



THE STATE OF ERITREA
MINISTRY OF LAND, WATER AND ENVIRONMENT

**6th National Report to the
Convention on Biological Diversity**



December 2019



**Convention on
Biological Diversity**



Forward

Since its accession to the Convention on Biological Diversity (CBD) on 21 March 1996, Eritrea has been regularly assessing the state of its biological diversity. Based on these assessments, five National Reports were prepared and their copies shared with the Secretariat of the Convention. Taking into account the need for due attention to the condition of the country's biodiversity, Eritrea also formulated its National Biodiversity Strategy and Action Plan (NBSAP) in 2000 and revised it in 2015. The NBSAP is imperative in translating the Aichi targets into national actions by defining national indicators, integrating the conservation and sustainable use of biodiversity into sectoral and cross-sectoral policies, strategies, legal instruments and activities.

This Sixth National Report, prepared with active participation of all relevant national stakeholders and in consonance with the guidelines provided by the CBD Secretariat, mainly focuses on the progress made in achieving the national targets stipulated in the revised NBSAP (2015-2020) and its contribution to the achievement of the Aichi Biodiversity Targets (2011-2020) as well as the 2030 agenda for Sustainable Development Goals.

Eritrea has been undertaking appreciable efforts to combat the environmental challenges, including land degradation, deforestation, invasion by alien species and climate change, all of which have detrimental impacts on biological diversity under terrestrial, marine and agricultural ecosystems. Although much is still to be desired, the establishment and management of protected areas and enclosures, community based activities of soil and water conservation, reforestation and maintenance of the integrity of coastal marine and island biodiversity constitute some examples of Eritrea's commitment and achievements in protecting its biodiversity. The concerted campaign on raising public environmental awareness is another essential activity inseparably linked to the overall efforts aimed at safeguarding the country's biodiversity.

As this Sixth National Report is made available to the Secretariat of CBD and the Eritrean general public, on behalf of the government of the State of Eritrea and myself, I would like to express due appreciation to all the stakeholders who diligently contributed for the preparation of the Report. Special appreciation also goes to UNEP and GEF for their financial and technical support. I also take this opportunity to reiterate Eritrea's commitment to work toward the achievement of the objectives of the CBD.

Tesfai G.S. Sebhatu

Minister of Land, Water and Environment



Acknowledgements

Eritrea as contracting party to the United Nations Convention on Biological Diversity is committed to submit country report to the Secretariat of the Convention every four years on measures taken in implementing the provisions of the Convention and their effectiveness. So far, it has prepared and submitted five national reports and this 6th national report has been prepared in a participatory and consultative process with different stakeholders.

First and foremost, I would like to thank H.E. Mr. Tesfai Gebreselassie, Minister of Land, Water and Environment of the State of Eritrea, for his enthusiastic support and continuous guidance in the whole preparation process.

I would also like to thank the Ministry of Agriculture, Ministry of Marine Resources, Ministry of Local Government, Ministry of National Development, Ministry of Finance, Ministry of Energy and Mines, Departments of the of Ministry of Land Water and Environment, Forestry and Wildlife Authority, Zoba Administrations, Eritrean Institute of Technology and Hamelmalo Agricultural College, for providing reliable data and information.

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Mogos Weldeyohannes,
Director General, Department of Environment



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List of Acronyms

ABT	Aichi Biodiversity Targets
AED	Agricultural Extension Department
BIHI	Buri-Irrori Hawakil Islands
CBD	Convention on Biological Diversity
CCD	Convention to Combat Desertification
CGRIS	Computerized Genetic Resource Information System
CITES	Convention on International Trade in Endangered Species of Wild Fauna & Flora
COP	Conference of the Parties
DoE	Department of Environment
DoL	Department of Land
DRS	Departments of Regulatory Services
ECMIB	Eritrea's Coastal Marine and Island Biodiversity
EIA	Environmental Impact Assessment
EIT	Eritrean Institute of Technology
FAO	Food and Agricultural Organization of UN
FFS	Farmers Field School
FRMP	Fisheries Resources Management Project
FWA	Forestry and Wildlife Authority
GBH	Girth at Birth Height
GEF	Global Environmental Facility
GIS	Geographical Information System
HAC	Hamelmalo Agricultural College
IAS	Invasive Alien Species
ICAM	Integrated Coastal Area Management
ICARDA	International Center for Agricultural Research in the Dry Area
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFAD	International Fund for Agriculture Development
IMO	International Maritime Organization
IPCC	International Panel for Climate Change
IPM	Integrated Pest Management
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IUCN	International Union for Conservation of Nature & Natural Resources
LDN	Land Degradation Neutrality
MARPOL	International Convention for the Protection of Pollution from Ships
COMSAT	College of Marine Science and Technology

MCS	Monitoring, Control and Surveillance
MHAP	Minimum Integrated Household Agricultural Package
MoA	Ministry of Agriculture
MoD	Ministry of Defense
MoE	Ministry of Education
MoI	Ministry of Information
MoLHW	Ministry of Labor and Human Welfare
MoLG	Ministry of Local Government
MoLWE	Ministry of Land Water and Environment
MoEM	Ministry of Energy and Mines
MoMR	Ministry of Marine Resources
IOSEA	Indian Ocean and South-East Asia
MPA	Marine Protected Area
MRRD	Marine Resources Research Division
MSY	Maximum Sustainable Yield
NARI	National Agricultural Research Institute
NBSAP	National Biodiversity Strategy and Action Plan
NEAPG	National Environmental Assessment Procedures and Guidelines
NEMP-E	National Environmental Management Plan for Eritrea
NIP	National Implementation Plan
NRSRA	Northern Red Sea Regional Administration
ODS	Ozone Depleting Substances
PAS	Protected Area System
PGR	Plant Genetic Resources
PPAs	Proposed Protected Areas
SLM	Sustainable Land Management
SoC	State of the Coast
UNCBD	United Nations Convention on Biodiversity
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change

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Executive Summary

The 6th National Report to the Convention on Biological Diversity of Eritrea provides an overview of the progress made towards the implementation of the National Biodiversity Strategy and Action Plan (2015-2020). The report has been prepared following the reporting tools of the CBD, which complement the guidelines adopted in the Decision XIII/27 of the 13th COP.

The report presents the national biodiversity targets, also referred as Ecosystem based targets (E-Targets) of the country, and an assessment of the progress made towards their achievement. The implementation measures taken by the relevant sectors and the effectiveness of the measures is reported. The report also includes achievements made towards the Global Aichi Biodiversity Targets and Sustainable Development Goals.

The NBSAP of Eritrea approach to the conservation and utilization of the biodiversity of the country has been on ecosystem basis and thus there were planned activities for the Agro-biodiversity, Terrestrial biodiversity and the Coastal, Marine and Island, biodiversity and ecosystems. Thus, the NBSAP document outlines 18 targets where each ecosystem has six major targets, objectives and plan of actions. The NBSAP has been implemented not as a separate project, but it has been streamlined to the various ministries' activities. Each line ministry as its main mandate has taken the E-targets into action and progress had been made in many of the targets.

The details of the assessment of the national targets (E-targets) show that many are on track towards the achievement of the targeted objectives and goals and there are also targets where no substantive progress was made. However, the implementing bodies are doing their level best to achieve the goals of each target. In the NBSAP, some of the targets were a little bit ambitious in which the progress that was expected to be reached could not be fulfilled within the planned period of time. In addition, some of the target areas such as coastal erosion and pollution were assumed as major threats during the preparation of the NBSAP. However, during this reporting period, the effect of these threats was minimal. Therefore, no visible measures were taken to mitigate the threats.

There has been substantive progress towards various targets that include decrease of land degradation and soil erosion through massive community based SWC activities and SLM, implementation of various afforestation programs and enclosures in the country, the use of alternative sources of energy, conservation of threatened and endangered species, etc. Community awareness on the issues of biodiversity is very high as all sectors are aware of the need to conserve and properly utilize the natural resources including biological diversity.

Regarding the targets related to the marine ecosystem substantial progress was made in enhancing the cover of mangrove along the coastal areas and on the islands. The status of coral reefs and endangered species remains healthy. However, no assessments were made on the status of marine pollution, coastal erosion and invasive/alien species.

Targets related to Agricultural biodiversity also showed some progress. Genetic resource management plan for agricultural crops developed, National Chemicals Profile (2016) and IPM frame work updated, morphological characterization of indigenous cattle conducted, assessment for various crops, vegetables and livestock conducted, improved varieties of different crops multiplied and released to respective communities.

There are limited publications related to biodiversity in Eritrea. Most of the information used in assessing the progress of the strategic plan was obtained from internal reports prepared by the

Ministries and from the interviews conducted with concerned authorities. Thus, the areas of biodiversity research and publications need to be strengthened.

The report shows that the biodiversity related activities and outcomes of Eritrea contribute to most of the Aichi Biodiversity Targets. Details of these achievements are provided in the report. Moreover, contributions of the country towards the achievement of Sustainable Development Goals (SDGs) were assessed and found to be positive.

The 6th National CBD report also provides an update of the biodiversity profile of the country. On the terrestrial ecosystem the status of endangered and threatened species is presented and the initiatives in conserving globally critical endangered species of the African Wild ass discussed. New records of one amphibian and one mammal species are documented. Furthermore, detailed account of marine biodiversity including seaweeds, invertebrates, corals, fishes, turtles and mammals is given.

The 6th National Report to the Convention on Biological Diversity of Eritrea has been presented and discussed in two consultative workshops with relevant stakeholders such as: MoA, MoLWE, MoMR, MoF, Eritrea Institute of Technology, Hamelmalo Agricultural College and other organizations. The presented document incorporates all the inputs made by the participants.

1. Background and Context

Life and development in Eritrea are based on natural resources; as an agrarian society, Eritrean dependence on agriculture is highly substantial; and safeguarding the productivity of the land is a major concern. Eritrea's pressing environmental problems are directly related to land degradation, deforestation, soil loss and the expansion of desertification, especially in the critical areas where agricultural output is vital (5th CBD National Report, 2014). The Eritrean Red Sea coast is endowed with valuable marine resources and it has rich biodiversity. There is relatively less anthropogenic pressure on the marine resources because the coastal area is sparsely populated and the fisheries sector is not developed. However, climate change has negative effects on the marine ecosystem; notably in the form of coral bleaching and sea level rise.

Eritrea acceded to the United Nations Convention on Biological Diversity (UNCBD) officially on 21st March 1996. As a party to this convention, it has been trying to meet the objectives of the CBD which are promoting the conservation of biological diversity; sustainable use of its components; and the fair and equitable sharing of benefits arising out of the utilization of genetic resources. The Ministry of Land, Water and Environment (MoLWE) through its Department of Environment (DoE) has therefore assumed the responsibility of coordinating all activities related to CBD. Eritrea has been fulfilling its national obligations. Various ministries and organizations in the country have worked towards conservation of biological diversity and its sustainable use. Thus, amongst others, the country has fulfilled the following obligations:

1.1 In line with **Article 26**:

- a) Prepared the first National Biodiversity Strategy and Action Plan (NBSAP) in August 2000 and revised it in 2015. The NBSAP states the policy and the position of the country with respect to biodiversity and it is a continuation to the government's earlier commitment to the broader environmental protection plans, including the National Environmental Management Plan – Eritrea (NEMP-E, 1995) and other relevant policies and legislations. The NEMP-E ensures that human activities in both terrestrial and marine areas would result in long-lasting global environmental benefits, while the NBSAP builds on this and outlines Eritrea's biodiversity targets that are specific to its biodiversity resources under terrestrial, marine, and agricultural settings. The targets set in the NBSAP are also in line with the Strategic Plan for Biodiversity 2011-2020 and its Aichi Biodiversity Targets.
- b) Prepared five regular country reports to the Conference of Parties (COP) on the measures taken towards the achievement of the NBSAP targets and the CBD action plans.

1.2 Identified and monitored components of biological diversity which are important for its conservation and sustainable use (Article 7).

To reverse the adverse environmental problems, various measures such as soil and water conservation, area closures, afforestation, rehabilitation of degraded areas (both in land and coastal areas), conservation of coral reefs, etc. have been undertaken by the government in collaboration with development partners and local communities. The Government of Eritrea with assistance from its development partners such as GEF, IFAD, UNDP etc., has made substantial investment in the environmental sector that has a major contribution to the conservation of biodiversity and the ecosystems that support it.

The above obligations form part of a long-term commitment to conserve the environment and promote sustainable use of natural resources viz. biodiversity.

2. 6th National Report for the Convention on Biological Diversity

The NBSAP (2015) document of Eritrea has described the national target actions for the country under Ecosystem based targets (E-Targets 1-18) and National Targets (1-20). The National targets are similar to the Aichi Global Targets (1-20). The reason of having the ecosystem based targets goes hand in hand with the overall functioning of the relevant ministries and their plan of actions. Thus, the targets aim at the three ecosystems existing in the country: Agro-biodiversity, Terrestrial biodiversity and the Coastal, Marine and Island, biodiversity.

In developing this 6th National CBD Report therefore, it has been found easier and would be best detailed if the reporting is based on the E-targets and they are taken as National Targets.

2.1 Information on the Targets Being Pursued at the National Level

Eritrea has adopted national biodiversity targets in line with the strategic plan for biodiversity 2011-2020 and the Aichi Targets. A total of eighteen targets grouped into three ecosystems were set in the revised NBSAP which was adopted in 2015. Targets 1 to 6 are related to the terrestrial ecosystem, target 7 to 12 to marine ecosystem, and targets 11 to 18 to agricultural ecosystem. This section provides detailed information on these targets. Rationale for each national target, level of application, relevance of the national targets to the Aichi Biodiversity targets, and relevant websites, web links, and files related to the targets is given below.

E- Target 1. Developed integrated action frameworks on the control of excessive firewood collection and construction wood that impact biodiversity resources, in a manner that enhances sustainable use of natural resources.

Rationale

The loss of biodiversity, along with climate change and desertification, are identified as the greatest challenges to sustainable development in Eritrea (NBSAP, 2015). The cutting down of trees for firewood and construction and clearing of forests for cultivation are significant concerns, because of increased human encroachment upon forest areas and increased resource extraction is threatening the forest resources and vegetation covers. The loss of terrestrial biodiversity worsens when other forces such as over grazing/over browsing, invasion by alien species, and habitat transformations are added to those mentioned earlier.

Establishing and ensuring effective implementation of sustainable use of forest resources and integrated control mechanism by the Forestry and Wildlife Authority and agricultural sector is expected to reduce excessive collection of firewood and construction wood. This can be approached by the reduction of pressure on plants in natural habitat through the strengthening of forestry and wildlife inspectors, promotion of alternative to natural fuels, afforestation, and sustainable utilization of forest products. In addition, establishment of an information system for the conservation and sustainable utilization of forest products becomes essential. This could be attained through: the integration of environmental education on sustainable conservation and

utilization of forest products, conducting awareness campaigns and training, and the enforcement and implementation of relevant proclamations such as the Forestry and Wildlife Conservation and Development Proclamation (No. 155/2006), Plant Quarantine Proclamation (No156/2006), etc.

This target of the NBSAP has a component related to awareness raising and capacity building as basic elements in the areas of intervention for the conservation and appropriate/sustainable utilization of biodiversity. Accordingly, measurable steps are being taken to increase the level of awareness of the Eritrean people in the conservation and sustainable use of biodiversity. Numerous awareness raising events have been organized on regular and on *ad hoc* basis to increase the people’s awareness.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets.

Main related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other relevant information

The Ministries that have mandates related to biodiversity are the Ministry of Land, Water and Environment (MoLWE), Ministry of Agriculture (MoA), Ministry of Marine Resources (MoMR), etc. All the regional offices, conduct training programs that raise the awareness in the conservation and sustainable utilization of biodiversity and related fields of study. Information is also disseminated through various means such as: manuals and guidelines, hand-outs, review of agricultural articles, booklets, newsletters, flyers, leaflets, posters, stickers, documentary films and TV spots, articles in local newspapers (*‘Hadas Ertra’* and *‘Eritrean Profile’*) radio programs like *“Hrshana Nemaabl”* (*‘Let us develop our agriculture’*). All these are produced and broadcasted in English, Tigriana, Arabic and Tigre languages.

Relevant websites, web links, and files

- [https:// www.cbd.int/doc/world/er/er-nbsap-v2-en.pdf](https://www.cbd.int/doc/world/er/er-nbsap-v2-en.pdf)
- www.shabait.com/Haddas-ertra
- www.shabait.com/Eritrea-profile

E-Target-2. By 2020 the use of alternative energy should be increased and pressure on forests significantly reduced.

Rationale

The country’s biodiversity resources are basic sources of livelihood that need to be sustainably conserved and utilized. Therefore, all stakeholders have the responsibility to contribute to the conservation of biodiversity and its sustainable use. Eritrea is not endowed with dense forest resources as its forests have been reduced significantly as a result of deforestation and land degradation. Most Eritreans depend on firewood for household energy. The use of alternative energy resources is therefore very crucial to the conservation of the dwindling natural forest. Taking this into account the NBSAP has set this target of utilization of alternative sources of energy to reduce the pressure on the natural forests.

The Government of Eritrea (through its relevant ministries such as the Ministry of Energy and Mines, the Ministry of Agriculture, and other stakeholders) has addressed the issue of alternative energy in various ways. It has undertaken intervention actions to promote the use of alternative energy sources such as biogas, wind and solar energy. Accordingly, it has distributed energy saving/efficient stoves (*Adhanet Mogogo*) to the rural communities to reduce cutting of forests for firewood.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other relevant information

The Government initiatives aim at maximizing every effort in the promotion of renewable alternative energy sources and appropriate technology to reduce biodiversity losses and ensure sustainable livelihood. This could be better attained through continuous awareness programs related to the conservation and sustainable use of biodiversity. These programs would be more fruitful if they are supported by technical and financial resources and are built on international and local knowledge and experiences.

The development of land use classification and land use maps accompanied with appropriate implementation strategies are expected to promote sound forest management. In addition, the harnessing and development of alternative renewable energy sources (e.g. wind and solar) and the development of non-wood construction materials will curb further depletion of forest resources. For

instance, the traditional Eritrean stove (*Mogogo*) uses a lot of firewood for making injera (local bread). Thus, cutting forests for firewood is one of the main drivers for the degradation of forests and wooded lands. The improved *Adhanet Mogogo*, which saves about 50% of firewood consumption, has gotten wide acceptance among beneficiaries. In a country where biomass constitutes at least 82% of the total energy consumption, the use of improved stove has significant impact on both the environment and health of the rural communities.

Relevant websites, web links, and files

- MoA, FWA Report 2018

E-Target 3: By 2020, at least 25% of grazer populations have developed the capacity to reduce overgrazing/over browsing.

Rationale

Approximately 75% of the total population in Eritrea depends on livestock and livestock production (NBSAP, 2015). However, there is limited rangeland that is estimated at 6 million hectares (49% of the total land mass of the country). About 30% of the total population is either pastoralists or agro-pastoralists. Almost all farming households own some livestock and many upland farmers move livestock to the lowlands in combined herds for grazing.

The country is also home to many pasture species of legumes and grasses. The pastures in the highlands are infertile and steep, hence fragile under continuous uncontrolled grazing regimes. The grazing area has been shrinking over the years because of over-grazing, extensive cultivation, improper utilization of water resources and deforestation. The resources of the browse layer have been dwindling due to the removal of forest cover and constant grazing. The pastures have no opportunity to recover because hungry animals are continuously searching for any edible plant that sprouts. As a result, the most palatable species of herbage and browse are decreasing in quantity and leaving space for less palatable species. If the present trend of deterioration persists for much longer, it could result in leaving the land bare and subject it to soil erosion that could lead to desertification. Thus, this target aims at reducing the overgrazing/overbrowsing pasture species by enabling farmers to grow animal feed for their livestock.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other relevant information

This target aims at addressing the lack of knowledge on the undesirable impacts of overgrazing/overbrowsing. As a priority, capacity building programmes for herders in local communities and training on cut and carry of forage production and sustainable utilization of enclosures will contribute significantly to the reduction of biodiversity loss from overgrazing/overbrowsing. The realization of this target will be considered a priority in the semi-arid and grassland ecosystems.

E-Target 4: By 2020 the extinction of threatened species has been prevented and the conservation status of those most threatened and endangered flora and fauna have been improved, with declining trends significantly reduced.

Rationale

The assessment of Eritrean biodiversity shows that there are species that are threatened/ endangered and some in the verge of extinction. Thus, the existing state of biodiversity development requires an integrated ecosystem management approach to the achievement of biodiversity conservation and sustainable use. One of the major goals of the NBSAP is to improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity. This is to be achieved through the establishment of protected areas and devising of appropriate management practices to conserve the biological diversity of the flora and fauna of the country.

This target aims to contribute to the conservation of threatened and endangered species of flora and fauna which are included in the IUCN Red List. One of the proposed intervention conservation measures is through the establishment of a protected area system and enclosures appropriate to Eritrean conditions.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets.

Main related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other relevant information

Eritrea is home to a number of globally rare and endangered species (IUCN Red List, 2018). The African Wild Ass (*Equus africanus*), the Nubian Ibex (*Capra ibex nubiana*) and the African

Elephant (*Loxodonta africana*) are among the endangered species while Dorcas gazelles (*Gazella dorcas*) and Soemmering's gazelle (*Gazella soemmerringi*) are listed as vulnerable species.

Out of the sixty endemic birds to the Horn of Africa, seventeen species are found in Eritrea (E.g. Wattled Ibis, Abyssinian woodpecker, Thick-billed Raven, Banded barbet, etc.). In addition, there are 6 Near Endemic birds (E.g. White checked Turaco, White rumped Babler, etc.). Moreover, 17 species of Western or Sahelian bird species found in Eritrea are hard to find elsewhere in the Horn Africa (E.g. Orange River Francolin, Long-tailed Nightjar, Cricket Warbler, etc.) (Redman, et al., 2009)

It is believed that uncharted amphibian and reptile diversity exists in Eritrea. The Horn of Africa, including Eritrea, is endowed with the highest levels of endemism of reptiles (Dr. Theodore Papenfuss personal comm.). However, until recently the herpeto-faunal records were mostly obtained during the Italian Colonial Period (1889-1941). Since then, not much study was made as far as the amphibians and reptiles are concerned. Accordingly, knowledge of the diversity of reptiles and amphibians in Eritrea has been very limited consequently not much information was obtained from desk review in general. The sole reliable source of information was obtained from the survey that was made for the last four years by Dr Theodore Papenfuss who is a senior scientist of amphibians and reptiles from University of California in collaboration with Forestry and Wildlife Authority of the state of Eritrea. This team has started to chart the uncharted reptiles and amphibian diversity of Eritrea.

The Eritrea Biodiversity Stocktaking Assessment Report (DoE, 1999), lists about 700 plant species, which reveals considerable plant diversity in human-altered landscapes. A total of 55 tree species have been listed in the Forestry and Wildlife Conservation and Development Proclamation (No 155/2006) as nationally endangered/threatened species which require special conservation attention. Among others, these include: *Boswellia papyrifera*, *Ficus vasta*, *Myrica salcifolia*, *Adansonia digitata* and *Balanites aegyptiaca*.

The diversity of crop, forage, shrub and tree browse landraces found in Eritrea has global conservation significance because Eritrea is primary and secondary centre of diversity for a number of cultivated crops. More importantly, the genetic diversity of these and other crops and forages in Eritrea plays an important role in the agricultural strategy, especially those practising rain-fed agriculture. Eritrea is also centre of origin for several crops such as okra (*Abelmoschuse sculentus*), taff (*Eragrostis tef*), Niger seed (*Guizotia abyssinica*), mustard (*Brassica carinata*), watermelon (*Citrullus lanatus*) and leafy vegetables Amaranths (*Amaranthus caudatus*). In addition, wild relatives of some crops such as *Amaranthus ficulneus*, *Cucumis melo*, *Eragrostis pilosa* and other *Eragrostis spp* are reported to exist in Eritrea. The country is also a primary and secondary centre of diversity for several crops such as barley, tetraploid wheat, chickpea, finger millet, grass pea and cowpea. Vavilov (1992) identified the Eritrean Centre of Diversity among others as the centre of origin for sesame, castor bean, garden cress, okra, indigo, barley, sorghum, pearl millet, cowpea, flax, taff, polish wheat, hard wheat, *emmer* and poulard wheat. Currently, however, there are threats of erosion to this important diversity due to their being susceptible to diseases and pests. For instance, the production of the local wheat called *Manna keih* and *Manna guandie* is decreasing since they are disappearing due their susceptibility to down mildew.

Relevant websites, web links, and files

- Birdlife international web site; <https://www.birdlife.org/> Sowb 201
- DoE (1999). Eritrea Stocktaking Assessment Report, Department of Environment, Ministry of Land Water and Environment, Eritrea.
- FWA Report, 2017
- <https://www.cbd.int/doc/world/er/er-nr-05-en.pdf>
- <https://www.thegef.org/sites/default/files/nca-documents/353.pdf>
- IUCN (2018). IUCN Red List of Endangered Animals, Version 2018. www.iucnredlist.org accessed on December 2018
- IUCN, 2019. The IUCN Red List of Threatened Species. Version 2019-1. <<https://www.iucnredlist.org>>ISSN 2307-8235
- Forestry and Wildlife Conservation and Development, Proclamation No. 155/2006
- Redman, et al., 2009

E-Target 5: By 2020 at least 25% of catchment sites and degraded lands of high biodiversity hotspots are rehabilitated within the terrestrial ecosystem.

Rationale

The NBSAP has the conservation of ecosystems and biodiversity as an essential action area that will reduce vulnerability of the populations. The strategic plan aims on climate resilient thereby ensuring that climate change mitigation and adaptation are major areas of action. This is through appropriate adaptation approaches for biodiversity conservation and sustainable use. To tackle the threats from watershed degradation and climate change and variation with a focus on forest and woodland ecosystem, an implementation of National Land Use Master Plan with the principles of Sustainable Land Management (SLM), and Integrated Strategy on Degraded Catchments Treatments Programme is proposed. Priority intervention here is to assess the impacts of rehabilitated degraded watersheds with high biodiversity hotspots and make an intervention through soil and water conservation, afforestation as well as enclosures establishment.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other related Aichi Biodiversity Targets

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Other relevant information

Majority of the Eritrean population (about 65%) lives in the central highland zone. Due to high population density, the nature of the land use system and climate changes resulted into severe land degradation and this in turn affects agricultural production negatively. The main causes of land degradation in Eritrea are deforestation, inappropriate agricultural practices, overgrazing, insecure land tenure, inadequate land use planning and limited application of knowledge and technologies by farmers to enhance productivity. Between the years 2009 to 2015 Sustainable Land Management (SLM) was implemented as a pilot project in Eritrea with a goal of 'better managed land that provides the basis for ecosystem service and meeting national development needs'. SLM is the adoption of land use systems through appropriate management practices that enables land users to maximise the economic and social benefits from the land while maintaining or enhancing the ecological support functions of the land resources. SLM is the remedy to increase average productivity, reducing seasonal fluctuations in yields, and supporting diversified production and improved incomes. SLM focuses on increasing productivity of agro-ecosystems and socio-economically improve resilience to environmental variability, including climate change and prevent degradation of natural resources. Profitable SLM has been used innovatively in Eritrea accompanying the new land tenure system that offers life-long usufruct of land to farmers (Land Proclamation 58/1994), in the Central Highland Zone. Previous SLM interventions were impeded by the cyclic land redistribution (every 5-7 years) that does not encourage SLM practices adoption and land care.

Biodiversity hot spot areas have been identified and actions are ongoing to rehabilitate degraded watersheds through the establishment of protected areas. In addition, afforestation programs are underway using indigenous species and construction of physical structures (terraces, check dams, etc.).

Relevant websites, web links, and files

- <https://www.cbd.int/doc/world/er/er.nbsap.v2-en.pdf>
- <https://www.unccd.int>
- www.er.undp.org

E-Target 6: Develop an integrated action plan of implementation to reduce the expansion of invasive alien species through control mechanisms and sustainable utilization.

Rationale

Deforestation, land degradation, over grazing/over browsing, climate change induced recurrent droughts; invasive alien species and habitat transformation are identified as a major threat to the loss of terrestrial biodiversity in Eritrea. Habitat degradation and loss is occurring due to several factors that include: excessive clearing of woodlands for agriculture, cutting of live trees for firewood, expansion of settlements, villages and towns, conversion of coastal habitats to other land uses, and pollution. When degradation occurs it increases the chance of it being invaded by aggressive plants and animal species that invade the degraded lands. In Eritrea, there are such species that have invaded degraded areas and have become threats to existing biodiversity and by virtue of being aggressive are becoming threats to the local flora.

There are many Invasive Alien Species (IAS) introduced in the country through different ways. The common IAS introduced in Eritrea include *Opuntia ficus-indica*, *Opuntia dillenii*, *Prosopis juliflora/chilensis*, *Lantana camara*, *Nicotiana glauca* (in the terrestrial ecosystem); several weeds like: *Xanthium spinosum*, *Xanthium strumarium*, *Tagetes minuta*, *Striga hermonthica* and pests

mainly white fly, *Trialeurodes vaporariorum* (in the agricultural ecosystem); and Indian House Crow, *Corvus splendens* (in the coastal and marine ecosystems).

From the invasive alien woody plant species, *Prosopis juliflora/P. Chilensis*, which was introduced through the Sudan in the 1970s, and from Ethiopia (to the Gahtelay area) in the 1980s, is of great concern in Eritrea. It is aggressively expanding and invading the riparian habitat and seriously affecting the indigenous plants in the western and eastern lowland.

Currently new invasive alien species are expanding in the crop land. For instance, *Senna abtisifolia* L., locally known as ‘*Abaeke harmaz*’, is covering 20% of farm land and almost 100% of grazing lands in most parts of Zoba Gash Barka. Similarly, such invasive species is also observed in Zoba Debub.

Considering this problem, the NBSAP has delineated this target to ensure integrated management approaches on the control of invasive alien species, to reduce the negative effects of the species, and to sustainably exploit the potential of the invasive species particularly (*P. juliflora/ P. chilensis*) in order to reduce pressure to the forest ecosystem. Proper management mechanisms and awareness raising programmes on the sustainable utilization and management of invasive alien species (especially *P. juliflora/P. chilensis*) have to be conducted at all levels by the relevant sectors.

As mentioned above, the major threats to biodiversity conservation in the country are the over exploitation of natural resources, habitat degradation and loss, and other environmental root causes. It is in this line that the NBSAP has in it a major target that aims at the reduction of the expansion of alien species through control mechanisms and sustainable utilization.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets Main related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
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Other related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Relevant websites, web links, and files

- <https://www.cbd.int/doc/world/er/er-nbsap-v2-en.pdf>
- Semienawi Debubawi Bahri Assessment Report, MoLG/FWA, 2016
- DoE (2004). Assessment of methodologies to evaluate and mitigate specific threats to components to biodiversity

E-Target 7. By 2020 mangrove forest and associated coastal forest degradation and loss would have been significantly reduced.

Rationale

The Red Sea of Eritrea supports well-developed mangroves as compared with other countries of the Red Sea (Khalil, 2015). Mangrove coverage along the coast of Eritrea is estimated to cover 15% of the total coastal area (Sato and et al., 2001). Estimates for total mangroves cover vary from 6,400 (FAO, 2007) to 7,000 ha reported by Ministry of Marine Resources of the state of Eritrea (De Grissac and Negussie, 2007). Three species have been confirmed along the Eritrea coast, *Avicennia marina* being the most abundant and distributed while *Rhezophora muchronata* is scarcely found and *Cerriopstagal* is rarely distributed (Rose, et al., 1996, De Grissac and Negussie, 2007).

There is limited information related to Eritrea mangrove forest diversity, distribution and mangrove area change over time. Extensive fieldwork was conducted by the Eritrean Coastal Marine and Island Biodiversity (ECMIB) project, a biodiversity project which was executed by the MoMR. From 2001 to 2007 the ministry collected quantitative and qualitative data on the mangrove forests. The main purpose of the survey was to assess the status of mangrove vegetation and to determine the intensity of anthropogenic and natural impacts. During the survey identification and characterization of mangrove species were carried out and their distributions patterns assessed. Results from this study indicate that the country's mangrove covers a total area of about 70 km² (De Grissac and Negussie, 2007).

Many factors cause deforestation and degradation of mangrove. These factors include cutting of mangrove for timber and domestic firewood, coastal developments causing alteration of the substrate and modifying hydrological regimes, oil and other pollution resulting into death of the trees. There is a growing evidence of continuous deforestation of mangroves in Eritrea as a result of numerable human activities (De Grissac and Negussie, 2007). According to Elias (2018) fishers cut down mangrove for cooking, for boiling sea cucumber, for repairing boat, and for building temporary shelter. The trees are also cut down for windbreaks (Semere, et al., 2008). In addition to cutting, coastal communities feed domestic animals (especially camel, goat and sheep) and graze/browse them on mangrove leaves and seeds (Manzanar project). The mangrove forest rehabilitated by the Manzanar project in the 1990's was destroyed in early 2000 mainly as a result of grazing by camels.

Significant part of the Southern Red Sea coast is covered by mangrove. The coastal people have a culture of conserving forests and wildlife. However, in some areas degradation of mangrove takes place due to diversion of ephemeral rivers and as a result of overgrazing. Thus, there is a need of conserving the mangroves and afforestation of degraded mangroves (Elias, 2018).

This target aims at strengthening the on-going approaches and mangrove rehabilitation programs. The priority actions planned for this target include: promotion of active mangrove rehabilitation programs and initiatives in the marine, coastal and island mangrove managements; strengthening of on-going approaches to reduce massive degradation and fragmentation of mangrove habitats; and development of mangrove plantation programmes on the intertidal areas of the main coast and the islands of Dahlak.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
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Other related Aichi Biodiversity Targets

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Other relevant information

Mangroves as any other plants can be planted and grown well in nursery or in the intertidal areas through seeds or seedlings. In Eritrea, planting mangrove (*Avicennia marina*) started in the late 1990'S by the initiative of Manzanar Programme under the coordination and administration of Ministry of Marine Resources. The main area that used to grow mangrove was the coastal area of Hirgigo and Massawa in which about 20 hectares of the coast was planted with about 1million seeds (MMR report, 2005). However, due to lack of proper management, the planted mangrove in Hirgigo was destroyed through grazing of camels and cutting of wood for fire and house construction. In 2007, the Manzanar programme halted planting of mangroves.

Mangrove swamps are dominant features of undisturbed tropical and subtropical shorelines around the globe. Throughout their range, however, these habitats are in a state of decline. Nearly 16% of mangrove species are at an elevated chance of extinction globally (Polidoro, et al., 2010). Approximately one-third of the world's mangrove forests have been lost to coastal development over the past 50 years (Craig & Faunce, 2006). Approximately 90% of the global mangroves are growing in developing countries and they are under the condition of critically endangered and nearing extinction in 26 countries (Kathiresan, 2008). Services offered by the mangrove forest may possibly be lost in the coming 100 years (Duke, 2007).

Mangrove forests throughout the tropics are affected by natural and manmade causes. Natural causes of mangrove disturbances include cyclones, dieback, diseases and pests. Both natural and man-made causes of mass mortal of mangrove were observed along Red Sea. The main causes for the observed disturbances were rapid change in the environment, camel grazing and logging (PERSGA/FAO, 2004).

Relevant websites, web links, and files

- Craig & Faunce (2006)
- De Grissac and Negussie (2007)
- Duke (2007)
- ECMIB project document
- Elias (2018)
- FAO (2007)
- Khalil (2015)
- Kathiresan (2008)
- MMR report, (2005)
- PERSGA/FAO (2004)

- Polidoro, et al., (2010)
- Sato, et al., (2001)
- Semere, et al., (2008)

E-Target 8. By 2020, all sources of coastal, marine and island pollution should be effectively controlled to reduce pollution and mitigate its impact on the ecosystem

Rationale

The Eritrean coast of the Red Sea is sparsely populated with the main settlements in the two port cities: Massawa and Assab. The major infrastructure along the coast is located in the two ports. These infrastructures include two cement factories in Massawa, seven fish landing sites (two in Massawa and one each in Gelalo, Tio, Eddi, Berasole, and Assab), Hirgigo power plant in Massawa and two salt production factories (one each in Massawa and Assab). Coastal tourism is not well developed in Eritrea. There are few hotels in Massawa and Assab and eco-tourism (snorkelling and diving) is not common.

Considering the low population density and underdeveloped coastal areas, no major pollution is expected in the Eritrean coast of the Red Sea. However, the current level of coastal settlements and infrastructure development should be assessed to find out the effect of these activities on the coastal ecosystem. Also, cleanliness of the cargo and fishing vessels that dock in the Eritrean ports should be checked to confirm the pollution status of the coastal waters. On the other hand, land based non-point pollution should be assessed by monitoring the coastal waters for levels of pollution from river run-off.

Recently the country has signed peace deal with Ethiopia, ending 20 years of hostilities. The economic sanction imposed on the country by the United Nations was also lifted in November 2018. The government has plans to expand the port activities, promote coastal development, and encourage tourism. These activities are expected to put pressure, including pollution, on the marine environment.

This target plans to assess the status of pollution of the Eritrean coast of the Red Sea. It seeks to strengthen control of pollution arising from urban wastes, coastal developments and maritime activities, which may have growing risk to the coastal, marine and island ecosystem. The target also plans to develop strategy to mitigate the impact of pollution on the ecosystem. Priorities actions for this target include: establishment of a collaborative mechanism to strengthen control and inspection of coastal, marine and island pollution; control of maritime activities to minimize their effects on pollution; and promotion to strengthen pollution control through community based approaches.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
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Other related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
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E-Target 9. By 2020, Coastal erosion should be greatly reduced and eroded coastal beaches rehabilitated.

