

**REPUBLIC OF YEMEN**

**Ministry of Water and Environment**

**Environment Protection Authority**

## **Fifth National Report**

**to the Convention on Biological Diversity (2010-2014)**

## **Part I: An update on biodiversity status, trends and threats and implications for human well-being :**

### **Q1. Why is biodiversity important for the country?**

#### **The Importance of Biodiversity in Yemen:**

The biodiversity and constituent ecosystems, are critically important to our well-being and economic situation, Yemen has a rich variety of both biodiversity and landscapes, reflecting the variety in geology and altitudes found within the country. As elsewhere in the world, biodiversity in Yemen has an important environmental role; ecosystems act to regulate current and water regimes, and influence climate. Biodiversity has an important role in maintaining atmospheric air quality and in ensuring a healthy ecological environment for humans. Elements of biodiversity also act to protect the soil from erosion. Humans have hunted, fished and gathered the plants and animals of Yemen since ancient times. Intensive use of natural resources continues today.

The ecosystems of Yemen provide habitats for plants, animals and micro-organisms which can be used or which perform useful functions. Specifically, they regulate thermal and water regimes, influence the climate, and play an important role in maintaining atmospheric air quality and in ensuring a healthy ecological environment for humans. Elements of biodiversity also act to protect the soil from erosion. Yemeni people have hunted, fished and gathered the plants and animals of Yemen for centuries and their uses of natural resources continuing today.

A number of factors have contributed to the relatively high levels of biological diversity found Yemen .

- Yemen, is located at the junction of major biogeographic zones.
- Yemen provides an important passage and resting sites for migratory birds and marine resources .
- five main geographic regions types are represented across the different altitudinal zones and coastal areas of Yemen within a relatively small island .
- Yemen is an important center of endemic for wild relatives of domestic crops and has long been a center for breeding and selection of cultivated plants and livestock.

Most components of social and economic development in Yemen can be related, directly or indirectly, to biodiversity.

- Biodiversity has provided important natural raw materials like leaves, fruits, and grain for the feed and food industry.
- In agriculture, biodiversity has provided sources of food, fodder and grazing for livestock, genetic variation for selection, etc.
- In medicine, some plants are extremely important sources of natural and commercial remedies (aloe ,dragon plant)
- Forest resources are used in construction , firewood and medicine .
- Landscapes have important aesthetic and recreational value and provide the basis for tourism.
- Coastal and Islands has provided the seafood for local people and export.

The biodiversity limited in the ecosystem provides forest dwellers with all their daily needs building material, fodder, medicines , food and a variety of other products.

Access to good quality green space contributes to positive mental health, childhood development and physical health. Yemen habitats and ecosystems make important contributions to many services, notably as part of our cultural landscapes and for regulating climate, and the quality and quantity of water.

Based on the importance of economic of conserving biodiversity, there are several cultural, moral and ethical values which are associated with the sanctity of all forms of life. Biodiversity also makes irreplaceable contribution to our aesthetics, imagination and creativity.

Natural ecosystems also help absorb the wastes we create and render them nontoxic. Wetlands are large filters which purify freshwater and remove heavy metals and other contaminants from it. We often depend on rivers to flush away and break down the sewage and effluents that we put into them, which again depends on the array of small and large organisms that decompose and transform wastes in water. Soil organisms can slowly decompose food items, paper products and other wastes produced by human activities Economic arguments for protecting biodiversity are criticized for being too utilitarian and human-centered. Indeed, an excessive emphasis on the economic values of different species is seen as dangerous for two reasons: there is bias towards the protection of species and ecosystems that have attributable economic value and this perspective may also lead to the conclusion that ecosystems that are not directly benefitting humans are worth more to humans developed than undeveloped.

These products and processes provided by natural ecosystems are especially important for the poor, as they depend largely on agriculture, fisheries, livestock and forestry. Healthy ecosystems also help them generate income through ecotourism and the leisure industry. So preserving biodiversity is a key element in the drive to improve economic development and reduce poverty.

Yemen is one of the countries well-endowed with natural resources ranging from forests, woodland, mountainous ecosystems to vast marine ecosystems. For instance, the country commands over 2500 km of shoreline. Over the years the country's remarkable biodiversity and key ecosystems have been threatened and degraded by devastating land use changes and unsustainable consumption patterns (EPA, 2000). Consequently, the highly valued key ecosystems have been continuously depreciated through pollution, degradation and depleted through overstocking, deforestation, lack of maintenance of terrace amongst other factors.

One of the underlying factors for the degradation of Yemen's key ecosystems is lack of integration of ecosystems economic values in economic decision making at national and local levels, lack of recognition and acknowledgement that ecosystem-economy is a closed system and that ecosystem deprecation feedbacks into slow economic growth and increase in poverty level particularly at the rural population. Thus, until such association is made and some somber efforts undertaken to ensure that environmental costs and benefits are integrated in economic decision making at

both national and local planning, then ecosystems will continuously be riddled with uncountable unsustainable and myopic consumption patterns and practices.

### **Status of terrestrial ecosystems :**

Yemen has a rich and diverse terrestrial fauna because of the wide range of habitats in the country and due to its position at the juncture of three major biogeographic regions, the Pale-arctic, Afro-tropical and oriental regions during the past years Yemen established 3 terrestrial protected areas. Each protected area managed by the local community under supervisor of the EPA.

Conservation of biodiversity is vital in a country such as Yemen, where eco-systems are fragile and the renewable natural resources are scarce.

Over the past few years, Government efforts to protect and sustainable use the various components of Yemen's biodiversity have focused primarily on establishing Protected Areas. The results of these efforts have led to the identification more than 35 areas throughout the country, which are of outstanding biodiversity/natural value and urgently need to be protected. For their important role in supporting wildlife and maintaining the diversity and viability of the various components of Yemen's biodiversity, dense forest cover in Jabel Bura'a, Jabal Eraf forest, KetFah, Hawf, and Jebel Lawz (Khawlan) are identified as most important areas for declaring and establishment of protected areas. In Coastal region and Islands, Socotra Island, the coastline of Balhaf Burum ,and the coastline of Sharma-Jethmun , Al-Lhaia and Al-Gwirah have been cited important for the protection of marine and coastal biodiversity .

The indigenous natural resource management systems of the Yemeni people will be supported, protected, utilized and seen as a rich natural heritage. The basic principles also incorporate responsible public management based on accountability, transparency, participation in decision making and a full analysis of impacts.

Effort has been made to mainstream biodiversity conservation into the plans and programs in the country. This is being done through the development of the new national strategy for economic development and poverty reduction which is being prepared, where environment has been put as a sector and is being defined as a cross-cutting issue. From these efforts, the components of biodiversity have been established as priorities areas of the country especially in environment sector, forestry, agriculture, private sector development, tourism, etc.:

### **Habitats and Floristic**

Yemen hosts a variety of habitats which range from coastal mangroves, shrub lands and dunes along the coastal plains to the eastern deserts and an array of mountain habitats that reach elevations of up to 3760 m at Jabel Al-NabiShauib, the highest point on the Arabian Peninsula. These habitats harbour a great number of unique species of plants. Rapid degradation of the environment, a direct result of desertification and droughts, among the oldest global environmental phenomena, are drastically reducing the country's vegetation cover and posing severe threats to wildlife, including many endemic species.

Over the last several decades, the area of natural habitat has decreased or been degraded, through over-exploitation of range resources, land conversion, poor agricultural practices and the pressures of an ever expanding population with a current growth rate of some 3.5% per annum, one of the highest rate in the region. Plant populations are thought to have declined considerably, and agricultural production has undergone dramatic changes due to the expansion of Qat plantations at the expense of other crops.. These alarming trends demand urgent conservation attention, if even representative portions of Yemen's natural biotic wealth are to remain for future generations.

The unique geographical position between the Arabian Peninsula and Africa, and at the junction point of the Red sea and Arabian Sea has given Yemen different climatic and topographical features, which are favorable for the existence of divers ecosystems along with a high level of biodiversity.

### Status of Yemen's Flora

The flora of Yemen is very rich and heterogeneous. Species diversity is a result of considerable climatic changes in former periods, which enabled different species to survive in the different ecological habitats. About 2871 plant species were recorded in Yemen, 15% of them are endemic<sup>1</sup>. Socotra Archipelago is unique in its flora and like many oceanic islands has a high level of endemism. The latest study reported that Socotra Archipelago contains approximately 825 plant species, 307 (about 37%) of which are endemic and 15 endemic genera <sup>2</sup>.

Table (1) : Yemen plant species

Families	Species	Genera	Naturalize	Cultivated	Introduced		Endemic to:	Endemic to:
							Yemen *	Arabia **
178	2871	1073	2635	126	110	2871	456 (280)	151

(Al Khulaidi, A.A. (2014).

The majority of endemic taxa in Yemen are associated with mountainous areas which provide a rich variety of ecological niches and offer a degree of environmental stability during periods of climatic changes. Endemism is generally very high among the succulent plants. The largest numbers of endemic species are found within the ASTERACEAE, APOCYNACEAE taking into account the Stapeliad genera (Caralluma, Duvalia, Huernia, and Rhytidocaulon). EUPHORBIACEAE, ACANTHACEAE, BORAGINACEAE (see table ). Preliminary data on the status and number of rare and endangered plants species are available. Some eight species (seven of these from Socotra) are included in the IUCN Red Data Book as being endangered or rare, and an additional 19 species are considered to be endangered or rare at the national level in Yemen .

Table ( 2 ) Endemic and near-endemic plant species with their status

The most important families regarding to the number of endemic are:

<sup>1</sup> (Al Khulaidi, A.A. (2014).

<sup>2</sup> (Miller, A.G. and Miranda, M (2004).

Family	No of endemic
1. ASTERACEAE (COMPOSITAE)	46
3. APOCYNACEAE (ASCLEPIADACEAE)	42
2. EUPHORBIACEAE	31
4. ACANTHACEAE	27
5. BORAGINACEAE	26
6. FABACEAE ( PAPILIONACEAE)	21
7. LAMIACEAE (LABIATAE)	21
8. CARYOPHYLLACEAE	15
9. RUBIACEAE	13
10. Aloeaceae	13
11. SCROPHULARIACEAE	12
12. POACEAE (GRAMINEA)	10
13. BURSERACEAE	10

## PLANT GENETIC RESOURCES FOR FOOD AND GRICULTURE IN YEMEN :

In many parts of the country traditional small *in situ* conservation areas can be found. These areas are mainly situated around or near villages and are privately or communally owned. Traditional rules are applied to manage these protected areas whose main use is grazing. These *in situ* conservation areas are normally managed by local communities, village leaders or Sheikh. They represent the best managed areas of Yemen and contribute to protect existing plant genetic resources for food and agriculture.

Recently, several areas in the country have been declared as protected areas, the largest and most famous is the Soqotra Archipelago. Its area is about 3799 km<sup>2</sup> and so far about 825 plant species have been recorded in these islands, out of which 307 are endemic.

*Ex Situ* conservation centers for plant genetic resources in Yemen have increased rapidly at the end of the 20th century and the beginnings of the current century. These centers mainly affiliated to the governmental sector mainly the agricultural research

and extension authority and public universities. The number of conservation facilities has increased from 7 in 1996 to 22 in 2006, conserving more than 6000 accessions.

Historically, Yemeni farmers demonstrated an exemplary capacity of survival under very difficult environmental conditions based on an economic and sustainable use of PGRFA. As a result of this, the country's crop diversity, comprised of cultivated crop varieties, heterogeneous landraces, and wild relatives, is utilized for different purposes by the community. These landraces have evolved through natural selection and selective breeding by traditional agricultural practices over long periods in the different environmental conditions of the country.

Sourced from local or introduced germplasm, many new cultivars have been released in the past ten years mainly of cereal and food legume crops and to a lesser extent of vegetable and fruit crops.

Presently there are no legislations or policies in force in Yemen, which deal specifically with PGRFA, and only several provisions related to certain aspects of PGRFA conservation exist.

The coordination of the activities of different institutions in the field of PGRFA was realized through the establishment of the National Committee (NC) for PGRFA in 1999. Membership of the NC includes representatives from MAI, the Universities, AREA, EPA, GSMC, Farmers Union (FU).

A Capacity Self-Assessment Study on the implementation of the International Conventions on Biodiversity, Biosafety, Desertification and Climate Change in Yemen clearly illustrated the extent of the problem in capacity building in the country which has three dimensions: individual, institutional and system dimensions.

There are about 29 legislations that either directly or indirectly deal with PGRFA with different levels of issuance from laws, Republican Resolutions, The Cabinet resolution, executive by laws. Nonetheless a specific and comprehensive legislation on PGRFA is still missing.

Crop improvement programs in Yemen have played an important role over the last ten years providing an increase of yield and sustainable production. Collected and conserved materials were made available to plant breeders and other specialists in crop management programs in any concerned sector which helped in the release of

crop cultivars addressing production constraints and contributed to improve food security in the country both in terms of quantity and quality.

### **Factors Influencing the State of PGRFA Diversity:**

The process of modernization and continuous development in agriculture during the last decades, more or less has led to activate the dissemination of improved varieties at production level. There is no yet accurate data for percentage of area grown by improved varieties. However, from rough estimate it can be indicated that more dynamic replacement to exist in vegetables with nearly more than 90%, in wheat 15-20% as well as in maize. Active introduction of improved varieties of fruits has also increasingly been expanded. Improved varieties are more likely introduced in conditions that are more favourable and where intensive agricultural system is experienced. Varietals replacement may also account to one land race to replace the other as this may be enhanced with the expansion of road networks and better communication and transport means making the transfer of seed of plant material from location to location easier.

The cultivation of most of major crops have been subjected to genetic erosion. Among the most important factors for genetic erosion are:

- 1) periodic drought.
- 2) change in cropping pattern and drastic shift towards each crops.
- 3) expansion of infrastructure and building in agricultural lands.
- 4) terraces erosion .and
- 5) sand dune movement and desertification.

There is an increasing focus pressure on minor wild plant species to meet the demand of increasing population. The diversity of minor wild plants in their habitats is getting dramatically decreased. Diversity of some species that are utilized by local people as traditional food or as medicinal plants are also in danger this due to intensive utilization of these plants and lack of ecological education and protection activities.

Diversity of some plants, extensively used by people with small industrial and sale is also in danger.

The loss of plants is related directly or indirectly to population growth. Population growth brings further pressure on the natural vegetation lands for urban development and cultivated production. The movement of rural population to main cities has caused major pressure on plant biodiversity. Due to over cutting, expand of buildings and infrastructure, species .

Intensive use of some wild plants as food or as feed has threatened some species. Overgrazing is also playing an important factor in decreasing of wild palatable grasses.

#### **Future Needs and Priorities PGRFA Diversity:**

- Further studies and collection of information about the traditional uses of wild crops .
- Studying the present state of diversity, relative important and regional important of wild crops.
- Studying threats of genetic vulnerability and causes of genetic erosion of plant diversity.
- Establishment and maintenance of large natural protected areas.
- Developing of potential sources for the local population, such as collection and storage of wild economical crop seeds.
- Cultivation and export of economic plants using small scale farms.
- Mapping of important plant biodiversity areas (e.g. vegetation and land use maps) .

” *Yemen - Second Country Report on the State of PGRFA to FAO February – 2009*”

#### **Access to Plant Genetic Resources for Agriculture :**

Despite the country has no clear restriction about certain types of PGRFA however all the endemic plants are restricted to access and access to another PGRFA became more difficult in the past few years because of miss management and miss coordination between different partners responsible for PGR and biodiversity (in Yemen now more than one ministry and authorities responsible for GR and biodiversity) beside to the limited financial resource thus created additional problems, including maintaining PGRFA located inside or outside the country.

#### **Sharing Benefit of the use PGRFA:**

Yemen has now clear vision and specific regulation on sharing benefit of the use of PGRFA and the regulation in law No.20 for 1998 " seed and agricultural fertilizer law has mentioned that “enabling farmers to have access to agriculture inputs and utilize it in better manner” in the objectives. However, there are no any articles or sentence indicating to sharing benefits. Therefore, the farmer rights are transgressed in Law 20 for 1998 and sharing benefits shall be regulated to implementing ITPGRFA.

Also Yemen already signed the Nagoya Protocol , the ratification still ongoing to finalize the process soon.

#### **Status of Terrestrial Fauna**

Yemen has 71 recorded land mammal species representing eight orders including bats (table 2). About one third of the mammals are relatively large species which are rare in other parts of Arabia such as the Idmi or Arabian Mountain Gazelle (*Gazella gazella*), Ibex (*Capra ibex nubiana*), Baboon (*Papio hamadryas*), Arabian Red Fox

(*Vulpes vulpes arabicus*), Sand Fox (*Vulpes ruppelli*), Blanford's Fox (*Vulpes cana*), Striped Hyena (*Hyaena hyaena*), Arabian Wolf (*Canis lupus arabs*), Jackal (*Canis aureus*), Arabian Leopard (*Panthera pardus nimr*), and possibly the Cheetah (*Acinonyx jubatus*).

It is notable that seven mammal species are now considered endangered including three of the four species of gazelle, and another three species the Cheetah, Arabian Oryx and the fourth gazelle, the Queen of Sheba's Gazelle are now extinct in the wild. Furthermore, most sizeable mammals have long since been hunted into extinction in this country where firearms abound and a large proportion of the natural forests have been cut down. With some dedication and luck, ecotourists may still spot rare land animals such as the Arabian leopard, hyena, Hamadryas baboon, honey badger, hedgehog, ibex, and fox.

Table( 3 ). Preliminary record of orders, families, genera, and species of mammals in Yemen			
Order	Family	Genus	Species
Insectivora	2	3	6
Primates	1	1	1
Carnivora	6	11	16
Hyracoidea	1	1	1
Lagomorpha	1	1	1
Artiodactyla	1	4	8
Rodentia	4	9	15
Chiroptera	8	18	23
Total	24	28	71

For long time, large mammals have been under considerable pressure and some of which vanished from the country and most of the others became rare and threatened.

Over the last century, four species have been killed and became extinct and these are listed in table.

The Nubian ibex -*Capra nubiana*-, the Arabian leopard -*Panthera pardus nimr*-, Arabian oryx *Oryx leucoryx* are and the three Arabian gazelles listed above are decreasing sharply and have become rare as a results of continues hunting and absence of protection, breeding and re-introduction programmes.

Yemen has ratified the Convention on International Trade in Endangered Species of Fauna and Flora (CITES), and has recently enacted by-laws to implement the treaty.

## Birds

The Arabian Peninsula is an important “land bridge” between Africa, Asia and Europe for approximately three billion birds which annually migrate along north-south or east-west routes.

Yemen has a very rich bird life with more than 363 species thus far recorded representing 18 orders, 61 families and 177 genera. It is a home to a large number of species that are endemic to southwest Arabia. For a country to be so richly endowed with endemic birds adds greatly to its international significance. With the exception of the Arabian Golden Sparrow, all endemic species occur in the Mainland. The loss of the terracing systems could adversely affect several of the endemics as a result of soil erosion and loss of trees. Terrestrial arthropods are represented by 5 classes, 38 orders, 313 families, 1 833 genera, and 3 372 species.

From an eco-tourism point of view, endemic birds have the highest relevance. The 13 endemic and near endemic species of the mainland found in the southern portion of Arabian Peninsula are: Philby’s and Arabian Partridges, Arabian Woodpecker, Yemen Thrush, Arabian Wheatear, Yemen Warbler, Arabian Golden Sparrow, Arabian Waxbill Yemen Accentor, Arabian Olive-rumped and Yemen Serins, Yemen Linnet, and Golden-winged Grosbeak. The six endemic species to Socotra Island include the Socotra Warbler, Socotra Cisticola, Socotra Sunbird, Socotra Starling, Socotra Sparrow, and Socotra Bunting The distribution of endemic and semi endemic birds in mainland Yemen and Socotra is shown in Table ( 4 ).

Table.(4) Endemic and near-endemic bird species in Yemen

Species	Endemic to Yemen	Semi Endemic
<i>Alectoris melanocephala</i> (Red-legge Partridge)	●	
<i>Alectoris philbyi</i> (Philby’s Rock Partridge)	●	
<i>Carduelis yemenensis</i> (Yemen Linnet)	●	
<i>Cisticola haesitata</i> ( Socotra cisticola)	●	
<i>Dendrocopos dora</i> (Arabian woodpecker)	●	
<i>Emberiza socotrane</i> (Soqotra Bunting)	●	
<i>Estrilda rufibarba</i> (Arabian Waxbill)	●	
<i>Incana incana</i> ( Socotra Warbler)	●	
<i>Nectarinia balfouri</i> (Balfour Sunbird)	●	
<i>Oenanthe lugens lugentoides</i> (Mourning Wheatear)	●	
<i>Onychognathus frater</i> ( Socotra Starling )	●	

Otus senegalensis socotranus ( Socotra Owl)		●
Parisoma buryi (Yemen Warbler)	●	
Passer euchlorus (Golden Sparrow)	●	
Passer insularis (Socotra Sparrow)	●	
Prunella fagani (Arabian Accentor)	●	
Rhynchostruthus s. socotranus (Golden-winged Grosbeak)	●	
Serinus menachensis (Yemen Serin)	●	
Serinus rothschildi (Arabian Serin)	●	
Turdus menachensis (Yemen Thrush)	●	

The important bird areas of the Middle East contains a detailed inventory of 57 sites, which are of vital importance for the conservation of birds in Yemen. These 57 sites, covering a total area of 7 300 sq km or about 1.4 % of the area of the country contain all the endemic or near-endemic bird species, as well as other rare, significant or limited-range species. These sites, distributed around the country (including Socotra Island), also represent prime eco-tourism destinations in Yemen since, apart from containing important and interesting avifauna, many of them consist of relatively undisturbed natural areas and are of great botanical interest. Some of them also contain other interesting types of animals. However, none of these sites are legally protected for nature conservation purposes (although some may be covered by traditional resource-use reserves, or Mahjur) and many of them are in serious risk of degradation or destruction. *M. Evans et al (1994) on the important Bird Areas of the Middle East*

Freshwater habitats specially near biologically rich mudflats along coastal areas and wadies are of particularly important for the following species: Carb Plover (*Dromas ardeola*), Greater Sand Plover (*Charadrius leschenaultii*), Lesser Sand Plover (*Charadrius mongolus*), Sanderling (*Calidris alba*), Little Stint (*Calidris minuta*), Curlew Sandpiper (*Calidris ferruginea*), Bar-tailed Godwit (*Limosa lapponica*), Grey Plover (*Pluvialis squatarola*), and Redshank (*Tringa totanus*). Storks, herons and egrets also occur on passage in small to moderate numbers but no important concentrations have been discovered. White Storks (*Ciconia ciconia*) winter in small numbers at freshwater sites and breeding species include Abdim's Stork (*Ciconia abdimii*) (on Tihama rooftops), Reef Heron (*Egretta gularis*) (coast), Cattle Egret (*Bubulcus ibis*) (trees on Tihama and foothills), Green-backed Heron (*Butorides striatus*) (mangroves), and Pink-backed Pelican (*Pelicanus rufescens*) (mangroves); though none have been censused.

Raptors frequently suffer more than other species in terms of both indirect (e.g. pesticide pollution) and direct persecution. However neither is common in Yemen. As a consequence there appears to be a healthy raptor population with some 17

resident species and a further 15 occurring regularly on passage or in winter. The limited information suggests that the country is in the path of an important flyway, at least in autumn, for migrant Steppe Eagles (*Aquila rapax*), Buzzards (*Botu* spp.) and Black Kites (*Milvus migrans*) passing from their Palearctic breeding grounds to their main wintering area in East Africa. Clearly there is an international responsibility to ensure that these birds are unmolested. Within the Arabian Peninsula, Yemen is probably now the only country with a self-sustaining population of Arabian Bustards. This may in fact be partly supplemented by migrants crossing the Red Sea. The species may be threatened from hunting on the Tihama, the only place where this bird occurs in the country.

A number of these birds can be observed along the coast of Yemen. About 82 species of sea and shore birds were recorded from the coastal area of Yemen along the Red Sea; in which 14 species were endemic to the region. Fifteen species were also recorded from the southern coastal region of Yemen. In Socotra Archipelago a total of 70 species were known to be found, however the following species were endemic to the region:

- 1- *Phalacrocorax nigrogularis*
- 2- *Onychognathus frater*
- 3- *Passer insularis*
- 4- *Fringillaria socotrana*
- 5- *Cyaromitra balfouri*
- 6- *Incana incana*
- 7- *Cisticola haesitata*

### Reptiles and Amphibians

A total of 103 species of Reptiles and 8 species of Amphibians have been recorded in Yemen (table 4 ). The reptiles of Yemen include 71 species of lizards, 28 snakes and 3 amphibians, all belonging to the Order Squamata which comprises the largest reptilian group. Turtles (Order Testudinata) are represented in Yemen by 7 species, one terrestrial species (*Geochelon sulcata*), one freshwater species (*Pelomadora subrufa*) and four species of marine turtles<sup>3</sup>. The amphibians include 8 species belonging to 3 families.

Table( 5 )Preliminary records of orders, families, genera and species of the classes of reptiles and amphibians in Yemen.

Group	Number		
	Family	Genus	Species
Amphibians	3	4	8

<sup>3</sup> See Section XXX under Marine Biodiversity for a list of species.

<b>Lizards</b>	6	22	71
<b>Amphibians</b>	1	3	3
<b>Snakes</b>	7	22	28
<b>Turtles</b>	4	7	7
<b>Total</b>			

The 71 species of lizards recorded in Yemen belong to 22 genera and six families, and the 28 snake species are shown in (Table 5 ).

Table( 6 ). Number of lizard species and their families, recorded in Yemen.

<b>Family</b>	<b>Number</b>	
	<b>Genera</b>	<b>Species</b>
<b>Agamidae</b>	3	11
<b>Chamaeleonidae</b>	1	5
<b>Geckonidae</b>	7	34
<b>Lacertidae</b>	5	9
<b>Scincidae</b>	5	10
<b>Varanidae</b>	1	2
<b>TOTAL</b>	22	71

Table ( 7). Number of snake species, and their families in Yemen.

<b>Family</b>	<b>Number</b>	
	<b>Genera</b>	<b>Species</b>
<b>Boidae</b>	1	2
<b>Colubridae</b>	12	15
<b>Elapidae</b>	2	2
<b>Hydrophiidae</b>	1	1
<b>Leptotyphlopidae</b>	2	3
<b>Typhlopidae</b>	1	1
<b>Viperidae</b>	3	4
<b>TOTAL</b>	22	28

## INVERTEBRATE ANIMALS

The terrestrial Arthropods in Yemen are belonging to 5 classes, 38 orders, 313 families, 1833 genera and 3372 species (table 8 ). Unfortunately all these species are listed in the foreign literature and Yemen has no recorded specimens in its collections.

Table( 8 ) Preliminary records of classes, orders, families, genera and species of terrestrial arthropods in Yemen

Class	Number			
	Order	Family	Genus	Species
<b>1-Arachnida</b>	8	52	134	252
<b>2-Malacostraca</b>	1	5	7	11
<b>3-Diplopoda</b>	2	2	2	5
<b>4-Chilopoda</b>	2	4	6	12
<b>5-Hexapoda</b>	25	250	1684	3092
<b>TOTAL</b>	38	313	1833	3372

The Class Arachnida (scorpions and spiders) are second after the insects in the number of species that have been recorded in Yemen. It is represented in Yemen by eight orders, 52 families, 134 genera and 252 species (Table 9 )

Table( 9 ). Preliminary record of orders, families, genera and species of the Class Arachnida

Order	Number		
	Family	Genus	Species
<b>Scorpiones</b>	3	8	19
<b>Amblypygi</b>	1	1	1
<b>Uropygi</b>	1	1	2
<b>Araneae</b>	31	85	160
<b>Opiliones</b>	2	2	3
<b>Acari</b>	8	25	49
<b>Pseudoscorpiones</b>	3	6	7
<b>Solifugae</b>	3	6	11
<b>TOTAL</b>	52	134	252

The remaining invertebrates recorded from Yemen are shown in (Table 10 )

Table ( 10 ) Invertebrates other than Archnida recorded from Yemen

Class	Order	Number		
		Families	Genera	Species
Malacostraca	Isopoda	5	7	11
Diplopoda	Polydesmida	1	1	3
“	Spirostreptida	1	1	2
Chilopoda	Scolopendromorpha	2	4	4
“	Geophilomorpha	2	2	3
Hexapoda	25 orders	250	1684	3092
TOTAL	30	261	1699	3115

### Agricultural Biodiversity

Arable land counts for 1.6 million hectares (3% of the country). It is estimated that during the last 5 years about 1.4 million hectares have been actually under cultivation in the year 2007. Main field crops are: cereals including sorghum, wheat, maize, millet and barley; vegetables including potato, tomato, beans, cucurbits, onions, carrots, crucifities, okra, eggplant and pepper; fruits including grapes, dates, citrus, guava, mango, peach, apples, banana, papaya, apricot, almond and pomegranate; cash crops including qat, coffee, cotton, sesame and tobacco; forage and feed crops including alfalfa, sorghum and grasses.

Rangelands, forests and other woodland areas comprise about 40% of the land area. More than 8 million sheep, goats and cows graze the land. The remaining land (57% of the country) is mostly desert.

Farmers have utilized genetic diversity in different ways: by using suitable cropping patterns and crop rotation systems (maximum benefits from rainfall), using crop varieties highly adapted to specific conditions at different agro-ecological zones, using varieties (grapes, dates) with different maturity periods to supply the market during the year. These and other useful practices need to be preserved.

Modem agricultural practices result in loss of much agricultural biodiversity through uniform practices, reduction in the importance of local and traditional methods of tillage and husbandry and widespread use of pesticides. Once Yemen loses all the local varieties and wild relatives of crops, breeds of sheep, goats and camels, or even breeds of salukis, it will be totally dependent on foreign imports for seed, plants and animals.

All plants, whether they are endemic, near endemic, threatened, vulnerable or believed to be extinct, are important in maintaining the integrity of their respective ecosystems. Unless measures are taken to safeguard all species, then some of the relict populations could face extinction in the near future.

The government identified EPC as a steering and controlling institution and strengthened its capacity in coordinating and facilitating information sharing between relevant partners through establishing an effective data collection system, effective and efficient procedures for the scrutiny and approval of investment, development projects and projects.

Establish a national land resource data base suitable for physical planning of agricultural development at regional and sub-regional level

Train the national staff in soil surveying at different levels of intensity, land use surveying, land evaluation, agro-economic and agro-sociologic analysis particularly where related to land use, land use planning techniques, data base establishment, computer operations and soil laboratory and cartographic facilities operations

Towards this end and to enhance monitoring of habitat degradation, the Government has establishment Land Resource Management Center in AREA (Damar Governorate). The center since its formation in 1998 has been surveying, searching and collecting information on various aspects of biodiversity and land degradation and has succeeded in producing the following results:

- ❖ National inventory and data base development of fauna and flora.
- ❖ Land resource utilization studies and plans for watersheds in Abyan and Shbwa.
- ❖ Developing guidelines and manuals for land resource utilization planning and land degradation monitoring.
- ❖ Soil survey, classification & mapping for Shabwah and Abyan Governorates.

## **Wetlands:**

### **Status of wetland ecosystems:**

The wetlands of Yemen are being degraded rapidly due to rapid development and population pressure, withdrawal of water for irrigation, destruction of swamp forest and many other anthropogenesis and natural causes. Large scale habitat conversion, unsustainable harvesting policies and lack of environmental consideration and awareness have led to destruction of valuable wetland habitat for water birds and other associated biodiversity.

Yemen's wetlands can be divided into natural and man-managed systems. The former include four subdivisions:

- a. Marshes and lagoons, around Aden, which form a suitable refuge for several species of birds.
- b. Mangrove sites in the Tehama "west coast of Yemen" and Bir Ali mangrove site on the southern coast.
- c. Valleys and permanent streams all over the country which support all kinds of freshwater biodiversity, including microorganisms, various invertebrates, fish, amphibians, birds, and many plant species.
- d. The swamps of Taiz, the only known site in Yemen for the globally threatened Bald Ibis *Geronticus eremicus*.

