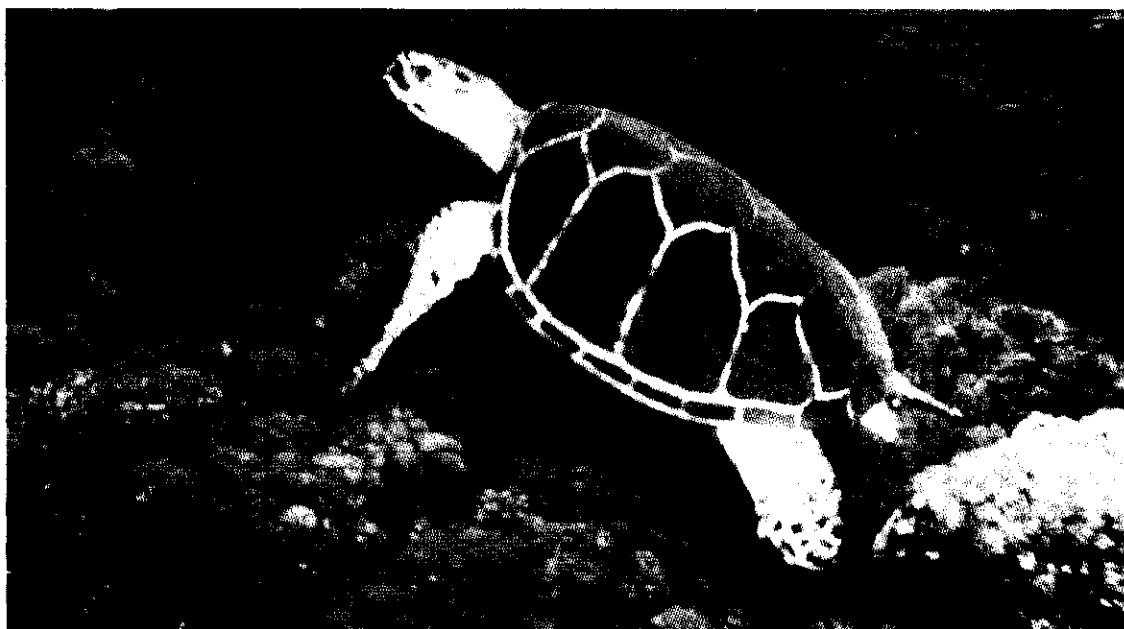


endangered African Wild Ass (*Equus africanus somaliensis*) and other terrestrial wildlife. In addition, negotiations to expand the closure system in the coastal plains are underway.



*Dolphins: Large marine mammals in the Eritrean waters of the Red Sea*



*Sea Turtle: One of the threatened marine mammals of the Eritrean waters of the Red Sea*



*Dugongs: One of the endangered marine mammals graze exclusively on seagrass of the Eritrean waters of the Red Sea*

**Strategy:** Develop and implement a participatory program for conservation and management of key CMI areas and for habitats and species of special concern outside of these areas.

**Activities:**

Activity	Responsibility (Lead Institutions and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
(i) Identify and delineate protected areas for the conservation of CMI biodiversity.	MoF/MLWE/MoA /MoLG/UoA/MoT /MTC.	Planned	Funds available	GoE/GEF
(ii) Establish protected area management plans and monitoring programmes.	MoF/MLWE/ MoA/MoLG/UoA/ MoT/MTC.	Planned	Funds available	GoE/GEF
(iii) Prepare a species conservation network and action plans for the protection of endangered endemic, migratory and/or indicator species, including marine turtles and mammals, migratory birds and sharks.	MoF/ MLWE/ MoA/ MoLG/ UoA/MoT/MTC.	Planned	Funds available	GoE/GEF

## 7.6 Ex-situ conservation

**Existing situation:** There are no current *ex-situ* initiatives for the protection of CMI biodiversity in Eritrea. Whilst there may be a strong case for captive-breeding programmes for critically endangered species, a more secure and cost-effective strategy for the protection of such species is *in-situ* conservation initiative through protection of critical habitats. *Ex-situ* interventions for the conservation of CMI species are therefore not considered as a viable option at this time within the NBSAP.

## 7.7 Taxonomic knowledge

**Existing situation:** Existing taxonomic knowledge and national capacity for acquisition of taxonomic data of CMI biodiversity is extremely limited, as highlighted in a recent independent report commissioned by the GOE/GEF-funded “Conservation Management of Eritrea’s CMI Biodiversity Project”. A sound understanding of CMI taxonomy and a national capacity for taxonomic profiling is a prerequisite for understanding CMI biodiversity, from which informed and rational decisions regarding the conservation management of CMI biodiversity can be developed. Without investment in this fundamental aspect of biodiversity knowledge, all other “down-stream” conservation, management and sustainable use activities will be compromised by “fuzzy” knowledge.

**Strategy:** Increase national capacity for CMI taxonomic data acquisition.

**Activities:**

Activity	Responsibility (Lead Institutions and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
(i) Develop national expertise in CMI taxonomy through training.	MoF/MLWE/MoA/ MoLG/UoA/MoT/ MTC.	Planned	Funds available	GoE/GEF
(ii) Establish a curated reference collection of CMI biodiversity and improve library acquisitions of key reference literature.	MoF/MLWE/MoA/ UoA/MoT	Planned	Funds available	GoE/GEF
(iii) Co-opt international expertise to assist in short-term CMI taxonomic profiling initiatives.	MoF/MLWE/MoA/ UoA/MoT	Planned	Funds available	GoE/GEF

## 7.8 Information acquisition and storage

**Existing situation:** During the course of the GEF-PRIF (Pre-Investment Facility) Project, MoF has established a pilot GIS geo-referenced database on CMI biodiversity. However, this database does not incorporate the numerous other Eritrean CMI-relevant datasets held nationally within other government agencies or other relevant datasets known to exist elsewhere. Furthermore, the structure and content of the MoF CMI database does not provide for adequate analysis or synthesis of the data sets held.

