

ENVIRONMENTAL THREATS AND OPPORTUNITIES ASSESSMENT FOR ERITREA

With Special Focus on Tropical Forestry
And Biological Diversity

USAID PURCHASE ORDER 661-0-00-02-00084-00

SUBMITTED TO:

USAID ERITREA MISSION

ASMARA, ERITREA

Submitted By:

CARL F. MAXWELL
IYOB TESFU

September 18, 2002

TABLE OF CONTENTS

TABLE OF CONTENTS	1
ACRONYMS.....	3
EXECUTIVE SUMMARY.....	4
A. Purpose of Environmental Threats and Opportunities Assessment	6
B. Overview of the socio-economic environment.....	7
Eritrea country development strategy	8
SECTION II – STATE OF KEY NATURAL RESOURCES.....	9
A. BIODIVERSITY ASSESSMENT FOR ERITREA	9
1. INTRODUCTION	9
2. STATUS OF THE BIODIVERSITY IN ERITREA	10
3. Terrestrial Biodiversity	11
4. Marine Biodiversity	14
5. Agro-Biodiversity	14
B. BIODIVERSITY CONSERVATION.....	15
1. Conservation Trend.....	15
2. Proposed Protected Areas (Potential reserve areas or national parks).....	15
3. Conservation outside Protected (Ex-Situ) Areas	17
C. THREATS TO BIODIVERSITY	17
1. Drought	17
2. Agro chemicals and high yielding alien seeds.....	18
3. Economic Activities and Tourism along the Red Sea Cost.....	18
4. Alien Invasive Plant Species.....	19
5. Alien Invasive Animal Species.....	19
6. Municipal Solid and Liquid Waste and Industrial Effluent Pollution	20
7. Land Clearing and Tree Cutting	20
<u>SECTION III - ENVIRONMENTAL POLICY FRAMEWORK.....</u>	21
A. Policy.....	21
1. National Constitution and Eritrea’s Development Policy.....	21
2. Biodiversity Conservation in the National Development Policy.....	21
3. Existing Legislative Framework.....	22
B. Institutions linked with Biodiversity Conservation.....	23
1. Ministry of Land, Water, and Environment (MLWE).....	23
2. Ministry of Agriculture (MOA)	23
3. Ministry of Fisheries (MOF).....	24
C. Recommendations in the National Biodiversity Strategy and Action Plan.....	24
SECTION IV – ANALYSIS OF IMPACTS ON NATURAL RESOURCES.....	27
A. Purpose	27
B. Impact of past and current events (Eritrea and donor supported)	27
1. The outbreak of war with Ethiopia in 1998-2000.....	27
2. The disengagement of forces in 2001-02.....	28
3. Economic Policy	28

4. Finance & Banking	28
5. Public expenditure	28
6. Monetary Policy.....	29
7. Infrastructure.....	29
8. Agriculture	31
9. Fisheries	32
10. Trade & Industry.....	34
11. Energy & Mining.....	34
12. Tourism.....	35
13. Health.....	36
14. Small and Medium Enterprise	36
SECTION V – CONSERVATION OF TROPICAL FORESTS AND ENDANGERED SPECIES	38
<i>A. Eritrea’s Integrated Strategic Plan (ISP)</i>	38
1. Opportunities and entry-points	38
2. Environmental Management Activities	39
SO4: Use of Primary Health Services Increased.....	39
SO5: Growth for Rural Sector Improved	40
SO6: Increased Capacity and Participation for Broad-based Development	42
<i>B. Biodiversity and Tropical Forestry Recommendations</i>	44
PROPOSED ACTIONS FOR USAID/ERITREA.....	44
<i>C. Public Institutions</i>	45
1. Effectiveness of relevant public institutions to utilize, develop and /or monitor environmental resources.....	45
2. Mitigate negative development impacts	46
ANNEX A - Typical USAID Supported Activities and Their Potential Environmental Implications	48
ANNEX B - PERSONS CONTACTED	49
ANNEX C - REFERENCE MATERIALS	50

ACRONYMS

ERREC	Eritrean Relief and Refugee Commission
NEMPE	National Environmental Management Plan for Eritrea
GSE	Government of the State of Eritrea
CBD	Convention on Biological Diversity
NBSAP	National Biodiversity Strategy and Action Plan
SO	Strategic Objective
MLWE	Ministry of Land Water and Environment
MOA	Ministry of Agriculture
MOF	Ministry of Fisheries
MEM	Ministry of Energy and Mines
DOE	Department of Environment
PMU	Project Management Unit
ERP	Emergency Reconstruction Program
ETOA	Environmental Threats and Opportunities Assessment
ISP	Integrated Strategic Plan
FAA	Foreign Assistance Act
USAID	United States Agency for International Development
GEF	Global Environment Fund
NEPFAP	National Economic Policy Framework and Program
NGO	Non Governmental Organization
FAO	Food and Agricultural Organization
NDVI	Normalized Difference Vegetation Index
NBSAP	National Biodiversity Strategy and Action Plan
EBSAR	Eritrea Biodiversity Stocktaking Assessment Report
UNDP	United Nations Development Program
UNEP	United Nations Environment Program

Executive Summary

The Environmental Threats and Opportunities Assessment (ETOA) will constitute the Environmental Annex required in the Mission's Integrated Strategic Plan (ISP) for 2003-2008. Carl F. Maxwell and Mr. Iyob Tesfu prepared this assessment under a short-term consultancy, Purchase Order 661-0-00-02-00084-00. The purpose of the ETOA is to advance USAID/Eritrea's ISP by providing and ensuring:

- An overall understanding of developmental threats to Environment, Biodiversity and Tropical Forests;
- An assessment of the environmental threats and opportunities (ETOA) within the Mission's geographic and programmatic scope of responsibility; and,
- Ensuring basic compliance with the environmental provisions of the FAA.

At present, the country faces a number of daunting development challenges: meeting immediate needs for emergency humanitarian assistance; reconstructing infrastructure damaged during the war; assisting nearly one-third of the population that has been displaced to integrate within a limited economy; demobilizing 200,000 soldiers; rebuilding the economy and restoring social services. Prior to the war in 1998, the National Environmental Management Plan for Eritrea (NEMPE) was prepared and approved by the Government of the State of Eritrea (GSE) in 1995. Implementation of the Plan was started in 1996. The GSE has formally approved the Convention of Biodiversity (CBD) on March 21, 1996 and has prepared its National Biodiversity Strategy and Action Plan (NBSAP) in July 2000. Interviews were conducted with key government officials, biologists, wildlife experts and conservationist to clarify details and to get a more informal understanding of the on-the-ground biodiversity conservation picture in Eritrea. Primary contacts with the GSE were with the Department of Environment (DOE) and the Ministry of Agriculture (MOA) concerning terrestrial forests and wild life of Eritrea, including a visit to the Ministry of Fisheries, whose head office located in Massawa in regard to Marine Biodiversity studies. The NBSAP was a major source of information for this assessment report. Other sources of information are listed in the Appendices.

The approach used in the assessment was to collect and analyze information on biodiversity and tropical forestry. This included document research, interviews with key individuals in organizations concerned with biodiversity and tropical forestry (see Annex B for a list of persons contacted), and field trips (Meeting reports available separately). In addition to extensive interviews with stakeholders in Eritrea, the team met in Massawa, Eritrea with key persons in the Ministry of Fisheries, other government institutions and NGOs. In addition the team visited various sites in the capital Asmara and surrounding urban areas including a visit to Zoba Anseba (Keren) and Zoba Gash-Barka (Barentu) experiencing firsthand many of the major landscapes and biodiversity in Eritrea. The recently completed National Biodiversity Strategy and Action Plan (NBSAP) including the USAID/REDSO/ESA Strategy – ETOA completed in May 2000 was a major source of information for this assessment report. The team reviewed the twenty-six recommendations of the NBSAP and recommends six actions to be considered for the Integrated Strategic Plan. These are listed on page 23 of this report.

Section V “Conservation of Tropical Forestry and Endangered Species” reviews the context for USAID/Eritrea’s actions, and considers each component of the strategy in terms of environmental issues, including appropriateness of strategic choices; potential impacts of activities; issues of environmental compliance; and opportunities for integrating and linking environmental activities.

Section IV “Analysis of Impacts on Natural Resources” reviews the Cause-Effect relationship of various sector activities, both past and present, in regard to their impact on the environment, biodiversity and the forest of Eritrea. This analysis was used to determine which actions best fit into the strategic objective activities of the ISP.

Section I - Introduction

A. Purpose of Environmental Threats and Opportunities Assessment

This Environmental Threats and Opportunities Assessment (ETOA) with Special Focus on Biological Diversity and Tropical Forestry supports USAID/Eritrea's Integrated Strategic Plan 2003-2008 and will advance USAID/Eritrea's Integrated Strategic Plan (ISP) by providing and ensuring the following requirements:

- An overall understanding of developmental threats to Environment, Biodiversity and Tropical Forests;
- An assessment of the environmental threats and opportunities (ETOA) within the Mission's geographic and programmatic scope of responsibility; and,
- Ensuring basic compliance with the environmental provisions of the FAA.

This Environmental Threats and Opportunities Assessment for Eritrea has three interlinked objectives:

- Document the state of key natural resources
- Conduct an analysis of how past events and current initiatives (both Eritrean and donor supported) have impacted on the country's natural resources.
- Identify opportunities and entry-points for USAID/Eritrea's efforts under the new ISP that could positively influence the conservation of Tropical Forests (FAA 118) and Endangered Species (Biodiversity) (FAA 119) and, improve Environmental Management Activities.

The USAID Eritrea Mission under a Purchase Order to Carl F. Maxwell, Environment and Natural Resources consultant, funded the assessment. A two-person team consisting of Carl F. Maxwell and Iyob Tesfu worked in Eritrea from 4 September to 18 September 2002 in the development and completion of the ETOA.

B. Overview of the socio-economic environment¹



Eritrea

Area: Total: 124,300 sq km

Land use: arable land: 12%

permanent crops: 1%

permanent pastures: 49%

forest and woodland: 6%

other: 32% (1998 est.)

Environment: deforestation;
desertification;

Current issues: soil erosion;

overgrazing;

loss of infrastructure from civil
warfare

Population: 3.6 million

Population growth rate: 3.84% (2001
est.)

Roads: total: 6,990 km

Paved: 874 km

Telephone lines (2000): 30,554

Ports and harbors: Assab, Massawa

Railways: total: 117 km

International airports: Asmara,
Massawa, Assab

Eritrea is Africa's newest independent republic, having gained its independence from Ethiopia in 1993. It lies to the north of Ethiopia and forms part of the North East African Region. The capital city is Asmara (391,000). Other major towns are the ports of Massawa and Assab and Dekamere. The main working languages are Tigrinya, Arabic and English. The government is committed to a free market economic system and has already privatized most of the public enterprises in the country. The Eritrean economy is largely based on agriculture, which employs 80% of the population but currently may contribute as little as 22% to GDP. Export crops include coffee, shrimp, cotton, fruit, hides, and meat, but farmers are largely dependent on rain-fed agriculture, and growth in this and other sectors is hampered by lack of a dependable water supply. Worker remittances from abroad currently contribute 40% of GDP.

Economic growth in Eritrea is dependent on overcoming social and economic problems such as illiteracy, unemployment, lack of training and the need for foreign investment and streamlining of the bureaucracy. The private sector is a primary area of growth. An immediate threat faced by Eritrea is that of armed conflict with Ethiopia. The Eritrean mining and oil industries are key elements in the economy of the country. Eritrea has considerable mineral and oil potential although there has been little exploration activity so far. The downstream oil industry is also well developed following government policies to encourage its development. The refinery at Assab used to supply the local market as well as neighboring Ethiopia, but is now shut down. The parastatal utility, Eritrean Electricity Authority provides electricity. The economy is agriculture

¹ A report by Christian Aid on the worsening food crisis –January 2000; CIA Country profile; Eritrea, A Country Handbook by the Ministry of Information of Eritrea, 2002.

based and employs a large percentage of the population through farming and herding. The industrial sector is small. Further developments are expected in the offshore oil, fishing and tourism industries. There is an international airport at Asmara served by Eritrean Airlines. The state of health, the current immunizations status, location and the local disease situation lead to the risk of contraction of hepatitis A, malaria, meningitis, schistosomiasis, tuberculosis, yellow fever (regional), and typhoid fever.

From late 1998, drought and the war with Ethiopia have become the two major influences on Eritrea's social, political and economic life, thereby defining the context of the food shortages.

Eritrea country development strategy

The three main elements of the country's development strategy, as articulated in the 1994 Macro-Policy Paper are:

- Inducing widely shared, sustained economic growth by establishing a competitive environment in which efficient, export-oriented private firms thrive.
- Raising the skills and well being of people by investing in education, nutrition, health care and water and sanitation systems.
- Reducing rural poverty by investing in rural infrastructure, agriculture, management of livestock and pastures, and development of fisheries.

SECTION II – STATE OF KEY NATURAL RESOURCES

A. BIODIVERSITY ASSESSMENT FOR ERITREA

1. INTRODUCTION

Eritrea, Africa's youngest nation, declared its Independence on May 24th 1993, two years after the end of a 30year-liberation struggle. It is located in the NE corner of the Horn of Africa, bordered by Sudan to the west, Ethiopia to the south, Djibouti to the southeast, and the Red Sea to the east. It has a population of 3.6 million and a land area of 124,300 km². The Eritrea has a 1200-kilometer costal line (18% of the total Red Sea costal line) and more than 350 islands. Mount Embasoira, which is the highest point in the country, is 3,013 m above sea level while the lowest point of the country, which is known, as the Dalol Depression is 75 m below sea level.