Rationale

In general, the coastal zone problems are already critical in many parts of the Red Sea and Gulf of Aden. The potential impacts of the predicted global changes will be diverse and important for human populations. The major impacts will follow from one or more of the following mechanisms: shoreline retreat; flooding and flood risk; direct exposure to coastal environment; and saline intrusion and seepage. The Eritrean coast of the Red Sea, like most other coastal areas in the world, is vulnerable to coastal erosion due to sea level rise. In its 4th report, the Intergovernmental Panel for Climate Change (IPCC) reported that a global sea level rise of between 18 and 58cm is expected by the end of the current century (IPCC, 2009).

In Eritrea there is no information on the coastal processes including coastal erosion, changing sea level, ground water salinity and land subsidence in the coastal regions. Most of the settlements of the Eritrean coast (including the two port cities) are located along the shore just above the upper tidal mark. For example, studies by the Department of Environment (MoLWE) show that elevation most part of Massawa ranges from below sea level up to one meter (Zekeria, 2018). Global climatic change is predicted to increase the sea level by 50cm at the end of the current century. According to the above study, a sea level rise of 0.5 meter would submerge valuable infrastructure and other installations causing an economic loss of more than 250 billion USD (Department of Environment, 2001).

This target calls for conducting studies to identify the underlying causes of coastal erosion and further promoting the rehabilitation of eroded coastal beaches by using cost effective local technologies. The priority actions in this target include: development and implementation of program to identify the underlying causes of coastal erosion and rehabilitation of eroded coastal area and beaches through the use of cost effective local technologies

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
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Other related Aichi Biodiversity Targets

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Relevant websites, web links, and files

- Department of Environment, 2001
- IPCC, 2009
- Zekeria, 2018

E-Target 10. By 2020, all coral reefs in the Eritrean Red Sea are identified to a species level and status of natural and human induced degradations regularly monitored.

Rationale

Climate change and multiple anthropogenic pressures are negatively impacting on the coral reef ecosystems and consequently on the wellbeing communities that depend on ecosystem resources for their livelihoods. Drivers of coral reef degradation include sedimentation, destructive fishing, uncontrolled development of the tourism industry, land reclamation for coastal development, excessive runoff of nutrient loaded rivers, and climate change. Coral reefs are slow growing and delicate ecosystems. Thus, there is a need to conserve the existing corals and to rehabilitate degraded ones. Therefore, actions need to be put in place that reduce the negative impacts of climate change and multiple anthropogenic pressures through the application of Integrated Coastal Area Management (ICAM) strategies and setback development.

Coral Reefs are common along the 1,350 km Eritrean coastline (18 % of the Red Sea) and around most of its 350 islands, occurring as patches in a relatively pristine condition. During the period between 1993 and 2006, numerous surveys and expeditions were conducted to study the status of Eritrean coral reefs and to propose an appropriate management strategy. Results of previous surveys, including the one conducted in November 2007 by Dr John Veron, indicate high diversity of coral and fish in many parts of the coast and the islands (De Grissac and Negussie 2007).

The coral reef ecosystems in Eritrean waters support a multitude of fish and invertebrates targeted by the artisanal fishery (Tesfamichael and Mahmud, 2015). The reefs are also home to hundreds of fish species including many endemic species (Zekeria, 2003). Overall, fishing pressure on coral reefs is relatively low, as the hot and dry coastal areas of Eritrea are not densely populated. However, some areas which are frequently visited by fishers have exhibited local depletion and deterioration (Tsehaye, 2007). Recently though, development of coastal areas is increasing, and the threats to coral reef health are growing (Tesfamichael and Mahmud, 2016). The coral reefs in the Southern Red Sea are subject to periodic bleaching due to high water temperature during summer months (Kotb, 2008).

In this respect the target seeks to develop and implement program to identify the coral and prepare reference sample of corals to a species level and establish a resources database. Programme activities in this target include: surveys of status of coral reefs, coral reef conservation, drafting legal frameworks to establish Marine Protected Area, strengthening of coral reef management plans, monitoring health of reefs, and promotion of awareness raising programmes.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

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Other related Aichi Biodiversity Targets

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Other relevant information

The Red Sea covers only 0.12 % of the global ocean but it accounts for 6.2 % of global coral reefs (Wilkinson, 2008). The Red Sea is one of the hotspots for coral reef ecology in the world. In coral bio-geography, the Red Sea is considered part of the Indo-Pacific region and contains the highest diversity of reef communities outside of the Southeast Asian ‘coral triangle’ (DeVantier, et al., 2000). There are 333 reported coral species (Dubinsky and Stambler, 2011), of which many are found in other Indo-Pacific locations. The Red Sea also has high level of endemism, estimated at about 10 % (DeVantier, et al., 2000).

The coral reefs of the Eritrean coast are subjected to high temperature during summer months (August and September). At this temperature the zooxanthellae, symbiotic algae which form mutual association with the corals, dissociate from the corals causing bleaching. Coral bleaching is common in the Eritrean coast at the end of the summer when sea surface temperature exceeds 33°C. But the phenomenon lasts for only few weeks after which the corals recover (Zekeria personal observation). In 1998 the Red Sea coral reefs suffered from severe coral bleaching. Some signs of recovery were seen in the central and northern Red Sea. In addition, extreme low tides in 2007 caused coral bleaching and mortality (Kotb, et al., 2008). Outbreaks of crown-of-thorns starfish devastating coral reefs have been reported at different places and times along the Red Sea (Wilkinson, 2008).

Relevant websites, web links, and files

- De Grissac and Negussie, 2007
- DeVantier, et al., 2000
- Dubinsky and Stambler, 2011
- Kotb, et al., 2008
- Tesfamichael and Mahmud, 2016
- Tsehay, 2007
- Wilkinson, 2008
- Zekeria, 2003

E-Target 11. By 2020, Invasive Alien Species in the Coastal, Marine and Islands (CMI) are controlled and monitored

Rationale

From 1998 to 2004 the Sea water farms Eritrea attempted to culture shrimps in Gurgusum beach around Massawa. The farm was culturing an exotic shrimp species (*P. vanamai*) which was introduced from Mexico. In addition to the shrimp species the farm also introduced some halophytes which were supposed to trap excess nutrients leaving the grow-out pond of the farm. Although each unit has been projected to generate revenue and even profit, the system as a whole has generated little income and eventually led to the failure and cessation of operation at the end of 2004 (De Grissac and Negussie, 2007). There is no report of invasion by any of these species in the

Eritrean coast although no formal survey was conducted to assess whether the species were introduced to the marine and coastal areas of the country.

Due to high salinity and temperature of the Red Sea it seems less likely for invasive species to expand in the Red Sea. Thus, the Red Sea has less vulnerability for alien and invasive species. However, the sea has heavy maritime traffic and introduction of species by ballast water is a potential source of introduction of alien invasive species. Thus, there is a need of monitoring the Eritrean coast regarding introduction and spread of invasive alien species.

The concern of invasive alien species is to be tackled through the establishment and institutionalization of an effective organ so as to control, implement and monitor the introduction and status of invasive alien species. This target thus intends to thoroughly survey the introduced alien invasive species so far and to prepare implementation plans, regulatory frameworks as well as strategic maritime and aquaculture master plan for the control of possible introduction of invasive alien species. The priority actions of this target include: establishment of an office for the control and implement monitoring programme for an alien and invasive species introduction; preparation of activities regulatory framework on a local, national and regional scale which address issues of exotic species, both from ship-sources and land-sources, with particular attention to island ecosystem; and development of implementation programme for control and monitoring of invasive alien species through ship ports and introduction of species through aquaculture.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

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Other related Aichi Biodiversity Targets

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Other relevant information

Invasive species have transformed marine habitats around the world. The most harmful of these invaders displace native species, change community structure and food webs, and alter fundamental processes, such as nutrient cycling and sedimentation. Invasive alien species have damaged economies by diminishing fisheries, fouling ships' hulls, and clogging intake pipes. Some can even directly impact human health by causing disease. For example, the Red Sea jellyfish (*Rhopilema nomadica*) entered the Mediterranean through the Suez Canal. Each summer, huge swarms appear along the Eastern Mediterranean shores. At certain times, there are 25 jellyfish per square metre forming a 'jellyfish belt' about 1km offshore. Coastal tourism and fishing industries are affected across Israel, Egypt, Lebanon, Turkey and Cyprus.

Relevant websites, web links, and files

- De Grissac and Negussie, 2007
- Molnar, 2008

E-Target 12. By 2020, Rare, Endangered and Threatened species of both marine flora and fauna species are protected, conserved and rehabilitated

Rationale

According to the Ministry of Marine Resources, five species of turtles, one species of dugong, at least four species of dolphins, and one species of whale are found in the Eritrean coast of the Red Sea. In addition, there are 78 species of sea birds and shore birds (De Grissac and Negussie, 2007).

Remarkable measures were taken from 1998 to 2007 by the ECMIB project in assessing the status of threatened marine birds, reptiles and mammals. As an outcome of the conservation works the MoMR signed Memorandum of Understanding on the Conservation and Management of Marine Turtles of the Indian Ocean and South-East Asia (MOU IOSEA). Moreover, the following draft policy documents were prepared:

- The National Coastal Policy (Draft 2006),
- The National Action Plan for the Conservation of Marine Turtles and their Habitats in Eritrea (Draft 2006),
- The Proclamation to Establish an Integrated Coastal Area Management (ICAM) (Draft 2007), and
- The Proclamation to Establish the Eritrean Coastal Authority (Draft 2007).

In continuation to the above efforts the NBSAP included one E-target related to the conservation of rare, threatened and endangered marine species. A number of priority actions related to the conservation of marine turtles, marine bird (Socotra cormorant), and marine mammals (dugong) was planned. The target focuses on the establishment, conservation and monitoring programme concerning the status of rare, endangered and threatened species such as sea turtles and dugongs.

In meeting the target, the NBSAP plans to undertake detailed status survey of rare, endangered and threatened species including their implementation and monitoring. Other actions in the target include preparation of a migratory species conservation network; and conservation activities for endangered, endemic, migratory and/or indicator species that are not in the conservation management areas, in particular: marine turtles, marine mammals, migratory birds and sharks. Priority actions in this target include: promotion of conservation and development programmes based on the status of rare, endangered and threatened species such as sea turtles and dugongs; undertaking detailed status survey of rare, endangered and threatened species and checklist produced; development a strategic plan and projects for the conservation and rehabilitation; and development of adequate legislation to protect indigenous flora and fauna.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

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11	12	13	14	15	16	17	18	19	20

Other related Aichi Biodiversity Targets

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11	12	13	14	15	16	17	18	19	20

Other relevant information

One species of dugong (*Dugon dugong*); four species of dolphins, the common dolphin (*Delphinus delphis*), the Spinner dolphin (*Stenella longirostris*), the Bottle-nosed dolphin (*Tursiops truncatus*), and the Indo-pacific Hump-backed dolphin (*Sousa plumbea*); and two species of whales, the Bryde's whale (*Balaenoptera edeni*) and the False Killer whale (*Pseudorca crassidens*) have been reported from the Eritrean coast of the Red Sea. Two main threats have been identified for the above marine mammals: collision with ships and poisoning during red tides. For dugongs, the occasional harvest by coastal communities seems to be the main threat (De Grissac and Negussie, 2007).

Eritrea being in the subtropical region, it contains a number of habitats that are suitable for migratory and resident bird population. These include the coasts from Massawa to Assab, from Massawa to Sudan, the islands of Dahlak Archipelago, Hawakil, Anfile and Assab Bays. As a result, the Eritrean coasts and islands are well known for the large diversity of seabirds and shorebirds. According to De Grissac and Negussie (2007) 78 species of seabirds and shorebirds have been identified, of which 22 are known to breed on the islands, mainly in summer while 25 species are true seabirds belonging to different families. The potential threats to breeding seabirds include egg collection, habitat destruction, and solid waste pollution.

Marine turtles are some of the oldest surviving reptiles on the planet, and have inhabited the tropical seas and oceans for millions of years. Recently, human actions, in particular in the 19th and 20th centuries have brought many populations to the brink of extinction. Today, there are seven species of sea turtles in existence: the leatherback *Dermochelys coriacea* (family Dermochelyidae), the loggerhead *Caretta*, the hawksbill *Eretmochelys imbricata*, the olive ridley *Lepidochelys olivacea*, the Kemp's ridley *Lepidochelys kempi*, the green *Chelonia mydas* and the fatback *Natator depressus* (all in the family Cheloniidae). According to the MoMR, of the seven turtle species, five occur in the Eritrean coast of the Red Sea. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) lists all marine turtles as endangered species (PERSGA/GEF, 2004).

The extensive coral reefs, seagrass meadows and mangroves support globally important biological diversity and maintain the ecological stability and productivity of the coastal marine and island systems. Despite limited research, more than 250 species of reef fish from 49 families and 86 marine and shore bird species from 41 families have been recorded. Two hundred ten islands of the Dahlak Archipelago support globally significant breeding populations of turtles and dugongs and serve as breeding, nesting and wintering sites for European, African and Asian migratory birds. Healthy relict populations of Eritrea's larger wildlife species, e.g. gazelle and wild ass, have also been found in the coastal areas and the islands (NBSAP, 2015).

Relevant websites, web links, and files

- De Grissac and Negussie, 2007
- NBSAP, 2015
- PERSGA/GEF, 2004

E-Target 13. Public awareness on the importance and sustainable use of agricultural biodiversity increased by 10%

Rationale

The continuing and increasing environmental challenges including biodiversity loss is due to inadequate information on the values of biodiversity as well as the inability to connect the sustainable use of the resource to our livelihoods. There is inadequate awareness on the adverse impacts of human development such as over exploitation of agriculture land. There is a need of communication and creation of awareness among all levels of society on the importance of biodiversity. Public awareness enhances protection of Eritrea's rich biological resources ranging from different plants to animal species. Educating the public, from the local to national level, about the relevance of conserving biodiversity will control the effects of over-exploitation of the natural resources and reduce species extinction.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other relevant information

The MoA conducts training programs to raise public awareness on agro-biodiversity and has trained several experts and farmers. The Ministry also prepare publications in the form of manuals, guidelines, hand-outs, agricultural text books for Ministry of Education, booklets, newsletters, flyers, leaflets, posters, stickers, documentary films and TV spots. In addition, articles have been published in the Eritrean Newspapers, 'Hadas Ertra' and 'Eritrean Profile'. The published articles are related to soil and water conservation, crop production and husbandry, vegetables production, meat and dairy production, improved seeds production, bee keeping, local poultry keeping, animal and plant health. Moreover, biodiversity related activities were broadcasted once a week in the national radio program under the program called "Hrshana Nemaabl". Numerous radio programs that are related to combating desert locust control, food security and maintenance of biodiversity broadcasted twice a week. The TV spot programs broadcasted in the last five years were in English, Tigrigna, Arabic and Tigre languages.

Relevant websites, web links, and files

- www.shabait.com/Haddas-ertra
- www.shabait.com/Eritrea-profile

E-Target 14. By 2020, Plans for sustainable management of agricultural genetic resources is implemented

Rationale

Agriculture which remains one of the main sources of income and employment to most Eritreans (70-80%) continues to thrive on important ecosystem services such as pollination, carbon and nutrient cycling, rock weathering and the self-purifying ability of water bodies. Agriculture can also aid in supporting and conservation of biodiversity by providing habitat and food for wildlife. However, activities such as deforestation and conversion of forest lands for agricultural intensification and expanding has declined the abilities of the agricultural lands and forests to conserve biodiversity.

The combined effects of maintenance of ecosystems towards the sustaining and conserving biodiversity are very important. Conservation of biodiversity by these ecosystems positively impact the environment by improving water quality and quantity, enhancing activities of pollinators, providing habitats, sustaining natural systems and increasing the resilience thereby can lead into sustainable management of conserving biodiversity.

The genetic resource management strategy is included in the agricultural policy and the MoA strategic plans. By 2020, detailed document on the national genetic resources conservation and management strategy will be produced.

The management plan for genetic resource includes identifying responsibility of stakeholders engaged in genetic resources conservation and management or related activities; studying genetic diversity and causes of genetic erosion; and identifying species prioritized for conservation corresponding with appropriate conservation and management methodologies. This management strategy plan on genetic resources conservation and management has resulted into effective products. As an example, farmers have included their indigenous varieties which exhibit high variability among and within varieties that covered large areas under cultivation in Eritrea.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

E-Target 15. By 2020, Pollution to agricultural biodiversity from agro-chemicals has been brought to levels that are not detrimental to ecosystem function and biodiversity

Rationale

Pollution due to agro-chemicals in general has not been a major problem in agricultural fields in Eritrea so far, since the MoA distributes limited pesticides and fertilizers. However, in private, farmers apply agro-chemicals illegally to farmlands as commercial fertilizers, pesticide spray, and herbicides. Thus, sediment (loose soil) washed off fields could be a source of agricultural pollution. Nutrients may also enter runoff from crop residues, irrigation water, wildlife, and atmospheric deposition.

It is known that among the most significant soil contaminants are hydrocarbons, heavy metals, herbicides, pesticides and chlorinated hydrocarbons. However, in Eritrea there is no major and comprehensive study made on the extent of occurrence of these pollutants.

This target calls for effective implementation of environmental assessment, regulation of agrochemical imports and supply to ensure proper pesticide use and promote the framework of Integrated Pest Management (IPM). One of the priority interventions is to consider the preparation of formal registered list of agro-chemicals. Besides, creating awareness to the farming community on pollution reduction measures, developing and adopting standards, guidelines and regulations, and improving pollution information management systems is important part of this target.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other relevant information

In 2018, the National Implementation Plan (NIP) for Persistent Organic Pollutants (POPs) of 2012 was revised. This revised chemical profile provides information on the strength and weaknesses of handling, storage, and usage of agro-chemicals. It also includes information on capabilities and necessities for sound management and handling of agriculture chemicals to be addressed. In 2017, the Eritrean Environmental Protection, Management and Rehabilitation Framework (No. 179/2017) and Legal Notice No. 127/2017 which includes Articles 11 – 17 on control of pollution were gazetted.

Relevant websites, web links, and files

- Proclamation No. 179/2017

- Legal Notice No. 127/2017
- National Chemicals Profile (2016)

E-Target 16. By 2020 threatened species prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

Rationale

Habitat loss and overexploitation of natural resources are the most widespread causes of species endangerment in Eritrea. Management programs of the threatened and endangered species of cultivated plants, forests and farm animals are executed by the National Agricultural Research Institute (NARI). When the ecosystems of animals are not maintained, they lose their home and are either forced to adapt to new surroundings or pass away. The same also applies in endangerments of crop species which are under severe threat due to changing climatic conditions and several habitat loss and degradation from farming, urbanisation and overexploitation of natural resources.

Although there are not many projects targeting specific species, achievements related general management of the threatened and endangered species was carried out as per the national gene bank’s annual work plan which is financially supported by the government. It is high time to carry out an inventory and document the conservation status of specific crop species and animals aiming at vulnerable and endangered species.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

E-Target 17. By 2020 conservation and management of genetic resources and diversities strengthened.

Rationale

Eritrea is center of origin for several crops such as okra (*Abelmoschuse sculentus*), taff (*Eragrostis tef*), niger seed (*Guizotia abyssinica*), mustard (*Brassica carinata*), watermelon (*Citrullus lanatus*) and amaranths (*Amaranthus caudatus*). Barley (*Hordeum vulgare* L), tetraploid wheat (*Triticum aestivum* L), chickpea (*Cicer arietinum* L), finger millet (*Eleusine coracana* L.), grass pea (*Lathyrus sativus* L) and cowpea (*Vigna unguiculata* L.) are also other field crops that have their center of diversity in Eritrea (Vavilov 1992). The country also shares with other countries as possible centre of origin for sorghum (*Sorghum bicolor*), sesame (*Sesamum indicum*) and pear millet (*Pennisetum glaucum* (L.)). The north east quadrant of Africa below the Sahara is the region

where the greatest variation of the genus *Sorghum* is found (Dogget, 1988). Looking at the wild sorghum relatives in the South western indicate that Eritrea is centre of origin for cultivated sorghum. Molecular study of genetic diversity of Eritrean sorghum landraces using SSRs markers revealed a distinct group of the landraces could be clustered compared to world collections (Ghebru, et al., 2002). In a similar study of SSR markers from East and Central Africa, unique traits were identified in the Eritrean sorghum collections (Tsfamicael, et al., 2014).

Among the vegetables, okra has been grown by farmers and it also grows as wild in the Western and Eastern lowlands of Eritrea. The wild relative reported existing in Eritrea is *Abelmoschus ficulneus*. The native leafy vegetables such as mustard, *Amaranthus*, and others are important as resilience crops and their status is underutilized.

Besides, Eritrea possesses a wealth of animal genetic resources. A case in point is the Barka cattle, which are the backbone of relevant and sustainable livestock production in Eritrea. Barka cattle are better adapted to survive and reproduce under harsh environments similar to Eritrea compared to high performing exotic breeds. Moreover, the Barka breed requires less input and management. Despite preliminary characterization of sheep and cattle which was conducted recently by the MoA-NARI, no conservation and management of genetic resources was conducted.

In general, Eritrea already has put various strategies and priority action plan in place to maintain the genetic diversity of both domestic and wild species, mainly through *in-situ* conservation systems (such as traditional conserving farmers own seed and protected areas) and *ex-situ* approaches using gene banks. The national target focuses on promoting conservation and management of genetic resources and supporting the collection and conservation of plant genetic diversity, which links directly to the Aichi Target 13 which states that by 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Relevant websites, web links, and files

- Dogget (1988)
- Ghebru, et al., (2002)
- Tsfamicael, et al., (2014)
- Vavilov (1992)

E-Target 18. By 2020, the traditional knowledge, innovations and practices of local communities relevant for the conservation and sustainable use of agricultural biodiversity properly documented and integrated in agricultural biodiversity.

Rationale

Local communities have used their indigenous knowledge of the diversity of their flora and fauna. They select and grow variety of seeds of the same crop or different crops as a buffer against variation, change and catastrophe; in the face of environmental changes, if one crop fails, another will survive. Growing diversity of crops and food resources is often matched as a safety measure to ensure the production of harvestable crops during extreme environmental conditions. Thus, farmers have widely used traditions of adaptation to climate change at the farm level, such as altering the timing of farm activities to suit rainfall variations or changes. Such traditional knowledge of farmers in cropping calendar in Eritrea helps the conservation and sustainable utilization of agricultural biodiversity.

The traditional knowledge of farmers also extends to the livestock breeds as well as forest trees and even extends to medicinal plants. There is a dire need to document the wealth of knowledge as well as exploit it for the conservation and sustainable utilization of biodiversity.

Level of application

National

Relevance of the national targets to the Aichi Biodiversity Targets

Main related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other related Aichi Biodiversity Targets

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Other relevant information

Many ministries are implementing different community based traditional knowledge activities in Eritrea which include: Community-based national soil and water conservation campaign and in-situ water harvesting by diverting floods into their farm land during crop growing period to mitigate drought.

Besides, in Eritrea, farmers largely depend on their own seed and cultivation of crops is also incorporated with local knowledge. Since farmers depend on their own seed it can be said that at the same time traditional crop is conserved on farm. Even though it is not well documented, local communities have their own way of utilizing indigenous knowledge. Farmers are well experienced in traditionally characterizing and selecting their own crop varieties based on their importance in

drought tolerance, biomass, grain yield and quality for food which attributes to the conservation of biodiversity by local knowledge.

Farmers recognize the strengths and weaknesses of their livestock breeds in terms of their productivity and have been selecting among them for enhancing breeding purposes for generations. They also prevent or control some animal and plant diseases by applying traditional methods from local plants and animals.

2.2 Implementation measures taken, assessment of their effectiveness, associated obstacles, and scientific and technical needs to achieve national targets

E-Target 1. Developed integrated action frameworks on the control of excessive firewood collection and construction wood that impact biodiversity resources, in a manner that enhances sustainable use of nature resources.

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

Awareness activity related to conservation and sustainable utilisation of forest/wooded land products is done throughout the country. As part of capacity building, nationwide, training and awareness raising programs were given by the MoA for forestry and wildlife experts and forest guards twice in the last four years (2015 – 2018) for two weeks each. In addition, in Zoba Anseba and Zoba Gash Barka, five types of trainings which include: forest management, establishment and management of tree plantation, enclosure establishment and management, conservation of biodiversity and compost preparation were given for 10 days each. In the trainings of Zoba Anseba, there were 27,596 beneficiaries from local community, government staff, and member of the Eritrean Defence Force (EDF), in which 42% of the participants were women. Likewise, 100 people participated in the Gash-Barka training and one training session was given in Zoba Dehub. In all the trainings and awareness raising programs, governmental offices and other stakeholders actively participated.

Awareness raising programmes have also been undertaken through mass media that include regular biodiversity related programs, TV interviews and broadcasts, interviews and documentaries on biodiversity related areas. Many of these programs aim at the use of natural products and biodiversity and the conservation efforts required by the local communities. In addition, in cooperation with the Ministry of Information (MoI), awareness raising programs about biodiversity related activities have been conducted for the last three years (2016-2018). In total, 750 booklets, 25 newsletters, 170 posters, 5 documentary films, 20 TV spots, and 25 radio programs were produced in Tigre and Tigrigna languages. In addition, 3 articles have been published in the Eritrean "*Hadas Ertra*" Newspaper and 2 in *Eritrean Profile* related to bird, amphibian and reptile diversity. Moreover, two video clips have been prepared and broadcasted through Eritrea Television to increase people's awareness on conservation of natural vegetation. The biodiversity related activities and programs are broadcasted in English, Tigrigna, Arabic and Tigre languages.

To raise awareness of the community, 750 copies of brochures about nursery establishment and management have been produced. To promote the implementation of sustainable utilization of forest and forest products, different activities have been conducted throughout the country. Activities like afforestation and delineation of temporary and permanent enclosures are undergoing in all regions of the country. According to FWA annual reports of 2019, the total size of enclosure in the country is about 374,890ha which represents 18,227ha in Zoba Maekel, 33,792ha in Zoba Anseba, 66,863ha in Zoba Dehub, 81,020ha in Zoba Gash Barka, 167,838 ha in Zoba Semienawi Keih Bahri and 7,155ha in Zoba Dehubawi Keih Bahri. These enclosures are effectively guarded, managed and utilized by the community.

Moreover, afforestation activities are undergoing throughout the country. The estimated area of planted forest at national level, during this reporting period, is approximately 4,320ha, out of which 3,024ha in Zoba Dehub & Maekel and 1,296 ha in Zoba Anseba, Gash Barka and Semienawi Keih Bahri. Since 1992, however, about 50,651 ha of degraded lands afforested with indigenous and

exotic species. Almost in all regions the communities use forest products as a source of energy and for construction purposes.

The extent of use of forest products is high because the communities depend their livelihood on farming and rearing animals. Forests are also used as the main source of energy (firewood and charcoal) and for construction. There are a number of forest or plantation areas but the protection mechanism is still weak due to different reasons.

The local communities have the right to conserve and control their forest products, properly utilize for home consumption, feed animals and also sell fire wood for their daily necessities.

For the implementation measure, please indicate to which National or Aichi Biodiversity Target(s) it contributes

National Targets: 1, 2, 3 and 4

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been partially effective

Tools or methodology used for the assessment of effectiveness above

The assessment was conducted using questionnaires which were distributed to zoba offices of MoA, FWA, DoE, and MoI. Interviews and discussions were also conducted with the concerned experts of the above organizations.

Relevant websites, links, and files

- <https://www.cbd.int/doc/world/er/er-nbsap-v2-en.pdf>
- www.shabait.com/Haddas-ertra
- www.shabait.com/Eritrea-profile

Obstacles and scientific and technical needs related to the measure taken

The activities indicated in the national target of the NBSAP are implemented through the relevant line ministries. However, there were many limitations such as: insufficient budget, shortage of skilled human resources, inadequate facilities, and low level of awareness in implementing these activities.

E-Target2.By2020theuseofalternativeenergyshouldbeincreased and pressure on forests significantly reduced.

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

Research study on improved electric stoves is in progress. The efficiency of this improved electric stove has increased. The electricity consumption is expected to be reduced by 50% as its power demand is reduced from 4Kw to 2Kw. However, the implementation progress is slow because of low material availability and financial problem. The responsible ministries are planning to purchase the required materials soon and it will be distributed to the end users in the near future.

The MoEM in collaboration with MoA distributed an improved biomass stove (*Adhanet Mogogo*) to end users. Based on greening day 2019 report, at national level, more than 161,995 improved biomass stoves have been distributed, out of which 54,340 in Zoba Debub, 49,792 in Zoba Maekel, 34,312 in Zoba Gash Barka, 18,757 in Zoba Anseba, 4,218 in Zoba Semienawi Keih Bahri, and 536 in Zoba Debubawi Keih Bahri. During the reporting period (2014-2018) about 15,034 improved biomass stove have been distributed throughout the country. However, the plan was to distribute double of this number. In addition, training was given to women at village and sub-zoba levels and the materials for the preparation of biomass stove are provided by the Ministries.

Many efficient lamps were also distributed in different parts of the country in the last four years. At present many households and commercial end users are starting to use Light Emitting Diodes (LED) lamps to replace incandescent lamps.

No study has been made on potential resources and development of alternative energy. However, in the last five years two training of trainers for 15 artisanal women and three trainings for 110 electricians on house and small PV installation and plant operation were carried out (2015-2018). A report for short term training of operators of PV system was generated.

Throughout the country, there was a plan to install 30MW of solar system, however, only three plants of 2MW each grid tide and 2.25MW solar PV system were installed. Moreover, 1.6MW PV combined capacity from 2-300KW PV system for agriculture post harvesting energizing has been installed. In addition, diesel and battery hybrid system has been installed and many organizations and households installed small PV system up to 30KW and most household has solar lantern. However, installing 5MW wind turbine and introduction of pilot Bio-gas plants for cooking was not implemented.

For the implementation measure, please indicate to which National or Aichi Biodiversity Target(s) it contributes

National Targets: 2, 3, and 4.

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been partially effective

Tools or methodology used for the assessment of effectiveness above

The assessment was conducted using questionnaires which were distributed to MoA and MoEM. Interviews and discussions were also conducted with the concerned experts of these ministries.

Relevant websites, links, and files

Reports of the MoEM and MoA

Obstacles and scientific and technical needs related to the measure taken

The major constraint in the utilization and popularization of alternative energy is lack of financial support.

E-Target 3: By 2020, at least 25% of grazer populations have developed the capacity to reduce overgrazing/over browsing.

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

The capacity of farmers involved in irrigated forage crops production and utilization is good; but a lot needs to be done to educate farmers engaged in extensive livestock production system on how to conserve and utilize feed resources. Even though it is not widely practiced, traditional farmers have already started crop residue conservation and closure establishment for critical time use through cut and carry system.

There are about six feed processing plants in the country. These plants, which are located in Zoba Maekel, Zoba Debub and Zoba Gash-Barka, mainly produce concentrate feed for poultry and dairy cattle. There was a zero grazing training for urban and peri-urban dairy cattle keepers in the highland of Eritrea including Zoba Debub, Zoba Maekel and Zoba Anseba. The Zoba extension agents conducted trainings to farmers.

Forage is developed in most parts of the country and there are about 1,460ha of land which is under irrigated forage crops production of which, 260ha is in Zoba Anseba. However, the status of increment in quality of cattle and reduction in number of traditional herders is negligible. This is because majority of the farmers, except in the urban and peri-urban areas, keep native breeds of cattle and are engaged in traditional herding.

In the country, attempts to allow regeneration of native pasture species by closing land to grazing have shown promising results and are becoming models for recovery. For example, area enclosed in Mai Mine and Goluj for the purposes of regeneration have shown positive trends of improvement in the availability of grazing feed. In addition, some sites were also enclosed and sown with grass species for cut and carry system of livestock feeding. Moreover, local herders are encouraged through appropriate training and demonstration to produce forage in their farms and enclosures.

Migration within the country still persists while cross border migration has been discontinued. This is mainly due to the availability of water points (ponds, micro dams and big dams) in most of the grazing lands and the 1998 border war with Ethiopia which discouraged herders from migration.

For the implementation measure, please indicate to which National or Aichi Biodiversity Target(s) it contributes

National Targets: 2, 3, and 4.

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been partially effective

Tools or methodology used for the assessment of effectiveness above

The assessment was conducted using questionnaires which were distributed to MoA and FWA. Interviews and discussions were also conducted with the concerned experts of these organizations.

Relevant websites, links, and files

Reports of the MoA and FWA

Obstacles and scientific and technical needs related to the measure taken

The lack of consistent monitoring of agricultural activities in the rangelands, delayed implementation of protected areas system, and inadequate material and financial resources are the main obstacles related to this target.

E-Target 4. By 2020 the extinction of threatened species has been prevented and the conservation status of those most threatened and endangered flora and fauna have been improved, with declining trends significantly reduced

Measures taken to contribute to the implementation of your country’s national biodiversity strategy and action plan

Parties to the UNCBD have agreed that efforts to develop and maintain their national protected area systems are central to their strategy of implementing the CBD aims. In this context, the national strategy aligns with and supports Eritrea’s commitment as a signatory to the Convention. The Convention is supported by a Programme of Works on Protected Areas that sets out global targets within which Parties to the Convention may develop national and regional targets and activities. Thus, establishment of protected area represents the state’s commitment towards achieving the goal and targets of the National Protected Area System (PAS) as outlined in the NBSAP (2015).

To this effect, draft Protected Area Proclamation has been prepared and is under intensive review and proposed protected areas are identified (Fig. 1). In addition, proposals for institutional framework for the establishment and management of protected areas, biodiversity conservation training program, national biodiversity conservation monitoring strategy, and national strategy for the conservation and financing of PA’s have been prepared.

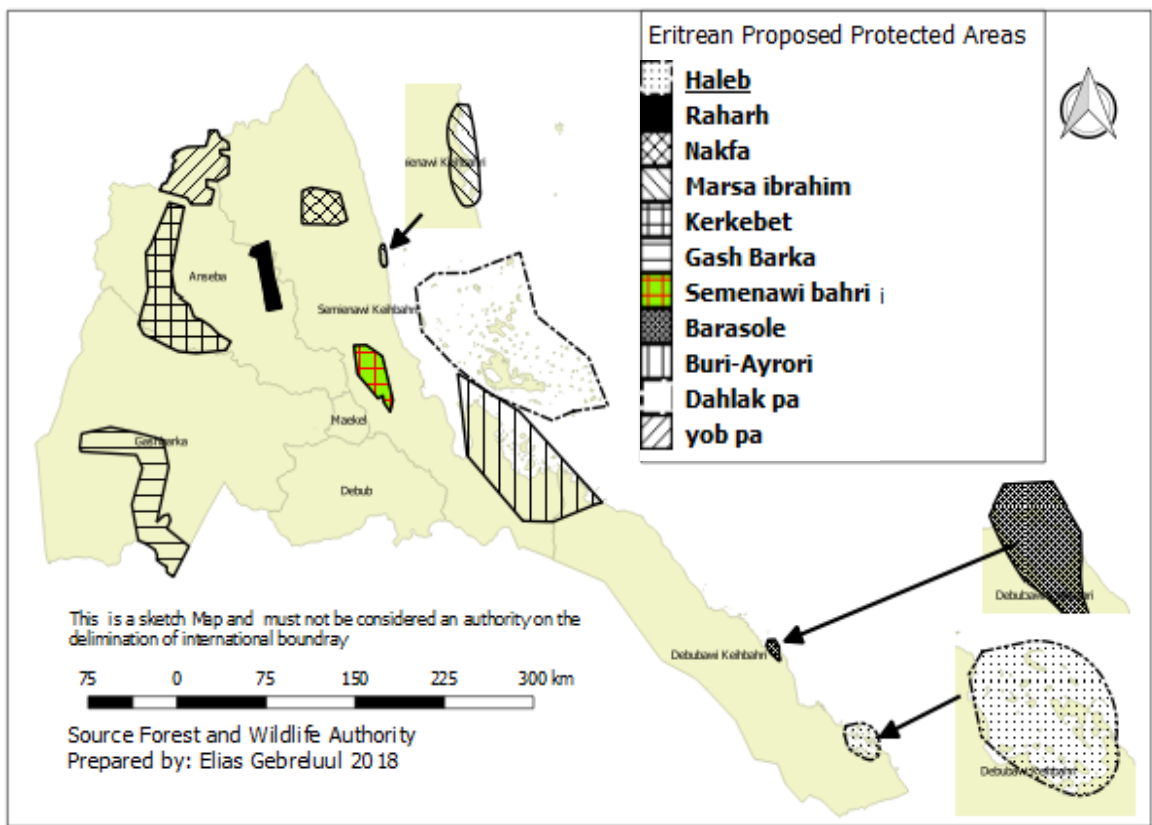


Figure 1: Proposed protected areas 2018 (Modified from FWA Report, 1997)

Although there are no officially gazetted protected areas in the country, there are some areas set aside for protection through government directives. A case in point is the Semienawi and Debubawi Bahri protected area which encompasses about 106,000 ha. The boundary of this protected area is delineated and mapped. The entire area is classified into different management zones mainly core areas, sustainable use zone and buffer zone. Likewise, the elephant sanctuary of the Gash-Setit corridor of about 44,000 ha is demarcated and mapped, but management zoning is not yet done and thus livestock encroachment is a major problem in the area. In the Buri Irrori and Hawakil, however, no progress has been made in terms of delineation and management zoning. The management and business plans of all this de-facto protected areas are not yet in place.

The identification and assessment of threatened species is not yet updated. However, both for the flora and fauna that are existing in the country, their status of endangerment, has been identified and categorized in relation to their global and national importance. There is no full-fledged project aimed at the conservation of threatened species. However, there are some initiatives to conserve the globally critical endangered species of African wild ass. On the basis of the thesis report by Futsum (2016), African Wild Ass is distributed within an area of 11,000km² in the Denakil area of Zoba Debubawi Keih Bahri (Fig. 2). The population size has fluctuated up and down due to drought and competition with livestock. The daily feed consumption by the existing livestock in the area is estimated at 12,192kg, which is really has a negative impact on the availability of feed for the African wild ass.



