The Republic of Yemen
Ministry of Water and Environment
Environment Protection Authority (EPA)

YEMEN

FIRST NATIONAL REPORT

TO THE CONVENTION ON

BIOLOGICAL DIVERSITY

October 2004

Contents

ACKNOWLEDGMENTS

The Environment Protection Authority (EPA), the national focal point for the convention on Biological Diversity, launches the Yemen first national report to the convention on biological diversity in response to reporting requirement spelled out by article 26 of the convention. The report describes the status of Yemen' biodiversity and also presents the measures taken by Yemeni Government to meet its obligations as specified by the provisions of the convention. The Yemen first national report is the result of in-depth review and assessment of national endeavors in protecting and presereving biological resources pursuant to the CBD convention.

The report was developed under the auspices of His Excellency Dr. Mohamed Lotf Al-Eryani, the Minister of the Ministry of Water and Environment, whose influential support and guidance of the overall process has been invaluable to the successful development of the report. The report was successfully compiled, drafted and finalized by Mr. Ali Abdulbari Al-Adimi, senior environment consultant, in close consulatation with senior EPA and UNDP staff. Mr. Mahmoud Shidewah, EPA chairman, and Mr. Abdul Hakim Aulaia, have provided substantive contributions and inputs to the content of the report. From UNDP side, Mr. Fuad Ali Mohamed -UNDP Programme Analyst and Mr. Waheeb Al-Eryani have provided the editing team with valuable feedback to the first draft of the report.

1. EXECUTIVE SUMMARY

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 montane habitats that reach elevations of up to 3760 m at Jabel Al-NabiShauib, the highest point on the Arabian Peninsula. For millennia, the Yemeni people were able to utilize their biological resources in a sustained fashion. In recent decades, however, 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.

Yemen's habitats harbour a great number of unique species of plants. 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. The centuries old harmonious relationship of people and environment that has characterized Yemen's culture and history is rapidly disappearing. These alarming trends demand urgent conservation attention, if even representative portions of Yemen's natural biotic wealth are to remain for future generations.

This report is prepared to represents the state of implementation of article 6 of the convention in seven chapters. Chapter I is introductory part, and it presents the legislative and institutional framework for managing and preserving biodiversity. It provides an overview of existing laws and management responsibilities of biodiversity issues, identifying deficiencies in both legislation and management frameworks.

Chapter II describes the current status of biodiversity in terms of flora and fauna's population, distribution and sate endemism. In brief, *t*he 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. Over 3000 plant species are possibly found in the mainland, and about 10% of them are endemic. One checklist comprised 467 plant species belonging to 244 genera from 71 families. Socotra Island is unique in its flora and like many oceanic islands, has a high level of endemism. The latest study reported that Socotra contains approximately 850 plant species, 254 (about 30%) of which are endemic. Out of the eighteen plant genera endemic to the Arabian Peninsula, ten genera are restricted to the Socotra archipelago.

Yemen has 71 recorded land mammal species representing eight orders including bats (table). 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.

Chapter III reviews the key biodiversity issues and concerns confronting Yemen in terms of water and land resource depletion, natural habitat and biodiversity degradation, and uncontrolled waste and pollution.

Chapter IV identifies key factors and root causes contribute to the existence of environmental problems and immediate needs to halt the depletion Yemen's habitats and biodiversity. Immediate country needs to address biodiversity are orinted to focus on measures to be taken for the implemntationof articles 6 of the conventions " Genral Mesures for Conservation and sustainable use of biological diversity". This chapter also identifies the country needs for meeting the provisions of the convention regarding: equitable sharing of biodiversity benefits, enhanced community role and public awareness, reviving of indigenous knowledge and traditions, improved system for monitoring biodiversity, effective policy, legislation and institutional Structure, transfer of technology and adequate capacity building in environmental impact assessment and in biotechnology and Biosafety.

Chapter V articulates government policy to address biodiversity issues over the period 1995 – 2000. This contains overall government interventions, including the state of development and implementation of policies, strategies, action plans and investment programmes that deals with environmental and biodiversity issues. Chapter V also reviews actions and measures that are being taken under such interventions, highlighting key results and impact of their implementation

The final chapter (chapter VI) demonstrates future national agenda for tackling biodiversity issues as spelled out by National Biodiversity Strategy and Action Plan (NBSAP) of 2004. The NBSAP strategy aims to promote the conservation and the sustainable use of biodiversity based on strategic vision, highlighting 21 strategic objectives each of which targeted to one sector or an issue hindering the sustainable use of biological resources. The scope of the strategy is broad and includes the protection, restoration, sustainable use, equitable sharing, and systematic monitoring of Republic of Yemen's biodiversity. The NBSAP includes a long-term comprehensive plan and a priority action plan. The later includes a set of 7 urgent actions expressed in project concept's format indicating project's title, goals, objectives, main outputs, main activities, timeframe, estimated fund and lead agency and key partners. It covers a range of actions from large-scale infrastructure to strategic policy making and human resource development. Key programmes of the action plan are:

1. Establishment and development of comprehensive National Integrated Protected Areas System (NIPAS) in Yemen
2. Development & implementation of an Integrated Coastal Zone Management Plan (ICZMP)
3. Developing and Implementing Specific Policy, Legislation and Regulations on Biodiversity
4. Essentials Measures for the Conservation of Agro-biodiversity in Yemen
5. Reviewing Traditional & indigenous Knowledge in Natural Resources Management Systems
6. National biodiversity education & awareness
7. Programme Regulation and guidelines for Bio-safety

2. Introduction to Yemen

2.1Geographical Location and Borders

The Republic of Yemen lies in the southwestern part of the Arabian Peninsula between latitude 12 40 and 19 00 North, and 42 30 to 53 05 East longitude. It is bordered by Saudi Arabia in the north, the Arabian Sea and the Gulf of Aden in the south, Oman in the east, and the Red Sea in the west.

2.2 Physical Geography

The Republic of Yemen is located on the southern coast of the Arabian Peninsula. Its land boundaries are with Saudi Arabia in the north and Oman in the east. The coastline is 1,906 km and maritime claims include a territorial sea of 12 nautical miles (nm) and an exclusive economic zone of 200 nm. Yemen controls Bab el Mandeb, the strait between the Red Sea and the Gulf of Aden, a heavily used shipping lane.

Yemen covers a total land area of 527.970 square kilometers. About 3 percent of the land can be used for agriculture, or about 1.6 million hectares, but only million hectares were actually cultivated each year from 1990 to 1994. The main crops are grain, fruits, vegetables, and qat. Range lands together with forest and woodlands comprise almost 40 percent of the land area. The land is grazed by about 3.5 million sheep, 3.2 million goats, and 1.1 million cattle. Other land, mostly desert with limited use potential, constitutes almost 60 percent of the total land area.

Yemen is a generally mountainous country .The altitudinal range extends from sea level up to 3760 meters at Jebel Al-Nabi Shauib, the highest point in the Arabian Peninsula. Such altitudinal variation results in a great diversity in climates and landscapes

Located at the cross- roads of the African, Asian, and Palearctic ecological zones, and with a wide range of terrestrial, coastal, and marine landforms, Yemen is characterized by a rich variety of natural habitats, species and genetic diversity, including many endemic species. These Resources are of major economic importance because of their potential for tourism and the wildlife and fisheries they support.
Also, numerous plants are used in traditional medicine, in local industries, and for grazing and fuel wood. However, in recent decades human activity has transformed the landscape and over-exploited available biological resources, which resulted the deterioration of many habitats, in major reduction in plant and animal species, and in extinction of endemic rare, and endangered species

The country is characterized by five major land systems: (1) a hot and humid coastal Tihama plain, 30-60 km wide, along the Red Sea and the Gulf of Aden, (2) the Yemen Highlands, a volcanic region with elevations between 1,000 and 3,600 m. parallel to the Red Sea coast, and with temperate climate and monsoon rains, (3) the dissected region of the Yemen High Plateaus and the Hadramawt - Mahra Uplands, with altitudes up to 1,000 m, (4) the Al-Rub Al-Khali desert interior, with a hot and dry climate, and (5) the islands, including Socotra in the Arabian Sea and more than 112 islands in the Red Sea. Yemen's coastal and marine ecosystems which include extensive mangroves, coral reefs, and sea grass areas are of major economic importance for fisheries and tourism.

2.3 Climate

Climate of Yemen is characterized by five major land systems: (1) hot and humid coastal plain, (2) the temperate Yemen Highlands, (3) the Yemen High Plateaus and Hadramawt – Mahra Uplands, (4) the desert interior, and (5) the islands. Reflecting this geographic variation, rainfall varies widely, from less than 50 mm along the coast, rising with the topography to between 500 and 800 mm in the Western Highlands, and dropping again to below 50 mm in the desert interior.
Rainfall and temperature are the most important factors for life. Because moisture from rainfall is the minimum factor it is determines much of the ecology. Rainfall varies from less than 50 mm in the coastal plains and desert plateau regions to more than 1200 mm in the western mountainous highland region occurring in two periods, first March-May and second July-September.
Rain falls primarily in spring and summer, and is determined by two main mechanisms: the Red Sea Convergence and the Inter Tropical Convergence Zone. Temperature depends primarily on elevation, and in the coastal areas, is determined by distance from the sea. Mean annual temperatures range from less than 12C in the Highlands (with occasional freezing) to 30 C in the coastal plains. Yemen lies within the northern stretches of the tropical climatic zone and its border with the sub-tropical climatic zone. The extreme differences in elevation are largely responsible for the great variations in temperature and climate over the country. Mean annual temperatures range from less than 15C in the highlands to 30C in the coastal plains.

2.4 Population factors

Since the country unification in 1990 Yemen has witnessed many changes in its economic development situation. Specifically, life expectancy at birth improved from 46.3 to 59.8, the fertility rate declined from 7.8 live births to 6.5, and under five mortality rates declined by 31%. Despite of this development, Yemen still facing serious environmental challenges including those attributed to water scarcity, soil erosion, desertification, overgrazing, and a high degree of vulnerability to current climatic variability.

With an annual growth rate of 3.5 percent-one of the highest in the world – Yemen's population is growing very rapidly. As of 2000, Yemenis numbered approximately 18.3 million, an increase of nearly 4 million over the course of just six years. During the same time, poverty increased nearly threefold, particularly in rural areas, where three quarters of Yemenis live.

Bearing in mind the current socio-economic conditions in Yemen, rapid population growth will have a negative impact on environmental conditions. The decrease in the per capita expenditure on basic services will widen the dependency on external sources for food and other essential services. Mass migration from rural to urban centers not only aggravates already poor services in the cities but also may further reduce farm production.

3. Legal and Institutional framework for biodiversity Conservation

3.1 Legal Framework

The legislative tools for biodiversity conservation and sustainable development in Yemen pre-date the ratification of CBD. They were issued as laws and presidential decrees and can be summarized as follows:

Law 26 of 1995 is by far the most **comprehensive environmental legislation** to date. It defines (in article 5) the scope and responsibilities of Environmental Protection Authority (EPA), calls (in articles 6 - 14) for the protection of water and soil and the establishment of Protected Areas, provides legal framework for control and use of pesticides (articles 15 - 21), provides legal framework for the control of pollution and the conservation of natural resources and the protection of wildlife and marine organism specially those endangered and threatened of extinction (articles 22-29), same articles also prohibit hunting of specified types of wild birds and animals (article 28) as well as the destruction of their natural habitats, authorize EPA and relevant agencies to prepare and enforce environmental standards, criterias and specifications(articles 30 - 34), spells out the necessity of environmental impact assessments as a pre-requisite for development projects licensees (articles 35-43), provides legal framework for handling hazardous wastes and materials (articles 44 - 55), establishes environmental monitoring networks (article 58-61) , and forbids the discharge of ships pollution into the sea water (articles 62 - 64). Articles 75-86 cover the protection of air, water and land from all sources of pollution. Articles 75-86 deal with violation and penalties.

Law No. 20 of 1995: aims to deal with procedures for **urban planning** in all parts of the Republic. In accordance with Article (3) of the Law, the Law aims at best usage of land, organizing its usage for various purposes, protection of agricultural land and sites for natural resources from infringement by construction and building works, protection of the environment from pollution, protection of valleys, water courses, flash flood courses, underground water and the coastline.

Presidential Decree on Law No. 43 of 1997: Regulates **fishing exploitation** and protection of live aquatic resources.

Yemeni Law No. 11 of 1993 concerning the **Protection of Marine Environment** from Pollution. It aims at protection of sea from pollution. It is mainly concerned with pollution by oil and pollution from passing ships. The law determines procedures for prosecuting, penalizing and requesting compensation from ships that violate the law. It gives the Public Corporation for Maritime Affairs the legislative power to deal with oil pollution at sea. In its article No. 35, the law prohibits any form of discharge of pollutants of any kind and from any source into the sea without prior treatment.

The Law prohibits shops, industrial and tourist complexes, facilities and public places to discharge, throw away or drown any polluting material, wastes or untreated liquids, which may cause pollution of the beaches of the Republic of Yemen, either done intentionally or unintentionally, directly or indirectly. The Law considers discharge as a punishable crime; as each discharge for any single day is considered as a separate single crime. The Law does not grant

permission to build on seacoast or near it, which may result in discharge that contravenes the provisions of the Law, unless sewage and wastes treatment units are provided.

Law No. 15 of 1994: It deals with the legal provisions of **ships registration**, documents, monitoring and supervision. It also deals with those provisions that are related to marine accidents/incidents. Amongst the most important subjects this Law deals with is the 'ship documents', the most important of which are the certificates which safeguards against pollution, a register for dispensing oils. Also among the most important documents of fishing boats are the documents that deal with permission to fish. The Law prohibits any foreign ship from leaving Yemeni ports, or which is passing through or mooring in territorial waters, unless it satisfies all safety Requirements as per provisions of international agreements valid in the Republic of Yemen with respect to safeguarding life in sea and in cargo ships, and protecting the marine environment against pollution.

Law No. 25 of 1999 regulating and handling of pesticides. The Article No. (3) of the Law states the objective of the Law that briefly deals with the handling of herbicides, and procedures for registry, monitoring and inspecting herbicides in an effort to avoid the danger posed by them and their toxic effects on the health of humans, animals and the environment. Article No.(28) subjects all sections of the armed forces, security, excise and duty, supply & commerce, seaports & airports to implement the Law.

Law No.1 of 1995: is concerned with **repossession for common benefit**. Its Article No. (1) allows ministries, corporations, authorities, and public establishments, when necessity arises, to repossess land for the common benefit against fair compensation for the sake of executing projects for the common benefit. Article No. (2) states that the "necessary projects" are those of common benefit and which have no other alternative, such as sewage reticulation networks, location of sites of mineral resources, oil, gas, airports, seaports, dams, and irrigation and potable water projects.

Law No. 37 of 1991: defines the **territorial waters** and the exclusive economic zones of 200 nautical miles, the boundaries of the islands. It also regulates free passage in the Strait of Bab al-Mandab. It emphasizes on the prohibition of dumping any wastes into these zones. The Law states that "the passage of a ship or submarine or a submerged ship will be considered as a non-land passage if such a ship or a submarine or a submerged ship has, while in territorial waters committed an act that caused intentional pollution that is harmful to human health, marine life and marine environment."