The man-managed systems, on the other hand include the lake of Marib Dam which is the largest freshwater body within the Arabian Peninsula. This lake can play an important role in the conservation of large numbers of freshwater species.  
*"Dr. Hussien A. AL-Gunaid, Deputy Minister for Environmental Affairs, Ministry of Water & Environment Country Report of Yemen Central Asian Flyway Action Plan Meeting Delhi, 10-13, June, 2005"*

Table ( 11 ) Yemen wet lands :

<b>Wetland Name</b>	<b>Coordinates:</b>	<b>Location:</b>	<b>Area</b>	<b>Altitude:</b>
<b>Wadi Surdud</b>	15°13'N, 43°20'E	15 km northeast of Bajil and about 65 km northeast of AlHudaydah, Al-Hudaydah and Al-Mahwit Governorates	Unknown.	
<b>Red Sea Coast: Midi to Al-Luhayyah</b>	16°21' N, 42°47'E to 15°33'N, 42°41' E	on the Red Sea coast from the Saudi Arabian border near Midi south for about 90 km to Al-Luhayyah, 105 km northnorthwest of Al-Hudaydah, Hajjah and Al-Hudaydah Governorates.	30,000 ha.	Sea level to 30m
<b>Islands off the Northwest Coast</b>	15°28'-16°02'N, 42°17'-42°42'E	in the southern Red Sea north and northwest of Kamaran Island, about 90-140 km north-northwest of Al-Hudaydah, Al-Hudaydah Governorate.	5,000 ha.	Sea level to 36 m.
<b>Red Sea Coast: A1-</b>	14°55'N, 42°55'E	on the Red Sea coast north from the city of A1-	Unknown.	Sea level

<b>'Urj to Al-Hudaydah</b>		Hudaydah to A1-'Urj , A1-Hudaydah Governorate.		
<b>Al-Hudaydah Sewage Lagoons</b>	14°49'N, 42°57'E	on either side of the main coastal highway about 10 km north of Al-Hudaydah city, Al-Hudaydah Governorate	50 ha.	Near sea level.
<b>Red Sea Coast: Nukhaylah to Wadi Nakhlah</b>	14°38'N, 42°58'E to 13°53'N, 43°13'E	on the southern Red Sea coast, 20-110 km south of A1-Hudaydah, A1- Hudaydah Governorate.	12,500ha.	Sea level.
<b>Red Sea Coast: Al- Khawkhah to Al-Mukha</b>	13°48'-13°19'N, 43°14'-43°18'E	on the southern Red Sea coast between AlKhawkhah and Al- Mukha, about 80 km east of Ta'izz, Ta'izz Governorate	7,000 ha.	Sea level
<b>Dhubab Flats</b>	12°55'N, 43°25'E	about 30 km north- northwest of the headland overlooking the entrance to the Red Sea (Bab al-Mandab), Ta'izz Governorate.	100-200 ha.	Sea level.
<b>Ta'izz Sewage Lagoons and Marsh</b>	13°39'N, 44°00'E	about 10 km north of Ta'izz city, Ta'izz Governorate.	250 ha.	1, 250 m.
<b>Wadi Warazan</b>	13°25'N, 44°15'E	about 8 km southeast of Ad Dimnah and 30 km southeast of Ta'izz city, Ta'izz Governorate.	90 ha.	1,200 m.
<b>Aden Mudflats and Marsh</b>	12°45'N, 45°02'E	immediately to the west of the city of Aden, Aden Governorate.	10,000ha.	Sea level.
<b>Wadi Jahr</b>	13°58'N, 46°23'E	north of the Lawdar to Habban road, about 60 km east of Lawdar and 80 km southwest of Ataq, Abyan Governorate.	500 ha.	600 m.
<b>Wadi Hajar</b>	14°06'N, 48°42'E	near the Gulf of Aden coast, about 70 km southwest of AlMukalla, Shabwa	50-100 ha.	Near sea level.

		Governorate.		
<b>Qishn Beach</b>	15°26'N, 51°45'E	near the village of Qishn on the Gulf of Aden coast, about 60 km west-southwest of Ra's Fartak, Al-Ghayda Governorate.	100 ha.	Sea level.
<b>Abdullah Gharib Lagoons</b>	16121'N, 52°20'E	on the Arabian Sea coast, 20 km northeast of Al-Ghayda, Al-Ghayda Governorate.	<b>50 ha</b>	Near Sea level.
<b>Qalansiya Lagoon</b>	12°42'N, 53°30'E	near the village of Qalansiya on the northwest coast of Socotra Island, 55 km west of Hadiboh, Aden Governorate.	100 ha.	Sea level.
<b>Mareb dam basin</b>		<b>Mareb dam</b>	<b>200 ha</b>	

### Status of marine and coastal ecosystems

The coastline of Yemen is over 2500 km long and includes three different coastal regions, namely the Red Sea, Gulf of Aden and Arabian Sea. The Red Sea region represents about one third of this coastline, with the remainder bordering the Gulf of Aden region. The Red Sea and Gulf of Aden region of Yemen represent a complex and unique tropical marine ecosystem with extraordinary biological diversity and a remarkably high degree of endemism. The Eastern Gulf of Aden and Arabian Sea region is a highly productive fishery region due to the Tropical Upwelling phenomenon, supporting a food web that ultimately sustains fish communities. Both the Red Sea and the Gulf of Aden are designated “special areas” under the international MARPOL convention.

Over 186 islands lie in the seawater of Yemen with distinct climatic and natural characteristics. More than 151 of these islands lie in the Red Sea region. Among those located in this region: Kamaran Island is the largest, and Mayoan Island, located in the Bab Mandab Strait, has strategic importance. Most corals and coral habitats exist around the Yemeni islands, but with different species communities.

No comprehensive up-to-date review of Yemen’s coastal and marine biodiversity is available which could facilitate the work of the I-SEA study team. The present

chapter is thus intended to cast an idea about the current status of knowledge concerning Yemen's marine and coastal biological diversity.

Coastal and marine areas are currently under intensive pressures associated with the growing use of their natural resources. If this situation continues unabated, it will lead to the depletion of coastal and marines divers ecosystems and reduction in their productivity. Reversing this situation requires to move towards integrated marine and coastal area management planning, addressing various threats contributing to marine and coastal biodiversity loss. The most important present and potential threats to marine and coastal biological diversity are:

- Alteration and loss of habitat, including destruction of watersheds;
- Global climate change;
- Pollution including from land-based activities;
- Invasion of alien species; and over utilization of living marines and coastal resources.

Other threats to the coastal and marine environment of Yemen include the uncontrolled use of coastal zones, destruction of marine and coastal habitats and ecosystems, spatial conflicts among various users, unplanned coastal reclamation, the destruction of benthic habitats by bottom trawling and the destruction of endangered species due to non-selective gear.

To protect marine ecosystems of the Yemen Red Sea coast, including coral reefs and other critical habitats by surveying on the marine ecosystems of the Red Sea, establishment institution as a branch of the Marine Science and Research Center for monitoring of marine environment, and Provide training of national counterparts through overseas training for higher studies and in-country, on-the-job training.

A report to the Convention of Biodiversity<sup>4</sup> summarizes the baseline for Yemen's coastal biodiversity as follows: *'Yemen's coastal and marine environment is both diverse and attractive from its rocky and sandy coasts to the saline mud flats, mangrove swamps, coral reefs and seagrass beds. A total of 416 species were recorded from the Yemeni Red Sea including 401 species of bony fish and 21 species of cartilaginous fishes (rays =5 species, sharks = 16 species). A total of 169 species were recorded from Socotra Archipelago. Compared to other parts of the Red Sea, the shallow nutrient rich waters above the wide continental shelf of Yemen are rich fishing grounds.'* This account does rather improperly reflect the current knowledge of Yemen's coastal and marine biodiversity. As a matter of fact the Red Sea and Gulf of Aden contain some of the world's most diverse and varied tropical marine habitats and communities. The combination of high levels of diversity, great biogeographical complexity, and high levels of endemism found in these bodies of water make them a region of global significance.

This is indicative of the fact that coastal and inshore ecosystem types are subject to higher levels of human pressures relative to offshore ecosystem types.

Table ( 12 ) marine resources

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<sup>4</sup> EPA 2009. Yemen's role in the conservation of biodiversity, 4<sup>th</sup> Biodiversity National Report submitted to CBD 2009.

no.	Items	Species
1	<b>Fish</b>	969 spp
2	<b>Mollusks</b>	625 species
3	<b>Crustaceans</b>	53 species (Lobster 5spp and Shrimps 4spp)
4	<b>Echinoderm</b>	168 species (Sea Cucumber 20 spp)
5	<b>Algae</b>	485 species
6	<b>Macro algae</b>	283 species
7	<b>Sea grasses</b>	9 species
8	<b>Phytoplankton</b>	283 species
9	<b>Zooplankton</b>	139 species
10	<b>Sea and shore Birds</b>	102 species
11	<b>Marine turtles,</b>	4 species
12	<b>Corals reefs</b>	300 species
13	<b>Coastal Fresh water vegetation</b>	3 species
14	<b>Halophytes</b>	21 species

All species of marine turtles are regarded as endangered animals worldwide by the IUCN. Four species of turtles were recorded from the Yemeni waters. These species are:

- 1- *Chelonia mydas* (Green turtle)
- 2- *Eretmochelys imbricata* (Hawksbill turtle)
- 3- *Caretta caretta* (Loggerhead turtle)
- 4- *Dermochelys coriacea* (Leatherbacks turtle)

*Caretta caretta* was recorded from Socotra Archipelago only. In particular, Ras Sharma beach is considered as the most important nesting area for the Green Turtle in the entire Arabian Region, including the Red Sea and Gulf of Aden. Approximately nesting 1,000 turtles were recorded in this area.

### **Marine Mammals**

The dugong dugon (Sirenia) and several species of dolphins and whales (Cetacea) are found in good numbers in several places along the Red Sea coast of Yemen. The common dolphin *Delphinus delphis* and the sperm whale *Physeter macrocephalus* are the only species recorded from Socotra Archipelago.

It is important to limit these, initiate and implement sound integrated coastal zone management for the sustainable use of Yemen's marine and coastal environment including the identification and management of protected areas.

The coast of the mainland is suffering from pollution and saltwater intrusion as most surface water is fully exploited upstream. The sea along the mainland coast and the numerous Islands in the Red sea are within the heavily sea traffic route for every kind of ships, and prone to oil spills from ships and oil terminals. Marine critical habitats such as mangrove, seagrass, and important coastal sites for bird feeding and breeding, are increasingly threatened by coastal development. If not planned correctly, development in Socotra Island will have considerable environmental impact on marine resources, including coral, fish and turtle species. Tourism attractions of the country include possibilities for diving and snorkeling in the coral reefs of the Red sea, the Gulf of Aden and Socotra Archipelago.

Moreover, coral reefs and seagrass important to fish and other marine life are destroyed by trawling and other unsuitable harvesting methods causing loss of productivity and threat to endemic and rare species. The formerly rich fish resources on the country's continental shelf are now reduced through outtake. Due to overexploitation of resources, a number of animal and plant species, some of which are globally threatened, rare and endemic to Yemen, are endangered or already extinct.

Covers the utilization of fish wealth and maintaining marine monitoring and inspection and quality control and development of fish exports and conserving the marine environment and the proper management of fishing operations.

Yemen also has formulated groups of sector strategies and action plans for the agricultural, fisheries, environmental and other development sectors enhancing the resources wise management. Regulate the marine resources fishing by issuing, Laws and bylaws which strictly inhibit fishing in the spawning seasons. Provide livelihood alternatives for the local communities to reduce the pressure and excessive demands on the natural resources. Besides, there are efforts to encourage the investment in the marine aquaculture industry to provide food and to enhance the country economics. Cooperation with local communities and NGOs through providing awareness programmes in using the traditional ways in natural resources management.

Good achievement been made in sustainable use of some biodiversity components, however, the sustainable consumption needs more efforts especially in scientific research programmes and in formulation policies for sustainable consumptions of biodiversity components outside the protected areas.

Yemen also devoting great efforts oil pollution or contamination to occur in the coastal and marine habitat. In addition to the institution responsible for species healing and habitat rehabilitations, there are special institutions were established to prevent and control oil pollution in the Yemeni waters. Yemen also has prepared the National Plan of Action to prevent land based activities marine pollution (NPA).

Group of training and awareness programmes addressing the sustainable use and wise natural resources exploitation were provided to the local communities and

stakeholders. Environment friend methods and techniques imposed and adapted as alternative to the bad practiced habitat destroyed methods such as fishing gears used in marine fishing and irrigations techniques to conserve ground water. Many studies been conducted on water quality, fish and marine resources stock assessments, fishing grounds and the taxonomy of marine species. Protected areas have been declared, with the main propose maintaining the ecosystem and provide alternative livelihoods.

The coast line of Yemen is characterized by a variety of habitats which supports a closely inter-linked and forms a unified system of major ecological and economic importance. Table ( 13 ) presents an over view of the main coastal / marine habitats of Yemen and their occurrences. Among these habitats a number of sites are of special scientific, ecological and economical interest along the coast line of Yemen .

Marine / coastal habitats are endowed and combined with a high biodiversity in terms of total number of flora and fauna species. They also provide natural ecosystems suitable for almost all kinds of commercial fisheries.

The flora and fauna of the Yemeni marine ecosystems are mainly of the Indo-pacific origin, with high percentage of endemic species. Previous studies had largely focused on the description, distribution; potential and the state of health of their habitats. These studies which clarified the general biota patterns were investigated by IUCN (1987a, b), Price; etal (1987), EH&A (1989), Can-Oxy (1993), Dekker and Capelle (1994), Rushdi; etal (1994), MA&P (1996a, b); DouAbul and Haddad (1996).

Table (13): Main coastal and marine habitats of ecological importance

<i>Coral reef</i>	<i>Mangrove</i>	<i>Palm trees</i>	<i>Reed &amp; Halophyte</i>	<i>Rock / Algal</i>	<i>Sabkha</i>	<i>Seagrass Beds</i>	<i>Turtle Nesting Sites</i>
Abu Zahr	Al Khawbah	Abu Zahr	Ahwar	Al Fataq	Al Luhayah	Al Jabanah	Al Quirm
Abdel Kuri Is.	Al Luhayah	Ahwar	Qaw'a	Al Hami	Al Mukha	Al Urj	Ahwar
Al Mukha	Al Urj	Al Fazzah	Ras Imran	Al Qiran	Al Urj	Ar Rauys	Al Fataq
Bir Ali - Balhaf	Ar Rauys	Al Jabanah	Socotra Is.	Burum	Dhubab	Bab El-Mandeb	Al Kawkha
Broum	Dhubab	Al Manzar	Wadi Riam	Damqut	Gholayfigah	N. Dhubab	Al Khobat
Creater Aden	Habl	Al Mujaylis	N. Mujaylis	Fowa	Habl	Habl	Al Raydah
Darasa Is.	Kamaran Is.	Al Urj	Al Fazzah	Jebel Swada	Mawshij	Khor Kalfut	Ar Ruays
N. Dhubab	Midi	Az Zahari	N. Az-Zahari	Khor Kalfut	Midi	Khor Omairah	Areha
Humar Is.	N. Bab El-Mandeb	Gholayfigah		Ras Qaw'a	Salif	Mawshij	Hunish Is.
Hunish Archi.	Salif	Nukhaylah		Ras Dharbat Ali	E. Ras Omran	Midi	Islands near Midi
Khor Omairah	Shouran(Bir Ali)	Qatabah		Shehir/Dhabbah	Wadi Hassan delta	Nukhaylah	Jebal Al Raydan
Ras Fartak	Socotra Archi.	Shuheer		East Shuqra		Salif	Sarma Jithmoun

Ras Isa		N.Wadi Raim		Yetnoon		Socotra Archi.	Khor kalfut
Samha Is.		Yakhtul		Gosier		Qatabah	Maabut
Shuqra		Ar Ruays				S. Mawshij	N. Dhubab
Socotra Archi		Aden				Ras Al Arah	Shehir/ Dhubab
Tikfash Is.						Suquiah	Socotra
Ukban Is.							Zugar Is.
Yakhtul							
E. Nishtoon							
Monoq							
N. Ibn Abbas							
Hodeidah							

**Table ( 14 ) : Coastal Marine Sites of Special Scientific and Ecological**

**Interest along the coastal line of Yemen (IUCN, 1987; MAE, 1989; Rusldi; etal, 1994)**

Site	Interest	Source
Perim Island	Coral reefs, hard bottom communities	Ghadaf & Stim, 1983
Ghuraira Lagoon	Coral reefs, hard bottom communities	Ghadah & Stim 1983
Ras al Ara	Offshore shallows	Red Sea & G. of Aden Pilot, 1967
Khor Omaira	Large protected bay, turtle feeding and breeding, sea grass, shellfish, mariculture potential.	CEMP, 1985
Bandar Fuqum	Shallow bay, rich fishing	CEMP, 1985
Ras Abu Quijara	Rocky shores, submarine hard bottom communities, coral fields	Ghadaf & Stim, 1983
Farisi Lagoon	Mud flats, bird and fish food resources	CEMP, 1985
Aden Inner Harbor	Mud flats, bird and fish food resources	CEMP, 1985
Khormaksar Beach	Exposed sandy beach	CEMP, 1985
Shuqra	Offshore rocks, coastal reef	RS & Gulf of Aden Pilot, 1967
Jabal Shouran	A crater filled with salt water, reportedly fringed with overhanging	Red Sea & G A Pilot 1967

	mangroves	
Ghadarain Islets	Rocky communities, sea birds	Red S & GA Pilot 1967
Baraqa Islet	Rocky communities, sea birds	Red S & GA Pilot 1967
Bandar Barum	Coastal reef	Red S & GA Pilot 1967
Ras Sharma/ Jithmoun	Turtle breeding ground	MA&P, 1996 & DouAbul & Abubakr 1996
Ras Fartak	Rocky communities, sea grass	CEMP 1985
Nishtun	Rich fishing grounds, rock and muddy bottoms	CEMP 1985
Liban	Unique terrestrial/marine environment, turtles	Ghadaf and Stim 1983; Sheppard, 1995
N-Midi	Seagrass, Mangrove & Recreational sandy beach.	IUCN 1987
N-Habl	Seagrass, Mangrove & Recreational sandy beach, focal point for wild life of the region.	IUCN 1987
Al-Luhayah	Seagrass , Mangrove , Reefs on Humar Island	IUCN 1987
Ukban Island	Sandy beach, coral reef, fossil reef, fisheries area / nursery ground.	IUCN 1987
Ibn Abbas	Mangrove, Seagrass, nursery / breeding / feeding areas.	IUCN 1987
Al-Salif	Mangrove	IUCN 1987 ; Rushdi, etal 1994
Ras Isa	Coral reef , Sandy beach , Focal point for coral reef associated species .	IUCN 1987 ; EH & A 1987 ; Rushdi, etal 1994
Al-Manzer to Ghulayfiqah	Silt flats , dunes , sandy beach , palm trees , nursery / feeding / breeding areas	IUCN 1987
Al-Fazzah	Palm sand, reed beds, focal point for the wild life of the region.	IUCN 1987
Abu-Zahr	Sand beach , palms , seagrass , coral areas , ideal location for recreational / educational establishment	IUCN 1987
Mawshig	Coral reef, Nursery / feeding / breeding ground for reef fish and turtles,	IUCN 1987

	Recreational resource.	
Ar Ru'ays	Sandy beach, palms, seagrass, Mangrove, salt ponds or sabkhat.	IUCN 1987
N-S Al-Mukha	Coral reef & occasional seagrass beds.	IUCN 1987 ; Rushdi, etal 1994

A total of 153 families and 969 fish species were recorded from the Yemeni waters.

Cartilaginous fishes include 11 families of rays and batoidei (44 Species) and 18 families of sharks contain 68 species. The rest are bony fishes (Osteichthyes) which include 124 families and 857 species. Great numbers of which are under great threats due to the intense fisheries pressure imposed on them. A large number of these species are sharks, reef fisher, and mollusks. (Dr. Mohamed Mahdi, *Marine resources* )

Sustainable use of the marine and coastal environment is a potentially important driver of development. Fisheries and aquaculture play important roles for food supply, food security and income generation. Coral reefs, sea-grass and mangroves provide coastal zones with important biodiversity and fishery potential. Yet, Yemen's coastal ecosystems are rich but also already experiencing critical environmental concerns such as declining productivity of marine flora and fauna, altered coastal vegetation and agricultural productivity, loss of mangroves, salt sea water intrusion, reduced inshore fisheries and increased pollution which are mainly attributed to man-made activities as well as climatic causes. These are the major types of current marine and coastal environmental concerns that could be exacerbated under climate change impacts. If no adequate decisive actions are promptly taken, more challenges will certainly come out. **“Fishery Sector Strategy and Climate Change April 2012. UNDP**

### Distribution and extent of the mangrove stands :

Only four species of mangrove are known from the Red Sea:

- *Avicennia marina*
- *Rhizophora mucronata*
- *Bruguiera gymnorrhiza*
- *Ceriops tagal*.

Three species have been reported from the Red Sea coast of Yemen.

Mangroves allocating along the Red Sea coast, Aden Gulf, Socatra Island and the near and offshore islands of Yemen (Table 15 ). This represents well above 95% of the mangrove areas in the country. Two areas reported to have mangroves were not visited during this survey. The first includes the islands off the north-east coast, particularly Tikfash and Humar that support small stands of *Avicennia marina*, and the second area is a crater lake, Kharif Shaaran, fringed by *Avicennia marina*. It is the only mangrove stand on the 1400km Gulf of Aden coast of Yemen. All surveyed mangrove forests, except for two, are mono-specific stands of *Avicennia marina*.

The exceptions include Kamaran Island and two stands near Al-Hudaydah, where stands of *Rhizophora mucronata* coexist with *Avicennia marina*. Typically, the mangroves grow as thin forests along the shoreline, on near- and offshore islands, and fringing tidal inlets and channels (locally known as khors). These extend landwards along depressed areas forming shallow inundated areas of various lengths. They are more common on the north than the central and south coast. In some areas like Al-Luhayah and Midi, the khors are particularly extensive with permanently flooded inlets often used as landing sites for fishing boats.

**Table (15) Location and extent of mangrove stands surveyed in Yemen, July and August 2002**

Stand code	Stand site	Position	Approximate length (km)
RSY1	Midi	16° 21'N, 42° 47'E	0.8
RSY2	Between Midi and Al-Habl (1)	16° 20'N, 42° 47'E	0.2
RSY3	Between Midi and Al-Habl (2)	16° 16'N, 42° 48'E	0.4
RSY4	Between Midi and Al-Habl (3)	16° 15'N, 42° 48'E	0.35
RSY5	Between Midi and Al-Habl (4)	16° 13'N, 42° 48'E	1.5
RSY6	Between Midi and Al-Habl (5)	16° 11'N, 42° 50'E	3.5
RSY7	Al-Habl	16° 09'N, 42° 49'E	7.0
RSY8	Al-Buhays	15° 59'N, 42° 49'E	29.0
RSY9	Between Al-Buhays and Al-Luhayah	15° 49'N, 42° 46'E	22.0
RSY10	Al-Luhayah North	15° 43'N, 42° 42'E	2.0
RSY11	Al-Luhayah	15° 42'N, 42° 41'E	3.0
RSY12	2km south of Al-Luhayah	15° 41'N, 42° 42'E	0.8
RSY13	6km south of Al-Luhayah	15° 39'N, 42° 43'E	1.5
RSY14	5km south of Al-Khawbah	15° 29'N, 42° 46'E	0.9
RSY15	12km south of Al-Khawbah	15° 27'N, 42° 46'E	3.5
RSY16	Ibn Abbas	15° 29'N, 42° 46'E	6.5
RSY17	Al-Harounia mersa	15° 18'N, 42° 48'E	7.0
RSY18	Between Al-Harounia and Al-Salif	15° 13'N, 42° 46'E	3.5
RSY19	Kamaran Island	15° 22'N, 42° 35'E	7.0
RSY20	Al-Urj	15° 06'N, 42° 52'E	0.8
RSY21	North of Al-Hudaydah	14° 52'N, 42° 57'E	0.95
RSY22	Hudaydah islets 1 (Am-Shura Islet)	14° 50'N, 42° 55'E	0.3
RSY23	Hudaydah islets 2 (Gandal islet)	14° 53'N, 42° 56'E	0.15
RSY24	Hudaydah islets 3 (Mugamalah islet)	14° 51'N, 42° 56'E	Few trees
RSY25	Hudaydah islets 4	14° 54'N, 42° 56'E	0.7
RSY26	Between El-Rowais and Yakhtul	13° 32'N, 43° 16'E	7.0
RSY27	5km south of El-Makha	13° 16'N, 43° 15'E	0.15
RSY28	Between Al-Kadaha and Al-Ubaidah	13° 08'N, 43° 18'E	16.0
RSY29	El-Ghurairah at Bab al-Mandab	12° 44'N, 43° 28'E	1.5
	Total		128.0

Although the mangrove stands are typically thin, ranging from 50 to 300m in width, their length varies considerably from 100m to over 20km (Table 15). The total length of the mangrove forests surveyed along the Red Sea shore and near shore islands was estimated at 128km. More than half of these (55%) are concentrated along the north coast between Midi and Al-Luhayah.

The mangrove stands are especially extensive at Al-Buhays (15° 59'N, 42° 49'E) and Al-Habl (16° 09'N, 42° 49'E). Distribution and density of the mangroves on the Red Sea coast may be classified into four areas according to ecological features:

1. Midi to Al-Luhayah area: mangroves stands are most dense and extensive in this area forming a semi-continuous belt along the shore.
2. Al-Khawbah to Ras Isa: mangrove stands are less dense than the coastal area to the north, interrupted by relatively large patches of bare shore.
3. Al-Urj to Al-Hudaydah: mangrove stands are limited in size and confined to a few tidal inlets and small islets.
4. South of Al-Hudaydah to Bab al-Mandab: mangrove stands are relatively thin and widely separated from each other, influenced by the topography of the shoreline and the higher aridity of the area. However, extensive stands are found where considerable fresh water seepage exists.

(PERSGA) *Status of Mangroves in the Red Sea and Gulf of Aden* DRAFT 09-05-2004

## Impact and Potential Threats:

### 1- Camel grazing:

Camel grazing was reported in almost all the mangrove areas surveyed in Yemen, excluding stands growing on inaccessible islands. In Yemen camel grazing a major factor causing mangrove degradation along the Red Sea coast. In areas affected by camel grazing , significant reduction in the number of trees, denuded patches, barren depressions, destroy new generation and compaction of soil surface.

### 2- Cutting Mangrove Trees:

Cutting and removal of the mangroves is more destructive than camel grazing. The impact is severe due to the limited size of most stands. Cutting is indicating to poor enforcement and inadequate management specially in the north part of the coastal areas of Al-Lohiah . In some areas, where dead standing trees are common, wood collection and felling is largely confined to the dry parts of the stand.

In areas affected by severe mangrove cutting, significant reduction in the number of trees,

denuded patches, barren depressions with modified hydrological regimes. Besides reducing tree cover, that cutting provides passage to the dense inner parts of the stands for camels to graze.

The combined stresses of grazing and cutting have accelerated degradation of several mangrove areas near major population settlements along the coast. Assessment of the status of mangrove areas in relation to the impact of camel grazing and cutting .

### 3- Mangrove mortality

Mass mortality of mangrove trees appears to be a serious problem in several mangrove areas, particularly in the southern parts of the Red Sea coast in Yemen (mangrove areas between Al-Ruays and Yakhtul and near Al-Ghuraira. In several other areas localized pockets of dead standing trees were reported in Midi and some parts of Bahr Ibn Abbas .

The major cause of the mangrove mortality in the Region appears to be localised modifications to the topography of the coastal area. This leads to diversion or

blocking of tidal water flow and drying up of the mangrove stands. This may be attributed to:

- ✓ Construction activities involving dredging and infilling on the shore e.g. for new harbours, jetties, dams, bridges, and ponds for aquaculture of shrimps.
- ✓ Diverting tidal water to feed salt pans through canals, e.g. the shore between Al-Ruays and Yakhtul in Yemen.
- ✓ Excessive sediment loads or infilling b sand that has buried tidal inlets and channels preventing flooding of the mangroves by seawater.

In many coastal areas, human-induced degradation of the mangrove and terrestrial vegetation has led to reduced soil stability, loss of sediment trapping capacity and excessive movement of sand dunes from land. In some areas sand is transported by wind through denuded patches created by grazing and cutting. The sediment is deposited in the lower reaches of the tidal inlets and channels. This modification of tidal regimes threatens the existence of the affected forests even where cutting or camel grazing does not significantly impact the inner stand.

#### **4- Freshwater damming**

Due to the lack of perennial rivers and the aridity of the Red Sea coastal area, the main source of freshwater, beside desalination plants, is rain water harvested from the lower reaches of major valleys. The population of the coastal area is increasing rapidly. Industrial development and the urbanisation of rural areas has increased the demand for freshwater. Soil dams are being constructed to harvest water from the lower reaches of major valleys (Wadi Mawr in Yemen). This considerably reduces the amount of freshwater reaching the sea from surface run-off.

#### **5- Pollution**

##### **Solid-wastes and garbage**

Domestic solid-waste e.g. polythene bags and bottles, rubber, plastic and metal cans etc. are disposed of in large quantities near population centres. Several mangroves, e.g. Al-Khawbah and Al-Hudaydah in Yemen. It is often dumped directly into the mangrove stands or near them and is transferred by wind and tidal water becoming trapped among the trees and their aerial roots. This has serious physical impacts, particularly on young seedlings and pneumatophores and may interfere with water circulation by blocking tidal channels. It may also disturb other mangrove-associated flora and fauna.

##### **Organic pollution**

Some mangrove areas in the Region, particularly Al-Hudaydah (Yemen) have been under stress from sewage pollution for several years. Untreated or poorly treated sewage flows directly into the mangroves or shore areas in vicinity of the mangroves. The affected mangrove stands are dominated by stunted, multistemmed trees. Branched, twisting and dead pneumatophores are common. However, it is difficult to attribute the effects to sewage pollution alone. Some of these stands also suffer stress from other sources such as camel grazing and cutting.

##### **Coastal construction and changes in land use**

Recently, the Red Sea Region has witnessed several construction activities such as roads, harbours, industrial sites, commercial areas, tourist hotels, airports, bridges, channels, aquaculture ponds, salt pans, etc. Mangroves on the Red Sea appear to be less affected by coastal infilling than those on the Arabian Gulf.

### **Objectives of mangrove management**

The immediate objectives of mangrove ecosystem management in the Region should include:

- Controlling the present impacts and stresses that are directly or indirectly causing adverse effects on the mangroves. These include the unsustainable use of the resources by allowing open access for people and camels and other impacts.
- Protection of mangroves against further degradation from potential threats in the near future.
- Extending the present mangrove areas by securing natural regeneration and mangrove plantation.

The long-term objectives of mangrove ecosystem management should include the development and implementation of an integrated management approach based on scientific research and longterm monitoring to ensure sustainable use and conservation of the resources.

### **Management strategies and prescriptive guidelines**

Strategies to be adopted for establishing a proper mangrove conservation and management system may include:

- ✓ Providing finance and long-term funding commitments for conservation and monitoring Programmes.
- ✓ Establishing legislative and institutional frameworks.
- ✓ Reviewing available databases and the establishment of scientific research and equipment for long-term monitoring programmes to provide guidelines for management.
- ✓ Capacity building and training of local technical staff to implement the management policies.
- ✓ Ensuring public awareness and local community participation in conservation and rehabilitation activities.
- ✓ Providing suitable mechanisms and equipment required for implementation of the adopted management policies.
- ✓ Efficient implementation of management policies, based on sufficient technical know-how and periodic evaluation of the programmes.

The protection remedies may include:

- Establishing an institutional and legislative framework, using environmental laws and efficient management to implement protective measures and enforce regulations.
- Prohibition and restriction of present activities causing mangrove degradation including uncontrolled camel browsing and wood cutting.
- Control of mangrove pollution and elimination of pollutants and their potential threats.
- Raising institutional awareness of the need for mangrove protection and conservation.
- Feasibility studies and management of industrial and coastal development projects and institutional participation in mangrove conservation programmes.
- Public and private sector awareness and participation in protection plans.