Figure 2: African wild ass photo by Ahmed Refik

According to FWA report 2018, endeavours are underway to conserve *Olea africana* and *Juniperus procera* which are in the list of nationally endangered/threatened tree species. Efforts have been made to conserve these species by establishing enclosures. A total area of 22,604ha (which is 4,870ha *Juniperus procera* and 17,734 ha *Olea africana*) is delineated and mapped in Semienawi and Debubawi Bahri protected area and they are under regeneration/restoration (Fig. 3). Likewise, 39,649ha of degraded areas (9,649ha of *Juniperus procera* and 30,000ha *Olea africana*) is delineated and mapped in Rora Habab plateau, but not yet enclosed. A project proposal of 10 million USD to be funded by GEF is submitted and waiting for endorsement by the government, to restore the degraded landscape in Rora Habab Plateau.



Figure 3: *Juniperus procera* Vegetation Community in Rora-Habab Plateau (left) and Semienawi and Debubawi Bahri (right) (Source: MoLWE, 2018 and NBSAP, 2015)

On the other hand, no action has been done on the conservation of the two endemic species of *Aloe* (*A. schoelleri* and *A. neosteudneri*). According to Ghebrehiwet and Maurizio (2016), *Aloe schoelleri* has a very restricted distribution, being known only from one place in Eritrea, the Kohaito plateau (14°52'N, 39°26'E). This is a windy, high altitude area (about 2600 m.a.s.l.) vegetated primarily with *Becium grandiflorum*, *Juniperus procera*, *Cadia purpurea*, and *Rumex nervosus* as well as three other *Aloe* species: *A. camperi*, *A. elegans* and *A. percassa*. It has been observed that *A. schoelleri* grows almost exclusively in sandy soil and in rock crevices on the edges of cliffs around the Kohaito plateau (Fig. 4). The species is known only from type collection. Its growth form and flowers have never been documented with illustrations before. However, *A. neosteudneri* is a regional endemic species found only in Eritrea and Ethiopia. *Aloe neosteudneri* seems to have a disjoint distribution within the region. In Eritrea it is reported from only one place: the top of Mt Endertai part of the larger Mt Saber (15°48'N, 38°47'E), while in north western Ethiopia it is known from the Simien Mountains, points separated by about 500 km of ragged and mountainous terrain. The Eritrean population of *A. neosteudneri* occurs at 2400–2500 m.a.s.l, and in fact all plants were found to grow only at the top of the mountain, on the north side of a very steep slope. The plants seem to grow under the shade of larger trees such as *Olea* and *Juniperus* and share their habitat with the alien species (*Opuntia ficus-indica*). Only about 80 plants of *A. neosteudneri* were observed in this area and there were no young plants.

In the last four years, a collaborative survey work between Dr Theodore Papenfuss (University of California) and the Forestry and Wildlife Authority of the State of Eritrea, has shown that there are rare and uncharted reptiles and amphibians species in Eritrea (FWA Report, 2017) (Fig. 5). The work revealed that there are still diversities of these animals. One of such findings is the toad around Asmara named 'Asmara toad' a species that was believed to have been extinct (Fig. 5). The team have also recorded that there are diversified types of fresh water turtles. To raise awareness of the people on these endangered species, the information was disseminated in a publication (Fig. 6). Initially, about 55 trees and shrubs species and 23 wildlife threatened species were identified. A preliminary checklist for the threatened species of both flora and fauna is in place. However, there is no specific genetic management plan.



Figure 4: *Aloe schoeleri* (critically endangered endemic species), Kohaito (left) and *Aloe neosteudneri* threatened species associated with invasive alien species of *Opuntia ficus-indica* (right)(Source: NBSAP, 2015)

According to FWA 2018 report, endeavours are on-going to conserve and assure the existence of threatened species. These endeavours, among others include: establishment of African Wild Ass sanctuary within the home range of African Wild Ass, establishment of Elephant sanctuary, etc.



Figure 5: Asmara Toad: Re-found toad species [left] and Eritrea Side neck Turtle in Eritrea [right] (Photo by Futsum Hagos, 2016)



Figure 6: Poster prepared by FWA to raise awareness on the toads present around Asmara.

For the implementation measure, please indicate to which National or Aichi Biodiversity Target(s) it contributes

National Targets: 11 and 12

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been partially effective

Tools or methodology used for the assessment of effectiveness above

The assessment was conducted using questionnaires which were distributed to MoA, FWA, and MoLWE. Interviews and discussions were also conducted with the concerned experts of these organizations.

Relevant websites, links, and files

- Futsum (2016)
- IUCN Red List Version 2018. www.iucnredlist.org accessed on December 2018
- Ghebrehiwet and Maurizio (2016)
- FWA Report, 2017
- FWA Report, 2018

Obstacles and scientific and technical needs related to the measure taken

The implementation of the proposed protected area system is hindered due to inadequate human capacity. Taxonomic knowledge on the threatened and endangered flora and fauna is also limited.

E-Target 5. By 2020 at least 25% of catchment sites and degraded lands of high biodiversity hotspots are rehabilitated within the terrestrial ecosystem

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

There is no assessment done on degraded lands specific to biodiversity hotspots. However, during the LDN target setting program, 23 major land degradation hotspot areas, which cover about 1,190,552.80ha, have been identified and will be addressed at national level. There are also approved integrated strategy documents that address the issue, such as: Five years' strategic plans for MoA (2014-2018) and (2019–2023) and Forest and Wildlife Authority (2017-2021); and Land Degradation Neutrality Target Setting program (2017).

In addition, there are several on-going and proposed programs and projects pertinent to the rehabilitation of degraded catchments:

1. Drought Resilience and Sustainable Livelihoods Program in the Horn of Africa (Project II) (DRSLP II)
2. Drought Resilience and Sustainable Livelihoods Programme DRSLP-IV ERITREA (P-ER-AAZ-002)
3. Catchment and Landscape Management Project (CLMP)
4. Integrated Semienawi and Debubawi Bahri -Buri -Irrori- Hawakil Protected Area System for Conservation of Biodiversity and Mitigation of Land Degradation
5. Restoring Degraded Forest Landscapes and Promoting Community-based, Sustainable and Integrated Natural Resource Management in the Rora Habab Plateau, Nakfa sub-zoba, Zoba Semienawi Keih Bahri, Eritrea
6. Mainstreaming Climate Risk Considerations in Food Security and Integrated Water Resources Management (IWRM) in Tsilima Plain and Upper Catchment Areas
7. Food Security and Sustainable Livelihoods at national level
8. Climate Change Adaptation Programme in Water and Agriculture in Anseba Region, Eritrea
9. Alignment of NAP to the UNCCD (10-year strategic objectives)
10. Micro-propagation of Date Palm Cultivars using Tissue Culture Techniques

The implementation mechanism is integrated with the organizational structure of the MOA/FWA/MOLG from the HQ up to the local administrative level and through community mobilization.

The traditional land use system, especially in the highlands of Eritrea, was not encouraging for wise land management. To reverse this situation, the government has issued Land Proclamation No. 58/1994 which avoids land fragmentation, cyclic land redistribution system and accordingly promotes sustainable land management. Thus a 5-year pilot project was initiated in Zoba Maekel, sub-zoba Serejeka in 28 villages covering 240,000ha. In this pilot project, more than 30,000 villagers have benefited. This project addressed the main causes of land degradation (i.e. deforestation, inadequate agricultural practices, overgrazing and insecure land tenure) in the Central Highland Zone of Eritrea. This project has proven that farmers are more ready to conserve and utilize the natural resources (DoE, MoLWE, 2016).

To encourage afforestation on degraded hillsides, 37 existing forest nurseries have been upgraded by providing tools, equipment and other necessary materials. Moreover, trainings were conducted in order to upgrade the capacities of forestry staff in seedling production and plantation establishment. Maintenance of water supply systems, fences and stores have been done in some forest nurseries.

In an effort to treat degraded lands since independence, about 150 million tree seedlings covering a total area of about 50,651ha were planted. Of these, 10.8 million were planted covering 3,600ha in the last three years. The seedlings, which include 54 different species, were planted by the local communities in almost all the six Zobas. The degraded landscape that have been afforested include hill sides, homesteads, farm boundaries, school compounds, road sides, and other places.

In addition, 374,890 ha of area are enclosed, and 146,422 ha of farm land have been treated. Moreover, to reduce the pressure on forest/ woodlands, over 161,995 efficient cooking stoves have been installed.

For the implementation measure, please indicate to which National or Aichi Biodiversity Target(s) it contributes

National Targets 5, 10 and 11.

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been partially effective

Tools or methodology used for the assessment of effectiveness above

The assessment was conducted using questionnaires which were distributed to MoA and FWA. Interviews and discussions were also conducted with the concerned experts of these organizations.

Relevant websites, links, and files

- <https://www.unccd.int>
- www.er.undp.org
- IUCN 2019. The IUCN Red List of Threatened Species. Version 2019-1. <<https://www.iucnredlist.org>>ISSN 2307-8235
- Birdlife international web site; <https://www.birdlife.org/> Sowb 2018
- MOA (2014-2018) and (2019 – 2023) Strategic Plans,
- Forest and Wildlife Authority (2017-2021) Strategic Plan
- Land Degradation Neutrality Target Setting program (2017).
- Terminal Evaluation “SIP SLM Pilot Project—Eritrea”, GEF Project ID: 2979 / UNDP Project ID: 00075747, DoE, 2016
- Pilot project documents from Serejeka of SLM project outcomes (Personal observation of consultants)

Other relevant information

Implementation of National Land Use Master Plan with the principles of SLM has proven to be fruitful. But up scaling of this practice has not yet been done as it needs several inputs that include: financial and human resource mobilisation at national level, reassessment of implemented project (to evaluate the effectiveness of the project on arresting land degradation which require enough time, coordination of activities among stakeholders, community awareness, etc.

Obstacles and scientific and technical needs related to the measure taken

Inadequate resource mobilization

E-Target 6. Develop an integrated action plan of implementation to reduce the expansion of invasive alien species through control mechanisms and sustainable utilization

Measures taken to contribute to the implementation of your country’s national biodiversity strategy and action plan

Comprehensive information regarding the expansion of *Prosopis* species is not available since no nationwide assessment was made. However, a partial assessment was done in Zoba Gash Barka and Zoba Anseba (Harnet, 2008). The results of this work indicated that in Zoba Gash Barka 17,491ha of land and 2,487ha in Zoba Anseba is covered by *Prosopis*. This represents only the highly infested areas but the total coverage is far beyond this.

As part of the integrated management approaches to the control of invasive species particularly the *Prosopis* spp. the Government has issued licences as pilot project to more than 300 beneficiaries to produce charcoal in Zoba Semienawi Keih Bahri, Zoba Gash Barka and Zoba Anseba. This is with the aim of controlling the invasiveness of the species and at the same time utilise it as a source of energy. Besides, it generates income and job opportunities to the local communities. The project has proven successful and there is a plan to replicate this in other areas where *Prosopis* exists. In addition, attempts are underway to make use of the invasive species for making briquette, animal feed and handles for farm tools, etc.

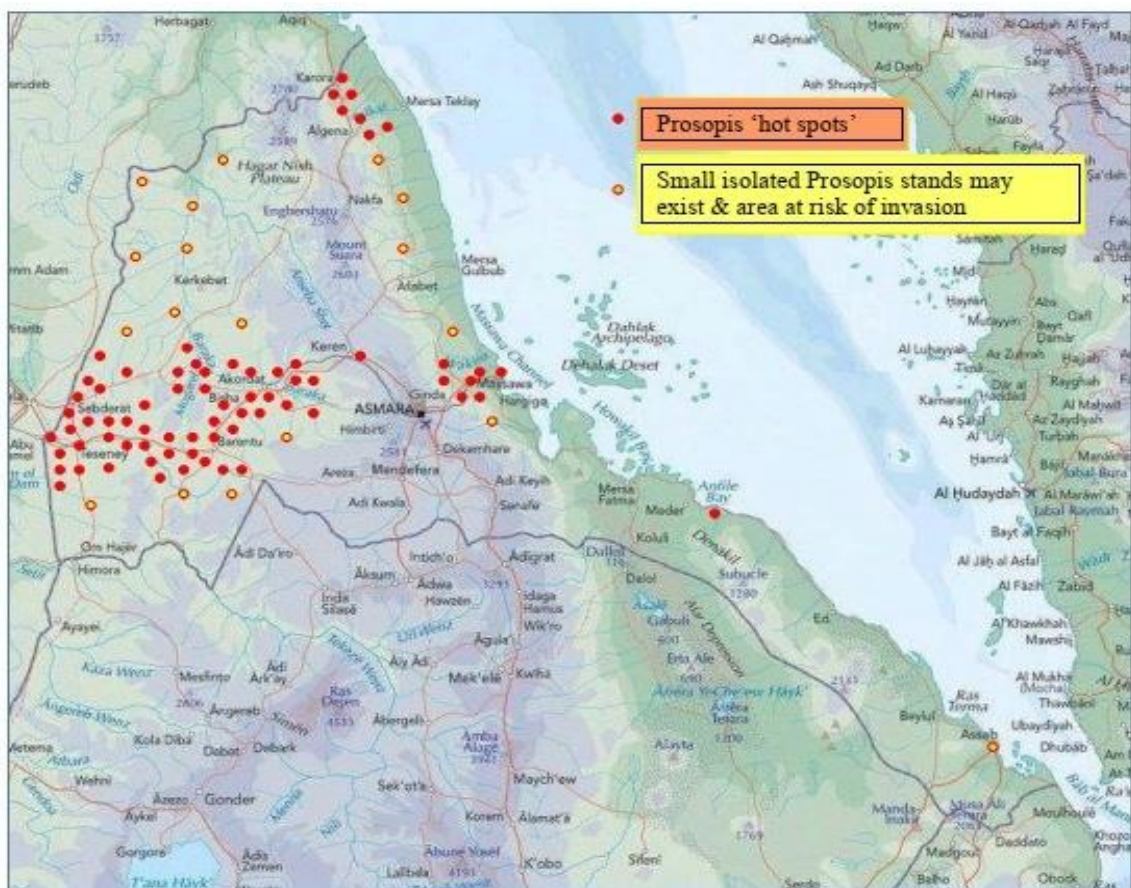


Figure 7: Distribution map of *Prosopis juliflora* in Eritrea (Harnet, 2008)

To raise the awareness and increase knowledge of the communities and other stakeholders on the invasiveness of the species and its control mechanisms interviews and promotion have been done in mass media and training programs have also been given to forest technicians, inspectors and

experts. About 12 events have been broadcasted through mass media. Besides, in every public meeting the issue was discussed with communities.

Besides, efforts have been made to identify investors who have interest to utilize the *Prosopis* species, specially the seeds for preparing animal feed and the whole biomass for making briquette for fuel. So far, two investors have shown their interest and started preparing their projects. If this initiative succeeded further spread of this species will be obliterated/ halted.

For the implementation measure, please indicate to which National or Aichi Biodiversity Target(s) it contributes

National Target: 9

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been partially effective

Tools or methodology used for the assessment of effectiveness above

The assessment was conducted using questionnaires which were distributed to MoA, FWA, and Zoba offices. Interviews and discussions were also conducted with the concerned experts of these organizations.

Relevant websites, links, and files

- Report of MoA/FWA
- [https:// www.cbd.int/doc/world/er/er-nbsap-v2-en.pdf](https://www.cbd.int/doc/world/er/er-nbsap-v2-en.pdf)

Other relevant information

The invasive capacity of *Prosopis* being fast it is surpassing the coping capacity of the communities to curb the damage that it does to the biodiversity of the affected areas. Thus, more efforts have to be done to increase the level of awareness of the local communities and train them on the control mechanisms of the species.

Obstacles and scientific and technical needs related to the measure taken

There was a financial constraint.

E-Target 7. By 2020, mangrove forest and associated coastal forest degradation and loss would have been significantly reduced.

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

Lessons have been learned from Manzanar Program. Thus the Ministry of Marine Resources has restarted planting mangroves since 2013 in the islands where there are less threats. Between 2013 and 2018 over 100 hectare of mangrove were planted by the coordination of Ministry of Marine Resources, Zoba administrative and the coastal community, through the support of IFAD (FDP and FReMP projects) intervention around Central Dahlak islands, Gelalo, Massawa and Assab areas. Most (95 ha) of the planted mangrove were in the Central Dahlak Archipelago such as Baradu, Dehil, Koremelil, Sejeret, Nakura, Seliet, Dahlak Kebir, Deleme, Ganforor and Dessie. Recent assessment of the planted mangrove shows, most of the mangrove planted have been grown to

more than 2 meter and are in good condition. The most prominent impact has been observed in Kormelil and Sejeret areas where the fishery production increased significantly. Fishers of the coastal community have started exploitation of fish such as mullet, Indian mackerel, milkfish and rabbit fish around the planted mangroves. Under the FReMP programme which goes for seven years (2017-2023), over 200ha of mangrove will be planted and 1,300ha will be enclosed to enhance natural regeneration.



Figure 8: *Avicennia marina* (Mangrove) planted in Dahlak Island (Kormelil area)

Parallel to mangrove plantation, 900 salt tolerant plants were distributed to the local community to propagate the plants in their compound. Inhabitants of Dehil, Jemihile, Durbishet, Selet, Dahlak Kebir, Norah, Dessie, Deleme and Engel have already started to plant seedlings. The salt tolerant plants distributed to the community are: *Ziziphus spina-christi* (*gaba*), *Phoenix dactylifera* (date palm), *Azadirachta indica* (*neem tree*), *Opuntia ficus-indica* (cactus), *Conocarpus lancifolius* (Eden tree), *Moringa oleifera* (Moringa), and *Leucaena leucocephala* (Leucaena).

Coastal areas around Massawa, including Kutmia, Grar, Emberemi, and Hirgigo, are covered by mangrove and many visitors get the opportunity to have close look at the plants. Dense mangrove forest is found in Sheik Said (Green) Island, which is located 1km south of Massawa Proper. The island is frequently visited by local and foreign tourists. Sometimes staff of MoMR join the trips and provide explanation about the marine and coastal biodiversity of the island. For example, in February 2017, during the 27th celebration of Massawa town independence (Fenkil Celebration), more than 10 Ministers and high ranking government officials visited the island, a brief introduction to mangrove plants in general and the major threats and conservation actions to be taken has been explained by the MoMR staff.

Awareness program on the importance and use of mangrove ecosystem was broadcasted through mass media. One hundred ninety-two weekly articles were published in the local newspaper *Hadas Ertra*, which has readership in the entire country. The published articles cover diverse topics related to marine biodiversity including the distribution and cover of mangrove. All of the published articles were broadcasted in the local radio *Demtsi Hafash*, which is broadcasted throughout Eritrea and transmitted via the internet. Moreover, MoMR in collaboration with the MoI prepares biweekly TV program which present the biodiversity and other aspects of the marine environment. So far more than seventeen sessions have been broadcasted in the *Eri TV*, which has national coverage

through cable and global coverage through the satellite and internet. In addition, live interviews with practitioners in the plantation and conservation was broadcasted through the TV channel.

There is no data which shows the number of people who follow the above programs. But from the distribution of the newspaper, coverage of the radio and TV it could be assumed that significant proportion of the Eritrean population are getting awareness about the marine, island and coastal environment and their natural resources. For example, the TV program is broadcasted on Sunday afternoons at a time when many people are at home watching TV.

The staff of MoMR organized several meetings with the local community and the Eritrean Navy in the coastal areas where the ecology and importance of mangroves was explained. Threats to mangroves and methods of rehabilitation were also discussed in the meetings. The people of Dahlak, Dehil, and representatives from five villages around Engel participated in awareness raising meetings. Also in Assab local community took a plantation and conservation training organized by MoMR in 2018. A total of 20 individuals representing various stakeholders participated in the training program. Organizations participated in the training include MoMR, MoLG (Zoba Debubawi Keih Bahri), MoA, MoLWE (DoE), MoD (Eritrean Navy), MoE, National Union of Eritrean Youth and Students, and National Union of Eritrean Women. Representatives of the local community also took part in the training. The trainees participated in planting mangrove near their villages.

Capacity building on assessment of mangrove was done by training local staff. One faculty from Massawa College of Marine Science and Technology was trained at MSc level in the application of GIS and remote sensing for assessing mangrove cover. Moreover, short training on similar topic offered to 12 staff of MoMR for two months.

Although most of the priority actions planned for this target were successfully conducted, some of the planned activities were not implemented. These activities include preparation of management plan and rehabilitation of degraded mangroves in Hirgigo, Akelo and Gurgusum area. The main cause for the degradation of mangrove in Hirgigo and Gurgusum is camel browsing/ grazing. In this case, the camels belong to herders that come from other areas. The reason for degradation of mangrove in Akelo could be due to blockage of the river which flow into the sea as a result of Massawa-Assab road construction.

For the implementation measure, please indicate to which National or Aichi Biodiversity Target(s) it contributes

National Targets: 1, 4, 5, 6, 7, 10, 14, 15 and 19

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been effective

Tools or methodology used for the assessment of effectiveness above

The assessment was conducted using questionnaires which were distributed to MoMR and Zoba Semienawi Keih Bahri and Zoba Debubawi Keih Bahri. Field observation was conducted on Mangrove plantation in Dahlak Island and Engel. Interviews and discussions were also conducted with the concerned experts of the above organizations. Moreover, reports of MoMR and recent satellite images of mangrove were consulted.

Relevant websites, links, and files

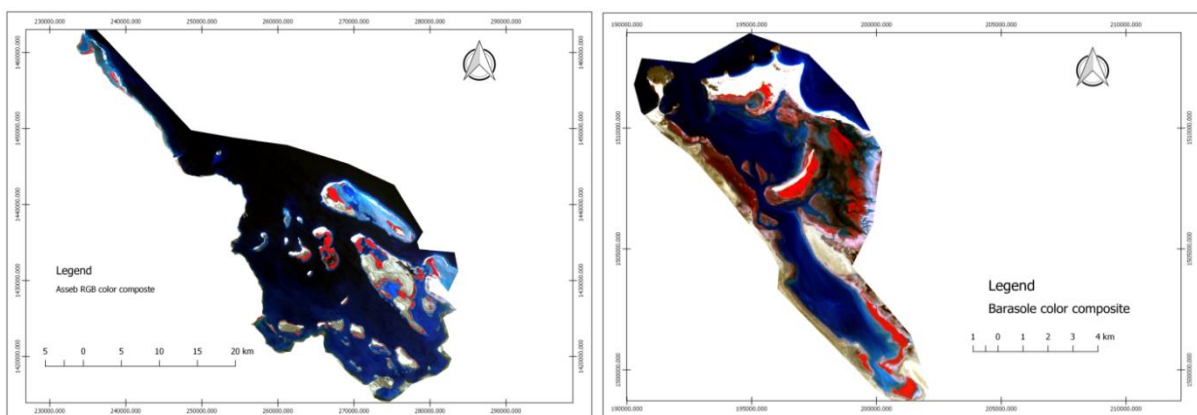
- Reports from the MoMR

Other relevant information

Spatial and temporal changes in mangrove cover were investigated based on remote sensed images (Elias, 2018). Baseline of coastal marine and island mangrove area was updated in 2017 by estimating the mangrove cover along the entire Eritrean coast using remote sensing techniques. The study, which was conducted in the form of MSc thesis, compares the mangrove cover of the Eritrean coast in 1999, 2009 and 2017 by using multi-temporary satellite image of land sat 7 & 5 and sentinel 2. Results from the study show that there had been no decline in mangrove coverage in the Eritrean Red Sea coast. Rather 13% increase in mangrove cover was recorded in the study from 1999 to 2017 (Fig-10). This expansion is a net result of the balance between losses and gain, where afforestation projects and natural regeneration of mangrove played an important role. According to Elias (2018) rapid development of sea cucumber fisheries from 2002 to 2006 resulted in decrease of mangrove cover in the central part of the Eritrean coast where mangrove trees were cut and used for processing sea cucumber, which was exported to the Far East as boiled and dried product. The absence of major settlements along the coast; the underdeveloped coastal areas; and traditional beliefs of the Afar people on protecting wild plants and animals played an important role in maintaining and expanding mangrove forest along the Eritrean Red Sea. However, coastal development and its related activities may pose potential threat for mangrove ecosystem unless mangrove conservation receives prominent attention.

In this study the distribution of mangrove was found to be patchy. High mangrove cover was reported from the south-eastern coast of Eritrea (including Ras Darma, Assab, Berasole and nearby islands) (Fig. 9a and b); from the central coastline which extend from Tio to Marsa Mubarek (including Massawa and Dahlak) (Fig. 9 b and c); and the Northern coast bordering with Sudan (Berite, Marsa Mubarek area) (Fig. 9 d and e). Compared with North, Central and southern coast has higher mangrove cover (Elias, 2018).

It is worth mentioning that the estimates of mangrove cover show marked variation among researchers. The main reason for the reported variations could be due to different data sources, lack of uniformity in accepted definition of mangrove community/habitat, and the methodology or enhancement of technology used for studying mangrove distribution through spatial and temporal data sets (Wilkie and Fortune, 2003, and FAO, 2007).



a)

b)

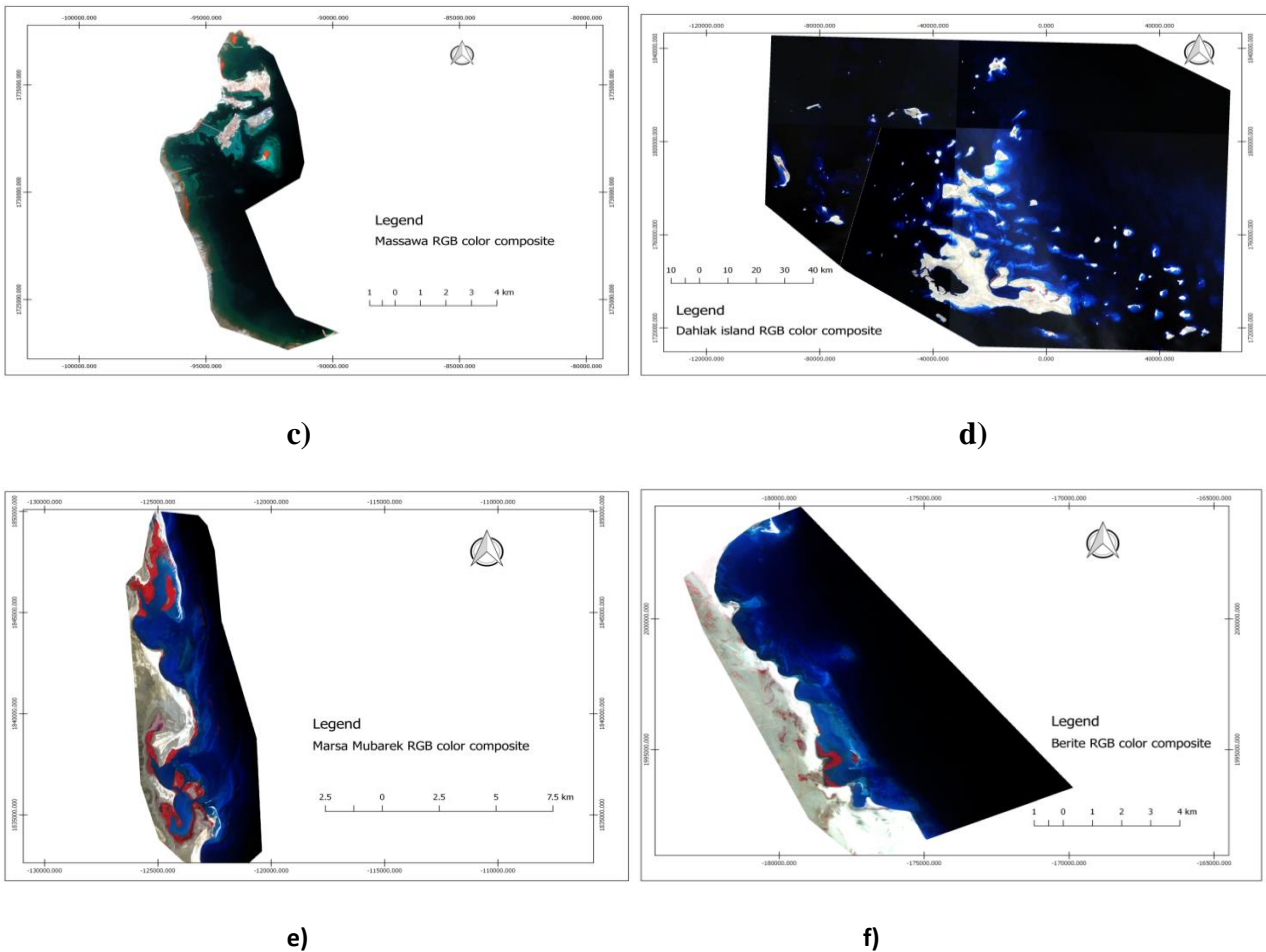


Figure 9: Satellite image of mangrove forest area cover in a) Assab b) Berasole c) Massawa d) Dahlak e) Marsa Mubarek f) Berite (Source: Elias, 2018)

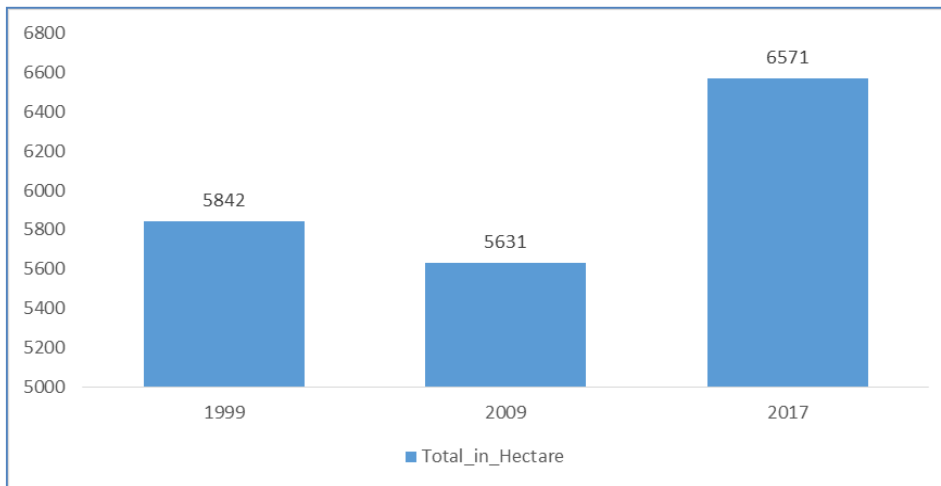


Figure 10: Estimates of mangrove cover in the Eritrean coast from 1999 to 2017 (Source: Elias, 2018)

As discussed in section 2 target 6, expansion of *Prosopis* is becoming a major threat to the terrestrial environment. This species was also reported to grow along the shore in Massawa area (Fig 11). Further investigation is required to establish salt tolerance of the species and the potential of invasion in the marine environment. In the future, the species could compete with the mangrove plants and pose threat to the mangroves.



Figure 11: *Prosopis* trees growing in the coastal area- Massawa environs

(Photo: Tesfamariam Arefe)

As discussed in Section 2, public awareness programs on the ecology and management of mangrove was organized by the MoMR. These programs were broadcasted through the mass media and by organizing meetings with the local community. Moreover, mangrove plantation campaigns were carried out by the MoMR, Zoba Semienawi Keih Bahri and local population residing in the coastal area. In some places the planted mangrove showed fast growth and they started to produce propagules. In few years time the planted mangrove is expected to self propagate and cover more area.

Obstacles and scientific and technical needs related to the measure taken

Mangrove rehabilitation plans were not implemented because:

- Grazing/ browsing by camels could not be controlled in Hirgigo and Gurgusum
- River flow blocked by road which was constructed before few years.
- Rehabilitation efforts may not bear fruit if grazing is not controlled and the river remains blocked.

E-Target 8. By 2020, all sources of coastal, marine and island pollution should be effectively controlled to reduce pollution and mitigate its impact on the ecosystem

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

The responsibility of protecting the coastal area from pollution is shared by many stakeholders including the MoMR, MoLWE, MoLG (Zoba Semienawi Keih Bahri and Zoba Debubawi Keih Bahri) and the Port Authorities. The Ministry of Marine Resources have made preliminary assessments of plastic bottle, oil, and heavy metal pollution. The Ministry surveyed plastic bottle littering, it checked level of oil pollution in Hirgigo Power Plant, and it made preliminary assessment of concentration of pollutants in selected commercial fisheries. Results from these surveys show that plastic bottle pollution along the coast is increasing; there is major oil pollution

from Hircigo Power Plant; and the concentration of pollutants in the commercial fishes is low. Even though the impact of oil pollution on the environment and in the marine organism is not yet investigated, discussions conducted between the staff of MoMR and officers of Hircigo Power Plant revealed that about 10 barrels of waste oil has been dumped in the coastal area close to the sea every day. Earlier, the waste oil was collected in containers and shipped to Asmara. However, the companies have stopped sending the waste (used oil) to Asmara, as a new waste oil recycling plant is being established by TOTAL Company in the vicinity of Grar, Massawa. It should be noted, however, that the surveys conducted by the MoMR is restricted to the Massawa area and no formal survey of pollution was done in other parts of the coast as per the action plan stated in the NBSAP.

The MoMR regulates marine pollution. The ministry issued the Fisheries Proclamation (Proclamation No. 176/2014) with the main objective of ensuring sustainable exploitation of living marine resources taking into account conservation of the environment and wellbeing of the society. The proclamation also safeguards the marine environment from pollution. As per Article 12 (6) of Fisheries Proclamation no person shall discharge or dump waste or any other polluting matter within any protected area.

The Government of Eritrea enacted a regulation which bans the use of plastic bags in the entire country (Legal Notice No. 99/2004). The regulation seems to be enforced in most zobas of the country. The Massawa city administration is making a commendable job of enforcing the regulation. Moreover, the administration is organizing regular cleaning campaigns by organizing the local community in cleaning their neighbourhoods. The city administration has put waste collection containers in many places around the city to collect plastic and other domestic wastes. Furthermore, the Zoba Semienawi Keih Bahri Administration has a plan to collect used-motor-oil in safe containers and then send to the waste oil recycling plant thereafter.

The port authority has guidelines for protecting the sea from marine pollution originated from vessels. According to the Port's Regulation (Legal Notice 103/2005) no ship may pollute the marine environment or injury to human beings and/or biodiversity. One of the Port Authority's objectives is to carry out and monitor security, safety and environmental conservation activities in harmony with national laws and international conventions and agreements. According to the guidelines ballast water should be collected from deeper sea and no air pollution is allowed elsewhere including in the vicinity of the port. Massawa port authority has assigned the operations division to follow the implementation of the Legal Notice.

With regards to awareness raising, many articles related to marine pollution were published in the local newspaper by the MoMR. As mentioned above many radio and TV programs were broadcasted in the mass media. Moreover, limited beach cleaning campaigns were organized by the MoMR. In 2016, a seminar was conducted by the research staff of Ministry for about 300 students of Keih Bahri Junior School in Massawa. Topics covered in the seminar include: marine biodiversity, marine pollution, and biological conservation. As a follow up to the seminar, sixty students toured Sheik Said Island where they observed the biodiversity of the island and conducted beach cleaning campaign.

As listed in section 1.0, in the NBSAP there was a plan that many actions to be undertaken with regard to minimizing marine pollution. However, most of these activities have not been implemented yet. For example, no formal inspection of pollution was conducted, no training on EIA was conducted for MoMR staff, and no community based guideline was prepared to control pollution.

For the implementation measure, please indicate to which National or Aichi Biodiversity Target(s) it contributes

National Targets:5 and 8

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been ineffective

Tools or methodology used for the assessment of effectiveness above

The assessment was conducted using questionnaires which were distributed to MoMR, COMSAT, Zoba Semienawi Keih Bahri, and MoLWE (DoE). Interviews and discussions were also conducted with the concerned experts of the above organizations and with the local community. Moreover, discussions were conducted with operation manager of Massawa Port Authority. Reports of MoMR and Zoba Semienawi Keih Bahri consulted. Dissertations of students of COMSAT were also consulted.

Relevant websites, links, and files

- MoMR Reports
- Legal notice for regulation of pollution by ships (Legal Notice 103/2005)
- Legal Notice No. 63/2002 (Regulations to Prohibit the production, Sale or Distribution of Plastic Bags in Eritrea)
- Legal Notice No.99/2004 (Regulation to Amend the Production, Importation, Sale or Distribution of Thin Plastic Bags Prohibition in Eritrea)
- Filimon, et al., 2017
- Bahlibi, et al., 2014
- Fisheries Proclamation (Proclamation No. 176/2014)

Other relevant information

Two groups of students from the Department of Marine Engineering of Massawa College of Marine Science and Technology (COMSAT) assessed the level of marine pollution for their senior research projects. The first group investigated marine pollution by operational and non-operational vessels in Massawa coast (Filimon, et al., 2017). This group investigated heavy metal concentration of water samples from four sites around Massawa: Massawa Port, Ghibi Fish Landing harbour, Twalot Boat repair yard, and Massawa Ship repair yard. In almost all the sites, the concentration of Iron, Manganese, Chromium, Nickel, Zink, Lead, Copper, Cadmium, and Arsenic was higher than the minimum standard set by United Arab Emirates standard office. According to their report, the main cause for the heavy metal pollution could be due to release of the heavy metals from operational ships, non-operational ships and shipwrecks.

According to the students' discussions with personnel of the ship yards and sea farers revealed that the ship repair yards and the fish landing sites are contaminated with sewage, bilge waste (sludge), and oil leakage. The study concluded that the presence of higher concentrations of heavy metals as well as the oil spills and discharge of sewages are mainly due to the lack of preventive techniques in the vessels, and lack of awareness and negligence by the crew.