Establishment of a comprehensive CMI biodiversity database is fundamental to the goal of protecting CMI biodiversity and a prerequisite for effective CMI management. It should not be viewed simply as the existing MoF database but rather as the entirety of CMI environmental, biological, ecological and sociological data and information available to support informed CMI biodiversity management decisions.

**Strategy:** Establish a comprehensive GIS database on CMI biodiversity and related cross-cutting information.

**Activities:**

Activity	Responsibility (Lead Institutions and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
(i) Upgrade the MoF, CMI biodiversity database.	MoF/MLWE/MoA/ MoLG/UoA/MoT	Planned	Fund available	GoE/GEF
(ii) Establish a meta-database of all relevant CMI datasets and update the MoF CMI database, including data from ongoing and planned baseline and monitoring data acquisition initiatives (Section 7.2).	MoF/MLWE/MoA/ MoLG/UoA/MoT/ MTC.	Planned	Fund available	GoE/GEF
(iii) Establish data exchange linkages and forums at national, regional and international levels.	MoF/MLWE/MoA/ MoLG/UoA/MoT/ MTC.	Planned	Fund available	GoE/GEF

## 7.9 Public awareness and education

**Existing situation:** There is a strong government commitment to human resource development in recognition that education and training are essential to the national development initiatives. This applies to environment and biodiversity as well as to the economic sectors. There are already a number of projects designed to increase the productive capacity of fishing communities and other commercial sectors of the coastal communities – this needs to be integrated with more general environmental information if a sustainable development pathway is to be followed. The need to improve national expertise in CMI taxonomy has already been identified (Section 7.7) and there is an additional need to enhance national capacity throughout the technical spectrum of CMI biodiversity assessment and monitoring.

There are currently no significant national campaigns for public awareness of CMI biodiversity values. This is an important activity if full community awareness and participation in CMI biodiversity conservation is to be successfully achieved.

**Strategy 1:** Increase national capacity to undertake CMI biodiversity assessments and monitoring through education and training.

**Activities:**

Activity	Responsibility (Lead Institutions and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
(i) Undertake a national Training Needs Assessment for CMI biodiversity-related activities.	MoF/MLWE/MoA/ MoLG/UoA/MoT/ MTC.	Planned	Funds available	GoE/GEF
(ii) Identify trainees and suitable training courses and agencies (where possible, training should be conducted <i>in-situ</i> )	MoF/MLWE/MoA/ MoLG/UoA/MoT/ MTC/MoE.	Planned	Funds available	GoE/GEF

**Strategy 2: Increase public awareness of CMI biodiversity values.**

**Activities**

Activity	Responsibility (Lead Institutions and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
(i) Develop suitable CMI biodiversity awareness supporting materials and establish a national campaign and network for community-based CMI biodiversity awareness.	MoF/MLWE/MoA/ MoLG/UoA/MoT/ MTC/MoE	Planned	Funds available	GoE/GEF
(ii) Incorporate CMI biodiversity awareness programmes into the national curriculum.	MoF/MLWE/MoA/ MoLG/UoA/MoT/ MTC/MTI/MoJ/ MoE	Planned	Funds available	GoE/GEF
(iii) Develop a suitable mechanism for routine dissemination of CMI biodiversity information at both technical and non-technical levels.	MoF/MLWE/MoA/ MoLG/UoA/MoT/ MTC/MoE	Planned	Funds available	GoE/GEF
(iv) Encourage community-based involvement in CMI biodiversity assessments and monitoring (i.e. increase community 'stewardship' of CMI biodiversity).	MoF/MLWE/MoA/ MoLG/UoA/MoT/ MTC/MoE	Planned	Funds available	GoE/GEF
(v) Develop plans for a national marine aquarium and CMI educational facility.	MoF/MLWE/MoA/ MoLG/UoA/MoT/ MTC	Planned	Funds available	GoE/GEF

**7.10 Legal and institutional structure (capacity-building)**

**Existing situation:** The recently promulgated Fisheries Legislation provides a strong foundation for legal protection of CMI biodiversity. However, any legislation is only as effective as the system for its implementation. Currently, both MoF and the Regional Administration lack expertise and experience in the use of legislation to protect CMI environments. Whilst there is a need for additional legislation and regulations to ensure conservation and sustainable use of CMI biodiversity, there is an equally important need for the development of human resources for the efficient and effective use of legislation. There is also an urgent need to ensure national coordination of legislation relating to the protection and sustainable use of CMI biodiversity.

**Strategy:** Improve legislative arrangements and coordination for the protection and sustainable use of CMI biodiversity and enhance institutional capacity to implement legislation.

**Activities:**

Activity	Responsibility (Lead Institutions and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
(i) Preparation and coordination of laws/regulations for Integrated Coastal Zone Management.	MoF/MLWE/MoA/ MoLG/UoA/MoT/ MTC/MTI/MoJ	Planned	Funds available	GoE/GEF
(ii) Preparation and coordination of laws/regulations for CMI Protected Areas.	MoF/MLWE/MoA/ MoLG/UoA/MoT/ MTC/MTI/MoJ	Planned	Funds available	GoE/GEF
(iii) Identification of capacity needs for effective enforcement of CMI-related laws/regulations.	MoF/MLWE/MoA/ MoLG/UoA/MoT/ MTC/MTI/MoJ	Planned	Funds available	GoE/GEF

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## SECTION 8

### BIODIVERSITY-RELATED ACTIVITIES FOR AGRICULTURAL BIODIVERSITY

The agricultural sector accounts for around 30% of total GDP and a much larger proportion of the subsistence economy which is not fully documented in national economic statistics. Over 70% of the population are directly or indirectly engaged in either subsistence or commercial agricultural activities. From a biodiversity perspective, the agricultural sector has considerable importance both in global and local terms. The diversity of crop, forage, shrub and tree browse landraces found in Eritrea has global conservation significance because Eritrea is a centre of diversity or centre of domestication 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 of farmers, especially those practising rain-fed agriculture. Cultivation of a range of different landraces provides a “bet-hedging” strategy minimising the risk of total failure of crops and livestock and maximising production of crops and livestock under harsh local conditions.