The highlands have a cool temperate climate while the lowlands are characterized by a hot and humid climate, especially along the coast. Eritrea has two rainy seasons. Large part of the country, the highlands and western lowlands, is in the Saharan rainfall zone and receives its heaviest rains from the southwest monsoons during winter June to September and the eastern coastal plain get rain during the summer, October to January, from the Red Sea and Arabian Gulf. Rainfall varies from an annual average of 400 mm to 650 mm in the highlands, and from 200 mm in the northwestern lowland to 800 mm in the southwestern lowland. Over half of the total land area is unsuitable or marginal for agriculture due to steep topography and lack of reliable annual rainfall.

Due to the fact that Eritrea is endowed with contrasting physical features and climatic zones, it has a variety of ecosystems, species and genetic complexes. Collection of biodiversity information in Eritrea has not been extensive over the past 40 years. There is also a large shortfall in the number of personnel, institutional capacity and financial resources, which are required to fill the existing biodiversity information gap. Despite all these shortcomings, Eritrea has prepared a number of national guidelines and action plans with regard to the environment in general and biodiversity in particular. One of these documents is the Eritrean Biodiversity Stocktaking Assessment Report (EBSAR), a report that has attempted to identify and quantify the various fauna and flora species diversity within Eritrea. According to this report there are a large number of extinct, endangered of extinction, and secured species that are identified.

The biodiversity of Eritrea is described under three core areas in the National Biodiversity Strategy and Action Plan (NBSAP). These are the natural terrestrial habitats, the diverse agro-ecosystems, and the Coastal Marine and Island (CMI) ecosystems.

The status of biodiversity across these three core areas is not known precisely at present. It is clear that throughout the 20th century, growing human influence amplified by war and drought has placed increasing pressure on the natural terrestrial biodiversity of the country. Similarly, the agro-biodiversity associated with indigenous, traditional farming systems has been disrupted

severely by the same forces. On the other hand, the CMI ecosystems of the Eritrean Red Sea coast have been much less affected by these pressures and relatively, are ecologically intact.

Although the long-term trend in biodiversity status in Eritrea over this century has been negative, there are encouraging signs of improvement over the recent past decade. Between 1991 and 1998, the overall status of wild terrestrial biodiversity in Eritrea has improved, albeit from rather poor initial condition. This improvement has resulted from the cessation of armed conflict and a sequence of relatively good years of rainfall. This period of stability has allowed both natural habitat and agricultural systems to recover from their degraded state. The period of relative stability and good rainfall has also contributed to the success of efforts to intensify agricultural production, increasing the (man-made) threat to some agro-biodiversity. In the marine sector, the increase in economic activity has proceeded fairly slowly and threats to marine biodiversity are still relatively localised (e.g. pollution impacts around Massawa and Aseb).

At present forest cover is about 1% of the land area of Eritrea. The forest cover is primarily found in the Green Belt Zone. This Zone is the natural gene bank of a number of indigenous plant and animal species of Eritrea. Woodland and acacia woodlands also occur in the Western Lowlands, Eastern Lowlands and Coastal Plains. Coral reefs and fringing mangrove vegetation are also very common in the Coastal, Marine and Islands (CMI) environment. There are no wetlands in Eritrea as such. With the exception of the Setit River all of the rivers in the country are seasonal.

Biodiversity-related information at the ecosystem, species and genetic level (where appropriate) has been collated and reviewed in the Eritrean Biodiversity Stocktaking Assessment Report (EBSAR) for terrestrial, marine and agricultural systems. The various ecosystem level classification of Eritrea are described from page 5 to 67 while the species level classifications are presented for the Terrestrial, Marine and Agro-biodiversity, at the end of each sections of the report. Genetic level diversity information is available only for the Agro-biodiversity. The summary of the information is given in the following section of this report.

2. STATUS OF THE BIODIVERSITY IN ERITREA

To date there are only a few studies that have been made about biodiversity in general and about species diversity in particular in Eritrea. The identification of the existing species in the Terrestrial, Agricultural and Marine environment is far from being completed and with the exclusion of a few vertebrates; no taxonomic (classification) research of any of the many identified species has been made. All the facts or proposals stated in this part of the report have been taken from the NBSAP and EBSAR studies.

There are a number of land cover classification maps developed for Eritrea. Eco-geographical, agro-ecological, and vegetation cover classifications are described in the Eritrean Biodiversity Stocktaking Assessment Report. These classifications confine the main regional ecological variations within Eritrea but provide little detailed information about the species diversity that exists within these different ecological regions. In almost all cases, the level of ecological and/or biodiversity information about particular ecosystems and habitats e.g. *Juniperus* forest, riverine forest, coral reefs, traditional farming systems are incomplete. However, encouraging progress in eliminating this information gap is being made by the government institutions that are mandated to carry out the assignment; Institutions such as the Ministry of Land, Water and Environment Department of Environment, Ministry of Fisheries and Ministry of Agriculture.

The natural habitat protection or conservation areas that are soon to be under protection and conservation management are identified. Currently, Eritrea has no formal protected areas that are legally gazetted, although a number of potential locations that have been identified and partially surveyed by the MOA. The species richness and biodiversity status of these surveyed protected areas can be noticed by just few primary surveys; therefore it is unlikely that more detailed biodiversity study will change the priorities given to these areas in the future. Detailed survey and analysis in the future may help to locate additional protected areas. The current absence of formal protected areas does not mean that biodiversity resources are not being conserved in Eritrea. Since 1989 around 148,000 ha. of land has been placed under partial or complete closure, for example, protection of the resource area from any type of human utilization for firewood and grazing. The establishment of closures is usually carried out through joint consultation and agreements between local communities and the Ministry of Agriculture. Although much of the land was placed under enclosure because it was degraded to some extent, it still represents a significant area of potentially valuable land for biodiversity conservation. These days many of the closures are showing clear signs of increase in vegetation cover, but their biodiversity status is not being adequately monitored so far.

3. Terrestrial Biodiversity

Terrestrial biodiversity is defined here as the natural biological systems occupying the land area of Eritrea, excluding the marine systems and the biodiversity associated with agricultural systems. Obviously, 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.

Few studies of ecosystem biodiversity have been completed in Eritrea but there are a number of national land use classifications that have been developed. Eco-geographical, agro-ecological, and vegetation cover classifications have been produced at coarse scales for some areas. These classifications capture the main regional ecological variations within the country but provide little detailed information about the species diversity that exists within these regions.

In the Ministry of Land, Water and Environment, the Department of Land has classified Eritrea into 6 agro-ecological zones on the basis of altitude, temperature and rainfall range and other agricultural factors. These classified zones correspond broadly with the ecological zones produced by FAO (1997) from aggregate Normalised Difference Vegetation Index (NDVI) data derived from NOAA-AVHRR satellite images. The agro-ecological zones clearly show the very high influence of adequate rainfall availability on vegetation productivity. The vegetation productivity is likely to correlate strongly with overall biodiversity species richness, although it is likely that each agro-ecological zone will contain some plant and animal species not found in any other zone. This makes it crucial that for full biodiversity conservation there must be a certain minimum area of natural habitat maintained under natural conditions in each agro-ecological zone. It is believed that the six agro-ecological zones correlate, to a reasonable extent, with the six new regional administrative boundaries, therefore there is a need of establishment of national reserves in each zone.

At this time, the status of natural terrestrial ecosystem biodiversity in Eritrea can be summarized conveniently under three broad categories (NBSAP, pp11)

Low biodiversity, but stable: Much land in Eritrea, for example, most of Agro-ecological zones Arid Highland, Arid Lowland and Semi-desert, currently have very low human population density and use. This situation is likely to remain the same for the near future at least and the biodiversity status of such regions can be considered to be relatively stable. These areas are quite similar ecologically and mostly low in terms of

biodiversity richness, although they may contain interesting and important endemic species in particular places.

Moderate biodiversity and threatened: The land in Agro-ecological zones namely Sub-humid, Moist Highland and Moist lowland has a higher overall level of biodiversity due to increased rainfall. This higher potential productivity also makes the land more suitable for agriculture and thus for associated human habitation and the additional pressures which this brings. In these areas, the potential for conflict between biodiversity conservation and sustainable use and conversion to alternative uses is high. Careful planning and strong management will be required to avoid unnecessary loss of biodiversity.

Degraded land: Land of this type may be found in most agro-ecological zones, but degraded land within zones Sub-humid, Moist Highland and Moist lowland is the most significant from a biodiversity perspective. Degraded land in these zones is likely to continue to lose its remaining biodiversity if it is left unmanaged. Active intervention of some kind is required to restore this land to a self-sustaining, ecologically useful condition (either as natural habitat or as productive land for agriculture).

With respect to diversity of species, the statuses of terrestrial Biodiversity can be summarized as follows:

Vertebrate Fauna: There are a limited number of Species level diversity reviews for a number of major vertebrate faunas prior to independence. There are some studies carried out by the Italians and British in the years presiding 1960. There exist 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. The species checklists presented in the EBSAR for mammals, birds, reptiles, amphibians, fish and plants are expected to be used as a resource for expanding the range of taxa for which information is collected. Summary of the statuses of each vertebrate fauna is given below.

Mammals: A total of 126 mammal species have been listed in a recent compilation of existing information. This total includes 9 marine mammal species known to occur in Eritrean territorial waters, but excludes 9 domesticated mammals: sheep, goat, cow, pig, horse, donkey, camel, plus cat and dog. The population status of most of these wild species is poorly known at present, but has been ranked in 6 categories: *Critical* [Extinct], *Critical*, *Endangered*, *Rare*, *Common*, or of *Unknown Status*. *Critical* [Extinct] these are the mammals that are not reliably recorded since 1990 and certainly, or almost certainly, extinct in Eritrea they are 9 in number. *Critical*: not reliably recorded since 1990 but known from anecdotal evidence, these are 9 in number. *Endangered*: known from less than 10 sighting and/or from less than 3 separate locations since 1990, 13 in number. *Rare*: known from between than 10 and 50 sighting and/or from between 3 and 10 separate locations since 1990, these are 11 in number. *Common*: known from more than 50 sighting and/or from more than 10 separate locations since 1990. These are 20 in number. *Unknown status*: not identifiable due to nocturnal habit, small size, lack of identification features, etc these are 64 in number; this total includes three species Brown and Black Rat and Domestic Mouse which are common, but not seen "in the field" by wildlife staff of MOA.

Of the seventeen mammal taxa (species/sub-species) of global conservation concern, which appear on the Eritrean checklist, only the Eritrean sub-species of the warthog (*Phacochoerus africanus aeliana*), Soemmerring's Gazelle (*Gazella soemmerringi*) and Dugong (*Dugong dugon*)

can be ranked as Common in Eritrea using the criteria above. Four species/subspecies, Gelada (*Theropithecus gelada*), Ethiopian Wolf (*Canis simiensis ruppell*), Walia Ibex (*Capra walie*) and Black Rhinoceros (*Diceros bicornis*) are certainly extinct in Eritrea. Two species / subspecies, African Wild Dog (*Lycaon pictus*), Lion (*Panthera leo*) are considered Critical, probably extinct. Three, Hartebeest (*Alcelaphus buselaphus*), Red-fronted gazelle (*Gazella rufifrons*), Nubian Ibex (*Capra ibex nubiana*) are considered Endangered; and two, Elephant (*Loxodonta africana*), African Wild Ass (*Equus africanus*) are considered Rare. Three bat species are of Unknown status in Eritrea.

It is clear that a number of mammals, notably Elephant (In Gash Barka), Wild Ass (In Southern Red Sea), Greater Kudu (In Gash Barka and In Southern Red Sea), and Civet are in danger of national extinction unless specific measures are put in place to protect them in the short-term.

Birds: There were comprehensive birds checklist compiled for Eritrea in 1957. This listed a total of 577 bird species. It is likely that the number birds presented here includes a number of species no longer present in Eritrea. In addition, the list includes a number of single unverified observations. Some of these may be correct sighting of resident or migrant birds, some may be sightings of rare vagrants and some may be misidentifications.

Of this total list species, around 320 are resident, of which about 50% have historical breeding records. Around 150 are Palaearctic migrants moving south from Europe to Africa; of these, around 40 are recorded as having breeding sites in Eritrea. Around 45 species are intra-African migrants, of which around 10 are thought to breed in Eritrea. The remainder are either vagrants or of unknown status.

Eritrea has no truly national endemic bird species, but does share up to 13 "endemics" with Ethiopia alone. These species are all located in the open upland country around Senafe, an area that has not been prioritised for protected area status. Only the Black-winged Lovebird and Golden-backed Woodpecker have been recorded since 1990. It should be a priority to survey the main bird species areas such as the Green Belt, Gash River and Barka river Basins, all the courses of the riverine forest in Gash Barka and Anseba zones, The Buri Peninsula, and other environmentally sensitive areas.

Reptiles and amphibians: Knowledge of biodiversity of Eritrean reptiles and amphibians is extremely weak. A recent checklist has dramatically improved the historical knowledgebase but wider and detailed information is still almost non-existent. In the checklist a total of 90 reptiles and 19 amphibian species have been recorded for Eritrea. This is certainly an underestimate because common, widespread taxa do not appear on the list and special reptiles distribution is very high in countries like Eritrea with arid and semi-arid environment.