- Establishing long-term mangrove monitoring programmes to monitor natural and human induced changes and follow up for rehabilitation and restoration programmes.

Mangrove rehabilitation and restoration programmes may include securing natural Re-generation where possible by:

- ❖ Restricting activities which disturb the growth of seedlings and young plants.
- ❖ moderating human-induced changes and modification of the habitat, which reduce the potential of mangroves to regenerate naturally. e.g. constructed channels, which deviate tidal flow, freshwater damming, pollution.

### Corals and coral communities.

Most of the coral reefs occur along the Red Sea coast and the Socotra archipelago, with some sites in the Gulf of Aden. Corals grow on the Red Sea coast as both coral reefs and coral communities on a variety of substrates. Coral reefs in the northern Gulf of Aden are limited by intense cold seasonal upwelling. Extensive coral reefs surround the Socotra archipelago.

The coastline of Yemen is 2,500 km long, with two thirds in the Gulf of Aden. The Red Sea and Gulf of Aden are markedly different environments and the reef types reflect these differences. The Red Sea coral reefs are mainly coastal and island fringing reefs, with some patch reefs and coral pinnacles; the reefs cover approximately 25% of the coastline. Reefs fringe the limestone islands (e.g. the Kamaran group or the southern Farasans), and the volcanic oceanic islands in clearer water (e.g. the Hunaish, Zuqar and Zubairy groups). There are strong seasonal southerly winds, which stir up the sediments, reduce water visibility and stress the corals. In addition, these shallow waters experience comparatively high water temperatures which further stresses the corals. The reefs are more like reef flats without true crests and slopes.

Table ( 16) : Species diversity of reef-building stony corals from the Yemen Red Sea (Turak & Brodie 1999), NE Gulf of Aden (DeVantier & Hariri) and Socotra archipelago (DeVantier & AbdalAziz unpubl.).

<b>Taxonomic level</b>	<b>Red Sea</b>	<b>NE Gulf of Aden</b>	<b>Socotra islands</b>
<b>Family</b>	14	14	14
<b>Genus</b>	56	38	56
<b>species</b>	176	100	253

### Sea-grass:

Sea grasses along the Red Sea coast of Yemen Fifty-eight species of seagrass, of 12 genera, have been described worldwide (Kuo and McComb, 1989). Eleven species of

seagrass have been recorded from the Red Sea, including the Suez and Aqaba Gulfs, and nine along the Red Sea coast of Yemen (Barratt et al. 1987; Table 3.1)

Table: (16) Species of seagrass recorded from the Red Sea. Species with asterisk(\*) were recorded from the Red Sea coast of Yemen by Barratt et al. (1987).

- *Halophila stipulacea*\*
- *Halophila ovalis*\*
- *Halophila ovata*
- *Halophila decipiens*
- *Halodule uninervis*\*
- *Thalassodendron ciliatum*\*
- *Thalassia hemprichii*\*
- *Cymodocea serrulata*\*
- *Cymodocea rotundata*\*
- *Enhalus acoroides*\*
- *Syringodium isoetifolium*\*

Although seagrass is patchily distributed along the length of Yemen's Red Sea coast, five principal seagrass regions have been identified offshore from Midi, Al Luhayyah, Khawba (Khobah), Al Hudaydah and Dhubab (Price et al.1988). These regions are sheltered as described above.

There was little evidence that human activity is responsible for seagrass loss along the Red Sea coast of Yemen. Epiphytes were abundant on seagrass in same areas location of sewerage discharge. But this may be a natural phenomenon, as epiphytes were found on seagrass in areas far from urban centers. Natural disturbance included erosion of seagrass beds due to strong wave action , and dugong feeding trails off Al Luhayyah.

#### Turtles:-

Marine turtles were among the endangered species which have great concern world widely. Five species of turtles were recorded from the Yemeni water. Their nesting and breeding ground extends along sandy shores of Yemen as indicated in table (17 ). These species are:-

No	Turtle name	Species
1-	<i>Chelonia mydas</i>	(Green turtle)
2-	<i>Eretmochelys imbricata</i>	(Hawksbill turtle)
3-	<i>Lepidochelys olivacea</i>	(Olive ridley)
4-	<i>Caretta caretta</i>	(Loggerhead turtle)
5-	<i>Dermochelys coriacea</i>	(Leatherbacks turtle)

Table : (17) Turtle names and species

However, the logger head turtle was recorded from Socotra Archipelago only (MAE, 1996 b). Although, turtles are among the endangered species, which have great concern worldwide, and protected under national legislation, they are under threat from human exploitation in Yemen. They are classified as endangered globally and any additional threats to population levels will decrease their numbers even further. Nesting beaches along the southern coast of Yemen are suggested to be some of the best remaining nesting ground in the world for green turtle (Hirth&Carr, 1977).

### Marine mammals:-

<u>Cetaceans</u>	
<u>Family: Odontocetes</u>	
<i>Tursiops truncatus</i>	Bottlenose dolphin
<i>Tursiops aduncus</i>	Bottlenose dolphin
<i>Delphinus delphis</i>	Common dolphin
<i>Delphinus cf. D. tropicalis</i> (Van Bree, 1971),	Tropical dolphin
<i>Stenella longirostris</i>	Spinner dolphin
<i>Stenella attenuata</i>	Spotted dolphin
<i>Stenella coeruleoalba</i>	Striped dolphin
<i>Grampus griseus</i>	Risso's dolphin
<i>Sousa chinensis</i>	Indo-Pacific humpback dolphin
<i>Sousa cf. S. plumbea</i> (G. Cuvier, 1829),	Humpback dolphin
<i>Steno bredanensis</i>	Rough-toothed dolphin
<i>Pseudorca crassidens</i>	False killer whale
<i>Feresa attenuata</i>	Pygmy killer whale
<i>Orcinus orca</i>	Killer whale
<i>Peponocephala electra</i>	Melon-headed whale
<i>Kogia simus</i>	Dwarf sperm whale
<i>Physeter macrocephalus</i>	Sperm whale
<i>Ziphius cavirostris</i>	Cuvier's beaked whale
<u>Family: Mysticetes</u>	
<i>Megaptera novaeangliae</i> ,	Humpback whale
<i>Balaenoptera edeni</i>	Bryde's whale
<i>Balaenoptera acutorostrata</i>	Minke whale
<i>Balaenoptera musculus</i>	Blue whale
<i>Balaenoptera physalus</i>	Fin whale

Two classes of marine mammals occur in the Red Sea of Yemen. These are the dugong *Dugong dugon* (Sirenia) and several species of dolphins and whales (Cetacean); Table, 12). The common dolphin *Delphinus delphis* and the sperm whale *Physeter macrocephalus* were the only marine mammals recorded from Socotra Archipelago (MAE, 1996 b). Table (12) lists the most likely marine mammals to be found in the Yemeni open waters. Dugong usually associated with seagrass beds of the Yemen Red Sea (Rushdi *etal*, 1994).

***Table ( 18 ):- lists the Cetaceans species of the Yemeni open waters***

### **Coastal and Marine Biodiversity Issues:**

#### ***Habitat damage:***

Studies indicate a number of threats to marine habitats, especially the sea bed, from fishing methods such as bottom-trawling. The marine species affected are, consequently, soft-bottom communities, demersal fisheries, sea grass ecosystems, and corals. The ‘bycatch’ in fisheries, including marine mammals and sea turtles, has steadily increased. Land is scarce, and despite the 2004 tsunami coastal lands are being coveted by non-coastal communities. Aquaculture, which was introduced as an *ex-situ* measure for harvesting marine species, especially prawns, is solely responsible for destroying large tracts of productive coastal land and mangroves. Severe deterioration undergoing to mangroves stands too caused by over grazing and wood cut for fuel.

coastal degradation has been large development and infrastructure projects along the coast as well as unplanned and unregulated growth in coastal areas. Ecosystems and critical habitats that are constantly being challenged are mangrove forests, seagrass beds, coral reefs, small island ecosystems, coastal headlands and cliffs, coastal wetlands, sand dunes, etc.

#### ***Lack of fisheries management:***

Lack of management policies and strategies make the fisheries in Yemen coasts and sea water un controlled, the lack of fisheries surveillance make it even worse. In addition, to that the inability to undertake proper stock assessment worsening fisheries management too especially during marine resources spawning and breeding. Fish landing out of the official landing site causes fisheries data scarcity which make it difficult to determinate the causes of marine resources quantitate fluctuation. Bad fish handling which is experienced almost at all artisanal fisheries in Yemen undermine the fish value and consequently its price.

### **Lack of monitoring and assessment fisheries Habitat :**

#### ***Over-exploitation of bio-resources:***

Living bio-resources found in the coastal zone are heavily exploited, and often the exploitation is unsustainable. This includes banned species such as sea cucumbers, rock lobsters, sharks, cuttle fish, molluscs and some fish species. There is practically no data available on the exploitation of any of these species. Fishing during the spawning and breeding seasons undermine the marine resources organisms and cause loose of marine resources of high value to the communities and the government at local and national level. Fishing methods and fishing areas seasonal controlling lack also causes species damage and disappearance.

***Pollution:***

The coastal zone receives waste generated by a number of point and non-point sources, especially sewage, industrial effluents, sediment, and agricultural chemicals, notably fertilisers and pesticides. These contribute to the degradation of the quality of coastal waters. There is very poor monitoring and management of marine pollution. In most coastal cities, sewage is released into the sea untreated. There are no effective/appropriate seawater quality and emission standards.

***Invasive species:***

Invasive alien marine species threaten biodiversity, marine industries (including fishing and tourism) and human health, and unlike oil spills only get worse with time.

Ever since people began travelling in ships, they have inadvertently carried “pests” with them, including diseases, rats and, largely unnoticed, marine organisms. the introduction of alien species as a major threat to marine biodiversity and a contributor to environmental change. As these marine introductions, intentional and accidental, can result from numerous human mediated activities, management responses need to cover a diverse range of human activity.

In Yemen still there is no effort to count and determinate the invasive species, its sources and ultimately its impact to the coastal and marine biodiversity in the country.

***Weak implementation of laws:***

The coast is traditionally a jurisdictional boundary between land-based laws and marine laws, and has rarely been recognised as an integrated zone of legal competence. The earliest laws concerning the coast generally relate to the ownership of coastal land and the division between public and private property. CZM must, however, operate within a legal framework, having either specific laws relating to a particular area or being covered by general national legislation that covers resource usage and conservation.

The Republic of Yemen, over the past fifteen years, has enacted large number of laws and by-laws conducive to natural resources and environment. However, most of the existing national legislations in the Republic of Yemen have evolved in an ad-hoc, fragmented and uncoordinated manner, leading to overlapping jurisdictions, and weak enforcement of the said laws. Furthermore, some legislation which is currently in

place is either outdated or inadequately addressing environment conservation and natural resources management even though most of them issued for natural resources management and conservation purpose. On top of above constraints, many laws lack complementary by-laws, guidelines and standards for their effective enactment. Inadequacies in legislative framework of national institutions have weakened the institutional performance in managing of natural resources leading to accelerate environmental degradation.

There is poor integration of marine and coastal biodiversity concerns in the Environment and natural resources legislations and lack of awareness and sensitivity towards the issue of marine and coastal biodiversity among the judiciary, policymakers, decision-makers and administrators. These gaps extend to laws that govern conservation and management. Moreover, current legislation and institutional mechanisms for protected area conservation and fisheries are inadequate and do not accommodate contextual models and frameworks for fisheries management and marine conservation.

The loose and decentralized working relationship between concerned agencies has resulted in a weak coordination, integration, and harmonization of overall efforts devoted for halting natural resources degradation. The limited financial and information resources limit the abilities of organizations and institutions to collaborate. Furthermore, there are number of root causes which influence the performance of national agencies responsible for environmental management. These include: insufficiency of qualified specialized manpower; unclear and duplicated mandates of environmental agencies, absence or incomplete organizational structure and job descriptions, and lack of appraising system for evaluating staff performance associated with absence of by-laws and internal operation system.

### *Knowledge and awareness:*

There are huge gaps in knowledge and understanding of many aspects of marine and coastal biodiversity such as sea grasses, corals, impacts of climate change, etc. There are also gaps in documentation of the anthropological, socio-economic, indigenous knowledge and practices of coastal communities. Moreover, there is no single stakeholder or platform that provides coordination and knowledge-networking.

There is a lack of qualitative and quantitative data on the status of natural resources in Yemen. Consequently, public awareness of environmental degradation, especially among decision-makers and relevant agencies is still very poor.

It is further complicated by the lack of awareness and communication strategy and action programmes. Furthermore, there is inadequate integration of coastal and marine resources importance into formal education programs and curricular, which in turn limits public appreciation of such issues.

Research on environmental issues is still poor or nonexistent. It is either due to inadequate financial resources, infrastructure and facilities for research institutions and/or to the lack of trained human resources.

Financial constraints is the most limiting factor, which hinders research institution capacity to deliver concrete scientific knowledge to improve policy makers and public understanding of biodiversity and natural resources issues at whole and coastal & marine resources exploitation in specific, thereby causing low level of societal commitment towards these issues.

As for information constraints related to policy development and research, it is worth mentioning that Yemen has considerable difficulties in the acquisition of reliable and timely information base, and the information related to fisheries and marine resources almost not sufficient and not real which make it inappropriate for use for planning and implementation of sustainable development strategies and management of natural resources.

## Q2: What major changes have taken place in the status and trends of biodiversity in your country?

Most protected area already declared to be protected and areas planned to be protected were defined and mapped as well as high resolution satellite images of these areas were prepared.

The total area of current protected sites are 4269.14 square km., as well as new Key Biodiversity Areas (KBAs) with total area of 25592.13 square km. are proposed to be included in the network which would encompass 6 % percent of the entire Yemen.

Gaps to achieve 10 % of Yemen's entire area, and in holding the proposed areas ,most of selected areas sites of:

- 1- global significance for biodiversity conservation
- 2- matched the IUCN categories.
- 3- areas with exceptional concentrations of endemic species and undergoing exceptional loss of habitat
- 4- communities of species that form a bio-geographic unit such Soqatra and Camaran Islands
- 5- Areas of an important relict of a vegetation types such as J. Fartak (Al Mahara) , J. Eraf (Lahj) and J. Al Arays (Abyan)
- 6- most of the sites are matching in terms of species richness

How these sites should be managed.

Under the Yemeni society conditions selecting and effectively managed networks of protected areas are so difficult.

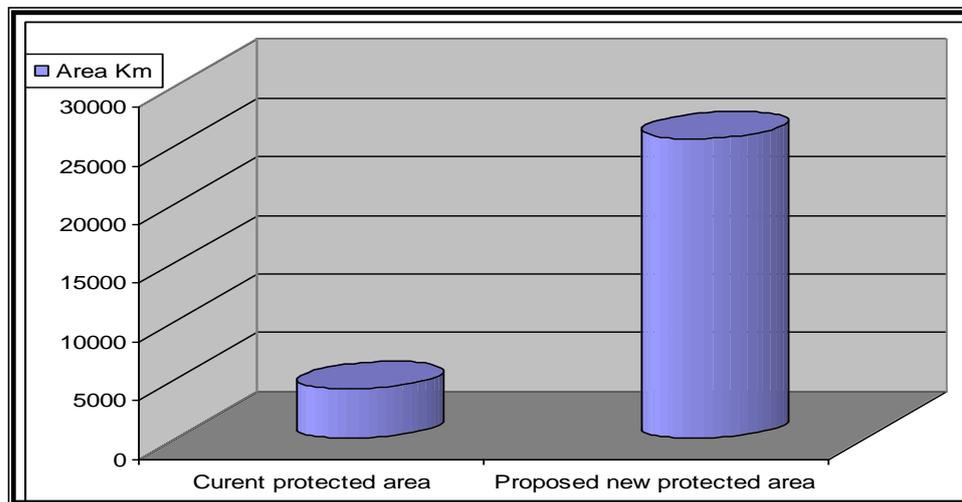
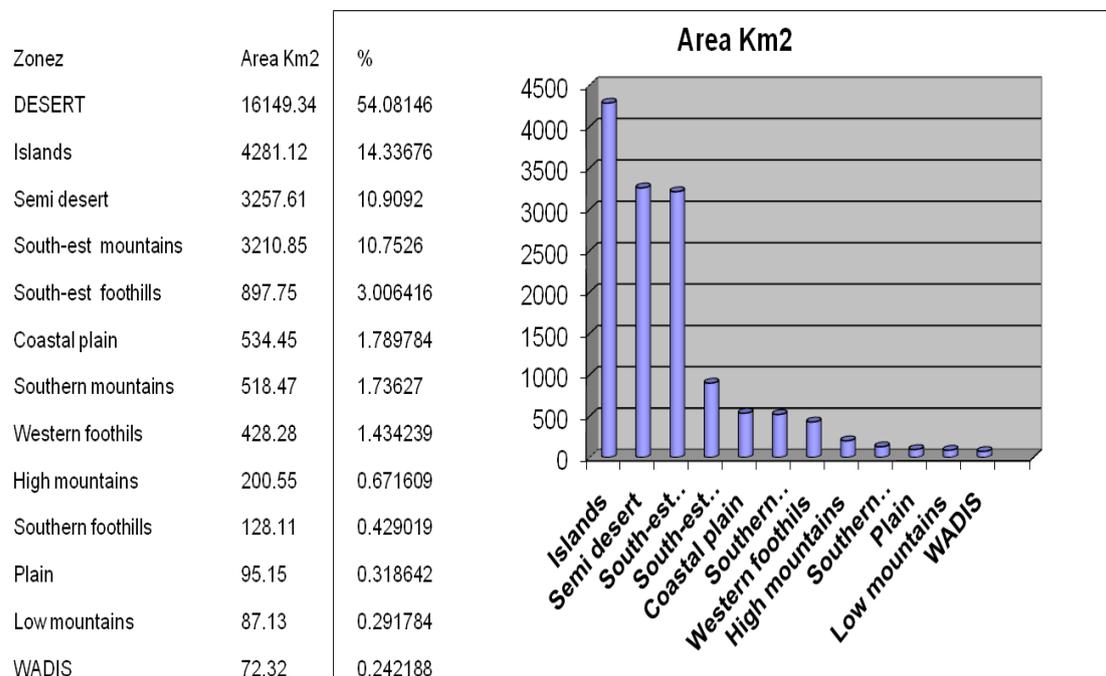


Figure 1. Current and proposed key biodiversity areas (KBAs).

**Gaps to achieve our goal in protecting the proposed areas**



Figure( 2 ). The Area in KM2 with percentage of each ecosystem holding KBAs.

**Desert Ecosystem will be represented very well (54%) in the proposed KBAs.**

Table ( 18 ) . shows Area in square meter and square kilometre of each KBA with their ecological site

Table ( 18 ) . The Area in square meter and square kilometre of each KBA with their ecological site

<b>Id</b>	<b>NAMES</b>	<b>Ecosystem</b>	<b>Class</b>	<b>Governorate</b>	<b>km2</b>
1	<b>HAT</b>	DESERT	2	Al Maharah	11184.4
2	<b>JARDAN SHABWAH</b>	DESERT	2	Shabwah	5103.5
3	<b>SOCOTRA</b>	Islands	1	Hadramaut	3704.1
4	<b>J. TOR SEEBSN</b>	South-est mountains	2	Hadramaut	3222.4
5	<b>ADH DHLIAAH SHABWAH</b>	Semi desert	2	Hadramaut,Shabwah	3113.5
6	<b>TARIM</b>	Semi desert	2	Hadramaut	1441.4
7	<b>HUF</b>	South-est foothills	1	Al Maharah	468.9
8	<b>RAS FARTAK</b>	South-est foothills	2	Al Maharah	436.5

9	<b>AL MA AFER</b>	Southern mountains	2	Taiz	397.6
10	<b>AL LUHEYAH AND MIDI</b>	Coastal plain	2	Al Hudaydah, Hajjah	178.6
11	<b>ABD AL KURI</b>	Islands	2	Hadramaut	133.5
12	<b>J. ALARAEES</b>	Southern foothills	2	Abyan	128.1
13	<b>ZOQAR</b>	Islands	2	Al Hudaydah	121.4
14	<b>J. ERAF</b>	Southern mountains	2	Lahj	120.9
15	<b>KAMARAN</b>	Islands	1	Al Hudaydah	106.7
16	<b>WUSAB AL ALI</b>	High mountains	2	Dhamar, Ibb	104.0
17	<b>QISHN</b>	Coastal plain	2	Al Maharah	97.0
18	<b>BIR ALI AND PELHAF</b>	Coastal plain	2	Shabwah	96.4
19	<b>ALHAWBAN</b>	Plain	2	Taiz, Ibb	95.1
20	<b>HONAISH ALKOBRA</b>	Islands	2	Al Hudaydah	71.4
21	<b>W. ANNAH</b>	WADIS	1	Ibb	67.3
22	<b>SHARMAH AND JATHMON</b>	Coastal plain	2	Hadramaut	62.2
23	<b>MAQBANAH</b>	Low mountains	2	Taiz	57.5
24	<b>Utomah</b>	Western foothills	1	Dhamar	448.5
25	<b>BURA</b>	Western foothills	1	Al Hudaydah	47.5
26	<b>JAZIRAT ANTUFASH</b>	Islands	2	Al Hudaydah	42.5
27		Islands	2	Hadramaut	42.2
28	<b>SUMARAH</b>	High mountains	2	Ibb	39.0
29	<b>ZAMHAR</b>	Islands	2	Hajjah	38.2
30	<b>ALMAFRAQ</b>	Western foothills	2	Taiz	35.1
31	<b>KHAWOR Umayrah</b>	Coastal plain	2	Lahj	34.3
32	<b>J. MILHAN</b>	Western mountains	2	Al Mahwit	29.6
33	<b>ALZBIR</b>	Islands	2	Al Hudaydah	23.0
34	<b>BIR ALI AND PELHAF</b>	Coastal plain	2	Shabwah	20.5
35	<b>BUQLAN</b>	Islands	2	Hajjah	12.7
36	<b>MAYYUN</b>	Islands	2	Aden	12.2
37	<b>AL BADI</b>	Islands	2	Al Hudaydah	11.0
38	<b>RAS AMRAN</b>	Coastal plain	2	Aden	10.5
39	<b>HONAISH ALSOURA</b>	Islands	2	Al Hudaydah	10.2
40	<b>AL URMAK</b>	Islands	2	Al Hudaydah	8.8
41	<b>BAB ALMANDABB</b>	Coastal plain	2	Taiz	8.5

42	<b>J. ALTIR</b>	Islands	2	Al Hudaydah	8.4
43	<b>QULENSYA</b>	Islands	2	Hadramut	8.2
44	<b>RAS AMRAN</b>	Coastal plain	2	Aden	6.4
45	<b>W.ALDABAB</b>	WADIS	2	Taiz	5.0
46	<b>ALARIRAH</b>	Coastal plain	2	Taiz	4.4
47	<b>J. AL LUAWZ</b>	High mountains	2	Sana'a	4.2
48	<b>J. ALTAKER</b>	High mountains	2	Ibb	3.7
49		Islands	2	Hajjah	2.7
50		Islands	2	Shabwah	1.0
51		Islands	2	Aden	0.7
52	<b>J. SABER</b>	High mountains	2	Taiz	0.4
53	<b>HESN HABB</b>	high mountains	2	Ibb	0.3
54	<b>Hadiya, Rayma</b>	Western foothills	2	Raymah,	345.6
55	<b>Al- Heswah</b>	Coastal plain	1	Aden	4.1
56	<b>Aden lake</b>	Coastal plain	1	Aden	0.9
57	<b>Aden lake</b>	Coastal plain	1	Aden	10.7
57	<b>Al-Memlah</b>	Coastal plain	1	Aden	10.7
58	<b>Al-Wadi Al-Kaber</b>	Coastal plain	1	Aden	1.3
59	<b>Khwor Ber Ahmed</b>	Coastal plain	1	Aden	13.1
Key 1 = Class : Current protected area 2 = Proposed to be protected area					

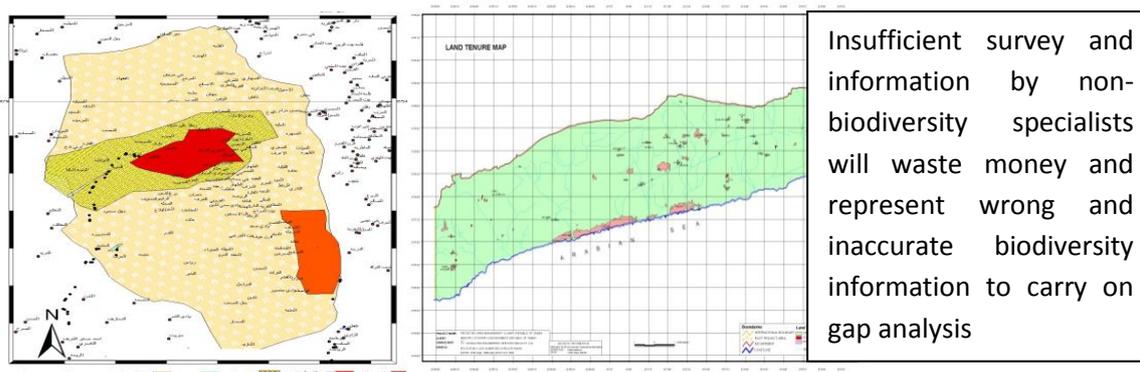
## Evaluating biodiversity distribution and status

These can achieved by:

- 1- Selecting biodiversity elements,
- 2- Capturing ecosystem elements.
- 3- Capturing species elements in particular endangered, endemic and near endemic

## Current distribution of biodiversity

For future gap analysis choosing some focal elements of biodiversity that give a reasonable representation of each KBA are important. Intensive survey by specialists to gather sufficient biodiversity information from KBAs as well as mapping the distribution of rare, endangered and endemic species are needed.



### Representing the biodiversity of Areas (KBAs) that have been proposed to be protected

Representing the biodiversity is not an easy task, The available biological data that have been gathered are not complete and not on the precise aims of the gap analysis, as well as none of these areas has complete data on all species. To be the future gap analysis and planning processes efficient intensive biological survey in these KBA with general to finer and more accurate information are needed. the collection of indicators used to identify distribution of biodiversity in a gap analysis needs to be:

- 1- Representative of the total biological and biodiversity elements
- 2- Recorded well enough, adequate and updated data on biodiversity
- 3- Gathering understood information to other stakeholders

These should not be done precisely and accurately if there are no specialists on biodiversity, and the level of accuracy is based on accurate knowledge of many species.

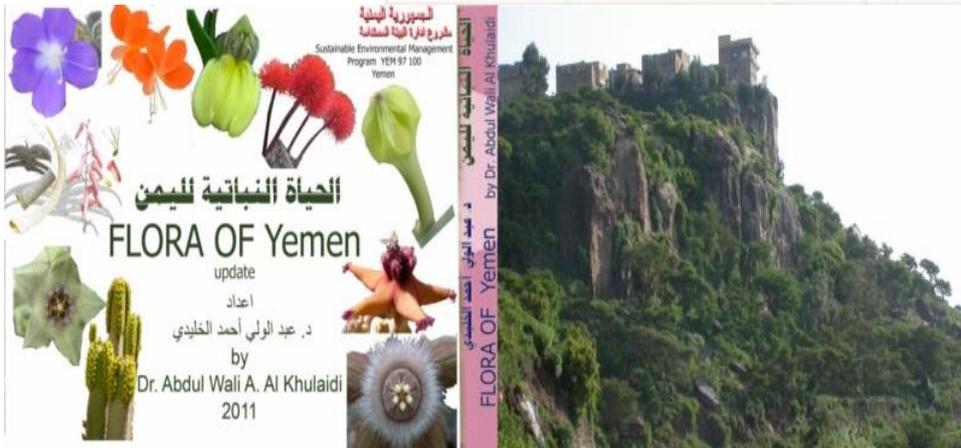
Providing specialists on biodiversity and ecologists is a challenge for Yemen. There is a lake or insufficient of information (e.g. Realms, landform, geology climatic, ecosystem, species and habitats that can be used in a gap analysis.

### Tools for biodiversity assessment

Yemen has not have extensive biological records, however there are quite reasonable data, the EPA presented the comprehensive flora plant list of Yemen in 2000 and the updated of this work will be prepared in December 2011. In addition there are few existing data on vegetation that national researchers can draw upon to help prioritise particular places to be protected. Satellite images and GIS databases, can help fill information gaps about broad vegetation patterns. But obtaining images are quite expensive.



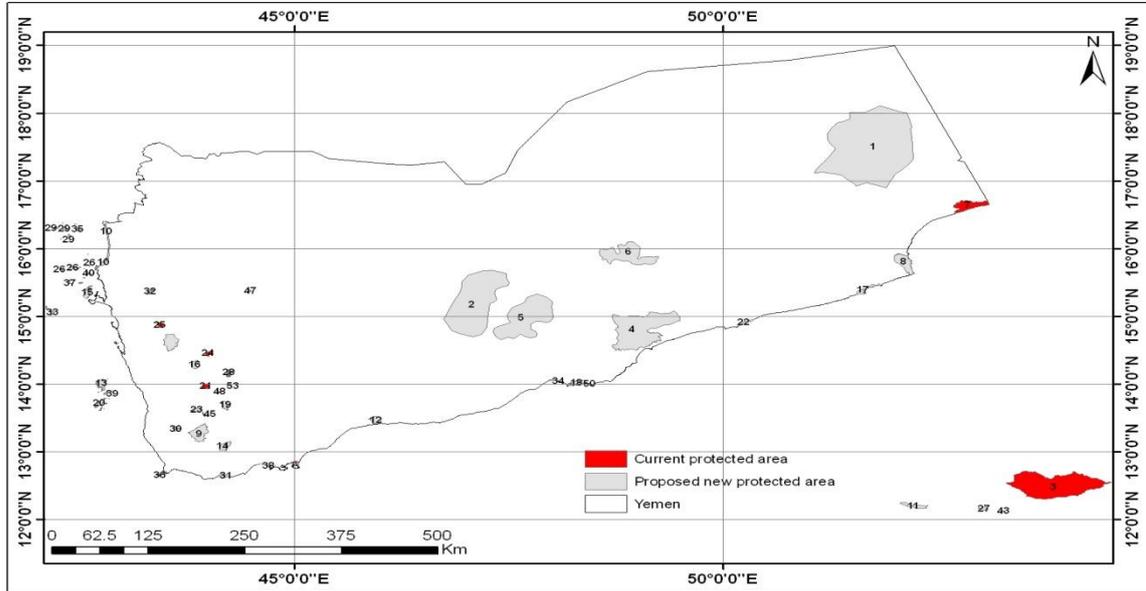
Generally Yemen has few information available on biodiversity, but most of them kept with individuals and not in one place. although this is frequently not collected together in one place.