The objective of biodiversity conservation is to minimise the decrease or irretrievable loss of landrace materials due to genetic erosion. In general, local genetic resources are low yielding but they possess a much wider genetic base than uniform high yielding varieties. The conservation of local genetic resources ensures a primary source of gene variation useful for today and tomorrow production improvement through breeding and selection programs.

Much of the documentation on crop diversity in the Horn of Africa has been focused on Ethiopia and much of the information on crop diversity in Eritrea is “embedded” in the literature of Ethiopia.

There is a large diversity of livestock in Eritrea which is widely distributed over the country. There are four indigenous breeds of cattle, four breeds of goats, four breeds of sheep, two types of donkeys and three types of camels. Mules and horses are found mainly in the highlands.

Although the grasses, shrubs and trees utilised by livestock have not been studied and documented in detail, the country has highly important grass species such as *Cynodon dactylon*, *Eragrostis* species, *Cenchrus ciliaris*, etc.; for shrubs, there are the *Acacia* species, *Phrosia* species, *Atriplex numularia*, *Cadaba rotundifolia*, etc.; for browse trees, *Acacia tortilis*, *Acacia nilotica*, *Salvadora persica*, *Acacia seyal*, *Acacia senegal* and *Hyphaene thebaica*, etc.

**The existing situation with regard to biodiversity-related activities in the agricultural sector is reviewed below with respect to the 10 strategic themes used for this report.**

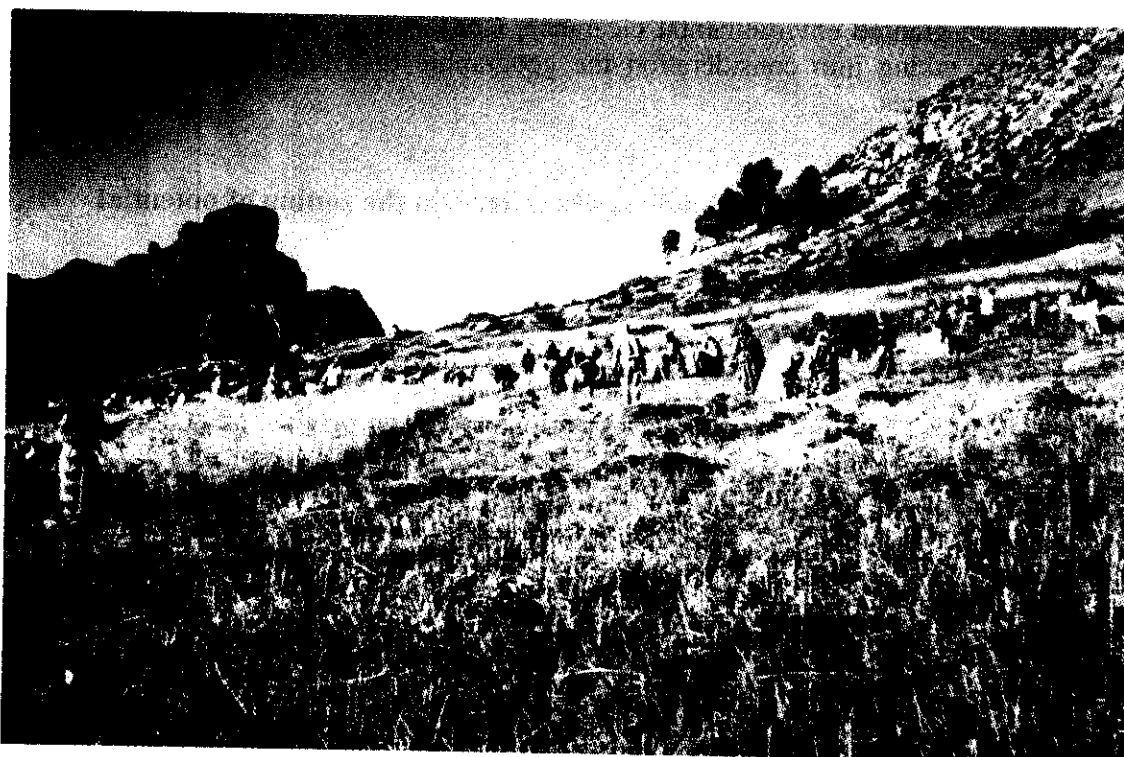


## 8.1 Integrated management

**Existing Situation:** The Ministry of Agriculture is responsible for the overall policy and planning for the agricultural sector but implementation of the policy is effected through the regional administration offices.

The overall policy is geared towards increased production, both in the crop and livestock sector. Whilst this is a clear national need and priority, the policy must be implemented in an integrated manner in order to prevent a significant decline in biodiversity value in the country. Low yielding, drought sensitive and not easily marketable landraces which have been maintained by peasant farmers until now could be replaced by high yielding, early maturing and easily marketable products. In such cases, efforts must be exerted to conserve them before they are lost. Local plant varieties possess a much wider genetic base than uniform high yielding varieties. Therefore, the conservation of local genetic resources ensures primary source of gene variation useful for today and tomorrow production improvement through breeding and selection programs. In this section, we focus on the impact on agricultural biodiversity resources themselves, not the impact on natural terrestrial biodiversity.

The Integrated Farming Systems (IFS – Tumur Hirsha) has the aim of increasing agricultural production through the introduction of mechanized farming on larger areas. The program plans to increase output through the supply of both improved landraces and outstanding exotic varieties and increased levels of chemical inputs (fertilizers and pesticides).