Flora: Plant biodiversity in Eritrea is under-collected and understudied. No national checklist exists and the regional Flora is still incomplete. A number of good regional vegetation descriptions exist and are summarised in the Eritrean Biodiversity Stocktaking assessment Report (page 110 to 119). In the absence of a national checklist, a number of site- specific checklists are included - one list that has almost 700 species indicates that considerable plant diversity may persist in human-altered landscapes. A number of endangered tree species are listed, but the quantitative basis for concern is not well documented

Other: For all other taxa (e.g. invertebrates and microbes), the level of knowledge of diversity is weak.

4. Marine Biodiversity

The Eritrean marine and coastal zone is situated in the southern sector of the Red Sea, an almost enclosed, hot, saline body of water that harbours 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 sub-set of that found in the Indo-Pacific Region, and is beginning to show signs of divergence following isolation, especially amongst the 1,248 species of fish.

The Eritrean coastline is hot and dry and sparsely inhabited. This has contributed to the survival of a relatively pristine coastal and marine environment, of which the coral reefs and their associated fish assemblages represent the most diverse ecosystems in Eritrea. Over 100 birds, 500 fish and 44 genera of hard corals have been recorded by recent surveys. In addition, the Eritrean 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.

Additional surveys are required to fully establish which of the many mainland coastal and island sites would be the best suited for protected area status, but this should be decided before, or in parallel with any increase in the levels of coral reef-based tourism. The number of coral reef sites of exceptional quality for dive tourism appears to be fairly limited - much of the Eritrea's reef is affected by natural turbidity, sedimentation and storm damage.

Increases in commercial fishing activity, oil and gas production offshore and pollution from onshore industry and urban waste flows all represent potential threats to marine biodiversity.

5. Agro-Biodiversity

Approximately 50% of the total area of Eritrea is utilized for some form of agriculture in the form of crops or grazing for livestock. The patterns of land use over this area will be a major determinant of biodiversity conservation and use over the entire country. Eritrea is among the countries recognized by the Russian scientist, N. Vavilov, as a centre of origin for some important crops: sorghum, pearl millet, finger millet, chick pea, taff, sesame, Niger, fenugreek, oats, mustard, grass pea, cowpea, okra and as a centre of diversity for barley and wheat crop species. Traditional farming systems have developed these indigenous crops and landraces over many hundreds of years and, in many parts of Eritrea, will persist for some time. Thus a considerable amount of agricultural biodiversity is still being actively conserved *in situ*. However, the present food deficit and current government agricultural policies will undoubtedly lead to significant changes in farming practices and may well lead to the long-term erosion of crop genetic diversity *in situ*. Current capacity to replace *in situ* conservation with *ex situ* storage of crop genetic resources is inadequate

In the virtual absence of chemical pest control, crop-plants must be "tested" for resistance and yield under difficult conditions every growing season - this indicates that Eritrean plant genetic resources could harbour an interesting selection of adaptations for use in crop improvement breeding programmes. A list of insect, weed and microbial pests was compiled in the Biodiversity Stocktaking Assessment; this is undoubtedly rather incomplete, but might serve as the basis for a more extensive compilation in the future.

There is a considerable number of livestock diversity in Eritrea. There are three indigenous breeds of cattle, including the Barka, which has great potential for future breeding programmes. There are also three breeds of sheep, three of goats and a range of poorly defined variation in equine and camel stock. At present, this indigenous diversity is relatively secure – all breeds are still widely distributed, population numbers are increasing and the rate of introduction of improved stock from overseas is low. There is a need to characterize the indigenous breeds more clearly as part of the national livestock improvement in order to guarantee that the best characteristics of the different varieties can be used for future breeding.

B. BIODIVERSITY CONSERVATION

1. Conservation Trend

Only a century ago, 30% of Eritrea was covered by forest. By 1952, that amount has dwindled to 11%. In 1960, forest cover was estimated to total a mere of 5% of the country. At the time of independence the forest cover of Eritrea was only 0.4% of the total land cover. In July 1997 FOA carried out an aerial survey inspection of the major closed to medium-closed forest areas a study for MOA and prepared a forest cover map of Eritrea. According to an FAO survey, vegetation cover data for forest (both closed to medium closed and open) is 1001 km² or 0.8% of the total land area. Woodland (both closed to medium closed and open) is 14,074 km² or 11.18%; Bush (Grassland, wooded grassland and bushland) is 79,401 km² or 63.12%; Riverine forest 1865 km² or 1.48%; and Mangrove forests 64 km² or 0.05%. According to some sources from the MOA, the forest cover of the country is slowly but progressively increasing.

Some of the positive developments that have contributed to the enhancement of environmental conservation in Eritrea since independence are:

1. Conservation policies followed by the GSE such as enclosures and regulations against cutting of non-dry vegetation.
2. Reforestation programs implemented by Students Summer Campaigns, Food for Work and Cash for Work Programs, National Service Programs.
3. Improved awareness of community members on the conservation of their environment.
4. Relatively improved rainfall patterns.

This positive trend could be made to have better impact on the environment if the afforestation programs that are conducted by MOA or other government and non-government organizations are geared to plant indigenous trees instead of exotic ones. For instance instead of jacaranda and eucalyptus such trees as Memona (*Acacia albida*) and Awliie (*Olea europaea africana*) could be planted (both trees provide economic and environmental benefits).

2. Proposed Protected Areas (Potential reserve areas or national parks)

GSE has demonstrated a strong commitment to both restoration and protection of the natural environment. It has taken the establishment of protected areas for environmental protection as one

of its national priorities. The most urgent specific conservation issues identified in the National Environmental Management Plan were:

- The loss of highland forest and the need to conserve the last remaining areas of *Juniperus procera* woodland;
- The need to conserve *Acacia-Zizyphus* woodlands and other woodland communities and associated wildlife in the Gash-settit area; these wildlife habitats in the area are threatened by expanding agricultural activities;
- The loss of critical Doum palm (*Hyphaene thebaica*) woodlands along the Gash and Barka rivers, on which many pastoral and agricultural communities depend for forage, building materials and other needs, to unplanned agricultural development;
- The urgent need to conserve the marine ecosystem of Eritrea, on which future fisheries activities will depend. The marine environment of Eritrea also has a significant potential for the development of tourism.

Based on these facts the MOA has proposed five priority areas for terrestrial ecosystems conservation using the following criteria:

- Representative vegetation
- Site of unusual species diversity
- Presence of endangered or vulnerable animal species
- Presence of wildlife/biodiversity crucial for the future prosperity of Eritrea;
- Landscape or geophysical features of aesthetic or scientific value;
- Hydro-geological protective functions;
- Facilities for national recreation and enjoyment; and
- Cultural site e.g. temples, shrines, and archaeological excavations.

The five priority areas proposed as protected areas are:

1. **Semenawi Bahri:** to protect Eritrea's last remnant of mixed evergreen tropical forest specially the *Juniperus* woodland and evergreen bushland associated wildlife and aesthetic cultural landscape. Called the "Green Belt" and is the gene bank for future generations of flora and fauna.
2. **Gash-Settit:** an area north of the setit River at the SE edge of the Gash-Barka to protect Eritrea's remaining elephant population. To conserve the Gash River, doum palm and Tamarix, Acacia bush lands.
3. **Riverine habitat** along the Gash and Barka Rivers;
4. **Buri Peninsula:** the NE edge of the Southern Red Sea zone. To conserve acacia bushland, dwarf-shrubs grassland, riverine woodland with doum palm, saline wetland in danakil Depression, Hawakil Bay and associated islands plus associated wildlife (Soemmering's gazelle, ostrich and Somali wild ass)
5. **Dahlak Islands:** a priority for the marine and coastal conservation. To conserve mangroves, halophytic vegetation, dugongs and sea turtles.

In order for the implementation of these protected areas systems to be enacted the following has to be completed:

- Clarification of legislative and institutional authority;
- Completion of ground inventories of priority areas to confirm presence of species of conservation concern and adequacy of area to support these species;
- Surveying of suitable boundaries for gazettment;
- Full assessment of socio-economic implications of protected area establishment;
- Acquisitions of appropriate funding for capital (establishment) and recurrent (management) expenditure.

3. Conservation outside Protected (Ex-Situ) Areas

Eritrea so far has not yet established a national Botanical Garden and specialized zoo for the purpose of ex-situ conservation. Currently there is on zoo in Asmara, which is mainly established for the purpose of recreation.

The Plant Genetic Resources Unit of the Ministry of Agriculture has a collection of more than 2000 indigenous crop cultivars.

C. THREATS TO BIODIVERSITY

There are several threats to biodiversity resources in Eritrea. These threats include:

1. Drought

Persistent drought due to inadequate rainfall; bush fire common in the western lowland that are deliberately set by the farmers for the purpose of shifting cultivation or by nomadic pastoralists accidentally.

Affects of the drought:

- Over one million people from diverse social groups who have been victims of the war and drought continue to need humanitarian assistance for their survival.
- Food rations distributed since May 2002 have been at only 60% of the standard relief package.
- The global malnutrition rate among children and pregnant and lactating mothers at the end of 2001 was as high as 21%.
- In most war-affected areas, basic services including housing, health facilities, water supply systems and schools remain partially damaged or completely destroyed.
- The economic asset base, including livestock and farm inputs, remains largely eroded.
- Landmine threats and insecurity along the southern border including large tracts of the most productive farmland has greatly reduced agricultural and other economic activities

Crop production, food and livestock

- The current drought is the worst in the decade since independence in 1992.
- By the end of the first 10 days of August, only 36.6% (203,050 ha) of the planned area (554,867 ha) has been planted.
- Livestock throughout Eritrea look increasingly emaciated.
- Concentration of animals in meager existing watering and grazing locations will result in fast overgrazing and increase the danger of exacerbating disease transmission.

Water Supply

- Prior to the late onset of the rains, almost all zones reported acute drinking water shortages.
- In major towns like Mendefera (Dehub) and Massawa, water trucking induced by the drying of dams has been necessary since May/June.
- In most of the winter rain Zobas of Northern and Southern Red Sea, the water level in wells has dropped by up to 4.0 meters.

Health and Nutrition

LOCATION	MALNUTRITION RATE	REMARKS
Anseba	23.0 %	Global in 2001
Maekel	12.0%	
Northern Red Sea Zoba	19.4%	
Southern Red Sea Zoba	22.9%	
Massawa	28.9%	
Molqi	12.1%	sub-soba of Gash Barka
Gogne	17.5%	sub-soba of Gash Barka
Habero (Zoba Anseba)	19.2%	April 2002

2. Agro chemicals and high yielding alien seeds

Increased agro-chemical inputs increased introduction of narrow line high yielding improved plant varieties etc. has increased the man-made threat to the environment. Although the current rate of agrochemical use is highly controlled and limited; with the growth of population and the governments initiative on intensifying agriculture for food security, there is fear that more agrochemicals will be used in the future.

3. Economic Activities and Tourism along the Red Sea Cost

In the marine sector, the increase in economic activity has proceeded fairly slowly and threats to marine biodiversity are still relatively localized e.g. pollution impacts around the major port towns Massawa and Aseb.

The coral reef ecosystem is very delicate and it is recommended that tourism or any economic activity in the Red Sea Coast should be carefully scrutinized for potential impacts before it is approved. Mitigation measures should be constantly monitored when activities are approved.

4. Alien Invasive Plant Species

Eritrea is endangered of being over-run by alien invasive plant and animal species. The fragile and degraded ecology of much of the landscape provides greater opportunities for alien invasive plant species to establish themselves and spread. Although less significant at the moment the spread of annual “weeds” is also likely to occur, as it is observed in other neighboring countries.

Genus	Species	Sub-species	Local name	Remark
<i>Prosopis</i>	<i>chiliensis</i>	-	Temri Mussa	Mesquite - Grows in western lowlands where it competes with Doum palms. - Has limited use as material for charcoal - Roots grow deep taking most of the moisture
<i>Opuntia</i>	<i>ficus</i>	<i>indica</i>	Beles	Imported from Asia more than 100 years ago - leaves can be used for animal fodder - Fruit is edible - can provide an economic benefit Produces between June –Sept.
<i>Nicotiana</i>	<i>glauca</i>	-	Asha Gereb	Believed to have come with food aid grains in 1985 Grows mostly In the highlands along the roads.
<i>Xanthium</i> (<i>spin osm</i>)	<i>strumarium</i>	-	Bano	weed

5. Alien Invasive Animal Species

A bird species particularly the crow species, introduced to Eritrea in the 1970s, is commonly known as the Indian House Crow. This bird is highly propagated around the major ports, Massawa and Assab, and is creating sound pollution.

Genus	Species	Sub-species	Common name	Remark
<i>Corvus</i>	<i>splendens</i>	-	Indian house crow	

6. Municipal Solid and Liquid Waste and Industrial Effluent Pollution

At the moment the solid waste as well as the liquid waste of the cities and towns of Eritrea are not treated. For instance, the solid waste of Asmara is dumped at an open site near the city about 4 km on the road to Massawa. Though some effort is being made to cover and compress the waste with earth the leachate from the pile of years of accumulated waste and surface ponds of water, drains downstream and pollutes the downstream streams used by communities for domestic use. In the case of liquid waste, the sewage system of the city as well as the industrial wastes, are drained without any preliminary treatment into the Maibela stream. This highly polluted stream flows through underground concrete channels through the city and finally flows to the Anseba River. The communities in the Anseba Region use the waters from the river for drinking, washing, cooking, irrigation and other purposes.