Law No. 32 of 1999 on Agricultural and Veterinary Quarantine regulations:
It regulates the introduction of plants and agricultural products into Yemen and the issuing of health certificates for any importation.

Law No. 20 of 1999 on Agricultural Seeds and fertilizer uses: It regulates handling and use of fertilizers and seeds species, including monitoring and inspection and recording of their use.

Law No. 39 of 1999: is concerned with the **general cleaning**. It, in accordance with Article No. (3), aims at protecting the environment and public health, and disposing of wastes by using proper methods, or treating them, or recycling them by using up-to-date techniques. The Law, in accordance with Article No. (5), prohibits dropping, placing, or leaving behind wastes on seacoast,

agricultural land, storm water courses and also wadis valleys. The Law also prohibits placing them in a hole in the ground and then covering them with earth, burning them, or placing them in places not designated for them. The Law also, in accordance with Article No. (10), prohibits the manufacture and import of plastic bags that do not breakdown and disintegrate with time. The Law states that subject matters must be coordinated with other concerned authorities so as to take advantage of other legislation on environment.

A Forest Law: The primary objectives of the Draft Forest Law include: "(1) forest protection and preservation; (2) forest development; (3) management and regulation of forest formations; (4) erosion and desertification control; and (5) contribution to the national economy. The law also prohibits six specific actions that are considered harmful to forests.

Water and Irrigation Law

It was Adopted by the Cabinet in 1999, and seek to promote the sustainable use of water, protect water resources from overexploitation, and balance the water needs of the various communities and sectors. Approved Water Law places more emphasis on conservation and sustainability rather than on water resources development.

The Irrigation parts of the law seeks to improve irrigation efficiency, to optimize its use, and to establish a strong central entity to oversee irrigation issues in the country. The law addresses a range of irrigation-related issues, such as institutional restructuring, mechanisms to prevent and resolve land and water tenure disputes, pollution prevention, and awareness campaigns. Given the dominant role that irrigation plays in Yemen's water consumption, these regulations have the potential to significantly reduce pressures on the resource.

Key legislative deficiencies

Despite the many obvious strengths of this array of legislative tools, it is generally felt that there is an urgent need for laws regulating some aspects of the conservation and sustainable use of biological diversity such as the importation of genetically modified organisms (GMOs), the transfer of biotechnology institution responsible for law enforcement, additional coordination between laws governing environmental affairs and tourism, and the protection of intellectual property rights. These gaps are adequetly addressed in the draft National Stategy and Action Plan (NBSAP) for the conservation and sustainable use of componants of biological diversity.

Like most other developing countries, Yemen has experienced an evolution of a fragmented institutional environmental management system that is exhibited through various sectoral entities in government. At the systemic level, Yemen does not yet have in place legislation to address specifically the Convention on Biological Diversity, or legislation for the management of protected areas.

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 are in place lack complementary by-laws, guidelines and standards for effectively enacting them. In addition to by law deficiency, there is shortage in national policies that support the conservation of biological resources wild & domestic mammals, cultivated biological resources, organisms, and policies supporting research.

The existing laws on urban planning and land use and on land registration do not cover all issues related to land tenure and are not consistently enforced in all govornorate. Under this situation the Principles of Islamic Shari'a & Yemen's and statutory law fills some gaps and deficiencies in this context but some issue are not fully addressed.
The concept of NGOs is still new and the organizations that exist need to be strengthened and supported with necessary resources. There is legislation that govern citizen associations, including NGOs, generally but this law is outdated.

The inadequate legislation still poses a threat to an estimated 200 - 300 endemic birds, mammals, plants, reefs and wildlife that are known, including globally threatened species. One of the principal obstacles to implementing measures to conserve biodiversity and use biological resources sustainably is the scarcity of financial resources. In this connection there is urgent need to promote the establishment of the Environment Protection Fund to support environmental activities that help in the attainment of the objectives of the Environmental Protection Law (EPL).

The EPL and other laws governing biological resources (the law on protection and use of living marine resources) are not consistently enforced and offenders often are not prosecuted. Neither the Attorney General nor other governmental authorities have yet used Yemen's existing environmental laws to enforce conservation and sustainable use of biological resources. Some legal and regulatory procedures are available but objective enforcement of these measures remains weak. Numerous aspects need clarification of jurisdictions of regulation enforcement and the development of new legislative and administrative measures to address new but priority issues.

In short, a comprehensive legislative framework for sustainable development exist in Yemen, the main elements include the Environmental Protection Law No 26 (EPL) of 1995, the Water Law of 2001, and the Local council authority law of 2000. However, many of the existing laws are either outdated and are irrelevant to the current environmental problems. Given that they were developed in the absence of coordinated and integrated way, they contains a number of conflicting and overlapping issues, which are thought to be responsible for their weak enforcement. According to a recent report on environmental legislation in Yemen, inadequacy of current legislation is often compensated by statutory provisions and regulations in the rural areas. The report proposes the following recommendations for improving the legal framework in Yemen:

- Review of laws and by-laws related to environmental management, which may overlap or create conflicting situations
- Develop necessary decrees and regulations related to EPL
- Urgent implementation of he EIA by law
- Establishment of the environment fund
- Strict law enforcement

Moreover, there is a need for the follow up the preparation, adoption and enforcement of the following legislations:

- Land tenure law, agricultural land holdings registration.
- Fertilizers and Feeding Stuffs
- Coastal Zone Management law
- Application decree for the law EIA
- Framework law for Protected Areas
- Decrees and by-laws to the establishment of EPA

3.2 International Conventions and Agreements

Yemen signed the convention on Biological Diversity (CBD) in June 1992,and the Government ratified it on 24 February 1996. Yemen has ratified UN Framework Convention of Climate Change, and the Convention to Combat Desertification. In addition, Yemen is also party to number of relevant international conventions and regional protocols (including the CITES, Hazardous Wastes, Law of the Sea and Ozone Layer Depletion, RAMSAR Convention, world Heritage Convention, Washington Convention- Cites and Bonn Convention), which make some provision for meeting global environmental objectives. A primary example of the regional protocols that the GoY is party to is the Agreement of the Cooperation for the strategic Action Plan for the Red Sea and Gulf of Aden. Its main objectives include, the strengthening of regional coordination and cooperation, reduction of navigation risks pollution, sustainable use of living marine resources, development and implementation of a regional network of marine protected areas, support to integrated coastal zone management, and enhancement of public awareness and participation in overall environmental management.

The main biodiversity conservation related conventions which Yemen has signed are as follows:

Ratified International conventions:

3.3 Institutional framework for CBD Implementation

Protocol on Interference on High Seas in Case of Marine Pollution with Substances other than Oil (London, 1973).	6.3.1979
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London, etc, 1972).	1.6.1979
Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons, and on their destruction (London, etc. 1972).	7.1.1981
Convention Concerning the protection of World Cultural and Natural Heritage (Paris, 1972).	4.6.1979
Agreement on Civil Responsibility of Marine Transport of Nuclear Materials (Brussels, 1971).	4.6.1979
Convention on Interference on High Seas in case of Catastrophes of Oil Pollution with Substances other than Oil (Brussels. 1969).	4.6.1979
Agreement on civil responsibility concerning Damage from Oil Pollution (Brussels, 1969). Amended (London 1981).	20.3.1969
Agreement for Combating Desert Locust (FAO, Rome, 1995).	1.6.1979
Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Underwater (Moscow, 1993).	
Convention for the Safety of Life at Sea (1960).	
Convention for the Prevention of Pollution of the Sea by Oil (1954).	6.6.1969

The Ministry of Water and Environment (MoWE). Was established in 1991 with broad responsibilities related to environment

al protection and management. It consists of three Directorate-Generals responsible for Environmental Policies, Planning and External Relations, Legal Affairs respectively. MoWE has 3 regional offices, which cover activities in 3 Governorates. In 2001 the Government of Yemen designated Environment Protection Authority (EPA) under MoWE to replace the old Environmental Protection Council (EPC), and to integrate environmental concern into national development policy, regulatory oversight, as well as to coordinated environmental activities among relevant stockholders.

Table 1: environment & environment related agencies in Yemen

Level and form of responsibility/agency	**Main area of concern**
General	
Environment protection council	Natural resources management, pollution control
Sectoral policy	
National water resources authority	Water resources
High council of economy and investment	Mineral resources
National population council	Carrying of natural resources
High committee for Socotra development	Sustainable development of the island
Sectoral & implementation	
Ministry of agriculture & irrigation	Land resources, wild life, vegetation, pesticide handling, desertification control, research
Ministry of electricity & water	Domestic liquid waste, water supply
Ministry of transportation	Marine pollution, climate recording
Ministry of fish wealth	Marine resources
Ministry of oil & mineral resources	Mineral resources
Ministry of public health	Health impact, industrial waste
Ministry of industry	Industrial impact, industrial waste
Ministry of local administration	Env. assessment, pollution control
Support agencies	
Ministry of planning and development	Sustainable development, donor & external cooperation
Ministry of information	Environmental awareness
Ministry of foreign affairs	External relations
General investment authority	Environmental impact assessment
Ministry of education	Environmental trade
Ministry of commerce	Environmental trade
Ministry of interior affairs	Pollution and degradation control
Ministry of justice	Environmental arbitration
Ministry of guidance	Environmental awareness
Ministry of legal affairs	Coordination of laws
Ministry of civil service & administrative reform	Coordination of regulation
Universities; Sana'a, Aden, Hadramout, Taiz, Ibb..etc.	Scientific support, research, training
Central statistical organization	Environmental accounting
Survey authority	Land use mapping

Within the framework of the NBSAP, The Government of Yemen appointed the Environment Protection Authority (EPA) as the Focal Point, which has taken the lead towards conserving biodiversity resources through the initiation and development of several legal and technical activities in coordination with line ministries and local communities according to priorities identified in the NEAP and based on its mandates and the Environmental Protection Law No. (26) for 1995 (EPL). EPA is recently working to improve coordination with line-ministries, by establishing its board of directors to act as coordinating body for Climate Change, biodiversity and Land Degradation e.t.c. The Structure of the proposed board will represent eight governmental agencies claiming responsibility for Climate Change, biodiversity and Land Degradation, these include the Environment Protection Authority (EPA) of the Ministry of Water and Environment (MoWE), the Ministry of Agriculture and Irrigation, the Ministry of Fish Wealth, the Ministry of Planning and international Cooperation, the Ministry of Electricity and Water Resources Authority, and the Ministry of Local Administration.
Other key partners in managing the natural resource base and implementing environmental strategies are shown in the table 2.

Few National NGOs operate in Yemen, including the Friends of the Environment and the Yemen Omithological Society, while international NGOs like IUNC, Bird Life International, WWF and Wetlands International are considerably active and have active focal points in the Republic. The collective interests of the national NGOs are represented through a Yemen NGO Forum.

The economic production sector and NGOs (includes academic institutes, consultancies and civil society organizations) are also very active in activities related to natural resource management and environmental protection. Table 2 shows NGOs operating at the national and local levels, and are involved in activities ranging from policy support to awareness raising and physical implementation.

Table2: Non-governmental agencies	
Yemen environmental protection society	Environment
Environment & coastline protection society	Environment
Friends of the environment	Environment
Yemen geological society	Land resources
Union of environment supports, Mahweet	Environment, Mahweet province
Annahl environment protection society	Environment
Hauf society	Environment, Hauf area, Mahra province
Yemeni geographic society	Land resources
Attakaful environment society	Environment
Yemen water protection society	Water resources
Environment communication society	Environmental awareness
Utma'a protected area society	Protected areasm Utoma
Taiz environment protection society	Environment, Taiz province
Yemeni ornithological society	Birds
Fishermen's union	Fish wealth, coastal line
Yemeni women society	Women & environment issues
Yemeni women committee	Women & environment issues
Chamber of commerce & industry	Environment & industry
Farmer's union & agricultural cooperatives	Land resources and vegetation

The Universities of Yemen (Sana'a, Hadramout, Aden, etc.) are at a very early stage of development. They potentially have a very important role, through teaching, in conveying an understanding of the central role of the environment in development. There is also scope for the eventual development of research programs, which can contribute to improved understanding of the need for modalities of environmental management.

The Government of Yemen is engaging in a process of decentralization of authority over natural resource management to provincial, district, and local community authorities. These will increasingly become key stakeholders, and will require a thorough analysis of capacity development needs.

4. Biodiversity status
4.1 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 montane 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. The centuries old harmonious relationship of people and environment that has characterized Yemen's culture and history is rapidly disappearing. 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. Broadly, Yemen is divided into 7 physiographic regions. These are: Coastal plains; low altitude mountains; medium altitude mountains; high altitude mountains; highland plains, eastern/ northeast mountains; eastern desert and Socotra island. Yemen's vegetation types, their habitats, population and distribution are summarized in table ( ):

Physiographic regions	Plant Species
Coastal Plains	***1)*** **Avicennia marina association**: *Aeluropes lagopoides, Suaeda spp* ***2)*** **Suaeda fruticosa shrubland:** *Suaeda fruticosa Aeluropus lagopoides; Halopyrum Mucronatum and Odyssea Mucronata* ***3)*** **Sandy plains covered by shrubland:** *Panicum torgidum; Suaeda fruticosa and Odyssea mucronata* ***4)*** ***Sand dunes area:*** *Odyssea mucronata and Panicum turgidum; Dipterygium glaucum; Leptedenia pyrotechnica, Acacia tortitis, Cassi sinna and Cassia italica* ***5)*** ***Gravelly plain areas:*** *Lasiurus scindicus, Sarcostemma sp., Acacia hamulosa, Panicum turgidum and Commiphora myrrh* ***6)*** **Acacia ehrenbergiana woodland:** *Ziziphus spina-christi, Panicum turgidum, Acacia tortilis and others; Acacia ehrenbergiana* ***7)*** **Ziziphus spina-christi - Dobera glabra cultivated lands:** *Dodera glabra ; Ziziphus spina-christi; Dactyloctenium scindicum; Eleusine floccifolia, Echinochloa colonum, Cynodon dactylon, Eragrostes ciliaris, Cyperus rubicundus and C. rotundus; Salvadora persica – Tamarix aphylla*
2) Low altitude mountains	*Ziziphus spina-christi and Dobera glabra and Acacia tortilis; Anogeissus dhofarica, Dodonaea angustifolia and Jatropha dhofarica* ***endemic plant species:*** *Maytenus dhofarensis, Euphorbia smithii, Jatropha dhofarica, Anogeissus dhofarica and Commiphora foliacea; Cassia italica, Acacia mellifera and Anisotes trisulcus; Trichilia emetica, Commiphora spp. Anogeissus dhofarica, Jatropha dhofarica and Euphorbia coneata*
3) Medium altitude mountains	*Acacia mellifera, Juniperus procera; Acacia asak, Euphorbia coneata , Cadia purpurea; Acalypha fruticosa, Euphorbia cactus, Euphorbia inarticulata, Euphorbia parciramulosa; Ficus vasta, F. sycomorus, F. palmata, F. cordata ssp. Salicifolia sp, Trichilia emetica, Tamarindus indica, Acanthus arboreus, Carissa edulis, Jasiminum grandiflorum and Acacia etbaica*
4) High altitude mountains	*Acacia origena; Acanthus arboreus, Barleria proxima, Scabiosa columbaria and Pennisetum setacem*
5) Highland plains	*Acacia origena; Andropogon spp., Eragrostes pappos, Tetrapogon villosum, Cenchrus ciliaris, Cynodon dactylon, Eragrostes papposa, Arisdida adscensionis and Acacia etbaica*
6) Eastern and northeast mountains	*Lavandula pubescens and Euphorbia balsamifera, Andropogon crossotos, Chrysopogon plumulosus and Teterapogon villosum; Lavandula pubescens, Helichrysum somaliense, Chrysopogon plumulosus, Kleinia odora and Psiadia arabica; Andrpogon crossotos; Acacia nilotica, Cadia purpurea, Acacia oerfota and Commiphora myrrha; Brreonadia salicina, Trichilia emetica, Tamarix indica, Ficus spp. And Ziziphus spina-christi.*
7) Eastern	*Panicum turgidum; Desmostachya bipinnata, Suaeda aegyptiaca, Salsola*

desert	*imbricata and Tamarix aphylla; Aerva javanica and Rhazia stricta; Acacia tortilis, Chrysopogon plumulosus and Aerva javanica.; Pennisetum sp., Panicum turgidum and a dwarf shrub species; Acacia tortilis, Panicum turgidum and Aerva javanica Suaeda aegyptiaca and Salsola imbricata*
8) Socotra Island	*aloes, dragon tree (Dracaena cinnabari)*

4.2 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. Over 3000 plant species are possibly found in the mainland, and about 10% of them are endemic. One checklist[1] comprised 467 plant species belonging to 244 genera from 71 families. Socotra Island is unique in its flora and like many oceanic islands, has a high level of endemism. The latest study reported that Socotra contains approximately 850 plant species, 254 (about 30%) of which are endemic. Out of the eighteen plant genera endemic to the Arabian Peninsula, ten genera are restricted to the Socotra archipelago.