Community participation in crop harvest as part of the integrated farming system

The Integrated Watershed Development project described under terrestrial biodiversity does not make any direct intervention at the level of crop and forage choice and thus has little positive impact on agricultural biodiversity. The project has the potential to influence diversity of both trees and forage through its interventions in catchment areas where both indigenous and introduced species are being used.

In the livestock sector, the development objective is to increase productivity through improved animal health, better feedstock supply and selection of improved breeding stock. Although this program will include introduction of foreign livestock, these will not deplete indigenous breeds which are dominant in the harsher open-grazing systems which form 90% of the livestock sector.

**Needs:** From a biodiversity perspective, there is a need for integrated management of agricultural biodiversity resources to ensure that globally and nationally significant genetic varieties of crops, forages and livestock are not “lost” as production systems change to improve the human welfare of Eritrean farmers and pastoralists. This is not a difficult task but cannot be achieved until the distribution of these resources is better known. It is unrealistic to wait for surveys to complete documentation of these resources at a national level to be completed. A more pragmatic approach would be to ensure that all areas proposed for significant “change in use” are surveyed for their agricultural biodiversity significance before conversion is approved; in this way, threatened crop, forage and livestock resources could be identified and conserved before project implementation. This could be completed within the framework of the National Environmental Impact Assessment Procedures and Guidelines which require projects to address these issues before they are granted environmental clearance. Conservation practices should focus at the ecosystem taking into consideration the geographic distribution of the agricultural biodiversity resources.

**Strategy:** Inclusion of agricultural biodiversity criteria in the zoning of potential agricultural land.

**Activities:**

Activity	Responsibility (Lead Institution and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
Identification of zones of high landrace (crop and livestock) diversity and incorporation of zones into national land use classification	MoA	Planned	Needs funding	

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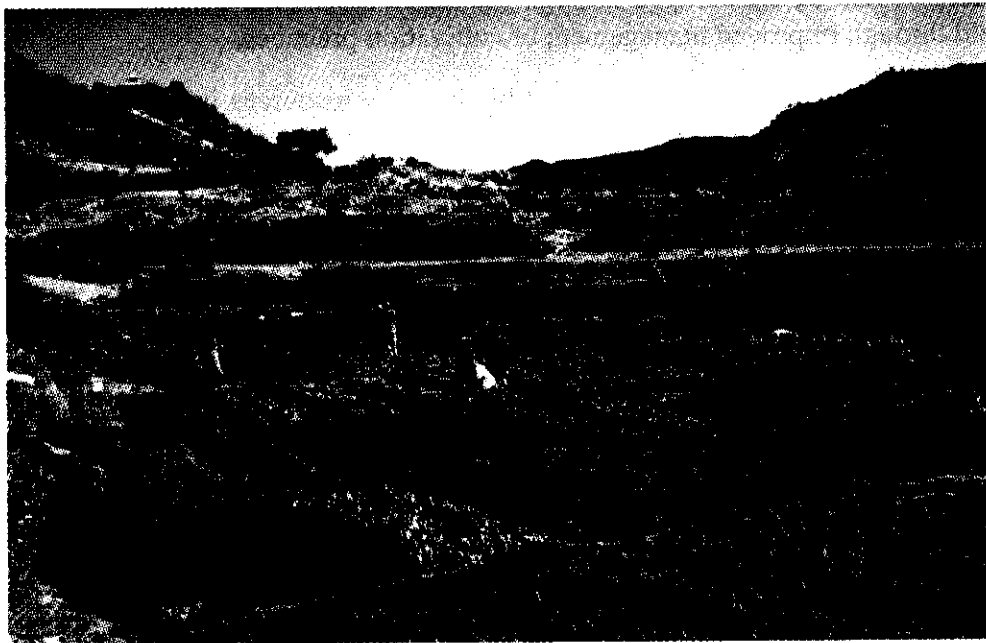
## 8.2 Sustainable use of natural resources

**Existing situation:** This theme is strongly linked to the previous one. Sustainable use of agricultural biodiversity comes from the integration of these resources into a broader, sustainable agricultural system. Traditional rain-fed agriculture is becoming unsustainable in many parts of Eritrea as plot sizes diminish, soil erosion continues and soil fertility declines. The situation is aggravated further by crop failures arising from drought and war, leading to loss of crop diversity. In the highlands, intensification is a viable solution to this problem<sup>1</sup>, since there is little or no land available for increases in agricultural activities. In the lowlands, a mixture of extensification and intensification can be implemented. Long-term maintenance of crop diversity will only occur in intensified agricultural systems if indigenous crop landraces continue to meet farmers' needs. As agricultural systems change some landraces may become less important in farmer's cropping strategy and will not be maintained at the level of individual farmers. Where these landraces may have potential useful long-term genetic potential (e.g. for future breeding), they should be conserved at the national level, i.e. taken into *ex-situ* conservation. At present, however, many farmers indicate that they have trouble maintaining the landraces, which they would wish to continue to use. Output is so low that it is often difficult to set aside sufficient quality seed for the next season, creating a vicious circle of declining yields, less seed, etc.. There is scope for national/ regional level intervention here, creating a system where rare but valued crop varieties are multiplied up for redistribution to farmers; this could occur either at research stations or on those farms which still use these landraces/varieties. Farmers who grow landraces should be encouraged through economic incentives which assist them to enhance yield through improved management of cultivation practices.

**Needs:** The most urgent need for agroicultural biodiversity resources in Eritrea should be better documentation of the distribution and status of the resources themselves. Without this information, the exact nature of any threat cannot be realistically assessed, nor can mitigation steps be taken to eliminate the risk of loss of diversity be put in place. Wherever possible, conservation of genetic resources should take place *in-situ*, maintaining crop and livestock diversity in an active farming environment. *Ex-situ* conservation facilities are limited and need to be strengthened if they are to act as a realistic "safety-net" to on farm, *in-situ* conservation. Wherever land constraints allow, the diversification of the agricultural landscape through agora-forestry, woodlots, closures, etc., should be encouraged – these activities can nearly always be included in soil and water conservation interventions.