7. Land Clearing and Tree Cutting

Large plots of land, and particularly in Zoba Gash Barka, are cleared every year for agricultural purposes. The land is cleared mainly either for returnees who are coming from the Sudan and for commercial purposes (land given to investors).

In 1995 about 25,000 returnees from the Sudan have been officially repatriated. In addition from 1991 up to 1998 about 175,000 returnees have come back spontaneously to their country from the Sudan. From 12 May, 2001 to 8 July, 2002 about 51,704 returnees have been officially repatriated. ERREC plans to repatriate about 30,000 more returnees before the end of the year 2002.

With UNHCR and MOA assistance, in 2001 about 400 ha of land has been cleared and ploughed; and in 2002 about 4000 ha has been cleared and ploughed. More land has also been cleared with the assistance of other organizations and by the returnees themselves. For instance in 2002 an NGO known as ICMC with the cooperation of MOA has assisted the returnees to clear and plough 300 ha.

Tree cutting carried out by the Army in the last four years is still not quantified but many organizations and local communities are concerned about the excessive cutting of trees. During the war the Army cut trees to build trenches and to use it as firewood. Now it is cutting trees mainly for firewood. Unless measures are taken to prevent or at least to control this practice, the forest cover of the country will go down to the pre-independence figure of 0.4% within a short period of time and no doubt the biodiversity of the country will be adversely and drastically affected.

SECTION III - ENVIRONMENTAL POLICY FRAMEWORK

A. Policy

The present policy and legal framework of Eritrea with respect to environment in general and biodiversity in particular will be briefly discussed in this section of the report.

1. National Constitution and Eritrea's Development Policy

Article 6 of the National Constitution of the State of Eritrea, which was approved by GSE on 23 May 1997 states that "Unity in Diversity" is the basic principle guiding national development objectives. Moreover, article 8 mandates the State to work for sustainable development and to "manage land, air, water and natural resources in a balanced and sustainable manner" and to "secure the participation of the people in safeguarding the environment". The Constitution thus provides the foundation for a national development policy based on sustainable principles and conservation of biodiversity.

The National Economic Policy Framework and Program 1998 - 2000 (NEPFAP) provides a framework for implementation of the Macro-Policy Statement of November 1994. Some of the biodiversity conservation related statements of the NEPFAP are:

"Restoration, enhancement, and preservation of Eritrea's ecological integrity" through

"Prudent utilisation of land, forest, air and water resources; establishment of sound environmental standards; introduction of sustainable land management practices; adoption and implementation of a comprehensive national environmental policy framework; sustainable exploitation of Eritrea's fishery resources; and monitoring and protection of Eritrea's Red Sea coastline".

The newly established Ministry of Land, Water and Environment, "*in collaboration with other relevant agencies of government and the private sector*", is identified as taking a leading role in "*protecting, restoring and enhancing the environment*". Also with "*developing standards, and taking steps to ensure that environmentally sustainable practices are pursued in Eritrea's economic endeavours*".

2. Biodiversity Conservation in the National Development Policy

Economic growth has, historically, been incompatible with "*restoration, enhancement, and preservation of ecological integrity*", simply because natural resource was unsustainably exploited. Such exploitation undoubtedly leads to the deterioration of the environmental quality.

From the experience of other countries Eritrea has learned to follow ways that allow economy growth and social development and at the same time safeguard environmental conservation. Each of the different sectors of the economy has the potential to have either positive or negative impacts on biodiversity and sustainable use through the implementation of their development program. The majority of the sectors have stated, explicitly or implicitly, that environmental protection will be a part of their development program. But, achieving economic expansion and

environmental protection at the same time will be a difficult challenge, requiring extensive consultation and collaboration between different sectors.

3. Existing Legislative Framework

At the time of independence, the provisional GSE has repealed all Ethiopian residual legislation. This created a legislative “vacuum” which the Government has been working to fill. The legislative framework for the State of Eritrea is in a process of rapid development. At present, there is no formal environmental legislation for Eritrea – an Environment Proclamation is in preparation by DOE.

In the other sectors of the national economy several legislations have been promulgated. These proclamations, legal notices and directives do provide some protection for the environment and biodiversity. Some of their contents may be summarised as follows-

- a. Proclamation to Reform the System of Land Tenure in Eritrea, to Determine the Manner of Expropriating Land for Purposes of Development and National Reconstruction, and to Determine the Powers and Duties of the Land Commission No.58/1994

Under Article 50 of this proclamation, the Government can appropriate land for “*forestry and animal conservation projects*”, amongst others.

- b. A Proclamation to Promote the Development of Mineral Resources No. 68/1995 and Legal Notice 19/1995

The legislation lays out some general requirements for environmental management and protection, which, if fully implemented and enforced, would ensure that mining operations do not have unnecessary negative impacts on biodiversity. In addition, it contains exemption clauses, which effectively make all environmental protection subject to decisions of the Licensing Authority.

- c. Regulations on Petroleum Operations Legal Notice No. 24/1995

Environmental protection is covered comprehensively in Article 11: Environment and, Pollution Control and Safety Measures. This legislation has the potential to provide strong protection of the environment if well implemented. One potential weakness of the legislation, from a biodiversity perspective, is the lack of an explicit requirement of regular reporting of data that could be used to monitor environmental performance.

- d. Proclamation 72/1995: A Proclamation to Provide for the Control of the Business Licensing System and for the Establishment of a Business Licensing Office.

This legislation gives a wide range of powers to different “competent regulatory authorities”. The main role of the Business Licensing Office (BLO) is to act as “clearing house” for license applications – it takes little responsibility for assessing potential environmental impacts. Under the present system, there is a danger that some businesses with potentially negative environmental impacts will be approved without adequate consideration due to the lack of formal procedures for referral. From a biodiversity

perspective, threats might arise from location of businesses in relatively bio diverse habitat, or from unsustainable utilisation of natural resources.

e. Proclamation for the Establishment of Local Governments No. 86/1996

This Proclamation lays down clear responsibilities for environmental protection at the regional level and highlights the need to ensure that any policy for biodiversity conservation and sustainable use is implemented at the same level of decentralization as the rest of the national development program.

f. Fisheries Proclamation No 104/1998

The legislation covering the fisheries sector comprises two Proclamations and five Legal Notices, all promulgated in May 1998. These laws provide comprehensive coverage of the marine sector in Eritrea and contain a number of Articles relevant to biodiversity conservation and sustainable use. From a biodiversity perspective, the legislation covering the fisheries sector is quite comprehensive. The legislation does not clearly define the responsibilities of MOF and of other government sectors in the CMI management.

B. Institutions linked with Biodiversity Conservation

In the new organizational structure of GSE, the three ministries that are directly or indirectly involved in the conservation of the Eritrean biodiversity are MLWE, MOF and MOA

1. Ministry of Land, Water, and Environment (MLWE)

The ministry has three Departments- Department of Land, Department of Water and Department of Environment.

The main objective of DOE is “to ensure proper protection and judicious use of the environment through effective harmonization of activities aimed at achieving a sustainable socio-economic development of the country”.

DOE has two divisions. These are the Environmental Information Division and the Environmental Management and Inspection Division. It also has a Legal Service Support Unit and a Documentation and Dissemination Support Unit.

2. Ministry of Agriculture (MOA)

MOA, which is largest Ministry in terms of number of employees (it employs about 1,000 persons), has a Forestry and Wildlife Division. This Division is responsible for the management of forests, closures, other protected areas and all aspects of tree and wildlife conservation and use. The Research and Human Resources Department of MOA covers a wide range of agricultural sectors, with an emphasis on increasing agricultural production. A number of its activities have importance to biodiversity themes, especially those of the Plant Genetic Research Unit. The

MoA Animal Resources Department has responsibility for the large livestock sector – their policy on rangeland use can have a major influence on biodiversity, especially in the lowlands, where open rangeland is the major habitat type.

3. Ministry of Fisheries (MOF)

MOF has a Research and Training Division carries out extensive studies on CMI biodiversity. This Division is responsible for environmental survey and monitoring work in the coastal region. It is the focal point for the on going Global Environment Facility (GEF) sponsored project ERI/97/G31 - Conservation Management of Eritrea's Coastal, Marine and Island Biodiversity. This project will dominate Eritrea's biodiversity-related activities in the coastal region for the next five years. The Surveillance Division of the Fisheries Resource Management Department is responsible for monitoring of fishing and other resource use.

C. Recommendations in the National Biodiversity Strategy and Action Plan

1. Put in place the human and material resources for collecting baseline ecological information and enhances capacity to identify and document distribution of biodiversity and to conduct inventories on all aspects of biodiversity.
2. Establish monitoring systems to determine whether the enclosure policy is actually protecting and increasing biological diversity.
3. To ensure that the maximum amount of diversity is maintained as efficiently as possible implement the national biodiversity conservation policy at regional and sub-regional levels.
4. Promote and supplement existing efforts to establish an appropriate level of conservation management for all biodiversity sensitive areas.
5. Integrate environmental management of all pertinent sectors with the aim of ensuring that information about biodiversity status will be available to all planning and project implementation activities in the country.
6. Provide the right kind of biodiversity information to decision-makers by careful modifying existing programmes- whenever necessary- rather than by generating new isolated projects that may over-stretch the limited implementation capacity of the authorities.
7. Improve land classification and zoning by completion of the National Land Capability Classification/ Land Use Plan and identify zones of high indigenous crop seed diversity and incorporate these zones into the National Land Capability Classification.
8. Continue the strengthening of data collection, information processing and mapping capacity within the relevant sectors and establish a simple, centralized database for all species level inventories.
9. Some of the works that need to be completed to make Biodiversity Conservation successful in Eritrea include:
 - Integrated Management of Riverine Forests;

- Implementation of National Plan for Combating Desertification;
 - Implementation of Wood fuel Substitution (solar energy, supply of alternative fuels such as briquettes, LPG; kerosene and electricity; efficiency improvement of stoves and ovens),
 - Strengthening of National Tree Planting Campaigns with the emphasis for planting indigenous trees;
 - Encouraging tree planting and cultivation for commercial purposes and Establishment of community forestry.
10. Survey of traditional plant for medicinal use and their potential for commercial production and promote the conservation, production, utilization and marketing of high value/industrial indigenous crops for income generation and economic development.
11. Produce, and distribute to farmers, improved varieties of indigenous crop seed and improve crop management practices that enhance soil moisture retention of agricultural land.
12. Collect information on control methods of known and potential invasive and exotic species such as *Prosopis Chiliensis* (Temri Musa) and *Nicotiana glauca* (Asha Gereb). Survey their distribution and spread and draw out strategies to control their spread and document trans-boundary species in Eritrea and increase collaboration with appropriate international agencies through exchange of information on migratory species between relevant national and international organizations.
13. Introduce screening procedures for all live imports and take precautionary measures to minimize risks of introduction of alien species into the CMI from ballast water and marine culture and follow strict surveillance and quarantine procedures at "ports of entry" for live biological materials.
14. To preserve flora and fauna: identify, survey and demarcate borders of representative protected area(s) such as:
- North Setit River (Elephant, Greater Kudu, *Tragelaphus strepsiceros*; Duiker, *Cephalophus* sp.; Warthog, *Phacochoeros aethiopicus*);
 - Buri Peninsula (Ostrich, *Struthio* sp; Soemmering's gazelle, *Gazella soemmeringii*; Dorcas gazelle, *G. dorcas*; Wild Ass, *Equus equus*);
 - Dahlak and other islands (Sciumma; Black Assarca; Dissei).
15. Improve biodiversity benefits associated with Closure - programs by formalization of selection criteria for closures, increasing monitoring of established closures, and establishing new closures.
- 16 Identify and establish, with clear geographical boundaries, protected areas for the conservation and sustainable use of threatened species, habitats, living marine resources and ecological process. Prepare a migratory species conservation network and activities for endangered, endemic, migratory and/or indicator species, in particular marine turtles and mammals, migratory birds and sharks
17. Prepare feasibility study for the establishment of Zoological and Botanic Gardens, Natural History Museum and Aquarium.

18. Increase integration of environmental education and activities among ministries, associations, enterprises and community members by raising environmental awareness of the common person through the mass media and by reviewing the existing educational system curriculum to adequately address environmental issues and by adequately treating environmental issues in relevant sectoral legislations and guidelines.
19. Finalize the preparation of the draft Environmental Proclamation and have it officially approved and provide biodiversity information to other sectors preparing legislation; regulations and guidelines related to environment.
20. Introduce a mechanism for controlling of fishing vessels: consistent with measures of sustainable yield and appropriate responsible fishing, and maintain an effective licensing system.
21. Establish artisanal fishing associations with agreed harvesting regulations and complete resource baseline surveys for Coastal resource use.
22. Identify and study potential sources of pollution impacting CMI. Install and maintain reception facilities for Crude Oil Wash (COW) at the ports of Massawa and Assab. Install receptacles at all fishing centers in which fishermen can dispose of used engine oil and issue a norm for the construction of septic tanks for all present and future coastal buildings.
23. Prepare an Oil Pollution Contingency Plan and have it officially approved; and implement the Plan.
24. Prepare a comprehensive identification guide for all Terrestrial, Marine and Ago-biodiversity taxa found in the Eritrean Red Sea.
25. Improve rangeland quality through temporary closures, enhancement of perennial grazing cover; increased forage/fodder crops.
26. Design a monitoring program to identify changes in crop and animal diversity at farm level, and establish baseline data for the program.