The second group of students investigated ship-based marine pollution around Massawa (Bahlibi, et al., 2014). This group collected data by interviewing crew of the vessels and staff of the ports. Questionnaires were also distributed to few officers on board ships. The group took data from the

literature to estimate level of pollution by different types of vessels. Results from the study show that:

- All the vessels in four sites (Massawa Port, Ghibi Fish Landing Harbour, Edaga Fish Landing Harbour, and Massawa Ship Repair Yard) produce different types of wastes. Foreign ships do not dispose wastes in Massawa port except small amounts of garbage. But these vessels dispose their wastes in the vicinity of Massawa when they just leave the port. The local ships, even though few in number, dispose large amount of waste.
- Fishing boats in the Ghibi harbour are the ones polluting the most. According to the information from the fishermen in the area bilge waters and sewage are occasionally disposed directly in to the sea. This is especially true with smaller fishing boats.
- All the foreign vessels greater than 30m long have standard pollution preventing equipment used on board ships (e.g. 15 ppm oily water separator, the ship board oil pollution emergency plan (SOPEP), incinerators, segregation of wastes by their types (IMO code) but some of these equipments are not operational. However, the local ships do not have the preventive equipment because their size is smaller than 30m (thus, they are not obliged to fulfil SOLAS requirements).
- There are no sewage and bilge waste collection facilities in all the harbours and in the boat yard, and no garbage collection facility in Ghibi fish landing harbour.
- It was estimated that 144 ships of different size generate 1008.5m³ of bilge water waste, 15.05m³ of sewage, 5,351.13m³ of garbage, and 13,073.14m³ of cargo associated wastes per month in the three harbours in Massawa.

As has been mentioned above, the study was conducted by college undergraduate students and thus it should be noted that the results of these studies should be considered with caution as their findings were not verified by other sources.

Obstacles and scientific and technical needs related to the measure taken

- Inadequate funds
- Insufficient technical capacity to assess pollutants
- Lack of laboratories for determination of pollutants
- Inadequate coordination among stakeholders

E-Target 9. By 2020, Coastal erosion should be greatly reduced and eroded coastal beaches rehabilitated.

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

Coastal erosion is protected by constructing structures or planting trees along the coast. As mentioned above (target 7) 100 hectares were planted with mangrove and salt tolerant plants in many coastal areas. The coral reefs along the Eritrean coast seem to be in good health (target 10). Mangroves, salt marshes and coral reefs have significant role in stabilizing the sediments and protecting the coast from erosion. Thus, efforts made by the MoMR and Zoba Semienawi Keih Bahri Administration in planting mangrove and protecting the coral reefs have significant contribution in reducing coastal erosion. However, as per the NBSAP more activities were planned

to be executed in the last three years. These activities include identification of underlying causes of coastal erosion and rehabilitation of eroded coastal area and beaches through the use of cost effective local technologies. However, during the last three years almost none of the priority actions for reduction of coastal erosion were implemented, except the rehabilitation of mangrove habitat.

For the implementation measure, please indicate to which National or Aichi Biodiversity Target(s) it contributes

National Targets: 10 and 14

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been partially effective

Tools or methodology used for the assessment of effectiveness above

The assessment was conducted using questionnaires which were distributed to MoMR. Interviews and discussions were also conducted with the concerned experts of MoMR. Literature related to coastal erosion and report of the MoLHW consulted.

Relevant websites, links, and files

- Zekeria, (2018)
- MoLHW Report, (2017)

Other relevant information

The Ministry of Labour and Human Welfare sponsored a study to investigate natural and manmade disaster in the coastal area. The study found out that sea level rise is one of the main natural disasters that can have devastating effect along the Eritrean coast. The infrastructure in the coastal villages is located along the shore close to the high tide mark. With the imminent danger of sea level rise these settlements are prone to coastal flooding. For example, inhabitants of the Akelo village in the Zoba Semienawi Keih Bahri reported that in the last few years some inhabitants were forced to relocate their house to higher grounds because the buildings were flooded due to sea-level rise. Observation in Berasole village show that part of the village has been flooded and sea water has approached the door steps of many houses. Also residents of Tio village narrated that before 50 years the area in front of the current fish-landing harbour was not covered by water. Children use to play there. The residents believe that the level of the sea has increased over the last decades. They believe that eventually most of the coastal houses have to be relocated to higher grounds but the financial cost of re-building the houses is too much (Zekeria, 2018).

Obstacles and scientific and technical needs related to the measure taken

- Insufficient funds
- Insufficient technical capacity to assess coastal erosion
- Inadequate coordination among stakeholders

E-Target 10. By 2020, all coral reefs in the Eritrean Red Sea are identified to a species level and status of natural and human induced degradations regularly monitored.

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

The coral species of the Eritrean Red Sea were identified by an expert from Australia in 2007. A total of 220 species in 33 genera were identified and 5 new species were collected (De Grissac and Negussie, 2007). In the last three years, the MoMR and COMSAT conducted preliminary surveys of coral reefs in Massawa area and Dahlak archipelago.

The MoMR conducted reef-check monitoring scheme in six sites in the Dahlak Archipelago. Results from the monitoring program revealed a sharp decrease in the live coral cover that is from 46% to 33% while the recently degraded coral and rocky substrate increased from 26% to 32%. Even though continues and detailed researches are needed to investigate the main cause of coral death, the factors that contribute to the deterioration of reefs could include sedimentation; predation by reef dwellers especially crown of thorns, overgrowing on corals by sponges and some sea weeds; temperature rise; and pollution.

Massawa College of Marine Science and Technology established monitoring sites in four reefs around Massawa and one reef in the Dahlak Archipelago (Fig. 12). The outcome of the study revealed that Twalot reef was highly degraded in 2012 when the percentage live-coral was reduced from 75% in 2011 to only 12% in 2013. In 2013, staff members from the college surveyed four reefs around Massawa and Durgella reef in Dahlak archipelago. In addition to Twalot the reefs of Resimedi and Shiek Said Islands were also degraded but the Reefs of Gurgusum and Durgela were healthy. The cause for degradation of the reefs could be attributed to high sedimentation caused by jetty construction in AGIP Depot. Gurgusum reef and Durgela Island showed little change in coral cover during the study period. The five reefs were monitored for three consecutive years. By 2016 the reefs have recovered fully (Abeselom, et al., 2017, and Zekeria, et al., 2017). Observations conducted during summer months by the staff of COMSAT and MoMR reveal that reefs found around Massawa undergo bleaching during summer (Fig. 13)

The MoMR is the major government body responsible for safeguarding coral reefs. It protects the corals from damages caused by fisheries and related activities. As per the Fisheries Proclamation (Proclamation No. 176/2014) it provides licences to local and foreign fishing vessels. The local fishers have less capacity and they use environment friendly fishing gear such as hook and line, long line and gill net. But foreign fishing vessels operate industrial fishing using trawlers, which can cause a lot of damage to coral reefs. In an effort to reduce damage to coral reefs the ministry allows trawlers to operate in deeper waters at minimum distance of 8 nautical miles from the coast (and 4 miles from the islands).

Awareness programs on coral conservation were broadcasted by the MoMR through the mass media to the general public, local community and tourists. Three articles that deal with coral reef conservation were printed in *Hadas Ertra*, local newspaper. Similar information was aired in the National Radio (*Demtsi Hafash*) and Eri TV. More than ten programs related to coral reefs were broadcasted in television. The program in Eri TV was broadcasted in one of the most widely watched programs on Sunday afternoon. In addition to the mass media, conservation of coral reefs is included in school curriculum. For example, in Grade seven science curriculum issues related coral conservations are discussed.

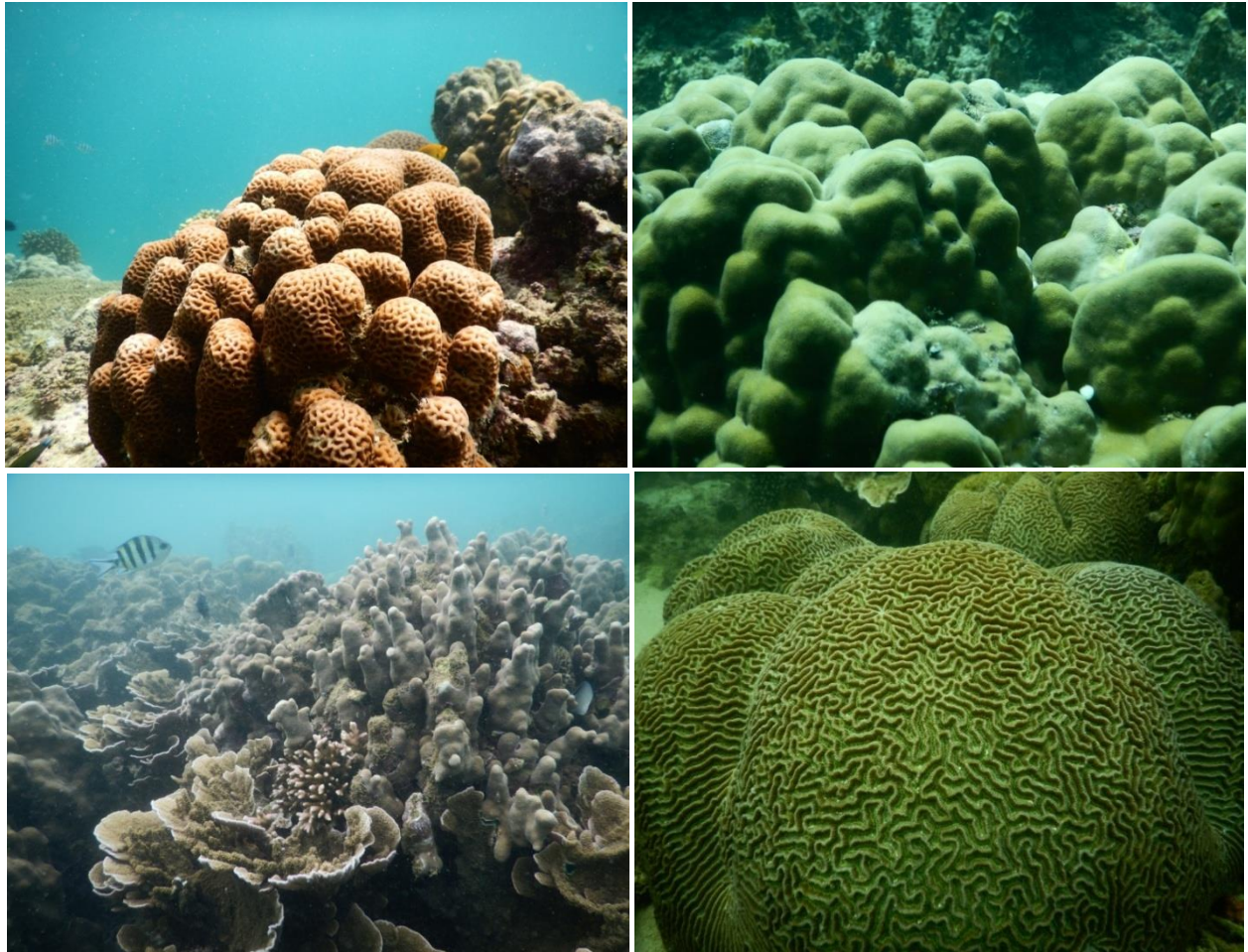


Figure 12: Corals from the reefs around Massawa (Photo: Zekeria Abdulkarim, February 2016)

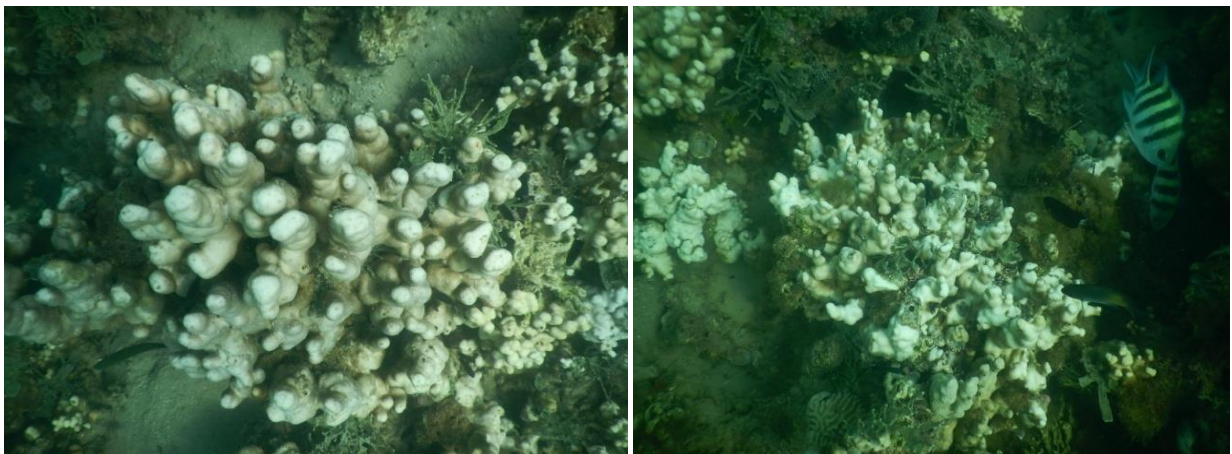


Figure 13: Bleaching corals in Twalot reef in September 2016 (Photo: Zekeria Abdulkarim)

With regards to capacity building COMSAT offers two courses related to coral reefs (Coral Reefs & Marine Protected Areas) to its students. Furthermore, the MoMR have a team of researchers who investigate the coral reef ecosystem. One senior staff of MoMR attended international workshop on marine protected areas.

Legislation for establishing protected areas has been drafted by MoLWE. In addition to the draft legislation, the Ministry also prepared documents on institutional setup, financing, monitoring and training related to protected areas.

As mentioned above many activities related to coral reef conservation were executed in the last three years. But some of the activities listed in the NBSAP as priority actions were not implemented. These activities include detailed surveys of coral reefs status, implementation of coral reef conservation projects, and development of management plans for conservation of coral reefs.

For the implementation measure, please indicate to which National or Aichi Biodiversity Target(s) it contributes

National Targets: 1, 5, 6, 10, 14 and 15

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been partially effective

Tools or methodology used for the assessment of effectiveness above

The assessment was conducted using questionnaires which were distributed to MoMR and COMSAT. Field visits were done to some islands in Dahlak Archipelago (Durgela Island and Dissie Island) and Massawa area (Resi Medri, Gurgusum, Twalot, and Sheik Said Island). Interviews and discussions were also conducted with the concerned experts of the above organizations. Reports of MoMR and literature related to monitoring of corals by COMSAT consulted.

Relevant reference documents websites, links, and files

- Abeselom, et al., 2017
- Fisheries Proclamation (Proclamation No. 176/2014)
- Kotb, et al., 2008
- MoLWE (DoE) Report
- MoMR Reports
- Zekeria, et al., 2017

Other Relevant Information

COMSAT conducts survey of coral bleaching during the summer months. Results from the survey show that annual bleaching of corals takes place during the months of September when the water temperature exceeds 30°C at the shallow depths. But the bleached corals recover in the months of October and November when the water temperature decreases below 28°C. Brief information on coral bleaching from the Eritrean coast of the Red Sea is given in Kotb, et al., 2008.

Obstacles and scientific and technical needs related to the measure taken

- Insufficient fund
- Shortage of expertise in coral identification

E-Target 11. By 2020, Alien Invasive Species in the Coastal, Marine and Islands (CMI) are controlled and monitored.

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

The research division of the MoMR has a unit which deals with marine habitat conservation. The unit has many teams which assess the distribution and abundance of various components of marine organisms including marine flora, invertebrates, fishes and marine mega-fauna (reptiles, birds and mammals). These teams have not reported any invasive alien species from the Eritrean coast of the Red Sea.

Eritrea is signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) which, among others, addresses control and regulation of exotic species in the country. The country has drafted CITES regulation in an attempt to control the introduction of alien and invasive species.

For the implementation measure, please indicate to which National or Aichi Biodiversity Target(s) it contributes

National Targets: 9, 10 and 14

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been ineffective

Tools or methodology used for the assessment of effectiveness above

The assessment was conducted using questionnaires which were distributed to MoMR. Interviews and discussions were also conducted with the concerned experts of the ministry. Literature related to invasive species consulted.

Relevant websites, links, and files

- Draft CITES Proclamation

Other Relevant Information

The flow of Red Sea species into the Mediterranean Sea, via the man-made Suez Canal ('Lessepsian migration'), is often considered as the major modern bio-geographical event, at the Holocene scale. Hundreds of Red Sea species, including 39 species of macrophytes (e.g. the *Rhodobionta Chondria pygmaea*, *Galaxaura rugosa* and *Hypnea anastomosans*, the *Magnoliophyta*, the stramenopile *Styopodium shimperi*), have entered the Mediterranean through this waterway since the 19th century. Because of the recent enlargement of the Suez Canal, this flow is expected to dramatically intensify. The flow is unidirectional. The migration in the opposite direction, i.e. from the Mediterranean to the 'anti-Lessepsian migration', is negligible because of the mainly unidirectional water flow (Red Sea towards the Mediterranean). No Mediterranean macrophytes have been found to occur in the Red Sea (Molnar, et al., 2008).

In their investigation on global threat of invasive species to biodiversity, Molnar et al (2008) assessed 350 databases and synthesized information on 329 marine invasive species including their distribution, impacts on biodiversity, and introduction pathways. Results from this assessment reveal high levels of invasion in the following ecoregions: Northern California, including San Francisco Bay (n = 85 species, 66% of which are harmful), the Hawaiian Islands (73, 42%), the

North Sea (73, 64%), and the Levantine Sea in the eastern Mediterranean (72, 50%). Realms that feature the highest degree of invasion are the Temperate Northern Atlantic (240, 57%), Temperate Northern Pacific (123, 63%), and Eastern Indo-Pacific (76, 45%). The least invaded realms are the Southern and Arctic Oceans (1, 100%, and 9, 56%, respectively). According to the study, there are only one or two harmful alien species in the Red Sea.

Obstacles and scientific and technical needs related to the measure taken

- Insufficient funds
- Inadequate taxonomic knowledge

E-Target 12. By 2020, Rare, Endangered and Threatened species of both marine flora and fauna species are protected, conserved and rehabilitated

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

According to the information from the MoMR, some progress was made on this target. The ministry has established linkage with the regional countries. As a result, Eritrea is part of regional conservation networks for tuna, turtle, dugongs and whales. The country has signed agreements with the regional countries to conserve the threatened species. Representatives of the ministry attend regular meetings and present status report of the species. Furthermore, staff from the ministry undertook annual survey of turtle nesting sites. Moreover, the ministry conducted awareness raising programs to the local community and members of the Naval Force.

Monitoring of turtle nesting sites was conducted. Tagging female sea turtles has been practiced by the research staff of the MoMR since 2000. A total of ninety-six female hawks' bills were tagged during 2006 of which 47 were tagged in Mujeidi Island, one of the known turtle nesting grounds. In 2017 and 2018 the nesting site was monitored and four additional nesting turtles were tagged and one previously tagged turtle was observed nesting in the Island. Hatching success of turtle eggs was investigated in the site. Observation in the nesting site show that 68% of the eggs were successfully hatched, 16% were rotten, unfertilized eggs constitute 15%, and the remaining 1% of the hatched turtles were found dead in the nest. The turtle nest monitoring sites are found far in the off shore islands of Mujeidi, Aucan and Muserie. The nesting sites have relatively low natural and human induced impacts.

In Mujeidi Island, 12 adult sea turtles were found dead. Out of the 12 dead turtles, 6 carapaces died some time back but the remaining 6 carapaces were fresh, which died few days before the visit. The cause of mortality of eight of the turtles could be due to disorientation of the female while returning from their nesting site or due to other natural causes. Considering the large number of nesting sites in Mujeidi Island, the observed human impact seems to be low, but to eliminate the impact on turtles there is a need to raise awareness of the members of the naval force regarding the problems facing on Turtles.

Due to the lack of systematic research, the conservation status of Red Sea cetaceans is not fully documented. This hampers the planning and follow-up of science-based conservation measures. The direct and indirect factors impacting the marine life of the Red Sea are: climate change, chemical and noise pollution, disturbance of critical habitat and direct killings. Other known threats also include by-catch, overfishing, and ship-strikes.

According to Notarbartolo, et al., (2017) the Red Sea at large may still be considered one of the world's marine regions where cetaceans are least affected by negative pressures deriving from

human activities, or by the ongoing changes in global environmental conditions. However, they recommended the status of cetaceans in the Red Sea be carefully monitored because of the increasing human requirements and resulting environmental exploitation.

In their recent publication on cetaceans of the Red Sea Notarbartolo, et al., (2017) provided detailed information on the biodiversity of cetaceans in the Red Sea. The work documented that the Red Sea is home to 16 species of cetaceans of which seven are whales and nine are dolphins. Out of the 16 species recorded from the Red Sea, fourteen have been recorded from the Eritrean coast. In fact, two of these species, the dwarf sperm whale (*Kogia sima*) and the rough-toothed dolphin (*Steno bredanensis*), have so far been sighted from the Eritrean coast only (Fig 14).

The MoMR consider all marine mammals as protected species. Article 12 of the Fisheries proclamation (Proclamation No. 176/2014) states that no person may fish for any marine mammal or other protected species in Eritrean waters. According to the proclamation any marine mammal or other protected species caught accidentally shall be released immediately and returned with the least possible injury to the waters from which it was taken.



Figure 14: Dwarf sperm whale (*Kogia sima*) stranded on Maka'aka beach north of Assab, Eritrea (Photo by K. Uombuda) [left]; and rough-toothed dolphin (*Steno bredanensis*) stranded on the beach near Massawa (Photo: Y.T. Mebrahtu) [right].

The effect of trawling on sea turtle has been assessed by the Ministry of Marine Resources. Information extracted from data collected on booklet by on board observers indicates, in 1996-2004, over 4000 sea turtles were incidentally caught on bottom trawlers of fish and shrimp, death of sea turtles was 20% (out of the 4000 incidental catch) indicating there is high mortality rate. Since 2005, although there has been sea turtle incidental catch on bottom trawlers, due to the lack of awareness record of sea turtle incidental catch by on board observes has reduced significantly. The Marine Resources Research Division has planned to conduct training and awareness to on board observes, and the Regulatory Services Department has a plan of addressing the case and motivates on board observers.

This target includes actions related to establishment of marine protected area management plans and strengthens institutional capacity for monitoring programmes. In this connection, the MoLWE prepared draft proclamation entitled: A proclamation to determine the establishment and management of protected areas. In addition to the draft proclamation, the Ministry has prepared the following documents related to the management of protected areas:

1. Institutional Framework for the Establishment and Management of Protected Areas,
2. National Strategy for the Conservation and Financing of Protected Areas in Eritrea,

3. National Biodiversity Conservation Monitoring and Evaluation Program for Protected Areas, and
4. Biodiversity Conservation Training Program for protected Areas.

With regards to capacity building, a course on Marine Protected Area is offered to undergraduate students of the COMSAT. Moreover, one senior staff of the MoMR attended an international workshop in MPA. Marine protected areas are expected to be declared soon when the PA proclamation comes into effect.

A number of awareness programs related to conservation were broadcasted through mass media (TV, Radio and Newspaper). In the past three years, more than four programs that incorporate sea turtles, their nesting grounds, and their challenges have been broadcasted.

However, many of the priority actions planned in the NBSAP for this target were not implemented. The activities which were included in the NBSAP but not implemented include monitoring of threatened and rare species was conducted (whaled, dolphins, etc.), development of strategic plans/projects for conservation and rehabilitation of rare and endangered species, and conservation of threatened and rare species were carried out.

For the implementation measure, please indicate to which National or Aichi Biodiversity Target(s) it contributes

National Targets: 9, 10, 12 and 14

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been partially effective

Tools or methodology used for the assessment of effectiveness above

The assessment was conducted using questionnaires which were distributed to MoMR and MoLWE (DoE). Interviews and discussions were also conducted with the concerned experts of the ministries. Moreover, literature related to rare, threatened and endangered species in the Red Sea consulted.

Relevant websites, links, and files

- De Grissac and Negussie, 2007
- Fisheries Proclamation (Proclamation No. 176/2014)
- Notarbartolo, et al., (2017)
- Report from the MoLWE (DoE), 2018
- Report from the MoMR

Obstacles and scientific and technical needs related to the measure taken

- Insufficient fund
- Inadequate capacity to assess status of threatened species

E-Target 13: Public awareness on the importance and sustainable use of agricultural biodiversity increased by 10%.

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

During the year 2015 to 2019, the MoA along with Ministry of Local Government and Department of Agriculture and land in all regional offices conducted training and awareness raising programs to strengthen agro-biodiversity. As a result, 1,998 experts and 7,008 farmers have been trained in biodiversity related activities. Besides, 6 manuals and guidelines, 305 hand-outs, 13 preparation and review of agricultural text books for Ministry of Education, 10,190 booklets, 8 newsletters, 6,002 flyers, 7,000 leaflets, 1,215 posters, 1,100 stickers, 10 documentary films and 10 TV spots have been produced. 260 articles have been also published in Eritrean '*Hadas Ertra*' Newspaper and 50 in Eritrean Profile. The published articles and training conducted were related to soil and water conservation, crop production and husbandry, vegetables and fruit production, meat and dairy production, improved seeds production, bee keeping, local poultry keeping and animal and plant health. Besides, biodiversity related activities were broadcasted once in a week in the national radio program under the program locally known as "*Hrshana Nemaabl*". In addition, about 250 radio programs that are related to combating Desert Locust control, food security and maintenance of biodiversity broadcasted twice a week. 12 TV spot programs were also broadcasted in the last five years in English, Tigrigna, Arabic and Tigre languages. Eight newsletter articles on fall army worm and other pests and about 60 TV interviews were conducted in Eritrean TV.

National soil and water conservation community-based campaign, minimum household integrated agricultural package (MHAP) and catchment and landscape managing community-based program and project implemented between 2015 and 2016. Improved seed multiplication of different crops in cluster form has been implemented through the community participation. Such activities help further dissemination of crop varieties and hence achieve increased productivity of the major field crops and vegetables.

Because of the continuous awareness raising program and trainings, the community participated and contributed in sustainable management of natural resources through (i) volunteer involvement of community on soil and water conservation campaign, (ii) active participation of community in animal and plant health programs. Some awareness and communication strategy have been also documented which includes communication strategy on disposal of obsolete pesticide, controlling of fall arm worm (FAW) and pests of ruminants (PPR) disease.

The institutional arrangement for the implementation was in line with the organization structure of the MoA from the Head Quarter up to the local administrative level in coordination with the Ministry of Local Government that mobilize the community to involve in community-based project activities. During the land degradation neutrality target setting program, 23 major degradation hotspot areas have been identified, which will be addressed at national level between 2019 and 2020. Besides, through community mobilization 52,532 hectares of farm land treated by different soil and water conservation measures and setup infrastructures in the last four years. About 60,000 households have been participated in this sustainable management practices.

For the implementation measure, please indicate to which National or Aichi Biodiversity Target(s) it contributes

National Target: 1

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been partially effective

Tools or methodology used for the assessment of effectiveness above target

This assessment is based on the feedbacks given from

- MoA, Department of Agriculture and Land of zoba offices and Ministry of Information,
- Expert interviews and visits to regional office
- Strategy documents, articles, annual reports,
- Radio programs, TV programs broadcasted and newspaper publications
- SLM and MHAP reports

Relevant websites, links, and files

- MoA Report, 2015-18
- Progress report for the Agricultural Extension Department and all regional offices of Eritrea
- Report of the Ministry of Information

Obstacles and scientific and technical needs related to the measure taken

Insufficient capacity to conduct short and long-term training for the staff of the MoA, particularly the extension and regulatory service experts, who are the key organizers of the community ecosystem management program.

E-Target 14. By 2020, Plans for sustainable management of agricultural genetic resources is implemented

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

The genetic resource management strategy is included in the agricultural policy and the MoA's strategic plans. By 2020 detailed document on the national genetic resources conservation and management strategy will be produced.

The management plan for genetic resources includes: identifying responsibility of stakeholders and their engagement in genetic resources conservation: management or related activities; studying genetic diversity and causes of genetic erosion; identifying species prioritized for conservation corresponding with appropriate conservation and management methodologies. This management strategic plan on genetic resources conservation and management has resulted into effective products. As an example, farmers have included their indigenous varieties which exhibit high variability among and within varieties that covered large areas under cultivation in Eritrea. Keeping and sustainable management of these traditional varieties has been insurance to the farmers against biotic and abiotic stresses.

Adaptation trials for high yielding and disease resistant crops of chilli pepper, sweet pepper, tomato, onion, cucumber, leafy brassicas and pumpkin were research plan of the horticultural research unit at National Agricultural Research Institute, NARI. Besides some crop introductions of varieties of horticultural crops were conducted in Eritrea. Adaptation trial for drought, tolerance, pest and disease resistance, earliness, adaptable high yielding of sorghum, pear millet, wheat, barley, maize, pulses (chickpea, faba bean, lentil, beans, cowpea, green gram) and oil crops (sesame, sunflower, rapeseed) were done by the National Agricultural Research Institute. In

majority of these crops, where improved varieties were used, 20-25% of yield advantages have been realized. This is especially confirmed in using field crops such as sorghum, pearl millet, barley and wheat where farmers have received improved seed varieties and grown them in clusters at community level.

Hamelmallo Agricultural College also conducted field trials in the development of drought and Striga resistant sorghum varieties in drought prone areas of Eritrea. Trials on indigenous vegetables were also conducted to identify promising vegetables for drought prone areas at Hamelmallo Agricultural College. Seeds of improved variety named as “Hamelmallo” has been distributed to Zoba Anseba particularly in sub Zoba Hamelmallo area (Fig. 15). Even though there is no impact assessment on the adoption rate of this variety, farmers in the sub Zoba Hamelmallo have been still cultivating this variety and appreciated it for its drought and Striga resistance.



Figure 15: Released Hamelmallo Variety in farmers’ field at late milk stage (left) and at Hamelmallo Agricultural College at late flowering stage (right) (photo by Tesfamichael Abraha).

In 2017, nine date palm varieties which cover more than 200 hectares are introduced by NARI after conducting adaptation trial on station and on farm level since 2001. In 2016 two Irish potato varieties were introduced to farmers and cultivated in an area which is estimated to about 500 hectares. Sorghum variety (Seare), wheat varieties (Sedra-1, Pavon-76, Croc-1 and Atilla-7) and pearl millet varieties (Kona and Hagaz) which were evaluated and released by NARI in the previous 10 years was further multiplied and used in farmer’s field in about 250 hectares annually benefitted about 1500 farmers.

The sorghum variety, *Hamelmallo* introduced by Hamelmallo Agricultural College and reported in the fifth national report of Eritrea to CBD has covered about 50 hectares annually in Hamelmallo sub-zoba during this review period. According to the National Variety Release reports of 2017 and 2018 released wheat variety “Sidra-1” recorded 4 tons per hectare as compared to 1.5 tons in farmer’s fields. Similarly, released sorghum variety named as “Seare” (ICSV 111 IN) gave a yield advantage of 2.5-3.0 tons per hectare as compared to traditional varieties that recorded less than 1 ton per hectare in farmer’s fields.

For the implementation measure, please indicate to which national or Aichi Biodiversity Target(s) it contributes

National Targets: 13 and 17

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been partially effective

Tools or methodology used for the assessment of effectiveness above target

The assessments are based on the feedback from

- MoA, the Department of Crop Improvement under the National Agricultural Research Institute
- Expert interviews of NARI and HAC
- MoA, Department of Agricultural Extension, Department of Agriculture and Land of zoba offices
- Expert interviews and visits to regional offices
- Land Degradation Neutrality (LDN) and MHAP reports

Relevant websites, links, and files

- Annual progress report for the Agricultural Extension Department and all regional offices of Eritrea, 2014-2018
- MoA, Land Degradation Neutrality (LDN) report, 2017
- MoA, Minimum Integrated Household Agricultural Package (MIHAP) Reports, 2015-2018
- National Agricultural Research Institute Reports, 2015-18
- HAC Biannual Newsletters and Research Reports

Other relevant information

In order to implement strategy for the conservation of genetic resources effectively for the achievement of national target as well as to contribute in the Aichi Biodiversity Targets, the concerned organizations need to have an institutional capacity, human resources capacity development and training. Besides, there is dire need of training on risk assessment and other scientific and technical expertise, risk management, information exchange and data management. It is also important that the organizations participate in the Biosafety Clearing-House, technology transfer, identification of Living Modified Organisms (LMO's), including their detection, handling of confidential information processes. Moreover, the technical and financial supports, measures to address unintentional and/or illegal trans-boundary movements of LMOs, scientific biosafety research relating to LMOs/GMO's and information on risks to human health need to be addressed.

Obstacles and scientific and technical needs related to the measure taken

- The major obstacles in promoting and enhancing crop varieties are lack of financial support for the implementation of the research programs and qualified research expertise such as breeders. Therefore, there is critical need for financial support and capacity development in conducting crop improvement program.
- There is limited information on the improved variety. There is a need more extension work to popularize the improved varieties to wider area and many farmer households to be benefitted.
- Capacity development: Training of extension workers both at regional and sub- regional levels is needed.
- Limited information on risk management, information exchange and data management.

E-Target 15. By 2020, Pollution to agricultural biodiversity from agro-chemicals has been brought to levels that are not detrimental to ecosystem function and biodiversity

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

In 2016, first National Chemicals Profile was prepared by the Department of Environment, Ministry of Land Water and Environment. This document provides information on the strength and weaknesses of handling, storage, transportation and usage of chemicals. It also includes information on capabilities necessary for sound management of chemicals. Under this study all chemicals including industrial, medical, and agricultural are addressed. Besides, the National Implementation Plan (NIP) was prepared in 2012 by the DoE (MoLWE) and updated in 2018. Besides, the Environmental Impact Assessment Procedures and Guidelines for Agricultural Projects developed by RSD are in place to assess the significance of potential impacts which the implementation of the project may have on the environment.

There is an approved regulation on agro-chemicals under the Legal Notice No. 114/2006 with provisions related to use, handling, storage and disposal of pesticides. This has been revised and updated in 2019 with the emphasis on its implementation and wider awareness in the zonal offices. Besides, the Legal Notice gives weight on safe disposal of pesticide and how to control the illegally entered agrochemicals to the country. In 2016/2017, about 363 tons of obsolete pesticides have been shipped to the UK for safe handling. The new inventory 2018 showed that there are about 30 tons of new obsolete pesticides in the stores.

Similarly, the Eritrean environmental protection, management and rehabilitation framework proclamation No. 179/2017 includes provisions to control hazardous and toxic substances during production storage, sale, distribution, import and transit subject to fulfilment of EIA procedures and sound management practices.

There is an updated IPM frame work which was developed by the MoA - Regulatory Services and Agricultural Extension departments. Training on IPM was conducted for 22 experts and 120 farmers that participated from all zobas together with farmer's field school program (FFS) about 7 times in five zobas in 2017. There is also an updated IPM approach for the establishment of farmer's field school as an IPM component. There was full coverage of the IPM training in all zobas of Eritrea except in Zoba Semienawi Keih Bahri.

Environmental and social impact assessment was conducted prior to the shipment of the obsolete pesticides to the UK. There is continuous follow up and safeguarding activities being undertaken for the remained obsolete agricultural pesticides. Besides, in 2018 an inventory on mercury was done. The objective of this assessment is to identify the usage of mercury, supply sources and assess its environmental and health impacts. Based on the assessment, National Action Plan will be developed to ensure sound management. An inventory and alternative survey were also conducted in 2017 on Ozone Depleting Substances (ODS). The result of the inventory indicates that the ODS alternatives that are imported to the country are HFC-134a, R-404A, R-410A and R-407C. However, R-507A and HC-600a were imported in very small quantities intermittently during the survey period. HFC-134a is the number one imported ODS alternative refrigerant to the country. Its consumption from 2012 to 2015 has increased from 13.0 to 18.6 Mt; which corresponds to an average annual increase of 10.8%. The trend analysis shows that the amount of consumption of this refrigerant will be 45.1 Mt by 2030. The refrigerant has been used in domestic refrigeration (60%), commercial refrigeration (15%), commercial air conditioning (6%) and MAC (14%). R-404A is also imported to the country with an increasing rate. Its importation has risen from 4.5 Mt in 2012

to 12.2 Mt in 2015. Moreover, inventory of ODS (HCFC-22) is conducted on annual bases since 2012, and the importation of R-22 has reduced from 20.3 tons in 2010 to 16.9 tons in 2017.

For the implementation measure, please indicate to which national or Aichi Biodiversity Target(s) it contributes

National Targets:8, 14 and 15

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been partially effective

Tools or methodology used for the assessment of effectiveness above target

The assessment is based on the feedbacks given from:

- MoLWE, Department of Environment (DoE)
- MoA, Department of Regulatory Services (RSD)
- MoA, Department of Agricultural Extension (AED)

Relevant websites, links, and files

- Eritrean National Environmental Assessment Procedures and Guidelines (NEAPG) DoE, 1999
- The National Chemicals Profile, Ministry of Land, Water and Environment, 2016
- National Implementation Plan (NIP), Ministry of Land Water and Environment, 2012, and updated in 2018
- Inventory of Agro-chemicals, Department of Regulatory Services, 2018
- Legal Proclamation of 114/2006 on regulation of agro-chemicals
- MoA, RSD Annual Reports, 2017
- Survey report of Ozone Depleting Substances (ODS) (DoE), 2010
- Eritrea Ozone Depleting Substances (ODS) Alternative survey report, 2017

Obstacles and scientific and technical needs related to the measure taken

- Inadequate capacity for strengthening and functional institutions
- Insufficient control of trans-boundary chemicals and thus the legal notice 114/2006 is not fully enforced
- Inadequate knowledge of agrochemicals
- Financial problems
- Limited capacity of experts on IPM and hence need training opportunity both short and medium term.
- Low level of understanding of stakeholders on IPM and on the amount and type of pesticide to be used
- Insufficient knowledge on consequences of the use of mercury and Ozone Depleting Substances (ODS)

Therefore, there is a need to strengthen public awareness on safe chemical uses and their health consequences, train (short- and long-term) experts on regulating chemicals, update equipment and technologies, and secure financial support.