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 Asclepediaceae taking into account the Stapeliad genera (Carraluma, Duvalia, Huernia, and Rhytidocaulon). Euphorbiaceae and Aloeceae also have high percentage of endemism as they include the succulent Euphorbia and Aloe species respectively. Precise data on the status and number of rare and endangered plants are not 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.

4.3 Status of Terrestrial Fauna

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

Yemen has 71 recorded land mammal species representing eight orders including bats (table). 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

[1] Compiled by S. Gabali & A. Gifri (1990).

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( ). 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 became 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.

Four specimens collected in the past few years were represented to be held in a private collection in the State of Qatar. Two specimens from Ma'bar were currently held in the Field Museum of Natural History, Chicago[2].

Recent reports indicate that a leopard(the Arabian Leopard (Panthera pardus nimr) was captured near the area of Wadeah, and was sent to the United Arab Emirates for a captive breeding program[3].

[2] Greth et al (1993).
[3] Nabil A. Obadi, personal communication March 1999

Birds

Yemen also 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 *10***.

Table 10. Endemic and near-endemic bird species in Yemen

Species	**Endemic to Yemen**	Semi Endemic
Alectoris melanocephala (Red-legge Partridge)		?
Alectoris philbyi (Philby's Rock Partridge)		?
Apus berliozi berliozi	?	
Carduelis yemenensis (Yemen Linnet)		?
Cisticola haesitata	?	
Dendrocopos dorae (Arabian woodpecker)		?
Emberiza socotrane (Soqotra Bunting)	?	
Estrilda rufibarba (Arabian Waxbill)		?
Incana incana	?	
Nectarinia balfouri (Balfour Sunbird)	?	
Oenanthe lugens boscaweni (Mourning Wheatear)		
Oenanthe lugens lugentoides (Mourning Wheatear)		?
Onychognathus frater	?	
Otus senegalensis pamela (Senegal Scops Owl)		?
Otus senegalensis socotranus	?	
Parisoma buryi (Yemen Warbler)		?
Passer euchlorus (Golden Sparrow)		?
Passer insularis (Socotra Sparrow)	?	
Prunella fagani (Arabian Accentor)	?	
Rhynchostruthus socotranus percivali		?
Rhynchoxtruthus s. socotranus (Golden-winged Grosbeak)	?	
Serinus menachensis (Yemen Serin)		?
Serinus rothschildi (Olive-rumped Serin)		?
Turdus menachensis (Yemen Thrush)		?

Zosterops socotrana (Soqotra White-eye)	?	

The authoritative report by M. Evans et al (1994) on 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.

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.

Reptiles and Amphibians

A total of 103 species of Reptiles and 8 species of Amphibians have been recorded in Yemen (table). 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 turtles4. The amphibians include 8 species belonging to3 families.

Table 12. 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
Lizards	6	22	71
Amphibians	1	3	3
Snakes	7	22	28
Turtles	4	7	7
Total			

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

Table 13. Number of lizard species and their families, recorded in Yemen.

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

Table 14. Number of snake species, and their families in Yemen.

Family	**Number**	
	Genera	**Species**
Boidae	1	2
Colubridae	12	15
Elapidae	2	2
Hydrophiidae	1	1
Leptotyphlopidae	2	3
Typhlopidae	1	1

[4] See Section XXX under Marine Biodiversity for a list of species.

Viperidae	3	4
TOTAL	22	28

INVERTEBRATE ANIMALS

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

Table 15. Preliminary records of classes, orders, families, genera and species of terrestrial arthropods in Yemen

Class	**Number**			
	Order	**Family**	**Genus**	**Species**
1-Arachnida	8	52	134	252
2-Malacostraca	1	5	7	11
3-Diplopoda	2	2	2	5
4-Chilopoda	2	4	6	12
5-Hexapoda	25	250	1684	3092
TOTAL	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**)

Table 16. Preliminary record of orders, families, genera and species of the Class Arachnida

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

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

Table 17. 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

4.4Agricultural Biodiversity

Arable land counts for 1.6 million hectares (3% of the country). It is estimated that during the last 5 years about 1 million hectares have been actually under cultivation. Main field crops are: cereals including sorghum, wheat, maize, millet and barley; vegetables including potato, tomato, beans, cucurbits, onions, carrots, crucifies, 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.

4.5 Coastal and Marine Species

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. Its patch, fringing and bottom reefs are known to contain at least 90 species of corals which have thus far been

recorded. There is likewise a great diversity of fish (416 spp), 82 species of sea and shore birds, 625 species of mollusks, algae (485 species), phytoplankton (283 species), as well as four species of marine turtles, including the most important nesting beach for Green Turtles in the entire Arabian Region at Ras Sharma. Compared to other parts of the Red Sea, the shallow nutrient rich waters above the wide continental shelf of Yemen are rich fishing grounds. Fish supply a great amount of protein in the diet of Yemenis, and now with the improved road communications systems, people in the populated mountainous areas can also enjoy a more diverse diet with seafood. An array of threats from pollution to coastal reclamation and bottom trawling currently threatens Yemen's coastal and marine environment. 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 over 2500 km 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 heavily trafficked, 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.

Mangroves

Mangroves are important biological features of Yemeni coast, providing the basis for many important marine food chain. The leaves after decomposition result in detritus and bacteria, which provide food for meiofauna, mollusks and crustaceans, including some commercial species of shrimps. They also provide nesting sites for shore and sea birds. They form one of the several recognized critical marine habitats in Yemen.

Two species of mangroves were recorded from the Yemen Red Sea coastal area; Avicenna marina (Black Mangrove), and Rhizophora mucronata (Red Mangrove). The total area of A. marina in Yemen Red Sea form 12% of the coastal strip with 100-200m wide and up to 5m high. The majority of mangrove stands occur to the north of Al-Urj; whereas the large stands occur around the Oreste point of the Yemen/Saudi border and Al-Luhayah/Bahr Ibn Abbas area. R. mucronata was recorded from a small island of one hectar area in Khor Kathib near Al-Hudydah.

The conditions along the Gulf of Aden coast are not suitable for mangroves growing. Because the upwelling phenomena which bring the deeper cold water to the surface, which is rich with nutrients cause more turbidity and because the competition with macroalgae, only one instance of a small (less than 1 ha) monospecific thicket was recorded. This is situated 4 km north of Khor

Showran near Bir-Ali. There is a crater lake fringed with mangrove. The species is A. marina. This species is also recorded from Socotra Archipelago.

Sea grass

Sea grasses are rooted plants found on soft substrata, with leave above ground and interconnected stem, or rhizoms and roots below the ground. Also they are flowering plants able to live under water in the marine environment. The importance of the sea grass beds is very high due to their high primary productivity, which is enhanced by large number of epiphyters. Decaying materials enter the detritus food chain; aid in stabilization of the seabed against wave action and other erosion forces. Moreover, they promote sedimentation and accumulation of organic and inorganic matter, providing direct food source for some invertebrates, fish, dugongs and turtles. They also harbor juveniles of various commercial fish and crustaceans, forming a nursery area. In Yemen **nine species of sea grasses** were recorded in the Red Sea subtidal area, and four species were recorded in the Gulf of Aden coastal area.

These are:- Halodula uninervis, Halophile ovalis, Cymodocea serrulata and C. rotundota. Their distribution is limited to Khor Omira, Ras Al-Ara to Suquiah and west of Mashhour to Babel Mandab. Cymodocea serrulata, Halodule uninervis and Halophila ovalis were the only seagrass species reported form Socotra Archipelago water. A clear zonation pattern was evident. In water greater than 1m depth the assemblage was dominated by Cymodocea (70% cover), while in water less than 1m the community was composed of Halodule uninervis and Halophila ovalis (cover less than 10%).

Algae

Marine algae differ from species to another in form and size. They range from microscopic flagellates to giant kelps.

In the Red Sea there are about 485 species of algae. There are 39 species recorded in the Yemen Red Sea coast in the intertidal area between Dhubab - Yakhtul and Al-Salif – Al-Urj. North of Hudydah substrates are generally dominated by Sargassum spp.. The dominant intertidal species were Padina and Turbinaria except for a notable area of reef flat in the north of Dhubab where dominated by green algae Caulerpa mexicana and brown macro algae Dectyota liturata.

In the Gulf of Aden because of the high primary productivity of the upwelling, about 53 species were reported from Mukalla until Qusaiyer in Hadramout. Whereas the area between Ras Qawa'a and Babel-Mandab is dominated by Sargassum sp. with little abundance of Codium sp. & Padina sp. The species Dictyota, Halimeda and Udotea were recorded from the intertidal zone between Shuqra and Ahwar. Twenty four species were reported in the subtidal area of Socotra Archipelago.

Fresh water vegetation

Fresh water vegetation include those plants which have a relatively low salinity tolerance and require an almost continuous supply of fresh water. Al-Khawkhah, Yakhtul, Al-Urj and Wadi Al-

Mulk (North of Al-Mukha) are suitable areas for growing this type of vegetation in the Red Sea coast and Ahwar, Al-Hiswa in the Gulf of Aden, also in Socotra because the fresh water source is close to the surface (ex. 10cm deep in Al-Khawkhah).

There are four species recorded from the Yemen coastal area of the Red Sea and Gulf of Aden, These are:

1. Phoenix dactylifera (Date Palm) covers most of the area between Al-Hudydah and Yakhtul in the Red Sea region and Ahwar in the Gulf of Aden.
2. Hypaene thebaica (Dom Palm) recorded from Al-Urj and Al-Jabanah north of Al-Hudydah.
3. Palm like trees Pandanus odoratissimus recorded only in Al-Mujaylis and al-Fassah in the Red Sea coast.
4. Salvadora persica trees (A'arak) dominate between Al-Mukha and Dhubab, also between Ras Qawa'a and Khor Umirah. Many local people use the roots of this tree as toothbrushes.

Phytoplankton

There are 283 species of phytoplankton was recorded in the Yemen Red Sea and Gulf of Aden waters. A total of 206 species of diatoms and dinoflagellates have been reported from Yemen waters. Thirty two species are restricted to the southern section of the Red Sea and Gulf of Aden. Fifty six species were recorded from Ras Isa Peninsula off shore water. Another 21 species were also recorded from Khalij Kamaran. A total of 130 species were recorded from the Gulf of Aden in February and May 1985. The plankton community of the Yemen Red Sea/Gulf of Aden waters shows that the majority of species are of Indo-Pacific origin.

Zooplankton

There are 139 species of zooplankton were recorded from the Yemeni water, representing 9 groups.

1- Protozoan tintinnids	(55 species)
2- Chondrophora and Siphonophora	(12 species)
3- Scyphomedusa	(10 species)
4- Ostracoda and Cladocera	(7 species)
5- Copepods	(34 species)
6- Decapoda	(1 species)
7- Chaetognatha	(11 species)
8- Echinodermata	(2 species)
9- Tunicates	(7 species)

Eggs and larvae of benthic fauna, polychaets, molluscs, copepods, cirripeds, decapods, echinoderms and fish were intensively distributed in the shallow water of Khalij Kamaran and subtidal zone of Ras Isa. The Gulf of Aden species distribution range extends to the southern part of the Red Sea where Hanish sill forms the maximum limits.

Halophytes

Halophytic vegetation usually occurs where a fresh ground water supply is limited or absent and where saline intrusion is rare. Five species of halophytes were recorded from the Red Sea coastal area of Yemen, and 16 species were recorded from Socotra Archipelago coastal area. This type of flora has the ability of limiting beach erosion and allows other less tolerant species to germinate

Halophytic vegetation supports a variety of fauna such as insects and birds. They also provide nesting places for several sea birds. Moreover, they form grazing ground for goats and camels.

Polychaeta
Only four species were recorded in all Yemeni sea waters; Red Sea, Gulf of Aden and Socotra Archipelago; these species are: Spirobranchus giganteus, Sabellastarte sanctijosephi, Diopatra sp. (Recorded only from the Gulf of Aden & Arabian Sea, not from the Red Sea) and Pamatoeios kraussii.

Echinodermata
Echinoderm animals are bottom dwellers and are found at all depths and latitudes. They usually thrive in shallow warm water. The species of echinoderms, which were recorded in the Yemen Red Sea, are the same species, which are found in the Gulf of Aden/Arabian Sea and indicates that these species have Indo-Pacific origins. There are a total of 72 species recorded in all Yemeni waters. Among the Yemeni echinoid community, Diadema setosum seems to be the most commonly distributed in the area.

Molluscs
A total of 625 species were recorded from the Red Sea representing four classes. One study presented a total of 117 species only from Al-Salif, Ras Isa, Al-Urj and north and south of Al-Mukha. This study shows that the Mollusc communities associated with the different habitats in that region, for example, the species associated with mangrove are 17 species, seagrass 32 species, sandy shores 37 species, and rocky and reef flats 72 species.

Another study recorded a total of 729 species representing four classes from Aden inner harbour and little Aden only from the Yemeni southern coastal area. Recently, 146 species of Gastropods, 63 species of Bivalve and 13 species of Polyplacophora were recorded from Gulf of Aden/Arabian Sea and Socotra Island.

Crustacea
Fifty three species of crustacea belonging to 6 families were recorded from the Yemen Red Sea coastal area and a total of 24 species were recorded from the Gulf of Aden/Arabian Sea. A total of 45 species of crustacea were recorded from Socotra Archipelago.