SECTION IV – ANALYSIS OF IMPACTS ON NATURAL RESOURCES

A. Purpose

Conduct an analysis of how past events and current initiatives (both Eritrean and donor supported) have impacted on the country's natural resources. The concern is how Eritrea's response to the global development setting and its internal development agenda are currently impacting Environmental Sustainability (Sect.117), Tropical Forest conservation (118) and Endangered Species (bio-diversity) (119) protection. These various development initiatives are assessed and investigated for their potential environmental impacts.

B. Impact of past and current events (Eritrea and donor supported)²

CAUSE	EFFECT
<p>1.The outbreak of war with Ethiopia in 1998-2000</p>	<ul style="list-style-type: none"> - The outbreak of war with Ethiopia in 1998-2000 brought progress to a temporary halt, damaging roads and bridges, power and telecommunications installations, schools and clinics, water supply and sanitation facilities, houses, factories, businesses and farms. - The war also created short-term losses in agricultural output and port revenues and declines in private sector activity and exports. - The mobilization of 250,000 men and women and steep increases in military spending also helped depress the economy and drive up inflation. - The tax collection rate reached just over 20% in 1997 but dropped to 16.5% in 2000. - The ports at Massawa and Assab were damaged and shipping traffic in Assab plunged but increased in Massawa - The Integrated Farming System (IFS) was introduced to cope with the shortage of labor and oxen (farm machinery was introduced). - Cutting of trees by the military for trenches and cooking has adversely affected the environment - Land mines have reduced the available agricultural land and killed and/or maimed people in the area including domestic animals (sheep, goats, cattle) and wildlife.

² Most of the information provided here is from the recent publication by the Ministry of Information, State of Eritrea called, Eritrea, A Country Handbook 2002 (cost 148 nakfa).

<p>2.The disengagement of forces in 2001-02</p>	<p>Set the stage for reconstruction and recovery.</p> <ul style="list-style-type: none"> - The government focused on immediate humanitarian needs - Reconstructing infrastructure (see Emergency Reconstruction Program - ERP) - Assisted war-displaced people to resume normal economic activity (see Eritrean Relief & Refugee Commission - ERREC) - Restoring a stable and supportive macroeconomic framework - Demobilizing and reintegrating former combatants - Continuing previously initiated projects
<p>3. Economic Policy Overall the economic policy is anchored in a commitment to free market-based, private sector-led, export oriented development as set forth in the government's 1994 Macro-Policy Paper and reaffirmed in its 1998 National Economic Policy Framework Program.</p>	<p>The government's medium-term objectives for the opening decade of the 21st century are:</p> <ul style="list-style-type: none"> - To develop new export markets - Rebuild the port business - Increase agricultural productivity - Achieve macroeconomic stability - Attract private-sector investment - Privatize the remaining state-owned business - Develop a sound financial system
<p>4. Finance & Banking The Ministry of Finance (MOF) mission is to maximize government's revenue, while effectively managing public expenditure, property, debt and investment.</p>	<p>Inland Revenue:</p> <ul style="list-style-type: none"> - A reduction in the number of income tax rates from eight to five. - A drop in top income tax rate from 38 to 30 percent - The replacement of the five corporate rates with a flat 30 percent - The complete elimination of the special rate on reinvested profits - A simplification of the sales tax structure (10% rate on all raw material and 12% on services) - The improvement of loss carry-forward provisions for business - The introduction of an urban property tax
<p>5. Public expenditure The expenditure policy in 2001-2003 is to integrate the costs of emergency recovery and demobilization into a budget that is consistent with macroeconomic and poverty reduction objectives.</p>	<p>This will entail a sharp reduction in defense outlays, and containment of non-defense spending</p> <p>The government's goal is to reduce total expenditures from 10 percent of GDP in 1999 and 2000 to 6.8 % of GDP in 2002.</p>

<p>6. Monetary Policy</p> <p>On 8 November 1997, the Bank of Eritrea issued the country's own national currency, the Nakfa.</p>	<ul style="list-style-type: none"> - During the first 18 months as legal tender—until the war broke out with Ethiopia—inflation remained at or below 2 percent. - The Bank of Eritrea will use its monetary policy instruments to hold nonfood inflation at modest rates. - Expansion of the monetary base will be limited by curtailment of credit to the government.
<p>7. Infrastructure</p> <p>At the time of independence, Eritrea's infrastructure lay in ruins. A program has been started to improve access between major towns and cities and the expansion and/or rehabilitation of other infrastructure (e.g. airports, ports and the railway).</p>	<p><u>Roads and Bridges:</u></p> <ul style="list-style-type: none"> - Reconstruction of the Asmara-Massawa road - Improving asphalt roads linking Asmara with Keren, Dekamare, and Zalemassa - Upgrading the Dekamare-Senafe, Keren-Barentu, and the Nefasit-Dekamare highways - Major new projects include the completion of a 600-kilometer all-weather asphalt road between Massawa and Assab. - Bailey bridges were built over the Gash River, Barka and Mereb Rivers near 5 major towns. - Vehicle fleet has grown from 8,669 in 1991 to nearly 40,000 by 2000. Registered busses increased during the same period from 267 to 1,562. Pollution from vehicle exhaust burning leaded fuel is increasing accordingly. <p>Assessment team recommendation: The mission supports policies and programs concerning clean burning fuels.</p> <p><u>Railways:</u> The railroad was started by the Italians in 1887 and finished in 1932. Service between Massawa and Ghinda resumed in 1996. The 117-km line to Asmara is currently on the way toward completion.</p> <p><u>Civil aviation:</u> The Asmara International Airport has new communications and lighting systems and state-of-the-art navigation aids.</p> <p>In 1996, construction started on a new full-service international airport in Massawa to serve export processing needs and expanding tourist trade, and is scheduled for completion in 2002.</p> <p>In the port of Assab, the terminal was expanded.</p> <p>The airport at Sawa in Gash-Barka was upgraded to international status to facilitate the export of fresh produce and livestock.</p> <p><u>Maritime Transport:</u> The ports at Massawa and Assab are rehabilitated. Modernization projects for both ports slated for completion in 2002 include extending the berths, dredging the harbor, reclaiming coastal land,</p>

constructing new container terminals, improving drainage and sewage, and building new workshops, warehouses and equipment sheds.

Housing and Urban Planning:

The Housing Commission was charged with returning previously nationalized houses to their original owners and developing a nationwide system of titling and registration. In the first ten years since independence, the commission received nearly 177,000 applicants in seventeen towns and resolved all but 2,467.

Master plans for most major Eritrean towns have been completed.

Water Resources:

In 2001, the World Bank estimated that 63 percent of urban residents and 42 percent of rural dwellers had access to safe drinking water in Eritrea.

In the decade since liberation, the Water Resources Department constructed 600 new rural wells and helped set up 243 village water committees to manage scarce local supply.

A new reservoir was constructed at Tokker, north of Asmara, to meet the capital's needs, and services were substantially improved in Keren, Massawa and other towns.

In 2002, the government will undertake a comprehensive assessment that will form the basis of a national water resources development plan.

Assessment team recommendation: The assessment team strongly recommends that sewage systems be included in this assessment and measures taken to include adequate sewage systems as part of the water resources plan. This is to mitigate the contamination of rivers and aquifers as a direct result of untreated sewage effluent from towns and cities throughout Eritrea. In addition solid waste management should be included (e.g. leachate, methane gas utilization and sanitary landfill development).

Telecommunications:

While cities are connected to one another and to the rest of the world, smaller towns and rural villages often lack services.

The government plans to privatize the telecommunications network and attract foreign investment to upgrade it.

The number of new lines increased from only 13,000 in 1992 to 30,000 in 2000. The first mobile telephone company became operational in 2002. Demand is expected to reach 200,000 over the next five years.

	<p>Established direct access to the internet in 2000.</p> <p>A year after going online, there were four internet service providers with approximately 1,500 subscribers.</p> <p>Eritrea plans to join an African-wide initiative to provide fast, low-cost internet service over fiber-optic cable.</p> <p>Eritrean Postal Services began operations in 1991. Since then postal units have more than quadrupled.</p> <p>Assessment team recommendation: Recommend that mission activities include to the extent possible computer hardware, software and training for the field agencies technical personnel in the region and sub-region offices to support access to environmental, biodiversity and tropical forestry literature, guidelines, and information.</p>
<p>8. Agriculture</p> <p>Agriculture, animal herding and fishing remain the primary source of income and food for the majority of the population, though agriculture accounting for only 16 percent of Eritrea's GDP and 20-30 percent of its merchandise exports in the year 2000. Staples comprise about 42 percent of annual agriculture production, while cash crops make up 28 percent and livestock and fisheries for the rest.</p> <p>In most areas, farming and animal husbandry are based on traditional techniques, where farmers use animal-drawn implements to till the land.</p>	<p>Eritrean farmers operate at a subsistence level, consuming most of what they produce and selling only a small surplus in local markets.</p> <p>Unpredictability of weather, agricultural inputs and market prices make farming a perennially risky enterprise.</p> <p>The use of pesticide in Eritrea is low as compared to many African countries</p> <p>In an average production year, the produce is enough to feed the population for about six months.³</p> <p>Different types of pests (insects, diseases and weeds) affect crop production in Eritrea</p> <p>At present, there is no information, monitoring and evaluation system on environmental impacts from pesticide use.</p> <p>The use of commercial fertilizers on a national basis is minimal. Organic fertilizers are the norm with the exception of large-scale commercial farming.</p> <p>Some returnees are bringing in livestock from Sudan in which some serious environmental impacts such as the spread of diseases or disease vectors were observed.</p> <p>The dependence on Eritrean farmers for seed stock from foreign countries (Sudan, Asia, Europe) is the inability for some farmers to stock seed requirements for the next year.</p>

³ Eritrea – Emergency Reconstruction Program, Environmental Assessment dated October 2001.

<p>Eritrean farmers are exposed to unpredictable weather conditions and wide seasonal fluctuations in input and product prices.</p> <p>Bee Colony Importation in the future</p>	<p>The practice to stock seed has been disturbed because the producing households eat all of the annual harvest before the next harvest season.</p> <p>The use of agricultural machinery is very limited but has increased as a result of the Integrated Farming System (IFS) introduced during the war to cultivate expanded agricultural land to increase production and cope with the shortage of labor.</p> <p>Food or cash for work programs by the MOA and MOLG are used in activities in soil/water conservation being carried out to establish nurseries, tree planting, terracing, closing areas and constructing check-dams and dam reservoirs.</p> <p>The MOA, with more than 50 forest nurseries functioning across the country, plans to distribute more than 40 million seedlings by 2004.</p> <p>The MOA, with more than 50 forest nurseries functioning across the country, plans to distribute more than 40 million seedlings by 2004.</p> <p>Bee colony importation has positive environmental impact by increasing the incomes of the smallholder farmers through the sales of honey. Imports of bee colonies are likely to be made because the supply availability of the local wild strain (<i>Apis mellifera</i>) is low. This may have a negative environmental impact on the indigenous strains through exotic disease spread. Additional potential negative impact is <i>infant botulism</i> or death due to contamination of honey with spores of <i>Clostridium botulinum</i>.⁴</p>
<p>9. Fisheries</p> <p>Fishing is one of most underdeveloped sectors of the Eritrean economy—and potentially one of the most lucrative.</p> <p>Eritreans are traditionally meat-eaters.</p> <p>Foreign fishing methods are not environmentally friendly.</p>	<p>The maximum sustainable yield of fish on an annual basis is 70,000 to 80,000 metric tons per year.</p> <p>The Red Sea is home to more than 1,000 species of fish, including tuna, reed snapper, kingfish, sardines and other prime food fish, and over 220 species of coral.</p> <p>There are large stocks of high-value species, such as lobster, crab, oyster, and shrimp.</p> <p>Fish consumption is relatively low apart from Asmara and the coastal areas.</p> <p>Fish caught in Eritrea is still set aside for export</p> <p>Eritrea has exclusive rights to almost 52,000 square kilometers (land area equals 124,300 sq. km.) of largely unexploited waters and is moving rapidly both to develop and to protect its extensive</p>

⁴ Environmental Report, ERP; dated October 2001.

The GSE protection of the coast resources and foreign investment. The Proclamations and legal notices on fishing were approved by the GSE in 2000.

marine resources.
Following is the volume of fish harvested:

- Year 2000 12,000 to 13,000 metric tons
- Year 2001 6,000 to 7,000 metric tons
- Year 2002 7,000 to 8,000 metric tons

The GSE is now trying to discourage foreign fishing off Eritrean waters because the fishing techniques used are not environmentally friendly. They are providing fishing permits on a selective basis for fishing only beyond the 12-mile limit from the coast. This reduces impact and damage to coral reefs.

Mangrove plantation preservation and conservation are encouraged by the MOF. They are called "Coastal Green" and are very important habitat for young fish and shrimp. Mangroves are located in estuaries off the Red Sea coast. There is a problem of camels foraging on the leaves of the mangrove trees but represents a very minor impact.

In 1998, a joint venture of the GSE with European investors established a modern fish-processing plant in Massawa at a cost of US 1.2 million. By 2000, Eri-Fish, was exporting frozen fish to markets in Europe. In 2002, new ice plants were added, with a combined production capacity of more than 150 tons of ice per day.