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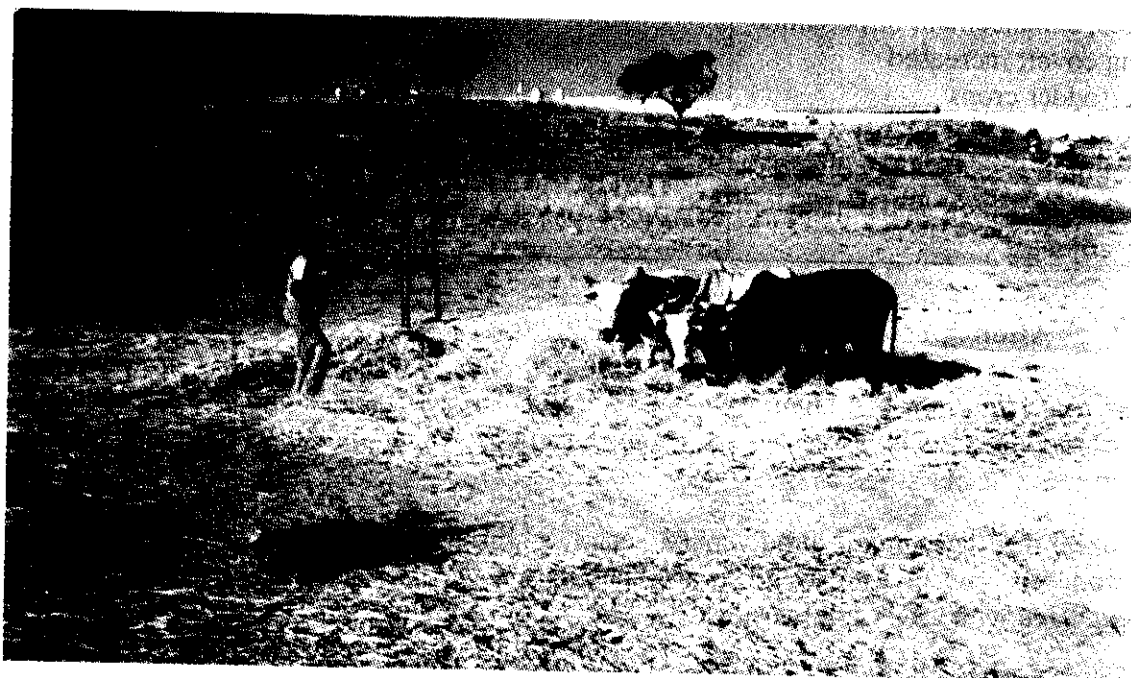
<sup>1</sup> Diversification, i.e. people shifting away from farming as a source of income is another alternative, but this is not easily included in a NBSAP.



*Sustainable crop and vegetable production through the introduction of water harvesting technologies in Eritrea*



*Sorghum selection/breeding in a research station in Eritrea*



*Traditional crop threshing in the highlands of Eritrea*

**Strategy:** To improve documentation of the distribution and status of agricultural biodiversity resources.

**Activities**

Activity	Responsibility (Lead Institution and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
(i) Promote the conservation, enhancement production, utilization and marketing of high value/industrial indigenous crops and livestock for income generation and economic development	MoA	Ongoing		
(ii) To produce and distribute to farmers improved varieties of indigenous landrace (crops and livestock) materials	MoA	Ongoing		
(iii) Improving the crop management practices that enhance soil moisture retention of agricultural land	MoA	Ongoing		
(iv) Improvement of rangeland quality through temporary closures, enhancement of perennial grazing cover; increased forage/fodder crops	MoA	Ongoing		
(v) Increase honey and wax production by establishing queen (bee) rearing centers and expansion of bee colonies	MoA/DANIDA	Ongoing	Needs additional funding	