Fish
Yemeni waters have a great diversity of fishes that because of the upwelling phenomena in the southern water Gulf of Aden/Arabian Sea. The different habitats and reef fish inhabit the coral reef area along all the coastal line. A total of 416 species were recorded from the Yemeni Red Sea water 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.

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. 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

Marine Turtles

Nearly, all species of marine turtles are regarded as endangered animals world wide 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.

4.6 Important Areas for Biodiversity Conservation

Over the past few years conservation efforts of the country biological resources have focused primarily on the establishment of protected areas, with the objective of protecting the country's best-known sites of outstanding biodiversity/natural value, aiming at maintaining the diversity and viability of the various components of Yemen's biodiversity, and to ensure their sustainable utilization.

These efforts have led to the identification of 15 areas throughout the country (including Socotra Island) that 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, Eraf forest, Ket Fah, Hawf and Socotra Island are of most important areas for declaring and establishment of protected at the **highlands region.**

Similarly, the remnant natural juniper vegetation cover in Jebel Lawz (Khawlan), Jebel Eraf (Taiz), Jebel Saber (Taiz), Ket Fah (Sa'da'a), Hawf (Al-Mahra), and Kabbeitah (Taiz) hosts unique flora assemblages including alpine type vegetation. For bird conservation M. Evans et al (1994), identified 57 sites, which are of vital importance for the conservation birds in Yemen.

In Coastal region, Balhaf-Bir Ali-Burum and Sharma-Jathmun, Dhobba,Ras Isa/Kamaran Island, Khor Umaira, Bab-al-Mandab & Perim Island, Luhayah and Hannish Archipelago) have been identified are for protecting mangroves, Aden Coastal Wetlands, coral reef have been cited important for the protection
Brief discription on status of these areas are given below

Socotra Archipelago

The Official Protected Area (Socotra Archipelago)

Socotra Archipelago is located in the Arabian Sea of Yemen, occupies some 3733 sq. km and is home to diverse terrestrial plant and animal life with a high degree of endemism. It has been established as a multiple-use protected area.
The Archipelago is characterized by very high number of species found nowhere else on the earth. Of the 850 plant species found in Socotra, at least 277 are endemic. Six endemic birds have been recorded on the Island

Hawf Protected Area has an area of 90000 ha and in is located in the southeast part of Yemen in Mahara governorate at the border of Oman. The area faces the Arabian Sea, has a coastline of some 18km and a relief of 1800m in its limestone mountains. The area has rich vegetation and of forests dominated by Anogeissus dhofarica, Dodonaea angustifolia and Jatropha dhofarica. The site is rich in species endemic to the Huf and Dhufar regions. Among the important endemic plant species are: Maytenus dhofarensis, Euphorbta smithit, Jatropha dhofarica, Anogeissus dhofarica, Commiphora faliacea.

The major floristic communities of Huf include:

1)Anogeissus dhofarica-Jatropha dhofarica community
2) Dodonaea angustifolia community
3) Acacia etbaica community
4) Maytenus dhofarensis - Dodonaea angustifolia
5) Allophylus rubifolia - Dodonaea angustifolia

Jabal Buraa has and area of 4100 ha and is located in the Tihama foothills at an altitudinal in the range of 400-2000 m. Jabal Buraa is considered to hold some of the richest habitats in the entire Arabian Peninsula. The main vegetation communities are:

1. Antsotes trisulcus community
2. Maytenus sp.
3. Acalypha fruticosa community
4. Abrus bottae community
5. Acacia asak community
1. Commiphora kataf community

2. Combretum molle community

Balhaf Burum is a coastal area located in the eastern Gulf of Aden, stretching and grouping of high aspect islands with extensive fringing coral reefs and rich fishing sites. Besides, they are an important site for nesting of important seabirds and threatened marine turtles. Yemen Several sites of conservation importance are located in this are. The three islands of Baraqa, Sikha and Hallaniyah are less than 10 km from the Bir Ali mainlabd. They are all important sites for breeding of the endemic Socotra Cormorant (Phalacrocorax nigrogularis) and Sooty Gull (Larus hemprichii). Karif Shoran, located in the area, is a site characterized with a unique habitat because of a volcanic crater along with a distinctive mangrove stand.

Sharma and Jathmun are coastal sites, located to each other along the coastline of Shabwa governorate, eastern Gulf of Aden,. The coastline of Sharma-Jathmun area is 50km long. The beach of the area is considered as the most important nesting area for the Green Turtle in the entire Arabian region, including Red Sea and Gulf of Aden. Approximately nesting 1000 turtles were recorded in the area.

Utomah is considered rich in biodiversity. It hosts birds including Palestine Sunbird Nectarinia osea, Palm Dove Streptopelia senegalensi, Arabian Golden Sparrow Passer euchloru, a pair of Kestrel Falco tinnunculus that had a nest in the wall of a house with two large offspring.
Utomah area also has been reported a major ecosystem for wild wild trees, including acacias and cactus like shrubs, which grows side by side or intermingle with a variety of domestic crops such as sorghum and coffee in what appears to be a mutually beneficial situation for all species concerned. This intermingling of domestic and wild flora is a living exa mple of conservation and utilization of natural resources as it has developed over the centuries. It deserves to be preserved for the benefit of future generations.

A small river and a waterfall are unique features of the bottom of the valley. It is here that one can see the Grey Hornbill Tockus nasutusus, the Grey-Headed Kingfisher Halcyon leucocephala, hanging nests of Ruppell's Weaver Ploceus galbula, and the South Arabian Wheatear Oenanthe lugentoides. A large number of crows can be seen in groups, as are swallows swooping over a pond,. There was no sign that anyone hunts the birds.

Khatifah is an eclologicaly important area located in Saada govornorate 60 km to the south of the nortehner border with Saudia Arabia. The location of Khatifah on the border between Yemen and Saudi Arabia, its scenic overlook lends itself well to the possibility of establishing a transborder protected area.
The area of Khatifah is reported to host rabbits, foxes, hyenas, wolves, leopards and various birds of prey. Over grazing by cattle, sheep and goats and the excessive cutting of wood for energy use and the increased drought witnessed over the past four decades are among major causes that threaten the habitat of wild life in the areas.

Jebel Al-Lawz is Jebel Al-Lawz is a large highland plateau in Sana'a govornorate, Khawlan district. It has been named as Jebel Al-Lawz because it is rich of large numbers of old and new almond trees (lawz). The natural beauty of this area is beyond description. The villages, as in many areas in Yemen, blend into the mountain landscape and are perfectly camouflaged because they are built out of local stone or mud.
The actual area, earmarked as a protected area was just across a deep valley and covered an area of about 30 sq. km. the area is full of old trees, mostly ar'ar, and numerous shrubs and herbs. There are also a number of natural caves that need to be explored.
The area is primarily used by:
a) medicinal herb collectors: who come regularly and spend days to fill their sacks with the plants they need.
b) livestock owners: who allow their goats and sheep to graze and browse the trees and shrubs and to climb all over them to reach the succulent growth. Fodder is also cut, collected and carried back for cattle that are not able to cross this mountain terrain. We were told that during the wet season the grasses grow waist high.
c) hunters: who it seems have a good, though diminishing, selection of animals to shoot. The principle game is the ibex and the terrain of this region is ideal for it. Other animals mentioned as living in this area are: mountain gazelle, rock hyrax, baboons, partridge, and wild pigeon.

Jabal Areys is located 150 km east of Aden. This is a mountainous area rich in endemic vegetation. Some 15 endemics have thus far been recorded from the area including Salvia areysiana, Cystostemon kissentoides, Kleinia deflersii. There is a good population of the Arabian Gazelle and a rich herpetofauna, and a number of important bird species including the Arabian Partridge and the Arabian Golden Sparrow.

Jable Jol and Fartak is a dissected limestone plateau located north of Bir Ali and eastwards to Al Ghaidha (Hadramout and Al -Mahara governorates). It is very rich in plant endemics (about 40 species including Pulicaria nivea, P. rauhii. P. lancifolia, Schweinfurthia latifolia, Anogetssus bentii, Kleinia maharana, Kissaina arabia, Ochradenus gefrii and many others.

Several areas are of particular importance avifauna conservation in the country, and consideration needs to be given to afford better protection for the **birds** in these areas.

Jabal Eraf is located on a plateau along the border of the Taiz and Lahj governorates (al Maqatera region). The vegetation is composed of forest dominated by Juniperus procera and Pstadia arabica and represents the Mediterranean region in Yemen. Among the endemics in the area are: Blepharispermum yemenense, Centaurea yemense, Crotalaria squamigera, Jatropha variegata.
A rocky plateau 1450 –1680m high with a good Acacia-Juniper woodland forms about 30% cover. This is the largest remaining area of Juniper forest in Yemen. There is a very rich herb and grass layer covering 50% of the area. Among the most significant endemic animal species recorded in the area are:

- The Arabian Wood Pecker (Dendrocopus dorae)
- The Arabian Waxbill (Estrilda rufibarba)
- The Golden-winged Grosbeak (Rhynchostruthus sacotranus)
- The Arabian Serin (Serinus rothschildi)

- The Baboon (Papio hamadryas)
- The Cat snake (Telescopus dhara)
- The Arabian toad (Bufo arabicus)
- The Dwarf day gecko (Pristurus flavipunctatus)

Al-Luhayah is an area of some 30,000 ha located on the Red Sea coast that stretches for about 90 km from Midi near the Saudi border to Al-Luhayah. The site contains a well-developed mangrove fringe, extensive sand bars and mudflats, several seagrass beds and some coastal vegetation. The area is very important for migratory waterfowl and provides good habitat for at least three globally threatened animal species including the Green Turtle (Chelonia mydas), Dugong (Dugon dugon) and White eyed Gull (Larus leucophthalmus).

Aden Coastal Wetlands (lagoon, marshes and beach)

The wetlands surrounding Aden city consist of:

- marshland covering an area of 50 ha which receives the run-off of the swage treatment plant located nearby;
- an artificial lagoon of the swage treatment plant;
- four large lagoons on the west side of the Aden peninsula;
- large intertidal flats; and
- sandy beaches and rocky cliffs.

The Aden Coastal Wetlands are considered to be one of the most important sites for migratory birds and regularly host over 10,000 waterfowl including three globally threatened and 12 regionally important species populations (**Table**). The site meets the conditions of the International Ramsar site and Bonn Conventions. Among the most significant species found in the area are Lesser Flamingo (Phoenicopterus minor) with 9200 birds counted on the last census (in 1996), the largest concentration any where in the Middle East. Other important species include Great Spotted Eagle (Aquila clanga), Imperial Eagle (Aquila heliaca), and Crab Plover (Dromas ardeola).

Table . Globally threatened and regionally important bird species populations found in Aden wetlands

Globally threatened		**Regionally important species populations**	
Scientific name	English name	Scientific name	English name
Aquila clanga	Great Spotted Eagle	Phoenicopterus minor	Lesser Flamingo
Aquila heliaca	Imperial Eagle	Phoenicopterus ruber roses	Larger Flamingo
Larus leucophthalmus	White-headed Gull	Dromas ardeola	Crab Plover
-	-	Larus hemprichii	Sooty Gull
-	-	Platalea leucorodia	Spoonbill
-	-	Tringa tetanus	Redshank
-	-	Egretta gularis	Reef heron
-	-	Sterna caspia	Caspian tern
-	-	Sterna nilotica	Gull-billed tern
-	-	Sterna bergii	Swift tern
-	-	Limicola falcinellus	Broad-billed sandpiper
-	-	Himantopus himantopus	Black-winged stilt

Several sites of conservation importance are located in **Bir Ali** area:

- Karif Shoran, a unique habitat, consisting of a volcanic crater lagoon with mangrove vegetation which is the only site on the southern coast.
- The three islands of Baraqa, Sikha and Hallaniyah lying less than 10 km off Bir Ali on the Gulf of Aden coast, all important sites for breeding of the endemic Socotra Cormorant (Phalacrocorax nigrogularis) and Sooty Gull (Larus hemprichii).

Khor Umairah site is characterized by a semi-enclosed lagoon isolated from the shore by a permanent sand spit running from the east consisting of fine mud and sand with rocks in the central part of the lagoon. There is also a coarse sand and gravel desert coastal plain in the surrounding area. The sheltered conditions in the lagoon reduce wave energy and limit the re-suspension of sediments. Additionally the sea grass beds downstream of Khor Umairah may be considerably important to the detritus food chain and sea turtle populations.

5. Biodiversity Problems

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-grazing and over-cutting of trees and shrubs for fuel consumption.
- 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.

5.1 Priority Problems

The immediate and most critical problems contributing to the evolvement and continuation of this un favorable situations are water depletion and pollution, land degradation, habitat loss and waste disposal. The nature, extent and underlying cause of these problems are presented in the following parts of the report.

A- Water scarcity and pollutions

Yemen is one of the most water scarce regions in the world. This is largely attributable to the great expansion of groundwater pumping. The over extraction of groundwater has been supported not only by the availability of pumping technology, but also by policies that make investments in groundwater profitable

The degradation of watersheds, from mountain ranges to coastal and marine zones in Yemen, leads to rapid declines in the quality and quantity of water resources that are available to the people. Deforestation of upper watersheds, overgrazing, terrace degradation and changes in land use are increasingly threatening downstream areas with floods, erosion and reduced dry-season river flows. The continued loss of water resources, forests, agro forestry land use systems and desertification reduces biolo gical diversity and ecosystem integrity.

Water scarcity contributes to the gradual loss of agricultural land and the extinction of livestock when severe droughts occur. This, in turn, leads to overgrazing of rangeland. The depletion of groundwater, especially in the coastal areas where seawater seeps into wells, makes surface water semi-saline and the poor are compelled to use such water for drinking. The most obvious impact of this trend is the increased cost of drilling deeper wells and increased pumping costs in existing wells. More disruptive is the interruption of what used to be reliable water supplies as a result of over pumping from nearby wells.

Water pollution

Water quality is deteriorating. Shallow aquifers, especially in urban areas, are becoming polluted and coastal aquifers are subject to saline intrusion.

Pollution of water resources has major negative effects to health and water availability. A number of diseases are reported as being caused by polluted water and the accumulation of garbage from houses. The number of typhoid has increased from 7.811 cases in 1998 to 8.287 in 2000 with the continuation of the spread of schistosomiasis, with 17.000 cases in 2000.

Ground-water contamination is pervasive and poses a serious health threat for those dependent on water from private tankers and neighborhood wells in urban areas. Water resources are contaminated primarily by industrial and residential waste, seepage of wastewater, and low pressure, back siphonage, and cross connections. Consequently, many wells, especially those drawing water from shallow aquifers, are contaminated with viruses and bacteria, leaving large segments of the population vulnerable to waterborne diseases. In addition, ground water used in public water supplies is not filtered. In the poor neighborhoods, inadequate environmental conditions have led to outbreaks of diseases such as cholera, bacterial dysentery, infectious hepatitis, salmonellosis, and typhoid. It is estimated that about 70 percent of infant mortality (or 107 deaths per 1,000 life-births) is due to waterborne diseases.

Surface water is fully exploited and essentially distributed in the upstream parts of watersheds, and only limited flows reach the sea. The immediate impacts include: decline in water quality from

diminished dilution of pollutants, seasonal or continuous shortfall in supply of downstream users, and increases in salinity in estuaries and other coastal areas.