In 1999, the aquaculture venture, Seawater Farms Eritrea, a joint undertaking with a U.S. firm uses untreated seawater instead of fresh water to produce shrimp and fish, together with Salicornia, a salt-tolerant plant that can be eaten as a vegetable while young. The mature plant also yields a high-protein edible oil and material for fuel briquettes, particleboard and animal fodder (see Meeting Report No. 9 – Fisheries 1).

The farm enhances environment by expanding wetland areas to filter the irrigation water, by planting new mangrove forests along the seashore, and by providing a refuge for rare and endangered wildlife. They have observed 208 species of birds at the refuge area. Seawater Farms have been exporting shrimp to France and Germany since June 2002. It need to be noted that the present closed system of the Sea Farm has to be continuously monitored since any leakage from the system to the Red Sea would have significant negative environmental impact.

Farther south, on Haleb Island off the Assab coast is the Harena Boatyard, a joint venture with an Australian company that is producing high-quality fiberglass boats for fishing and other purposes.

<p>10. Trade & Industry</p> <p>The industries that Eritrea inherited at liberation were small-scale, based on obsolete technologies and processes and unable to provide goods and services competitively.</p> <p>There is inadequate technology input, lack of supplies and raw materials and poor and politicized management.</p> <p>Under Ethiopian control exports were limited to basic commodities and consumer products</p>	<p>The manufacturing and service enterprises are operating at 20-50 percent capacity.</p> <p>Exports did not generate foreign exchange needed to import machinery, equipment and production inputs.</p> <p>The manufacturing sector producing goods for export and domestic consumption rose from 645 in 1991 to more than 1,900 in 1999, with an active workforce of more than 20,000.</p> <p>Foreign investment is encouraged in all sectors without restrictions related to ownership or capital structure.</p> <p>Foreign investors are treated the same as domestic investors in obtaining access to land, utilities and other production inputs.</p> <p>There are no exchange controls limiting foreign and capital gains through the domestic foreign exchange market.</p> <p>Profits, dividends, fees, royalties, proceeds from sale or transfer of shares, expatriate staff salaries are permitted.</p>
<p>11. Energy & Mining</p> <p>At the start of the 21st century, Eritrea's annual per capita energy consumption ranked among the lowest in the world.</p> <p>It is estimated that 82% of the demand is met from biomass; 16.8% from mineral oil products and 1.2% from electricity (MEM, 1996).</p> <p>All rural communities, as well as most of the household families in the semi-urban and urban areas including some</p>	<p>Dependence on wood fuel for energy has created a large-scale deforestation in the acacia woodland area of the lowlands.</p> <p>A survey conducted by MEM in 1998 revealed that fuel wood per capita per year consumption was 250 kg or 115kg per household per month, which means the country, consumes a total of 882,000 tons per year. A roadside survey conducted by the assessment team of the cost of one quintal (100 kg) of wood costs in the range of 40 to 70 nakfa and sells for 140 nakfa in Asmara. It should be noted that this is dry, dead wood and not green (protected by law from cutting).</p> <p>As fuel wood becomes scarce, many households in urban areas are shifting to kerosene. About 20% of the population of the country is believed to have access to electricity.</p> <p>ELECTRICITY: The new generating plant at Hirgigo will more than double Eritrea's total electricity production from 52 megawatts to 136 megawatts. Electricity transmission and distribution systems are also being expanded and upgraded, while power grids in major consumption centers (Asmara, Massawa, Keren, Dekamare, Mendefara) have</p>

<p>commercial enterprises, are high dependent on biomass fuel (fuel wood, charcoal, farm animal manure and crop residues) for energy.</p> <p>A new generating plant is scheduled for completion at Hirgigo, on the Red Sea coast at Massawa .in 2002.</p> <p>Solar and wind power generating capacity is being expanded throughout Eritrea.</p> <p>Geological data indicate that Eritrea contains significant deposits of</p> <p>Gold, base metals, Ferro-manganese and construction and industrial materials such as granite, marble and limestone.</p> <p>Commercial recoverable deposits of oil and natural gas along the Red Sea coast may be substantial</p>	<p>been interconnected.</p> <p>All rural electrification projects will operate on a cost-recovery basis once the systems are built, though the government will subsidize construction where services are not otherwise available.</p> <p>Schools and clinics in remote areas are using Solar and wind power. Studies by the US Geological Survey indicate that the potential for developing thermal energy is also significant. For example the hot springs locate near Massawa is only used for taking hot showers.</p> <p>MINING:</p> <p>Marble is of high quality and suitable for export to the Middle East and Europe.</p> <p>Eritrea’s mining sector development strategy is focused on promoting domestic and foreign direct investment in prospecting, exploration and development.</p> <p>Mining laws stipulate the terms and conditions that investors have to fulfill and the environmental requirements to which they are subject.</p> <p>By 2001, fifteen foreign firms had acquired prospecting and exploration rights in different parts of the country.</p> <p>A U.S.-based company signed a contract to explore for oil and gas over nearly 14,000 square kilometers of land and water in the northeast.</p>
<p>12. Tourism</p> <p>Eritrea is Africa’s youngest nation with a history as old as humanity. Its rich cultural heritage and its widely varying natural beauty, coupled with its friendly and honest people, make it a delightful place to visit.</p>	<p>The Inter-Continental, a 5-star hotel, opened in January 2000 in Asmara. The Sunshine Hotel, also in Asmara, offers moderate prices and comfortable rooms.</p> <ul style="list-style-type: none"> - There are more than 400 hotels and pensions and 300 restaurants and cafes registered with the Ministry of Tourism (MOT). - Asmara with its old-Italian-style buildings, multiple churches and mosques, is one of the best-preserved colonial cities in Africa. - The extended Red Sea coast and numerous offshore islands offer exquisite, unspoiled beaches and some of the best scuba diving sites in the world. - Eritrea boasts magnificent mountain scenery, dotted with picturesque traditional villages and ancient archeological sites. -Sport fishing is available. - The largest of the Islands, Dahlak Kebir, offers a modern air-conditioned hotel and opportunities to visit Afar fishing villages or ancient Turkish and Islamic ruins. - Safaris are available to catch sight of whales, humpback dolphins, the endangered dugong or one of five turtle species.

	<ul style="list-style-type: none"> - With more than 20,000 identified sites, Eritrea has the highest density of ancient archeological sites in Africa outside the Nile Valley. - Sites associated with the war for independence are also plentiful notably in Nakfa and northern Sahel. - The island of Naqura, near Dahlak Kebir, was the location for a brutal Italian prison colony, later used by Ethiopia to hold and torture members of the national resistance.
<p>13. Health</p> <p>Renewed conflict with Ethiopia in 1998-2000 created a host of overlapping humanitarian crises that demanded an urgent response well beyond the capacity of these social welfare programs.</p> <p>Most prevalent⁵ Environmental disease categories:</p> <ol style="list-style-type: none"> 1. Diarrhoeal Diseases (<i>gastro-enteritis and helminthiasis</i>) 2. Vector-borne diseases (<i>malaria, schistosomiasis, leishmaniasis, onchocerciasis</i>) 3. Gastro-intestinal diseases (<i>amoebiasis and shigellosis</i>) 	<ul style="list-style-type: none"> - Infant mortality rates have been reduced from 72 per 1000 births in 1992 to 60 in 2000. The mortality of children under five declined from 140 to 105 per 1000 live births (compared to 161 for the rest of Sub-Saharan Africa). - The GSE built or upgraded 45 health centers, 48 health stations and 37 small clinics in 1993-99. By 2001 most of the zonal administrations had secondary care centers. - Over 65% of facilities were also provided with solar power and other energy sources to keep cold chain and emergency operations intact. - All blood for transfusions is screened and all hospitals are equipped for HIV testing. By mid-2000, 9,599 cases had been reported with 70 percent in the 20 to 39 age group, 60 percent of them male. Most incidences were in urban centers. - A nation-wide drug list has been prepared and the MOH has worked with the U of Asmara to identify and register traditional herbs within Eritrea. - Good sanitation and a safe water supply can effectively control Diarrhoeal diseases. - Malaria accounts for over 43.6 per thousand of the total outpatient morbidity in the MOH clinics. - Schistosomiasis or bilharzia is an infection caused by one of three kinds of worm. Long-term effects include severe liver damage, kidney failure and cancer of the bladder. Humans are infected through bathing, wading, washing or drinking water containing living cercariae.
<p>14. Small and Medium⁶ Enterprise</p> <p>There are no direct routes for cargo planes to Europe.</p> <p>Nairobi is the clearing house for horticultural products and flowers from Eritrea</p>	<p>Eritrean businessmen are not able to ship their horticultural products and flowers directly to Europe and must export to Nairobi, which serves as an agent for Eritrean produce to be shipped to Europe. This results in higher costs and Eritrean products have lower priority if there is competition with similar Kenyan produce. For example, the Nairobi airport is 3 hours further. This is a big factor when considering the high cost of jet fuel.</p> <p>Massawa airport is now complete and is closer to the European market (Paris, Amsterdam and London) than any other country in this region.</p>

⁵ National Environmental Management Plan for Eritrea; 1995.

⁶ Information from Mr. Robin Greaves; UNMEE; 9/16/02

<p>Visas are difficult to obtain for foreigners to enter Eritrea</p>	<p>747 Jets are available in South Africa to ship produce from Eritrea to the European market. A 747 jet can haul 150 tons of cargo at a cost of approximately 2 U.S.\$ per kilo.</p>
<p>There is virtually no crime in Eritrea</p>	<p>The Massawa airport is ideal for cargo plane takeoff with full loads because it is at sea level, whereas the airport at Asmara is 7,600 feet above sea level, which limits the amount of cargo at take off.</p>
<p>The biggest resource in Eritrea is its people.</p>	<p>The Dutch government has offered to provide cold storage facilities and guarantee aircraft for shipment of goods from Eritrea, if the business enterprise can guarantee the quantity of flowers and horticulture products.</p>
<p>Eritrea can grow flowers, fruit and vegetables available for markets in Europe during the European winter, when no produce is grown.</p>	<p>Dubai would serve better the needs of the region and could serve as a clearinghouse for products from Eritrea at a much lower cost than through Nairobi.</p>
<p>Flowers in Eritrea are of the highest quality and can compete with the best in the flower business as stated by Dutch businessmen visiting nurseries in Asmara, but are not able to export.</p>	<p>Small and medium enterprise entrepreneurs and tourists are discouraged by the difficulty of getting visas to enter the country, which limits the tourism industry.</p>
<p>Eritrea has an exceptional amount of rare and endangered bird species and other animals such as Elephants, Nubian Ibex, Arabian Bustard, and Abyssinian Hornbill.</p>	<p>Zobas, such as Gash-Barka (Barentu) and/or the Red Sea coastal area can serve as high-priority bird watching sights providing eco-tourism dollars to the local villages and communities.</p> <p>Bed & Breakfast type enterprises and/or guesthouses can flourish in the rural areas to accommodate eco-tourists resulting in tourist dollars to the local communities in lieu of resources taken from the environment for revenue.</p>

SECTION V – CONSERVATION OF TROPICAL FORESTS AND ENDANGERED SPECIES

A. Eritrea's Integrated Strategic Plan (ISP)

1. Opportunities and entry-points

Population pressure represents a root cause of environmental degradation and biodiversity loss. Activities that help stabilize population will therefore contribute to environmental conservation, and help stem biodiversity loss. Targeting population activities in priority ecosystems (i.e., those that have: high biodiversity; high population density; degraded natural resources; or high food production potential) can increase the overall effectiveness of USAID's (and the GSE's) sustainable development goals.

- To influence conservation of tropical forests and endangered species

a. Land Classification and Land Use Plan need to be developed for all of the regions of Eritrea. MLWE has developed for several areas in Zoba Maekel and in some other regions. MOA regional office based on its own initiative and needs has started to develop using its own limited resource on a pilot basis land use plan of two sub regions in Zoba Gash Barka. It has given to the consultant's copies of these plans. Land Classification and Land Use Plan are essential for environment management and biodiversity conservation and it is recommended that this be used as one of the entry points for USAID assistance to Eritrea.

b. MLWE, MOA and MOF have already identified potential Protected Areas for the conservation of the fragile natural resources. All of the concerned government authorities have by consensus agreed that these five areas are the priority areas for environmental protection. Never the less the proposal is still not officially approved though the concerned authorities are doing their best to ensure that the biodiversity in these areas are protected. Probably shortage of fund is the cause that is deterring GSE from approving the proposal. If so assistance from USAID would not only expedite establishment of national reserves and national parks but it would also help to make it viable by attracting tourists and naturalists. In its master plan, the Ministry of Tourism has also provisions for eco-tourism.

c. With respect to health, there are indigenous traditional medicinal plants in Eritrea. These plants need to be identified and studied in detail. The outcomes of the study could come up with recommendations on how to grow these plants in commercial scale and thus help the communities not only to improve their health but also to generate income by selling them.

2. Environmental Management Activities

SO4: Use of Primary Health Services Increased

SO#4 proposed strategy would continue to focus on improving sustained use of primary health care services, especially in core program areas. Improving quality of care will continue to be emphasized, as will demand. The concept of demand will be broadened to include:

- Active involvement of the people at each level.
- Systems to improve the management of scarce resources will be strengthened to enhance impact and sustainability.