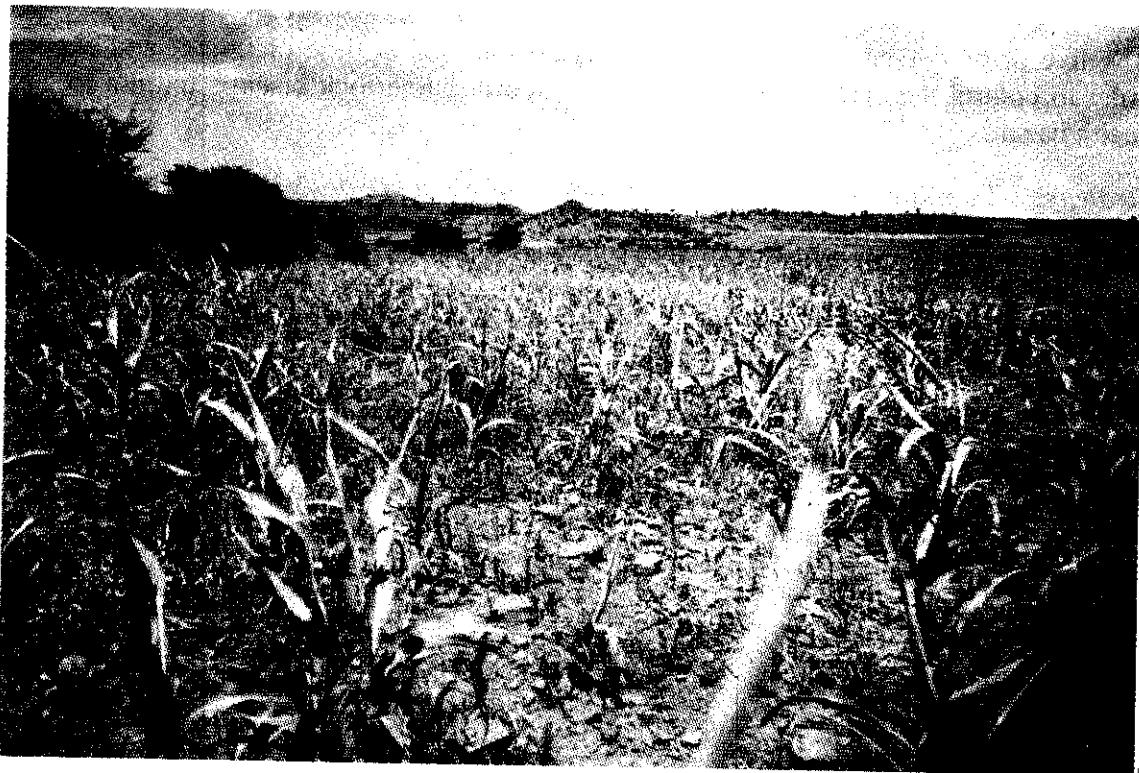
### 8.3 Alien species

**Existing situation:** All alien species of crop and forage species and livestock should be assessed for their invasiveness. Alien introductions which spread without the support of man could be classified as invasive.

Within the agricultural biodiversity sector, alien introductions are of two kinds: (i) introduced crop, livestock and forage species and varieties; and (ii) the introduced pests associated with crops and livestock.

High Yielding Varieties (HYVs) of sorghum and pearl millet are being introduced to Eritrea but the total area of these varieties grown is small relative to total cultivated areas. Wheat is the most threatened cereal to genetic erosion since old (Kenya varieties) and

recent introductions (Canada, Australia, Boohoy, HRD, Pavoni varieties) are cultivated by farmers in scattered but relatively frequent in Zoba Maekel and Debub subzones. Exotic barley varieties are being studied by DARHRD but so far no outstanding variety has been released to farmers.



Striga: Common invasive weed species on sorghum

Weeds and other crop pests are a major problem in Eritrean agriculture where the level of use of chemical pesticides is extremely low. A total of 94 weed species were identified recently by the Ministry of Agriculture survey<sup>2</sup>, with the most serious being: *Striga hermonthica* (Purple witch weed), *Orobanche minor* (Broomrape), *Convolvulus arvensis* (Creeping Jenny) and *Cyperus rotundus* (Purple Nutsedge). The majority of the serious weed species in Eritrea are introduced species which have “followed” their preferred crops around the globe<sup>3</sup>. These pests in general reduce agricultural productivity rather than representing direct threat to indigenous biodiversity. Lists of some major crop insect pests and diseases in Eritrea indicates a similar pattern of a wide range of “global” pests.

<sup>2</sup> Adhanom Negasi (Ed.) (1999) Workshop on the weed status of the Integrated Farming Schemes (IFS)/Turnur Hirshas in the different Agro-ecological Zones of Eritrea

<sup>3</sup> Some of these species may have been introduced hundreds, even thousands of years ago, along with the original crop.

Despite the fact that plant quarantine is the first line of defense against the invasion of alien species, there are some constraints to achieve the goal of this activity efficiently. These are:-

- absence of well facilitated laboratory for identification of pests and diseases; and
- absence of bye laws.

Any live or processed biological material is quarantined at time of import and export in order to control the spread of economically important livestock disease and not to create health hazards.

**Strategy:** To improve knowledge and control of alien species within agricultural ecosystems.

**Activities:**

Activity	Responsibility (Lead Institution and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
(i) To design a monitoring program to identify changes in crop and forage diversity at farm level and establish baseline data for the program	MoA/MLWE	Planned	Needs funding	
(ii) Increased surveillance and quarantine activities at "points of entry" for live biological material	MoA	On-going but requires strengthening of capacities		
(iii) Increased survey and documentation of agricultural and livestock pests	MoA	On-going		

#### 8.4 Pollution management

**Existing situation:** So far, pollution is not a serious problem for the majority of agriculture in Eritrea. The level of industrial activity is currently very low so that whatever air and water pollution that exists is localized and distant from most agriculture. Pollution from agriculture itself is also of minor significance due to the low levels of chemical inputs, both fertilizer and pesticides. As the economy grows, this situation will change but should not represent a serious threat to agricultural biodiversity if the proposed National Environmental Impact Assessment Procedures and Guidelines are implemented effectively. If use of fertilizers and pesticides allows intensification of agricultural production and helps to prevent additional land conversion, then it will be beneficial for biodiversity.



**Needs:** The most important needs for this strategic theme are: (i) the effective implementation of environmental assessment of all new industrial activities, especially with regard to project location; (ii) the development of an effective system for the regulation of agro-chemical import and supply and for ensuring that pesticide use takes place in the framework of Integrated Pest Management (IPM).

**Strategy:** To reduce impact of industrial pollution on agricultural systems.

**Activities:**

Activity	Responsibility (Lead Institution and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
Use of environmental assessment procedures for new projects and monitoring of potential impacts of industry on agricultural biodiversity.	MoA/MLWE	Planned		

### 8.5 *In-situ* conservation

**Existing situation:** *In-situ* conservation of plant genetic resources is taking place spontaneously at the level of individual farms throughout Eritrea. It is estimated that 3-4 landraces of each major crop species may be found in each “locality” but it is not clear how many landraces exist across all localities. Sometimes the same landraces have a different name in different localities; sometimes different landraces can have the same name in different locations. Landrace conservation at this uncoordinated level carries a risk that local landraces will be lost if (i) farmers suffer severe crop failure due to drought, pest damage or war; or (ii) farmer’s agricultural strategies change so that some varieties are no longer maintained. There is some evidence that this type of genetic erosion is happening but the extent is not clear due to lack of documentation of landrace distribution.