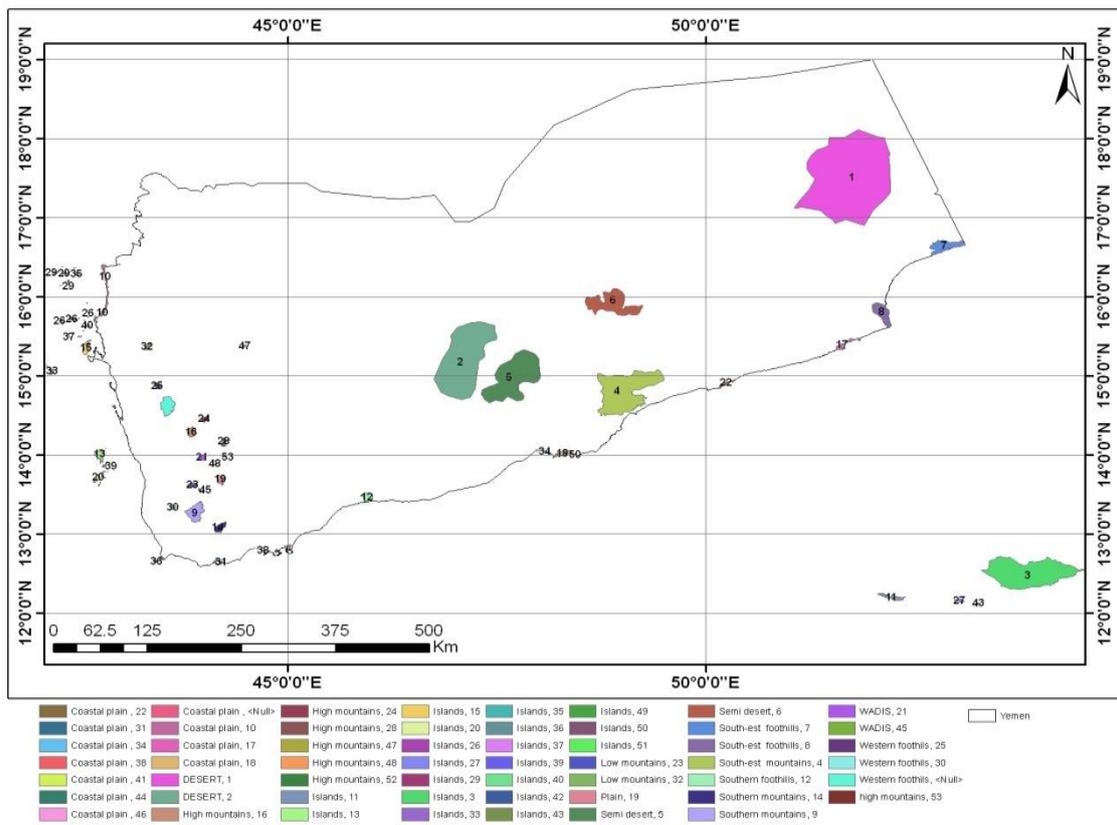
## Analyzing protected area distribution and status

The distribution, location and area of all protected areas:

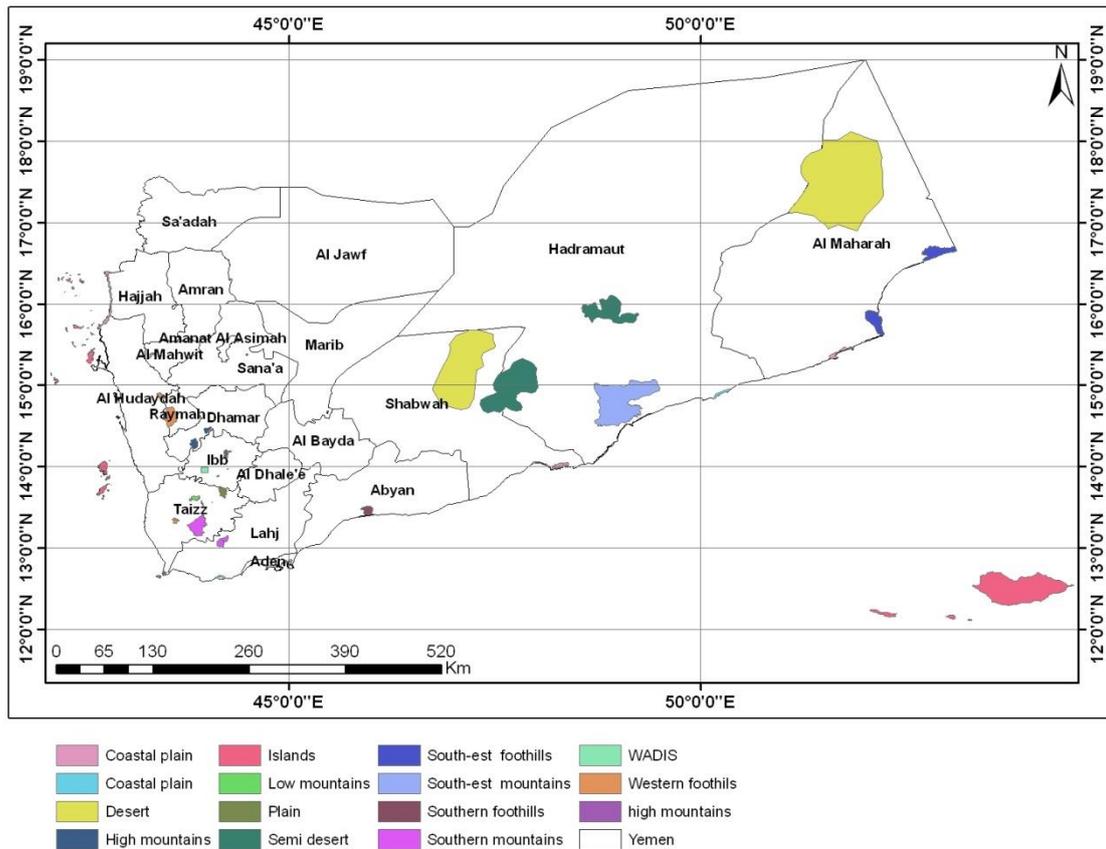
The following maps show the location of protected areas:



Map 2. Current and proposed protected areas



Map 3. Key Biodiversity Areas of Yemen



**Map4 . The Ecosystems of Key Biodiversity Areas of Yemen**

## GENERAL STATE OF PROTECTED AREAS IN YEMEN

The World Wildlife Foundation (WWF) intends to improve management effectiveness of protected areas where possible through implementing recommendations from individual assessments. Analysis of protected areas by the WWF network has identified a series of key steps that from experience, they believe are almost always the minimum requirements needed for effective management.

Dudley and Stolton (2003)<sup>5</sup> developed a “Guidance Note” on ‘Minimum requirements for protected area management’. identifies six (6) priority requirements including: legal designation; demarcation of PA boundaries; clear management objectives; operational plan; operational budget; monitoring plan.

The guidance note also identified the two additional requirements and these involve:

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- Improving relations with indigenous and local peoples and increasing their participation in management structures
- Reducing threats to protected areas particularly through illegal exploitation of resources.

### **Legal designation and the creation of protected areas**

It is important to note that protected area status does not suppose that the protected areas are being effectively managed. Many of these areas currently lack the capacity for effective management.

All six assessed protected areas have been legally declared and gazetted by law. However, for both Autma Protected Area and Kamaran Protected Area there are no regulations governing them. In addition there are no management activities in place due to funding lacks.

### **Management Effectiveness**

Management of protected areas has been mixed. Weak areas include ecological outputs, research and monitoring. There are a number of strengths, including design and layout of the protected area and legal security. Critical management issues surround zoning and boundary demarcation in protected areas, surrounding land use, critical site level law enforcement, infrastructure, staff numbers and employment conditions, community outreach, conflict resolution and communication. Furthermore, capacity building appears to be a relative weakness and is critical at mostly all the PAs. Likewise public education and awareness on the importance of protected areas in biodiversity conservation are very limited.

Though training has been given some focus in particular sites, there is still need for greater emphasis on capacity building. Likewise, greater efforts are needed to ensure that environmental protection goals are incorporated and embedded into all aspects of policy development. There is also need for improved levels of collaboration and cooperation amongst natural resource departments.

The general feeling is that the areas protected to maintain natural processes are quite inadequate. There are no periodic assessments to determine gaps and weaknesses to the system on an ongoing basis.

There are factors external to the system that directly affect management effectiveness and are an essential part of the management context to be considered in the evaluation. While there may be no direct control over these types of challenges or issues, they must at least be recognized. Climate change is a critical factor both currently and in the future. However, it was noted that climate change and natural

disasters were beyond the control of protected area personnel but that at least they need to be acknowledged and respected. PAs provide the ecosystems and habitats in which important biodiversity reside and can be sheltered from the effects of climate change. Ensuring that PAs exist within a system can in some ways help to minimize or mitigate the effects of climate change on them.

## **LIST OF IDENTIFIED PAS MANAGEMENT GAPS**

### **Planning**

- Inadequate protection objectives
- Lack of consistent policies
- Shortage knowledge of PAs staff
- Limited community support
- Lack of PAs boundary demarcation
- Weak law enforcement
- Inappropriate surrounding land use

### **Input**

- Shortage of PAs staffing and inadequate PAs staff skills
- Inadequate training programme
- Insufficient employment conditions
- Inadequate communication with adjacent land users
- Lack of communication with local communities
- Lack of proper inventories
- Insufficient field equipment
- Limited staff facilities
- Shortage of visitor facilities
- Limited PAs management Budget
- Insufficient PAs financial management
- Inadequate resource allocation for PAs implementation

### **Process**

- Lack of PAs Institutional Capacities
- Lack of inventories
- Lack of threats analysis and recording
- Lack of day to day work plan
- Limited community participation in PAs management
- Poor record of impact to PAs
- Lack of ecological and social research
- Lack of monitoring and evaluation

Table (19) Base line information on Yemen PAs

NO	Protected area/site	Location	Type	Date established	Legal Status	Policies Situation	Implementation Status
1	Autma	Dhamar – Autma	Terrestrial	June 05, 1999	Cabinet declaration no.137	- No Management plan	No management setup in place The NGOs active with some project funded by donors
2	Socotra	Hadramout	Coastal/Marine and Terrestrial	Sep.27 2000	Presidential declaration no.275	Management plan been prepared according to site thorough studies	Day to day Active management process for the PA with support of International donors and the government.
3	Hawf Nature Reserve (HNR)	Al-Mahara	Terrestrial	August.16 2005	Cabinet declaration no. 260	Management plan been prepared according to site thorough studies	No management set up in place
4	Jabal Bura'a National Park (JBNP))	Al-Hodidah	Terrestrial	January ,2006	Cabinet declaration no24.	Management plan been prepared according to site thorough studies	The management process initiated by 2007 with support of the SRNMP I and still ongoing
5	Wetland Aden	Aden	Wetland	August,01 2006	Cabinet declaration no304.	Management plan been prepared according to site thorough studies	Management has delegated to NGOs. The management process initiated with support of SRNMP during its phase I life period.
6	Kamaran Island	Al-Hodidah	Coastal/Marine	August.16 2009	Cabinet declaration no 310.	No Management plan.	No management activities in place.
7	Malhan Forest	Al-Mehweet	Terrestrial	,2010	Cabinet declaration no. 349		
8	Wadi Anaa	IBB	Terrestrial	2010	Cabinet declaration no. 389		
9	Sharmah-Jathmoun	Hadramout	Coastal/Marine, Sea turtle nest	Still on process	Under processing	Management plan been prepared at result of site thorough studies	No management activities in place
10	Bir Ali-Burum	Shabwah and Hadramout	Coastal/Marine, Nursery area	Still on process	Under processing	Management plan been prepared at result of site thorough studies	No management activities in place

### Current status of protected areas

Current protected areas are without or poorly managed, or with management objectives that do not correspond with the needs of biodiversity (see table 19 ).

Human activities have affected all kinds of habitats in one way or another. Some of these activities and their effects are:

- 1- Arial photographs show that, during 1973 – 1988, up to 60% of Bura'a Forest has deteriorated. Over 53% of its woodland and 13% of the biodiversity, have disappeared.
- 2- Sharks are facing aggressive fishing for their flesh and fins, especially at the southern coasts.
- 3- Coral reefs are being destroyed in the expense of developing harbours. A good example is the damage caused to the coastal protected area at Balhaf, in Shabwa Governorate, where a harbour is being constructed for the export of liquefied natural gas.
- 4- Ibex hunting and leopard killing in Wadi Hadhramout and Wadea'a, respectively.
- 5- Overgrazing by sheep, goats, cattle and camels.
- 6- Wood harvesting for construction, firewood, manufacture of furniture and beehives.
- 7- Expansion of agriculture and/or urbanization on the expense of natural habitats

### **Assessing and Evaluating Current biodiversity status of some communities and protected areas using spatial software and data to develop suitability indices for further gap analysis**

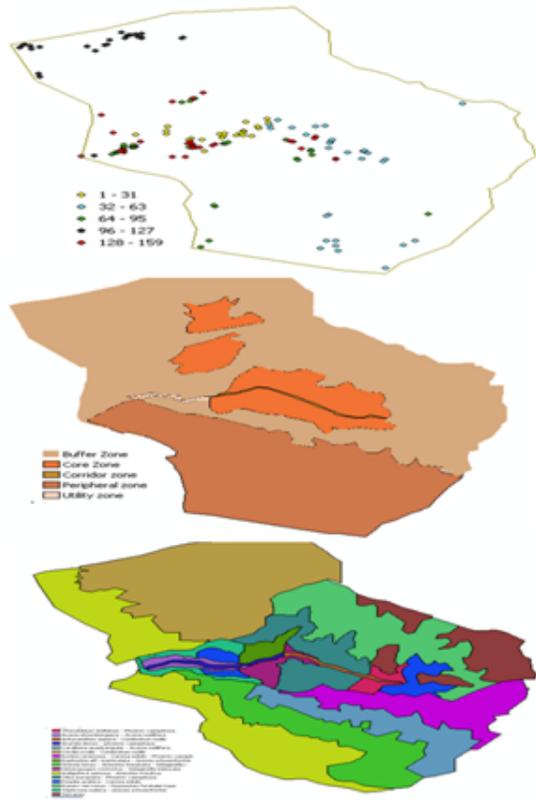
To evaluate ecological condition of woodland, shrubland or grassland community conditions. Using GIS techniques, the experts delineated polygons of current and past community cover or status . In case of Wadi Anna protected area (freshwater ecosystem) the main wadi and small tributary ecosystems can be used as the spatial assessment unit, here maps of patterns of road/stream crossings and land use are needed.

Gap analysis relies on different data layers. These are:

1. The distribution of actual vegetation types or communities,.
2. The distribution of land use
3. The distribution of land ownership
4. Topography map
5. The distribution of endangered and threatened species.
6. The distribution of species of conservation concern (rare, endangered, endemic, near endemic), and economically important species

A gap analysis itself literally consists of overlaying a map of biodiversity on a map of

protected areas and seeing where the gaps are. Maps of 3 protected areas (J. Bura' and Wadi Annah) and distribution of ecosystems and species are available



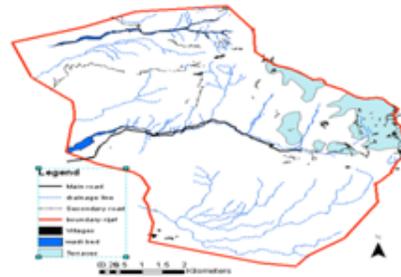
Richness

Zoning

Vegetation types

**Jabal Bira' protected area**

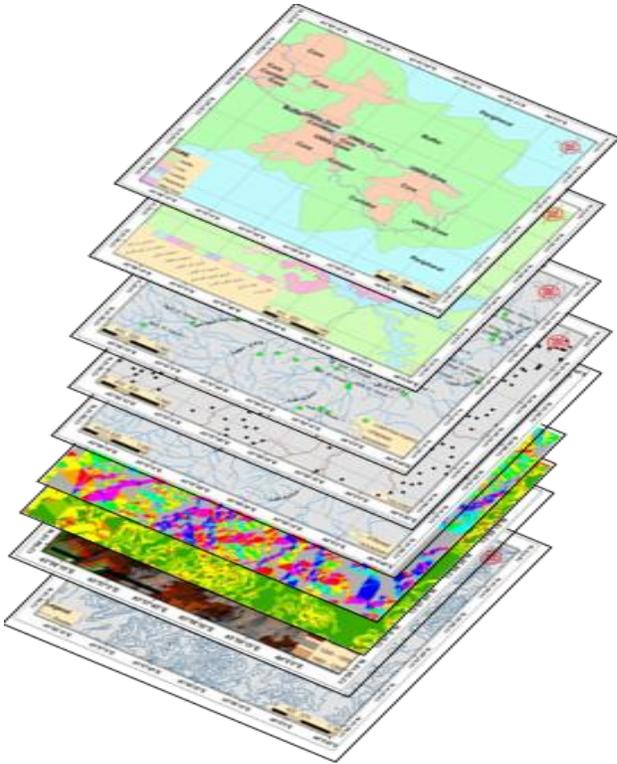
Gap analysis is a method for evaluating the status of biodiversity protection at large spatial scales by examining and comparison data on the distribution of habitat types, the distribution, the status and the geographic ranges of biodiversity, and land use changes, and then to determine what the next course of action for a project or process improvement undertaking should be, as well as to see where the protected area is adequately reserved and managed.



Topography & land use

**Wadi Anna Protected area, Ibb Governorate**

**Wadi Annah protected area, Ibb** representing the status of biodiversity by examining and comprising data on the distribution of different habitat types.

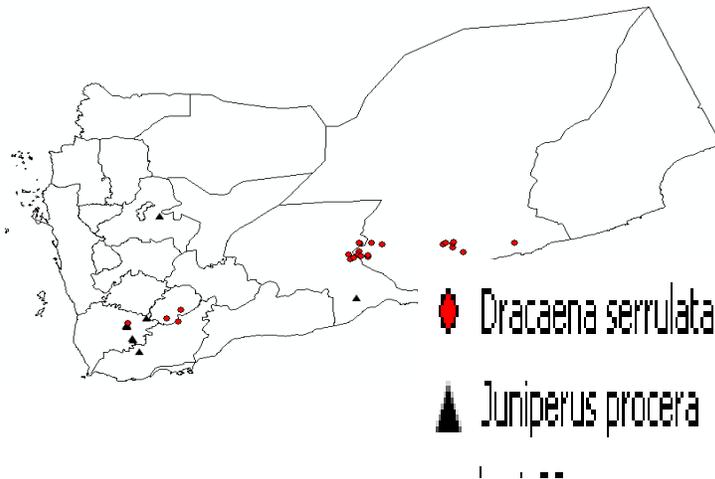


- Core Area
- Land use Map
- Vegetation Type
- Villages
- Drainage
- Slope Map
- Aspect Map
- D E M
- Contour Map



*Dracaena serrulata* is one of the threatened species, with very limited distribution. It is currently not represented in any protected area, new proposed areas to be protected will include this species

*Juniperus procera* is one of the threatened species, with very limited distribution. It will be represented well in the new proposed protected areas



*Representing some of threatened plant species in the protected area*

#### Future activities to be done:

The aim of future activities should focus to provide regional assessments of the conservation status of local species and natural land cover types and to facilitate the application of this information to land management activities. This can be done through the following process (GAP, 2007).

1. Map the land cover of the current and proposed protected areas.
2. Map the distributions of species and vegetation types.
3. Identifying biodiversity elements such as Climate, Elevation, Soil, Watersheds
4. Document the representation of plant species and land cover types in areas managed for the long-term maintenance of biodiversity such as Jabal Bura', Wadi Annah and Huf.
5. Recording the Red List Data of endangered species

6. Provide this information to the public and those entities charged with land use research, policy, planning, and management.
7. Provide freely available, accurate and up-to-date database about situation of KBAs network
8. Build institutional cooperation in the application of this information to governorate and regional management activities.

### Question 3: What are the main pressures on biodiversity?

Biodiversity is under serious threat as a result of human activities. The main dangers are population growth and resource consumption, climate change and global warming, habitat conversion and urbanization, invasive alien species, over-exploitation of natural resources and environmental degradation.

## BIODIVERSITY PROBLEMS

### Existing Threats for biodiversity

Pressures on **terrestrial ecosystems** include loss and degradation of natural habitat, invasive alien species, pollution and waste, and climate change. However, absolute loss of natural habitat resulting from conversion of natural vegetation for cultivation, mining and oil production, forest plantations and urban expansion is regarded as the main pressure. Rates of natural habitat loss are especially high in some parts of the country.

**Coastal, inshore and offshore ecosystems** are most pressured by coastal development and Over-exploitation of living marine resources, respectively ,has led to severe depletion of some fish resources (e.g. rock lobster, shrimp)., pollution and mismanagement of fishing in the Red Sea, Arabian sea, Gulf of Aden and Yemeni Islands are very risky on the marine resource's sustainability.

It is clear that human activities are playing the main impact on biodiversity in Yemen through loss of species and ecosystems. As the human population passes the 30 million we will have degraded or destroyed most of the Yemen's biodiversity . With appropriate and well managed system we could reserve the biodiversity in the protected areas and avoid the disappearing and destroying of the ecosystems.

The land ownership or the land tenure is the main difficulties and complexities to achieve our goal in selecting the protected areas and preserving the different ecosystems.

Under current accelerating growth of economy, environmental quality is fast deteriorating, as dramatized by the increased occurrence of environmental problems. Specifically, the gains of economic growth are being diminished and /or even negated by numerous problems including:

- ❖ Habitat destruction caused by activities associated with development.
- ❖ Degradation and conversion of natural habitat.
- ❖ Desertification, including wind erosion and sand dune encroachment
- ❖ Agricultural expansion and poor agricultural practices.
- ❖ Wood cutting for firewood, timber and charcoal production.
- ❖ Overgrazing of rangelands including loss of sustainable practices of sound rangeland management by local people.
- ❖ Over-hunting and indiscriminate killing of wildlife species, especially ungulates and carnivores.
- ❖ Overuse and depletion of limited fresh water.

- ❖ Degradation of wetland ecosystems.
- ❖ Contamination of ecosystems with sewage, industrial waste and other pollutants.
- ❖ Smuggling and uncontrolled exporting of indigenous livestock and native genetic species.
- ❖ Marine and coastal habitat degradation caused by unplanned coastal reclamation.
- ❖ Over-exploitation, pollution and mismanagement of fishing in the Red Sea, Arabian sea, Gulf of Aden and Yemeni Islands.
- ❖ Degradation of coastal and marine habitats caused by ship dumping, industrial, agricultural and sewage waste.
- ❖ Sharp decline in important marine resources especially lobsters, cuttlefish, shrimps and sharks caused by over-fishing, poaching of foreign vessels, uncontrolled gear and fishing effort, and lack of quality controls.
- ❖ Destruction of coral reefs and underwater habitats caused by bottom trawling, ornamental fishing
- ❖ Deterioration of native genetic resources as a result of introduction of alien species.
- ❖ Desertification, terraces and rangeland degradation associated with rapid urbanization.
- ❖ Increased water depletion for qat production and agriculture irrigation associated with lack of water conservation systems.
- ❖ Declining agricultural production caused by drought and degradation of agro-systems.
- ❖ Over-cutting of trees and shrubs for fuel consumption and timber.
- ❖ Loss of natural habitats as a result of deforestation, desertification and land conversion.
- ❖ Destruction of sensitive natural habitats caused by unplanned land reclamation.
- ❖ Rapidly growing population with intensive use and pressure on natural resources particularly in the densely populated centers of the country.
- ❖ Reduced economic values of marine and coastal biodiversity as a result of increasing pollution and habitat destruction.



### **Over Grazing**

A desert grasslands with its unique biodiversity and ecosystems are amongst the least protected and most threatened in particular by over grazing and oil working activities. At this circumstances how we could manage to select the protected area and reserve the ecosystem



**Plant collection impact on protected ecosystem**



**Plant collection, and Infrastructure of roads, buildings etc..**

These activities are the main impact on the biodiversity ecosystems.

**Infrastructure of buildings impact on fertile and park areas.**



Gap analysis is a method to identify biodiversity (*i.e., species, ecosystems and ecological processes*) not adequately conserved within a protected area network.

Land Use Impact on protected area (agriculture ): New terraces were established after clearing the vegetation cover in Jabal Bura' protected area



### **Hunting**

Hunting has been a significant cause of the extinction of hundreds of species, such as Wolf, gazelle and ibex in particular in Hadhramaut and Al Mahara.

The wolf is becoming extremely rare and threatened, it needs urgent conservation programme.

The image of died hung wolf and the head of ibex from Al Mahara desert area are shown,



Species often become threatened or disappear when several of these factors are combined. The fragmentation of habitats decreases the size of populations and makes these more vulnerable to other factors. Once the population is weakened, small external perturbations such as disease can wipe out the remaining individuals entirely.

## Q4: What are the impacts of the changes in biodiversity for ecosystem services and the socio-economic and cultural implications of these impacts?

### *Economic benefits*

#### **Ecosystem services**

The benefits provided by ecosystems that contribute to making human life both possible and worth living. Ecosystem services are context dependent. Some ecosystem services involve the direct provision of material and non-material goods and are associated directly with the presence of particular species of plants and animals. Other ecosystem services arise, either directly or indirectly, from the continued functioning of ecosystem processes. The service of formation, retention, and sustained fertility of soils necessary for the production of plants and animals considered important by different human societies depends on the ecosystem processes of decomposition, nutrient cycling and the retention of water and soil particles .

Republic of Yemen has unique biodiversity assets as multi-environments, mountainous, coastal areas, valleys and deserts that have the potential to contribute to the economy and to support human wellbeing. We believe that the relationship between biodiversity and ecosystem services is complex. Until now Republic of Yemen couldn't have a systematic quantitative to measure the assessment of how changes in biodiversity.

The notion that biodiversity has provided us with many benefits is well understood. Some of these benefits come in the form of **goods** that can be directly valued and costed because they provide something that can be extracted and sold. These goods include everything from all the domesticated agricultural crops that form the basis of the food supply, medicines , fibers. Thus biodiversity is widely valued as food pantry, genetic storehouse for biotechnology.

Biodiversity also provides critical indirect benefits to humans. These benefits contain ecosystem **services**, such as air and water purification, climate regulation, and the generation of moisture and oxygen.

Yemen has a large stock of ecosystem services and its management, that meet the needs of food and medicine and others services . The inherited experience of the Yemen's ensured that, sustainability of ecosystem services supply which facing many challenges ,such as population growth, climate change affect and irrational investment of the Yemen's natural resources.

#### **Human well-being**

The human well-being is strongly dependent on the specific cultural, geographical, and historical context in which different human societies develop, and is determined by cultural-socioeconomic processes as well as by the provision of ecosystem services. In Yemeni is known that, most of the pasture and coastal and marine areas is as common lands it open for investment and in another form that provide services systems are owned by individually or by groups , tribal gathering. Yemeni's communities facing many difficulties to meet their needs of development and resources conservation , which obstructs the achievement of the goals of the protection of resources while people lacked to access to basic needs.

#### **Agricultural Benefits:**

The agriculture sector in Yemen is labeled a traditional one. It mainly depends on primitive methods and rain steams which make it vulnerable to extreme climate changes such as draught and floods.

Arable land is estimated at 1.6 million hectares, of which the cultivated area is estimated at 1.3 million hectares. The agriculture land represents 2% of the total area of Yemen. “The Second National Millennium Development Goals Report 2010”

Agriculture accounts for 17.5% of the national GDP. About 74% of the population of Yemen lives in the rural areas. Direct employment is estimated at 33.1% of the workforce. In addition, the agriculture sector also accounts for significant employment in the transport, processing, and trading sectors that may raise the percent employed to 54%. Therefore, the agriculture sector is the most important sector for Yemen’s development for generating employment in rural areas, supporting the economy in farming communities, and providing food and nutritional security, despite a modest contribution to the national GDP.

Despite severe resource constraints, the agriculture sector has been growing. From 2006 to 2009, average growth in production of value added agriculture was 7.5% annually. All types of crops showed positive growth from 2005 to 2010, with largest increases in grain, coffee and honey. This increase shows the importance of agriculture to rural farmers, as they realize gains with their outmoded technologies. It also highlights the potential in the agriculture sector to continue to provide growth and income to rural people.

The agriculture sector is also a key element in terms of food security. The total grains production in Yemen in 2009, 674,000MT, which covers only 15.2% of local demand of the Year (2009)<sup>2</sup> . Currently, Yemen only meets 7.8% of its demand for wheat in 2010, which is down from 8.9% in 2005, and 89% in 1970. Yemen relies on imports of wheat, which opens it up to severe price swings, such as in 2008, and quite possibly in 2011. In addition, the World Food Program recently conducted a rapid assessment and identified 24% of households are food insecure. The agriculture sector can address both food sovereignty and food security through higher production of grains, and increased incomes from expanded production of cash crops. In the meantime, Yemen may need to consider either a national or regional grain reserve program to help alleviate issues from global price shocks due to their dependency on imports.

“National Agriculture Sector Strategy 2012-2016 March 2012 “

Desertification of agricultural land ranges from 3-5 percent annually, whereas the area of deteriorated land due to soil erosion and salinity is estimated to be 12 million hectares and another 3.8 million hectares, respectively. The situation is further worsened as a result of encroachment of sand dunes (NSES 2005-2015). The potential for greater desertification is high considering a number of factors including changes in socio-economic patterns and farming practices and increasing demand for fuel, abandonment of terraces, overgrazing and depletion of tree cover and water erosion problems. *Concept note Environmental strategy documents February 2012.UNDP*

### **Ecological infrastructure:**

Healthy mountain catchments, wetlands, marine and coastal ecosystems – provides services that are essential for supporting built infrastructure, contributing to water security and food security, and reducing the risk of disasters such as floods and droughts.

The loss of biodiversity will impact strictly on the livelihoods of the many Yemeni's who directly or indirectly depend on natural resources, be it for production, trade or consumption. For example, it is estimated that between 13 and 15million people in impoverished rural areas directly use natural resources such as fuel wood as a source of energy, food and building material respectively.

In Yemen, traditional medical lore along with its practitioners – namely druggists and healers – survives in our time. Approximately 60 % of Yemeni medicinal plants are mentioned in the *Material Medica* written by the famous Andalusian pharmacologist and botanist Ibn al-Baytar (1197–1248). But a large part has not been described by any classical author – a fact which underlines the originality of Yemeni herbal medicine.

The rural population use traditional medicine as a form of health care. Out of the 150 known medicinal plant species, are actively trade in local medicinal markets.

More than half of species are become rare or threatened, the significances of loss of these medicinal species could be severe for the health care of future generations, and urgent action is necessary to address their threat status.

## Ecotourism

**Tourism**, an important contributor to Yemen (GDP) and one of the important sectors in the country contributing hundred millions of YR to the national economic and creating thousands of job chances.

The Republic of Yemen is particularly well endowed with the key ingredients of successful ecotourism; nature, culture and hospitable local communities but these alone are not enough to secure the development of sustainable ecotourism opportunities.

The Government of Yemen (GOY) recognizes the strong emphasis on ecotourism development is required for the advancement of the protected areas to promote sustainable development and to reduce poverty, although, significant progress has been made on biodiversity conservation, little has been achieved in tourism development, nor have the local people in the protected areas benefited sustainability from the small amount of tourism development that has occurred. There remains a wide disparity between actual and tourism potential opportunities on the protected areas and there are still significant challenges ahead to ensure sustainable tourism development in the country.

It is vital to include local communities to participate in managing their waste. The Poor's interests in benefiting from tourism motivate such initiatives, if preceded with information and awareness raising campaigns.

## Opportunities in the Development of Sustainable Ecotourism

Aden protected wetlands provide job opportunities and a livelihood source for a quite good number of the community members in addition to contribution to the national income.

Ecotourism has the potential to provide a significant and divers of low of income to local communities living in or around the protected area as well as those providing services in Aden and on routes in or out of the region.

Despite the lack of a proper management for these lands to make use of their natural resources in a way that secures regeneration and sustainability due to the low awareness of the officials and beneficiaries of the wetlands however we eventually find a good number of those beneficiaries who depend on the products of these lands as a main source for their livelihood as in the wetland of Caltex-Al-Hiswa where the number of male and female beneficiaries amounted to approximately 175 persons affiliated to a number of neighboring areas of these wetlands as discussed in the Management Plan of the Wetlands.

Considering the potentials of these wetlands that may be used for tourism purposes and for education and guidance the beneficiaries may be involved in the management of these wetlands through raising their awareness of the importance of the environment of the wetlands and their role to maintain environmental balance and the organization of their management of the natural resources (wooding, pasturing, hunting) to achieve sustainability and renewal of these resources and prevent depletion and to promote the cultural heritage ( traditional artifacts) , vinegar and salt industry and make use of these wetlands for the purposes of studies, scientific research, education and guidance.

The challenge is to transfer opportunities into competitive advantage in the market place. However, tourism opportunities in Yemen in general are constrained by other factors including recent regional instability problems that occur from time to time especially tourist kidnappings and the isolation of the area.