To increase utilization, the Mission will continue to focus on quality and demand. Three factors are considered essential for achieving increased use: greater access to, quality of, and demand for primary health care (PHC) services. Core program areas have included integrated management of childhood illness (IMCI), obstetric life saving skills, family planning, polio eradication, salt iodination, malaria, and HIV prevention.

Identification of positive impacts of development program activities (SO4)

- Long-term and short-term training has been the principal means to strengthen quality.
- Demand is being enhanced through the systematic development of an information, education, and communication program including not only the MOH but also other sectors and NGOs.
- It is anticipated that core program areas will continue to include IMCI, obstetric life saving skills, family planning (as birth spacing and post-abortion care), polio eradication, malaria, and HIV prevention.
- Nutrition will be integrated with IMCI, health communications, food security, and maternal health.
- Female genital cutting will be addressed with information, education, communication, and training.
-

Identification of potential negative impacts of development program activities (SO4)

Environmental impacts. Most SO#4 activities involve training, institutional strengthening and similar activities with no direct effects on the environment.

Appropriate mitigation measures (SO4)

A SO-level IEE would appear to be the most effective strategy for achieving compliance. While Field Support mechanism is being used to implement most SO#4, activities are generically covered by Initial Environmental Examinations (IEEs) approving Categorical Exclusions. Local-level validation of that determination can be done by looking at specific activities to verify applicability of the Categorical Exclusion, and provide an opportunity for proactively incorporating environmental concerns into activities;

- Training modules could be added (or strengthened) to include proper procedures for disposal of Biohazardous wastes; and for proper water and sanitation practices as they relate to disease transmission;

- Promote integration of health into other "sectors" or SOs as in dealing with water and sanitation (e.g. construction of latrines).

How Strategic Objective teams might enhance the quality of the environmental condition of strategic objective activities (SO4)

Opportunities. Several potential opportunities for increasing effectiveness of environmental programming are presented:

Several explicit steps can be taken to enhance the contributions of the health SO to environmental sustainability in Eritrea, while also enhancing health outcomes. For example,

- First, SO teams involved in promotion of insecticide treated netting (ITN) for malaria control will need to ensure that a Pesticide Evaluation Report and Safe Use Action Plan (PERSUAP) is developed. This can be done in conjunction with the national experts and related programs supported by USAID, WHO and other donors, and the Programmatic Environmental Assessment of ITN being organized by AFR/SD. In this way, unintended negative health risks associated with inappropriate insecticide use will be avoided or minimized.
- Second, SO teams could seek to understand better the environmental components of health problems, for example as part of the child survival program. If during the implementation, linkages to environmental changes are established, the SO partners could work to enhance the sustainability and impact of their programs in appropriate ways, such as including education about these linkages in its outreach efforts in child survival/reproductive health/family planning and HIV/AIDS services.
- Third, SO teams can encourage the Ministry of Health and other appropriate actors to ensure that WHO guidelines and standards are applied to the management of healthcare wastes, esp. those associated with testing and treatment of HIV/AIDS-affected persons. All these approaches are addressed and encouraged through the environmental review process to which all the SO programs are subjected, and all new implementation mechanisms will be likewise. Any activity related to environmental health, which may benefit by environmental sanitation and health services, could potentially include components of health programs' child survival, malaria, maternal health and HIV/AIDS services, and the like.

SO5: Growth for Rural Sector Improved

SO#5 will focus on both the household and enterprise level to improve the economy in rural areas.

- At the household level, the Mission will focus on micro-lending programs to target populations, especially women-headed households.
- Support to small and medium enterprises will have greater focus on the development of agribusiness and the agricultural sector.
- In addition, the Mission will provide technical assistance to help with market assessments and good business practices.

Identification of positive impacts of development program activities (SO5)

- Under the existing SO, USAID has promoted “increased income of enterprises, primarily rural with emphasis on export”.
- The SO has concentrated on developing service, production, processing and marketing enterprises, with particular emphasis on high-value agriculture.
- In spite of the economic repercussions caused by the conflict, the Mission’s existing strategy of private sector strengthening through training, technical assistance, and the provision of financial services to mostly rural entrepreneurs continues to respond to the key constraints to private sector development and economic growth.
- After individual farmers, enterprises represent the agriculture sector's most important supporting organizational element to the development of the economy.
- Existing and new enterprises have the potential to generate rural employment and increase production of key marketable food commodities, which in turn will impact incomes.

Identification of potential negative impacts of development program activities (SO5)

- Approximately 50-60 percent of the population is dependent on some form of agriculture.
- The current human and technological capacity to increase productivity is low, thus increasing rural incomes or ensuring adequate food security is unlikely without making significant changes to the current traditional system and practices.⁷
- The GSE’s limited resources are stretched due to efforts to resettle Internally Displaced Persons (IDPs) and returnees and plans for the demobilization of soldiers. On a positive note, there will be an increase in available labor as a result of the resettlement and demobilization process.
- However, the skill sets of returning laborers will be limited. In addition, their return will place greater pressures on the limited amount of arable land.
- The nascent private sector is under-capitalized, dependent on obsolete technology, operating far below capacity, and in product areas with limited trade-ability.
- Private investment remains low and is unlikely to support the level of production required for the country's development vision.
- The financial sector is not offering the range of credit instruments and banking services necessary to support the development of a modern, competitive economy.
- The GSE and donors expect that technical firm-to-firm cooperation and increased investment and development of human capital can mitigate the technological and managerial gaps for enterprises in Eritrea, especially in the agribusiness sector.

Appropriate mitigation measures (SO5)

Environmental impacts. Most of the activities supported involve analyses, studies, and information

Collection/dissemination, workshops and similar activities with no direct effects on the environment. Potential modest environmental impacts may be associated with agronomic research activities to be carried out by the various partners and USAID usually considers indirect support to input and output marketing as potentially influencing pesticide use, therefore the actual linkages need to be thought through, per 22 CFR 216.3(b).

⁷ The definition of food security, which the Mission subscribes to, is that found in the Agricultural Trade Development and Assistance Act of 1990: "Access by all the people at all times to sufficient food and nutrition for a healthy, productive life. "

- An Initial Environmental Examination (IEE) for these activities may call for application of an environmental review process for individual activities as they are designed and implemented (Negative Determination with Conditions). This may entail some strengthening of the implementers on USAID's environmental review procedures.
- Several of the components of the Agricultural production agenda will reasonably lead to new practices or changes in practices related to seeds, pesticides, etc., in addition to water and energy use, land clearing, etc. These components include business linkages, targeting of new market niches, technology transfers, restructuring of publicly owned operations, and capacity building/management training.
- It is recommended that USAID to proactively put specific requirements in the technical assistance and associated grants and/or contracts to encourage sound environmental practices.
- Also, there are also clear, non-tangential business reasons to encourage safe/minimal use of pesticides, for example. One relates to the contribution of HIV/AIDS to productivity issues in the labor pool. It has been well demonstrated that poor pesticide handling and use practices result in widespread illness among farm workers in developing countries. It seems particularly prudent, therefore, to carefully manage chemical use (and probably fertilizer use) to adequately protect the health of immune-deficient HIV/AIDS victims and labor productivity.

How Strategic Objective teams might enhance the quality of the environmental condition of strategic objective activities (SO5)

- When at all possible, it is desirable to encourage "upstream" thinking of potential issues, such as in Requests for Proposals, including a criterion encouraging partners to think through the environmental "win-win" opportunities in agribusiness programs. In this process they could be asked to respond in their proposals with how they would incorporate environmental sustainability and soundness into the program.

SO6: Increased Capacity and Participation for Broad-based Development

SO#6 will support an informed citizenry and broad-based participation

- It will address Eritrea's needs in capacity development, especially related to the reintegration of demobilized soldiers
- It will aim to improve policy-making and leadership skills at different levels of government.
- The Mission will engage community-based organizations, such as parent teacher associations.
- The Mission will assist in developing capacity to facilitate the government as it explores ways for greater decentralization.

Identification of positive impacts of development program activities (SO6)

- The number and capacities of associations and or non-partisan organizations will be increased
- Foster dialogue between Community Based Organizations (CBOs) and local authorities
- The social and economic reintegration process will be facilitated in target areas
- Crisis prevention/mitigation will be promoted

- The foundation for basis democratic development and good governance will be established
- Linkages with other sectoral programs will be explored to promote synergy and optimize the impact of USAID/Eritrea's limited resources.

Identification of potential negative impacts of development program activities (SO6)

- The potential negative impacts are similar to that of SO5 (The reintegration of demobilized soldiers)

Appropriate mitigation measures (SO6)

Environmental impacts. Most of the activities supported involve analyses, studies, and information

Collection/dissemination, workshops and similar activities with no direct effects on the environment. Potential modest environmental impacts may be associated with the reintegration of demobilized soldiers to be carried out by the various partners and USAID usually considers indirect support to land allocation and use, if provided, therefore the actual linkages need to be thought through, per 22 CFR 216.3(b).

An Initial Environmental Examination (IEE) for these activities may call for application of an environmental review process for individual activities as they are designed and implemented (Negative Determination with Conditions). This may entail some strengthening of the implementers on USAID's environmental review procedures.

How Strategic Objective teams might enhance the quality of the environmental condition of strategic objective activities (SO6)

- Civil society groups with environmental agenda may provide useful entry points, as a numbers of conflicts revolve around universally tangible issues of access to and management of natural resources. This may occur upon the reintegration of demobilized soldiers into the communities.
- Similarly, the Ministry of Land, Water and Environment (MLWE) can contribute to the mitigation of negative environmental impacts in the rehabilitation area through identification and land classification in relation to its potential for sustainable productivity. However, implementation of land classification should be accompanied with the establishment of effective CBOs and carrying out regular educational programs on the subject of environmental protection. USAID could leverage their program in conjunction with MLWE.

B. Biodiversity and Tropical Forestry Recommendations

PROPOSED ACTIONS FOR USAID/ERITREA

1. Assist in the capacity building and institutional strengthening of the regional and sub-regional local administrations to successfully manage their environment and thereby enhance biodiversity conservation. Mission support could include-

- a. Training of the technical personnel involved in the conservation of the environment and in the testing or inspection of natural resources such as water
- b. Awareness raising programs for community members in the areas of environment conservation, sanitation and primary health care.
- c. Provide and/or leverage other donor programs for the provision of essential logistics-particularly to regional and sub regional offices- such as vehicles for field work, computers, printers, copiers, measuring instruments and other essential facilities that improve their performances and effectiveness.

2. GSE has already identified 5 potential protected areas in the country. All of these areas are sanctuaries for endangered wildlife, birds and plants. USAID could assist GSE in the establishment of these areas to be national reserves and national parks. For instance, the Green Belt (Semenawi and Debubawi Bahri) is a natural gene bank for many indigenous species of the country. USAID has an opportunity to continue this support, previously provided by the Danish Government, and use this as an entry point in the establishment of protected areas in Eritrea.

3. In the reforestation program of MOA, exotic plants such as jacaranda and eucalyptus are being planted in lieu of indigenous trees. There are many indigenous trees that are more disease resistant and provide economical and environmental benefits such as Memona (*Acacia albida*) and Awliie (*Olea europaea africana*) that could successfully substitute these plants. USAID could assist in the establishment of nurseries, collection of indigenous plant seeds and in the reforestation programs for indigenous plants.

4. With regard to clean energy, USAID could assist in the training of community members (with special emphasis on women) in the area of efficient traditional oven making skills, solar energy, and traditional cooling (refrigeration) stores for food, drinks etc. The technical assistance could also include provision of efficient kerosene stoves and kerosene as well as briquette production. It is recommended that such form of assistance focus on the rural areas of Eritrea. The Energy Research Center of the Ministry of Energy and Mines has already done some work in this area and should be consulted and invited as a partner in any endeavor.

5. For rural-micro and small-scale development there are a number of environmentally friendly income generating activities that could be implemented by USAID to meet the strategic objectives with positive effects on the biodiversity and environment. These are poultry farming, flower production and bee keeping. USAID could assist in the establishment of poultry feed plants (wastes of the fish processing plants and of fish markets could be an input to such plants) and in the provision of chickens at reasonable cost. At present poultry farmers complain about

the high cost of feed (385 Nakfa per quintal) and of chicks (21 Nakfa for a one month old chick). Flower production and bee keeping are complementary activities. The more flowers, the more the bees could flourish and the greater the amount of the honey that could be produced. Flowers could also be sold in the European market and provide income to the local communities.

Even under the existing constraint, such as shortage and high cost of airfreight, there are enterprises in Eritrea that are growing flowers and selling their products not only in the local market but also in Europe. Flower production is a lucrative agro business for Eritrean farmers- has quick return, provides foreign exchange (flowers have high demand in Europe) and it is an activity that enhances environmental quality. In the case of bee keeping: introduction of modern beehives will be essential. The technical assistance package of these three activities needs to include a training package for the persons who will carry out the activities.

6. It is recommended that sewage systems be included in the comprehensive assessment that will be undertaken in 2002 by GSE and that will form as the basis of the National Water Resources development plan. Measures need to be included to mitigate the contamination of rivers and aquifers as a direct result of untreated sewage effluent from towns and cities throughout Eritrea. In addition solid waste management also needs to be addressed in the plan because the present practice of solid disposal, even in the capital city, have significant negative environmental impact. The leachate needs to be treated or disposed safely, recovery and utilization of the methane gas has to be studied and sanitary landfill systems management needs to be introduced. In the rural areas VIP latrines also need to be introduced. Some of these health- need related environmental issues could be entry points for USAID assistance to Eritrea.