**Needs:** There is a clear need for a “safety net” to assist individual farmers to cope with the first of these problems and to ensure that, if farmers choose not to use a landrace, that the landrace is not lost forever. This is best achieved through a combination of on-farm (*in-situ*) conservation of those landraces which are in demand but scarce, coupled with a strategy of off-farm (*ex-situ*) conservation of less popular landraces which still have long-term breeding potential. The former could be achieved by contracting farmers to grow threatened varieties for guaranteed prices, so that the harvested seed can then be distributed to more farmers. Alternatively, threatened landraces can be multiplied on government research farms. This is the existing strategy of the MoA Plant Genetic Resources Unit (PGRU) but full implementation has proven to be difficult due to human resource, equipment and funding constraints.

In the livestock sector environmentally, socially and economically important indigenous livestock species could be conserved *in-situ* through conservation and proper use of range resources and the establishment of breeding centers for cattle, sheep, goats, poultry, etc. This could be done at representative locations in the six zobas. Establishment of queen rearing centers in the central highlands could also have paramount importance in the conservation and expansion of bee colonies in the country.

The livestock export market should be regulated so as to not exceed the sustainable exploitation of our livestock off-take.

**Strategy:** To increase conservation of agricultural biodiversity within on-farm systems.

**Activities:**

Activity	Responsibility (Lead Institution and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
(i) Implementation of existing plans for <i>in-situ</i> conservation of landraces (crops and livestock)	MoA	Planned	Needs funding	
(ii) Develop a system of effective incentives for farmers to maintain diverse landraces (funding, training, input supply, etc.)	MoA	Planned	Needs funding	
(iii) To develop and adopt complementary conservation strategies and methods ( <i>in-situ</i> and <i>ex-situ</i> - contracting farmers to grow threatened landraces; multiply threatened landraces in research stations)	MoA/MLWE	Planned	Needs funding	

### 8.6 *Ex-situ* conservation

**Existing situation:** There is an *ex-situ* collection of agricultural biodiversity resources maintained at the PGRU of the MoA Research and Human Resources Development Department. This gene bank has limited capacity for collection, storage and characterization of agricultural biodiversity genetic resources. A total of 1900 accessions, predominantly cereals, legumes, oil crops and few wild relatives have been collected and stored. This represents a considerable amount of the total crop landrace variation in Eritrea. Human resource availability and physical space limitations are being reduced through the DANIDA funded construction of new buildings and employment of additional staff – this will allow to increase the coverage of the collections. Characterization of over 70% of the accessions has been completed and the gene bank can make this information and small amounts of seed available for research use.

There are relatively good linkages between the gene bank and international organizations concerned with plant genetic resource conservation. Few out-of-country material has been

returned although some exotic material has been provided by ICRISAT and ICARDA for screening, whilst IPGRI and FAO provide mostly technical support. There is a partial inventory of Eritrean genetic resources held in other countries (e.g. Ethiopia) and the legal situation with regard to ownership and use of these plant genetic resources remains unclear.

**Needs:** Space and other infrastructure capacities of the gene bank, operating under the DARHRD of the MoA, is expected to improve greatly under the DANIDA funded project currently being implemented. This will definitely strengthen the exploration and collection, conservation, characterization / evaluation and utilization of landraces germplasm. In 1997 and 1998, in collaboration with DANIDA, ICARDA and ICRISAT, collections of barley, lowland sorghum, pearl millet and wheat cultivars had been undertaken for further breeding programs. However, for safer maintenance and enhancement of landrace materials, *ex-situ* conservation must be complemented by new project of *in-situ* conservation.

The gene bank currently focuses mainly on orthodox crops and their wild relatives but in the future should aim to conserve biological diversity which includes recalcitrant crops (field gene bank) and forages. Commonly, the conservation of threatened breed in livestock in the form of frozen semen and embryos are maintained in separate specialized laboratories.

**Strategy:** To increase conservation of agricultural biodiversity within *ex-situ* systems.

**Activities:**

Activity	Responsibility (Lead Institution and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
(i) To increase representation of indigenous landrace material in <i>ex-situ</i> collections through: (a) in country collection; (b) repatriation of material from international collections	MoA	Planned	Needs funding	
(ii) Combating drought as an agent of genetic erosion through selection and improvement of drought tolerant/resistant varieties from local landraces	MoA	On-going	Needs additional funding	
(iii) Promote conservation of threatened species in the form of frozen semen and embryos	MoA	Planned	Needs funding	

## 8.7 Taxonomic knowledge

**Existing situation:** The role of taxonomic knowledge in the agricultural biodiversity core area is primarily for (i) knowledge of crop and livestock diversity; and (ii) knowledge of the biota associated with crops and livestock (weeds, pests and pathogens; fodder and forage crops, etc.). For (i) the level of knowledge at both government and farm level appears to be quite strong – farmers know their crops and livestock! For (ii) the knowledge base is not so strong, especially at the scientific level; there are few personnel fully-trained in identification of crop and livestock “pests”. Taxonomic knowledge of microbes, especially plant diseases and soil biota in general appear to be especially weak. More significant than a weakness in pure taxonomic knowledge, there is a lack of “associated knowledge” for pest species. Associated knowledge is the applied information needed for effective pest management and control; for example, the most up-to-date and relevant methods and materials for integrated pest management (IPM) which maximizes control with minimal use of chemical inputs.

**Needs:** The main needs for agricultural biodiversity in this strategic theme are: (i) an improved taxonomic skill base for full identification of crop and livestock “pests and diseases” – this would be best achieved through short and long intensive overseas training courses; (ii) increase capacity to undertake field surveys of pest status; (iii) increased access to “associated knowledge” to provide farmers with appropriate, cost-effective pest control strategies.