Inadequate water supply services

Although water requirements for domestic and industrial purposes are estimated at less than 10 percent of total water consumption, competition among these water users is increasing due to population growth and increasing urbanization. In a situation where connections to the water network remain unchanged, water availability per capita is decreasing and the percent of the population that has access to piped water supply is decreasing as well. The problem in urban basins is compounded by growing water demand for agriculture and unclear water rights.

Currently, only 50 percent of the estimated 3.5 million urban population have access to public water supply systems. However, supplies are not always available, especially in the north. Sana'a, Taiz, and Mukalla are already running out of water for their existing populations and there are periodic shortages. The National Water and Sanitation Authority (NWASA) is officially responsible for the provision of water supply and sanitation services in urban centers with populations over 10,000 people. This agency, however, has not been able to fulfill its mandate. NWASA provides piped water to serve about 33 percent of the population of Sana'a, 39 percent of the population of Taiz, 25 percent of the population of Ibb, and 78 percent of the population of Dhamar. Pricing policies and incentives have not been used to increase the efficiency of urban services. In urban water supply, prices do not reflect the resource constraint; the prices charged do not even cover the cost for operating and maintaining the system, water is thus provided at a subsidy. Urban residents with no access to public drinking water (often the urban poor) must obtain water from private networks, private water tank trucks, or their own wells. Bottled water is available too. The cost of all non-public supplied water is high.
Currently, about 40 percent of the estimated 11 million rural population receives piped supply. Here, expansion of public water supply is even more difficult given the high capital cost of new systems due to scattered or remote locations of settlements. At the same time, much of this population is concentrated in the highlands and alternative water supply from seawater desalination is not an economically feasible option.

B- Land Degradation

With regard to land resources, the environmental problems are evident in soil erosion, loss of vegetative cover, deterioration of agricultural land and rangeland and loss of such areas due to the expansion of construction. Agricultural land in different areas of Yemen is subjected to deterioration due to numerous factors, of which the most important arc the rapid runoff of water in the valleys (Wadis), sandstorms, and the excessive pumping of underground water, in addition to the long successive periods of drought. Desertification of agricultural land ranges from 35% per annum, whereas the area of deteriorated land due to soil erosion is estimated to be 12 million hectares and another 3.8 million hectares due to salinity. The situation is further worsened as a result of the sand dune encroachment, which only exacerbates the desertification problem.

Soil erosion

Although **soil erosion** occurs naturally and has been a major problem in Yemen since the dawn of civilization, the rate of erosion is increasing as a result of the removal of vegetation and

unsustainable land-use and farming practices, particularly the development of large-scale irrigation schemes and deterioration of terraces due to inadequate maintenance. Sedimentation also is affecting reservoirs and diversion channels downstream. The areas most seriously affected by soil erosion are Anas, Bani Matter, Wadi Serbah, Hammam Ali, Wadi Afk, Raymah, Wadi Shiras, Wesab, and Wadi Bani.

The erosion of arable land undermines agricultural production and therefore leads to substantial economic losses. Although there are no quantitative data on the magnitude of soil erosion and the possible increase in erosion as a result of unsustainable land use practices, terrace erosion has emerged as priority resource management issue in Yemen. Without the proper maintenance of the terraces, and related farming systems and water management practices, productive land reverts to a barren landscape of upper catchments with no soils and a gravel-strewn wadi-beds with no water flow. The collapse of the terrace system also forces rural population off the land and into the cities, which are already suffering from overcrowding.

Deforestation

Land resources in Yemen face the threat of desertification with its various manifestations including sand dunes progression, water resources depletion, and vegetation cover deterioration. Watershed ecosystems are rapidly changing through accelerating soil erosion, landslides, deterioration of range resources, and loss of biological diversity. Their ability to support water resources development, regulate runoff, maintain down-stream resources and structure, and support the livelihood of their inhabitants is becoming increasingly limited.

The natural wooded vegetation consisting of wadi and desert shrubs, savanna, and mountain trees has largely degenerated into open woodland or low scattered shrubs due fuel wood consumption, stock grazing, clearance for agriculture. Currently, the forests are the country's principal source of domestic fuel and account for 90 percent of household energy consumption in rural areas. The widespread practice of cooking on stoves fueled by wood is leading to the stripping of vegetation because the demand for fuel wood exceeds the regeneration capacities of Yemen' woodlands. The total forest cover has degreased from 2.5 million hectares in 1970 to 1.5 million hectares 1n 1993. If forest harvest continues at level, tree cover is likely to vanish by 2030.

Agricultural and Rangeland Deterioration

Land area allocated for cultivation of cereals has dwindled from 787,000 hectares in hectares in 2000. Productivity of the hectare has also declined during the same period from 1.68 tons to 1.62 tons for wheal, from 0. 96 tons for sorghum and millet, from1.9 tons to 1.14 tons for barley and finally from 1.3 Ions to 1.14 tons for legumes. **Overgrazing of rangelands** is regularly cited as a major cause of degradation. Yet, little is actually known concerning the grazing pressure on the marginal rangelands. To what extent overgrazing has caused or is contributing to degradation of rangeland is presently unknown, as detailed and specific studies have not been undertaken. Overgrazing is usually attributed to significant increase in animal population. Examining official figures relative to animal population in Yemen, gives the following: the total animal population of the country has increased from 7,830,000 in 1987 (MAI statistics, 1992) to 8,439,342 in 1990 (MAI statistics, 1995).

Deficiencies in both regulatory and economic policy frameworks are key factors contributing to land degradation. For example, there is no effective legislation on key aspects of land conservation (e.g., maintenance and use of terraces). Pricing policies also have led to overuse or degradation. For example, the implicit subsidization of food crops encourages land degradation by providing incentives to farm on marginal lands, thereby increasing deforestation and soil erosion. Other threats to rain fed farming include subsidized import of competing crops (e.g., wheat) and competition from areas using highly subsidized ground-water irrigation.

Urbanization

Yemen's urban centers occupy vast territories and are expanding rapidly. In many areas rich habitats (especially in coastal regions) and valuable agricultural land adjacent to urban centers are being indiscriminately swallowed up by expanding cities and villages.

Transactions for the acquisition of land for urban and industrial development have gained in febrility and momentum in all parts of the country, principally beside main roads and along coastal shores. Owing to this, and to steady and rapid rural to urban migration, Yemen faces immediate as well as long-term environmental problems. Due to lack or urban planning, most agricultural land in cities and along main roads is illegally exploited for residential and other urban usage, resulting in loss of highly productive agricultural lands as noticed in many coastal areas.

Inadequate regulation is a key factor accounting for the occupation of hazard-prone areas. In some cases, there are no clear rules governing the settlement of urban areas or guiding urban expansion away from areas poorly suited to urban development. In some southern governorates hazard-prone areas were actually designated for residential development. In other situations, excessive regulation artificially reduced the supply of land and raised the price by requiring large lot sizes or excessive amount of land for traffic or recreation. By reducing the amount of land in the formal land market, excessive land restrictions have increased costs and thus constrained access by low-income populations to safe lands in suitable locations.

C- Habitat Degradation

Located at the cross-roads of the African, Asian, and Palearctic ecological zones, and with a wide range of terrestrial, coastal, and marine landforms, Yemen is characterized by a rich variety of natural habitats, species and genetic diversity, including many endemic species. These resources are of major economic importance because of their potential for tourism and the wildlife and fisheries[5] they support. Also, numerous plants are used in traditional medicine, in local industries, and for grazing and fuel wood. However, in recent decades human activity has transformed the landscape and over-exploited available biological resources, which resulted in the deterioration of

5 Red Sea fish include the Indian mackerel, Spanish mackerel, emporers, barracudas, and perch-like fishes. In the Gulf of Aden, the bulk of the catches landed by artisanal fishery consist of sardines and anchovies, sharks, scads, Spanish mackerel, jacks, Queen fish, Indian mackerel, and tunas. Resources for industrial fishing are cuttlefish, deep sea lobster, spiny lobster, perch-like fishes, catfish, Japanese mackerel, and penaeid shrimp.

many habitats, in major reduction in plant and animal species, and in extinction of endemic, rare, and endangered species 6.

Depletion of plant cover through over-exploitation and clearing of woody vegetation for fuelwood and construction wood is of major concern at these domestic products are highly demanded and their exploitation remains a very lucrative form of trade. Improved transport facilities and recent increase in gas prices have seriously curbed the substitution of fuelwood by alternative sources of energy. The natural annual wood increment represents only a small fraction of the populations' current needs of fuelwood woodlands have been and are still eradicated for agricultural land reclamation, particularly in the Tihama and in the mountain regions.

The present depletion of the natural vegetative cover is in no way counterbalanced by afforestation activities. In addition to fuelwood and construction materials, shurbland and woodlands provide significant quantities of folder. This occurs often in the form of early grazing of young trees and sprouts, which prevent vegetation recovery.

Deterioration of marine and coastal environment

The marine and coastal environment are of major priority issues since they are subjected to deterioration and pollution from land or marine sources, although most of the components of this environment arc still clean and have not yet been damaged significantly by human activities along the whole coastline and throughout the islands. Fish production has risen from 86,000 tons in 1995 to about 135,000 tons in 2000, which is an average growth of 9.4 % over the same period. The major problem, which increasingly exacerbates the poverty problem among fishing communities, is exemplified by excessive fishing using sea ground dragnet boats, which have increased in number over the past few years and have harmed the reserves of marine life of high commercial value such as shrimps and cuttlefish. These boats have also harmed the undersea natural refuges and coral reefs. The entry of large numbers of fishermen into certain coastal fishing areas such as those for rock lobsters has led to the depletion of this resource and the fall of the productivity unit of fishing work/day to less than 20%, and for cuttlefish productivity to about 12%. The absence of monitoring and control systems exposes the fishing areas to pilferage by fishing boats that are not licensed or the abuse of fishing licenses, especially in the Gulf of Aden, Socotra Island and within the territorial waters and especially the economic waters. The lack of control that led to the abuse of licenses issued for fishing decorative household species of fish has also contributed to the destruction or coral reef. This is also the case for diving. The filling of the coastal areas and construction of tourism villages is undertaken without considering environmental assessments leading to heavy environmental damage and to depriving fishing communities from income sources and thus exacerbating their poverty.

Costal biodiversity is threatened through bottom dragnets in fishing or the use of explosives, by landfills in costal areas, expanded construction, pollution from chemicals and waste from electric

6 FAO. National Action Plan for Environment and Development (NAPED): Policies and Guidelines. **C**ompiled by FAO on the basis of information produced in UNDP program YEM/92/TO. FAO, Rome, 1995

power generating stations. These problems also affect the poor leading to environmental damage and depriving fishing communities of their income and thus exacerbating poverty.
In addition toxic gaseous emissions from fuels e.g. diesel and cement factories affect the environment and health situation especially in urban areas.
The gradually increasing temperatures due to the global and regional climate change leave their impacts on agricultural production e.g. through the displacement of current climatic zones changing plant types and vital ecological systems. The productivity of the current agricultural crops will go down. While the present irrigation systems can not control flooding. These two factors lead to the risks of land erosion.

Loss of Biodiversity

The continuing reduction of native forests; the destruction of reef systems and the depletion of fish and shell fish; the loss of endemic species; the degradation of mangrove and watershed areas are among the most important indicators of biodiversity degradation in Yemen.

Over-grazing occurs often in the form of over clearing of woody vegetation for fuel, construction and trade. In addition to fuelwood and construction materials, shurbland and woodlands are utilized for feeding countless herds of cattle, sheep and goats in the mountain regions of Yemen. The practice of cutting branches of old and young trees alike to feed livestock is weakening and weakening and slowly killing off forested areas.

The excessive and uncontrolled use of wood for cooking on a year round basis and for warming the houses in the cold months is taking a very heavy toll on all woody trees and shrubs. Improved transport facilities and government subsidies of gas prices have recently mitigated over cutting of trees and introduced better substitution of fuel wood.

Hunting wild birds and animals is a passion among all the peoples of the Arab world. Yemen is no exception to this rule particularly with such a rich collection of wildlife to hunt. Unfortunately if hunting is not controlled it invariably eliminates most wildlife, particularly the larger mammals and birds. This sad fact is one of the main reasons for the establishment of protected areas for the conservation of biodiversity.

Lack of Management of Eco-tourism

Tourism posses pressures on species diversity through aggressive coastal zone development and inland pollution. There is considerable potential benefit for Yemeni nationals to develop Eco-tourism. However, this sector is not developed now and the few initiatives taken do not necessarily benefit local interests. Plans to organize the sector are needed as well as a modest unit in the Ministry of Tourism to guide sustained Eco-tourism and to ensure that tourist developments are environmentally acceptable. Eco-tourism possibilities should be explored in conjunction with protected area establishment.

D. Waste Management

Waste management is one of the major environmental problems. The volume of solid, liquid and gaseous waste generation including hazardous waste increases rapidly in the absence of sound and competent waste management. This may lead to serious environmental problems affecting soil, ground water, air, human health, animals and plants, especially since some of these wastes are hazardous.

The principal sources of environmental pollution in Yemen can be summarized as follows:

- Disposal or treatment of sanitary wastewaters and their adverse effects on rural and urban areas alike.
- Disposal or recycle of solid waste, which is a more serious problem in the cities and adversely affects poverty in the rural and urban areas alike.
- Lack of any management for dangerous waste/toxic waste and the absence of any monitoring at the inlets into the country, through which substances that, in the long run could lead to the deterioration of natural resources and increase the severity of poverty in rural and urban areas, besides the harm they could bring to the population in general.
- Mismanagement of hospital wastes, mainly in cities that could affect the total population.
- Abuse of pesticides and chemicals in agriculture. This is an environmental problem, with its adverse effects mainly in the rural areas, although the agricultural products, especially Qat, are consumed in larger proportions in the urban areas, and thus they affect the population as a whole.

5.2 Problems Analysis

5..2.1 Root Causes of Biodiversity Problems

Several factors and root causes contribute to the existence of environmental problems and to the continuation of degradation and resource depletion. These are of Societal, managerial, institutional, financial, regulatory, cultural and technical nature and are presented in following boxes:

Regulatory Policy and Legislative factors:

To achieve sustainable and lasting improvement in natural resources management and environmental protection, there is a need for coherent policy and regulation frameworks and sector-specific actions to address the following policy and legislative constraints:

- Incomplete legal framework for protected areas, and flora and fauna.
- Lack of enforcement of wildlife protection measures;
- Absence of preventive and remediation measures;
- Lack of adequate legislative tools to control introductions of alien invasive species;
- Improper application and use of persistent pesticides and chemical fertilizers;
- Inappropriate agricultural practices.
- Abandonment of sustainable practices of sound rangeland management by local people;

Inadequate legislative tools and conservation measures for the protection of indigenous plant and animal species/varieties;

- Non- functional fishing law;
- Abandonment of productive traditional agricultural practices.
- Improper use of agro-chemicals (pesticides, fertilizers, fruit ripening agents, etc.);
- Weak implementation of EIA procedures for development projects.
- Lack of policy addressing air pollution, wastewater, and solid waste production from industrial sources.
- Weak enforcement of standards regulating industrial activities;
- Lack of protection measures and legislations to regulate the use and release of living modified organisms;
- Absence of policy addressing biotechnology and biosafety issues.
- Inadequate legislative framework and weak enforcement of eco-tourism legislation.
- Weak enforcement of solid waste management guidelines.
- Inappropriate practices/ lack of norms regarding waste management;
- Weak enforcement of existing standards for air-pollution control;

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.