E-Target 16. By 2020 Threatened species prevented and their conservation status, particularly of those most in decline, has been improved and sustained

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

Program of management for the threatened and endangered species of plants (including trees and shrubs), and farm animals are executed by National Agricultural Research Institute (NARI). No activities have been conducted for on farm conservation of landraces and vegetatively propagated collections despite being high priority of the Genetic Resources Division of the NARI during 2015–2019. However, activities related to manage the threatened and endangered species were carried out as per the gene bank annual work plan which is financially supported by the government.

Similarly, there was no major activities conducted related to domestication of indigenous fruit trees during the period of this review, but efforts have been made on domestication of some of the endangered wild fruit trees. *Mimusops kummel*, *Tamarindus indica*, *Adansonia digitata*, *Hyphaene thebaica* and *Diospyros mespiliformis* (*African ebony*) are few examples of critically endangered multipurpose wild fruit trees in Eritrea.

During this reporting period morphological characterization of indigenous cattle breeds a PhD study by Goitom, et al., (2016) conducted phenotypic characterization of Barka cattle and genetic diversity of cattle population in Eritrea. This study is expected to strengthen the management of threatened and endangered species as well as the conservation status of the Barka cattle. However, establishing cryopreservation of farm animal genetic resource and supporting community conservation of farm animals not yet initiated.

In addition, study on indigenous chickens was conducted by MoA and HAC to evaluate their phenotypic variability in Gash Barka region. The result revealed that there is tremendous variability of the indigenous chickens in the study area which needs special attention for their genetic conservation and further use.

The Hamelmalo Agricultural College has carried out an assessment on indigenous leafy vegetables. Wild leafy vegetables are important as resilience crops and could be important for food and nutritional security of people. However, the utilization of such wild plants in Eritrea is not common and people only opt to these as medicinal or during severe drought conditions. In some cases, they are considered as weeds. Thus, most of the wild leafy vegetable species are getting threatened and endangered due to natural and human-induced factors (Kesete, MSc thesis, 2018 unpublished). The people do not consider domesticating them or even conserving them as important plants, especially in these days. Thus plants like *Gynandropsis gynendra*, *Colocasia esculentum* and night shade species, are on decline over the last three decades, mainly because of droughts, application of herbicides and loss of know-how on the uses (Fig. 16). Regardless of the wide utilization of these leafy vegetables, much work needs to be done on their domestication as they can serve for mitigating drought stress.



Figure 16: Wild vegetable species *Gynandropsis gynendra* (Left) and *Colocasia esculentum* (Right) (Source: Kesete, 2018)

Study on nine sesame landraces with two wild species *Sesamum alatum* and *Sesamum indicum* (Fig.17 a) have been evaluated at Hamelmalo Agricultural College to enhance and enrich sesame diversity in Eritrea. Preliminary study indicated that some of these sesame accessions have good tillering capacity, are tolerant to drought and have non-shattering capacity. Strengthening the conservation of the wild species is necessary to protect them from extinction (HAC, 2018).



a) *Sesamum indicum*

b) *Vernonia gulmensis*

Figure 17: Wild species evaluated by HAC (2018)

Besides the seeds of the endangered wild Vernonia (*Vernonia gulmensis*) (Fig. 17 b) was collected in 2018 from Hamelmalo Agricultural College and its surrounding for conservation and for breeding program. Eritrea is one of the centres of diversity of Vernonia where it occurs in wild state in Anseba region stretching from *Tsebab* to *Genfelom* and in sub region Shambuko on the road to Barentu in Gash Barka.

Study was carried out to assess the genetic diversity of 48 cowpea accessions from the national gene bank. The National Agricultural Research Institute also took initiative to expand cultivation of chamomile by distributing seeds from the gene bank to potential interested growers.

The management of threatened and endangered species of cultivated plants forests and farm animals are executed by the NARI and MoA. During the period under review, no new specific project targeting specific species with independent financial support was approved. However, the

efforts made to strengthen protected and conserved areas supports in-situ conservation of threatened and endangered indigenous species; establishing cryopreservation for farm animal genetic resources; and supporting community conservation of farm animals has not yet initiated. However, in 2017, morphological characterization of indigenous cattle breeds (Solomon, *et al.*, 2017, unpublished) and genetic diversity of cattle population in Eritrea were studied by Hamelmalo Agricultural College. In addition, phenotypic characterization of Barka cattle breed (NARI's 2018 annual report) and genotyping 48 cowpea accession of the gene bank carried out by NARI.

For the implementation measure, please indicate to which national or Aichi Biodiversity Target(s) it contributes

National Targets: 12 and 13

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been partially effective

Tools or methodology used for the assessment of effectiveness above target

The assessments are based on the feedback of:

- MoA, Division of Crop Improvement under the National Agricultural Research Institute
- Expert interviews of NARI and HAC

Relevant reference websites, links, and files

- HAC annual research reports 2015-2018
- Kesete, A. MSc thesis, 2018 unpublished
- Goitom, S., et al., 2016, PhD thesis
- National Agricultural Research Institute, 2015-2018 reports

Obstacles and scientific and technical needs related to the measure take

- Insufficient coverage of assessing the threatened and endangered species
- Limited financial support
- No study has been conducted on cultivated and wild crops and fruit tree species
- No integrated approach has been taken to assess in the management of threatened and endangered species
- Limited capacity of experts in management of endangered species and hence need training opportunity both in the short and medium term.

Therefore, there is a need of integrated approach to strengthen the management of endangered and threatened species, undertake short- and long-term trainings and ensure financial support.

E-Target 17. By 2020 Conservation and management of genetic resources and diversities strengthened.

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

The Genetic Resources Division at NARI of the MoA executes national program for conservation and management of cultivated plants, forests and farm animal genetic resources. The National Gene Bank maintains food crops, forages, industrial crops, medicinal plants and others. The national gene bank holds over 6,000 accessions and more than 130 species of cultivated and wild plants. However, no community-based seed bank and in-situ conservation of crop wild relatives program have been executed. Limited capacity building program includes supply equipment and providing short-term training entitled genetic resources conservation and utilization conducted during this assessment.

The short-term training is aimed to make staff members of NARI knowledgeable about cultivated plant, forests and farm animal's genetic resources conservation and sustainable use including trainees from different research stations to assist the Genetic Resources Division in germplasm collection and estimating genetic threatened their courses.

A total of 248 tons of field crop seeds were multiplied and distributed to the community in the last five years (2014-2018) of which: 18.3 tons is wheat, 0.6 tons barley, 0.4 tons maize, 27.0 tons sorghum, 25.4 tons pear millet, 2.1tons emmer wheat, 0.15 tons of red kidney bean and 5.7 tons rape seed and other crops. Besides, 1,968kg of vegetable seeds were distributed to the community in the last five years. So far, about 7.0 tons of native forage seeds has been collected from potential areas and distributed back to four zobas for reseeded on grazing lands.

Even though there is no cryopreservation of farm animal resources developed nationally, the Ministry of Agriculture has liquid nitrogen facility which could be used to conserve semen that resulted from crosses between indigenous and exotic animal breeds. This is therefore an area of future project that could be supported by partners on the establishment of cryopreservation facilities. Moreover, Genetic Resource Information System (GRIS), an instrument helpful for documenting and disseminating data and information of genetic resources, is in place and is being implemented by the national genetic resource program of the country.

The activities at the Gene Bank mainly aim at collecting germplasm. For instance, there were assessments and collections of germplasm during 1997, 2008 and 2014. However, despite having defined project areas for the conservation of genetic resources, due to financial constraints the activities are limited. As mentioned above, there is only some activity in the ex-situ conservation component and as such not many projects have been developed to address the conservation of genetic resources. However, staffs have been deployed on an attempt to improve and strengthen the genetic resources programs by the Genetic Resources Division at NARI with limited supply of equipment and materials.

For the implementation measure, please indicate to which national or Aichi Biodiversity Target(s) it contributes

National Targets: 12 and 13

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measures taken has been partially effective

Tools or methodology used for the assessment of effectiveness above target

The assessments are based on the feedbacks:

- MoA, Division of Crop Improvement under NARI,
- Agricultural Extension Department (AED) and Regulatory Services Department (RSD),
- Expert interviews of NARI and HAC,
- Germplasm collections, characterization, multiplication, regeneration and conservation of collections are undertaken depending on Biodiversity International, Food and Agriculture Organization, CGIAR centres' publications such as exploration and collection germplasm, descriptors, gene bank standards and germplasm multiplication and regeneration.

Relevant websites, links, and files

- NARI, AED, and RSD annual research reports
- Agricultural Extension and Regulatory Services departments, 2015-2018
- HAC biannual newsletters

Other relevant information

There has been limited capacity development in relation to genetic resources conservation in general and community based *in situ* conservation in particular. Besides, farmers have been poorly awarded on existence of improved variety and their managements. There was a standing plan for the community seed bank and *in situ* conservation programmes to be developed, however, it has not been implemented yet. Therefore, for strengthening the conservation and management of genetic resources there is a need for capacity development, strengthening the extension program to make aware the farmers on improved varieties and project on community based seed bank of *in situ* conservation programmes to be implemented.

Obstacles and scientific and technical needs related to the measure take

The major constraints are:

- Gene bank facilities have to be updated and staffed appropriately
- Inadequate financial resources
- Shortage of skilled human resources
- Lack of infrastructure

E-Target 18. By 2020, the traditional knowledge, innovations and practices of local communities relevant for the conservation and sustainable use of agricultural biodiversity properly documented and integrated in agricultural biodiversity

Measures taken to contribute to the implementation of your country's national biodiversity strategy and action plan

The history of Eritrean agriculture is under study since 2000, through interviews with older people and experts in Agriculture but is not yet well documented and processed. There are also manuals, videos recorded and reports that focus on pastoralist's indigenous knowledge. Furthermore, a study was conducted in four sub-zobas (Hamelmallo, Segeneiti, Tesseney and Goluj) of Eritrea to determine farmer's perceptions and traditional knowledge on sorghum diversity, utilization, post-

harvest and production problems and their management practices using a semi-structured questionnaire and focused group discussions. On this study, farmers reported various traditional methods of storage pest management options which included treatment with ash and herbs; washing with water, sun dry and winnowing methods (Tesfamichael, et al., 2013). Farmers in these sub-zobas have also good traditional knowledge and farming practices relevant to the conservation and sustainable use of agricultural biodiversity.

In view of this, there is a plan to start community based conservation activities from 2019 onwards by incorporating local knowledge into the conservation program. In Eritrea, farmers are well experienced in traditionally characterizing their crop varieties based on important traits such as drought tolerance, biomass, grain yield and quality for food preferences which attributes conservation of biodiversity by local knowledge. They also keep their own seed for sowing in the next seasons and beyond. This is based on their evaluation of the local varieties and can be assumed that the crops are conserved on farm.

In addition, even in the rearing of animals, the farmers select the best animal for their agricultural setting. They know the pros and cons of their animal types and breed them for this need. They also transmit their knowledge to their community by sharing for instance sires in cattle. Even though, there is no formal documentation on conservation, the farmers share their knowledge with their immediate family and their community orally.

For the implementation measure, please indicate to which national or Aichi Biodiversity Target(s) it contributes

National Targets: 18 and 19

Assessment of the effectiveness of the implementation measure taken in achieving desired outcomes

Measure taken has been ineffective

Tools or methodology used for the assessment of effectiveness above target

- Feedback from NARI, MoA, and HAC
- Reports and literature

Other relevant information

Even though few attempts have been done to document traditional knowledge in general and agricultural biodiversity in particular, there is still a need to look into the importance of documenting such valuable information that is related to humans and threatened by the growing technologies.

Obstacles and scientific and technical needs related to the measure take

Lack of initiation from researchers and financial problems

2.3 Assessment of progress towards each National Target

E-Target 1. Developed integrated action frameworks on the control of excessive firewood collection and construction wood that impact biodiversity resources, in a manner that enhances sustainable use of nature resources.

Category of progress towards the implementation of the selected target:

Progress towards target but at an insufficient rate

Date the assessment was done:

January, 2019

Additional information

In general, awareness is conducted in the country to enrich the knowledge on the conservation of biodiversity and utilization of forests and forest products. In all the trainings and awareness raising programs, governmental offices and other stakeholders actively participated and there was great integration almost in all zobas.

To promote the implementation of sustainable utilization of forest products different activities are conducted throughout the country. There is established enclosure area which is managed by community mainly in the highlands of the country i.e. in Zobas Debub, Maekel and Anseba. These community enclosures are many in number. The management effectiveness of the enclosures is good, because the enclosures are generally guarded, managed and utilized by the owner community. Afforestation activities are going on yearly basis at zoba and sub-zoba levels. The extent of use of forest products for household energy is high because, the only thing they have at their environs is wood and other agricultural residues. In addition, they use wood for construction especially in the rural areas.

Indicators used in this assessment

- Needs of assessment study
- Types of training programs conducted
- The status of awareness integration
- Number of stakeholders participated
- Status of the local communities used forest products
- Published manuals and brochures
- The size of enclosure areas delineated
- Status of management of enclosures and its effectiveness
- The extent of use of forest products and trend in local communities
- Number of established forest/plantation areas and protection mechanisms.
- Status of afforested area

Please describe any other tools or means used for assessing progress

Feedback from zobas, FWA, MoA, DoE, MoI, interviews and discussion with office experts

Level of confidence of the above assessment

Based on partial evidence

Please provide an explanation for the level of confidence indicated above

The methodology used has tried to assess the level of implementation through various ways such as questionnaires, expert interviews of relevant stakeholders and the involvement of the BD focal point in all the assessment process. However, the information available was not comprehensive and information on all the mentioned indicators that could be available from the implementing bodies was scarce or partially available. Nonetheless, the achievements made were evident and measurable to assess the progress made in the major target.

Adequacy of monitoring information to support assessment

Monitoring related to this target is partially adequate

Please describe how the target is monitored and indicate whether there is a monitoring system in place

Although not regular, monitoring was done at both local level (zoba and sub-zoba) and national levels. At the local level, well trained staff visited the communities on regular intervals to educate the population about the importance of biodiversity conservation. At the national level, there were supervising mechanisms to monitor the awareness given at the local level (by staff) and how the population are implementing the trainings given to them to achieve sustainable conservation and wise use of biodiversity.

Monitoring of activities related to the implementation of forest products and their sustainable utilization is carried out at local levels within a zoba or sub-zoba. Activities under the MoA are evaluated and reported in formal meetings of the ministry and also in annual reports.

Despite the above mentioned activities, the impact of the awareness raising programs has not been measured in a systematic way.

E-Target 2. By 2020 the use of alternative energy should be increased and pressure on forests significantly reduced

Category of progress towards the implementation of the selected target:

Progress toward target but at an insufficient rate

Date the assessment was done:

January, 2019

Additional information

The efficiency is increased; electricity consumption is expected to be reduced by 50% as its power demand is reduced from 4KW to 2KW. However, implementation progress is slow because of low material availability and financial problem. Different organizations such as the MoA have been involved in distributing improved biomass stoves. Despite the pace is not as planned, around 15,034 stoves have been distributed between 2014-2019. In addition, many households and commercial end users are starting to use LED lamps to replace incandescent lamps.

In promoting capacity building, no comprehensive study has been done; however, in the last five years, two Trainings of Trainers for artisanal women and three trainings of electricians for in house installation and small PV installation and plant operation were carried out for more than 80 persons.

Throughout the country many solar PV systems have been deployed of which three plants each grid tide 2.25MW PV which totally generates 7MW, diesel and battery hybrid system has been installed. Moreover 1.6MW PV combined capacity from 2-300KW PV system has been installed for agriculture post-harvest energizing. In addition to this, many organizations and households install small PV systems of up to 30KW and most household has solar lantern. However, there is no progress on wind energy and bio-gas plants.

Indicators used in this assessment

- Number of electric stoves distributed
- Number of biomass stoves distributed
- Number of efficient lamps distributed
- Action taken on research and development on alternative energy
- Feasibility study done on potential resources development
- Number of training programs and beneficiaries
- Reports produced
- Number of 30MW solar energy implemented
- Number of 5MW wind energy implemented
- Number of pilot bio-gas plants implemented

Please describe any other tools or means used for assessing progress

Feedback from MoEM, interviews and discussion with office experts

Relevant websites, web links

- Report from MoEM

Level of confidence of the above assessment

Based on partial evidence

Please provide an explanation for the level of confidence indicated above

The level of implementation of this target was assessed through questionnaires and interviews with lead stakeholder (MoEM) experts. The information gathered was comprehensive for some of the indicators but not for all. For instance, detailed information on some of the targeted activities such as on research and development on alternative energy, potential resources development, and level of beneficiary impact could not be gathered.

Adequacy of monitoring information to support assessment

Monitoring related to this target is partially adequate

Please describe how the target is monitored and indicate whether there is a monitoring system in place

As this is a core issue regarding the livelihood of all Eritrean population in terms of energy provision adequate follow up is undertaken.

At zoba and sub-zoba levels, MoA and MoEM staff and extension persons are constantly addressing the issues of alternative energy and the distribution and popularization of the introduced

gadgets such as the Adhanet Mogogo is one of the prominent community based activity. In addition, all extension agents train farmers especially women on issues and utilization of alternative energy. Their activities are also visited by zoba higher officers and the MoA, MoEM, and DoE assessment teams.

At zoba and sub-zoba levels, MoA and MoEM staff and extension persons of the MoA are constantly addressing the issues of alternative energy and their distribution and popularization alternative sources. MoA, MoEM, and DoE officials also monitor the activities of zobas and sub-zoba branch offices. In addition, zobas and sub-zobas prepare periodic reports and have annual gatherings where country wise assessment of all activities, including biodiversity, were evaluated.

E-Target3: By 2020, at least 25% of grazer populations have developed the capacity to reduce overgrazing/over browsing.

Category of progress towards the implementation of the selected target:

Progress towards target but at an insufficient rate

Date the assessment was done:

January, 2019

Additional information

To implement this target, the involvement of farmers in irrigated forage crops production and utilization was good and an extensive education is given on livestock production system on how to conserve and utilize feed resources. Traditionally, rural farmers have been widely conserving crop residues for livestock feed. Closure establishment for critical time use is also being practiced in many parts of the country. In addition, even though it is not widely practiced, cut and carry system of animal feed is also underway. About six feed processing plants are established in the country, and mainly produce concentrate feed for poultry and dairy cattle. Trainings were also conducted for urban and peri-urban dairy cattle keepers.

Forage is developed in most parts of the country, also under irrigated production. However, there is no significant increment in quality of cattle, except in the urban and peri-urban areas. The majority of the farmers keep native breeds of cattle and are engaged in traditional herding. Migration of livestock within the country still persists, due to shortage of water sources. On the other hand, migration has reduced due to the border war with Ethiopia in 1998.

Indicators used in this assessment

- Status of capacity building programmes for communities
- Production of processed animal feed
- Introduction of zero grazing education, awareness and training
- Status of forage area developed
- Status of increment in quality of cattle and reduction in number of traditional herders
- Status of decreased migration rate

Please describe any other tools or means used for assessing progress

Feedback from MoA and FWA, interviews and discussion with office experts at zoba and sub-zoba levels

Relevant websites, web links and files

Reports from MoA and FWA

Level of confidence of the above assessment

Based on partial evidence

Please provide an explanation for the level of confidence indicated above

The level of implementation of this target was assessed through questionnaires, expert interviews of relevant stakeholders and the involvement of the BD focal point in all the assessment process. The information gathered was comprehensive for some of the indicators but not for all. For instance, detailed information on some of the targeted activities such as the status of increment in quality of cattle, the reduction in number of traditional herders, and the status of decreased migration rate is not fully assessed since the activities targeted have not been implemented. Assessment on the mentioned indicators also revealed that adequate information on the progress made could not be measured.

Adequacy of monitoring information to support assessment

Monitoring related to this target is adequate

Please describe how the target is monitored and indicate whether there is a monitoring system in place

At the zoba and sub-zoba levels, the extension staff of the MoA are monitoring the activities related to forage production and are also providing basic trainings to the rural communities. The progress of activities is also reported in the annual meetings.

Target 4. By 2020 the extinction of threatened species has been prevented and the conservation status of those most threatened and endangered of flora and fauna have been improved, with declining trends significantly reduced

Category of progress towards the implementation of the selected target:

Progress toward target but at insufficient rate

Date the assessment was done:

January, 2019

Additional information

Some of the proposed Protected Areas have been established, however, they are not yet officially gazetted. Gash-Setit elephant sanctuary and Semienawi and Debubawi Bahri protected areas were delineated but not in Buri-Irrori protected area. Management zoning has been done in Semienawi and Debubawi Bahri Protected Areas but so far no management and business plans are in place. However, training is given to graduate staffs, wildlife inspectors, wildlife scouts on protected area management and protection. The establishment of legal and institutional framework is on pipeline.

Identification of threatened genetic species has been done but may not be exhaustive. For example, there are some initiatives to conserve the globally critically endangered species of African wild ass. Likewise, endeavours are underway to conserve *Olea africana* and *Juniperus procera* in their natural habitat.

A preliminary checklist of nationally threatened species of flora and fauna is around 55 trees and shrubs and 23 wild animals which require immediate conservation measures. However, the change is slow.

Continuous assessments are on-going to conserve, protect and assure the existence of the threatened species. However, there is no significant change.

Indicators used in this assessment

- Status of formally established PAs
- Status of physical delineation of the PAs
- Status of management and business plans
- Number of PA staffs trained
- Status of established legal and institutional framework
- Number of threatened genetic species assessed and identified
- List of threatened species in relation to their global and national importance
- Project to conserve the threatened species
- Status of genetic species protected
- Threatened species promoted and replicated
- Status of the area seeded and reseeded

Please describe any other tools or means used for assessing progress

Feedback from MoLWE, NARI and FWA, interviews and discussion with office experts

Relevant websites, web links and files

Reports from MoLWE and FWA

Level of confidence of the above assessment

Based on partial evidence

Please provide an explanation for the level of confidence indicated above

The implementation of this target has been assessed with the involvement of DoE through questionnaires, expert interviews of relevant stakeholders. The information gathered was comprehensive for some of the indicators since they were implemented but not fully. The full establishment of the proposed Protected Areas was one of the targets that has been partially achieved. However, many of the indicators of the progress such as: the production of the list of threatened species in relation to their global and national importance; the initiation of projects aimed at the conservation of threatened species; the promotion and replication of threatened species and the cover of seeded and reseeded area have not been initiated.

Adequacy of monitoring information to support assessment

Monitoring related to this target is partial

Please describe how the target is monitored and indicate whether there is a monitoring system in place

The establishment of Protected Areas being a priority in the country's agenda of conservation and sustainable utilization of biodiversity and restoration of natural habitat, there is constant follow up of activities. Currently, the drafting of Protected Area proclamation is in progress

E-Target 5. By 2020 at least 25% of catchment sites and degraded lands of high biodiversity hotspots are rehabilitated within the terrestrial ecosystem.

Category of progress towards the implementation of the selected target:

Progress toward target but at insufficient rate

Date the assessment was done:

January, 2019

Additional information

There is no any impact assessment done, but during the LDN Target setting program, 23 major land degradation hotspot areas have been identified. Five years' strategic plan of MoA 2014-2018 and 2019–2023; and the strategic plan of FWA (2015-2018) are approved. Several planned integrated actions were proposed.

Rural communities are aware of some SLM practices in a traditional way. Individual farmers for instance, make attempts to build boundaries and structures that enable them conserve water in their fields. But because the land distribution was done every 5-7 years, they were not encouraged to retain the structures and also build permanent structures or grow trees. The Government has raised the awareness of the rural community on SLM practices and the implementation of Land Proclamation No 58/1994. However, the Land Proclamation was not yet fully implemented. A pilot project of SLM was successfully implemented in Serejeka, sub-zoba of Zoba Maekel and SLM practice is expected to continue across the whole country in the coming years.

Tools and equipment and other necessary materials have been distributed to 37 tree nurseries and to improve seedling production and plantation establishment training have been given. Maintenance of water supply systems, fences and stores have also been done in 8 nurseries. About 10.8 million seedlings of 54 different species have been distributed in the last five years for communities to establish plantations on hill sides, out of which 26% were indigenous plants, 56.7% were Eucalyptus species, and 17.5% were other exotic species. The trends in Eucalyptus planting reduced by 1% while indigenous plant species increased by 1%. Almost in every zoba, communities are actively participated in catchment rehabilitation. To intensify their involvement, awareness raising and training is also provided.

Indicators used in this assessment

- The impact assessment done on degraded lands of biodiversity hotspots
- Status of approved integrated strategy document
- Status of planned integrated actions
- Status of implementation mechanism established
- The level of community awareness on the Land Use and SLM principles
- The level of community used SLM practices
- Status of area coverage by SLM practices
- Action to strengthen the national nurseries and establishments of new nurseries

- Type and number of species distributed
- Number of communities involved

Please describe any other tools or means used for assessing progress

Feedback from MoA and FWA, interviews and discussion with office experts,

Level of confidence of the above assessment

Based on partial evidence

Please provide an explanation for the level of confidence indicated above

Assessment of the progress made towards this target has been gathered from questionnaires, expert interviews and literature. The achievements registered in many of the planned activities were found not to be comprehensive. For some of the activities, no full account could be gathered. These are: the impact of the implemented activities on the degraded lands of BD hotspots; the status of approved integrated strategy document; the Status of established implementation mechanisms and the status of the establishments of new nurseries.

Adequacy of monitoring information to support assessment

Monitoring related to this target is partial

Please describe how the target is monitored and indicate whether there is a monitoring system in place

Monitoring of the practices of SLM and Rehabilitation of Degraded areas are undertaken by implementing bodies like the MoA and FWA and branches of respective zobas annual reports. The reports however may not be comprehensive.

E-Target 6. Develop an integrated action plan of implementation to reduce the expansion of alien species through control mechanisms and sustainable utilization

Category of progress towards the implementation of the selected target:

Progress towards target but at an insufficient rate

Date the assessment was done:

January, 2019

Additional information

The assessment made so far focused on major infested areas of Zobas Gash Barka and Anseba, not including the whole Zobas. With regards to controlling methods, no intensive study has been conducted. A number of permits have been issued to individuals and investors to make use of the species for making charcoal, briquette, animal feed and handles for farm tools etc. Around 290 beneficiaries were issued permit to produce charcoal from *Prosopis*. To raise the awareness and increase the knowledge of communities and other stakeholders on the invasiveness of the species

and its control mechanisms interviews and promotion have been done in mass media and training programs have also been given to technicians, inspectors and experts.

Partial assessment was done and has shown that the coverage area for these invasive species in the country is high in Zoba Gash Barka and Anseba, and to some extent in Semienawi Keih Bahri and Debubawi Keih Bahri. To promote sustainable utilization of invasive species, the community was encouraged to utilize the resource to produce various products.

There is no active project at present to control the invasive species, but there are few projects initiated by investors to make use of the invasive species mainly on *Prosopis* and these should be intensified.

Indicators used in this assessment

- Study done on controlling method of invasive species
- Engagement of stakeholder in controlling invasive species
- Any action conducted on awareness raising
- Specific studies done on the invasive species
- Available data on the coverage of surface area invaded
- Action taken to promote sustainable utilization of invasive species
- Coverage of invasive species per specific ecosystem
- Any active projects to control and use of invasive species
- Action taken to strengthen quarantine mechanism for invasive alien species

Please describe any other tools or means used for assessing progress

Feedback from FWA, interviews and discussion with office experts

Level of confidence of the above assessment

Based on partial evidence

Please provide an explanation for the level of confidence indicated above

The achievements registered in many of the planned activities were found not to be comprehensive except some of the activities. Assessment of the progress made towards this target has been gathered from questionnaires, expert interviews and literature. Some of these were not assessed well such as: the controlling method of invasive species, no study has been done on the specific invasive species, available data on the coverage of invaded surface area and no action was taken to strengthen quarantine mechanism for invasive alien species.

Adequacy of monitoring information to support assessment

Monitoring related to this target is partial

Please describe how the target is monitored and indicate whether there is a monitoring system in place

The MoA reports on the aggressiveness of *Prosopis* in its annual reports. In addition, since the aggressiveness of the plant is very high and fast, the local communities are under continuous observation and indirect monitoring process. However, this monitoring is not comprehensive and accurate.

E-Target 7: By 2020, mangrove forest and associated coastal forest degradation and loss would have been significantly reduced.

Category of progress towards the implementation of the selected target:

On track to achieve target

Date the assessment was done:

January, 2019

Additional information

Recent surveys by Elias (2018) show that the mangrove cover of the Eritrean coast of the Red Sea has increased by 13% from 2009 to 2017. This is significant gain for biodiversity conservation as the mangroves in other parts of the world are decreasing. The main factor that contributed to healthy marine ecosystems is the low pressure put on mangroves by the coastal community. Moreover, the coastal area is sparsely populated and the coastal community has strong culture of protecting the mangroves. The combined efforts of planting mangrove by the MoMR, Zoba Semienawi Keih Bahri and the local community have also contributed to the increase of mangrove cover. Thus, Eritrea has exceeded its target of reducing degradation and loss of mangroves and associated coastal forest.

Indicators used in this assessment

- Number of M & E frameworks prepared
- Number of awareness meetings conducted
- Number of training programs implemented
- Number of villages rehabilitated
- Number of mangrove trees planted
- Area of mangrove forests

Please describe any other tools or means used for assessing progress

Two global databases were used to assess the changes in mangrove cover. The first database was obtained from the UN Biodiversity Lab (www.UNBiodiversityLab.org) which prepares periodic atlas of mangrove cover. The atlas prepared in 2010 shows distribution of mangrove along the Eritrean coast, which is more or less the same as the distribution patterns obtained from the local assessment (Elias 2018).

The second database used for assessing mangrove cover was compiled in the Ocean Health Index – OHI (www.ohi.org). The OHI assess health of the marine environment. The parameter used to assess the cover of mangrove is carbon storage capacity which measures the extent and condition of the natural coastal ecosystems – sea-grasses, tidal marshes and mangroves - that store large amounts of carbon in their roots, stems and leaves and sequester it for decades or centuries in the sediment. According to the Ocean Health Indexing 2016 Eritrea scored 86 points for carbon storage and it was ranked 80th out of 215 Exclusive Economic Zones (EEZs). It is worth mentioning that the global average score for carbon storage is 70.

Relevant websites, web links and files

- Elias 2018
- Report from the MoMR

- www.ohi.org
- www.UNBiodiversityLab.org

Level of confidence of the above assessment

Based on comprehensive evidence

Please provide an explanation for the level of confidence indicated above

Assessment of the progress made towards this target was gathered from questionnaires, field visit, and expert interviews of relevant stakeholders. The information gathered regarding plantation of mangrove was comprehensive. Coastal area planted with mangrove was observed during field visit. Mangrove cover was also assessed using remote sensed (satellite data), which is also comprehensive.

Adequacy of monitoring information to support assessment

Monitoring related to this target is adequate

Please describe how the target is monitored and indicate whether there is a monitoring system in place

- The MoMR monitors the status of mangroves of selected area by conducting field trips to the sites and taking morphometric measurements from selected mangrove trees (length of tree, width of stem, area covered by mangrove. etc.).
- Monitoring of mangrove cover was also done using remote sensed data (satellite images). Detailed historical and current information on yearly mangrove cover of the whole world can be downloaded from the above mentioned website.
- Ocean Health Index provides annual score of carbon storage capacity of the coastal areas of the world. The carbon storage capacity measures the extent and condition of sea-grasses, tidal marshes and mangroves, which store large amounts of carbon in their roots, stems and leaves and sequester it for decades or centuries in the sediment.

Relevant websites

- www.UNBiodiversityLab.org
- www.oceanhealthindex.org

E-Target 8. By 2020, all sources of coastal, marine and island pollution should be effectively controlled to reduce pollution and mitigate its impact on the ecosystem

Category of progress towards the implementation of the selected target:

- Unknown

Date the assessment was done:

January, 2019

Additional information

According to the NBSAP, the Eritrean coastal area was in plan to be assessed for marine pollution. Moreover, collaborative mechanism to strengthen control and inspection of marine pollution was planned to be established and maritime activities were expected to minimize their effects on pollution. No progress was made in all the above activities. No comprehensive assessment of

pollution was conducted along the Eritrean coast. However, preliminary assessments of pollution level indicate that there is notable plastic, oil, heavy metal and garbage pollution in four sites that provide services to the maritime and fisheries industry (harbours and ship yards). There is no evidence that indicates whether Eritrea has achieved its target of reducing pollution and mitigating its impact on the ecosystem. Thus progress towards the target remains unknown.

Indicators used in this assessment

- Number of pollution assessment reports
- Number of integrated pollution control platforms established
- Population trends of species in CMI ecosystem, number of CMI establishment and number of zoning provided
- Number of training for trainers conducted
- Number and quality of control facilities introduced
- Number of active pollution control posts established
- Number of pollution inspections conducted
- Number of sites with waste-collection facilities
- Number of guideline to control pollution prepared
- Number awareness raising programs conducted

Please describe any other tools or means used for assessing progress

Information from UN Biodiversity Lab (www.UNBiodiversityLab.org) reveals that the coastal water near the two ports (Massawa & Assab) and the international shipping route in the middle of the Red Sea has noticeable oil pollution from oil tankers (Fig. 18). It is to be noted that the Red Sea has heavy traffic of tankers that carry oil from the Middle East to Europe.

One of the goals of ocean health index is to assess cleanness of the waters in the world. This goal measures contamination by chemicals, excessive nutrients (eutrophication), human pathogens and trash. According to the Ocean Health Index (www.oceanhealthindex.org) in 2016 Eritrea scored 56 points for this criterion while the global average score is 74 points.

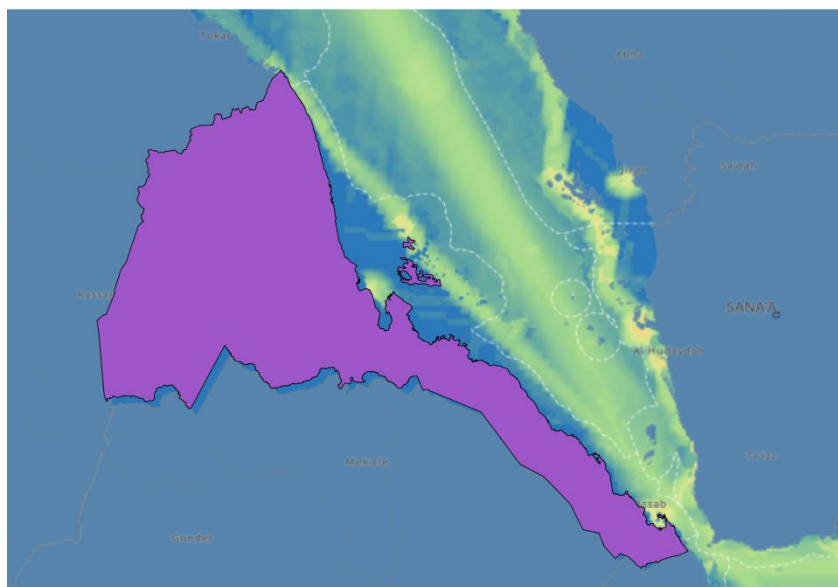


Figure 18: Ocean Pollution along the Eritrean Coast of the Red Sea (Pressures 2013 – KNB)
(Source: UN Biodiversity Lab)

Relevant websites

- www.UNBiodiversityLab.org
- www.oceanhealthindex.org

Level of confidence of the above assessment

Based on limited evidence

Please provide an explanation for the level of confidence indicated above

Assessment of the progress made towards this target has been gathered from questionnaires and expert interviews of relevant stakeholders. The information gathered from MoMR show that no comprehensive survey of pollution was done and no pollution assessment report has been prepared. There is no information regarding the pollution level of the coastal area. The only information which could be obtained was reports of preliminary assessments of pollution level. Pollution studies conducted by undergraduate students have been cited in this report.

Adequacy of monitoring information to support assessment

No monitoring system in place

Please describe how the target is monitored and indicate whether there is a monitoring system in place

No regular monitoring for marine pollution

E-Target 9. By 2020, Coastal erosion should be greatly reduced and eroded coastal beaches rehabilitated.

Category of progress towards the implementation of the selected target:

Progress towards target but at an insufficient rate

Date the assessment was done:

January, 2019

Additional information

No study was conducted to assess the status of coastal erosion in Eritrea. Sea level of the Red Sea is predicted increase by 50cm in the 21st century. Studies conducted in other areas show that sea-level rise is accompanied by coastal erosion. On the other hand, mangroves, coral reefs, seagrass beds and salt marshes are expected to protect the coast from erosion. Thus the future of the Eritrean coast will depend on the balance of the rate of sea level increase and growth rate of the coastal vegetation.

Indicators used in this assessment

- Number of in-depth studies conducted on coastal erosion
- Number of initiatives and projects undertaken
- Number of CMI areas rehabilitated or reclaimed
- Number of projects implemented and prepared management plan.

- Eroded area rehabilitated
- Number of people participated in identification of local technology

Please describe any other tools or means used for assessing progress

Data from the Ocean Health Index show that there is no major problem of coastal erosion in Eritrea (www.oceanhealthindex.org). With regard to coastal protection the Ocean Health Index (OHI) measures the condition and extent of five ecological habitats that protect the coasts against storm waves and flooding. Habitats assessed are mangrove forests, seagrass meadows, salt marshes, tropical coral reefs, and sea ice. Eritrea ranked 38 among 221 Exclusive Economic Zones (EEZs) with regard to coastal protection in 2013. Eritrea scored 98 points and the global average score for coastal protection is 87 points. Storm protection by coastal habitats saves lives, property and it protects coastal erosion. The relatively weak wind system in the Red Sea combined with low wave actions along the coast could be the main reason for the high score obtained by Eritrea. There is limited progress in protecting the coast from erosion due to mangrove plantation. However, the actual situation of the coastal erosion should be monitored.