### **Key ecosystems economic valuation and climate change:**

Key ecosystems in Yemen have astronomically high economic values and contribute immensely to both household and national income. Most importantly, they play critical roles in safeguarding food security and poverty reduction at the rural level. This insinuation is made from the findings that the economic value for the four (4) key ecosystems is ten (10) times the value of country's GDP. The implication of a highly substantial economic value of ecosystem relative to GDP is that a high proportion of these values are not currently integrated into economic decision making. Consequently, evidence of widespread unsustainable ecosystems utilization accompanied by widespread ecosystems degradation and depletion (water and marine resources) is partly a result of lack of accounting for values of ecosystem in economic decision making. It is therefore important that ecosystems economic values are integrated at both national and local developmental planning decision making levels. This can be achieved through implementation of WAVES, ensuring that at project appraisal stage environmental costs and benefits are integrated in decision making and ensuring that PES concept is embraced.

Ecosystems mainly forests, woodland and rangelands have huge potential to alleviate poverty at the rural areas through value addition. Globally there is a huge international demand for organic products mainly medicinal and cosmetics. As Yemen has various medicinal and cosmetic plants, this presents colossal opportunities to undertake rangeland value addition initiatives with the objective of alleviating poverty.

Economic sector (agricultural, oil and gas, manufacturing and industry and service) are the primary causes of ecosystem degradation in the country together with policies particularly on subsidies. It is therefore vital that subsidies be replaced with environmentally friendly incentives such as development of terrace fund for rehabilitation and preferential markets for organic and environmentally friendly products.

In addition to impacts of economic activities on key ecosystems, climate change will aggravate and intensify ecosystem degradation. According to IPCC, GCM are in agreement that Yemen would experience an increase in temperature in the range of between 1.8 to 4.5 °c by 2100. On the other hand, the GCMs are not in agreement on rainfall scenario, while some models project increases in precipitation by as much as 25% others project a decline of up to 25% by 2050. Changes in these ecosystem drivers (rainfall and temperature) will impacts key ecosystems in various ways such as SLR, inundation of mangroves, increase in incidents of forest fires, migration of flora and fauna. These impacts will culminate in decline of ecosystems services thus compounding poverty levels in the country

It is thus advisable to implement measures that will enhance ecosystems natural adaptation capacity to climate change. The enhancement measures should be targeted for ecosystems that offer preventive and protection functions. These include mangroves, forests, Sea grass and coral reefs. Moreover, it is important to come up with measures targeted at improving the health of key ecosystems such as reducing carrying capacity, decreasing pollution in marine ecosystems and reducing harvesting rate to sustainable levels. In addition, it is important to increase PA coverage and management at the landscape level and also create migration corridors as enhancement mechanisms.

Addition to implementation of ecosystem adaptation enhancement measures, it is crucial to improve key ecosystems ability to carbon sequestration. Identified areas for carbon sequestration include afforestation of the mangroves, forests and woodlands, declaration of coral reefs and sea grass as PAs and sustainable management of rangelands.

Key ecosystems are multifunctional, offering diverse products and services to various users and non-users. Consequently, the multiple uses imply conflicts between the uses and users. Primary stakeholders include farmers, fishermen (commercial and subsistence), wood harvesters (commercial and subsistence), tourism operators, honey producers, herbalists, traditional doctors, tourists, governmental departments, international organisations and NGOs. Thus, tradeoffs in the form of reducing harvest rate and pollution rates to sustainable limits will ensure minimisation of conflicts.

PAs in the country are faced with various sombre challenges which hinder their operational effectiveness. Specific challenges include lack of human and financial resources, lack of institutional capacity to manage the PAs, limited coverage of PAs amongst others. Thus, there is need to define programme of works for the PAs in the country.

Situational analysis reveals that Yemen has a lot of ecosystems challenges. However due to limited resources, NBSAP has identified seven (7) priority investment needs as follows: National Integrated Protected Areas system, Integrated Coastal Zone Management Plan (ICZMP), Policies, Legislation and Regulations on Biodiversity Issues, Agro-Biodiversity, Reviving Traditional Indigenous Natural Resource Management Systems and National Biotechnology/Biosafety Frameworks. Thus a Financing Action Plan for these priority areas has been developed.

The latest national valuation study , Yemen key ecosystems economic valuation as following:

## **Economic valuation**

### **Forests**

Forests are multi-functional providing various ecosystem services used directly and indirectly by economic agents. Some of the products, functions and services that were valued included fuelwood, fodder and medicinal plants, carbon sequestration, wildlife habitat, pollinators, honey production and soil erosion

prevention. The economic value was estimated at USD 260,787 million per year. The value of fuelwood is inclusive of the contribution from rangelands.

### Wetlands

Wetlands in this assignment are defined as *wadis*. They are an important source of water supply for rural population, irrigation and livestock. In addition, *wadis* are an important source of fodder for livestock during drought periods. Estimating the value of *wadis* as a source of water supply was based on the willingness to pay for water. The total economic value of water was estimated at USD 13,873 million per year.

### Rangelands

Globally, rangelands are the most important ecosystems supporting majority of the world's population, covering over 70% of the ecosystems. Rangelands provide fuelwood, a source of energy for the rural poor population, fodder for livestock (cattle, camels, goats, sheep and donkeys) and medicinal plants. In addition, rangelands offer services and functions which support economic production processes such as habitat for wildlife, pollinators, soil erosion prevention and soil maintenance, carbon sequestration and watershed properties. Based on data availability and the value of goods and services produced in the country, the value of rangelands was estimated at USD 12,146 million. This excludes the value of fuelwood and carbon sequestration which have been estimated under forests. Acknowledgement that rangelands also contribute to these products is made.

### Mangroves

Mangroves are forests but have been classified under marine ecosystems. Covering approximately 980 hectares, mangroves provide vital functions mostly protective roles for the coastline and other marine ecosystems such as sea grass. Mangroves are also known to have extraordinary properties of absorbing nutrients thus reducing marine pollution. Moreover, they provide food, in the form of fish to communities and are a source of tourism opportunities. Based on the assumptions and availability of data, the use values of mangroves were estimated at USD 482 million. Other functions such as absorption of nutrients, reduction of pollution and protective functions of mangroves were not estimated due to lack of data.

Thus, overall economic value of the key ecosystem was estimated at USD 287,829 million per year. The estimated economic values for the key ecosystems were for use values only (direct and indirect values). No attempt was made to estimate the non-use values due to lack of data. The unstable security condition in the country prevented undertaking such exercises.

### Economic sector and impacts on the environment

Yemen's economy is characterized by high unemployment, with majority employed at the agricultural sector. Moreover, it is dominated by the informal sector with over 90% employed. Thus, the economy is typically of a least developed country. The main economic sectors are agriculture, oil and gas, manufacturing and industry, and service sectors. The service sector makes the main contributor to GDP at over 49% followed by the oil and gas sector. The manufacturing sector, though promising, is the least contributor at a meagre 7%. The country's economic activities are responsible for widespread environmental degradation and pollution. For instance, the agricultural sector is the major consumer at 90% of all water abstraction. Thus, the sector is the chief contributor to groundwater depletion. In addition, the agriculture sector adds significantly to water pollution both surface and groundwater, due to intensive and reckless use of pesticides and fertilisers. There is widespread rangeland and mangrove degradation from overstocking and overgrazing. The marine ecosystem has not been exempted from unsustainable use and degradation. There is overexploitation of fishery resources and reportedly the coral reefs have been destroyed by destructive fishing methods.

The economic costs of economic activities in the country are natural capital stock depreciation which will manifest in decline in production/output levels, household income and widespread poverty levels at the rural settings.

### **Climate change and key ecosystem**

Climate change will worsen the current situation of widespread environmental degradation as evident from deforestation, pollution, grave groundwater depletion and mining, marine ecosystem destructions. GCMs project an increase in temperature while there is significant variance amongst the models on the directional change of precipitation. While some models project an increase of as much as 25% other models project a decrease of 34%. Coincidentally, Yemen is located on a region that is difficult to project precipitation. As impacts of climate change are based on climate scenario, variation in model prediction implies that assessing the impacts will be complex. However, based on the mid scenario, it is projected that runoff will increase slightly between 2030 and 2050 with a decline in 2080. Thus, in the future, climate change could worsen water situation in the country. For ecosystems such as forests, climate change could influence species migration and the country could experience some regions having more forests area coverage others devoid of forests. In addition, fire incidents could increase significantly due to increase in biomass as well as the drying of biomass due to high temperatures. Moreover, forests pests' outbreak could also be on the rise thus affecting forests' productivity.

One of the major envisaged impacts of climate change is SLR. The GCMs project a 3.3 mm/year rise in sea level, this resulting in inundation of ecosystems and built up areas. In consequence, the service and functions provided by ecosystems such as mangroves will be compromised.

Another potentially disastrous impact of climate change is increase in sea water temperatures. Marine species are generally sensitive to changes in temperature to the extent that a slight increase in temperature could shift the system to a new equilibrium. This has potential to affect marine productivity particularly fishery production.

### **Areas important for improving nature's ability to adapt to climate change**

The potentially catastrophic climate change calls for stern actions in improvement of nature's ability to adapt to climate change. Improving nature's ability to adapt to climate change must be understood from the view point that relative to degraded ecosystems, healthy and diverse ecosystems have the ability to withstand impacts. Subsequently, the primary step is to enhance ecosystems' stability and resilience by improving management to sustainable levels. Some of the enhancement strategies include:

- Reducing pollution
- Reducing harvesting rates to sustainable levels
- Defining carrying capacities for rangelands, coral reefs and mangroves
- Introduction of individual transferable quotas for water use efficiencies

In addition, it is imperative that the following strategies be implemented

- Increase PA coverage through landscape management as opposed to zone management
- Adapt co-management approach to increase coverage area of the PAs
- Create corridors particularly Trans frontiers Conservation areas (TFCAs)

- Afforestation of the mangroves and forests

### **Areas important for carbon sequestration**

Equally important is climate mitigation, and it involves carbon sequestration. Some of the areas identified include:

- Afforestation of the Arabic woodlands, forests and mangroves
- Conservation of sea Grass through declaring them as PA and encouraging co-management practices.
- Conservation of coral reefs and declaration of vulnerable and threatened ones as PAs to be co-managed.

### **Ecosystem stakeholders, conflicts and beneficiaries**

As indicated, ecosystems offer various products, functions and services for use by stakeholders. Some of the ecosystem stakeholders include: timber harvesters, fishermen, livestock owners, farmers, members of communities, governmental departments and international communities. The varying uses by different stakeholders create conflicts. For instance, harvesting timber from forests potentially reduces its service of watershed properties and soil erosion prevention, these posing conflicts between stakeholders. Thus, there is need to determine tradeoffs such as reduction of harvest rate to sustainable levels, reduction of stocking rates and limitation of pollution levels to sustainable levels, to lessen conflicts amongst users. The ultimate goal of tradeoffs is to ensure that utilization of ecosystems by one user does not result in decline of another users' decline.

### **Policy measures to restore and safeguard Yemen's ecosystem**

The previous sections have demonstrated ecosystems' economic values and the corresponding general widespread environmental degradation culminating from pollution and unsustainable consumption. There is need to protect the country's valued natural capital stock from accelerated depreciation due to myopic decision making and planning. The primary step towards safeguarding and restoring the country's natural wealth is integration of the economic value of key ecosystems into national and local development planning levels. Selected tools and techniques to be used in the integration include WAVES, PES and development of the legal framework compelling all proposed projects to integrate environmental costs and benefits at the appraisal stages. Appraisal techniques that can be used in the exercise include CBA and MCDA.

In addition to integration of economic values of ecosystems at the national and local planning levels, it is important that harmful subsidies are removed and environmental friendly incentives implemented. Analysis has revealed that subsidies are the secondary causes for environmental degradation in the country. For example, subsidies on diesel have resulted in accelerated groundwater pumping leading to unsustainable water mining rates while subsidies on pesticides and fertilisers led to unprecedented utilisation of chemicals resulting in widespread pollution. Setting up of terrace fund for rehabilitation and restoration, preferential markets for organic and less water intensive crops make up some of the proposed environmentally friendly incentives.

## Part II: The NBSAP, its implementation, and the mainstreaming of biodiversity

### Question 5: What biodiversity targets are set by Yemen?

The biodiversity targets still under development, the NBSAP 2 the updating stated late it need one year as planned to finalize the NBSAP2. For this reason the national targets not set yet.

Yemen is undergoing politically and economically transition from a centralized policy and economy to Federalism conditions, and at this time it is important to recognize the inter-relations between human society and the natural environment. The wealth of biodiversity in Yemen is widely used in different spheres, and provides an important contribution to the social and economic development of the country. In this context the development of a Biodiversity Strategy and Action Plan, to meet the obligations of the country to the CBD, is of vital importance.

### Ratification of the Convention on Biological Diversity

The Republic of Yemen signed to the Convention on Biological Diversity at the Rio Summit, in 1992, and the Convention was ratified by the National Assembly on the 14th of May 1993. In becoming a Party to the Convention, Yemen accepted its commitment to biodiversity conservation and sustainable use within the country, as well as to active co-operation in tackling the biodiversity issues of regional and global relevance, including the sharing of genetic resources and biodiversity information. In accordance with its obligations under the CBD, the Government of Yemen started to develop its Biodiversity Strategy and Action Plan (NBSAP) and first National Report in 1997.

Currently the NBSAP II under developing using information collated in a comprehensive review of the existing situation for biodiversity and its conservation, and social and economic factors affecting the biodiversity in the country. All issues relating to biodiversity, including research, education, conservation, management, ecosystem value, policies and legislations have been assessed and analyzed, and an integrated plan for the improve future management of biodiversity in the country.

### NBSAP I Evaluation:

The NBSAP been formulated with stakeholders, local communities and NGOs included coordination and consultation at the time been, however, the strategy experienced gaps in addressing enough threats due to the shortage of suitable knowledge in biodiversity conservation and lacks of information on Yemen biodiversity.

According to the rapid review 2008 of the NBSAP found that there had been significant progress towards the goals of the national strategy. However, there are needs for a greater focus on key priorities and for specific thematic objectives and targets to be developed.

The weak capacities in the NBSAP implementation were attributed to the limited staff available and limited training provided as well as limited financial resources.

The important information we have to know that no progress achieved during the past years due to the politics and economic country situation, during the an before the Arab Spring Revolutions. Than not allowed us to develop new NAPSAP evaluation.

## **Q6. How has the NBSAP been updated to incorporate these targets and to serve as an effective instrument to mainstream biodiversity?**

### **Updating of NBSAP**

#### **How NBSAP 2 differs from NBSAP 1?**

Yemen's first NBSAP1 was implemented during the period 2004-2013 . It covered 18 Strategic Themes, the review of NBSAP1 indicated that less than 60 per cent of these targets were at least partially achieved.

Still the NBSAP under development it need one year to complete the document 2015. The direction of the NBSAP2 sets about building on areas that were under-achieved but still considered priorities as well as identifying new priority areas for action. Although NBSAP1 was well designed and very ambitious in scope, the review indicated that it was overly ambitious. For this reason NBSAP2 will be more focused, practical and outcome-oriented with the strategic targets and strategic initiatives and ecosystem services values. It also considered on the resource mobilization which was not taken to account to implement the NBSAP1 .

The coordination framework for the implementation and monitoring and evaluation of NBSAP1, while initially weak and ineffective, due to the absent of institutional initiatives and weak of financials support for this reasons a new NBSAP2 Yemen will establish national committee to coordinate and facilitate the cooperate and collaboration between the relevant biodiversity agencies in the NBSAP 2 implementation .

In the reviewing process further shown that awareness levels of NBSAP1 were very low, and the general public. Communication, Education and Public Awareness activities were not well coordinated, except the Environmental Students Clubs in mean cities . which was an impediment to effective implementation. For this reasons, Awareness Strategy implementation will be included within NBSAP2.

Associated to the absent of financial support and weak of national capacity, technology and infrastructure postponed implementation of NBSAP1 in a number of areas including biosafety, biotechnology and environmental monitoring. In addition ,difficulty to getting financing of GEF which addressed to Biosafety implementation project as example .These gaps will effectively addressed and prioritized in NBSAP2.

#### **How the actions in NBSAP2 will contribute to the achievement of Yemen's Targets?**

Within the NBSAP2 will consider and take to account to overcome the pitfalls and mistakes faced in the previous strategy the actions and involve the stakeholders including various Government ministries ;local and regional government authorities; the scientific community; non-governmental organizations (NGOs) and research centers . Thus the actions will prioritize in NBSAP2 are considered to be inclusive of all sectors and comprehensive for the achievement of the respective targets.

#### **Contribution of NBSAP2 to the achievement of the Strategic Plan for Biodiversity**

Regarding to the outcomes of the national and regional prioritization exercises undertaken as part of the consultative process, NBSAP2 is closely aligned with the Strategic Plan for Biodiversity and the Aichi Targets (2011-2020). This means that Yemen contribution to the achievement of the Strategic Plan for Biodiversity will be relatively easy to measure.

## NBSAB II Action Plan :

### Priorities and objectives :

No	Priority issue	objectives
1	1- Ecosystems loss & Habitat destruction 1.1 Inadequate protected areas Coverage	To protect, recover and restore biological diversity through <i>adequate and effective protected area networks, restoration of degraded ecosystems, and conservation of endemic and threatened species..</i>
2	2: Over-exploitation of natural resources 2.1: Overharvesting of forest resources 2.2: Over-exploitation of Agro-biodiversity products. 2.3: Overharvesting of Fishery resources	<p>Promote the sustainable harvesting of forest products through promotion of rotational grazing scheme, introduction of forage alternative sources for animal grazing, implementation of forest restoration plans, provision of alternative sources of income for local livelihoods and enactment of mechanism to monitoring forest use and land use changes within forest lands.</p> <p>To increase agricultural productivity and sustainability through the diffusion of green technology in irrigation, pest control, protection of soil erosion against flood, removal of harmful subsidies, reform of land tenure, restructuring of economic &amp; policies distortions and inclusion of local poor and women in decision-making, policy development and planning that would enable them to withstand against poverty, eliminate malnutrition, benefit from expanding employment and raise their standards of living;</p> <p>Strengthen climate change resilience of marine ecosystems to ensure sustainable delivery of marine products to support Yemeni people livelihoods, including local poor &amp; women .</p>
3	3: Natural and Anthropogenic Disturbances	<i>Objective:</i> Enhance the local community & ecosystems resilience against natural disasters through <i>mitigating impacts of energy GHG emissions, strengthening disaster preparedness, renovation of terraced agriculture, river bank protection, establishment of flood protection structures and restoration &amp; conservation of degraded watersheds, rangelands, forest, &amp; costal wetlands.</i>
4	4: Policy and economic failures causing biological diversity loss: 4.1: Legislation and Policy Distortion 4.2: Inappropriate spatial planning land use planning	<p>To incorporate values of key ecosystems goods and services into the decisions making while developing &amp; implementing sectorial policies and legislations</p> <p>Strategic Objective 1: Minimize uncontrolled urbanization on biodiversity loss by promoting sustainable land use planning &amp; management</p>

	<p>4.3: Wasteful Consumption &amp; Production in In Development and Economic sectors: energy production, manufacturing, infrastructure and Mining)</p> <p>4.4: Unfavorable Tourism.</p>	<p>Objective: Reducing industrial adverse impacts on ecosystems through introduction of green-tech, EIA enforcement, prevention of pollution, efficient use of energy, control of hazards and waste and promoting recycling</p> <p>Achieving the conservation of biological resources based on integrating ecologically sustainable management practices into tourism and recreation sector.</p>
5	<p>5: Institutional weakness</p> <p>5.1 duplicated mandates among environmental agencies</p> <p>5.2 Weak information, technologies and science base on biodiversity loss and ecosystems services.</p>	<p>Rationalization of Institution frameworks for effective Management &amp; planning of Biological Resources:</p> <p>Enhance knowledge sharing &amp; public awareness and outreach based on establishment of easily accessible information &amp; technologies and science base, including clearing house mechanism and modernized ICT systems for information exchange combined with adequate and representative observations networks for meteorology, agro-meteorology and hydro-meteorology elements, including an early warning systems for weather and flood forecasting..</p>

**Question 7: What actions has Yemen taken to implement the Convention since the last report and what have been the outcomes of these actions?**

Yemen has made significant progress towards implementing the Convention, the updating NBSAP2 ongoing and the National Environmental Strategy 2011 -2025 established on the year 2012 since the last report (July 2009). The progress is not enough well caused the country policy and economic situation during the previous years , that resulted weak of achievements action taken, and very limited of outcomes.

The existing national legislation in the Republic of Yemen has evolved in an ad hoc fragmented manner, leading to increased potential for overlapping jurisdictions associated with weak law enforcement.

There are only limited provisions in the Environmental Protection Law (EPL) No. (26) for 1995 dealing with biological resources. Although the existing provisions in EPL are inadequate to comply with Yemen's obligations under the Convention on Biological Diversity (CBD), they provide a basis for a national legislative framework for biodiversity conservation. In addition, a number of outdated laws, by-laws, and regulations are responsible for unclear mandates, role and responsibilities of designated environmental entities, creating confusion, lack of trust, and long lasting dispute among them.

The reasons for legislation not being enforced are multiple, including insufficient staffing, financial and technical capacity of responsible departments, and unclear enforcement procedures for existing legislation for this reason the EPA working on updating the EPL to be on line with the new biodiversity issues.

The current Environmental policy is generally lagging behind development issues and has seldom been coordinated with the economic development decisions that commonly shape the environment. This is leading to a situation where biodiversity issues are being addressed in the National Environmental Action Plan (1996-2000) in general terms which are not adequately meeting CBD requirements. This policy also obscures potential compatibilities among competing interests, and increases the difficulty of resolving conflicts.

The current Environmental policy must therefore be replaced by effective policies and legal frameworks that ensure takes into consideration the interests of current and future generations, as well as the productivity and diversity of the natural resources. This endeavor would require institutions capable of an integrated, forward-looking, cross-sectoral approach in decisions making related to environmental conservation. More importantly, there are immediate needs to incorporate the objective of sustainable use of natural resources in the agenda of agencies dealing with national economic policy and planning and international policies. Some of the recommendations in the National Environmental Action Plan (NEAP) incorporated into the second National Five-Year Development Plan (2001-2005) contain specific policy statements to this end. These first steps toward integrating environmental and biodiversity concerns at the national policy level indicate that awareness of these issues within the central government is increasing. This trend is very positive and should be advanced through additional actions at the policy and legislative levels as soon as possible.

With the exception of EPA's planning, policy development and coordinating role, the responsibility for biodiversity and protected areas management is "entangled" between several government agencies and parties. Overlapping areas of responsibility and disputes arising from territorial imperatives have been a hindrance to progress, and a detriment to resource conservation.

Clarification of the different roles and responsibilities of the line agencies has become an urgent matter, and a confirmation of EPA's coordinating role and authority is equally important.

In addition to the above policy and legislative deficiencies, there are number of root causes which influence the performance of national agencies responsible for environmental management. These include: inflated organizational and functional structure of the public administration; insufficiency of qualified specialized manpower; inappropriate practices/ lack of norms and standards; retardation of traditional practices and norms in environmental protection; lack of partnerships with NGOs and the private sector in protecting the natural resources and environment, as well as limited information flow and weak external coordination.

Therefore, there is strong need for a mechanism to harmonize the existing policy and legislations through extensive review and assessment. In this context, the Government is now launching a nationwide reform program aiming to rationalize government institutions and policies, to be more responsive to the public and international needs, and to become more efficient and effective in developing and executing government policies and programs. In the environment sector, the objective of the initiative is to restructure the environmental agencies to effectively meet their ultimate objectives nationally and internationally. This will be reached through:

- Restructuring and rationalizing environmental agencies with redefined mandates and responsibilities;
- Strengthening collaborative working relationships among environmental agencies supported with solid legislative and regulation framework for environmental protection;
- Updating and implementing the Environment policy and its action plans;
- Creating a reliable resource mobilization mechanism to finance environmental protection and facilitate greater involvement of private sectors, NGOs and local councils in environmental protection activities.

#### **Q8. How effectively has biodiversity been mainstreamed into relevant sectoral and cross-sectoral strategies, plans and programmes?**

##### **The mean sectoral and cross-sectoral integration or mainstreaming of biodiversity considerations :**

###### ***Environmental Policy and Strategy :***

The government has recognized the importance of integrating environmental issues in the developmental plans. In the recent years significant steps have taken place to enable a more systematic consideration of environmental issues. Provisions have been made in the Environment Protection Law to enable incorporation of environmental aspects and concerns at all stages of the developmental plans. The NEAP acknowledges the inter-relationship of socio-economic developments and sound environmental developments. This NEAP formed the basis for the environmental chapters in the Five Year Development Plan for the period 1996-2000 and for the National Population Strategy and Action Plan for the same period. These plans recognized this approach. These provisions and documents form the basis to integrate environmental concerns in development policies and plans and reflect the commitments and efforts of the country in integration of environmental concerns into developmental plans as being a major item in the country's development agenda. Furthermore this commitment is evident in the government initiative for the development of the Socotra Island with strong commitment for environmental

protection and biodiversity conservation of the island.

### *National Environmental Action Plan*

The NEAP was issued in mid 1996. The developmental objectives of the plan are based on the national awareness that the well being of the Yemeni people in the present and future generation depends on the nation natural resources base. The plan promotes sustainable use of natural resources through a set of policy options in addressing priority issues.

Environmental issues of national concern were identified and environmental analyses including biodiversity were carried out on the major resource assets and economic sectors; particularly on biodiversity and natural habitats, water, land, marine and coastal resources, urban environment, cultural heritage, , oil and energy sector, mining sector and the industrial sectors

The NEAP promotes sustainable use of natural resources and biodiversity through a set of policy options addressing priority issues. These policy options deal with legislative, institutional, economic and financial measures in addition to information and community involvement.

### *The Second and the third Five-Year Developmental Plan to 2010*

Environmental protection strategy in the Second and the Third Five-Year Developmental Plan was based on preserving sustainability of the nation's natural resources and maintenance of ecological system through maintaining a balance between socio-economical growth and available resources.

The plan proposes a number of measures and actions including institutional restructuring, strengthening of natural resources planning and management capacities, establishment and operation of environmental monitoring systems, upgrading of legal frames and information bases, resource mobilization and support participation of relevant agencies, target groups and local communities.

### *The Poverty Reduction Strategy Paper 2003 – 2005*

The government acknowledges its commitment towards poverty eradication. This commitment is evident through adaptation of a set of policy actions undertaken since early nineties, such as the economic and financial reform policy and the PRSP. The PRSP acknowledges relationship and linkages between poverty issues and environment protection. The poor are one of the most population groups reliant on environment for their livelihood. As the same time they are the most affected group by environmental problems and the way natural resources are exploited. Also poverty increases pressure on natural resources, though poverty does not necessarily lead to environmental deterioration.

PRSP indicated four major developmental challenges of which two issues, water resources and population problems, have direct linkages with natural resources management practices and relate to carrying capacities of natural resources. The other two challenges have indirect linkages as they deal with having the right to use natural resources for the benefit of current population without undermining the ability of the future population and of improving institutional structure and efficiencies for sound environmental management.

PRSP aims to reinforce sustainable management of natural resources, mobilize beneficiaries, involve the poor and support the role of women and youth in environmental conservation.

### *Vision 2025*

Vision 2025 supports environmental and poverty reduction actions. The vision noted that environmental degradation affects the poor and development. It reviews major environmental problems such as water resources depletion and pollution, degradation of land resources, natural habitat and biodiversity, waste management, over exploitation of natural resources such as fisheries, and urban expansion over agricultural land. In terms of environmental interventions following measures have been proposed:

- Development and implementation of sustainable management and monitoring programmes for water and land resources, agriculture, coastal zone, biodiversity and waste management.
- Development of desertification control programme.
- Provision of energy substitutions.
- Application of environment friendly technologies and enhancement of renewable energy resources.
- Application of environmental impact assessment for developmental projects.
- Enhancement of environmental awareness.

### *Environment and Sustainable Development Investment Programme 2003 – 2008*

The plan presents an outline strategy and priority interventions aimed at controlling and gradually reversing environmental impacts. It also aims at supporting sustainable human development for the people of Yemen. 6 main areas of interventions were identified in the plan as follows:

- Habitat and biodiversity conservation
- Sustainable land management
- Sustainable water resources management
- Sustainable waste management
- Sustainable climate change and energy management
- Institutional development / capacity building

Within each programme area, the plan proposes priority actions and budget for each action. The total proposed investment budget is estimated to be US \$ 30.2 million.

### *The National Strategy for Environmental Sustainability (NSES) 2006*

The National Strategy for Environmental Sustainability (NSES) was completed in 2006 through UNDP's Sustainable Natural Resource Management Programme (SNRMP). The NSES examined the environmental problems in terms of impacting causes, Pressures and Driving Forces and hence suggests strategic framework and action plan for environmental Sustainability. The NSES calls undertaking a numbers of short and medium term interventions to address the following critical environmental issues:

- Water.
- Land resources.
- Biological diversity.
- Coastal and marine environment.
- Waste management.

The NSES attempts to link the effect of environmental degradation on poverty, and seek to investigate means to achieve the Millennium Development Goals (MDGs).

### *Environmental and Sustainable Development Investment Program 2003–2008*

The plan presents an outline strategy and priority interventions aimed at controlling and gradually reversing environmental impacts. Six main areas of interventions were identified in the plan. The total proposed investment budget is estimated to be US \$ 30.2 million. The six main areas of interventions are:

- Habitat and biodiversity conservation.
- Sustainable land management.
- Sustainable water resources management.
- Sustainable waste management.
- Sustainable climate change and energy management.
- Institutional development/capacity building.

The list depicted in the plan does not reflect priority areas for interventions, but emphasizes areas where some funding was available under ongoing projects

### *Millennium Development Goals (MDGs):*

Targeted to integrate the principles of sustainable development into country policies and programs, reverse the loss of environment resources by 2015.

### *National Capacity Self Assessment*

NCSA action plan prepared to enable Yemen to fill full its obligation to wards the implementation of the environmental conventions. NCSA primary focus on capacity needs assessments in the three main areas: biodiversity conservation, climate change and desertification, land degradation, particularly in the context of MEAs. The NCSA comes with Action Plan for Environmental Capacity Development which presents an outline strategy and priority interventions to achieve the MEAs goals. Six strategic objective addressing synergistic and conventions specific capacity development intervention areas were revealed during long participatory process undertaken with the related to the environment and natural resources conservation stakeholders, the six areas of interventions are:

- ✓ Policy Development and planning.
- ✓ Resource mobilization.
- ✓ Institutional and legislative strengthening.
- ✓ Research and technology development.
- ✓ Data and information collection, dissemination and monitoring.
- ✓ Rising environmental awareness and education of Yemeni society.
- ✓ Sustainable use of natural resources.
- ✓ Sustainable climate change and energy management.

### *National Adaptation Programme of Action*

The primary goal of the NAPA process to broadly communicate to the international community priority activities that address Yemen's urgent needs for adapting to the adverse impacts of climate change through:

- Ensuing adequate shareholder representation in the development of NAPA process.
- Identify a comprehensive range of climate change adaptation strategies.
- Establishment of country-driven criteria to evaluate and prioritize adaptation measures.

Make consensus-based recommendations for adaptation activities. And Recommend capacity building and policy, programme and policy institutional integration as part of adaptation priority activities

### *National Agricultural & Natural Resources Management Policies (PRSP) Agriculture:*

#### *Specific Goal:*

Contribute to increasing economic growth; diversification of the base of the economy; and the provision of basic services in order to reduce poverty, which is more widespread in the rural areas, as well as improving efficiency within the sector.

#### **Policies**

- Promoting bio-protection and resistance to plant diseases and aphids and supporting.
- Giving incentives to the private sector to investing in agriculture production and marketing and to adopt projects outside the densely populated areas, with a view towards creating extensive and diversified job opportunities, in addition to those projects that promote integration between agriculture and industry.

#### *Main relevant Sectoral Agricultural Policies Plant Production Policies*

- Raise the levels of production through achievement of higher yields per unit area.
- Find the compatible environment that will help in the improvement of the conditions and efficiency of rain-fed crop production as well as increasing its returns.
- Promote the cultivation of market-oriented cash crops, in terms of enhancing the efficiency of production techniques used and to market those products that have a comparative advantage.
- The Introduction of modern techniques in rain-fed agriculture that is compatible with the traditional practices.