Inexistence of a staff evaluation system within the public administration.

Inadequate policies to comply with Yemen's obligations committed under international conventions.

- Antiquated environmental plans;

Uncontrolled hunting of wildlife along with unregulated utilization of fuelwood,

rangelands and agricultural lands.

Institutional, Managerial and monitoring issues: Achieving sustainable improvement in environmental management and monitoring depend in large part on the establishment of and Institutional and Management frameworks /and Monitoring systems: Specific focus should be given to resolve the following constraints:

- Lack of effective administration and conservation management regimes for protected areas;
- Lack of Institutional Capacities for protected area;
- Inadequate systematic population monitoring of species, specially endangered ones;
- Weak monitoring capabilities for endangered and rare species.;
- Lack of institutional capacities in evaluating and preserving alien species;
- Lack of monitoring system for alien invasive species;
- Lack of institutional framework for the management and monitoring of biotechnology and biosafety issues;
- Inadequate systems for water management, inadequate restrictions on well drilling and inefficient use of irrigation facilities.
- Fragmented and non-participatory management and planning of watersheds.
- Unclear mandates of agencies involved in watershed management;
- Lack of national mitigation and adaptation plans for climate change.
- Weak recognition of the climate change issue relative to other development priorities.
- Absence of an institutional structure aimed at integrating climate change issues into national plans;

  Insufficient financial auditing system.

  Unregulated inter-agencies coordination for biodiversity and protected areas.

  Incomplete hierarchical structure of environmental agencies;

  Lack of coordinated mechanism for monitoring biodiversity deterioration.

  Lack of monitoring tools
- Inadequate records on the state and extent of abandonment of traditional environmental norms and practices;

  Lack of land property registration.

  Outdated land survey and registry records;

  Outdated data on species and their habitat as a result of research and monitoring inadequacy.

  Absence of national indicators related to biodiversity.

Societal: Community participation, and Indigenous Knowledge and Traditions: To effective management and use of biological resources, involvement of all concerned parties, including local community, in the management and planning of natural resources should be facilitated by addressing the following most critical issue:

- Poor investment from the private sector in community-based biodiversity projects;
- Weak local communities and private sector participation in tourism management and investment in this sector;
- Limited participation of local communities and NGOs in biodiversity

related initiatives;

- Lack of participation of local communities;
- Insufficient community role in planning, monitoring and managing natural resources;

Lack of allocation system to share, access and use rangelands and hunting grounds equitably.

Inadequate delegation of responsibilities from the center to the govornorate district level;

Lack of allocation system for equitable sharing of fishery resources.

Conflicts among fishery users over the control and use of marine resources.

Retardation of environmentally friendly traditional and indigenous techniques, practices and management systems.

Cultural: Information, Research and Public Awareness: To facilitate effective resource management, sport should be targeted for expanding information and public awareness raising on environmental issues, focusing on the following areas of deficiency:

- Lack of precise information on the number of fauna and flora species present in Yemen, or on rare, threatened endemic species and their habitats;
- Criteria for defining critical habitats or biotypes are missing;
- Lack of information on the status and habitat requirements of species at risk
- Lack of adequate information of the type, numbers, status and structure of alien species;
- Low public awareness and appreciation for biodiversity conservation;
- Insufficient and unreliable information and networking on agricultural biodiversity;
- Limited capacity and funding for biodiversity and agricultural research;
- Poor knowledge and understating of the nature and potential impacts of living modified organisms (LMO) on biodiversity;
- Lack of knowledge on eco-tourism attractions.
- Poor environmental awareness and ecological education amongst populations;
- Weak awareness and knowledge of solid waste impact;
- Lack of information on the vulnerability of watersheds to climate change;
- Limited public awareness on climate change and biodiversity issues;
- Poor understanding of the science of climate change domestically;
- Weak public awareness on biodiversity issues;

  Lack of national policy on Environmental education (EE)
- Biodiversity conservation and environmental protection themes are not integrated into school and university curricula.
- Notable absence of youth green clubs, green press, and eco-industry;
- Low level of public awareness in traditional and indigenous natural resource management systems, biodiversity conservation and sustainable development;

Financial: Tight Budget and limited financial resources are among the principle factors for the current deficiency in Infrastructure and facilities needed for addressing the following deficiencies:

- Lack of genetic resources centers that can collect genetic materials and conserve them to be available for research and genetic improvement.

- Lack of botanical garden for collecting and preserving rare and endangered flora.
- Absence of a Natural History Museum for biological diversity in Yemen
- A generalized deficiency in eco-tourism facilities.
- Limited geographic coverage of Protected areas (PA) associated with lack of PA management plans;

Technological:

Use of environmentally unfriendly technologies;

- Weak of national capacity in the field of modern biotechnology specially in Biosafety;
- Development and access to alternative energy source;

Capacity building: Reversing resources degradation require not only major investment in infrastructure, but the development of technical, financial, managerial and regulatory capacity to carry out effective environmental management and monitoring of available resources. Specific focus should be given to resolve the following capacity constraints:

- Insufficient staff and resources
- Insufficient level of professionalism and training in the tourism sector, including eco-tourism;
- Weak technical capacities in watershed management;
- Lack of human resources to address climate change issues;
- Notable shortage of trained manpower, specially of environmental educator and facilitators;
- Lack of professional and systematic training in the field of biodiversity 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 Interne;

Insufficient manpower of regional and local environmental bodies in planning and monitoring managing natural resources.

5.2.2 Needs and Opportunities to Address Biodiversity Issues

The conservation and sustainable use of Yemen's natural resources requires translation of Yemen's environmental problems/ issues into a well-defined capacity needs for enabling various concerned agencies address environmental issues at system institutional and individual levels in line with biodiversity convention provisions and pursuant to national priority goals. Below is an outline of overall needs for conservation and sustainable use of Yemen's biological resources

4.2.2.1 HABITAT & BIODIVERSITY CONSERVATION

Protecting the nation's habitats and reversing degradation requires a good understanding and adequate information on Yemen's habitats and eco-systems, particularly the following:

- Database for biodiversity resources and protected areas
- Research on protected areas and conservation management practices.
- Inventory existing information on endemic plant and animal species.
- An IUCN red list of rare and endangered species of Yemen.
- Database for alien species
- Reporting system for monitoring biodiversity deterioration.

Other important needs are establishing sound institutional and policy frameworks and the building of management capabilities with special focus on the following most important needs:

- Co-ordinating management mechanisms protected areas.
- A single department to manage protected areas
- Specialized unit for alien invasive species.
- Strengthen quarantine centers to control introduction of alien invasive species
- Establishment of gene banks, seed banks, green belts and public gardens.
- Adequate network of protected areas, representing key eco-systems of Yemen.

Of special concern in the conservation of critical habitats in Yemen is the development of new protected areas in new sites of importance to the conservation and preservation of the remaining country's biotic assets. This has been a concern for some time and the following sites has been identified as most important:

- Six sites representing mountain ecosystems. Potential areas Jabal Bura'a, Jabal Hawf, Utoma, Jabal Eraf, an Jabal Al-Lawz,
- Additional three costal zone Protected Areas in Jathmon, Sharman and other areas are needed for complete representation of key marine eco-systems of Yemen.
- Support should be given for small-scale village conservation projects in combination of awareness raising, gender, NGO and community participation and ecotourism.

Existing initiatives in establishing ex-situ collections of plants and animals need to be strengthened and expanded. There is a particularly urgent need to develop botanic gardens that have conservation goals explicitly built into their management plans. In addition, municipalities need to be encouraged and assisted in making municipal parks and zoos more useful as repositories of biological material as well as centers of environmental education.

The illegal logging of mangrove forests will be reduced through cooperation with local communities, authorities, through awareness raising as well as law enforcement measures.

However, investment in conservation programme should be supported with adequate and enforced policy, legislation and action plans for effective utilization of biological resources particularly in the following areas;

- A national policy on ex-situ conservation.
- By-laws and regulations enforcement on endangered and threatened wildlife species.
- Legislation controlling the importation and trade of alien invasive species.
- Recovery and rehabilitation plan for threatened species.

Community involvement is crucial for the success of any conservation management program. Therefore, it is of special important to encourage and support local community-based programs on conservation of endemic, endangered fauna and flora.

5.2.2.2 Sustainable use of components of biological diversity
Terrestrial Wildlife Resources

To facilitate effective of management Terrestrial Wildlife Resources, technical support will be needed to expand information on biodiversity, land resources (e.g., endangered ecosystems, habitats, vegetation and threatened or rare endemic species, rates of depletion of land) and manage that information through an appropriate database and introduction of a low-cost GIS. To ensure effective biodiversity monitoring and land management, efforts should focus on filling the following critical data needs.

- Maps on endangered ecosystems, habitats, vegetation and threatened or rare endemic species.
- Surveys of rangeland utilization and management patterns
- Adequate mapping of soil degradation and desertification
- Surveys, habitat mapping, and sensitivity analysis of coastline, including distribution of rare and endangered species.
- Surveys of areas suitable for eco-tourism, considering habitat vulnerability.
- Criteria for eco-tourism development in protected areas.
- An Update of a directory for Eco sites.

Coastal and marine resources

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 and eutrophication, including from land-based activities;
- Invasion of alien species; and over utilization of living marines and coastal resources.

Priority actions to address these treats are:

- Integrated Coastal Zone Management Plans (ICZMP) for coastlands and marine eco-system
- Fisheries management plans and fish stock assessments.
- Halting uncontrolled urbanization and enhance land-zoning and land use management plans.
- Plans for improving sewage systems.
- Watershed management plans for limited pilot areas.
- Developing and implementing a National Adaptation Program of Action (NAPA).
- A National mitigation plans (NMP) for reducing greenhouse gases emissions from energy sector.
- An emergency and disaster management plan.
- Pilot tourism projects based on significant natural and/or cultural attractions.
- Pilot projects for composting, recycling, and reuse of solid waste
- Programs to decrease waste production in households.

Forest, terraces, and rangeland Conservation

Efforts to combat desertification needs to expand conservation of plant cover, and reduction of soil erosion through watershed management, establishment of green belts against moving sand dunes and sand expansion in selected areas. The sustainable use of agricultural biodiversity also needs conservation and protection of forest, terrace, and rangeland which mobilizing resources for the following immediate needs:

- Resources for forest restoration and desertification control.
- Rangeland policies and programs
- Pilot projects on land use management, terrace management, desertification, and in situ conservation of rangeland.
- Re-plant/re-forest mangroves wherever feasible.
- In situ conservation programs of indigenous crops by farmers.
- Integrated pest management Programs.
- Programs on conservation of plant cover, reduction of soil erosion and watershed management.

At institutional level, it has become necessary, and steps were taken, at present, to establish a central coordinating body national body for ICZMP. Similarly, to mitigate adverse effects of natural disasters frequently occurring in the country, there is urgent need to create national coordination body for emergency and disaster management

- Enforcement of rangeland management and controling illegal logging.
- Enforcement of land regulation, pricing and registration.
- EIA Enforcement waste projects (e.g. landfills, waste projects, and treatment plants).
- Nation-wide application of water quality standards (standards for drinking water, irrigation water, wastewater disposal and bottled water).

The Yemeni Government needs to set up an Incentives System which may offer incentives to the authorities, establishments, individuals, and others who undertake works or projects that protect the environment. Incentives for propagation of local and crop varieties and replacing Qat plantations with cash crops, coffee and grapes would reduce overuse of depleting under ground water for qat plantation. Generally, evaluation of subsidy programmes in different sectors would help to modify those measures that negatively affect the conservation and sustainable use of biodiversity. Financial subsidies from the government to promote biodiversity in agriculture, can be designed by cultivation of rare species and varieties.

5.2.2.3 Access to and transfer of technology

A greater effort should be made to transfer green technologies, in particular related biotechnologies, within the framework of aid and development programmes. The private sector, however, can plays an important role in this respect, particularly in the following areas:

- Application of eco-tech in industry.
- Assess needs for mitigating GHG emission and potential use of renewable energy.

- Switching to cleaner energy sources and technologies to reduce fuelwood consumption.

4.2.2.4 Environmental impact assessment

To enhance national capacity in monitoring Biological resources utilization it is needed to create an operational monitoring and assessment system , including EIA policy & Procedures, clearer criteria and responsibilities for EIA application and enforcement. Specific need in this area include establishment of laboratory for air, water, and soil quality along with improved Information and Knowledge Management System and Enhanced staff capacity in preparing and implementing EIA.

Efforts should be made to amend EIA regulation 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. Enforcement of EIA procedures implementation for planed project, focusing on:

5.2.2.5 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 the risks on biodiversity associated with the transfer of biotechnology and the use of living modified organisms (LMOs). Furthermore, there is no specific entity responsible for handling the safe use and transfer of biotechnology and LMOs. 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, there is a need to develop a national biosafety framework.

- Assessment of existing biotechnologies and their safe application and use.
- A national biotechnology policy and biosafety frameworks.
- An entity for the management of biotechnology and biosafety issues.
- National Biosafety Database.
- Strengthen institutional capabilities in the field of Biosafety.
- Enhance management skills in biosafety issues through training.

5.2.2.6 Public Awareness and Participation

It is generally agreed that the current level of ecological awareness, especially among decision-makers and relevant agencies, is still very poor. So long as it remains so, conservation measures will be less than adequate and policies for sustainability are unlikely to be adequately supported by policy makers. Similarly, the impacts of human actions on ecosystems and the level of biological monitoring remain poorly limited.

Efforts by government agencies and NGOs are under resourced and the following actions are needed to overcome this situation:

1) Developing a national strategy that addresses issues of environmental awareness and education at the national and local levels,

2) Ensuring the effective transfer and integration of new HQYLURQPHQWDO knowledge into the educational and training system,
3) Strengthening and raising environmental awareness through a nationwide public campaign,
4) Improving the free flow of information to the public; and
5) Establishing mechanisms for monitoring the state of the environment and progress towards sustainability

Future Specific Need to in this area are**:**

- Capacity needs assessment for including environmental themes into schools and universities.
- A nation-wide and comprehensive campaign on biodiversity issues
- Expansion of youth organizations, green clubs, green media and NGOs to act as advocacy groups for the protection of nature and the environment
- Green themes adequately included in curricula of schools and universities.
- Strengthening the capacity of non-governmental conservation and development organizations as advocacy groups to promote biodiversity conservation.

5.2.2.7 Indigenous Knowledge and Traditions

Traditional knowledge have play most important role in the conservation and sustainable uses of natural resources for long time. Many of these skills, practices and techniques presently retarding leading to significant loss of agricultural landscapes, terraces, rangelands and habitats. Therefore, reviving traditional knowledge, skills techniques and practices has become most important for the future survival and continuing production of the remaining ecosystems of Yemen. Of priority needs in this context are:

- Documenting traditional knowledge, skills and practices on biodiversity conservation.
- Reviving and improving abandoned systems, techniques, practices, skills and methods on biodiversity conservation.
- Incentives for adapting eco- technologies, both new innovations and traditional systems, in resource management.