Relevant websites, web links and files

- www.oceanhealthindex.org

Level of confidence of the above assessment

Based on limited evidence

Please provide an explanation for the level of confidence indicated above

Assessment of the progress made towards this target has been gathered from questionnaires and expert interviews of relevant stakeholders. The information gathered from MoMR show that no study was conducted on coastal erosion. Also, no projects and initiatives were undertaken to rehabilitate eroded coasts. It is clear from these findings that the current level of coastal erosion is not known.

Adequacy of monitoring information to support assessment

- No monitoring system in place

Please describe how the target is monitored and indicate whether there is a monitoring system in place

- No monitoring system in Place

E-Target 10. By 2020, all coral reefs in the Eritrean Red Sea are identified to a species level and status of natural and human induced degradations regularly monitored.

Category of progress towards the implementation of the selected target:

- Progress towards target but at an insufficient rate

Date the assessment was done:

January, 2019

Additional information

The Eritrean coast of the Red Sea has a rich coral cover. The coral reef ecosystem is in good health and it harbours diverse marine organisms. As shown in Fig. 19, the coastal area in the central Eritrean coast (Massawa and Dahlak archipelago) and in the southern coast (Assab Area) has rich coral cover. In 2007, Dr. Veron identified 220 species of corals from the Eritrea coast (MoMR report).

In the last three years, surveys and monitoring of coral reefs around Massawa were conducted. Results from these surveys indicate that the reefs along the coast remain healthy. The main reasons for having healthy coral reef ecosystem along the Eritrean coast could be due to the low anthropogenic pressure as a result of only limited coastal development activities and underdeveloped fishing industry. No comprehensive surveys were conducted and no conservation projects were implemented in the last three years. Therefore, some progress was made to achieve the target but at insufficient rate.

Indicators used in this assessment

- Number of coral species identified
- Number of coral surveys conducted
- Number of conservation initiatives and projects undertaken
- Number of MPA established
- Number of awareness programs conducted
- Number of coral reef conservation programs commitment by decision

Please describe any other tools or means used for assessing progress

According to UN Biodiversity Lab (www.UNBiodiversityLab.org) the Eritrean coast of the Red Sea has rich coral cover (Fig. 19). The central and southern coast of the Eritrean Red Sea has relatively high coral cover. Relatively higher coral cover is found in the Dahlak archipelago. Coral reefs are home to diverse marine fauna and flora. Thus, areas of high coral cover are expected to harbour rich diversity of marine plants and animals. As a result, these areas are key biodiversity areas (see E-Target 12).

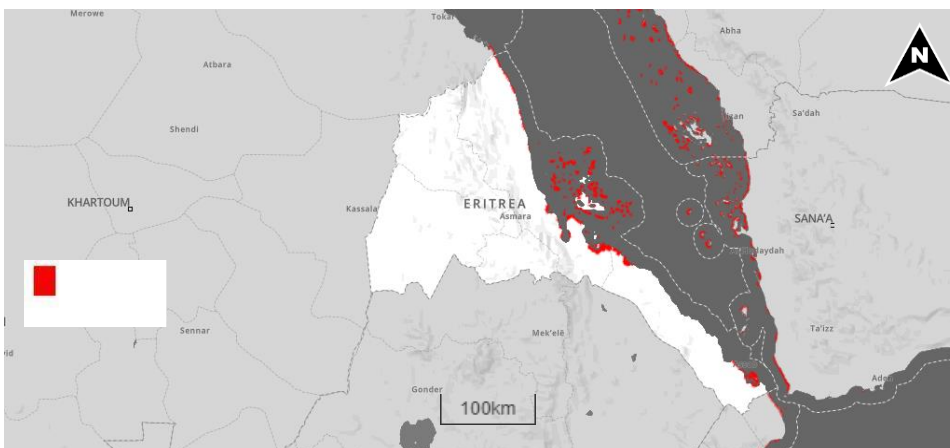


Figure 19: Distribution of coral reef along the Eritrean coast (Source: UN Biodiversity Lab)

Relevant websites

- www.UNBiodiversityLab.org
- www.BiodiversityMapping.org

Level of confidence of the above assessment

Based on partial evidence

Please provide an explanation for the level of confidence indicated above

Assessment of the progress made towards this target has been gathered from questionnaires, expert interviews of relevant stakeholders, and field visits. The information gathered from MoMR and COMSAT show that the coral species of the Eritrean coast were identified by an expert. Moreover, there were surveys of coral reefs in Massawa area and in some islands in the Dahlak archipelago. However, the status of coral reefs in the other parts of the Eritrean coast is not known. Thus, there is only partial evidence for assessing the progress of the target.

Adequacy of monitoring information to support assessment

- Monitoring related to this target is partial (e.g. only covering Massawa area)

Please describe how the target is monitored and indicate whether there is a monitoring system in place

There is partial monitoring of coral reefs in the Eritrean coast. The MoMR monitors the coast by conducting reef check around Massawa and in some islands in the Dahlak archipelago. COMSAT monitored the selective reefs around Massawa and in one island in the Dahlak archipelago from 2014 to 2017. This monitoring employs line transect and underwater census methods to determine the abundance of corals and fish respectively.

E-Target 11. By 2020, Invasive Alien Species in the Coastal, Marine and Islands (CMI) are controlled and monitored

Category of progress towards the implementation of the selected target:

- Unknown

Date the assessment was done:

January, 2019

Additional information

The status of invasive alien species of the Eritrean coast of the Red Sea was not assessed. However, regulations are put in place by CITES focal point in Eritrea, the MoLWE, MoMR and by the Port Authority to control the introduction of exotic species. However, there is no active monitoring of invasive/alien species in the country. Global assessment of alien and invasive species show that the Red Sea is one of the least affected marine environments with only one or two harmful invasive species (Fig. 20). The reason for lower vulnerability to invasive species could be the very harsh

oceanographic conditions (high temperature, high salinity, and oligotrophic waters) prevailing in the sea. In the absence of monitoring program and lack of primary data it is not possible to confirm whether Eritrea has achieved its target of controlling alien and invasive species.

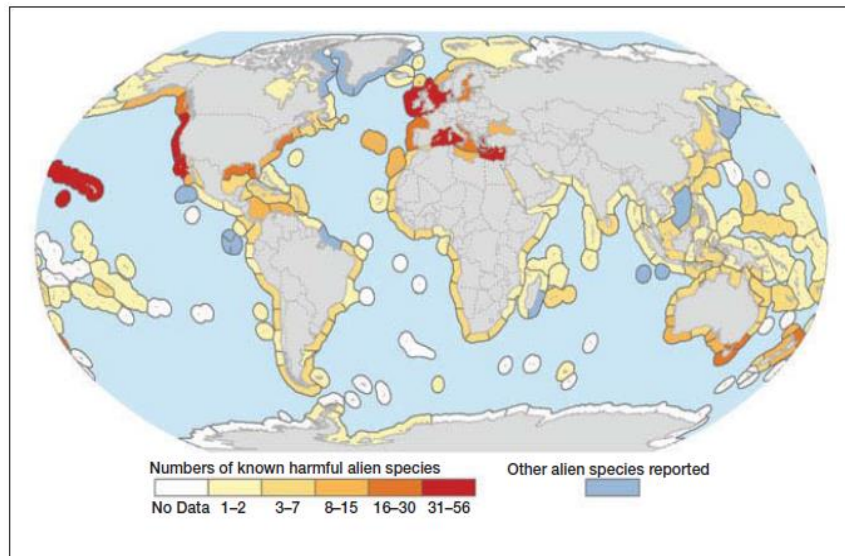


Figure 20: Map of the harmful alien species by coastal ecoregion (Source: Molnar, et al., 2008).

Indicators used in this assessment

- Number of offices for the control and monitoring of alien invasive species established
- Number of Strategic Master plan produced
- Number of awareness and trained people
- Number of surveys for alien and invasive species
- Number of awareness programs conducted

Relevant websites, web links and files

- Molnar, et al., (2008)

Level of confidence of the above assessment

- Based on limited evidence

Adequacy of monitoring information to support assessment

- No monitoring system in place

Please describe how the target is monitored and indicate whether there is a monitoring system in place

Assessment of the progress made towards this target has been gathered from questionnaires and expert interviews of relevant stakeholders. The information gathered from MoMR show that no study was conducted to assess occurrence and distribution of alien and invasive species. Office for the control and monitoring of alien and invasive species was not established. Thus, there is limited evidence for assessing the progress of the target.

E-Target 12. By 2020, Rare, Endangered and Threatened species of both marine flora and fauna species are protected, conserved and rehabilitated

Category of progress towards the implementation of the selected target:

- Progress towards target but at an insufficient rate

Date the assessment was done:

January, 2019

Additional information

There are a number of rare, endangered and threatened marine plants and animals in the Eritrean coast. According to the NBSAP, the status of these species was planned to be assessed and conserved by developing projects. But due to the lack of funding no survey or assessment was conducted for most of the endangered species.

There are limited fishing, industrial, agricultural and other development activities along the Eritrean coastal areas. Habitat destruction as a result of these activities seems to be low. There seems no major effect on the marine biodiversity due to anthropogenic effects. In other parts of the world threats to the rare, endangered and threatened species are usually related with the pressure put by humans through fishing, pollution and coastal developments. There is no record of major pollution by coastal development along the Eritrean coast. The only formidable threat to the rare species could be due to fishing activities. Turtle fisheries for human consumption and incidental catch of turtles by trawlers were recorded from the Eritrean waters. The Ministry of Marine Resources is undertaking limited survey to assess the nesting sites of turtles.

The positive note on conservation is the high regard of the coastal community on wild animals. The Afar community, which dominate the southern Eritrean coast, have strong tradition of conserving marine organisms. They have customary laws that prevent destructive fishing and over exploitation of marine resources. The other positive note regarding biodiversity conservation is the fact that the government of Eritrea has proposed large part of the coast to be protected (Fig. 21).

There is limited data related to the abundance of the rare, endangered and threatened species. Thus, the progress of achieving the target of protecting, conserving and rehabilitating the species remains unknown.

Indicators used in this assessment

- Number of in-depth surveys conducted
- Number of survey reports on endangered and threatened species prepared
- Number of checklist of rare, endangered and threatened species prepared
- Number of project plan developed
- Number of public awareness programs organized

Please describe any other tools or means used for assessing progress

According to the information of the UN Biodiversity Lab (www.UNBiodiversityLab.org), the Eritrean coast of the Red Sea has relatively few threatened coral and marine fish species (Fig. 22 and 23). The central coast (which includes the Dahlak and Hawakil Archipelagos, Massawa Area

and the Zula Bay), and the southern coast (which extend from Berasole to Assab) are designated as key biodiversity areas. The coastal area around Massawa and the islands is covered by coral reefs which harbour thousands of species of microorganisms, marine plants, invertebrates, and chordates. Some of the corals, marine turtles, marine birds and marine mammals are included in the IUCN Red List.

Information from the ocean health index referred to determine the overall biodiversity status of the coast.

Relevant websites

- www.UNBiodiversityLab.org
- www.oceanhealthindex.org

Level of confidence of the above assessment

Based on limited evidence

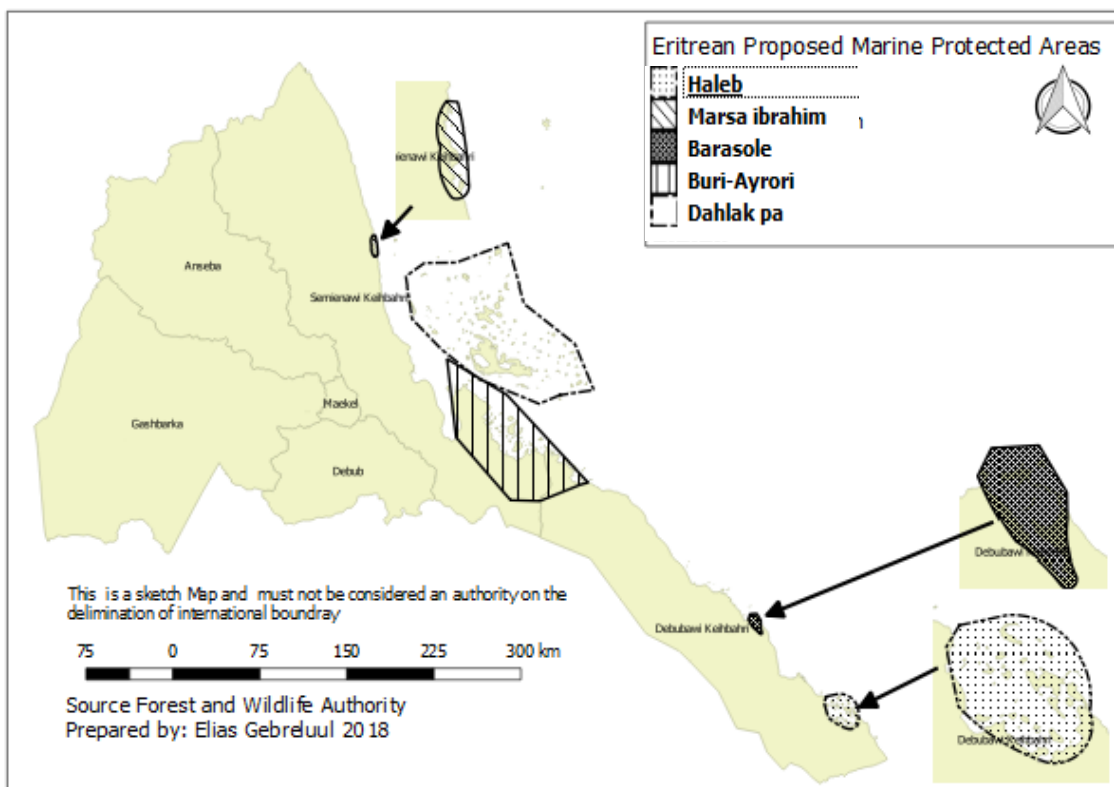


Figure 21: Proposed Marine Protected Areas 2018 (Modified from FWA report, 1997)

Please provide an explanation for the level of confidence indicated above

Assessment of the progress made towards this target has been gathered from questionnaires, expert interviews of relevant stakeholders, and field visits. The information gathered from MoMR show that effort is being made to assess the nursery ground of turtle. The Ministry has also been surveying the coast to prepare checklists of coral, fish, birds and mammals. But no in-depth survey was conducted to assess the status of rare, endangered and threatened species. Also, there is no

project plan to conserve these species. Thus, there is limited evidence to assess the progress of the target.

Adequacy of monitoring information to support assessment

- No monitoring system in place

Please describe how the target is monitored and indicate whether there is a monitoring system in place

There is no monitoring of abundance and distribution of rare, threatened and endangered species. The Ministry of Marine Resources conducts annual survey to assess nesting of turtles.

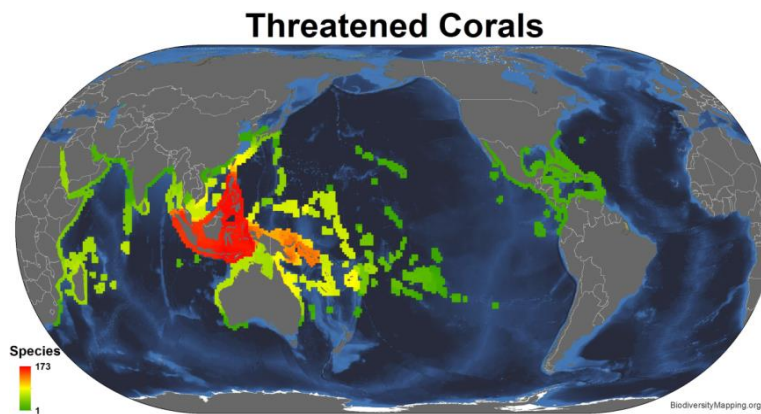


Figure 22: Locations of threatened corals in the World
(Source: www.BiodiversityMapping.org)

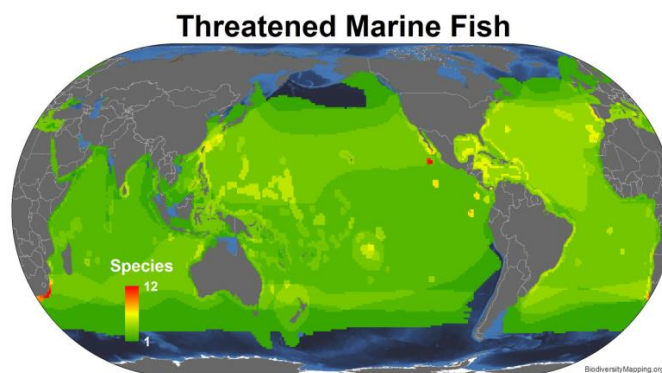


Figure 23: Locations of threatened marine fishes of the World
(Source: www.BiodiversityMapping.org)

E-Target 13: Public awareness on the importance and sustainable use of agricultural biodiversity increased by 10%.

Category of progress towards the implementation of the selected target:

Progress towards target but at an insufficient rate

Date the assessment was done:

January, 2019

Additional information

The additional information to strengthen agro biodiversity awareness programs on sustainable use of agricultural biodiversity is covered in detail in section 2 E-Target 13.

Community-based National Soil and Water Conservation campaign and Minimum Household Integrated Agricultural Package (MHAP) are major progress undertaken pertinent to the conservation and sustainable use of agricultural biodiversity. Because of the continuous awareness raising programs and trainings, the community participated and contributed through (i) volunteer involvement on soil and water conservation activities and campaigns, and (ii) active participation in animal and plant health programs.

Some awareness and communication strategy have been also documented which include: communication strategy on disposal of obsolete pesticides, controlling of fall army worm (FAW), pests of ruminants and PPR disease. Besides, farming community in different zobas of Eritrea have been clustered and grouped together to grow improved crop varieties which they create awareness and further disseminate the crop varieties.

The institutional arrangement for the implementation was in line with the organizational structure of the MoA from the head quarter up to the local administrations level and the Ministry of Local Government at sub-zoba and village levels that mobilize the community to be involved in community-based project activities.

As stated in section 2 E-target13, twenty-three major degradation hotspot areas have been identified, which will be addressed at national level between 2019 and 2020. Besides, through community mobilization 52,532 hectares of farm land were treated by different soil and water conservation measures and setup infrastructures in the last four years. About 60,000 households have participated in these sustainable management practices.

Indicators used in this assessment

- Number of awareness raising events and trained people
- Number and type of training materials
- Mass media used to create awareness on agricultural BD
- Number of community-based programs and projects established
- Number of community's participation and contribution to sustainable management
- Awareness and communication strategy document
- Institutional arrangement for the implementation of community-based projects

Please describe any other tools or means used for assessing progress

The tools used to assess progress of this target include the 2015-2018 MoA Report, Progress Report for the Agricultural Extension Department, and all regional offices of Eritrea. Besides, the progress

towards this target was assessed through questionnaires, interviews with concerned authorities and divisions of ministries, MoA, MoLWE and also literature reviews.

Relevant files

- Reports from MoA and MoLWE
- Progress report for the Agricultural Extension Department and all regional offices of Eritrea.
- MoA, Annual variety evaluation and inspection report

Level of confidence of the above assessment

Based on partial evidence

Please provide an explanation for the level of confidence indicated above

The implementation of this target has been assessed with the involvement of DoE (the CBD focal point) and task team through questionnaires, expert interviews of relevant stakeholders. The information gathered was comprehensive for some of the indicators since they were partly implemented. The full establishment of community based programmes and projects have been partially achieved. However, many of the indicators of the progress such as: documentation of awareness and communication strategy and institutional arrangement for the implementation of community-based projects has not been initiated as needed.

Adequacy of monitoring information to support assessment

Monitoring related to this target is partial (e.g. only covering part of the area or issue)

Please describe how the target is monitored and indicate whether there is a monitoring system in place

Partial monitoring was done at both local level (regional and district) and national levels. At the local level, well trained staff from sub-zoba visited the communities on regular intervals to educate them about the importance of biodiversity conservation. At the national level, there were supervising mechanisms to monitor the education given at the local level (by staff) and how the population are implementing the education given to them to achieve sustainable biodiversity.

E-Target 14. By 2020, Plans for sustainable management of agricultural genetic resources is implemented

Category of progress towards the implementation of the selected target:

Progress towards target but at an insufficient rate

Date the assessment was done:

January, 2019

Additional information

The genetic resource management strategy is included in the Agricultural Policy and the MoA strategic plans. By 2020 detail document on the national genetic resources conservation and management strategy will be produced.

The management plan for genetic resource include identifying responsibility of stakeholders and engage in genetic resources conservation and management or related activities; studying genetic diversity and causes of genetic erosion; and identifying species prioritized for conservation along with appropriate conservation and management methodologies. This strategic plan on genetic resources conservation and management has resulted to effective products. As an example, farmers have included their indigenous varieties which exhibit high variability among and within varieties that covered large areas under cultivation in Eritrea.

In addition, the National Agricultural Research Institute and Hamelmalo Agricultural College have conducted a number of research trials on the development of crop varieties for yield, diseases and pests as well as resistant to abiotic factors to mitigate climate changes. Some of the achievements have been included in Section-2, E-target 14.

The coordination between the extension workers and researchers of the MoA and HAC, ensures that the improved varieties such as drought and disease resistant, climate resilient crops and economically accepted varieties reached the farming community.

With regards to the domestication and consumption of new crop varieties, in 2017, nine date palm varieties which cover more than 200 hectares were introduced by NARI after conducting adaptation trial on station and on farm level since 2001. Two Irish potato varieties were also introduced in 2016 and 2017 to farmers and cultivated in an area which is estimated to about 500 hectares. Sorghum variety (Seare), wheat varieties (Sedra-1, Pavon-76, Croc-1 and Atilla-7) and pearl millet varieties (Kona and Hagaz) which were evaluated and released by NARI in the previous 10 years were further multiplied and used in farmer's field in about 250 hectares annually by about 1,500 farmers.

HAC has also introduced (reported in 5th report to CBD) one sorghum variety that is called Hamelmalo and covered about 50 hectares annually in Hamelmalo sub-zobas.

The implementation of the SLM project in Zoba Maekel (Serejeka Area) is also a component of the sustainable management practices that is expected to contribute to the conservation and utilization of the natural resources (including agro-biological diversity in the rural setting) (Terminal Evaluation Report, 2016).

Indicators used in this assessment

- National genetic resources management strategic plan prepared
- Products of management strategic plan on genetic resources
- Number of beneficiaries in the conservation
- Research plans on drought and disease resistant crops
- Type of drought and disease resistant crops released
- Type and area coverage by the new crop varieties and used by farmers
- Production of crops increased
- Number of impact assessment report
- Prioritized areas and designs
- Area covered under sustainable management
- Number of people used sustainable management practices

Please describe any other tools or means used for assessing progress

The NARI Reports, Progress Reports for the Agricultural Extension and Regulatory Service Departments of the MoA, Reports of HAC, and reports of all zoba offices of the ministry of agriculture.

Relevant websites, web links and files

- Annual report of the MoA and annual variety evaluation reports (2015-2018)
- NARI Reports (2016-2018)
- MoA, AED and RSD Reports (2016-2018)
- HAC reports (2017)
- Report of DoE, MoLWE, 2016

Level of confidence of the above assessment

Based on partial evidence

Please provide an explanation for the level of confidence indicated above

The information gathered was comprehensive for some of the indicators since they were partly implemented. The implementation of this target has been assessed with the involvement of DoE (the CBD focal point) through questionnaires, expert interviews of relevant stakeholders. The full establishment of the following indicators: number of impact assessment report, prioritized areas and designs, area covered under sustainable management, and number of people used sustainable management practices were some of the targets that has been partially achieved.

Adequacy of monitoring information to support assessment

- Partial monitoring system in place

Please describe how the target is monitored and indicate whether there is a monitoring system in place

- The National Agricultural Research Institute of the Ministry of Agriculture annual reports
- National Agricultural Research Institute Strategic Plan 2017 – 2021

E-Target 15. By 2020, Pollution to agricultural biodiversity from agro-chemicals has been brought to levels that are not detrimental to ecosystem function and biodiversity

Category of progress towards the implementation of the selected target:

Progress towards target but at an insufficient rate

Date the assessment was done:

January, 2019

Additional information

The pollution to agricultural biodiversity from agro-chemicals has been indicated in detail in section 2 E-Target-15.

In relation to agro-chemical import and supply, there are provisions under Legal notice 114/2006 which is important for the use, handling, storage and disposal of pesticides. Besides, Eritrea's environmental and social impact assessment has been prepared for obsolete pesticide. Accordingly, in 2016/2017, about 363 tons of obsolete pesticides have been disposed and shipped to the UK. The new inventory of 2018 by the MoA under the Regulatory Services Department showed that there are about 30 tons of new obsolete pesticides in the stores. There is also a national pesticides list and draft pesticide isolation prepared by the MoA under the regulatory services department.

On the other hand, there is an update on the Integrated Pest Management (IPM) framework that is covered in Section 2 E-Target 15.

Indicators used in this assessment

- Pollution control and management plan
- Functional institution established
- Approved regulation
- Amount of pesticide use
- List of registered agro-chemicals
- Number of environmental impact assessment conducted
- Monitoring of agricultural wastes
- Established IPM framework
- Number of training programs conducted on IPM
- Coverage of IPM

Please describe any other tools or means used for assessing progress

- Expert interviews, reports of concerned ministries and questionnaires

Level of confidence of the above assessment

Based on partial evidence

Please provide an explanation for the level of confidence indicated above

It was tried to assess the level of implementation through various ways such as questionnaires, expert interviews with relevant stakeholders and the involvement of DoE (the CBD focal point) and task team. However, the information available was not comprehensive and information on all the mentioned indicators that could be available from the implementing bodies was not sufficient or only partially available, and these include: regulations and statistics on the amount of pesticide use, list of registered agro-chemicals, number of environmental impact assessment prepared and thorough monitoring of agricultural wastes conducted. Nonetheless, the achievements made on some components of the target were evident and measurable to assess the progress made

Adequacy of monitoring information to support assessment

- Monitoring related to this target is partial (e.g. only covering part of the area or issue)

E-Target 16. By 2020 Threatened species prevented and their conservation status, particularly of those most in decline, has been improved and sustained

Category of progress towards the implementation of the selected target:

Progress towards target but at an insufficient rate

Date the assessment was done:

January, 2019

Additional information

Achievement made for strengthening the management of threatened and endangered species has been reported in section 2 of the same target.

Besides, there was no comprehensive participatory program implemented to promote integrated approaches for the management of threatened and endangered species. However, endangered species such as *Colutea abyssinica* is maintained in the national gene bank as well as in the field and emmer wheat was recovered.

Indicators used in this assessment

- Work programmes and projects developed for wild fruits and Barka cattle
- Monitor implementation plan
- List of endangered species documented

Relevant file

- NARI and HAC reports

Level of confidence of the above assessment

Based on partial evidence

Please provide an explanation for the level of confidence indicated above

The implementation of this target has been assessed with the involvement of DoE and the task team through questionnaires, expert interviews of relevant stakeholders. The information gathered was comprehensive for some of the indicators. Monitoring the implementation plan and the documentation of endangered species have been initiated but not fully implemented. Besides, the work programmes and projects developed for wild fruits and Barka cattle need to be fully implemented and assessed.

Adequacy of monitoring information to support assessment

- No monitoring system in place

E-Target 17. By 2020 Conservation and management of genetic resources and diversities strengthened.

Category of progress towards the implementation of the selected target:

Progress towards target but at insufficient rate

Date the assessment was done:

January, 2019

Additional information

With regard to the priority area assessment, there was no systematic genetic resource assessment conducted during the period under review. Besides, deployment of staff members to the Genetic Resources Division at NARI and supply of equipment and materials was very limited.

Indicators used in this assessment

- Status of gene bank report
- Number of species established/recovered
- Area conserved by cultivated crops and forest genetic resources
- Quantity of seed distributed to community
- Number of capacity building programs
- Management plan for strengthening genetic resource
- Area where genetic resources well conserved

Relevant file

- The NARI and HAC reports

Level of confidence of the above assessment

Based on partial evidence

Please provide an explanation for the level of confidence indicated above

The implementation of this target has been assessed with the involvement of DoE and the task team through questionnaires, expert interviews of relevant stakeholders. The information gathered was comprehensive for some of the indicators. The area covered under cultivated crops and forest genetic resources, number of capacity building programs and management plan for strengthening genetic resource has been partially achieved.

Adequacy of monitoring information to support assessment

Monitoring related to this target is partial (e.g. only covering part of the area or issue)

E-Target 18. By 2020, the traditional knowledge, innovations and practices of local communities relevant for the conservation and sustainable use of agricultural biodiversity properly documented and integrated in agricultural biodiversity

Category of progress towards the implementation of the selected target:

Progress towards target but at an insufficient rate

Date the assessment was done:

January, 2019

Indicators used in this assessment

- Type and amount of information available
- Area recovered and maintained by community's knowledge and practices
- Integrated plans to incorporate local knowledge into national BD conservation
- Number of ecosystems managed through community participation

Please describe any other tools or means used for assessing progress

- Oral communication with local farmers and agricultural experts working close with the farming community.

Level of confidence of the above assessment

Based on limited evidence

Please provide an explanation for the level of confidence indicated above

The implementation of this target has been assessed with the involvement of DoE (the CBD focal point) and the task team, through questionnaires, expert interviews of relevant stakeholders. The information gathered was comprehensive for some of the indicators. The documentation on the type and amount of information on indigenous knowledge available and number of ecosystems managed through community participation has been initiated but not fully achieved or completed. However, some of the indicators of the progress such as: area recovered and maintained by community's knowledge and practices and integrated plans to incorporate of local knowledge into national BD conservation have not been initiated.

Adequacy of monitoring information to support assessment

- No comprehensive monitoring system in place

2.4 Description of the National Contribution to the Achievement of each Global Aichi Biodiversity Target

Aichi Biodiversity Target 1

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

In Eritrea, awareness activity and training is given to build skilled human resources and to raise the awareness of the community on the conservation and sustainable use of the biodiversity. For example, training and awareness raising programs were conducted for forestry and wildlife experts and forest guards on forest management, establishment of planted forest, enclosure development and protection, biodiversity conservation and compost preparation. Community education is held on regular basis to educate communities about the importance of the protected and conserved areas to their environment, health and economic improvement. Awareness raising programs are run in mass media on regular basis to sensitize people to refrain from degrading biodiversity. In all the trainings and awareness raising programs, governmental offices and other stakeholders actively participated and there was great integration level almost throughout the country.

Various awareness raising activities were conducted with regards to marine biodiversity conservation. The MoMR conducted meetings with the administrators, local communities, and the Navy to raise awareness on the conservation of mangrove, coral reef, turtle, and other marine organisms. Moreover, the ministry published more than twenty conservation related articles in the local newspaper and broadcasted many programs in the national radio and TV channels. Massawa city administration organizes regular environmental cleaning campaigns including beach cleaning. Staff members of the MoMR provide awareness on marine biodiversity to tourists and government officers in Sheik Said (Green) Island.

Integration of biodiversity related training and educational information is mainstreamed in the curricula of the Ministry of Education at junior and secondary level. Many topics related to biodiversity conservation are included in the science and geography textbooks published by the Ministry of Education. Also, three colleges in the country have courses related to biodiversity conservation. List of courses offered by the colleges is given below:

1. Eritrea Institute of Technology – Department of Biology: Plant Systematics (Biol 212), Invertebrata (Biol 221), Vertebrate (Biol 222), Protista and Fungi (Biol 231), Flowering Plants (Biol 311), Plant Ecology (Biol 331), Principles of Plant Taxonomy (Biol 315), General Microbiology (Biol 334), and Biodiversity and Conservation (Biol404).
2. Hamlemalo College of Agriculture – Department of Land Resources and Environment: Introduction to Forestry (LREN 231), Forest Management (LREN 232), Integrated Watershed Management (LREN 412), Wildlife Conservation (LREN 431), Protected Area Management (LREN 432), Rangeland Management (LREN 412), and Biodiversity and Conservation (LREN 434); Department Agronomy: Principles of Plant Breeding and Genetic Resources (AGRO 362) and Breeding Field Crops and Biotechnology (AGRO 461).

3. Massawa College of Marine Science and Technology – Department of Marine Biology and Fisheries: Invertebrates (MABF 201), Fish Biology (MABF 211), Systematics and Taxonomy (MABF 301), Marine Botany (MABF 311), Marine Protected Areas (MABF 322), Marine Ecology (MABF 331), Integrated Coastal Zone Management (MABF 402), and Coral Reefs (MABF 412).

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional)

Eritrea's contribution in awareness creation on biodiversity is in line with the achievement of the global biodiversity conservation plan of activities. Eritrea observes many international awareness raising events and also undertakes several campaigns that contribute to biodiversity awareness in the population:

- International Day for Biological Diversity (May 22)
- Environmental Day (June 5)
- World Food Day (October 16)
- National Greening Day (May 15)
- Summer Tree Planting Campaigns by secondary education students and Community Tree Planting activities in various zones of the country

Aichi Biodiversity Target 2

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

Biodiversity economic assessment was done in 1998 as part of the first NBSAP, by Lucy Emerton, Biodiversity Economics consultant to IUCN Eastern Africa Regional Office. In this assessment report, the total quantifiable annual value of economic activities in Eritrea which were supported by biological resources and their diversity was estimated at Nakfa 2.8 billion (~0.19 billion USD) a year out of which Nakfa 2.3 billion (~0.15 billion USD) a year direct benefits and Nakfa 0.5 billion (~0.03 billion USD) a year indirect benefits. Out of the total quantified direct benefit: 40 % from agricultural resources, 35 % forest resources and 25 % marine resource. This information was used to develop the first NBSAP (2000) as well as the revised one (2015). The NBSAPs came out with different actions and mainstreamed into different sectors. Since then, however, no economic assessment pertinent to biodiversity resources has been carried out.

Aichi Biodiversity Target 3

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

No harmful subsidies exist in Eritrea. The MoA and the Ministry of Marine Resource provide technical support and advice to farmers and fishers to boost their production but these subsidies do not have negative effect on biodiversity. In fact, the ministries encourage them to enhance biodiversity by planting trees and conserve ecosystems by maintaining local reserves. The MoA encourages farmers by providing farming tools, bee hives, solar lanterns, and bicycles to exemplary farmers. Students who participate in summer plantation programs are also provided with pocket money to cover expenses for educational materials such as text books, notebooks and other stationery. The Ministry also distributes certificates of recognition to individuals, villages, government and nongovernment offices, who contributed towards conservation of biodiversity. The MoMR also provides coastal community with incentives for their services in planting mangroves.

Aichi Biodiversity Target 4

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

The MoA, the Ministry of Local Government, the Ministry Marine Resources, Ministry of Land Water and Environment, and other relevant sector ministries are working towards the sustainable use of Eritrea's natural resources in the three ecosystems: marine, terrestrial and agricultural. Despite the non-availability of earmarked financial resources for the implementation of the NBSAP, as part of their sectorial mandate all concerned bodies are doing their best towards the conservation and sustainable use of Eritrea's Natural resources including biodiversity.

With the increased demand for food, Eritrea's food production and yields will be forced to increase. Most of this productivity boost will be achieved mainly through the increased utilization of the genetic resource base of food crop species. The MoA through the National Research Systems (NARI and HAC) recommend and encourage the farmers of the country to access and utilize improved genetic resources and use of natural resources wisely. In pursuing the agricultural production, it has been increasingly recognized that the wide range of existing food productions systems require different approaches to the sustainable utilization of natural resources and genetic diversity, with diverse objectives, methods and institutional arrangements being promoted to meet development goals. While utilizing the natural resources and biodiversity, tremendous efforts need to be done by the local and indigenous communities and raise awareness in the conservation and sustainable management of the biodiversity that feeds the country. To achieve this, the Ministry of Agriculture has developed agricultural strategic plan that is based on crop commodity production

and advises the six zobas to cultivate crops rotationally so that the soil in particular and ecosystem in general could be stabilized.

Currently fisheries production and consumption of fishes is very low in Eritrea. The maximum Sustainable Yield of fishery products is estimated to be 80,000 tons per year. The maximum annual catch recorded in the last thirty years is 13,000 tones, which is only 15% of the potential yield. Similarly, fish consumption in the country is low, with per capita value of only 0.7 kg (IFAD, 2017). Compared with global rate of consumption, which is about 20.5 kg/person/year, Eritreans consume small amount of fish. Thus, the current level of fish production and consumption is sustainable. The fisheries management strategy used by the MoMR is in line with FAO's guidelines of Ecosystem based sustainable fisheries.

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional)

Eritrea is signatory and party to a number of conventions and international agreements relating to biodiversity conservation. These include: Convention on the International Trade in Endangered Species of Wild Fauna and Flora, and Convention on the Conservation of Migratory Species and Convention on Biological Diversity including Cartagena and Nagoya Protocols, and International Treaty on Plant Genetic Resources for Food and Agriculture. As part of these conventions the country's activities are expected to contribute to the aims of the ABT at global level.

Aichi Biodiversity Target 5

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

The marine vegetation is well conserved in Eritrea. For example, the mangrove cover of the Eritrean coast has increased by 13% from 1997 to 2017. The coral reefs of the Eritrean coast seem to be in good health. No major degradation of marine ecosystems (mangrove, coral reef and others) were recorded in Eritrea. The reasons for flourishing of mangrove and for the good health of corals include low population density along the coastal area, low number of livestock (grazing pressure by camels), and the notable culture of the coastal community to conserve forests and wildlife.

In the terrestrial environment, much effort is being done to reduce the deforestation process and increase planted forest through various ways such as enforcing regulatory instruments and planting trees and replacing dead trees in almost many parts of the country. In addition, protected area systems are being established and local community enclosures are being promoted so as to reduce pressure on the existing forest cover. These coupled with the introduction and popularization of energy saving stoves, like *Adhanet Mogogo*, the loss of natural habitat is curbed. Moreover, land degradation is being tackled in various forms of catchment treatment which include physical and biological soil and water conservation measures. The implementation of the new land tenure system together with the SLM practices will also reduce the pressure to farm land and the permanent allocation of land to farmers encourages long term investment such as planting trees and soil conservation practices. Despite such efforts, the success rate is not very high in terms of increase in forest cover due to the shortage of rainfall and its uneven distribution.