C. Public Institutions

1. Effectiveness of relevant public institutions to utilize, develop and /or monitor environmental resources.

- a. At the moment shortage of skilled personnel is common constraint to all public and private organizations in Eritrea. Even with the demobilization of those who are in the National Service, most of the government organizations will still have acute shortage of skilled manpower. GSE has initiated a Human Resource Development Program and sent many Eritreans to South Africa and some other countries for further studies but this will not be enough. A comprehensive huge skill-upgrading program that would include specialized fields such as solid waste management, environmental quality and mitigation measures monitoring, water and sewage quality analysis needs to be prepared based on a need analysis and implemented. Until such training is completed and qualified skilled persons are hired, the existing institutions will not be sufficiently effective to meet the current needs.
- b. During the field visits that the consultants conducted in Zoba Northern Red Sea, Zoba Anseba and Zoba Gash Barka, they observed that the regional and sub-regional offices have serious logistics constraints. Most of the time the enthusiastic experts in the various fields who make plans to go to the field and carry out their duties are not able to travel to sites due to unavailability of vehicles. Logistic support in their offices is insufficient (e.g. computer hardware and software, Internet access). As a result they are unable to use their skills and

knowledge effectively. They also lack technical books, periodicals and other reference materials and simple testing or measuring instruments. This shortage of essential equipment and logistic support is one of the reasons for the low effectiveness of public institutions at the regional and sub-regional levels.

- c. Eritrea is a new nation and all of its public institutions were established recently. It would be unrealistic to expect all of them to have in operational, the legal framework necessary to direct their operations. Some of them have already set in place all of the necessary proclamations and regulations and are adequate in legal terms. However in the case of environment and biodiversity-related functions- with the exceptions of the CMI and in the area of mining and petroleum exploitation, the legal framework is still not officially proclaimed. The absence of the necessary legislation with regard to environment in general and with regard to forestry, wild life, biodiversity, protected areas and pollution in particular, has constrained the effective functioning of public institutions at national and local levels. It is extremely important that GSE take action to submit to the legislature the draft proclamations for approval. The approval would increase the effectiveness of natural resource utilization monitoring and give the field administrators the regulations backed up by law needed to protect the environment and biodiversity in the Zobas.

2. Mitigate negative development impacts

- a. As per the environmental guidelines of DOE, all Class A Projects such as large road construction works, airfield construction works and power generating stations are required to carry out Environmental Impact Assessments (which includes mitigation measures). In practice these projects follow the environmental guidelines and it is the responsibility of the affected authorities to monitor and follow up the implementation of the proposed mitigation measures.
- b. To mitigate the economic and environmental biomass-based energy at household and enterprise levels, the Department of Energy through its Energy Research Center is carrying out studies of efficient kerosene stoves, efficient traditional ovens, solar energy, biogas production and wind energy. The application of the research outcomes of this Center in rural areas will help in mitigating the environmental degradation that is occurring such as cutting of trees.

MOA needs to be empowered to control the cutting of trees for agricultural purposes, for firewood, for housing construction and other construction works that is being carried out by commercial farmers, returnees, IDPs and community members. Most significantly, the major abuse of the forest resources is by the Military for burning wood on a daily basis for bonfires.

- c. Land and soil conservation mitigation measures such as reforestation, construction of hillside terraces, check dam construction; soil and stone construction have been conducted in Eritrea since the early 1980s. After independence such campaigns were continued with more vigor and better planning. Community members on food-for-work and cash-for-work basis, and Summer Student Programs and National Service Programs carried out these activities.
- d. GSE in collaboration with UNHCR is repatriating hundreds of Eritrean refugees in the Sudan. More than 90% of the returnees are settling in Zoba Gash Barka. It is not difficult to imagine the negative impact that the implementation of the repatriation program is making on the

environment of the region. To mitigate the immediate impact, ERREC is providing the returnees with alternative materials such as metal framework of their shelters and kerosene stoves for cooking, with the aim of controlling the excessive cutting of trees for wood. Without these alternative methods for shelter and cooking, the natural resources in the area would be severely impacted. Taking into consideration the trees that are cut to clear land for agricultural purpose and despite ERREC's efforts to provide alternative shelter material and fuel, there is a concern by the Zoba administration that these are short-term measures and the negative impacts will continue once the kerosene ration is depleted. It is recommended that GSE and UNHCR look at long-term sustainable solutions.

- e. Protected Areas (Discussed in previous sections)
- f. The Ministry of Health is carrying out some measures to mitigate negative environmental impacts as a result of its primary health care activities. The water, sanitation, primary health training that is being given to community members need to be strengthened. Diarrhea (caused by poor sanitation and drinking of contaminated water) is still one of the major diseases in the rural areas. It is recommended that the water sources be regularly tested and whenever necessary, attempt be made to treat them before they are distributed to the public. Moreover, the rural communities need to be assisted by GSE, non-government organizations to have VIP latrines.

Campaign that is being made for malaria eradication is progressing satisfactorily. The campaign includes covering ponds of stagnant water, distributing, free of charge, medicated mosquito nets and awareness raising on malaria of its causes and consequences.

Another serious environmental problem related to health is clinical waste disposal. The consultants have observed that in the cities clinical waste is disposed with other municipal waste (e.g. in Asmara), it is dumped or buried in the landfill site of the city, which is about 4 km on the road to Massawa. In health centers or clinics, the clinical waste is burned in a pit within the premises of the health center or clinic. Contaminated leachate and/or dioxin, a cancer-causing agent from burning plastic, are significant environmental impacts. According to MOH officials, in the new hospitals that are under construction or that are to be constructed in the future, there is a plan to install incineration units with the hospital premises.

ANNEX A - Typical USAID Supported Activities and Their Potential Environmental Implications⁸

Type	Activity	Potential Adverse Environmental Impacts
Irrigation	<ul style="list-style-type: none"> - Rehabilitation of older schemes or new construction - River diversions - Dam and pond construction - Land leveling 	<ul style="list-style-type: none"> - Transmission of waterborne diseases - Destruction and/or impairment of wetlands - Salinization of soils - Alteration in aquatic ecology, including fisheries - Water pollution (non-point source farm runoff) - Effects on downstream water flow - Water use conflicts
Water Supply and Sanitation	<ul style="list-style-type: none"> - Potable water supply - Latrines & sewerage - Water catchments - Wells & ponds 	<ul style="list-style-type: none"> - Groundwater aquifer draw down or depletion - Waterborne disease transmission - Contamination of groundwater
Health Services Programs	<ul style="list-style-type: none"> - Immunizations - AIDS/HIV treatment 	<ul style="list-style-type: none"> - Medical and biohazardous wastes - Disposal of used/spent needles
Rural Infrastructure	<ul style="list-style-type: none"> - Construction and/or rehabilitation of secondary and tertiary (farm to market) roads - Construction of public buildings (health posts, schools) 	<ul style="list-style-type: none"> - Opening of otherwise intact forest or protected areas to exploitation and/or destruction - Erosion and uncontrolled runoff from improper construction practices or lack of adequate drainage - Impacts on land use, e.g., wetlands or farmlands
Natural Resources Management	<ul style="list-style-type: none"> - Soil and water conservation, e.g., bunds, terracing, etc. - Reforestation - Land clearing - Exotic species introduction, e.g., non-indigenous seed 	<ul style="list-style-type: none"> - Improper/incomplete structures add to erosion potential - Inadvertent shifts in land use patterns - Destruction of natural or secondary forest for reforestation with exotic species - Disruption of ecosystem balance through commercial production or harvesting of fauna or flora - Displacement by exotic species of endemic (local) species; weeds
Crop Protection, Livestock Disease Control	<ul style="list-style-type: none"> - Introduction and application of pesticides - Use of dip vats 	<ul style="list-style-type: none"> - Water pollution (non-point source farm runoff) - Environmental contamination - Human contact with toxic substances - Residues in food commodities, milk and meat - Poisoning of livestock

⁸ For more detailed review of activities in Eritrea and their potential adverse environmental impacts see the Eritrea – Emergency Reconstruction Program (ERP), MOF: Environmental Assessment; volume II, dated October 2001.

ANNEX B - PERSONS CONTACTED

1. Arefaine Berhe - Minister of Agriculture, MOA, Asmara
2. Mebrahtu Iyasu - Director General, Crop Production and Land Resource Department, MOA, Asmara
3. Hagos Yohannes - Wildlife Unit Head, MOA, Asmara
4. Yacob Yohannes - Expert, Forestry and Wildlife Division, MOA, Asmara
5. Daniel Zeratzion - Repatriation Director, ERREC, Asmara
6. Ghebremicael Mengistu - Program Manager, Program Management Unit, Emergency Reconstruction Program, Asmara
7. Dr. Tekeste Araya - Environmental Health Unit Head, MOH, Asmara
8. John Lichte, Team leader of the GBTI Task Order/SME Sector Assessment Group - Chemonics International Inc., USA.
9. Yosief Admekom - UNDP Project Officer, UNEP focal point, Asmara
10. Fisehaie Haile - Chief Executive, Zoba Northern Red Sea Administration, Massawa
11. Haile Awalom - Director General, Fish Production Department, MOF, Massawa
12. Ahmed Sheik Mohamed - Operation Head, Landing Site Massawa, MOF, Massawa
13. Abdu Omer - Expert, Research and Statistics Division, MOF, Massawa
14. N.L.B. Pantulu - Aquaculture expert, Research and Statistics Division, MOF, Massawa
15. Tesfamicael Kiflemariam - Diving Master, Eritrea Diving Center, MOF, Massawa
13. Beyene Asghedom - Finance Head, Sea Water Farms Eritrea, Massawa
14. Kibrom Tekeste - Shrimp Farming Unit Head, Sea Water Farms Eritrea, Massawa
15. Dr. Hamid Mohamed Ali - MOA representative, Zoba Anseba Administration, Keren
16. Berhane - Laboratory technician, MOH. Zoba Anseba Administration, Keren
17. Abraha Gharza = MOA representative, Head Zoba Gash Barka Administration, Barentu
18. Kebrom Emun - MOA Forestry and Wildlife, Zoba Gash Barka Administration, Barentu
19. Yonas Sium - MOA Agricultural Engineer, Zoba Gash Barka Administration, Barentu
20. Goitom Tekeste - MOA Agricultural Engineer, Zoba Gash Barka Administration, Barentu
21. Seltene Berhe - MOA Veterinarian, Zoba Gash Barka Administration, Barentu
22. Tsehaye Siilu - MLWE representative, Zoba Gash Barka Administration, Barentu
23. Marat Zarifov - Program Officer, UNHCR, Zoba Gash Barka, Barentu
24. Tekleab Mesghena, Director General, DOE, Ministry of Land, Water and Environment

ANNEX C - REFERENCE MATERIALS

1. National Environmental Management Plan for Eritrea (February, 1995) Government of the State of Eritrea and the people of Eritrea
2. Eritrean “Refugee Reintegration Project ” Environmental Assessment Draft Report (September, 1996) – By consultants, DOE, Ministry of Land, Water and Environment
3. Convention on Biological Diversity – Secretariat of the CBD
4. A Guide to the Convention on Biological Diversity – IUCN (1994)
5. Environmental Assessment Source book, Volume I Policies, Procedures, and Cross Sectoral Issues – (July 1991), World Bank, Environment Department
6. Environmental Assessment Source book, Volume II- Sectoral Guidelines – (August 1991), World Bank, Environmental Department
7. Environmental Assessment Source book, Volume III – Guidelines for Environmental Assessment of Energy and Industry Projects – (October, 1991) World Bank, Environment Department
8. National Environmental Assessment Procedures and Guidelines– (March, 1999)– DOE, Ministry of Land, Water and Environment
9. Eritrea Biodiversity Stocktaking Assessment Report (May, 1999) DOE, Ministry of Land, Water and Environment
10. Eritrea Biodiversity Economic Assessment (February, 1998) DOE, Ministry of Land, Water and Environment
11. National Biodiversity Strategy and Action Plan for Eritrea (August, 2000) DOE, Ministry of Land, Water and Environment
12. Workshop Proceedings “National Biodiversity Consultation Workshop” (February 2002, Asmara) DOE, Ministry of Land, Water and Environment.
13. Conservation Management of Eritrea’s Coastal, Marine and Island Biodiversity Project Inception Report (August, 2000) By GEF consultants and Ministry of Fisheries.
14. Eritrea Country Handbook (August 2002) Ministry of Information.
15. Eritrean Community Development Fund, Saving and Credit Program ECDF/SCP Performance Report (February, 2002), ECDF
16. Environmental Assessment Requirement for Eritrean Emergency Reconstruction Program -ERP, (October 30th, 2001)
17. Environmental Assessment Volume I, Executive Summary; (October 2001), Program Management Unit- PMU/ ERP.
18. Environmental Assessment Volume II, Main Report, (October 2001), Program Management Unit- PMU/ ERP.
19. Environmental Assessment Volume III, Annexes, (October 2001), Program Management Unit- PMU/ ERP.
20. Pesticide Management Plan in Support of the Environmental Assessment Requirements for the Eritrean ERP Project (September 2001), Program Management Unit- PMU/ ERP.
21. USAID/REDSO/ESA – Strategy: Environmental Threats and Opportunities Assessment with Special Focus on Biological Diversity and Tropical Forestry; Daniel Moore, Walter Knausenberger, May 2000.