5.2.2.8 Capacity Building

Yemen lacks national capacity in the field of biodiversity conservation and sustainable use, which is hampering the nation's ability to conserve and manage its unique and critical biological resources. The Government has yet to enable the environmental agencies in fulfilling its responsibilities under Law EPL and international conventions. Furthermore, Line Ministries and Govern orates lack capacity in natural resource management and continue to monitor biodiversity loss and to implement projects, which needlessly and detrimentally impact Yemen's natural assets. Specific needs in this area are:

- Training needs assessment for environmental agencies and NGOs.
- National, regional and local training plans for biodiversity issues.
- Training programs in desertification control planning, sand dune management, monitoring and impact assessments, GIS and remote sensing techniques.

5.2.2.9 Equitable Sharing of Biodiversity Benefits

Currently, there is no adequate policy and legislation regulating the sharing of benefits derived from the use of genetic resources. Therefore in order to enable local communities and central government better uses these resources, there is urgent needs for undertaking the following actions:

- Income generated from nature-based tourism.
- Increase the income generated from wild plants through finding and propagating new commercially valuable plants
- Incentives for marketing cash crops products in protected areas
- Incentives for fishing communities in adopting equitable quotas of fishery resources.
- Policies and programs to facilitate equitable participation of local communities to resource management and benefits from the use of these resources.
- Guidelines for trading Yemen's native genetic resources for pharmaceutical and biotechnological uses.

5.2.2.10 Access to genetic resources

In Yemen, access to genetic resources is relevant for varieties used in agriculture. Access to wild species with the exception of endangered and threatened protected species, is not restricted. Yemen strategy is to establish a gene bank, whose task is to provide free access to genetic material.

5.2.2.11 Policy, Legislation and Institutional Structure

Fragmented and uncoordinated development of policies and legislations in addition to deficiencies in regulatory and economic policies are key factors contributing to biodiversity loose and land degradation. Managing Yemen's habitats requires the establishment and implementation of effective institutional framework. The existing mandates of the relevant institutions needs to be harmonized based on in-depth review of current legislative and policy framework. To remedy this situation, 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 environmental policies and programs. 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;
- Strenghtening 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 sectorss, NGOs and local councils in environmental protection activities.

- Expanding decentralization policy through providing adequate power to regional, local governments and local communities in addressing biodiversity issues.

5.2.2.12 Monitoring and Reporting

To effectively assess the implementation of the NBSAP, a comprehensive monitoring, and reporting mechanism should be established to guide all stakeholders to meaningfully participate in the process of operationalzing the implementation of NBSAP. Such a mechanism will also help institute broad-based accountabilities and responsibility for sustainable development among members of society. This mechanism may include the following elements: (a) a system to coordinate and evaluate the extent to which the NBSAP has been adopted and implemented by all stakeholders; (b) a system to coordinate, support and enhance existing national and local multi-sectoral as well as sectoral monitoring, evaluation and information exchange on the implementation of initiatives related to the NBSAP; and (c) a system for reporting, feed backing and utilizing the monitoring and evaluation results on the implementation of the NBSAP for international, national and local stakeholder communities.

Prior to the above there is need for a nationwide coordination committee for implementing the NBSAP and for and entity for application of EIA for all development projects as well as to environmental indicators for monitoring resources deterioration.

6. Government's Response to Address Environmental Challenges:

Halting biodiversity and natural resources degradation requires multiple interventions, some broad-based to deal with environmental and natural resources management in general, and others more specific to biodiversity management. Based on this understanding, the Government has developed several policies, strategies, action plans and investment programmes which are either partly or fully conducive to environmental considerations. The National Biodiversity strategy and Action Plan (NBSAP), the National Environmental Action Plan (NEAP), National Action Plan to Combat Desertification (NAPCD), National Wastewater Strategy, water strategy, National Watershed Management Policy, Aden Agenda, and Water policy are among policy documents that more responsive to environmental concerns. Of key policies and strategies that have parallel aims to those of biodiversity objectives are: second five years development plan (2000-2005), Vision 2025, Poverty Reduction Strategy Paper (2003- 2005), Yemen's National Report Submitted to the World Summit on Sustainable, and National Population Action Plan. Below is a synopsis and descriptions of the goals, objectives and programmes of actions identified by each of these policy documents, particularly those addressing conservation and sustainable use of Yemen's biological resources.

61 Environmental Policies and Strategies

National Environmental Action Plan (NEAP)

The conservation and sustainable use of Yemen's natural resources requires translation of Yemen's environmental problems and issues described in chapter ( ) into a national vision highlighting overall conservation goals, objectives and potential program of actions for achieving the targeted objectives. Therefore, the EPA in cooperation with line ministries developed the National Environmental Action Plan (NEAP) of 1995 to be the first environmental planning document outlining the government's Vision, objectives, strategy and priority actions for halting environmental degradation for the period 1996-2000.

The NEAP identifies 5 environmental problems as main areas of focus for halting biodiversity and natural resources degradation. These issues are water depletion, land degradation, habitat loss and waste disposal. Under these main environmental problems, the NEAP identifies 14 sector-specific issues that are most critical and need immediate remedies if sustainable development pattern for managing depleting natural resources is to be maintained. To resolve environmental issues, the NEAP recommends 14 objectives, each targeted to an area of critical issues as listed in table( ).

Table : Sector-Specific Objectives

Main problems	Specific concerns	NEAP objectives
Water depletion	1. Over extraction of water resources	1. To conserve water resources
	2. Water Pollution	2. To protect more resources from pollution
	3. Inadequate water supply	3. To provide clean drinking water to 75% of the population by year 2000
Land degradation	4. Soil erosion	4. To execute the national programme for desertification control
	5. Deforestation	5. To improve management of forests
	6. Agricultural and rangeland deterioration	6. To improve the management of agricultural land and rangeland
	7. Urban encroachment	7. Establish a system of land use planning /zoning and identify protected agricultural areas
Habitat Degradation	8. Degradation of natural habitats	8. To stop the degradation of natural habitats
	9. Loss of biodiversity	9. To protect Loss of biodiversity (endemic, rare and endangered species from extinction)
	10. Lack of management of eco-tourism	10. To develop and regulate Eco-Tourism sector
Waste disposal	11. Waste water disposal and treatment	11. To provide waste water collection, treatment, and disposal facilities
	12. Disposal of solid waste	12. To provide Solid waste management, including recycling and Re-use of waste
	13. Disposal of hazardous waste	13. To manage hazardous waste. And to rganize environmental inspection
	14. Pesticide management	14. To manage pesticide

National Action Plan to Combat Desertification (NAPCD)

Given the significance of desertification and land degradation in Yemen, the Government has been very active in combating land degradation and acceded to the United Nations Convention to Combat Desertification and Drought (UNCCD) on January 1997. Following this step, the government appointed the General Directorate for Forestry & Desertification Control (GDFDC) as a Focal Point for the CCD and subsequently developed the National Action Plan to Combat Desertification (NAPCD) was in 2000. The NAPCD The plan was prepared via a thorough consultative process and provides a comprehensive picture on the national capacity constraints and needs of land degradation management. It outlines the direct & indirect causes of Desertification; physical & sociological aspects of desertification; desertification policies; and Programme implemented; and strategic framework and action plan to combat desertification. The objectives of the action plan include sustainable and integrated land management; poverty reduction; institutional and legislative improvement in the area of desertification and draught. These are to be accomplished through specific recommended actions at the national and regional levels such as: drafting new strategies and laws, (particularly in the water and resources sectors), tree planting, water shed protection, terrace rehabilitation, sand dune and river bank stabilization.

Yemen's first National communication

Yemen's natural systems and economy generally suffer from the mounting pressure of high population growth rate, limited natural resources, and economic problems. Under anticipated climate change, these problems is expected to exert additional stress on and deterioration of country limited resources, including ground water, arable land, forests, and rangelands, and costal zone. Recognizing climate change threats, the government of Yemen ratified the United Nations framework convention on climate change (UNFCCC) on 21 February 1996 and immediately initiated a process to meet the commitments of the Convention. With a joint GEF/Netherlands financial/technical assistant the Government of Yemen has completed the following important enabling actives:

1. The first National communication (NC)
2. GHG inventory
3. GHG abatement analysis
4. Policy frameworks to abatement GHG emissions and enhance forest sinks.
5. Climate change scenarios.
6. Vulnerability assessment and adaptation analysis on the agricultural production (selected crops).
7. Vulnerability assessment and adaptation analysis on the water resource sector (targeted site)

The NC provides an inventory of GHG emissions and sinks, a brief analysis of vulnerability to climate change, and a description of past and potential measures to mitigate GHG emissions.

Waterpolicies

Given the current limited quantity of freshwater resources, and the anticipated future pressures of growing human demand, effective water management and conservation are absolutely critical planning and sustainable use of natural resources. Therefore, number of strategies and policies have been adopted by the government to address water resource issues, including watershed management, water reuse and conservation, and irrigation. Some have been passed into law while others are awaiting approval. These measures are therefore described in more detail below.

National Wastewater Strategy: In March 2000, a draft National Wastewater Strategy was prepared with the assistance of the FAO. This strategy is oriented towards improving the sustainability of agriculture and encouraging on-farm reuse of water; creating and strengthening institutional and legislative mechanisms dealing with water reuse; and supporting improved planning and management of water resources. As irrigated agriculture accounts for the overwhelming majority of freshwater demand, such measures are actual steps toward adaptation and can lay the groundwork for increased conservation in this sector.

National Watershed Management Policy:

This Policy was endorsed by the Cabinet in 2000, this policy has as its objective the implementation of integrated watershed management planning for the protection and development of natural resources, as well as institutional capacity-building to implement existing legislation and the development of appropriate natural resource legislation.

The Vision 2025

The Vision 2025 the government of Yemen has clearly stated that the increase in population has a negative impact on the situation of the natural resources and environment of the country. Especially the water resources are threatened by over exploitation and pollution. Land degradation and desertification is increasing due to deforestation, unsustainable livestock management and irrigation practices. Costal and marine environments are affected by over-fishing as well as by land based activities such as the dumping of industrial waste in the shores. Urban expansion and the absence of a nationwide waste management program e.g. for hazardous waste cause major pollution. Gaseous emissions from industrial activities, oil refineries, energy generating stations and vehicles cause air pollution, which additionally effects the environment and health situation of the people in Yemen.

Therefore Vision 2025 supports following actions:

- To develop and implement sustainable management and monitoring programs for water resources, land resources and agriculture, costal zones, biodiversity and waste.
- To develop a desertification combating program.
- To provide energy substitutions.
- To use environment friendly technology and enhancement of renewable energy resources.
- To implement environmental impact assessments for projects.
- To increase public awareness in all environmental fields.

Poverty Reduction Strategy Paper (PRSP)

Poor people contribute to the loss of biodiversity and natural resources through several unsustainable forms of utilization, including woodcutting, over harvesting of flora, and fauna. These patterns of utilization contribute to deforestation, loss of vegetation cover, soil erosion (12 mill hectares), desertification (3-5%) and land degradation. The deterioration of natural resources and loss of biodiversity occurs due to poor environmental awareness and control.

In response to this situation, the Government Poverty Reduction Strategy Paper (PRSP) of 2002 acknowledged the relationship between poverty and environment and thus calls for meeting the needs of poor people, while accounting for conservation of natural resources through number of actions including the following:

- Enhance the technical capacities of relevant institutions to develop comprehensive environment and development projects and programs relying on community participation
- Development of a legal framework
- Institutional empowerment of local organisations
- Carry out field studies to ass the environmental conditions
- Find incentives, accompanying awareness programs
- Provide job opportunities through environment projects
- Undertake environment assessments of development projects
- Finance projects that provide soft loans for the poor

Priority programs and projects as mentioned in the PRSP are:

1. Sustainable environmental Management
2. Update and activate Environmental Protection Law
3. Monitoring the Environmental Impact of Agriculture
4. Comprehensive development plan for Socotra

Yemen's National Report to the World Summit on Sustainable Development

Yemen's National Report submitted to the World Summit on Sustainable Development provides a very general overview of social, economic, and environmental conditions in the country; identifies key challenges in these areas; gives an account of institutional arrangements for sustainable development; and makes recommendations for improvements in the various sectors. The WSSD report could be quite valuable in placing adaptation activities into a "bigger picture" and in identify potential synergies with other national sustainable development goals.

The Second Five Years Development Plan

The Government of Yemen is presently executing its Second Five Year human development plan for the period 2001-2005. The overall objective of the plan is to achieve economic growth, job opportunities, and the realization of economic & social stability.

The Second Five Years Development Plan, which was launched in 2001, also addresses sustainable development priorities and sets as an objective “to preserve the nation’s natural resources and maintenance of the ecological system through a balance between socio-economic

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 supporting the participation of relevant agencies, target groups and local communities.

6.2 Priority Environmental Programmes for the period of 1996-2000

To meet NEAP targets identified in table( ), the Government developed NEAP Priority Action, 1996-2000, designed for the protection of coastal and marine environment, sustained use of land, water and marine resources, conservation and sustained use of countries biodiversity and natural habitats & improved quality of life in rural and urban areas including the public health. The investment Programmes, presented in table, covers NEAP's issues of specific concerns, particularly those related to biodiversity such as degradation of natural habitats (forests, wetlands, coastal habitats), loss of biodiversity (extinction of endemic, rare and endangered species), and, lack of management of eco-tourism.

Table: NEAP Priority Action - 1996-2000

CATEGORY	PRIORITY ACTION
Institutional	1. National - Capacity building of Environment agencies 2. Local – Pilot program for improvement of environmental conditions at local level 3. International – Disaster preparedness at Aden and Hodeidah ports for oil spills
Water Resources	4. Strengthening of the National Water Resources Authority 5. Development of a National Water Resources Information System 6. Design of a comprehensive Water Law 7. Improvement of rural and urban water supply services 8. Economic control of water waste and water pollution
Land Resources	9. Establishment of land use planning center to promote land zoning and land registration 10. Implementation of three top-priority projects in desertification control 11. Promotion of traditional grazing reserves and modern pest management techniques
Natural Habitats	12. Establishment of Socotra as a National Protected Area. 13. National inventory and data base development of fauna and flora 14. Preparation of a Coastal Zone Management Plan 15. Constitution of eco-tourism department at General Tourism Authority

Waste Management	16. Privatization of solid waste collection and recycling 17. Privatization of treatment, storage, and disposal of hazardous waste 18. Regulation of hospital waste treatment and disposal, plus pilot project

Being the first country planning policy, the NEAP Priority Action has been used as guiding principles for incorporating environmental issues in the first and second national five-year plans and its subsequent investment Programmes as well as for mobilizing donors support for environment Programmes for the period 1995-2000. Based on this planning policy the government has planned and implemented several environmental programmes some of which funded fully from government source and some others have been jointly funded by government and donors community. The scope, objectives and durations of these from both sources of funding are provided in tables 1 and 2, which are annexed to this report.