Aichi Biodiversity Target 6

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

Eritrea is endowed with rich fishery resources. As it has been stated in section 4, Aichi Biodiversity Target4, it is estimated that up to 80,000 tons of fishery resources can be harvested annually on sustainable basis from Eritrean coast of the Red Sea. However, the current level of fishing is below 13,000 tons per year, which accounts for only 15 % of the potential yield. The majority of the catch is collected by trawlers that target demersal resources such as shrimp and lizardfish and supply them to the foreign market. The local fishers (artisanal fisheries) take only about 10% of the catch and most of this catch is sold in the domestic market.

The MoMR follows the guidelines on Ecosystem Based Fisheries Management (FAO, 2005). The ministry manages the fisheries stock by employing input and output control techniques. The input control includes restriction of mesh size, limiting the number of trawlers, restricting fishing season, and banning certain fishing gears. The output control includes restricting maximum catch in a season and minimum size of fishes. Trawling is prohibited for five months per year (June to October) in order to allow recovery of exploited stocks. Size restriction of catch is ensured by minimum mesh size of fishing nets. Trawling is also restricted to specific blocks and deeper depths so that sensitive ecosystems are protected and the shallower coast is reserved for small scale artisanal fishers. The total amount of fish allowed in a year is also determined by the ministry. The management actions are taken in order to protect the marine ecosystem and avoid overfishing. Nevertheless, there are some violations of the fisheries management rules in which some turtles are caught by trawling as by-catch, sea cucumber fisheries cause local over exploitation of the stock, and shark fisheries seem to exceed the sustainable level of fishing. Illegal, Unreported and Unregulated (IUU) fishing by external fishing vessels also occurs in the Eritrean coast (Tesfamichael and Mahmud, 2015).

Small pelagic fishes (Sardines and anchovies) account for more than 50% of the fisheries potential of Eritrea. Fisheries for small pelagic was very active in the 1950's and 1960's. But at the moment such fisheries are almost non-existent. The MoMR, through the IFAD funded Fisheries Resources Management Project (FRMP), plans to revitalize the fisheries introducing new fishing and processing techniques. FAO is assisting the Ministry for developing management plan for small pelagic fisheries resources.

Aichi Biodiversity Target 7

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description

Agricultural biodiversity include plants (utilised as food/feed, industrial, spices, medicinal etc.).The agricultural sector accounts for around 11.6% of total GDP and a much larger proportion of the subsistence economy which is not fully documented in national economic statistics (World Bank, 2018). The majority of the population of Eritrea is living in the rural areas

where their economic livelihood is derived from agricultural activities both crop and livestock production. The diversity of crop, forage, shrub and tree browse landraces found in Eritrea has regional and global conservation significance because Eritrea is primary and secondary centre of diversity for a number of cultivated crops. More importantly, the genetic diversity of these and other crops and forages in Eritrea plays an important role in the agricultural strategy, especially those farmers practising rain-fed agriculture. Cultivation of a range of different landraces provides on-farm conservation of the crops and securing total failure of crops and livestock under harsh conditions. There are many crop species especially food crop cereals and pulses which are climate resilience that contribute to the achievement of food security of Eritrea (World Bank, 2018) and will have a spill over effect to world food security.

There are little aquaculture activities in Eritrea. Limited dams and lakes are stocked with freshwater fish but there is no regular fishing in these water bodies. Thus, management of aquaculture is not a problem in Eritrea. Reasons for absence of aquaculture activities include shortage of permanent freshwater bodies (lakes, dams, etc.), hot and arid climate of the coastal areas, abundance of wild fish in the marine environment, absence of fish eating culture in the highlands, and low domestic demand of fishes. The MoMR has prepared a draft Aquaculture Development Strategy.

[Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level \(optional\)](#)

Eritrea is a member of the United Nations Forestry Forum (UNFF) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which have direct relevance to forestry.

In 1999 a Management plan was prepared for the riverine forest ecosystem, which is more resilient to fire and human encroachment. The plan restricts undertaking agricultural practices within 700 m from river banks. The Doum palm forest contributes a lot to the livelihood of the local people economically, because they utilise all the plant parts for various uses. The leaves are weaved into baskets, mats, and other ornaments; the tree trunk is used for construction; its fruits are eaten and the seeds used as ornamentals.

Aichi Biodiversity Target 8

By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity

[Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:](#)

No comprehensive survey was done to assess the level of pollution in Eritrea. The limited studies conducted on the subject show that there is no major land based pollution. The reason for the low level of pollution include: undeveloped manufacturing industry that pollute the environment and low level of fertilizers and pesticides inputs in agriculture. However, there are signs for increased plastic pollution in the country following the popular utilization of plastic bags and plastic bottles. The government of Eritrea has banned selling and utilization of plastic bags. As a result, pollution due to plastic bags has relatively decreased. However, plastic containers are still creating pollution on the environment.

Land based pollution in the marine environment seems to be low but preliminary survey shows that there is noticeable ship based pollution in the Massawa area. The concentration of heavy metals

around the harbours and ship yards seems to be high and there is oil pollution from Hirgigo power plant near Massawa.

The government has made commendable progress towards minimizing pollution through improving its policy frameworks and legislatives. Proclamations related to pollution control include:

- The Port Authority Regulations: (Legal Notice No.103/2005) issue by the Port Authority
- Legal Notice No. 63/2002 Regulations to Prohibit the Production, Sale or Distribution of Plastic Bags in Eritrea
- Legal Notice No.99/2004 Regulation to Amend the Production, Importation, Sale or Distribution of Thin Plastic Bags Prohibition in Eritrea,
- ProclamationNo.179/2017: The Eritrean Environmental Protection, Management and Rehabilitation Framework:

Please describe other activities contributing to the achievement of the Aichi Biodiversity Target at the global level (optional)

Eritrea ratified the following conventions pertinent to pollution and wastes.

- Rotterdam Convention on Prior Informed Consent (PIC) (1stMarch, 2005)
- Montreal Protocol on Substance that Deplete Ozone Layer (ODS) (2nd March, 2005)
- Stockholm Convention on the Persistent Organic Polluants (POPs) (1st March, 2005)
- Basel Convention on the Trans-Boundary Movement of Hazardous Wastes and other wastes (1st March, 2005)

Aichi Biodiversity Target 9

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

Eritrea is signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) with a focal office in the Regulatory Services, Department of the MoA. The focal office has conducted a number of meetings with its stakeholders and is working towards the implementation of the convention's objectives.

The MoA is responsible for controlling introduction of alien species to the country. It has control posts in the sea ports, airports and along the border. However, there is shortage of human capacity for identifying invasive alien species.

Prosopis juliflora/ Prosopis chilensis (Mesquite tree), which was introduced to Eritrea in the 1970's through the Sudan in the western and north-eastern lowlands and in the 1980's from Ethiopia in the eastern lowland, is becoming a noxious invader of major concern in regard to the loss of natural habitat specially on the sides of ephemeral rivers. Recognizing the adverse impacts of this species on biological diversity and its components, especially on vulnerable ecosystems, such as the riverine vegetation and mangroves, the FWA has issued license to 290 farmers to produce charcoal out of the tree, so as to control its spread. It also encourages the farmers to utilize the tree as animal feed.

Outbreak of fall army worm (*Spodoptera frugiperda*) was reported in Eritrea in 2018. The MoA played remarkable role in controlling the spread of the pest by sensitizing the farmers and by informing the general public on the modes of habits and modes of reproduction of the worm. The MoA issued directives to all farmers to destroy maize and sorghum plants when they see areas infested by the pest. During the reporting period, fall army worm is under complete control and there is continuous survey and periodic monitoring of this pest to control its outbreak.

Aichi Biodiversity Target 10

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

No comprehensive survey of corals was done in the last three years. But investigation of corals in Massawa area shows that the corals in the area are healthy. The coral reef ecosystem supports a multitude of fish and invertebrates. Overall, anthropogenic pressure on coral reefs is low because the coast is sparsely populated and due to little coastal infrastructure and other developmental activities.

However, there is periodic bleaching of corals as a result of high summer temperature. Usually at the end of summer, the temperature of shallow coast exceeds 30°C causing massive bleaching of corals in the central Eritrean coast (Dahlak Archipelago including Massawa area). But at the end of October the corals recover by regaining the symbiotic algae. This indicates that the corals of the southern Red Sea are not vulnerable to the prevailing high temperature in the area.

Aichi Biodiversity Target 11

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

As party to the Convention on Biodiversity, Eritrea is committed to establish and manage protected area under terrestrial and marine ecosystems. There are four priority areas for protection and these are: Semienawi and Debubawi Bahri (106,000 ha), Buri-Irori-Hawakil (867,000 ha), Berasole estuary (13,100ha) and the Gash-Setit Elephant Sanctuary (44,000ha). Although not officially gazetted, Semienawi and Debubawi Bahri protected area and the Gash-Setit Elephant Sanctuary, which encompasses 150,000 ha (~1.2% of the country) are demarcated and well protected through government directives. Bure-Irori-Hawakil and Berasole (about 7% of the country) is also expected to be demarcated and zoned in the coming two years. The Buri-Irori area is the home of globally endangered species, African Wild Ass. The ultimate goal of these protected areas is ensuring the integrity of Eritrea's diverse ecosystems and secures the viability of the nation's globally significant biodiversity. Besides, two islands in the Dahlak Archipelago are also proposed for protected area.

Eritrea has communities' conserved areas (enclosures) which are common in the highlands. The village level enclosures are mainly designed to rehabilitate degraded landscapes and sustainably

manage wooded lands/forests around the villages. These enclosures contribute to biodiversity conservation by serving as habitat to many wild animals. The enclosure areas established and managed by the local community through customary laws. Cases related to dispute and transgression of the local rules and regulations are settled based on the customary laws. The total area of these enclosures (conserved areas) is estimated at 224,890 ha (~1.8% of the country).

The DoE (MoLWE), along with relevant institutions and stakeholders, is in the process of preparing regulatory instrument pertinent to protected areas. It has prepared a draft protected areas proclamation. The title of the proclamation is “A proclamation to determine the establishment, and management of protected areas”. In addition to the draft proclamation the DoE also prepared documents related to institutional framework, conservation and financing, monitoring and evaluation, and training in protected areas.

There is little progress in establishing marine protected area. The MoMR proposed Dessie/ Madot and Sheik Said Island to be designated as protected area. However, no action has been taken so far to declare the sites. These islands are small in size and there is a need to identify more islands/or coastal areas for protected areas.

Aichi Biodiversity Target 12

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

Eritrea is home to many endangered and threatened species. According to the Forestry and Wildlife Authority, Africa Wild Ass and Nubian Ibex are critically endangered and Elephant is endangered in Eritrea. Besides most of the existing species that include: Sommering gazelle, Dorcas gazelle, ostrich, greater kudu, bushback, klipspringer and aardvark are recognized as nationally threatened due to habitat loss, drought, and human wildlife conflict. Around 55 flora species are listed as nationally endangered/threatened in the Forestry and Wildlife Conservation and Development Proclamation No. 155/2006. There are also endangered crop varieties that most of these are varieties which require long growing period and, prefer very fertile soil. Over exploitation or over grazing of wild crop relatives are the main reasons for putting them at risk. In respect to animal breeds no medium or long-term conservation facilities are in place. Thus phenotypic as well as genetic diversities studies indicate genetic drift is a serious problem.

The Eritrean marine environment is home to five of the world’s seven turtle species, which all of them are threatened with extinction globally. These are: Green (*Chelonia mydas*), Hawksbill (*Eretmochelys imbricata*), Olive ridley (*Lepidochelys olivacea*), Loggerhead (*Caretta caretta*) and Leatherback (*Dermochelys coriacea*) turtles. Green and hawksbill turtles are the most abundant and widely distributed along the broad shallow continental shelf of reef but the other three species are rare. There are a number of mammals which occur in the marine waters of Eritrea in which most of them are in the IUCN Red List of Endangered Species. These species include Dugong (*Dugon dugong*) and 15 species of cetaceans (7 whales and 8 dolphins). The MoMR through the Eritrean Coastal Marine and Island Biodiversity Project (ECMIB, 2016) conducted extensive survey of the Eritrean coast and investigated the abundance and distribution of birds and turtles. Detailed information on the status of the marine mega fauna is given in the fifth national report (DoE 2015). The Ministry also continued to monitor nesting of turtles along the coast. But no assessment of the other species was done

Aichi Biodiversity Target 13

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description

Eritrea has made worthy effort towards this Aichi target of maintaining genetic diversity for minimizing genetic erosion and safe guarding their genetic resources. At this stage, the strategic plan of genetic diversity is included in the agricultural policy and strategic plans. By 2020, however, national genetic resources conservation and management strategy document will be produced as standalone document, identifying responsibility of stakeholders that engage in genetic resource diversity and cause of genetic erosion; identifying species prioritized for conservation and management methodologies. The strategic plan on genetic resources conservation and management will result ineffective products. Farmers' varieties which exhibit high variability among and within varieties covered large areas under cultivation in Eritrea.

However, the country has yet to act on maintaining genetic diversity through the establishment of regulatory and monitoring systems by the Department of Regulatory Services, MoA and DoE to lead regulatory mechanisms of GMOs/LMOs.

Aichi Biodiversity Target 14

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description

The implementation of numerous national programs to increase forest cover through afforestation and reforestation programs, whilst improving management of protected areas through enhanced legislatives and formalized community participation, contributes directly to the Aichi Target 14 to restore and safeguard ecosystems that provide essential services including ecosystem services.

Aichi Biodiversity Target 15

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

Degraded land in Eritrea is estimated to cover 1,190,552 ha (LDN, 20 17). The effects of degradation are being tackled through various means that include; soil and water conservation projects; treatment and management of catchment areas; establishment of protected areas systems; community based sustainable and integrated natural resources management projects. Furthermore, implementation of the new land tenure system together with the SLM practices are expected to reduce pressure on farm land and encourages long term investment in farm lands.

The most important forest in the coastal area is mangrove. The observed increase of mangrove cover by 13% will have significant contribution to carbon sequestration.

Aichi Biodiversity Target 16

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

Eritrea has acceded the Nagoya Protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their utilization on 11 June, 2019. This demonstrates that Eritrea's commitment to the third pillar of the convention on Biological Diversity, while also contributing to the other two objectives of the convention i.e. conservation and sustainable use of biodiversity. Upon ratifying the Nagoya Protocol, the country will continue to act to develop a domestic access and benefit sharing policy and to work towards benefit sharing in communities.

The genetic resources division at the National Agricultural Research Institute of the MoA executes national programs for conservation and management of domesticated plants, forest and farm animal genetic resources. The national gene bank maintains food crops, forages, industrial crops, medicinal plants and others. There have been meetings with communities and stakeholders to provide them with an opportunity to consider possible elements of a domestic access and benefit sharing endeavors and contribute to an increased understanding of the Nagoya Protocol.

The protocol will enable Eritrea to protect biodiversity resources from exploitation, ensure direct benefits to the local communities and enhance legal certainty and clarity for both users and providers of genetic resources. However, it can also help create equitable partnerships between communities and other groups, such as scientific organizations or companies that seek to develop new products based on natural resources. Besides, Eritrea is party to the International Treaty on Plant Genetic Resources for Food and Agriculture with the objectives that include the conservation and sustainable use of plant genetic resources for food and agriculture; and the fair and equitable sharing of benefits derived from their use, in harmony with the Convention on Biological Diversity, for sustainable agriculture and food security. Article 5 of the Eritrean Environmental Protection, Management and Rehabilitation Framework No.179/ 2017 is concerning sharing and equity for sustainable development for present and future generation

Aichi Biodiversity Target 17

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

Eritrea has developed the National Biodiversity Policy and updated the NBSAP in 2015. The Policy seeks to promote and contribute to conservation and sustainable use of biodiversity. The conservation of biodiversity in Eritrea depends on the commitment of the Ministry of Land Water and Environment and the different line ministries and authorities. Therefore, the successful implementation of the NBSAP requires a concerted action at all levels of governance including the local authorities, community and civil society organizations.

The key considerations in the implementation of NBSAP are efficient allocation of resources, strengthening linkages between different stakeholders and coordinating their activities. The MoLWE through the DoE is the lead ministry in the implementation and, in most cases, lead in mainstreaming to the sector activities.

At the policy implementation level, MoLWE in collaboration with the Ministries of Agriculture, Ministry of Marine Resources, Ministry of Local Government, Ministry of Finance, Ministry of National Development, Forestry and Wildlife Authorities, Higher Education and Research Institute and Crop and Livestock Corporation are working to ensure the enactment of the relevant legislation to support biodiversity mainstreaming and coordination.

Aichi Biodiversity Target 18

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

Inclusion of traditional knowledge with scientific research can change and improve crop yields. Some documentation related to the traditional knowledge has started as a compilation of the history of Eritrean agriculture, interview with elder people, documented and processed as working paper focusing on pastoralists indigenous knowledge in the North Western part of Eritrea are some of the important traditional knowledge to mention.

Besides, promoting community based conservation of landscapes, by incorporating indigenous knowledge and use of bylaws, contribute to the overall natural resources conservation and sustainable utilization.

Eritrea's contribution to this target is reflected in the actions which contribute to E-Target 18 described in Sections 2 and 3 of this report.

Aichi Biodiversity Target 19

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

Eritrea in line with the CBD Convention has prepared its NBSAP in 2015 and specific targets were included to meet the objectives of the Aichi Biodiversity Targets. In the implementation of the targets set in this document, various ministries and relevant institutions are taking part to realise the objectives. Several activities are being undertaken and the results are also documented in various formats including publications in journals. The main line ministries, MoA, MoMR, and MoLWE (DoE) are organizing various awareness raising events and meetings to disseminate the progress being made in the three biodiversity ecosystems of the country: Terrestrial, marine and coastal, and agro-biodiversity.

Aichi Biodiversity Target 20

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

Please describe how and to what extent your country has contributed to the achievement of this Aichi Biodiversity Target and summarize the evidence used to support this description:

Eritrea developed its NBSAP 2011-2020, and this document contains several targets that the country wanted to achieve with regard to the conservation, and sustainable utilisation of its biodiversity for the planned number of years. Nonetheless, most of the targets are in line with the mandates and objectives of the line ministries and have been implemented as part of the business as usual approach of the ministries. Thus, the financial resources that have been mobilized are from the budgets of the ministries and their projects.

2.5 Description of the National Contributions that support the implementation of the 2030 Agenda for Sustainable Development Goals

Based on the description of your country's contributions to the achievement of the Aichi Biodiversity Targets, please describe how and to what extent these contributions support the implementation of the 2030 Agenda for Sustainable Development and the Sustainable Development Goals.

SDG 1. End Extreme Poverty in All Forms by 2030

Eritrea intends to develop integrated action frameworks on the control of excessive firewood collection and construction wood that impact biodiversity resources, in a manner that enhances sustainable use of nature resources (E-Target 1). Deforestation of mangrove and associated coastal forest degradation will be reduced (E-Target 7). The country also plans to promote the use of alternative energy so that the forests will be saved (E-Target 2). In another target (E-Target 5) there is a plan to rehabilitate degraded lands. Protection of the forests and rehabilitation of degraded lands will result in conservation of soil and water. As a result, agricultural productivity will increase resulting in reduced poverty in the country.

Agriculture production will increase through sustainable management of agricultural genetic resources and strengthened conservation and management of genetic resources and diversities (E-Targets 14 and 17). These targets aim at conserving disease and drought resistant crop varieties. Increased agricultural production will improve the livelihood of the rural population by increasing their income.

SDG 2. End Hunger, Achieve Food Security and Improved Nutrition and Promote Sustainable Agriculture

In the last four years some farmers in Eritrea have developed their capacity to reduce overgrazing/over browsing (E-Target 3). The traditional way of feeding livestock (mainly in the form of crop residues) is being enhanced by supply of improved forage. This has changed the feeding system of the livestock resulting in better feed quality. As a result, higher yield of milk and meat production have been recorded in some areas.

As part of the NBSAP Eritrea has rehabilitated catchment sites and degraded lands of high biodiversity hotspots (E-Target 5). These sites have reduced soil erosion and the yield obtained has shown improvement. As a result, agricultural production increased. As mentioned above (SDG 1) conservation and sustainable management of agricultural genetic resources have resulted in improvement of agricultural production (E-Targets 14 and 17)

Mangrove swamps and coral reefs are valuable nursery grounds for fish and other marine organisms. Conservation of these ecosystems is vital for the health of the coastal areas. Eritrea has two targets for conserving these habitats (E-Targets 7 and 10). For example, plantation of mangrove in Dahlak area has created nursery ground. Fishers from the area have now started to fish from these sites.

All the above activities have contributed towards enhancement of agricultural and fisheries production where by increasing availability of food to the local people. This has contributed to the achievement of SDG 2 by Eritrea.

SDG 3. Ensure Healthy Lives and Promote Well-Being for All at All Ages

The Government of Eritrea has worked hard to increase the use of alternative energy and to reduce on forests usage significantly (E-Target 2). Distribution of energy saving stoves reduces the use of forests as firewood and parallel to the release of excessive smoke to the environment decreases. Therefore, the females usually use this energy saving stove in our daily life, as it releases less smoke it will not harm their health. In general, the usage of the alternative source of energies like solar energy, helps in reducing pollution to the environment and human health.

Eritrea's NBSAP includes two targets (E-Target 8 and 15) that reduce land and marine pollution. Pollutants from these sources accumulate in the marine environment, causing health risk to marine organism. When polluted sea-food is consumed by humans concentrated pollutants are transferred to the consumers at higher concentration (bio-magnification). By controlling pollution Eritrea thrives to ensure healthy lives of its population.

In the agricultural aspects farmers use different fertilizers to increase their products and excessive usage of these fertilizers will induce a great pollution to the water bodies and the environment as they are composed of different types of chemicals, so they can also show their effect on the health of animals and human beings. Eritrea is working to control pollution to agricultural biodiversity induced from agro-chemicals (E-Target 15). All these activities contributed to the achievement of SDG 3 by Eritrea.

SDG 4. Ensure Inclusive and Equitable Quality Education and Promote Lifelong Learning Opportunities for All

The preparation and review of agricultural text books for Ministry of Education, and inclusion of biodiversity related courses in the Hamelmalo Agricultural College contributes to improve educational quality. The published articles and training conducted were related to soil and water conservation, crop production and husbandry, vegetables and fruit production, meat and dairy production, improved seeds production, bee keeping, local poultry keeping and animal and plant health. Besides, biodiversity related activities were broadcasted once in a week in the national radio under the program locally known as "*Hrshana Nemaebi*". This result in increasing awareness regards to biodiversity and ensures quality education and also promotes lifelong learning opportunities. The Importance and sustainable use of agricultural biodiversity also increased as a result of training of farmers. (E-Target 13)

SDG 5. Achieve Gender Equality and Empower All Women and Girls

The Government of Eritrea has achieved success on empowering women and girls by giving different types of trainings that help them lead their life. For example, through conducting trainings in the construction and utilization of energy saving stove known as '*Adhanet Mogogo*' and trainings for the installation of solar power (E-Target 2). The participants of these trainings are mostly females as gender empower opportunity. This contributes to the achievement of SDG 5 by Eritrea.

SDG 6. Ensure Availability and Sustainable Management of Water and Sanitation for All

Shortage of drinking water is one of the critical problems in Eritrea, especially in the coastal areas. In the last decades the amount of rain has decreased. As a result, ground water has been depleted in some areas. Salt intrusion into the ground water has been a common phenomenon. By implementing E-target 1, Eritrea have started to control excessive firewood collection and construction wood. It also has reduced deforestation by encouraging the people to use alternative

energy (E-Target 2). Catchment sites and degraded lands of high biodiversity hotspot have started to be rehabilitated (E-Target 3). Reduction of expansion of alien species is expected to reduce the evapo-transpiration by *Prosopis* and other invasive species (E-Target 6). Agricultural agro-chemicals contaminate water rendering freshwater unsafe for human consumption. The NBSAP includes (E-Target 15) which reduces pollution due to agro-chemicals.

SDG 7. Ensure Access to Affordable, Reliable, Sustainable and Modern Energy for All

The Government of Eritrea has addressed the issue of alternative energy by implementing intervention actions to promote the use of alternative energy source (biogas, wind and solar) and the distribution of energy saving stoves to reduce forest degradation in the country (E-Target 2). Furthermore, an integrated action frameworks have developed on the control of excessive firewood collection and construction wood to enhances sustainable use of forest, mangrove and forest products (E-Targets 1 and 7). The country also develops an integrated action plan to reduce the expansion of alien species through control mechanisms and sustainable utilization (E-Target 6). This activity enables the local community to produce charcoal as a source of energy with the aim of controlling the invasiveness of the species and utilize the resource sustainably. The result of all the above mentioned activities will provide affordable, sustainable and modern energy source for all the communities.

SDG 8. Promote Sustained, Inclusive and Sustainable Economic Growth, Full and Productive Employment and Decent Work for All

The Government of Eritrea has planned to develop an integrated action plan of implementation to reduce the expansion of alien species through control mechanisms and sustainable utilization (E-Target 6). The activity done to control for the expansion of alien species creates a job for the local communities as a sources of income. For example, one of the control mechanisms is to produce charcoal from an invasive species known as *Prosopis* and also using it as animal feed. Therefore, by selling these products they can get an income for their daily life. In addition, Eritrea has achieved a success on empowering women and girls by giving different trainings to lead their life, as a source of income. For example, conducting trainings for the preparation of the energy saving stove known as '*Adhanet Mogogo*' and for the installation of solar power (E-target 2). These plans have played a great role in creating a job to the user. These have a contribution for the achievement of SDG 8 by Eritrea.

SDG 11. Make Cities and Human Settlements Inclusive, Safe, Resilient and Sustainable

According to the predictions of the Intergovernmental Panel for Climate Change the sea-level of the coastal areas is expected to increase due to climate change. This will cause flooding in many coastal cities and towns. Coastal erosion is also expected to create problem in coastal settlements. For example, the port city of Massawa is vulnerable to flooding due to sea-level rise. Some coastal settlements have already started to feel the effect of sea-level rise. Eritrea plans to control coastal erosion by planting mangrove along the coast (E-Target 7) and by protecting its coral reefs (E-Target 10). Also, it plans to reduce coastal erosion and rehabilitate eroded beaches (E-Target 9).

SDG 12. Ensure Sustainable Consumption and Production Patterns

In the previous years, farmers were using the traditional way of feeding their livestock such as the crop residues and also they let their livestock to graze on open area which lead to overgrazing and overbrowsing. However, recently some farmers start to use improved forage crops, cut and carry

system from enclosures and rotational grazing. This helped to reduce overgrazing/ over browsing and also increase milk and meat productivity. (E-Target 3)

The management plan for genetic resources includes: identifying responsibility of stakeholders and their engagement in genetic resources conservation: management or related activities; studying genetic diversity and causes of genetic erosion; identifying species prioritized for conservation corresponding with appropriate conservation and management methodologies. This management strategic plan on genetic resources conservation and management has resulted into effective products. As an example, farmers have included their indigenous varieties which exhibit high variability among and within varieties that covered large areas under cultivation in Eritrea. Keeping and sustainable management of these traditional varieties has been insurance to the farmers against biotic and abiotic stresses. The Genetic Resources Division at NARI of the MoA executes national program for conservation and management of domesticated plants, forest and farm animal genetic resources. The short-term training is aimed to make staff members of NARI knowledgeable about domesticated plant, forest and farm animal's genetic resources conservation and sustainable use including trainees from different research stations to assist the Genetic Resources Division in germplasm collection and estimating genetic resources. (E-Target 14 and 17). As a result of management and conservation of genetic resources the agricultural production will increase, resulting in higher food consumption.

SDG 13. Take Urgent Action to Combat Climate Change and Its Impacts

Through the NBSAP Eritrea has started to reverse deforestation and land degradation. In many of the targets attempt is being made to enhance forest cover by reducing cutting of firewood and construction wood (E-Target 1); reducing dependence on firewood for house hold energy demand by introducing alternative energy (E-Target 2), rehabilitation of catchment sites and degraded lands (E-Target 5); and reducing degradation of mangrove forests (E-Target 7). Those activities reduce burning of firewood, enhance sustainable use of forests and increase forest cover in the country, resulting in more CO₂sequestration. This will play a role in reducing the effect of greenhouse gas (E- Target 1).

The NBSAP has a target which aims at conserving coral reefs in the coastal areas. Oceans are the main sinks for excess CO₂ in the atmosphere. Moreover, coral reefs absorb CO₂ for building their exoskeleton which is made-up of calcium carbonate. Thus, conserving the coral reefs will contribute in combating climate change. (E-Target 10)

SDG 14. Conserve and Sustainably Use the Oceans, Seas and Marine Resources for Sustainable Development

Eritrea has a long coastline in the south western Red Sea. The coastal area is rich in biodiversity and it is endowed with valuable marine resources. The NBSAP have six targets which contribute to sustainable management of the marine resources and conservation of the marine ecosystems. The mangroves of the coastal area are in good conditions due to plantation and raising public awareness (E-Target 7). Monitoring of the coral reefs shows that the coral reefs are intact but climate change is causing coral bleaching (E-Target 10). The NBSAP include a target for controlling coastal, marine and island pollution (E-Target 8) and pollution from agro-chemicals (E-Target 15). Protection of rare endangered and threatened marine species have also been taken as one of the main targets of the NBSAP (E-Target 12). Control and monitoring of marine invasive and alien species is also been done as part of the NBSAP (E-Target 11). All these activities contribute to the wellbeing of the marine organisms and to conservation of the ecosystem.

SDG 15. Protect, Restore and Promote Sustainable Use of Terrestrial Ecosystems, Sustainably Manage Forests, Combat Desertification, And Halt and Reverse Land Degradation and Halt Biodiversity Loss

Forest degradation through cutting down of trees for the purpose of firewood, charcoal production and construction is significantly threatening the forest resources and vegetation covers in Eritrea. Therefore, the country has developed an integrated action framework on the control of excessive firewood collection and construction wood that impact biodiversity resources, in a manner that enhances sustainable use of natural resources (E-Target 1). The country also plans to promote the use of alternative energy so that the forests will be saved (E-Target 2). Loss of terrestrial biodiversity also resulted from overgrazing/ over-browsing and invasive alien species. Therefore, the country made an intervention by developing the capacity of grazer populations to reduce overgrazing/ over browsing (E-Target 3). This activity will provide available food source for wildlife and avoid feeding competition from livestock. Moreover, developing an integrated action plan to reduce the expansion of invasive alien species through control mechanisms and sustainable utilization (E-Target 6) will reduce the pressure on excessive utilization of those threatened woody perennials in the country. All the above mentioned activities will promote protection and sustainable utilization of forest and forest products and halt biodiversity loss.

Eritrea established protected and conserved areas to prevent the extinction of threatened species and to improve the conservation of those most threatened and endangered species (E-Targets 4 and 16) and also rehabilitation of catchment sites and degraded lands (E-Target 5) are resulting in the restoration of degraded lands and halt biodiversity loss.

In Eritrea, most farmers have implemented good traditional knowledge and farming practices which are relevant for the conservation and sustainable use of agricultural biodiversity (E-Target 18). Furthermore, the country made an intervention to protect agricultural biodiversity from agro-chemical pollution and minimize the detrimental effects to ecosystem function and biodiversity (E-Target 15). All the above mentioned activities will contribute to ensure life possible on land.

3. Biodiversity Country Profile (Updated)

3.1. Introduction

The updated Biodiversity Profile presented here provides the overall country profile and an update of Eritrean biodiversity of the three ecosystems: Terrestrial, Marine and Agricultural.

3.2 Country Profile

Location

Eritrea is located in the Horn of Africa, lies north of the equator between latitudes 12° 22' and 18°02' North and the longitudes 36°26' and 43°13' East. Eritrea shares boundaries with the Sudan in the West, Ethiopia in the South, Djibouti in the Southeast and with the Red Sea in the East. The country covers a total area of 124,320km² and has a long and pristine coastline of about 1900Km. Its territorial waters are around 120,000km² and has around 350 off shore islands, the biggest being the Dahlak Archipelago. The Eritrean coast of the Red Sea is rich in marine biodiversity and the country is situated along the important Red Sea oil and shipping route connecting the Mediterranean Sea with the Indian Ocean.

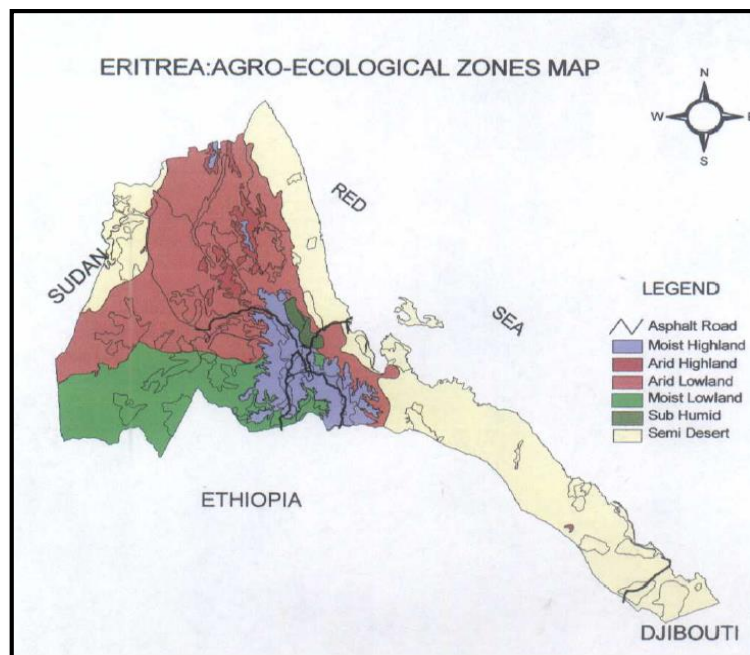
Population

The population of Eritrea is estimated to be about 3.5 million (Department of National Statistics, 2015) of which 70-80% live in the rural areas and derive their livelihood from agricultural activities both crop and livestock production (PHS 2013) the population is unevenly distributed with 65% of them living in the Central Highlands. The population consists of nine ethnic groups: Tigrigna, Tigre, Saho, Afar, Hidareb, Bilen, Kunama, Nara, and Rashaida, each with its own language and cultural diversity.

Climate and Geography

The country exhibits a varied topography, rainfall and climate with altitude that ranges from 120 meters below sea level to over 3,000 meters above sea level. In regard to climate, soil types and other parameters, Eritrea is divided into six agro-ecological zones (Fig. 24): (i) the Moist Highlands, (ii) Arid Highlands, (iii) Sub-Humid Highlands, (iv) Moist Lowlands, (v) Arid Lowlands and (vi) the Semi-Desert. Elevation ranges from 100 m (Semi-Desert) to 3018 m (Moist Highlands). Mean annual temperature ranges from 15°C in the Moist and Arid Highlands to 32°C in the Semi-Desert. Annual precipitation varies from less than 200 mm in the semi-desert to 800 mm in the Sub-Humid Zone. Over half of the total land area is not suitable for conventional agriculture due to steep topography and unreliable rainfall conditions.

The coastal plains zone which is found adjacent to the Red Sea shoreline extends for more than 1350km along the South-Western coast of the Red Sea. The most serious climatic condition of the coastal zone is the shortage of rainfall for agricultural, domestic and other uses (De Grissac and Negusse, 2007).



(NB: This Map is not intended for political map)

Figure 24: Agro-ecological zones of Eritrea (Source: DoL, 1997)

Government

Administratively, the country is divided into six zobas (regions) namely Maekel (Central), Debub (Southern), Anseba, Gash Barka, Semienawi Keih Bahri (Northern Red Sea) and Debubawi Keih Bahri (Southern Red Sea). The country has a decentralized form of governance and administration and each is assigned with the responsibility for rural development on the zobas. The mandate and responsibilities of the various levels of administration are set-out in Proclamation for the Establishment of Regional Administration No. 86/1996.

Economy

Eritrea is an emerging country that has suffered a lot from the long war for liberation that destroyed most of Eritrea's infrastructure and devastated its economy and environment. Thus, it is under the reconstruction of its social, economic, and physical infrastructure from the bare minimum. The government is committed to develop the country through various efforts and accompanying national economic and social development strategies and policies.

Agriculture and pastoralism are the main sources of livelihood for about 80 percent of Eritrea's population. The agricultural sector depends mainly on rain, with less than 10 percent of the arable land currently irrigated. Consequently, productivity is low. The agricultural sector, including livestock and fisheries, accounts for only one-fifth of the gross domestic product (GDP). Agriculture accounts for only 11.6% of the GDP as compared to 30.6% for industry, and 57.8% for services.

Eritrea has abundant natural resources including arable land (26% of the total area) of which only about 4% is under cultivation (PHS, 2013). Although surface water is inadequate in Eritrea, there are adequate supplies of ground water, particularly in the western lowlands and in some parts of the coastal plains that can be used for both household and industrial purposes. Eritrea also has varied and extensive mineral resources including copper, gold, iron, nickel, silica, sulphur, and potash. Good quality marble and granite also exist in large quantities. The Red Sea offers opportunities for

the fishing industry, for expanding the salt extraction industry, tourism, and other economic resources.

Forestry and fishing currently account for less than 5% of GDP; artisanal fishing also makes a large contribution to the informal subsistence sector of the coastal economy. Historically, the fishing sector peaked in the 1950s at a catch of 25,000 tons when there were around 20,000 fisher-folk. Currently, the artisanal sector lands around 700 tons per annum; the catch from artisanal fisheries increased to 3,773 tons in 2009, but remains at an average of 1,000 since then. Egyptian trawlers enter into contract with the government of Eritrea to fish along the Eritrean coast of the Red Sea. A maximum catch of 12,000 tons was recorded in 2000. (MoMR report). The total Maximum Sustainable Yield (MSY) from the Eritrean Red Sea continental shelf area of 52,000 km² is estimated to range from 36,000 to 79,500 tons per year (De Grissac and Negussie, 2007).