**Strategy:** To increase taxonomic knowledge of biodiversity within agro-ecosystems.

<b>Activities:</b> Activity	Responsibility (Lead Institution and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
(i) To survey and document the distribution of indigenous landraces and their wild relatives	MoA/MLWE	Planned	Needs funding	
(ii) To conduct surveys of soil biota associated with different crops and livestock, especially indigenous landraces	MoA/ UoA	Planned	Needs funding	
(iii) Increased knowledge of biodiversity of agro-ecosystems	MoA/MLWE	Planned	Needs funding	
(iv) To conduct general insects, pests, diseases and weeds survey in all agro-ecological zones; General fruit & vegetable insect pest survey on the major growing areas of Eritrea	MoA/ UoA	On-going		
(v) Study and Identification of races of fungi on sorghum (Leaf blight, Anthracnose and rust)	MoA/ UoA	On-going		

## 8.8 Information acquisition and storage

**Existing situation:** This strategic theme is related to those discussed above. As already mentioned in most previous themes, there is a need to undertake field surveys in order to improve the knowledge base on distribution of crop and livestock diversity and the kinds of threats acting on this diversity. A good deal of information of indigenous knowledge and traditional farming systems has been collected over the past few years and is available in a variety of published reports and government papers.

**Needs:** There is no central collection of the existing data, nor any useful synthesis of the entire set of information to provide a national overview. This kind of analysis would be best undertaken by either the College of Agriculture and Aquatic Sciences (CAAS) of the University of Asmara, or the DARHRD of the MoA, with the DoE having the role of co-ordination and facilitation. These institutions would be the logical repository for centralized storage of existing survey information. With respect to “associated knowledge”, this would be best located in Land Resources and Crop Production Department so that knowledge can be passed to farm level as efficiently as possible. Until Eritrea gains full access to the Internet and increases its international contacts through the return of staff from overseas training, the best approach to filling the gap in “associated knowledge” lies in linkages to international organisations which compile and distribute such information to users. Examples include ICIPE, ILCA, ICRAF, IPGRI, technical departments of FAO and UNEP, etc. Where these organisations make charges for services, the NBSAP could assist with subscription and service charges.

**Strategy:** To increase use of knowledge about biodiversity within agro-ecosystems

### Activities:

Activity	Responsibility (Lead Institution and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
(i) To conduct surveys to document farmers/agro-pastoralists and pastoralists knowledge of use of biodiverse production techniques.	MoA/MLWE	Planned	Needs funding	
(ii) Study biodiversity system of crops and livestock in all agro-ecological zones	MoA/MLWE	Planned	Needs funding	
(iii) To map rangeland quality in relation to livestock density and seasonal patterns of use	MoA	Planned	Needs funding	
(iv) Develop and strengthen early warning system for sustainable management	MoA/MLWE/ Meteorological Office/Grain Board	Ongoing		
(v) To develop a national system for agricultural biodiversity information collection, dissemination and exchange;	MoA/MLWE/ UoA	Planned	Needs funding	

## 8.9 Public awareness and education

**Existing situation:** This theme can be considered as an extension of the above. It is unclear how much use is being made of the media for the promotion of agricultural biodiversity. Farmers appear to be well aware of local diversity and genuinely concerned about its actual and potential loss. They are perhaps less aware of the actions which could be taken to reverse these trends. Radio would appear to be the best medium to use for dissemination of information on farming methods to promote on-farm biodiversity given the lack of TV and low levels of literacy in many villages. At school level, much environmental education appears to be set at a very general level, discussing global rather than local issues.

**Needs:** There is need for increased dissemination of agricultural biodiversity information through the national media. The Ministry of Information is willing to disseminate information on environmental issues in general, including biodiversity. There is a good deal of potential to prepare short information bulletins which could assist biodiversity surveys or disseminate information on pest management, etc. Similarly, there is scope for inclusion of more information on Eritrean agricultural systems and their associated biodiversity into the school curriculum. Wherever possible, relevant local information should be incorporated into teaching materials and this should be reflected in changes being made in the on-going revision of the school curriculum.

**Strategy:** **To increase knowledge of benefits arising from biodiversity within agro-ecosystems**

### Activities:

Activity	Responsibility (Lead Institution and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
To create awareness at scientific, policy and community level on the importance of agricultural biodiversity conservation and use through the national media, bulletins and incorporate in teaching materials.	MoI/ MoE/MLWE/ MoA/ UoA / MoLG	Planned	Needs funding	

## 8.10 Legal and institutional structure (capacity-building)

**Existing situation:** There is no formal legislation covering biodiversity in the agricultural sector. The MoA has drafted some laws (the Plant/Animal Quarantine draft laws, the draft Seed Law, for example), which in one or the other would promote the conservation and sustainable use of agricultural biodiversity resources.

It is likely that the National Environment Proclamation, which is in the process of drafting, will also contain articles covering biodiversity conservation, both within the agricultural sector and elsewhere. The Environment Proclamation should contain legislation to regulate some threats to biodiversity in the agricultural sector (e.g. pollution from industry, pesticides, etc.).

In the interim period, until this legislation is promulgated, all projects proposing to make commercial use of indigenous species or for access to genetic resources should be passed through an Environmental Evaluation Questionnaire [EEQ 3.2 (g) and 3.2 (j) respectively], presented in the National Environmental Impact Assessment Procedures and Guideline, as part of the overall project approval process. This will ensure that issues of intellectual property rights, farmers rights, etc. are resolved before projects are implemented.

It is clear that the capacity of the government agricultural sector to fully implement and monitor the activities described above is fairly limited. Capacity building from such low levels is a difficult and slow process. The collaboration between relevant government agencies involved in the conservation and use of agricultural biodiversity resources could lessen shortages of human and technical capacities.

**Strategy:** To increase protection of agricultural biodiversity within agro-ecosystems

**Activities:**

Activity	Responsibility (Lead Institution and Collaborators)	Priority Ongoing or Planned	Funding and Other Needs	Funding Agency
Make assessment studies on how agricultural biodiversity resources, including local knowledge and practices, are better protected and sustainably used through the legal means.	MoA/MLWE	Planned	Needs funding	