#### *Seeds and Fertilizer Production Policies*

Increase agriculture output through the exploitation of the natural resources by the methods that will lead to conservation of natural resources, and that will ensure their continuity, by means of upgrading the productive capacity of one unit area, quantitatively and qualitatively, with the participation of the beneficiaries to ensure the efficient use of the natural resources available.

- Meet local requirements of improved seeds and appropriate fertilizers.
- Preparation of the regulations for handling agricultural seeds and fertilizers.
- Set up an effective mechanism for coordination among the relevant entities in the production of seeds and fertilizers.
- Vitalize the role of the quality control unit and coordination of its activities in accordance with international and domestic standards in effect.
- Continuation of the research in the production of original breed seeds and drought resistant seeds.
- Provision of technical research information for the beneficiaries.
- Improve technical awareness and training of human resources of the beneficiaries in producing and handling seeds and agricultural fertilizers.
- Support the establishment of specialized associations for the producing and supplying seeds

and agricultural fertilizers in the different agricultural regions.

- Upgrade the efficiency of control of fertilizers and seeds at the entry points.

### *Protection Policies*

- Support to the research on protection from agricultural diseases and aphids.
- Activate the agriculture quarantine measures.

### *Forestry and Anti-Desertification Policies*

- Provision of forestry and pasturage seeds and the expansion of rangeland areas and provision of incentives for this.
- Promotion of recreational parks, based on the concept of available social efficiency.
- Expand the establishment and dissemination of natural protected zones and, with a view towards conserving inherited plant assets and protecting the ecological bio-sphere.
- Provision of investment conditions for the private sector that encourage the establishment of health resorts in the range land areas and as a first pilot project to include the planting of mixed forestry trees.
- Development of the legal frameworks by taking advantage of traditional social practices in forestry and range land management.
- Improvement of the management, conservation and development of the existing forests and natural vegetative pasturage areas, and to involve local communities in this respect.
- Support farmers and social institutions to set up windbreaker tree belts and the construction of terraces and water barriers.
- Coordination with non-governmental organizations and the relevant environmental protection agencies through having them support the government efforts to combat desertification of the hinterland, which is threatened by encroaching sands.
- Support activities, at the school, university and social levels for the establishment of vegetative grounds and recreational parks.
- Promote the use of terraces to protect soil from erosion and provide economic benefits, using efficient techniques, in which the government and the communities participate jointly.

### *Agriculture Research Policies*

Agricultural research is important for the achievement of the objectives of agricultural and sustainable development and for directly contributing to increasing agricultural production, and, accordingly, to the alleviation of poverty. Research shall remain a general service of public benefit that the public sector will continue to provide. Accordingly, research programs will be associated with and linked to whatever will serve the implementation of agricultural development and whatever will lead to increasing the efficiency of production, the determination of the priorities of research and concentration on the activities of direct and immediate impact on increasing and improving production through research plans and programs. Agricultural research shall seek to improve production and productivity on sustainable grounds, to develop different varieties of crops, improve livestock production, improve the uses of land and water resources as well as forests and prairies, whereby **agricultural research shall work towards:**

1. Increase productivity of crops through development of improved varieties of farm and garden crops, that would have be adapted to different production systems, as they have been applied, scientifically and practically, to different agricultural environments; .
2. The development of production techniques that are applicable and economically sustainable, and which will lead to reducing the reliance on scarce groundwater and which will help to enhance the efficient use of rainwater.

3. Exploring alternative production methods with emphasis on the conservation and efficient use of water, the development of watersheds and the improvement of water harvesting techniques.
  4. Ensure food security at the level of the rural family, especially for cereals and legumes for the small farmers who are dependent on agriculture, and who work in rain-fed system settings and eroded settings; improve the efficiency of farmers and rural women through the development of production systems and techniques that help to provide for stable yields and to process the necessary goods that are required for the rural families.
  5. Develop efficient sustainable systems, and an integrated pest control system that is environmentally safe and reduces the reliance on chemical pesticides.
  6. Development of improved systems for sustainable and high yielding agriculture, including integrating crop production systems with environmental livestock production systems; and integrating fruit production systems with forestry, and integrating feed production systems with farm systems; with a view towards working towards halting environmental deterioration through the participation of farmers and beneficiary customers.
  7. The development of an integrated soil fertilization management process, through the use of a number of options that lead to the increase of production in a sustainable manner and to increase the optimal benefit of the farm resources and agricultural inputs purchased.
  8. To improve the free access of small holding families with limited resources to fulfill nutritional requirements, through the development of appropriate techniques that work to improve their purchasing power<sup>5</sup> and the production of the appropriate foods in the farm, as well as support the activities of rural women through training.
  9. Explore the possibilities of increasing the use of the appropriate drawing animals, manual implements and the effective cost mechanisms that will enhance the efficient use of labor and reduce arduous labor.
  10. Increase the abundance and production of natural rangeland pasturage and the vegetative cover, through the participation and rehabilitation of beneficiary users.
  11. Improve the productivity of livestock with emphasis on selectivity and proper health care and the improvement of feed resources.
  12. Reinforce the dissemination of research efforts without any sexual discrimination, through the development of techniques that are helpful to rural women in improving their incomes and reducing arduous labor.
  13. The development and improvement of natural resources for the purpose of achieving better and more efficient use of such resources.
  14. The development of techniques for qat and farming that depends on qat , which will help to reduce the use of pesticides and increase the efficient use of water and achieve the optimal productivity per unit of cultivated area used.
  15. Reduction of post-harvest losses of farm products through improving the handling and storage techniques, and adding value to such products, as well as the secondary products through the development of storage and processing techniques there for.
  16. Development of the techniques for the rapid proliferation of seeds and the vegetative accretion materials, provided that the contribution of The General Authority for Agricultural Research and Extension is output for the relevant institutes, the priority refined seed breeds of farm and garden crops, for the follow-up proliferation of the original seed breeds and the approved seeds of the National Center for Seed Accretion at the farmer's fields; AREA will also participate in inspections of farms during the agricultural season.
  17. Improvement of the relationships with the private sector in the areas of reciprocal benefit, such as in training, post harvest techniques, marketing and processing, provision of consultancy that help to solve the problems faced by the private sector.
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18. Start on the preparation of a policy on Research in the agriculture sector that will provide guiding signs for the continuing the design of policies for comprehensive economies of production.
19. Reusing the deteriorated land or soil resources and combating desertification for agricultural purposes, with a view towards developing appropriate agricultural systems for the reclaimed land after its use.

### *Livestock Policies*

- Motivation of small farmers to create small enterprises for producing dairy products, and to form associations for assembling milk; and encouragement of the manufacture of dairy products.
- Issue the required legislation for the preservation of animals and livestock by banning the sale of young female livestock, and to set the bottom age limit for slaughtering livestock.
- Activate the animal quarantine in all the entry points to prevent the entry of animal diseases and aphids from these entry points.
- Increase veterinarian services and encourage the private sector to enter this field.
- Increase the production of poultry products through adoption of the essential measures to improve the quality of production, reduce costs, especially feed costs. This could be done by supporting the establishment of companies that produce poultry feed, by the use of the maximum amount of local raw materials available.
- Increase the production of red meat by disseminating and spreading the cultivation of high nutrition feed crops that animals require; and expand on the use of concentrated nutritional supplements.
- Improve livestock extension directed towards rural women, concerning the feeding and care methods in the barns and stables; and spread awareness on the importance of minimum weight requirements before slaughtering, in view of the fact that most animal husbandry is undertaken by rural women and small farmers.
- Direct attention to the Domestic Livestock Breed Improvement Centers by taking advantage of imported breeds to arrive to highly productive breeds.
- Motivation of the private sector to adopt and provide veterinary health services.
- Expand in the dissemination of national campaigns against livestock diseases and aphids.
- Enhance the performance level of and activate internal and external veterinary quarantine.
- Improve the quality of veterinarian technical training and enhance veterinary awareness among breeders and producers.
- Direct attention to grazing areas and to shepherds; and to commence using the concepts of feed units and the spread of such concepts using the public media channels.
- Motivate the cooperative sector in spreading and expanding agriculture and livestock integration and the expansion of livestock producing farms.

### *Fisheries Sector Strategy:*

The general directions of the national strategy for the development of the fisheries sector were prepared from a perception and deep understanding of the importance of the fisheries sector and its role in supporting and developing the national economy. It aims at providing detailed analysis of the current situation and assessment of the magnitude of previous policies and supporting programs provided, the assessment also included topics and major directions for the sector

development and preparation of suitable conclusions and recommendations for the future directions and for all potential donor agencies to ensure support to the sector. The assessment will provide to the government and donors clear vision to develop the fisheries sector in the medium and long term prospects. The strategy contains three domains:

#### **The First Domain:**

Provides comprehensive explanation on the conducted studies and prospects in research in fisheries and the status of fisheries resources, institutional structure of the fisheries sector.

#### **The Second Domain:**

Covers the utilization of fish wealth and maintaining marine monitoring and inspection and quality control and development of fish exports and conserving the marine environment and the proper management of fishing operations.

#### **The Third Domain:**

Analysis of the status of infrastructure and major structures of the service and production sectors.

### ***Education and Public Awareness***

Though the responsibility of environmental education and awareness lies on all institutions dealing with biodiversity, the education and awareness unit of EPA has been the most active. The unit issues Environment Magazine on quarterly basis and actively participates in publishing the environmental page in Al-Thawra daily newspaper through providing environmental news, information and newspaper articles. It also provides the national TV and radio with environmental information and audio-visual materials to produce TV spots, and documentaries programmes when necessary. EPA cooperates with many national partners in producing bulletins and posters and brochures to enhance public awareness in general workshops, environment clubs, school campaigns, and summer camps.

The EPA organize and actively participate in exhibition, campaign and educational activities conducted annually for the celebration of environmental events like world international environmental day, water environmental day, desertification day and Arabs environmental day etc. Annually, EPA organizes meetings to celebrate international day of biological diversity. This event publicizes the knowledge and information on biodiversity through the dissemination of biodiversity's books and brochures to organizations and interested persons.

### ***Genetic Resources in Yemen***

Yemen is characterized by large diversity of native species, varieties and soil types adapted to different agro-ecological zones. Crops such as wheat, lentil and millet are examples of local varieties whose yield and quality are deteriorating as a result of introducing homogenous high yielding varieties.

Yemen is characterized with rich genetic resources as a result of its rich biodiversity and natural resources base; associated with different climatic conditions and agro-ecosystems. Historically, the ancient people developed traditional practices to preserve the genetic resources. However, in the recent period and due to increased demand for foodstuff, mechanical systems and new alien species were introduced to agricultural practices. There was no efficient and proper attention given

to the use of the indigenous genetic resources. There are no breeding programs to improve local strains, collect data, characterize, research and evaluate them.

Sustainable use of agro-biodiversity depends largely on the inherited knowledge and experience and understanding of natural resources. Endogenous genotypes are the result of long selection process by ancient local farmers that were inherited to successive generations. They used indigenous breeding methods for selections for new genotypes to improve species productivity and adaptability to different agro-ecosystems. Examples of such selections were in sorghum, which had been practiced to improve seed's color and size with super early maturation and free of pests. New varieties of sorghum were developed as a result of such processes, which are still widely used in Tihama, Taiz, Ibb and Lahj.

Although Yemen hosts rich biodiversity and genetic resources, and progress made in this respect is minimal compared to other countries that do not have large genetic resources. This had impacted on the productivity of various varieties. For example, the introduction of chicken breeds caused large reduction in local strains. In addition, there have not been any breeding programs to research, evaluate, characterize and improve local strains.

Some research centers use breeding process for species improvement. However most of their activities have been limited to certain varieties such as sorghum, wheat, and onion. Their research work has focused on production of synthetic varieties. An excellent achievement in this respect is improved onion variety called Bafatim, which was developed from mass selection in Syeiun Research Center. This variety was later on released to many regions in the country.

Some genotypes of the endogenous species have excellent unique genetic characterizes. Research need to be done to assess the potentiality of utilizing these resources along with modern knowledge to improve the sustainable use of agro-biodiversity.

Improvement of genetic resources depends of research work and selection of breeding method based on sufficient evaluation process. The academia and research centers have and important role in such research work. Particular roles involve the collection and conservation of genetic materials. The establishment of genetic resources centers in the Faculty of Agriculture of Sana'a is an important step toward genetic resource conservation and assessment in Yemen. These centers have initiated processes to collect and preserve genetic resources for vegetables, and other crops in order to study genetic behavior of the collected species and their potential for species improvement.

### ***Biotechnology and Biosafety***

Given that biotechnology and biosafety are relatively new issues in Yemen, there is poor understanding and knowledge on the nature and extent of risks on biodiversity associated with transfer of biotechnology and use of genetically modified organisms (GMOs). Furthermore, there is no specific entity responsible for handling the safe use and transfer of biotechnology and GMOs. There is still a urgent need to develop guidelines for their safe application and to control the impact of the modification operation on human health and agro-biodiversity. These deficiencies, combined with unavailability of policy and legislation framework for regulating biotechnology and biosafety issues, are likely to cause high level of risk on the country fragile ecosystems and its endemic species. Therefore in order to foster this situation and halt any further biodiversity destruction, this national biosafety framework has been developed to regulate their application.

There is however, no legal instrument to regulate use and application of GMOs. There is no research work on GMOs at the national level and no such crops are produced locally. The awareness level is low and presently no authority has been assigned to regulate and research and monitor safe application of biotechnology.

Biotechnology can play an important role in addressing agricultural research and contribute to agricultural development. Presently, there are basic facilities and capacities for biotechnology both at the academia and research centers. Technical capacities and institutional capabilities need to be further improved and public awareness needs to be enhanced. Policies and systems need to be developed and put in place to regulate biotechnology and biosafety. There is a need to develop adequate policies and legal frameworks, as well as on technical, institutional, international cooperation, research and social aspects main issues are as follows:

- On the policy aspects, policies need to be developed to address research work giving due attentions to challenges and priorities, capacity building needs and awareness raising. Due attention should also be given to intellectual property rights and linkages with regional and international efforts.
- On the legal aspects, legal framework, guidelines and instruments for biotechnology and biosafety need to be developed to regulate use and monitor safe applications.
- On the research aspects, there is a need to improve and enhance scientific capacities and technological infrastructure, to research and integrate biotechnology risk management into existing environmental, health, and agricultural regimes. Sufficient funds, incentives and facilities need to be provided
- On the institutional aspects, there is a need to assign an authority to oversee, coordinate, monitor and enforce biotechnology and biosafety issues. Adequate power, facilities and funds need to be provided to effective operation of the agency.
- On the technical level, there is a need to develop technical capacities through capacity development of research and scientific cadre, provision of adequate equipment and facilities and laboratories.
- On the social aspects, targeted awareness programs need to be developed and implemented. Due attention should be given to stakeholders and community participation.
- On international cooperation, mechanisms need to be developed for exchange of experience and linkages with regional and international efforts to ensure biotechnology development, transfer of knowledge and safe and sustainable applications.
- On the role of private sector, due attention should be given to the involvement of the private sector who should be encouraged through provision of incentives for creation and financing of local private biotechnology enterprises and promote local public research and development.

## Q9. How fully has the NBSAP been implemented?

### Current Status of National Biodiversity Strategies and Action Plans

#### Goal 1. Conservation of Natural Resources

##### 1- protected Areas:

Key Issues	Priority Objectives	Performance Indicators	Status of implementation
<p>-Lack of effective administration and conservation management regimes for protected areas;</p> <p>-Limited geographic coverage of Protected areas (PA) associated with lack of PA management plans</p> <p>-Insufficient staff and resources.</p> <p>-Incomplete legal framework for protected areas.</p> <p>-Lack of precise information on the number of fauna and flora species present in Yemen, or on rare, threatened endemic species and their habitats;</p> <p>-Lack of adequate legislation to protect flora and fauna;</p> <p>-Lack of Institutional Capacities for protected area</p> <p>Criteria for defining critical habitats or biotypes are missing.</p>	<p><b>Short-Term(1-3years:)</b></p> <p>-Develop and strengthen coordinating management mechanisms to improve integrated management of the protected areas system.</p> <p>-Maintain and develop an integrated and adequate network of protected areas, representing key eco-systems of Yemen.</p> <p>-Prepare management plans for selected priority protected areas.</p> <p>-Establish an integrated database for biodiversity resources and protected areas</p> <p>-Establish a single department to manage protected areas.</p> <p><b>Medium-Term(4-8 years)</b></p> <p>-Expand the Protected area network to include Ramsar sites, World Heritage sites, and World Biosphere Reserves.</p> <p>-Expand management planning and implementation in selected protected areas.</p> <p>-Promote research targeted on protected areas improved conservation management practices.</p> <p>-Provide equipment, transport, communications and other material to strengthen conservation of protected areas.</p> <p><b>Long-Term (&gt;8 years)</b></p> <p>- Expand the program in protected areas management to include one trans-border reserve with Saudi Arabia or Oman.</p> <p>- Review management needs for key priority conservation areas and facilitate implementation.</p>	<p>-Single department for protected area management in place.</p> <p>-By 2010, at least 7 new protected areas created.</p> <p>-Results of research on protected areas published and made publicly accessible.</p>	<p>Increased awareness among relevant authorities and individual on the environmental issues and the importance of biodiversity and the role of local communities in environmental systems conservation..</p> <p>Thorough surveys and studies were made with community participation results on formulation management plans several locations and declare them as natural protected areas such as:</p> <p>The Socotra Archipelago protected area.</p> <p>The main land protected area in “Bura'a” mountain, “Hawf” mountain forest.</p> <p>Utma District in Dhamar Governorate has been declared protected area in 2<sup>nd</sup> of June 1999 as per the Council of Ministers Resolution No. (137)</p> <p>The declaration of wet land as protected areas in Aden Governorate in August 2006.</p> <p>Coastal protected areas. There are efforts to declare these areas as natural protected areas in Bal-Haf, Brum, and Sharma - Gathmoon.</p> <p>Declare 9 ICZMP</p> <p>There are other sensitive area been rapidly assessed and needs thorough study to enable the GoY to declare them as protected areas. These area are: Rayma Governorate, Gabal Allawz, Gabal Al-Ahgor in Al-Mahweet Governorate, Gabal Al-Areas in Abyan Governorate, Gabal Gowl in Hadramout, Ras Fartak in Al-Mahara Governorate, mangroves areas in Al-Luhayya-Medi, and Kamaran Island in the Red Sea.</p> <p>A number ranging from fifteen to sixteen sites have been identified as sensitive areas in the coastline of Yemen.</p> <p>The launching the management process in “Bura'a” and “Hawf” and Aden wetland Pas at Aden Governorate along with progress achieved in Socotra Island which is considered the most important protected area in Yemen.</p> <p>- A comprehensive checklist of flora of Yemen including endemic, near endemic and rare species was obtained,</p>

## 2. Endemic and Endangered Species

Key Issues	Priority Objectives	Performance Indicators	Status of implementation
<p>-Weak monitoring capabilities for endangered and rare species.</p> <p>-Lack of enforcement of wildlife protection measures.</p> <p>-Inadequate systematic population monitoring of species, specially endangered ones.</p> <p>-Lack of information on the status and habitat requirements of species at risk.</p> <p>-Habitat destruction caused by activities associated with development.</p>	<p><b>Short-Term(1-3years:)</b></p> <ul style="list-style-type: none"> <li>-Inventory existing information on endemic plant and animal species.</li> <li>-Prepare and effect by-laws and regulations on protection of endangered and threatened wildlife species.</li> <li>-Prepare and establish an IUCN red list of rare and endangered species of Yemen.</li> </ul> <p><b>Medium-Term(4-8 years)</b></p> <ul style="list-style-type: none"> <li>Design and implement a local community-based program related to in situ conservation of selected endemic, endangered fauna and flora.</li> </ul> <p><b>Long-Term (&gt;8 years)</b></p> <ul style="list-style-type: none"> <li>Prepare and implement recovery and rehabilitation plan for threatened species</li> </ul>	<p>By 2006, inventory of endemic species published.</p> <p>By 2007, relevant by-laws and regulations on wildlife protection prepared and enacted.</p> <p>Pilot community-based in-situ conservation programs for endemic, endangered fauna and flora implemented.</p> <p>Recovery and rehabilitation plans prepared and implemented.</p>	<p>-Inventory of endemic species Published in 2008 .</p> <p>- IUCN red list of rare and endangered species -prepared in 2008.</p> <p>- initial information on status of enedemic and near endemic plant species was obtained</p>

## 3. Ex situ Conservation

Key Issues	Priority Objectives	Performance Indicators	Status of implementation
<p>Lack of genetic resources centers that can collect genetic materials and conserve them to be available for research and genetic improvement.</p> <p>Lack of botanical garden for collecting and preserving rare and endangered flora.</p> <p>Absence of a Natural History Museum for biological diversity in Yemen</p>	<p><b>Short-Term(1-3years:)</b></p> <p>. Develop and establish a basic reporting system for monitoring biodiversity deterioration.</p> <p>Prepare and adopt a national policy on ex-situ conservation.</p> <p><b>Medium-Term(4-8 years)</b></p> <p>Stimulate ex situ conservation through the establishment of gene banks, seed banks, green belts and public gardens.</p> <p>Develop guidelines for collection, maintenance and reintroduction of plants and animal species in ex-situ programmes.</p> <p><b>Long-Term (&gt;8 years)</b></p> <p>Expand the establishment of botanical gardens, National Herbarium and Seed Banks to collect, house and preserve rare and endangered native taxonomic groups of plants species of Yemen.</p>	<p>By 2005, a reporting system for monitoring biodiversity in place.</p> <p>By 2008, a national policy on ex-situ conservation prepared and enacted.</p> <p>Number of gene banks, seed banks, green belts and public gardens established.</p> <p>Guidelines on collection, maintenance and reintroduction of plants and animal species developed and used.</p>	<p>-Among the significant efforts exerted by the EPA, the following can be recorded:</p> <p>-Preparation of by laws by the EPA to support the principle of biodiversity protection in protected areas with emphasis on rare species in this diversity located ex situ. Moreover, several memorandum of understanding were signed between Yemen and neighboring Arab Countries with the aim of organization of conservation efforts of rare species of plants and animals and birds threatened by distinction (the Panthera Pardus (Leopard), Ardeotis Arabs (Arabian Bustard) birds... etc.)</p> <p>-Despite the rich biodiversity and the wide range of diversity in Yemen, the progress achieved so far in the construction of Gene Banks for plants and animals is still modest. There is a nucleus of Gene Banks in Yemen represented by the Faculty of Agriculture in Sana'a University and the Agricultural Research and Extension Authority in Dhamar.</p> <p>-There is a program conducted in the Livestock Research Center in Lahej and the Central Highlands Regional Research Station in Dhamar under AREA where animal species are introduced and kept in the two research sites for further research and reproduction. The EPA has generated financial support through a regional project supported by</p>

			<p>UNDP under the title “Sub Program-2, (SP2)” under the title “Information and consultancies on the use of land resources” which was implemented through AREA during the period 1998-1999. The sub program was considered a response to the national plan of action for environmental protection which stipulates the creation of a center for renewable resource management. The Renewable Resource Center was established through a donor support from the Netherlands and further strengthened by SP2. The center has three units. These are:</p> <p style="padding-left: 40px;">Utilization of land resources unit.</p> <p style="padding-left: 40px;">Land degradation monitoring unit.</p> <p style="padding-left: 40px;">Genetic resources unit.</p> <p>-The Genetic Resources Unit (GRU) was further developed into a National Center for Genetic Resources. This center was financially supported by the “Evaluation of environmental Resources for rural land use planning” during period 1994-1999. The support covered the following areas:</p> <p style="padding-left: 40px;">The establishment of a National Herbarium.</p> <p style="padding-left: 40px;">Connect the collected data into the Geographic Information System.</p> <p style="padding-left: 40px;">Disseminate information on collected genetic resources.</p> <p style="padding-left: 40px;">Securing a MScs. Scholarship for one of research staff in the center.</p> <p style="padding-left: 40px;">Purchase of equipment and supplies for the GRU .</p> <p>-The GRU in AREA has a number of local research staff with various backgrounds and training. There is Ph.D holder and two MSc holders and six BSc holders plus five technicians.</p> <p>-The Genetic Resource Center in Sana’a University is mandated to collect and conserve genetic resources. One PhD holder and two MSc holders and seven BSc holders comprise the staff of this center. The center accommodates a tissue culture lab and has good storage facilities.</p> <p>-There are several efforts to conserve and protect species outside their natural habitats. These can be summarized as follows:</p> <p><i>The reproduction of the Panthera Pardus (Leopard)</i></p>
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			<p><i>in "Taiz" Governorate through national efforts.</i></p> <p><i>The reproduction of the Panthera Pardus (Leopard) through regional cooperation between Yemen and "Al-Sharjah" Emirate in the UAE.</i></p> <p><i>The reproduction of Ardeotis Arabs (Arabian Bustard) birds through regional cooperation between Yemen and the UAE.</i></p> <p>-There were several attempts to cultivate coastal shrimps especially in Al-Luhayya in Hodeidah Governorate by the private sector. The Marine Research Center in Aden conducted several experiments to raise coastal shrimps. However, these attempts did not materialize into concrete actions to reintroduce the reared species into their natural habitats to compensate for the high percent loss of this valuable species.</p> <p>-The Marine Research Center was able to breed and cultivate small shrimps in the laboratory. However, this was not accompanied by commercial rearing of these lobsters and reintroducing them into their natural habitats to compensate for the losses of this species.</p> <p>- First Botanic Garden was established in Taiz city</p>
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#### 4. Alien Invasive Species

Key Issues	Priority Objectives	Performance Indicators	Status of implementation
<p>Lack of adequate information of the type, numbers, status and structure of alien species.</p> <p>Lack of institutional capacities in evaluating and preserving alien species.</p> <p>Lack of monitoring system for alien invasive species.</p> <p>Lack of adequate legislative tools to control introductions of alien invasive species.</p> <p>Absence of preventive and remediation measures.</p>	<p><b>Short-Term (1-3 years)</b> Prepare a list of alien invasive species and identify the most dangerous ones. Monitor and control the expansion of key alien invasive species. Strengthen quarantine measures to control intentional and unintentional introduction of alien invasive species</p> <p><b>Medium-term (4-8 years)</b> Develop and implement control programs for key alien invasive species.</p> <p><b>Long-Term (&gt;8 years)</b> Develop relevant legislation to control the importation and trade of alien invasive species. Develop and strengthen database of alien species Establish a specialized unit to be concerned with alien invasive species.</p>	<p>By 2007, a list of some alien invasive species published and disseminated. Number of control programs for key alien invasive species completed. By 2010, adequate legislation regulating import and trade of alien invasive species in place. By 2012, a list of most dangerous alien invasive species eradicated and controlled.</p>	<p>- Prepare scientific reports (list ) on alien invasive species .</p> <p>- Number of control programs for key alien invasive species completed (mitigating and investigating)</p>

#### Goal 2. Sustainable Use of Natural Resources

##### 5. Terrestrial Wildlife Resources

Key Issues	Priority Objectives	Performance Indicators	Status of implementation

<p>Degradation and conversion of natural habitat.</p> <p>Desertification, including wind erosion and sand dune encroachment</p> <p>Agricultural expansion and poor agricultural practices.</p> <p>Wood cutting for firewood, timber and charcoal production.</p> <p>Overgrazing of rangelands including loss of sustainable practices of sound rangeland management by local people.</p> <p>Over-hunting and indiscriminate killing of wildlife species, especially ungulates and carnivores.</p> <p>Overuse and depletion of limited fresh water.</p> <p>Degradation of wetland ecosystems.</p> <p>Improper application and use of persistent pesticides and chemical fertilizers.</p> <p>Contamination of ecosystems with sewage, industrial waste and other pollutants.</p> <p>Smuggling and uncontrolled exporting of indigenous livestock and native genetic species.</p> <p>Low public awareness and appreciation for biodiversity conservation.</p> <p>Inadequate legislative tools and conservation measures for the protection of indigenous plant and animal species/varieties.</p>	<p><b>Short-Term (1-3 years)</b></p> <p>Evaluate maps and data availability, information accuracy and gaps for endangered ecosystems, habitats, vegetation and threatened or rare endemic species.</p> <p>Develop and update data-base and GIS information systems on biodiversity, including species, habitats, vegetation and other thematic information.</p> <p>Conduct surveys and research on rangeland utilization and management patterns to assess effectiveness of rangeland management and utilization.</p> <p>Halt hunting and capturing wildlife until utilization of wildlife is surveyed, assessed and regulated.</p> <p><b>Medium-term (4-8 years)</b></p> <p>Formulate rangeland policies and programs for improving rangeland management.</p> <p>Expand action program for forest restoration and desertification reduction.</p> <p><b>Long-Term (&gt;8 years)</b></p> <p>Support traditional and environmentally sound land use practices.</p> <p>Expand rangeland management program, to include more areas in the country.</p>	<p>Gaps in maps and information pertaining to endangered ecosystems, habitats, vegetation and rare species identified.</p> <p>Data-base and GIS information systems on biodiversity established and functioning.</p> <p>Assessments report on rangeland management and utilization published and accessible.</p> <p>Survey and assessment report of wildlife utilization published.</p> <p>By-laws on wildlife utilization prepared and enforced.</p> <p>A rangeland policy in place and a number of rangeland management programs completed.</p> <p>Number of forest restoration and desertification control programs implemented</p> <p>Traditional and environmentally sound land use practices in place</p>	<p>the Government has establishment Land Resource Management Center in AREA (Damar Governorate). The center since it formation in 1998 has been surveying, searching and collecting information on various aspect of biodiversity and land degradation and has succeeded in producing the following results:</p> <p>National inventory and data base development of fauna and flora.</p> <p>-Land resource utilization studies and plans for watersheds in Abyan and Shbwa.</p> <p>-Developing and guidelines and manuals for land resource utilization planning and land degradation monitoring.</p> <p>-Soil survey, classification &amp; mapping for Shabwah and Abyan Governorates.</p> <p>Several legislations were issued prohibiting hunting or attacking wild animals.</p>
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## 6. Coastal/Marine Life and Fisheries

Key Issues	Priority Objectives	Performance Indicators	Status of implementation
<p>Marine and coastal habitat degradation caused by unplanned coastal reclamation.</p> <p>Over-exploitation, pollution and mismanagement of fishing in the Red Sea, Arabian Sea, Gulf of Aden and Yemeni Islands.</p> <p>Degradation of coastal and marine habitats caused by ship dumping, industrial, agricultural and sewage waste.</p> <p>Sharp decline in important marine resources especially lobsters, cuttlefish, shrimps and sharks caused by over-fishing, poaching of foreign vessels, uncontrolled gear and fishing effort, and lack of quality controls.</p> <p>Destruction of coral reefs and underwater habitats caused by bottom trawling, ornamental fishing</p> <p>Non-functional fishing law</p>	<p><b>Short-Term (1-3 years)</b> Design and conduct inventory, surveys, habitat mapping, and sensitivity analysis of the entire coastline, including distribution of rare and endangered species.</p> <p>Assess impact and extent of mangrove cutting and grazing and find alternative sources of wood and camel fodder.</p> <p>Establish improved data base management systems of fishery resources based on stock assessment for cuttlefish, rock lobsters, shrimps, sharks, sea cucumber and other species.</p> <p>Prepare and implement pilot Integrated Coastal Zone Management Plans (ICZMP) for Balhaf-Bir Ali area, Al-Hodidah and Jethmun-Sharma and red ses ecosystem</p> <p>Declare protection areas on Sikha Island, Jethmun-Sharma, AlloHayah and Kamaran</p> <p><b>Medium-term (4-8 years)</b> Complete coastal zone mapping for the mainland and islands.</p> <p>Establish a national body, with appropriate representation of communities, local administrations and NGOs, for ICZMP.</p> <p>Enhance ICZM planning through establishing regional branches of central authorities.</p> <p>Develop fisheries management plans based on fish stock assessments.</p> <p>Continue stock assessment for other commercial pelagic and demersal fishes.</p> <p>Conduct studies on coastal and marine environment to develop and implement local communities' strategies on sustainable management and use of their fishery resources and recovery of depleted areas.</p> <p>Assist fishing communities in protecting traditionally used areas from outsiders, implementing alternative programs during fisheries recovery periods, and marketing their marine products.</p> <p><b>Long-Term (&gt;8 years)</b> Conserve key threatened coastal and marine species, habitats and ecosystems.</p> <p>Re-plant/re-forest mangroves wherever feasible.</p>	<p>By 2007, inventory reports and maps on coastline habitats and endangered species published.</p> <p>By 2007, assessments report on mangrove clearance and alternative options for camel fodder published.</p> <p>By 2007, data base management systems for fishery resources in place and Functional.</p> <p>Four pilot Integrated Coastal Zone Management Plans implemented.</p> <p>By 2009, two marine areas legally declared as protected areas.</p> <p>By 2009, a national agency for costal zone management legally declared and functioning.</p> <p>Fish stock assessment report prepared.</p> <p>Adequate fishery management plans officially approved.</p> <p>By 2008, local communities' strategies on sustainable management of fishery developed.</p> <p>Pilot area of forest mangroves re-planted.</p>	<p>Identification and classification of fish and other marine species in the coastal water of Yemen using international guides for classification.</p> <p>Management plans including zonation were formulated as results of intensive surveys in Balhaf-Broum &amp; Sharma-Jathmoun, 2007.</p> <p>ICZM plans were declared for the coastal governorates in Yemen, 2008.</p> <p>Zoning plan were formulated for Socotra Archipelago in 2000, and declared as world heritage site 2008</p> <p>Surveys and inventories were undertaken for Shark, Sea cucumber and shrimps. Study for lobsters in Yemeni water was also carried out, 2002 and 2003, 2004.</p> <p>Stock assessment were undertaken for the marine resources such cuttlefish, lobsters, shrimps and the main (commercial species) of fish.</p> <p>Fishery management plan for Socotra were prepared and approved, 2003.</p> <p>Fishing regulating laws and bylaws were issued and enacted 2006.</p> <p>Collection reference for marine fauna established with support of PERSGA in 2004.</p> <p>Detail vegetation maps of different ecological zones were implemented</p>