Eritrea's industrial base is still extremely narrow and is made up mostly of small- and medium-scale consumer-goods producing industries (food, beverages, leather goods, textiles, etc.) whose technology is largely out of date as a result of neglect of investment during the long war. Industry and manufacturing accounted for around 25% of GDP in 1995 but production of this sector was increasing by around 50% per annum. A summary of key physical, economic and social indicators is included in Table 1 below (reference). Selected physical, economic and social indicators for Eritrea are given in Table 1.

The Eritrea Biodiversity Stocktaking Assessment Report (DoE, 1999) and the National Biodiversity Strategy and Action Plan (NBSAP, 2000), categorized the Eritrean biodiversity under three main ecosystems. This new version (NBSAP, 2015) has also maintained the three ecosystems as listed below:

- The terrestrial ecosystem,
- The coastal, marine and islands ecosystem, and
- The agricultural ecosystem.

3.3. Biodiversity Profile (Biodiversity facts)

3.3.1 Terrestrial biodiversity

Establishment of protected area represents the State's commitment towards achieving the goal and targets of the National Protected Area System (PAS) as outlined in the NBSAP (2015). Currently draft report of protected area proclamation, institutional framework for establishment and management, biodiversity conservation training program, biodiversity conservation monitoring strategy and strategy for the conservation and financing of PA's have been prepared. Semienawi and Debubawi Bahri protected area (106,000ha) and the elephant sanctuary of the Gash-Setit corridor (44,000ha) are already delineated and mapped. In the Buri Errori and Hawakil, however, no progress has been made in terms of delineation and management zoning.

Generally, the knowledge of the status of individual terrestrial species is incomplete and the recent records are few and insufficient to provide clear data on present day distributions of species. The status of terrestrial biodiversity in Eritrea at the species level can be summarized as follows.

Table 1: Selected Physical, Economic and Social Indicators for Eritrea

	Parameter	Measure	Unit
General	Land Area*	124,320	km ²
	Forested*	1	% of land area
	Coastline (mainland)*	1,350	Km
	Continental shelf*	52,000	km ²
	GDP Per capita**	544	USD
Social Indicators*	Population	3.5	Million
	Population Growth Rate	2.8	% per annum
	Rural	35	%
	Population Density	29	per km ²
	Life expectancy at birth	62	Years
Water***	Access to safe water	78	%
	Access to improved sanitation	11.3	%
	% of urban population	>90	%
	% of rural population	>70	%
Education****	Female literacy rate	56.5	%
	Adult literacy rate	64.6	%
	Literacy rate (15-24 yr-olds)	85.2	%
	Primary school enrolment	GER 98%-NER 76.7%	% of relevant population
	Junior secondary enrolment	GER 67.3%-NER 38.3%	% of relevant population
	Secondary school enrolment	GER31.7%- NER 23.2%	% of relevant population
	Pupils per teacher (Primary)	PR 1:41 - MD 1:44 - SEC: 1:54	
	Pupils per textbook	PR 1:1 -MD 1:1 -SEC: 1:1	

Source: *PHS (2013), **World Bank (2013), ***MoH-HRD report (2013) ****WRD assessment report (2011) *****MoE Research and Statistics (2012)

Mammals

According to IUCN Red List 2018, Eritrea is home to a number of globally rare and endangered species. Mammals such as the African wild ass (*Equus africanus africanus*), Nubian Ibex (*Capra ibex nubiana*), and African Elephant (*Loxodonta Africana*) are among the endangered and the Dorcas gazelles (*Gazella dorcas*) and Soemmering's gazelle (*Gazella soemmerringi*) are listed as vulnerable. Currently, no assessment is conducted on the ecological and conservation status of those threatened species. However, there are some initiatives to conserve globally critical endangered species of the African Wild Ass. Based on Futsum (2016) thesis report, the African Wild Ass is distributed within an area of 11,000 km² in Denkalia region of Zoba Debubawi Keih Bahri and their population size has fluctuated up and down due to drought and competition for food with livestock. Furthermore, Eritrean gazelle (*Eudurcas tilunora*) has been re-discovered after being out of the checklist of Eritrean Mammals for more than 80 years. According to IUCN the species is endangered and it lives within the horn of Africa, primarily along the Nile River (FWA report 2018).

Birds

Presently, there is no updated information about the conservation status of Birds species in Eritrea. However, study made by Redman et al., 2009, reported that out of the 60 endemic birds to the Horn

of Africa, 17 species are found in Eritrea (e.g. Wattled Ibis, Abyssinian woodpecker, Thick-billed Raven, Banded barbet etc.). In addition, there are 6 nearly endemic birds (e.g. White checked Turaco, White rumped Babler, etc.). Moreover, 17 species of Western or Sahelian bird species found in Eritrea are hard to find elsewhere in the Horn of Africa (e.g. Orange River Francolin, Long-tailed Nightjar, Cricket Warbler etc.).

Amphibians and Reptiles

Until recently the known herpeto-faunal records were mostly obtained during the Italian Colonial period (1889-1941). Since then, not much study was made as far as the amphibians and reptiles are concerned and the knowledge of the diversity of reptiles and amphibians in Eritrea has been very limited. In the last four years, a collaborative survey was conducted by Dr. Theodore Papenfuss from University of California and Mr. Futsum Hagos from FWA of the State of Eritrea. During the study, more than 10 reptile species (mainly lizards) were recorded in Eritrea. Moreover, one species of amphibian, Asmara toad, was believed to have been extinct but rediscovered during the study. The team have also recorded that there are diversified types of fresh water turtles. One of the prominent turtle species recorded during the study was the Eritrea Side-Neck Turtle (*Pelomedusa gehafie*), a species found only in Eritrea that had not been observed in a century and was feared extinct (FWA report 2017).

Flora

Plant biodiversity in Eritrea has been relatively documented; much of this information is only available outside of Eritrea, notably in Ethiopia and Italy. In Eritrea, today, plant diversity is under-collected and under-studied by different relevant stakeholders and institutions. Since the last three years various BSc and MSc thesis have been carried out by the Eritrea Institute of Technology, Hamelmalo Agricultural College and the College of Marine Science and Technology. Draft national plant checklist was prepared. A number of regional vegetation descriptions exist and are summarised in the Eritrea Biodiversity Stocktaking Assessment Report. A total of 55 tree species have been listed in the Forestry and Wildlife Conservation and Development Proclamation No. 155/2006 as nationally endangered/threatened species, but the quantitative basis for this status is not clearly documented.

Other Taxa

Recently, for all other taxa like invertebrates and microbes, the level of knowledge of diversity makes compilation of national checklists impossible. There are a few collections of insect, plant and microbe agricultural pests at the Ministry of Agriculture under the National Agricultural Research Institute and at the Eritrean Institute of Technology and Hamelmalo Agricultural Colleges and a list of weeds and insect pests is provided in the Eritrea Biodiversity Stocktaking Assessment Report. This is one of the major gaps to be filled by the relevant institutions in the future.

3.3.2 Marine biodiversity

There is no systematic taxonomic work done in the Eritrean coast. The Ministry of Marine Resources have been investigating the mega-fauna, mangrove, and corals of the Eritrean coast. COMSAT has done preliminary taxonomic works mainly in the form of students' research projects. Thus, there is limited information regarding the biodiversity of the Eritrean coast. The following summary is based mainly on literature review on studies conducted in other parts of the Red Sea.

Marine Plants and Algae

a) Seaweed

Papenfuss (1968) compiled a catalogue of previously published records of Red Sea algae, totalling 493 specific and intraspecific taxa, of which 116 (24%) were in the genus *Sargassum*. Intensive collection of seaweeds was carried out by 1962 and 1965 Israel South Red Sea Expeditions. An overall account of the collections made by the Israeli expeditions was published by Lipkin & Silva (2002). This account treats 127 specific and intraspecific seaweed taxa representing 73 genera. Among these algae, 13 genera and 47 species had not been recorded previously from the Red Sea.

In their survey of seaweeds from the Eritrean coast of the Red Sea, Ateweberhan and Van Reine (2005) identified 101 specific and intraspecific taxa, including 26 Chlorophyta, 20 Phaeophyta and 55 Rhodophyta. The survey resulted in 36 new records for Eritrea (11 Chlorophyta, 7 Phaeophyta and 18 Rhodophyta). Of these Eritrean records, 26 are new for the Red Sea (5 Chlorophyta, 4 Phaeophyta and 17 Rhodophyta).

Table 1. Number of specific and intraspecific taxa of macroalgae reported from Eritrea (Ateweberhan and van Reine, 2005)

	Chlorophyta	Phaeophyta	Rhodophyta	Total
Previous records	39	101	110	250
Reported by Ateweberhan and VanReine, 2005	26	20	55	101
New records by Ateweberhan and van Reine, 2005	11	7	18	36

b) Sea grass

Investigations conducted from 2005 to 2007 by the ECMIB project reported that out of the 60 species of sea grasses existing worldwide, 10 species were recorded from the Red Sea coast of Eritrean. These species include: *Thalassia hemprichii*, *halassodendron ciliatum*, *Halodule uninervis*, *Syringodiun isoetifolium*, *Halophila ovalis*, *Halophila stipulacea*, *Cymodocea rotundata* and *Enhalus acoroides*. The majority of the shallow intertidal zones in Eritrea are dominated by *Thalassia hemprichii* and by *Halodule uninervis* (co-dominance). *Enhalus acoroides* stands are also found covering large areas at depths below 4m in specific sites, such as Norah Island (De Grissac and Negussie, 2007)

c) Mangrove

According to De Grissac and Negussie (2007) about 380 km of the Eritrean mainland and islands coastlines are occupied by mangrove forests. Of the seven mangrove species present in the Red Sea area, three are recorded from the Eritrean coast. These species are namely *Avicennia marina*, *Rhizophora mucronata* and *Ceriops tagal*.

Marine Animals

a) Marine Invertebrates

The Red Sea is rich in invertebrate biodiversity. Taxonomy of marine invertebrates is very difficult because many of the species are small in size and a number of them are cryptic. There are only a few taxonomic studies conducted on the invertebrates of the Eritrean coast. These studies are limited to corals, sea cucumber, and to some extent shrimp. However, taxonomy of the following invertebrates remains unknown: protozoa, porifera, worms,

arthropods (with the exception of commercially important shrimp), molluscs and echinoderms (with the exception of sea cucumber). These studies show that there are 18 species of sea cucumbers (Kaleab, et al., 2008) and 6 species of shrimps in the Eritrean Red Sea.

b) Marine Fishes

The Red Sea is rich in fish species diversity. According to Golani and Bogorodsky (2010) there are 1078 species of fish in the Red Sea belonging to 154 families, 25 orders and two classes. Ormond and Edwards (1987) pointed out that about 18% of the Red Sea fishes are endemic to the area. It should be noted that the available information on Red Sea fishes was mainly gathered from the Northern part of the sea and there is little information on the fish diversity from the southern Red Sea.

Students of COMSAT compiled the list of fishes for the Eritrean coast for their senior research projects (Lielti, et al., 2019). These students found that 715 fish species were reported from the Eritrean coast in the literature. Out of these 574 species are reported in the global fish database (www.fishbase.org), 64 species in the FAO fish identification book, and 553 reported by Golani and Bogorodsky (2010). But they recommended that the list has to be refined before a definite answer could be given regarding the diversity of fish of the Eritrean coast.

c) Marine Reptiles

There are seven species of sea turtles: the Leatherback (*Dermochelys coriacea*, family Dermochelyidae), the Loggerhead (*Caretta caretta*), the Hawksbill (*Eretmochelys imbricata*), the Olive ridley (*Lepidochelys olivacea*), the Kemp's ridley (*Lepidochelys kempi*), the Green turtle (*Chelonia mydas*) and the Flatback (*Natator depressus*) (all in the family Cheloniidae). According to the MoMR, of the seven turtle species, five occur in the Eritrean coast of the Red Sea. These species are: Green turtle (*Chelonia mydas*), Hawksbill turtle (*Eretmochelys imbricata*), Olive Ridley turtle (*Lepidochelys olivacea*), Loggerhead turtle (*Caretta caretta*), and Leatherback turtle (*Dermochelys coriacea*) (De Grissac and Negussie, 2007).

d) Marine Birds

As per 2005 and 2007 ecological surveys, 78 species of seabirds and shorebirds have been identified, of which 22 are known to breed on the islands, mainly in summer. While 25 species are true seabirds belonging to different families such as tropic bird, booby, gull, tern and cormorant, the remaining utilize the marine environment partly or completely, including families such as pelican, spoonbill, heron, flamingo, duck, plover and sandpiper (De Grissac and Negussie, 2007).

e) Marine Mammals

In their recent publication on cetaceans of the Red Sea, Notarbartolo, et al., (2017) provided detailed information on the biodiversity of cetaceans in the Red Sea. The work documented that the Red Sea is home to 16 species of cetaceans of which 7 are whales and 9 are dolphins. Out of the 16 species recorded in the Red Sea, 14 have been recorded in the Eritrean coast. In fact, two of these species, the dwarf sperm whale (*Kogia sima*) and the rough-toothed dolphin (*Steno bredanensis*), have so far been sighted from the Eritrean coast only

3.3.3 Agricultural biodiversity

Status of threatened and endangered species and strengthening their management strategies

Eritrea being as the centre of origin for several field crops, there are clear indicators of rich genetic diversity both in cultivated and wild forms. Besides, diverse species of vegetables and fruit tree biodiversity existed in the country. There is also animal biodiversity unique to Eritrea. However, some of these agricultural biodiversity species are on the verge of being endangered or threatened. The major factors that lead to the level of such risk include:

- Disturbance of the ecology of agricultural biodiversity: These includes population pressure that lead to excessive clearing of woodlands for agriculture disturbs the wild crop species and fruit trees, inappropriate farming practice such as mono cropping and dependence on few crop species only and ignoring the rich landrace diversity. War is also another human induced factor that affects the ecology of agricultural biodiversity.
- Climate change (recurrent drought, fluctuation in the amount and poor distribution of rainfall). This is believed to cause serious genetic threat to crops which result to endangering or extinction of crops and animals.
- Disease and insects: Some landrace varieties are abandoned by farmers due to their susceptibility to diseases and pests.

a) Crops

During the last 5-6 decades, plants, animals and ecosystems have been seriously affected by genetic erosion potentially caused by war, drought and pests. Drought in Eritrea is the most limiting factor for crop production and also a cause of genetic erosion. The statistical data of the annual rainfall, both spatial and temporal, registered in the last 50 years shows a great decline in amount and an increase in the variability of rainfall distribution. The recurrent drought the country encountered during the last 2 – 3 decades and erratic nature of rainfall influence farmer's choice on crop varieties. Due to these circumstances, farmers prefer varieties that cope with drought or early maturing crops are only selected and there is a condition of neglecting late maturing or long season varieties.

For instance, study undertaken on sorghum indicate that early maturing variety, (47%) reported to consider as good variety by the household farmers while 32% express giving reasonable yield during unfavourable conditions and 21% adaptability consideration (Tesfamichael, et. al., 2013). The same study explored that as a result of recurrent droughts some varieties are disappearing including *Gunseber*, *Aklamoya*, *Kinibiba* and *Ajebaidu* (extinct); *Amige*, *Korokora*, *Brown chimro*, *Feterit*, *Arfaegedam*, *Anseba* and *Kibra* (grown in limited area).

Four row barley landrace varieties such as *Kuinto* is almost not growing due to lack of tolerance to drought while the six row and *Dessie variety* are under cultivation in limited areas of the Central highlands. Eritrea was recognized among others as centre of origin for emmer wheat *Ales* (*Triticum diccoun*) which was on the verge of extinction. Currently some efforts are going on by the MoA and concerned farmers to repatriate the crop for cultivation in the country.

Most landrace varieties of maize used for several decades in Eritrea are disappearing which is considered among the most genetically eroded crops in the country due to drought and pests such as fall army worm. Currently, its cultivation is limited in areas with supplementary irrigation such as spate irrigation in Eastern lowlands and in the highlands of semi commercial farming as offset of vegetables or mixed crop.

Disease and insects are also believed causing serious genetic threat to crops. Some landraces varieties are abandoned by farmers due to their susceptibility to pest. There is a worrying situation in the production of the Wheat locally called *Manna keih* and *Manna guandie* are disappearing due

to susceptibility of the variety to down mildew. Recently introduced new insects such as Woolly white fly (*Aleurothrixus floccosus*) affecting Citrus, Banana white scale, Tomato leaf miner (*Tuta absoluta*) and Date palm white scale are affecting production severely. Stem rust (*Puccinia graminis*) is a very dangerous disease of wheat and barley in the world.

Area covered by pulses and oil seed are steadily decreasing. The cultivated area of chick pea, the major pulse food crop sown is decreasing in certain areas due to heavy root rot attack problems.

Linseed and Niger seed were cultivated both for home use and marketing. Currently these crops are grown in limited areas and their cultivation is declined in the country primarily due to drought and farmer's preference to grow basic food crops and availability of cheap imported edible oils.

Indigenous leafy vegetables are among the most important for food and nutritional security. These vegetables are wild and grow in fields as weeds but now days most of them are found in very scares condition. The cause could be combination of drought and human intervention. Wild leafy vegetables like *Gynandropsis gynendra*, *Colocasia esculentum* and night shade species, are on decline over the last three decades, mainly because of droughts, application of herbicides and loss of know-how on their uses.

Wild food/ fruit trees and fodder crops are also among the endangered species that include *Mimusops kummel*, *Tamarindus indica*, *Adansonia digitata*, *Hyphaene thebaica*, *Balanites aegyptiaca*, *Ficus vasta*, *Ximenia Americana*, *Ziziphus spina-christi*, *Sclerocarya birrea*, *Syzygium guineense* and *Diospyros mespiliformis* (African ebony). Some efforts have been made to domesticate some of these endangered wild tree fruits and fodder trees.

b) Pasture species

A collection mission undertaken in 2004 resulted in collection of a total of 238 accessions from 53 legume pasture species (Snowball, et al., 2012). The pasture establishment during rainy season was poor and many species of pasture legumes encountered during the 2004 germplasm collecting mission were found to be scarce. The situation is not improving unless otherwise worsening. The pastures in the highlands are infertile and steep, hence fragile under continuous uncontrolled grazing regimes. The grazing area has been shrinking over the years because of over-grazing, extensive cultivation, improper utilization of water resources and deforestation. The removal of forest cover and constant grazing has depleted the resources of the browse layer. The pastures have no opportunity to recover because hungry animals are continuously searching for any edible plant that sprouts. Attempts to allow regeneration by closing land to grazing have shown promising results and are becoming models for recovery. However, generally because of the above mentioned reasons the most palatable species of herbage and browse are decreasing in quantity and leaving space for less palatable species. If the present trend of deterioration persists for much longer, it may not only destroy the palatable species completely but it could also change the land to bare soil and initiate the process of desertification.

Enclosures have been established in Mai Mine and Goluj Sub-zobas of the Zoba Debub and Zoba Gash Barka respectively for the purposes of regenerating the native pasture species and ultimately improve availability of grazing feed. In addition, sites around Goluj are enclosed and sowed with grass species of *Urochloa trichopus* (*Abertata*) which was collected from Mensura sub region (NBSAP, 2015).

c) Livestock

At present, the diversity of indigenous livestock species is relatively intact - all breeds are still widely distributed, population numbers are increasing and the rate of introduction of improved stock from overseas is also increasing (Table 2). Limited efforts have been done on morphological characterization of the Eritrean Barka cattle, this local breed still under threat that needs effective

conservation measures. So, there is a need to thoroughly characterize the indigenous livestock breeds in general and Barka cattle in particular as part of the national livestock improvement program in order to guarantee that the best characters of the different breeds can be sustained and used for future breeding work.

Table 2: Estimated Livestock Population, Nationwide (MoA, 2019).

Livestock type	Livestock Population (millions)
Cattle extensive –Traditional	2.38
Cattle intensive -Pure & cross breeds	0.024
Sub-total Cattle	2.40
Goat	5.75
Sheep	2.62
Camel	0.39
Total	11.16

Agricultural biodiversity conservation and status of management strategies

The Government of Eritrea initiated the establishment of a Gene Bank, administered under the National Agricultural Research Institute of the MoA, for the collection, conservation and documentation of PGR. The objective of biodiversity conservation is to minimize loss of PGR due to genetic erosion. Inside the PGR there is an *ex-situ* collection of agro-biodiversity resources program maintained by the Agricultural Crops Genetic Resources Unit of the division. The gene bank has limited capacity for collection, storage and characterization of agro-biodiversity. So far a total of 5000 accessions, predominantly cereals, legumes, oil crops and wild relatives have been collected and stored. This represents a considerable amount of the total crop landrace variation in Eritrea.

There are relatively good linkages between the gene bank and international organizations concerned with PGR conservation. Among these good linkages exist with ICRISAT, ICARDA, Biodiversity-International, FAO and ITPGRFA. Such linkages help to update on the latest information of plant genetic resource conservations.

Eritrea also possesses wealthy genetic resources of animals. Among these are indigenous cattle especially Barka breed. Barka breed form the backbone of relevant and sustainable livestock production in Eritrea. This is because they are better adapted to survive and reproduce under harsh environments compared to high performing exotic breeds. Moreover, they require less input and management. However, there have been limited research activities on the conservation and management and characterization of the Animal Genetic Resources despite characterization of sheep was conducted recently. Therefore, the management plan will focus to the morphological and phenotypic characterization of animal genetic resource in general and the Barka breed in particular.

For safer maintenance and enhancement of PGR, *ex-situ* conservation must be complemented by *in-situ* and on-farm conservation methods. The gene bank has been assembling mainly orthodox seeds of field crops and wild species but urgently it should include vegetative propagated plants and old varieties of orchards in vicinity of the gene bank. The Forest Genetic Resources Conservation Program requires primarily human capacity building. Furthermore, it needs appropriate storage facility, materials, and equipment. Therefore, establishing tree and shrubs seed bank, botanical garden and arboretum are of priority task of the concerned organizations.

There is an insufficient skilled manpower and facility or materials in Animal Genetic Resources Conservation and Management Unit at the NARI. Hence technical and capacity building requires to fully functional. Priority will be given to genotyping the Barka cattle breed for assessing genetic diversity for conservation and management of the resources and ultimately to exploit the resources in sustainable way. Providing technical and material support through project to strength on-farm conservation of Barka cattle breeds is an urgent need. On-farm conservation of Barka cattle breed could be complimented by maintaining semen in cryopreservation method.

3.3.4 Main pressures on & drivers of change to biodiversity (direct & indirect)

In Eritrea, the three ecosystems are facing threats due to land degradation, deforestation, erratic rainfall patterns, and land use changes. In the Marine and Coastal areas, the threats to the rare, endangered and threatened species are usually related with the pressure put by humans through fishing, moderate pollution and coastal developments. The corals of the Eritrean coast are particularly subject to periodic high temperature which causes massive bleaching in shallow areas.

In the terrestrial environment, deforestation, land degradation, over grazing/over browsing, invasive alien species and habitat transformation (land use changes) are identified as a major threat to the loss of biodiversity. Habitat degradation and loss are occurring due to several factors that include: clearing of woodlands for agriculture, cutting of live trees for firewood, expansion of settlements, villages and towns, and to a lesser extent coastal pollution.

In the agricultural environment, there is a pressure on the agro biodiversity due to the climatic changes which is causing changes in the amount and distribution of rainfall that is threatening the local landraces. New and improved varieties are slowly being used by the farmers and they may replace landraces and possibly lead the extinction of the few landraces. In the local livestock breeds there is a threat coming from drought and lack of browse and management in some localities.

3.3.5 Measures to enhance implementation of the Convention and Implementation of the NBSAP:

Although Eritrea did accede to the UNCBD and prepare its NBSAP (2014-2020) as its obligation to the convention, the rate of implementation of the action plan was slow. This is mainly because there was no specific fund allocated for implantation of the strategic pan. Thus all of the activities planned in the NBSAP were being implemented by all relevant sectors as part of their national mandate. Therefore, expenses related to implementation of the NBSAP activities came from Government funding and to some extent from development partners.

For Eritrean NBSAP to be managed and implemented successfully and therefore achieve its objectives there is a need to coordinate activities more effectively, raise the awareness of all bodies concerned, mainstream the activities with different stakeholders, build capacity, and mobilize resources.

Thus the CBD focal point, in collaboration with relevant stakeholders, need to work on the following key actions for conservation, sustainable use and equitable sharing of biological resources and ecosystem services of the country:

- Improve the integration of traditional knowledge with scientific research to enhance the skill, capabilities and competence of relevant stakeholders on the conservation of biological diversity.
- The improvement of the scientific knowledge base (e.g. taxonomy) of biodiversity by continually organizing awareness campaigns and involving all stakeholders in the endeavor and especially streamlining the concept in the educational system in a more workable way.
- Work closely with the relevant Institutions and local communities to enhance the sustainable use of biodiversity and ecosystem services.
- Strengthen the integration of biological diversity considerations into all sectoral plans, programs, policies and strategies
- Intensify the participation of all citizens on conservation, development and sustainable use of biological diversity.
- Review and update existing sectoral legislations pertinent to biological diversity and also develop and enforce new legal instruments such as Protected Area Legislation.
- Strengthen the implementation of the National Environmental Impact Assessment Procedures and Guidelines to ensure all development projects and activities are environmentally sound.
- Support biodiversity related awareness raising programs and information sharing at all levels, including the use of the CBD Clearing House Mechanism.
- Establish and secure appropriate resource mobilization for biological diversity conservation and sustainable use.
- Strengthen the use of alternative energy sources so as to reduce the pressure being imposed on natural resources in general and biological diversity in particular.
- Harmonize biodiversity conservation actions with various activities of environmental conventions and agreements to which Eritrea has signed.
- Enhance regular monitoring and evaluation on the implementation of NBSAP.
- Enhance the human capacity of the relevant institutions including the focal point and the stakeholders so as to effectively implement and manage the activities of the strategic plan.

3.3.6 Overall actions taken to contribute to the implementation of the Strategic Plan for Biodiversity 2011-2020:

- Awareness raising and training programs conducted at different levels.
- Small projects like SLM, LDN, Mangrove Rehabilitation, degraded landscape restoration etc. have been implemented.
- Afforestation and greening day events are done nationwide yearly.
- Two proposed protected areas have been delineated and several management tools prepared. In addition, regulatory instrument for the establishment and management of all Protected Areas is drafted.
- Some management interventions on invasive alien species are being undertaken.

3.3.7 Support mechanisms for national implementation (legislation, funding, capacity-building, coordination, mainstreaming)

In Eritrea, as mentioned previously, resource mobilization for the smooth implementation of the NBSAP is not sufficient. However, there are legislations relevant for the implementation of the CBD objectives. In terms of capacity building (both human and infrastructural) efforts have been carried at different levels but requires further action through the involvement of the relevant bodies. Insufficient coordination between stakeholders seems to reduce the impact of the efforts made by various institutions and this needs to be improved. Mainstreaming biodiversity into sectoral policies could be one of the measures that could enhance BD conservation and utilization.

3.3.8 Challenges

The main challenges in the conservation of BD in Eritrea comprise the following:

- Despite the efforts made in terms of awareness raising, human pressure on the use of biological diversity is still high. Therefore, awareness raising on conservation and sustainable use of biodiversity at all levels should be intensified.
- Biodiversity should not be left to one organization such as Ministry of Land Water and Environment. It should involve all stakeholders and a concerted effort is required to safeguard the biological resources of the country.
- Some components of existing Biodiversity such as insects, reptiles, amphibians, weeds, fungi, etc. are not well documented. Hence, a nationwide assessment should be done at the earliest possible time.
- Inadequate integration and coordination of biodiversity issues, especially at the local level, including the implementation of activities established for in-situ and ex-situ conservations, invasive alien species, agricultural biodiversity and traditional knowledge
- Shortage of taxonomic knowledge is one of the hindrances to the proper documentation of BD. Thus there is a need for an herbarium for biological reference. The country also needs to establish a botanical garden and a museum where some of the available BD can be conserved and also where the population could learn and enhance the existing knowledge of BD. In this endeavor the young generation needs to be addressed.
- Encroachment of biodiversity hot spots in the country should be curbed.
- Insufficient resource mobilization for the conservation of biological diversity hinders the smooth implementation of NBSAP and thus securing of funds and other resources is imperative.
- Inadequate monitoring and evaluation in the implementation of BD related activities.

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Annex 1. Methodology

The assessment process used to compile data for this report, was following the CBD 6th National Report Tracking Tools and assessing the effectiveness, efficiency, sustainability and impact of the planned actions in the NBSAP Eritrea. The consultants collected secondary data from literature (relevant publications, strategic action plans, implementation plans and progress reports) and analysed them, interviewed experts in the ministries (implementing agencies) and their partners/stakeholders, etc. questionnaire aiming at evaluating the overall Goals and Targets including the E-Targets of the NBSAP was prepared, distributed to relevant ministries/organizations and captured the achievements made in the conservation and sustainable use of terrestrial, marine and coastal, and agricultural biodiversity.

Furthermore, the team also organized site visits to observe the biodiversity hot spot areas in a) Dahlak Archipelago coral reefs and mangrove plantation, and Massawa area and Durgela Island coral reefs b) the Wild Ass area in Danakil and the Elephant Sanctuary in Gash Barka Area, and c) for Agrobiodiversity in Zoba Gash Barka Guluj and Omhajer areas, and Zoba Debub- Imni Hayli and Kudobuur localities and Gene bank collections in Halhale.

The list of implementing organizations/ stakeholders consulted and persons contacted for the data and information collection are provided in Annex 2 and 3. In addition, a task force was established from the relevant ministries and implementing bodies of the NBSAP to ease the flow of information and get detailed information on progress made.

The team assessed the progress of measurable outcomes of the project targets as stated in the matrix of project activities and measured the achievements of each activity by assessing the indicators for each target. This was at ecosystem level (Terrestrial, Marine and Coastal, and Agricultural).

The team also assessed progress made towards achieving the Aichi Biodiversity Targets (ABTs) and Sustainable Development Goals (SDGs). Moreover, an update of the Biodiversity Country Profile has been included.

The writing of the 6th National CBD report is based on the resources manual for the 6th National CBD Report preparation given by UNEP/CBD/COP/13/21 and also upon the modification of the content recommended by the country CBD focal point, the DoE, MoLWE. Moreover, the report was validated in a workshop conducted on the 17th December 2019 (Annex-4)

Annex 2. Persons interviewed and offices visited during CBD Survey

	Full Name	Position	Zoba
1.	Abubeker Osman	DG, Agriculture and Land	Gash Barka
2.	Tekeste Kiflemariam	Division Head ,Forestry and Wild life	Gash Barka
3.	Goitom Hailemichael	Division Head, Crop Development	Gash Barka
4.	Abraha Gebreamlak	Division Head, Environment	Gash Barka
5.	Hagos Gebremariam	Regulatory Services	Gash Barka
6.	Daniel Frezghi	Irrigation Engineer, SWC	Gash Barka
7.	Bahta Tedros	DG, Agriculture and Land	Anseba
8.	Kesete Tesfatsion	Division Head Forestry and Wild Life	Anseba
9.	Yonas Abraha	Crop Development	Anseba
10.	Zeray Nur	Division Head of SWC & Irrigation	Anseba
11.	Tsegazeab Embaye	Animal Production	Anseba
12.	Daniel Mehari	Regulatory services	Anseba
13.	Teklemariam Zerom	Head Planning and Statistics	Anseba
14.	Zenawi Okbaeab	Plant Protection	Anseba
15.	Kiflay Woldu	Head Soil and Water Conservation	Anseba
16.	Dawit Kibreab	Division Head, Environment	Anseba
17.	Yemane Abay	DG, Agriculture and Land	Debub
18.	Kiflemariam Andebrhan	Agronomist	Debub
19.	Tesfamariam Tekle	Division Head, SWC& Irrigation	Debub
20.	Ghebremichael Berhe	Division Head, Forestry and Wild Life	Debub
21.	Zaid Tekle	Beekeeping expert	Debub
22.	Michael Tekie	DG, Agriculture and Land	SKB
23.	Sansom Zekarias	Division Head, Ministry of Marine Resources	SKB
24.	Huruy Yohannes	Division Head, SWC & Irrigation	SKB
25.	Daniel Kesete	Unit Head Horticulture	SKB
26.	Semere Yohannes	Division Head, Environment	SKB
27.	Mahmud Husain	Unit Head, Animal Health & Protection	SKB
28.	Daniel Tekie	Division Head, Animal Resources	SKB
29.	Mulubrhan Ghebreyohannes	Division Head, Environment	Maekel
30.	Yakob Yohannes	Division Head, Regulatory Service Department, MoA	Maekel
31.	Mahta Goitom	Division Head, Marine Research	MMR
32.	Mekonen Shishay	Staff Fisheries Research	MMR
33.	Tekle Mengistu	Director, Office of the Minister	MMR
34.	Mehari Fessehazion	Head of Program, Mangrove Plantation	MMR
35.	Tesfamariam Arefe	Head, Habitat & Conservation Unit	MMR
36.	Efrem Kiflemariam	Unit Head, Department of Environment	MoLWE
37.	Amanuel Mahdere	Division Head, Genetic Resource	MoA
38.	Michael Berhane	Unit Head Soil & Water Conservation	MoA
39.	Estifanos Bein	Technical Advisor, Department of Environment	MoLWE

Annex 3. List of 1st Consultative Workshop Participants (August 16, 2019)

No	Full Name	Organization/ Institution	Remark
1.	Dawit Siyum	MoT	
2.	Dr. Yishak Gebrekidan	College of Science	
3.	Meron Ghirmay	College of Science	
4.	Astier Redaezghi	MoLWE, DoE	
5.	Mekonnen Araia	MoEM	
6.	Dr. Woldeselasia Ogbazghi	HAC	
7.	Aman Saleh	MoLWE, DoE	
8.	Amanuel Bokrezion	MoLWE, DoL	
9.	Simon Kefela	MoA	
10.	Efrem Tesfai	MoF	
11.	Mebrahtu Iyassu	MoLWE, DoWR	
12.	Kibrom Asmerom	MoLWE, DoE	
13.	Mebrahtu Zewde	BS&E	
14.	Bereket Hailezghi	MoA, RSD	
15.	Dawit Kibreab	MoA	
16.	Mussie Robel	FWA	
17.	Tekeste Kiflemariam	FWA	
18.	Mussie Fekadu	NARI	
19.	Asmerom Fkadu	MoA, RSD	
20.	Mogos Woldeyohannes	MoLWE, DoE	
21.	G/meskel Tewelde	MoA, Anseba	
22.	Berihley Gebreslasie	DoE, Debub	
23.	Tekie Teklemichael	DoE, Debub	
24.	Abraha Gebreamlak	MoLWE, Gash Barka	
25.	Mehari Fsehatsion	MoMR, NRS	
26.	Tekue Kidane	MoA&Land, NRS	
27.	Mekonen Shihay	MoMR, NRS	
28.	Abdu Mohammed Ali	MoLWE, SRS	
29.	Dr. Zekeria Abdulkerim	College of Science (/COMSAT)	Consultant
30.	Dr. Tesfamichael Abraha	HAC	Consultant
31.	Angesom Abraham	College of Science	Consultant
32.	Dr. Bissrat Ghebru	BS&E/HAC	Consultant
33.	Futsum Hagos	FWA	Task force
34.	Efrem Kiflemariam	MoLWE, DoE	Task force
35.	Amanuel Mahdere	NARI	Task force
36.	Abdella Omer	HAC	Task force
37.	Zekarias Andebrhan	College of Science	Task force
38.	Elias Gebreluul	College of Science (/COMSAT)	Task force
39.	Michael Berhane	MoA	Task force
40.	Tesfamariam Arefe	MoMR	Task force
41.	Estifanos Bein	MoLWE, DoE	Task force

Annex 4. List of Validation Workshop Participants (December 17, 2019)

No	Full Name	Organization/ Institution	Remark
1.	Dawit Siyum	MoT	
2.	Dr. Yishak Gebrekidan	College of Science	
3.	Astier Redaezghi	MoLWE, DoE	
4.	Aman Saleh	MoLWE, DoE	
5.	Amanuel Bokrezion	MoLWE, DoL	
6.	Simon Kefela	MoA	
7.	Mebrahtu Iyassu	MoLWE, DoWR	
8.	Kibrom Asmerom	MoLWE, DoE	
9.	Mebrahtu Zewde	BS & E	
10.	Bereket Hailezghi	MoA, RSD	
11.	Dawit Kibreab	MoA	
12.	Mogos Woldeyohannes	MoLWE, DoE	
13.	Berihley Gebreslasie	DoE, Debub	
14.	Tekie Tesfamariam	MoA & Land, NRS	
15.	Natsnet Haileab	MoLWE, Gash Barka	
16.	Yohannes Teclmariam	MoMR, NRS	
17.	Mahta Goitom	MoMR, NRS	
18.	Weini Ghebreslasie	MoLWE, DoE	
19.	Mulubrhan Gebreyohannes	DoE, Maekel	
20.	Adel Osman	MoLWE, DoE	
21.	Tesfai Gebremariam	MoF	
22.	Robel Kibrom	MoLWE, DoE	
23.	Petros Araya	FWA	
24.	Dr. Zekeria Abdulkerim	College of Science (/COMSAT)	Consultant
25.	Dr. Tesfamichael Abraha	HAC	Consultant
26.	Dr. Bissrat Ghebru	BS & E/ HAC	Consultant
27.	Futsum Hagos	FWA	Task force
28.	Efrem Kiflemariam	MoLWE, DoE	Task force
29.	Amanuel Mahdere	NARI	Task force
30.	Abdella Omer	HAC	Task force
31.	Zekarias Andebrhan	College of Science	Task force
32.	Elias Gebreluul	College of Science (/COMSAT)	Task force
33.	Michael Berhane	MoA	Task force
34.	Tesfamariam Arefe	MoMR	Task force
35.	Estifanos Bein	MoLWE, DoE	Task force