmental assessment (EIA) of the coastal and marine areas;

- Strengthen the nation Plant Genetic Resources Unit (PGRU) of the National Agricultural Research Institute in terms of human capacity, infrastructures, equipments and facilities;

- Establishing baseline information on the national biodiversity and clear national indicators that correspond to global indicators so that it would be easy to measure achievements made through the implementation of NBSAP;
- Put in place policy and legal frameworks and management instruments that ensure fair and equitable share of benefits arising from the utilization of genetic resources.

4.3.4. Suggested Actions at the Regional and Global Levels

- Eritrea is committed to allocate its limited available resources for the conservation and sustainable use of its natural resources. Continued financial and technical resource will be needed to ensure that this commitment is continually achieved. This has to be coupled with financial and technical support from donor countries and organizations for implementation of programmes and projects that are in line with national priorities, and aligned to the objectives of CBD;
- Provide technical and financial support to countries so that they would be able to establish baseline information and relevant indicators to measures progresses in respect to contracting parties' commitment in conservation and sustainable use biological diversity.

Appendix I Information concerning reporting Party and preparation of national report

A. Reporting Party

Contracting Party	The State of Eritrea
NATIONAL FOCAL POINT	
Full name of the institution	Department of Environment, Ministry of Land, Water & Environment
Name and title of contact officer	Mr. Mogos Weldeyohannes Director General
Mailing address	P.O. Box 5713, Asmara, Eritrea
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CONTACT OFFICER FOR NATIONAL REPORT (IF DIFFERENT FROM ABOVE)	
Full name of the institution	Department of Environment, Ministry of Land, Water & Environment
Name and title of contact officer	Tewolde G. Siratu, Director, Environmental Information & Assessment Division
Mailing address	P.O. Box 5713, Asmara, Eritrea
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Fax	291-1-126095
E-mail	depenvdg@eol.com.er
SUBMISSION	
Signature of officer responsible for submitting national report	
Date of submission	

B. Process of preparation of national report

Designate an Agency:- The preparation of the Fourth National Report to the United Nation Convention on Biological Diversity was coordinated by Department of Environment of the Ministry of Land, Water and Environment (national focal institution) in consultation with key stakeholders identified as lead agencies in the implementation of the NBSAP and those involved in the conservation and sustainable use of biological diversity.

Establishing the Core Team - The Director General of the DoE has identified core experts to lead the national report preparation process from the relevant institutions that have prior knowledge on the convention and the reporting process. The core team was assisted by experts form the respective sector and agencies who are directly involved in the monitoring and evaluation of biological diversity related works.

Identification of Key Stakeholders – Considering the importance to ensure national report reflects comprehensively national situation the established core team at the initial stage has identified all key stakeholders which would be involved and/or consulted through out the process of this national report writing. The identified and/or consulted sectors or institutions are:

- The three main Departments of the Ministry of Agriculture (APDD, RSD and NARI)
- Department of Land of the MoLWE,
- Department of Environment
- Water Resources Department,
- Ministry of Education,
- Ministry of Fisheries,
- Ministry of Information,
- Hamelmalo Agricultural College,
- National Union of Eritrean Women,
- National Union of Eritrean Youth and Students
- UNDP,
- FAO,
- TICD,
- RTI,
- The Six Zoba Administrations.

Review of relevant documents:- Prior to developing of the work plan, methodology and starting the consultation process, the core team has reviewed all relevant documents, previous national reports, available sectoral annual reports, research papers, web sites, project reports to collect information relevant to reporting the progress on the implementation of the NBSAP, status, trend and threat to biodiversity, mainstreaming of biodiversity and the 2010 target and implementation of strategic plan.

Develop a work plan: the core team in consultation with Director Genral of the DoE has prepred a workplan that elaborate the whole 4th National Report preparation process starting form document reviewe up to final report submission.

Conduct Consultation: the core team has conducted a number of consutations with key stakeholders at headquartes, zoba levels particulrily on regions where biodiversity hot spot areas exist and with communities. Particpatory methodology using tables, checklist and leading questions were used to facilitate the gathering of data and information.

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