## 7- Agro-biodiversity

	Priority Objectives	Performance Indicators	Status of implementation

<p>Deterioration of native genetic resources as a result of introduction of alien species.</p> <p>Improper application and use of pesticides.</p> <p>Insufficient and unreliable information and networking on agricultural biodiversity.</p> <p>Desertification, terraces and rangeland degradation associated with rapid urbanization.</p> <p>Increased water depletion for qat production and agriculture irrigation associated with lack of water conservation systems.</p> <p>Declining agricultural production caused by drought and degradation of agro-systems.</p> <p>Abandonment of productive traditional agricultural practices.</p> <p>Improper use of agro-chemicals (pesticides, fertilizers, fruit ripening agents, etc.).</p> <p>Over-grazing and over-cutting of trees and shrubs for fuel consumption.</p> <p>Limited capacity and funding for biodiversity and agricultural research.</p>	<p><b>Short-Term (1-3 years)</b></p> <p>Conduct research on improvement of drought resistant varieties, terrace management, traditional land use and water management systems, and introduction of efficient irrigation systems.</p> <p>Encourage research on the use of alternative feed resources and agro-processing by-products as a ruminant feed to reduce pressure on rangelands.</p> <p><b>Medium-term (4-8 years)</b></p> <p>Promote in situ conservation of indigenous crops by farmers.</p> <p>Promote integrated pest management techniques.</p> <p>Develop incentives for natural fertilizer use in replacement of imported agrochemicals.</p> <p>Provide incentives and implement pilot projects in propagation of local and crop varieties and replacing qat plantations with cash crops, coffee and grapes.</p> <p><b>Long-Term (&gt;8 years)</b></p> <p>Implement pilot projects on land use management, terrace management, desertification, and in situ conservation of rangeland.</p> <p>Adopt programs to reduce ground water consumption through wastewater recycling, efficient irrigation, etc.</p> <p>Enhance seed banks.</p>	<p>By 2007, results of research in five agro-biodiversity areas published.</p> <p>Number of farms applying integrated pest management techniques.</p> <p>Quantity of natural fertilizer use increased and level of agrochemical fertilizer import reduced.</p> <p>Areas of cash crops, coffee and grapes increased and qat plantation reduced.</p> <p>Number of pilot projects on terrace rehabilitations, desertification, and in-situ conservation of rangeland implemented.</p> <p>Number of wastewater recycling and efficient irrigation programs completed.</p>	<p>The sustainable agricultural systems are expanding in the country. This is evident in the tree planting campaigns,</p> <p>Research efforts during the sixties and the seventies before the unification of Yemen led to identification of significant information in the plant kingdom. These studies were carried out in joint collaboration with the UN and the International Centers such as ICARDA and others.</p> <p>These Efforts were geared at collection and preservation of local genetic resources and preserving them in the Gene Banks of the International Centers for future use. Equal amounts of these resources were retained locally for renewal and conducting local research in plant breeding and evaluation of varieties and local land races. The efforts were expanded to cover fruit tree species, cash crops such as coffee</p> <p>- By 2007 results of research on main Agro-forestry of Yemen published</p>
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### Goal 3. Integration of Biodiversity in Sectoral Development Plans

#### 8. Infrastructures and Industry

Key Issues	Priority Objectives	Performance Indicators	Status of implementation
<p>-Weak implementation of EIA procedures for development projects.</p> <p>-Poor investment from the private sector in community-based biodiversity projects.</p> <p>-Lack of policy addressing air pollution, wastewater, and solid waste production from industrial sources.</p> <p>-Weak enforcement of standards regulating industrial activities.</p> <p>-Use of</p>	<p><b>Short-Term (1-3 years)</b></p> <p>Enforce EIA procedures implementation for infrastructure and industrial projects.</p> <p>Regulate the use of dangerous chemicals.</p> <p>Develop policies and regulations concerning use of appropriate and safe technologies.</p> <p><b>Medium-term (4-8 years)</b></p> <p>Promote certification processes leading to the adoption by industry of more responsible and efficient production.</p> <p>Review, amend and adjust laws, by-laws, and regulations to prevent industrial pollution.</p>	<p>EIA procedures in place.</p> <p>Laws, by-laws, and regulations on preventing industrial pollution reviewed, updated and enforced.</p> <p>Laws on dangerous chemicals prepared and enacted.</p> <p>Industrial certification for eco-industry and eco-production in place.</p> <p>Policies and regulations on safe technologies prepared and enforced.</p>	<p>Updating the Environmental Law.</p> <p>Issuing of Environment Protection Law No. (26) for the year 1995, which imply the environmental impacts assessment, and the mechanism of conducting EIA.</p> <p>The establishment of Disasters control unit is considered one of the major achievements in the coordination of efforts to confront disaster such as "Tsunami Disaster". During the period 17-18 April 2006. There are plans to prepare a national plan and the adoption of policies and measures among which, the approval and ratification of "Cairo Declaration".</p> <p>Support coordinating efforts with regional</p>

environmentally unfriendly technologies.	<p><b>Long-Term (&gt;8 years)</b></p> <p>Promote eco-tech in replacement of unfriendly industrial technologies polluting coastal and marine habitats and ecosystems.</p>		<p>organizations such as the Regional Organization for Protection the Environment of Red Sea and Gulf of Aden (PERSGA). This regional organization supports several initiatives and adopts a participatory approach in conservation and sustainable of biodiversity.</p> <p>Some actions were taken to implement EIA measures in the context of development projects.</p>
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## 9. Biotechnology and Biosafety

Key Issues	Priority Objectives	Performance Indicators	Status of implementation
<p>Poor knowledge and understating of the nature and potential impacts of living modified organisms (LMO) on biodiversity.</p> <p>Lack of protection measures and legislations to regulate the use and release of living modified organisms.</p> <p>Lack of institutional framework for the management and monitoring of biotechnology and biosafety issues.</p> <p>Weak of national capacity in the field of modern biotechnology.</p> <p>Absence of policy addressing biotechnology and biosafety issues.</p>	<p><b>Short-Term (1-3 years)</b></p> <p>Carry out stock-taking and assessment of existing biotechnologies and their safe application and use.</p> <p>Identify and analyze options for biotechnology applications and implementation of biosafety frameworks.</p> <p>Prepare and enact national biotechnology policy and biosafety frameworks.</p> <p><b>Medium-term (4-8 years)</b></p> <p>Create an entity responsible for the management and control of biotechnology and biosafety issues.</p> <p>Implement priority activities and information exchange requirements.</p> <p>Develop National Biosafety Database.</p> <p>Assess feasibility and impacts of applying genetically engineered seeds to introduce drought-resistant, herbicide-tolerant, insect-resistant and saline-resistant species of crops, fruits and vegetables.</p> <p>Regulate, manage or control the risks associated with the use and release of living modified organisms (LMOs) resulting from biotechnology which are likely to have adverse environmental impacts affecting the conservation and sustainable use of biological diversity.</p> <p><b>Long-Term (&gt;8 years)</b></p> <p>Strengthen institutional capabilities in the field of Biosafety.</p>	<p>Stock-taking of safe use of biotechnologies published.</p> <p>A national biotechnology policy and biosafety frameworks prepared and enforced.</p> <p>Laws on LMOs and Biotechnology prepared and enacted.</p> <p>An entity for the management of biotechnology and biosafety created and functional.</p> <p>A National Biosafety Database established and made publicly accessible.</p> <p>Assess report on applying genetically engineered seeds published.</p> <p>Number of genetically engineered species safely introduced and controlled.</p> <p>Number of staff trained in Biosafety.</p>	<p>National Biosafety Framework (NBF) was approved.</p> <p>The legal basis of the NBF is the current policies, laws and the administrative regulations and decisions. These documents were put together in an integrated manner to ensure transparency in order to take decisions in the field of Biosafety in the Republic of Yemen.</p> <p>The formulation of NBF was organized in such a way to be in harmony with prevailing laws, regulations and practices within the neighboring regional countries. This was vital for NBF to serve as an effective tool for the implementation of Cartagena Protocol on Biosafety. Moreover, the NBF was tailored locally to accommodate local laws and regulations.</p> <p>To cope with Global efforts, and in accordance with Cartagena Protocol, the Government of Yemen prepared a by law for the NBF. This by law aims to contribute to the provision of certain level of protection in transport, handling and utilization of GMOs as an output from the modern biotechnologies. These technologies might have negative impacts on the sustainable use of biodiversity and human health.</p> <p>The NBF implies the formulation of National Committee on Biosafety. Members and mandates of this</p>

	<p>Enhance management skills in biosafety issues through training.</p>		<p>committee were identified in the NBF document.</p> <p>The NBF also implies the formulation of a technical committee under the National Biosafety Committee. The membership and tasks of this technical committee were highlighted in the NB document. Moreover, as secretariat of the NB Committee was also highlighted. The membership of the secretariat was illustrated in the same document.</p> <p>The NBF stressed the importance of formation of sector committees in sectors that are engaged or likely to be engaged in dealing with GMOs in research, transport, handling or marketing across borders. A mechanism for submission of requests was dealt with in details in the NBF document. The deadlines for finalizing procedures at each level were also highlighted.</p> <p>The NBF gave the assessment of risks and risk management in handling GMOs due attention to be in harmony with the importance of this issue in the Cartagena Protocol.</p> <p>The NBF stressed the importance of participation and increasing public awareness on Biosafety issues. The role of local communities in monitoring and follow up of activities related to GMOs was highly stressed. The capacity building and the role of communication channels were given priority in their impacts on the public to increase their awareness on the dangers of mishandling of GMOs and the likely negative impacts on the environment and human health in this respect.</p> <p>A web site was created for Biosafety by EPA.</p> <p>Several newsletters on Biosafety issues were prepared and disseminated.</p> <p>Biosafety Clearing House was completed and start working providing information.</p> <p>A roster of national experts was</p>
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## 10. Tourism and Eco-tourism

Key Issues	Priority Objectives	Performance Indicators	Status of implementation
<p>Lack of knowledge on eco-tourism attractions.</p> <p>Insufficient level of professionalism and training in the tourism sector, including eco-tourism.</p> <p>Poor environmental awareness and ecological education amongst populations.</p> <p>A generalized deficiency in eco-tourism facilities.</p> <p>Inadequate legislative framework and weak enforcement of eco-tourism legislation.</p> <p>Weak local communities and private sector participation in tourism management and investment in this sector.</p>	<p><b>Short-Term (1-3 years)</b></p> <p>Conduct surveys of areas suitable for eco-tourism, taking into account habitat vulnerability.</p> <p>Consider criteria for eco-tourism development in protected areas and buffer zones.</p> <p>Minimize the impact of tourism activities on biodiversity and natural habitats.</p> <p>Assess impacts of recreational activities in coastal areas.</p> <p>Prepare proposals of pilot tourism projects based on significant natural and/or cultural attractions.</p> <p>Develop manpower development plan for the sector.</p> <p><b>Medium-term (4-8 years)</b></p> <p>Promote cooperation and participation of the private sector, NGOs and local communities in tourism investment and management.</p> <p>Review, update and publish a directory for eco-tourism sites.</p> <p><b>Long-Term (&gt;8 years)</b></p> <p>Promote eco-tourism in established and managed national parks.</p>	<p>Survey reports on eco-tourism published.</p> <p>Criteria for eco-tourism development published and enforced.</p> <p>Four assessment reports on eco-tourism impacts on coastal sites published.</p> <p>Number of pilot tourism projects in areas of significant natural and/or cultural attractions implemented.</p> <p>Human resource development plan for tourism sector implemented.</p> <p>Number of investment project in tourism completed by private sector, NGOs and local communities.</p> <p>A directory for eco-tourism sites published.</p>	<p>- established an eco-tourism department in the General Tourism Authority (GTA) as an entity responsible for managing and monitoring eco-tourism impact on environmentally valuable sites, landscapes, monuments, ecosystems and species across the country.</p> <p>- In order to handle monitoring responsibility, the GTA collected, analyzed and disseminated information on potential of ecotourism in Yemen to relevant national and international organizations.</p> <p>- In support to ecotourism management, local authority has developed a Coastal Zone management plan for Aden and the coastal areas .</p> <p>- prepared the tourism strategy</p>

## 11. Climate Change and Energy

Key Issues	Priority Objectives	Performance Indicators	Status of implementation
Intensive use of fuelwood	<b>Short-Term (1-3 years)</b>	A report on options to	

<p>leading to rangeland degradation. Weak enforcement of existing standards for air-pollution control. Development and access to alternative energy sources. Lack of national mitigation and adaptation plans for climate change.</p> <p>Limited public awareness on climate change and biodiversity issues. Lack of human resources to address the issues. Weak recognition of the climate change issue relative to other development priorities. Poor understanding of the science of climate change domestically. Absence of an institutional structure aimed at integrating climate change issues into national plans.</p>	<p>Assess current energy use to identify key areas for mitigating GHG emission and potential use of renewable and alternative energy. Reduce the use and GHG emissions from fuelwood through switching to cleaner energy sources and technologies (e.g. LPG lamps, solar water heating and LPG stoves in replacement of fuel-wood stoves). Establish energy balance and scenario. Implement “no regrets” mitigation policy and technologies in energy sector. Identify causes of desertification associated with climate change and revive indigenous knowledge of land use management systems to help combat desertification. Integrate biodiversity principles into climate change through developing and implementing a National Adaptation Program of Action (NAPA). Conduct feasibility studies on alternative sources of energy (solar, biotechnology, wind) while taking into account their potential impacts on biodiversity.</p> <p><b>Medium-term (4-8 years)</b></p> <p>Develop and implement a National Mitigation Plan (NMP) for reducing greenhouse gases emissions from energy sector. Develop an investment strategy for Clean Development Mechanism (CDM) and implement pilot projects of best practice. Promote agriculture drought management. Improve irrigation efficiency.</p> <p><b>Long-Term (&gt;8 years)</b></p> <p>Develop energy use and air-quality strategy. Develop and enact air quality control measures. Establish national coordination body for emergency and disaster management. Prepare emergency and disaster management plan.</p>	<p>mitigate GHG emissions from energy sector published. Reduction rate of fuelwood consumption. Utilization rate of cleaner energy sources/technologies. Energy balance scenario prepared. “No regrets” mitigation policy and technologies implemented in energy sector. Number of indigenous land use management systems to combat desertification applied. A National Adaptation Program of Action (NAPA) approved. A National Mitigation Plan (NMP) for reducing greenhouse gases emissions from energy sector developed and implemented. Feasibility studies on promising alternative sources of energy (hydro-power, biotechnology, wind) published. Agriculture drought management adopted. Irrigation efficiency increased. Energy use and air-quality strategy developed. Air quality control measures developed and enacted. A national coordination body for emergency and disaster management in place. An emergency and disaster management plan developed.</p>	<p>- published the first National communication . -published report on options to mitigate GHG emissions .</p> <p>-approved National Adaptation Program of Action (NAPA) - preparing the Second National Communication.</p>
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#### Goal 4. Implementation of Enabling Mechanisms

##### 12. Public Awareness and Participation

Key Issues	Priority Objectives	Performance Indicators	Status of implementation
<p>Weak public awareness on biodiversity issues</p> <p>Limited participation of local communities and NGOs in biodiversity related initiatives.</p> <p>Lack of national policy on Environmental</p>	<p><b>Short-Term (1-3 years)</b></p> <p>Assess capacity needs for incorporating environmental themes into schools and universities.</p> <p>Promote public awareness of various aspects biodiversity issues</p>	<p>By 2005, needs for incorporating environmental themes identified</p> <p>A nation-wide environmental awareness campaign minimally addressing 18 environmental themes</p>	<p>EPA organizes meetings to celebrate international day of biological diversity. This event publicizes the knowledge and information on biodiversity through the dissemination of</p>

<p>education (EE) Biodiversity conservation and environmental protection themes are not integrated into school and university curricula. Notable shortage of trained manpower, specially of environmental educator and facilitators Notable absence of youth green clubs, green press, and eco-industry.</p>	<p>through TV and radio mass campaigns, press campaigns, community workshops, fact sheets and brochures production, electronic information and other communication materials. Promote the development and expansion of youth organizations, green clubs, green media and NGOs to act as advocacy groups for the protection of nature and the environment Develop a nation-wide environmental awareness campaign, addressing priorities of biodiversity and environmental issues</p> <p><b>Medium-term (4-8 years)</b></p> <p>Integrate green themes into the education curricula of schools and universities. Expand public education and awareness program to cover various aspects of biodiversity issues such as protected areas, habitats and wildlife conservation, biosafety, alien invasive, energy saving, etc. Improve professional skills of teachers and university lecturers in producing and teaching environmental topics. Encourage community-based participatory research and management at local levels to revive traditional indigenous knowledge and practices for biodiversity conservation and sustainable use of natural resources. Strengthen the capacity of non-governmental conservation and development organizations as advocacy groups to promote biodiversity conservation.</p> <p><b>Long-Term (&gt;8 years)</b></p> <p>Promote and facilitate community awareness and involvement in biodiversity conservation programs, particularly women and the underprivileged. Expand public awareness and education programs to target government officials and promote the conservation and sustainable use of biodiversity. Integrate more biodiversity environmental themes into university and school curriculum.</p>	<p>implemented. Adequate TV and radio mass campaigns, press campaigns, community workshops completed. Adequate awareness materials publicly distributed. Number of youth organizations, green clubs, green media and NGOs agencies in place. By 2007, at least six themes introduced into formal curricula of schools and universities. Number of teachers and university lectures trained. Number of women participating in biodiversity conservation programs Percentage of population aware of the importance of conservation and sustainable use of biodiversity. By 2012, all environmental themes incorporated into curriculum of universities and schools.</p>	<p>biodiversity's books and brochures to organizations and interested persons.</p> <p>Awareness raising among relevant authorities and individual on the environmental issues and the importance of biodiversity and the role of local behaviors in the conservation of the environmental eco-systems.</p> <ul style="list-style-type: none"> <li>➤ Preparation of various materials on conservation of biodiversity and natural habitats.</li> <li>➤ Preparation of systematic programs through communication channels (Radio and Television).</li> <li>➤ Issuing of a periodical journal and some newsletters and pamphlets by the EPA.</li> <li>➤ Promotion of activities in schools among environment friends and clubs as well environmental NGOs.</li> <li>➤ The integration of environmental into school curricula, and organizing fixed columns in local newspapers as a first step in raising awareness among communities on the importance of local environment and the dangers facing its conservation.</li> </ul>
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### 13. Indigenous Knowledge and Traditions

Key Issues	Priority Objectives	Performance Indicators	Status of implementation
<p>Retardation of environmentally friendly traditional and indigenous techniques, practices and management systems.</p> <p>Low level of public awareness in traditional and indigenous natural resource management systems, biodiversity conservation and sustainable development.</p> <p>Inadequate records on the state and extent of abandonment of traditional environmental norms and practices.</p> <p>Lack of participation of local communities</p>	<p><b>Short-Term (1-3 years)</b></p> <p>Compile and verify information on traditional knowledge and skills pertaining to biodiversity.</p> <p>Document and disseminate traditional knowledges addressing sustainable use of natural resources.</p> <p>Identify sites where traditional systems are successfully functioning to be studied for potential replication.</p> <p>Prepare case studies in consultation with knowledgeable rural people at selected sites to revive and improve abandoned systems, techniques, practices, skills and methods.</p> <p>Promote replication of environmentally friendly systems, practices, skills and methods to other areas through appropriate awareness campaigns and by facilitating cross visits to demonstration sites.</p> <p>Based on research results, revive indigenous practices, including terraces management, water harvesting, etc.</p> <p><b>Medium-Term (4-8 years)</b></p> <p>Provide incentives for integrating traditional resource management systems into modern management practices, and their adaptation among agricultural, pastoral and fishing communities country-wide.</p> <p>Expand extension services to assist rural and coastal communities in adapting eco-technologies, both new innovations and traditional systems, in resource management.</p> <p><b>Long-Term (&gt;8 years)</b></p> <p>Expand integration of appropriate traditional and indigenous management systems in rural and coastal areas of Yemen.</p> <p>Provide incentive, materials, guidance and monitoring to farmers to enable them to repair terraces.</p> <p>Develop a funding program to stimulate traditional experience and sustainable use of biodiversity at a local level.</p>	<p>Information on traditional knowledge and skills pertaining to biodiversity gathered and published.</p> <p>By 2006, number of thematic reports on traditional biodiversity practices, skills, techniques and management are published.</p> <p>Number of models on traditional biodiversity management developed and replicated.</p> <p>Traditional systems of biodiversity conservation are parts of provided extension services.</p> <p>Funding program to stimulate traditional experience in place.</p>	<p>There is a lack in reporting the traditional knowledge and skills related to biodiversity conservation, there are however, site specific collection and adaptation of indigenous knowledge during surveys prior the establishment of the terrestrial and marine PAs and ICZM. These practices were accommodated in the legal frame work of the protected areas. Moreover, it appears through involving the local communities in practicing their knowledge in the management of the protected areas which the work in their management were launched these as:</p> <p>Involving local communities in the management of protected areas to ensure sustainability in the utilization of natural resources in Socotra protected areas, and wet lands protected areas in Aden Governorate as well as in Hawf protected area.</p>

#### 14. Capacity Building

Key Issues	Priority Objectives	Performance Indicators	Status of implementation
<p>Lack of professional and systematic training in the field of biodiversity</p>	<p><b>Short-Term (1-3 years)</b></p> <p>Conduct training needs assessment for environmental agencies and NGOs regarding their capacity in effective biodiversity management.</p> <p>Based on the assessment findings, develop and implement national, regional and local training</p>	<p>Biodiversity training needs for environmental agencies and NGOs identified.</p> <p>National, regional and</p>	<ul style="list-style-type: none"> <li>On job training for the local communities, NGOs and EPA staff on</li> </ul>

<p>conservation. Shortage of biodiversity specialists and general lack of adequately trained human resources in research, planning, policy development, monitoring and documentation. Poor training opportunities for local communities. Lack of training and financial support for electronic networking and access and use of the Internet.</p>	<p>plans addressing relevant biodiversity issues. Develop specialized training programs in desertification control planning, sand dune management, monitoring and impact assessments, Geographic Information Systems (GIS) and remote sensing techniques. Strengthen the capacities of relevant institutions, including NGOs and local communities in the implementation and management of biodiversity and protected areas projects. Provide training for various stakeholders on coordinated policy planning, project development, implementation, and monitoring of environmental resources.</p> <p><b>Medium-term (4-8 years)</b></p> <p>Review and assess training plans and amend appropriately.</p> <p>Establish regularly information system on biodiversity.</p> <p>Build national staff capacity in preparing and enforcing EIA regulations for development projects.</p> <p>Develop and strengthen national capacity in monitoring biological resources utilization. Develop the capacity in combating oil pollution. Continue capacity building of various stakeholders, including local communities, fishery management, coastal and marine protection. Develop staff capacities in preparing, reviewing and updating action plans.</p> <p><b>Long-Term (&gt;8 years)</b></p> <p>Strengthen biodiversity management capabilities line environmental agencies.</p>	<p>local training plans developed and implemented. Number of national staff trained in desertification control planning, sand dune management, monitoring and impact assessments, GIS and remote sensing. Number of staff trained in EIA, policy planning, project development, implementation and monitoring. Information system on biodiversity functional. Number of staff trained in management plan development, combating oil pollution, and monitoring of biological resources utilization. Number of stakeholders, including local communities, trained in fishery management, coastal and marine protection. Number of stakeholders trained in solid waste management.</p>	<p>biodiversity conservation and protected areas management in two pilot areas mountains forest and wetlands.</p> <ul style="list-style-type: none"> <li>Local experience exchange on protected areas management and monitoring.</li> <li>Overseas study tours for the local communities and makers on protected areas management.</li> <li>Handicrafts training for the women communities.</li> </ul>
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## 15. Equitable Sharing of Biodiversity Benefits

Key Issues	Priority Objectives	Performance Indicators	Status of implementation
<p>Lack of land property registration. Outdated land survey and registry records. Lack of allocation system to share, access and use rangelands and hunting grounds equitably. Inadequate delegation of responsibilities from the center to the governorate district level. Uncontrolled hunting of wildlife along with unregulated utilization of fuelwood, rangelands and agricultural lands. Reduced economic values of marine and coastal biodiversity as a result of</p>	<p>Short-Term (1-3 years)</p> <p>Strengthen local capacity to access and benefit from crop and genetic diversity through provisions of seeds, seedlings, fingerlings, etc., and through extension services, participatory dialogues, and promoting the establishment of cooperatives within communities. Promote and facilitate the development of community forests integrating useful trees (nuts, fruits, animal fodder, etc.) into existing habitat, and tree plantations for construction, fuel and domestic use. Encourage marketing of cash crops products in protected areas to create job opportunities for peoples living there. Provide incentives and support for fishing cooperatives and communities in adopting equitable quotas of fishery resources.</p>	<p>Number of rural peoples accessing/benefiting extension services. Marketing schemes for protected area products functioning and percentage of local people benefiting from the scheme. Equitable quotas of fishery harvest adopted by number of fishing cooperatives. Rehabilitation cost of damaged resources born by polluting industries. Number of studies on indigenous medicinal plant published and disseminated.</p>	<p>Efforts to improve access to Genetic Resources are still in the initial stages of implementation. This is mainly because concepts of property rights are still not understood properly. There is no clear direction in this regard. The absence of scientific and academic institutions did not allow for exchange and</p>

<p>increasing pollution and habitat destruction. Lack of allocation system for equitable sharing of fishery resources. Conflicts among fishery users over the control and use of marine resources.</p>	<p>Medium-Term (4-8 years) Establish “polluter pays“ legislation to recover rehabilitation costs of damaged resources by polluting industries. Conduct studies on indigenous medicinal plant and assess the feasibility of replicating traditional methods nationally and globally. Integrate in resource-based development policies and programs the notion of equitable participation of local communities to resource management and benefits from the use of these resources. Long-Term (&gt;8 years) Establish guidelines for trading Yemen’s native genetic resources and for pharmaceutical and biotechnological uses.</p>	<p>The principle of Equitable Sharing of Biodiversity Benefits incorporated in national development policies. Guidelines on trade of pharmaceutical genetic resources published</p>	<p>mutual use of these genetic resources in scientific, commercial or industrial fields.</p>
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## 16. Policy, Legislation and Institutional Structure

Key Issues	Priority Objectives	Performance Indicators	Status of implementation
<p>Absence or inadequacy of existing legislation and standards regulating biodiversity use and management, including agricultural practices. Inadequate law enforcement. Overlapping and unclear mandates of environmental agencies. Inexistence of establishment decrees for a number of agencies. Insufficient financial auditing system. Inexistence of a staff evaluation system within the public administration. Unregulated inter-agencies coordination for biodiversity and protected areas. Incomplete hierarchical structure of environmental agencies. Inadequate policies to comply with Yemen’s obligations committed under international conventions. Insufficient manpower of regional and local environmental bodies in planning and monitoring managing natural resources. Insufficient community role in planning, monitoring and managing natural resources Antiquated environmental plans</p>	<p>Short-Term (1-3 years) Review the adequacy of government agencies’ mandates and management responsibilities for biodiversity and harmonize them according to EPL and other relevant regulations. Develop biodiversity management and co-ordination mechanisms recognizing the legitimacy of NGO, private sector and local community involvement in the planning and management of natural resources. Develop strategies for sustainability, and implement them directly and through regional and local planning. Adopt an integrated approach to environmental policy for the conservation and sustainable use of natural resources. Prepare waste reduction, reuse and recycling strategies, policies, and legislation. Strengthen and enforce legislations, regulations and guidelines on agro-chemicals import, plant quarantine, water use and harvesting, and protected areas. Promote approval of by-laws for relevant agencies: EPA and NWRA. Review, amend where necessary and enforce existing laws and by-laws for tourism sector.</p> <p>Medium-Term (4-8 years) Enforce laws, by-laws, and regulations prohibiting sea pollution from passing ships and land-based sources. Enforce laws, by-laws, and regulations national marine resources. Enforce fishery legislation to halt catching sharks and cuttlefish by nets, destruction of coral reefs by any method, turtle slaughtering or egg collecting, and prohibit collection of aquarium and reef fishes. Develop a renewable energy policy. Prepare and enforce by-laws on Protected Area and Forest Create a partnership mechanism with community groups and the private sector to enhance law enforcement. Promote biodiversity research and funding.</p> <p>Long-Term (&gt;8 years) Review, update and enforce regulations for land use. Develop and implement hazardous waste policy, including incentives and law enforcement. Review national policy, legal and institutional framework and amend where necessary to support decentralization. Strengthen decentralizing through devolution of sufficient power to regional, local governments and local communities in monitoring the effectiveness of modified</p>	<p>By 2006, overlap and duplication in regulation and mandates of environmental agencies identified By 2006, co-ordination mechanisms for Biodiversity management created and functional. Strategies and policies for renewable energy, hazardous waste and waste reduction officially endorsed. Enforce Legislations on agro-chemicals import, plant quarantine, water use and harvesting approved. EPA and NWRA laws and by-laws enacted. Laws and by-laws for tourism sector reviewed and amended. Laws for Protected Area, Forest and Land use enforced.</p>	<p>See attachment</p>

	systems of natural resource management.		
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### 17. Regional and International Cooperation

Key Issues	Priority Objectives	Performance Indicators	Status of implementation
Continued commitment in global and regional efforts for environmental protection and biodiversity conservation. Continued implementation of national obligations under international environmental agreements.	<p>Short-Term (1-3 years)</p> <p>Enable national expertise, through the provision of adequate training, to actively participate in the development of a regional biodiversity strategy and studies related to the Red Sea.</p> <p>Promote exchange of information on mutual biodiversity issues at both regional and international levels.</p> <p>Medium-term (4-8 years)</p> <p>Develop regional co-ordinating mechanism for biodiversity issues of common interest.</p> <p>Continue regional projects in the Red Sea.</p> <p>Long-Term (&gt;8 years)</p> <p>Develop international partnerships and cooperation in biodiversity.</p> <p>Enhance country capacity in negotiating and follow up biodiversity issues at the regional and international levels.</p>	<p>Number of national experts, involved in the development of a regional biodiversity strategy and studies related to the Red Sea.</p> <p>A regional co-ordinating mechanism for biodiversity issues in place.</p> <p>Number of new regional projects in the Red Sea approved and implemented.</p> <p>Number of international and regional agreements approved.</p> <p>Up-to-date information on international and regional biodiversity issues accessible.</p>	<p>-Scientific and technical cooperation and coordination with international and regional organizations and donor agencies has been launched in the field of the conservation and the sustainable use of biodiversity.</p> <p>Examples are: UNDP, UNEP, GEF, PERSGA ,Italian ,France and others.</p> <p>- The neighboring countries.</p> <p>- Efforts to develop and increase capacities of individuals and institutions of agencies working in the environmental sector are progressing.</p> <p>- Research activities and cooperation with neighboring countries are gaining momentum.</p>

### 18. Monitoring and Reporting

Key Issues	Priority Objectives	Performance Indicators	Status of implementation

<p>Outdated data on species and their habitat as a result of research and monitoring inadequacy. Absence of national indicators related to biodiversity. Lack of coordinated mechanism for monitoring biodiversity deterioration. Lack of monitoring tools</p>	<p>Short-Term (1-3 years)</p> <p>Prepare annual reports and submit to government coordination committee.</p> <p>Review and adapt plan of activities and relative priorities in response to changing situations.</p> <p>Review the adequacy of administrative controls, and of implementation and monitoring mechanisms, recognizing the legitimacy of local approaches.</p> <p>Develop environmental indicators for monitoring resources deterioration.</p> <p>Develop a nationwide coordination committee for implementing the NBSAP and for monitoring natural resources depletion.</p> <p>Subject development projects to environmental impact assessment.</p> <p>Prepare and submit national reports on the convention implementation to the conference of the parties (COP) of the convention as per agreed upon reporting requirements</p> <p>Conduct annual review of implementation, and revise NBSAP document regularly.</p> <p>Medium-term (4-8 years)</p> <p>Conduct feasibility studies for initiating a national biodiversity monitoring program.</p> <p>Develop regional and local plans for the conservation and sustainable use of biological resources.</p> <p>Long-Term (&gt;8 years)</p> <p>Assess the various sectors' (protected areas, rangeland management, fisheries, agriculture, and tourism) achievements with a view towards generating improvements.</p>	<p>Annual reports on NBSAP submitted to government coordination committee.</p> <p>Environmental indicators for monitoring resources deterioration published.</p> <p>A national coordination committee for NBSAP implementation in place.</p> <p>EIA applied to all development projects.</p> <p>Regular national reports submitted to the COP of the biodiversity convention.</p> <p>Implementation of NBSAP regularly reviewed and amended.</p> <p>Number of regional and local plans on biodiversity developed.</p>	<p>-The government of Yemen has approved environmental Impact Assessment Policy and regulation in 1998</p> <p>- Efforts made to amend EIA law to integrate wider aspects of biological diversity. This would allow the impact on biodiversity to be estimated at an early stage and permit appropriate precautionary measures to be addressed and planned. An effort must be made to better incorporate issues raised in the convention on biological diversity.</p> <p><i>Yemen submitted the first national report in October 2004. Moreover, a report on sustainable development was also submitted. Currently the second and third national reports are being prepared.</i></p> <p><i>The periodical report on the status of the environment in the Republic of Yemen was prepared.</i></p> <p>Reports prepared and submitted to the World Summit.</p> <p>Issued the fishery law no.2 for the year 2006.</p>
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### Part III. Progress towards the 2020 Aichi Biodiversity Targets and contributions to the relevant 2015 targets of the Millennium Development Goals

*Q10. What progress has been made by the country towards the implementation of the Strategic Plan for Biodiversity 2011-2020 and its Aichi Biodiversity Targets?*

Aichi Targets	Yemen Baseline Status	Indicators	Targets %
<p><b>Target 1:</b> 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.</p>	<ul style="list-style-type: none"> <li>❖ Until now no efforts done , just very limit tv and radio programed on the biodiversity in general, absent of the awareness of the values of biodiversity .</li> <li>❖ Poor awareness among all stakeholders of the values and conservation of biodiversity on sustainable levels .</li> </ul>	<ul style="list-style-type: none"> <li>✓ Awareness raised on the values of biodiversity through wide national programs.</li> <li>✓ Awareness tools implemented.</li> </ul>	30
<p><b>Target 2:</b> 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.</p>	<ul style="list-style-type: none"> <li>➤ Biodiversity issues was integrated in to the national development plan and strategies were included but has not been implemented on the ground.</li> </ul> <p>PRSP aims to reinforce sustainable management of natural resources, mobilize beneficiaries, involve the poor and support the role of women and youth in environmental conservation.</p> <p>The situation are :</p> <ul style="list-style-type: none"> <li>▪ Lack of integration of biodiversity values into national and local development strategies and plans until now.</li> <li>▪ Increasing poverty among rural communities .</li> </ul>	<ul style="list-style-type: none"> <li>- Values of biodiversity have been integrated in to national and local development and the others strategies.</li> <li>- Prioritized the ecosystem services .</li> <li>-Integrated the biodiversity issues within Five-Year Developmental Plan based on preserving sustainability of the nation’s natural resources.</li> <li>-Integrated the biodiversity into sectoral, regional and local plans and respective budgetary allocations.</li> </ul>	10
<p><b>Target 3:</b> By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or</p>	<p>Until now, no action take to eliminated or reduce the incentives including ,harmful to biodiversity conservation and sustainable</p>	<ul style="list-style-type: none"> <li>➤ Listed and identified the incentives and subsidies of magnitude of negative impact on biodiversity .</li> </ul>	20

<p>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.</p>	<p>use .</p>		
<p><b>Target 4:</b> By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.</p>	<p>High rate of biodiversity resource consumption and absence of the legislation enforcement .</p>	<ul style="list-style-type: none"> <li>➤ National environmental legislations , laws and developments enforced .</li> <li>➤ Strict monitoring systems in place to regulate the use of natural and wildlife resources.</li> </ul>	<p>25</p>
<p><b>Target 5:</b> 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.</p>	<p>✓ The rate of degradation of forests and rangelands is quite exacerbate that makes it difficult to achieve the target , within the absence of balanced of development and the scarcity of businesses and widespread of poverty.</p>	<ul style="list-style-type: none"> <li>➤ Natural habitats conservation strategies plan implemented.</li> <li>➤ Regional and local plans .</li> <li>➤ National Forest conservation strategy in place.</li> <li>➤ Mountains biodiversity conservation prepared.</li> <li>➤ Watershed Management Plan implemented.</li> </ul>	<p>30</p>
<p><b>Target 6:</b> 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</p>	<p>❖ all fishes and invertebrate stocks and aquatic plants are threatened by severe overexploitation and overfishing .</p>	<ul style="list-style-type: none"> <li>- National regulations enforcement in place.</li> <li>- Stocks of commercial fisheries resources at sustainable levels and under control by the government .</li> <li>- spatial planning of marine ecosystem.</li> <li>- identified the ecologically and Biodiversity significant areas as well as protection measures effective monitoring, and Control system in</li> </ul>	<p>40</p>

significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.		place for inland aquatic resources. - monitoring systems for the marine resources and aquatic plants in place . . - national guidelines .	
<b>Target 7:</b> By 2020, areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	Management plans for agriculture and forestry to conserve and sustain biodiversity are poorly implemented in Yemen.	<ul style="list-style-type: none"> <li>❖ Map of land uses and natural resources done.</li> <li>❖ Principles of sound rangeland and sustainable forest management, and good environmental practices in agriculture are applied.</li> <li>❖ Agricultural strategy is implemented.</li> </ul>	30
<b>Target 8:</b> By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	The pollution and hazards wastes of the petroleum industry; and the by-products of cement and others industries are increasing.	<ul style="list-style-type: none"> <li>❖ Waste and Pollution Management &amp; Control system in place.</li> <li>❖ Oil Spill Emergency Plan and Coastal Sensitivity Mapping Implemented .</li> <li>❖ Pollution standards in place.</li> </ul>	40
<b>Target 9:</b> 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.	<p>Invasive alien species are widely spreading in the country .</p> <ul style="list-style-type: none"> <li>▪ Absent of management plans for invasive alien species.</li> <li>▪ Absent quarantine measures or systems.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Identify and listing the invasive alien species in Yemen .</li> <li>▪ control measures of the invasive alien.</li> <li>▪ quarantine measures that control their introduction.</li> </ul>	20
<b>Target 10:</b> 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.	The multiple anthropogenic pressures on coral reefs and other vulnerable ecosystems are still prevailing.	<ul style="list-style-type: none"> <li>• Identify the pressures sources.</li> <li>• Monitoring system.</li> <li>• Legal enforcement</li> </ul>	15
<b>Target 11:</b> By 2020, at least 17 per cent of	The percentage of terrestrial areas conserved	<ul style="list-style-type: none"> <li>▪ Declared and announced for more than 20 sites of sensitive</li> </ul>	30

<p>terrestrial and inland water areas, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes.</p>	<p>or protected is far less than the proposed 17 %.</p> <ul style="list-style-type: none"> <li>❖ These protected areas system have been selected to cover habitat and species of special importance to Yemen, within the principals of sustainable wise management to conserve a groups of sustainable ecosystem. The ICZMP also aims to plan and the use of the coastal areas in sustainable manner involving all the sectors to wisely manage the natural resources.</li> </ul>	<p>areas .</p> <ul style="list-style-type: none"> <li>▪ Approved management plans for more than 20 sites of sensitive areas.</li> <li>▪ Management Effectiveness of Yemen's terrestrial protected areas .</li> <li>▪ Sustainable Financing Plans for Protected Area System .</li> </ul>	
<p><b>Target 12:</b> 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.</p>	<ul style="list-style-type: none"> <li>➤ Increase in the number of threatened species of forests, rangelands, agricultural crops varieties, wildlife, marine and other water species .</li> <li>➤ absent monitoring and assessment .</li> </ul>	<ul style="list-style-type: none"> <li>✓ Threatened and vulnerable species lists are updated and improve their conservation status.</li> <li>✓ Management Plans under Implementation.</li> </ul>	15
<p><b>Target 13:</b> 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.</p>	<ul style="list-style-type: none"> <li>❖ No strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.</li> <li>❖ Weak of capacity building.</li> <li>❖ Weakness of the gens banks.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Strategic Action Plan for the conservation of plant genetic resources for food and agriculture developed and implemented .</li> <li>✓ Gens Banks built and strengthen in the mean regions.</li> </ul>	20
<p><b>Target 14:</b> By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored</p>	<ul style="list-style-type: none"> <li>✓ The necessary services provided by the ecosystems related to water and contribute to health, livelihood and well- being are reduced in quantity and /or quality affected</li> </ul>	<ul style="list-style-type: none"> <li>❖ Implementation of Integrated Water Resources Management Plan in place.</li> <li>❖ Identified priority areas and degraded ecosystems for action.</li> <li>❖ Number of rehabilitation and</li> </ul>	30

and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	by degradation and over used.	restoration programmes implemented.	
<b>Target 15 :</b> 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.	The current ecosystem resilience and the contribution of biodiversity conservation and restoration efforts so far reached are far below the proposed 15 % of the area of the degraded ecosystems .	<ul style="list-style-type: none"> <li>▪ Declared and announced for more than 20 sites of sensitive areas .</li> <li>▪ Approved management plans for more than 20 sites of sensitive areas.</li> <li>▪ Management Effectiveness of Yemen's terrestrial protected areas .</li> <li>▪ Sustainable Financing Plans for Protected Area System .</li> <li>▪ NAPA Strategy implemented.</li> </ul>	30
<b>Target 16 :</b> 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.	The Nagoya protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their utilization is already approved by the Cabinet it will be enforce soon .	National by law in ABS (legislation and regulation )enforced .	25
<b>Target 17:</b> 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.	The updated of the NBSAP under preparation we expect that end of 2014 will be completed.		30
<b>Target 18:</b> By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their	The participation of the indigenous and local communities in the implementation of the convention is very poor at all relevant levels.  Absent of national strategies	Traditional knowledge and the innovations and practices of indigenous and local communities relevant to the conservation and sustainable use of biodiversity are recognized, respected ,promoted and documented.	30

<p>customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.</p>	<p>,plans , and programs of the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity.</p> <p>Limited and scattered documentation of traditional knowledge relating to natural resources.</p>		
<p><b>Target 19 :</b> 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.</p>	<ul style="list-style-type: none"> <li>▪ Poorness of the institutional capacities in the national and regional level.</li> <li>▪ Weak of financial availability .</li> </ul>	<ul style="list-style-type: none"> <li>✓ Instructional Capacities building Strengthened.</li> <li>✓ Biotechnology laboratory established.</li> </ul>	20
<p><b>Target 20:</b> By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.</p>	<ul style="list-style-type: none"> <li>✓ Insufficient and/or poor financial resources are allocated for effective implementation of biodiversity, especially at the national level.</li> <li>✓ Regarding to the country situation national financial resources allocated for effectively implementing the Strategic Plan will be scarce.</li> </ul>	<ul style="list-style-type: none"> <li>➤ Recourse mobilization strategy implemented.</li> <li>➤ National Environmental fund in placed.</li> </ul>	15

**Q11. What has been the contribution of actions to implement the Convention towards the achievement of the relevant 2015 targets of the Millennium Development Goals in the country?**

Yemen suffers from the limited stable arable lands that do not exceed 2% of the total natural area which is dominated by desert and mountainous areas. This is in addition to the continuous deterioration in the arable lands by 1.8% annually during the period 1999-2006 as a result of the water erosion, the creeping of sand dunes, desertification and salty soil, in addition to the expansion in road construction, industrial and residential construction and weak environmental awareness of the dimensions and impacts of natural resources deterioration.

Statistics point out that the percentage of lands covered by forests until 2005 remained around 1.5% of the total area of Yemen. Preserving green areas requires more attention to the Tree Day and make this day as a national day with various events.

With regard to protected land and sea areas, despite the existence of approximately 36 natural locations with high environmental characteristics and features qualifying them to be natural protected areas, yet so far only six locations were announced as protected areas, namely: Otmah, Socotra, Hawf, Buraa, Wetlands in Aden and Kamaran. The total area of these locations is 4500 km<sup>2</sup> representing 1% of the total area in 2005. The Environment Protection Authority is currently working to finalize studies to announce three natural protected areas in the near future including Balhaf as a coastal protected area, Sharma-Jathmoon as a sea protected area in Hadhramout and Erf as a land protected area in Lahj.

Renewable water sources in Yemen reach 2.5 billion m<sup>3</sup> (1.5 billion m<sup>3</sup> of groundwater and 1 billion m<sup>3</sup> of surface water), while annual consumption is 3.4 billion m<sup>3</sup>. Therefore, the current annual water deficit is app. 0.9 billion m<sup>3</sup> compared to a deficit of 0.4 billion m<sup>3</sup> in 1990. The deficit is expected to reach 1 billion m<sup>3</sup> in 2010.

With regards to urban development the fifth years plan 2006-2010 including the package of policies and actions aimed at reducing slums and random constructions. The rapid population growth in Yemen, during the past four decades and the lack of rural development, contributed to the increasing trend of domestic migration from rural to urban areas, especially the main cities. This issue resulted in more random constructions in the fringes of main cities and increased pressure on basic services and difficult access to these services, especially education and health services. Still more than 8% of the population in 2005 cannot access safe accommodation.

**Challenges:**

There are a number of challenges weakening the government ability to achieve the 7th MDG by 2015. The key of these challenges are:

**A- Main challenges:**

**Environmental sustainability challenges:**

- ✓ Weak environmental awareness of the dimensions and consequences of natural resources deterioration and the risks of climate changes.
- ✓ Weak enforcement of laws related to biodiversity protection and deficient mechanisms of environmental impact assessment.
- ✓ Deficient urban planning systems, especially the policies for urban planning and land usage.
- ✓ Low community awareness by the importance of natural protected areas resulting in adverse practices in these protected areas such as firewood collection and hunting.

- ✓ Limited financial support to the declared protected areas resulting in poor administrative and control activities. This is in addition to the lack of national staff competent to manage protected areas up to international standards.
- ✓ Lack of information on the status of species threatened by extinction.

## **B- Emerging challenges:**

### **Climate Changes:**

Global climate changes resulted in adverse impact on the achievement of MDGs, especially the goal of sustainable environmental resources. Key aspects of climate change effects may be highlighted as follows:

Global warming phenomenon and increasing earth temperature resulted in fluctuation in the quantity of rain and seasons. In this respect, the First National Notification on Climate Changes Yemen 2001, delivered to the United Nations Framework Convention on Climate Change Secretariat 2001, pointed out to the expected decline in rainfall by at least 24%. This issue exacerbates the problems of desertification and lack of food security in the coming decades.

- Risks of rising sea level with associated consequences of sea waters overflowing on to the Yemen coasts inhabited by large portion of the population in addition to economic losses in public and private properties.
- Increasing temperatures with associated health hazards and spread of diseases.

In the field of ensuring biodiversity sustainability:

- Activate the law on environment protection and develop legal, legislative and procedural frameworks to protect the biodiversity and environment, land and marine species at risk and management of natural resources.
- Raise the awareness on the sustainable use of natural biodiversity and environmental resources and building a modern system for environmental information.
- Assess environmental impact of projects, activate the system of environmental management of industrial facilities and industrial zones, power generation stations and improve these facilities to be up to international best practices and apply the procedures of best production .
- Implement regulations and laws related to natural protected areas and increase efficiency of their management in addition to implementing the plans regarding the creation of proposed natural protected areas.
- Serious thinking in alternative fuel means in rural areas and construction materials that guarantee the non-utilization of trees for these purposes.
- Declare a national day for trees where events are held to encourage plantation of trees nationwide.

**Q12. What lessons have been learned from the implementation of the Convention in the country?**

The Republic of Yemen reaffirms its acknowledgement and recognition of the importance of sound natural resources management in achievement of sustainable socio-economic development. The government is increasingly promoting greater community participation and livelihood approaches for the sound natural resources management. Valuing that, it began with a group of steps towards the conservation of biodiversity component.

#### **conservation of the biological diversity of ecosystems:**

According to the biodiversity strategy and action plan, 8 protected areas and 9 integrated coastal zone management plans for nine coastal governorates have been declared, which hardly reach the 8 % of Yemen total area. These protected areas system have been selected to cover habitat and species of special importance to Yemen, within the principals of sustainable wise management to conserve a groups of sustainable ecosystem. The ICZMP also aims to plan and the use of the coastal areas in sustainable manner involving all the sectors to wisely manage the natural resources. Furthermore, there is a list of areas of outstanding natural value in needs of protection .

In fact Yemen has been achieved more than this value so far if we consider the lately declared coastal management plans which covered mostly the whole coastal line of Yemen (the main task is the sustainable use of coastal resources).. These areas need thorough study to enable the country to declare them as protected areas in the coming future.

The declared protected areas are maintaining the diversity and viability of various components of Yemen's biodiversity, dense vegetation forest cover on mountains (in main lands and Islands endemic and medicine plants), coastal/marine areas (zoning plans, areas of special management for its habitat and species importance) and wetlands (mudflats, marshes and mangrove).

#### **conservation of species diversity**

Republic of Yemen has diverse both marine and terrestrial fauna and flora. However, more concern has been devoted in conservation the threatened and endangered species, with special attention to large mammals, birds, marine turtles and some of the plants (medicine plants) the endemic species. Preliminary list of threaten and endangered species has been prepared according to IUCN category. Sea turtles tagging programmes were carried out with local community participation, management plans also implemented in different areas under protection to conserve endemic plants and animals precisely at Gabl Bura'a and Hawf. Attempts to conserve the wildlife in its natural habitats especially to protect the Ibex in Hadramout valley are about to become true in coming future. These recognized by the desire and effort of the local communities to protect the Ibex in its natural areas. Awareness rising programme on the conservation and natural resources sustainable use widely implemented and its results been recognized by the public decision making behavior improvement to importance of biodiversity component and its sustainable use in socio-economic development. Efforts also continue in ex-situ conservation of the endangered species such as the Arabian Leopard. Many of crop plants were conserved in the gene banks and gardens established for these propose. The country also encourages the marine resources aquaculture especially for shrimps and different species of fish to reduce the fishing pressures on the marine resources in the Red Sea.

It is important to mention that the Ex Situ conservation of plant genetic resources in Yemen increased rapidly at the end of the 20th century and the beginnings of the current century. The first Botanic Garden in Yemen has been established also in southern uplands of Yemen (NE of Taiz) in which different wild plant species were planted as Ex Situ farm.

Gene banks were established in agricultural research and extension authority and Sana'a

University. They conserve more than 6000 accessions. There are also some Yemeni plant genetic resources conserved in the Agricultural Research and Extension Authority, Taiz farm and in international centers.

These allowed due to shortage of technical of financial resources efforts is contribute in successful biodiversity conservation to achieve the 2010 targets.

### **conservation of genetic diversity**

Yemen keen special concern to conserve its genetic resources, these concern been acknowledged through the establishment of the plant gene resources unit in the Agricultural Research and Extension Authority (AREA) with UNDP support by Sustainable Environment Management Programme.

In relation to the gene bank of field crops, fodder and vegetable, AREA has good collection at the head quarter in Dhamar, but it has modest facility. The major problem is the unreliable power supply and well-trained staff to maintain in previous years currently since 2013 the situation became better. Another gene bank also established at Sana'a University and also has good collection of plants.

In general no modern biotechnology facility or research are there at AREA, although it is the oldest research institute in Yemen, most of the staff were trained for classical type of research, laboratories, reagents, faculties, research funds, and rehabilitation in addition to biotechnology policy are needed at AREA personal for risk assessment of plant genetically modified material are less in number.

Yemen also extreme conservation efforts of rare species with cooperation with neighbouring Arab Countries especially with the UAE Al-Sharqah to conserve and reproduce the Panthera Pardus (Leopard) and Ardeotis Arabs (Arabian Bustard). Success to conserve and protect the Pardus (Leopard) in "Taiz" Governorate reveals to reproduction of these species.

Yemen with the support of UNDP has established National Livestock Research Center in Lahej and the Central Highlands Regional Research Station in Dhamar under AREA in which animal species are introduced and kept for further research and reproduction

The government through the Environment Protection Authority encourages the local communities to conserve the genetic biodiversity in their natural sites or areas. Through providing the possible help to enable them to use the indigenous methods in the natural recourses conservation. However, conservation the genetic biodiversity still in it first step because this issue needs lacks of the technical and financial support to continue and to expand widely to cover the fauna and flora marine and terrestrial.

### **Sustainable use and consumption**

Yemen was a good example of economical and sustainable use of the available natural resources, where conservation of soil, crops, rangelands and fisheries were part of the traditional systems, and agricultural terraces were mainly built for conserving water and preventing soil erosion.

Yemen also has formulated groups of sector strategies and action plans for the agricultural, fisheries, environmental and other development sectors enhancing the resources wise management. Regulate the marine resources fishing by issuing, Laws and bylaws which strictly inhibit fishing in the spawning seasons. Provide livelihood alternatives for the local communities to reduce the pressure and excessive demands on the natural resources. Besides, there are efforts to encourage the investment in the marine aquaculture industry to provide food and to enhance the country economics. Cooperation with local communities and NGOs through providing awareness programmes in using the traditional ways in natural resources management.

Good achievement been made in sustainable use of some biodiversity components, however, the sustainable consumption needs more efforts especially in scientific research programmes and in formulation policies for sustainable consumptions of biodiversity components outside the protected areas.

### **Pressures from habitat loss, land use change and degradation, and unsustainable Water use**

The Government of Yemen priorities in the development strategies are integrated sustainable development projects. Some of these projects are directly related to land degradation, natural resources losses. These were reflected in the second five-year plans 2001-2005 and 2006-2010. The National Environmental Action Plan (NEAP) has priorities the environmental problems in Yemen and gives a plan to overcome these problems of land and natural resource degradation and the depletion and contamination of water resources. Yemen has prepared also national plan to combat desertification, which give special attention to land and resources degradation. Yemen has already implemented several directly related projects to combating desertification in different parts of the country. Moreover, several similar projects are currently being implemented in different agro ecological zones of Yemen in land and traces rehabilitation, and forest and natural resources preservation

Yemen involves the local communities in rural areas in land resources management. Revive traditional knowledge and improving their application in conservation and rehabilitation of terraces, watersheds and rangeland management and using them in a sustainable manner. Furthermore, Yemen enhanced and enforced the environmental law and applies and activates the EIA mechanisms in all the development projects to avoid habitat and species degradation. Yemen has improved its research agenda in the field of rangelands, rain- fed agriculture, irrigated agriculture, resource management and land use planning techniques scientific.

Environmental conservation and environmentally friendly natural resource management need to be further promoted. Until today interventions such as forest restoration and terrace rehabilitation, which does not have a direct and short-term impact on family income is seldom considered a priority for local communities.

Environmental awareness and natural resource management skills need to be improved. Yemen, undertakes research programmes to improve the efficiency of irrigation by adapting new irrigation systems and techniques and widely apply them among the farmers in the country, and plant alternative crops requires less water for irrigations. These helps to some extant to reduce unsustainable water uses.

### **Control threats from invasive alien species**

Alien invasive species are still away from control and rating their economic, social and environmental effects. In spite the recognition of the problem but still there is no data base information about the invasive species and their spreading magnitude in Yemen. Agricultural quarantines in the main gates are ineffective in addition the absence of internal quarantine has led to spreading of these species between the different governorates.

There are attempts to document the alien invasive species and prepare monitoring programme to facilitate their control in Yemen. In addition the EPA is about to prepare a national policy addresses the problems, integrated risk-based approach to control and manage intentional and unintentional introductions of alien invasive species. In spite of the effort devoted by the government but Yemen still lacks the capacities to control the invasive alien species entrance to and spreading in its territory.

### **Address challenges to biodiversity from climate change, and pollution**

The potential impact of climate change on the development in Yemen is expected to make the current sustainability challenges further complicated. Rural livelihoods are expected to decline due to decreasing water access and agriculture productivity, or even asset destruction. Yemen requires enormous adaptation investments to adjust for climate change impacts besides making transition towards low-emission economic development paths. However, as a Least Developed Country (LDC), Yemen has only limited resources and capacities while experiencing tremendous development challenges. It is unlikely for Yemen with the existing capacities and resources to build up adequate community resilience to project climate change impact . “concept note Environmental strategy documents February 2012”

The harsh environment already set a major challenge for the people of Yemen before the consequences of the climate change. Yemen is the most-water stressed country in the world and one of the 10 poorest countries in water resources with water per capita share of less than 120 cubic meters per year.

On October 2008, floods and heavy rains caused one of the most serious natural disasters in Yemen in the last decades. The most affected areas are in the Governorates of Hadhramout and Al-Mahrah. The floods caused significant damage to houses, infrastructure and the agricultural sector destroying or considerably affecting the livelihoods of about 700,000 people. 73 people were also killed and over 3,000 families internally displaced, corresponding to 20,000 – 25,000 persons most of them are women and children.

It is expected that climate change will have multiple and adverse effects on the fundamental pillars of sustainable, environment, economic and social development. It also undermines the country’s ability to reach the MDGs and other development targets, not the least poverty reduction and environmental sustainability. Maintaining environmental sustainability requires combined efforts to address challenges related to climatic changes and conservation of natural resources particularly energy, water and soil. Also, selection of appropriate adaptation strategies will be critical as adaptation is a priority for ensuring the long-term effectiveness of national efforts to eradicate poverty and achieve sustainable development through the decisions of the United Nations Framework Convention on Climate Change, (UNFCCC). Work has been initiated to develop the adaptive capacity of poor people and poorer countries (including Yemen)

to cope with the impacts of climate change. As part of the National Action Program for Adaptation (NAPA,) the Government of Yemen has initiated the following Programs:

1. Develop and implement Integrated Coastal Zone Management programs.
2. Conserve water through reuse of treated waste water and irrigation saving techniques.
3. Develop and implement an awareness program on adaptation to the potential impacts of climate change.
4. Establish and maintain a database for climate change and adaptation.
5. Plant and re-plant mangroves and palms for adaptation to projected sea level rise.
6. Develop and implement programs to improve Yemen's preparedness to cope with extreme weather events.
7. Rainwater harvesting through various techniques including traditional methods.
8. Rehabilitation and maintenance of mountainous terraces.
9. Promotion of research on drought resistant and heat-and salinity- tolerant crops.
10. Design and implement sustainable land management strategies to combat desertification and land degradation.
11. Sustainable management of fisheries resources.
12. Incorporation of climate change and adaptation into school education.

### **Maintain capacity of ecosystems to deliver goods and services and support livelihoods**

The rural communities rely on the natural resources, agriculture, livestock and fishing in their livelihood. However, the high population growth rate ascends the demand to the natural resources render it to be vulnerable and degradable to extinct. So, to maintain the capacity of ecosystem to continue deliver goods and services and support livelihood, Yemen has had prepare several policies and regulations in order to preserve the natural resources. These policies and regulations provide roles and arrangement to control the fisheries, agriculture and environment. Group of training and awareness programmes addressing the sustainable use and wise natural resources exploitation were provided to the local communities and stakeholders. Environment friend methods and techniques imposed and adapted as alternative to the bad practiced habitat destroyed methods such as fishing gears used in marine fishing and irrigations techniques to conserve ground water. Many studies been conducted on water quality, fish and marine resources stock assessments, fishing grounds and the taxonomy of marine species. Protected areas have been declared, with the main propose maintaining the ecosystem and provide alternative livelihoods.

Information on the Yemen ecosystem, terrestrial and marine as a source of livelihood, these been obtained through group surveys and inventories undertaken in different fields of biodiversity such rangelands, forest, crops, livestock, surface and ground water, wetlands, mangrove, coral reefs and fish. Yemen still needs help to study the ability of the ecosystem in providing goods and livelihoods sustainably and undertake the proper measures to maintain them to continue grant daily subsistence for the current and future generation in Yemen.

### **Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources**

At the national level, the recognition of biodiversity contributing positively and directly to Yemen's economic well-being, is giving conservation a new priority among policy makers. And the development of the country's genetic reserves offers the opportunity to generate the revenues necessary to finance further conservation and protection efforts, particularly protected areas management.

There is no existing legislation regulating the sharing of benefits derived from the use of genetic resources. Fortunately, neither are there provisions in either existing legislation or Islamic Shari'a, which would prevent or restrict the sharing of such benefits. Therefore, it is also important to look at the legislation governing contracts in Yemen. Contracts of any kind between state bodies (ministries, authorities, etc.) or corporations and others are subject to the general provisions of the Civil Code, the Law on Public Purchasing (which needs to be reviewed) and other legislation. Contracts entered into by any government entity for the purpose of access to genetic resources or benefit sharing would also be subject to the provisions governing biological resources such as State ownership of those resources, among others.

Also Environmental Protection Authority (EPA) of the ministry of water and environment has issued a national regulations and law in contest with CBD as follows:-

Environment Protection Law No.26 of 1995 related to protect natural recourses and conservation of endemic plant species.

Prime Minster decree ( resolution ) No.104 of 2002 related to protection of some wild animal and plant species and management of its trade.

### **Improvement of financial, human, scientific, technical and technological capacity to implement the Convention**

Yemen experiences a shortage of specialists in several biodiversity related disciplines such as, taxonomy, marine biology, entomology, land-use planning and resource management. The country is also in need of experienced public relations and community development specialists. This situation is aggravated by lack or shortage of funds and resources to conduct proper training on a regular and systematic basis.

Therefore, there is an urgent need to increase funding support to establish a systematic programme for scientific and technical training of human resources within the formal and informal education systems. Only with this investment will the country be able to meet the required qualifications and training needs in biodiversity conservation and natural resource management.

There is still a lack of understanding of the value of biodiversity, even when it is admitted that the situation was better in the past, in terms of biomass production and in terms of number of species present. There is a lack of understanding on how over-exploitation of one species can affect the wellbeing and the productivity of the ecosystem as a whole.

There is fragmentation and lack of coordination among environmental agencies related information exchange and management. This results in the proliferation of several incompatible Geographical information systems, which produce unreliable, inaccurate and inconsistent information for the management and monitoring natural resources. This situation is aggravated by limited funding, lack of technical capacity and trained manpower to maintain and operate established systems sustainably. There is in fact need for to establish

coordination mechanism among environmental agencies to enable them collect, process and produce accurate and harmonized products for planning natural resources.