However the donors community funded programmes has addressed the biodiversity concerns in link with protected area establishment, forest restoration and conservation, databank and genetic resources center establishment, eco-tourism, desertification, sand dune stabilization and the regeneration of watersheds, examples of these initiatives are:

- Watershed Management and Wastewater Reuse in Per-urban Areas
- Sustainable environmental management, YEM/97/100: Planning for Desertification Control
- Sustainable environmental management, YEM/97/100: Information and Advice on Land Resource Utilization
- Establishment of windbreaks in farming areas in Hadhramawt and Sand dune stabilization, west of Wadi Sihamm
- Socio-Economic Development and Master Plan for Socotra Surrounding Islands
- Protected area and Coastal zone management Project (PAM &CZM Project)- On-going project
- Socotra Conservation Development Project (On-going project)
- Conservation and Sustainable Use of the Biodiversity of Socotra Archipelago
- Environment, Natural Resources and Poverty alleviation for the population of Socotra Archipelago
- Biodiversity strategy & action plan
- Strategy Action Plan for the Red Sea and Gulf of Aden
- Protection of Marine Ecosystems of the Red Sea Coast
- Basic Needs of Socotra Assistance for the People Socotra Archipelago
- Sustainable environmental management, YEM/97/100- sp5: promotion of eco-tourism
- TAIZ Flood Disaster Prevention and Municipal Development Project

Government programmes on the other hand has focus on restoring and ensuring the sustainability of land and water resources through: Watershed protection, terrace rehabilitation, control of sand dune movement, wadi bank protection, afforestation, agro-forestry, and a variety of forest management and watershed protection techniques. The key results and the state of implementing Government and programmes are discussed in section ( ).

6.3 Key Achievements in Addressing Environmental Problems Related to the Biodiversity Convention

The overall achievement from the implementation of the National Policies, Strategies and Action Plans addressing Conservation and Sustainable Use of Biodiversity since CBD convention ratification in 1995, are as follows:

6.3.1 Land Degradation

In its attempts to address environmental issues, the Government has been very active in combating land degradation and acceded to the United Nations Convention to Combat Desertification (UNCCD) on January 1997. Following this step, the government appointed the General Directorate for Forestry & Desertification Control (GDFDC) as a Focal Point for the CCD and subsequently developed the National Action Plan to Combat Desertification (NAPCD). In addressing land degradation issues, the Government has undertaken several activities which deal with topical foci of CCD convention such as water shed protection, terrace rehabilitation, sand dune and riverbank stabilization.

Over the Project lifetime, 1996 –2003, Tihama Environment Protection Project has stabilized sand dune encroachment in Wadi Siham and Wadi Zabid, and Hudaydah through number of successful measures, including shelterbelts establishment, introducing water-saving measures in irrigation, provision of extension services, provision of credit for improved agricultural and animal husbandry practices and veterinary services.

In Marib area, the Tihama sand dune stabilization Project has protected 850 hectares of agricultural land, trained local technician, encouraged villagers to participate in land preservation, and compiled database and reports useable for dunes-stabilization in other areas. The two projects have introduced new species of tress useful for stabilization and windbreaks.

In the Wadi of Hadhramout, the Wadi Hadramoud Agricultural development project has enabled the Ministry of Agriculture and Irrigation to consolidate, expand and ensure sustained development of land and water resources in the Wadi Hadarmout area. This results have been achieved through similar activities including construction and rehabilitation of irrigation infrastructure, spate irrigation systems in addition to forestry and sand stabilization activities.

The Land and Water Conservation Project (1995 -1999) of the World Bank has helped the government in strengthening forestry management by restructuring GDFDC mandate, structural organization and forestry regulations. In addition, the project has strengthened the sustainable management of agriculture and forestry through introducing technologies for irrigation, forestry and land conservation, expansion of indigenous practices in forestry, soil and water conservation, including urban waste water effluent reuse for irrigation, watersheds management and terraces stabilization.

In Abyan delta, which is the center of very important sand movement of marine origin, the "Land and Water Conservation Project" has undertaken several anti-erosive measures through coastal foredune construction and shelterbelt establishment for systematic protection of the shoreline

6.3.2 Biodiversity conservation

Over the past few years, Government efforts to protect and sustainably 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 of 16 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, Eraf forest, Ket Fah, 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 have been cited important for the protection of marine and coastal biodiversity. Progress made towards establishment of protected area at these sites are presented below:

Prtotected Area of Socotra Archipelago

For its diverse terrestrial plant and animal life with a high degree of endemism, Socotra Archipelago is the first conservation system, which is officially declared and established as protected area in Yemen. It has been established as a multiple-use protected area.

Based on the high degree of endemism and unique vegetation types on Socotra Archipelago, it has been described by the World Wide Fund for Nature(WWF) as an Indian ocean version of the Galapagos. For its national biological importance, the Government of Yemen has declared it as Protected area. In same year the government established the inter-ministerial committee Island (HCDSI) for the development of Socotra and designated the environment protection authority as the secretariat of the high committee. More importantly, the government announced the allocation of US$ 2 million for the initial cost for developing a master plan for development of Socotra Archipelago. In response to government initiatives, EU, UNDP, UNICEF, WHO and others donors allocated additional US$ 5 000 000 for formulating the plan, which was completed in early of 2001. Based on secotoral surveys and socio economic studies, the plan identifies 69 project concepts and 7 proposals of priority projects for the development of the Island.

Conservation and Sustainable development efforts are best described in the results of the GEF/UNDP/UNOPS Project "Conservation and Sustainable use of Biodiversity of Socotra Archipelago", 1997-2001,. The principle achievement of the Project was the establishment of a Socotra Protected Area, including the preparation of biodiversity conservation Zoning plan for the archipelago. The Government in the year of 2000 endorsed the plan and by this step the Archipelago is now meeting all the requirements for its declaration as a man and biosphere and possibly a world heritage Site by UNESCO. According to the zoning plan of Socotra archipelago, total area of archipelago is divided into three zones designated for following uses:

- Resource Use Reserve, including General use zone, with total land area of 890 sq. km, or 23.8 percent of the archipelago's total area
- National Parks, including areas of special botanical importance, with total land area of 2748.3 sq. km, or 73.6 percent of the archipelago's total area

- Nature Sanctuaries with total land area of 95 sq. km, or 2.5 percent of the archipelago's total area

2 MP and one underway

To facilitate implementation of zoning plan, the government with support from GEF is creating Socotra Conservation Fund to foster and promote all future conservation efforts in Socotra including the implementation of the zoning plan.

Given the virtually absolute dependency of Socotra people on renewable water and rangeland resources for meeting their basic needs, the government gave special attention to the preservation of such resources through Socotra Basic Needs project. The project contributed towards the conservation of rangelands through construction and rehabilitation of protected rainwater catchments systems (kareefs), reinforcement of watering holes and construction of small dams. Under this project, information and maps on vegetation, and rangelands patterns of land utilization were gathered for many parts of the Island and used for developing and improving database on rangelands and watershed.

In-Land Protected Areas:

In view of their representation of what remains from ancient tropical rainforests, there is currently a joint WB/GEF/Gov. project for declaring Jabal (Mount) Bura'a and the Hawf Forest as protected natural zones.

Since its commencement, the project had surveyed, mapped and studied the status of biodiversity, flora and fauna socio economic factors of Hawf and Bura'a and has successfully completed the following important results:

1. Comprehensive management plan for Hawf forest complete with conservation zoning Plan, community-based management plan , and eco-tourism plan;
2. Similar management plan for Bura'a area is expected to be finalized by December, 2004;
3. Surveys of biodiversity, flora and fauna and land tenure patterns in the two areas;
4. Legal Studies and Economic Opportunities Reports;
5. Training Needs Assessment Report;
6. Guidelines for replicating PAM model, selection, establishment and management of other protected areas;
7. Guidance for institutional framework for developing and supporting a Protected Areas Network in Yemen; and
8. Maps for Hawf and Bura'a areas including the following:
    a. General vegetation map for the two areas
    b. Topographic map base showing local administrative boundaries, forest reserve boundary and protected area boundary
    c. Geographic , Geological and Hydrological Map
    d. Land Use Map
    e. Natural habitat/biodiversity management map

Coastal Zone Protected Areas:

Under the same project, similar studies surveys and mapping activities are taking place with aim to enable Government declaring the coastline of Balhaf- Burum and the coastline of Sharma-Jethmun as protected area over the year of 2005.

Planned and Future Protected Areas

On 2 June 1999 the Council of Ministers issued the Decree No. 137 declaring Utomah as a Natural Protected Area. The area is 60 km from Dhamar govornorate which is in turn 90 km south of Sana'a capital. It has a population of about 120,000 people, mostly farmers working in cultivated terraces and livestock, principally cattle, small sheep and goats.

6.3.3 National Biodiversity Strategy and Action Plan

The loss of biodiversity is the main specific issue of the habitat degradation problem in Yemen, and emphasized the need for inventorization of flora and fauna, including those species that are endemic, rare and endangered. Development of a Biodiversity Strategy and Action Plan is urgent as it will be the basis for implementing a national policy on protection of natural resources from over-exploitation.

Conservation of biodiversity is vital in a country such as Yemen, where eco-systems are fragile and the renewable natural resources are scarce. Those ecosystems are deteriorating rapidly due to multiple interacting factors mostly due to socio-economic changes which result in excessive grazing, soil erosion, over-fishing, over-hunting, land degradation and declining biological diversity. Yemen has recognized the necessity to protect natural resources and biodiversity as reflected by the ratification of the Convention on Biological Diversity (CBD). To capture part of its commitment as specified in Article 6 of the Convention, the EPA has secured the funding of UNDP/ GEF project YEM/96/G1 to develop National Biodiversity strategy and Action Plan (NBSAP) for the conservation and sustainable use of Yemen's biological diversity. Main results of this project are National inventory and data base development of fauna and flora, and the production of a National Biodiversity Strategy for conservation, sustainable use and for benefit sharing of Biodiversity resources. The project also has produced several studies, identifying biodiversity loss, threats, and needs for halting such loss. During the development of the strategy, several activities were completed including capacity building of relevant institutions, provision of on-the-job training in cross-sectoral planning and information management, biodiversity planning, biodiversity assessment methodology and public awareness.

Eco-tourism

In view of increasing tourist activities in Yemen, the government under Sub-programme 5- promotion of eco-tourism- of Sustainable environmental management 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. 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. In support to ecotourism management, local authority has developed a Costal Zone management plan for Aden coastal area and now is in the process of mobilizing resources for its implementation.

Ex-situ Conservation

AREA in corporation with UNDP project on Sustainable Environment Management Programme has established a Plant Gene Resources Unit under its land resources management and planning Center. The aim of the unit is to collect and conserve wild and crop plant species, both native and exotic. Since its establishment, the unit has been involved in research programs mainly focused on classical plant breeding of field crops like wheat, sorghum, maize millet, barely and pulses (lentil). The vegetable breeding program of potato, tomato, and onion has many successes. The cash and oil crops like cotton, sesame, and peanut breeding programs started so early. Germ plasm of potato where imported from Netherlands and France and cotton germplasm were introduced so early from Sudan. Other Germphsm are of local varieties and from international research center ICARDA.

Gene bank of field crops, fodder and vegetable at the head quarter in Dhamar has good collection but it has modest facility. The major problem is the unreliable power supply and well-trained staff to maintain, evaluate and characterize the germplasm in adequate way.
Since 1998 in collaboration with national atomic energy committee fertigation project started for potato, banana, tomato to efficiently use irrigation water. The mutation-breeding program using irradiation started for wheat, barely, cottons sesame and lentil.
In general no modern biotechnology facility or research are there at AREA, although its 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 generically modified material are less in number.

6.3.4 Biodiversity information, identification and monitoring

The government of Yemen has approved environmental Impact Assessment Policy and regulation in 1998. Yet, its implementation in large-scale projects is weak and there is urgent need to studying and analyzing the environmental feasibility of proposed projects, whose construction or activities might affect the safety of the environment.

Efforts should be 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.

During the development of National Biodiversity Strategy and Action Plan (NBSAP), sectoral papers of special importance to the strategy development and to the documentation and monitoring of natural biodiversity were completed. These include

- Yemen's report on Protected Areas Management system, including Protected Areas Identification of Prioritization.
- National inventory of flora and fauna, particularly those species that are endemic, rare and endangered.
- Study on traditional knowledge and management of natural resources of Yemen.
- Sustainable use and conservation of agricultural biodiversity.

- Report on coastal and marine biodiversity. Assessments report on socio-economic biodiversity.

There is a lack of qualitative and quantitative data on the status of natural resources in the country. Consequently, public awareness of environmental degradation and its implications is fragmentary and not founded on complete information on ecosystems and land use systems. While people in the primary sector may clearly see the effects that depletion of land has on crop, animal production etc, neither the seriousness of the problems nor the causes and the process involved are always well understood. 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 well being 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.

For above reasons, 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.

The NEAP will be up-dated and fully integrated in the national development plans. In-service training and study tours for EPC, MPD and other agencies staff will be arranged.

- 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 Govornorate). 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:

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

In support to these activities ,

- Comprehensive study on underlying causes of desertification in Yemen;
- Report on management of traditional grazing reserves and community participation in land resource management;

Environment Resource Assessment for Rural Land Use Planning

- Rehabilitation and development of dam reservoirs
- Preparation of national irrigation policy;
- Priority action for improved irrigation

6.3.5 Preparation of a National Biosafety framework:

Yemen has actively participated in the negotiations of the " Biosafety Protocol "which have led to signing the protocol which is now in the final process of its ratification. At present, the EPA is in the process of preparation of a National Biosafety Framework involving the assessment of: current and potential application of biotechnology, existing administrative measures, relevant legislation and regulations, adequacy of existing human resources and capacity of existing institutions, identification of gaps and priority needs, preparation of a national biosafety framework and action plan, and prioritization of requisite capacity building needs called for in the UNEP Guidelines.

EPA in cooperation of national specialist from Agricultural Genetic center in Sana'a University is currently implementing programmes for developing National Biosafety Framework. The project includes activities such as, mobilizing expertise, developing common understanding on what is needed to support the preparation of a National Biosafety Framework. It contains stocktaking and assessment of the state biosafety through a number of surveys. These include a survey of existing biotechnologies and status of safety in biotechnology application including review and assessment of existing biosafety legislation and guidelines, sectoral manuals, institutional mechanisms and administrative measures. The surveys include also application of biotechnology. Existing mechanisms for harmonization of risk assessment/risk management, mutual acceptance of data and data validation must be surveyed. Survey of extent and impact of release of LMOs and commercial products is also required .

6.3.6 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.

6.3.7 Community Participation in Natural Resource Management

Conservation of biodiversity for the mutual benefits of Yemeni society at local and national levels require effective partnership and collaboration of all potential actors particularly at local level. Recognizing this fact and in light that local communities are the major factors around which conservation and sustainable use of natural resources must operate, the NEAP identified community participation as an important environmental policy tool in implementing needed actions conservation of biodiversity.

In line with NEAP policy, the GOY has progressively enabled local community to participate in conservation and restoration activities in many areas. In land resource management, local communities in Sana'a, Hadarmout, Shabwa and Taiz were actively involved in planning designing and implementing 20 village-base activities on flood control, water harvesting, tree planting and management, terrace stabilization etc. Yet, structural changes are needed in society to produce lasting solutions to the increasing environmental problems that are developing. Such changes need to be developed through appropriate nature and environmental policies.

Protection of the Marine Ecosystem for the Red Sea Coast

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.

Strategy Action Plan for the Red Sea and Gulf of Aden

Strategic Action Programme for the Red Sea and Gulf of Aden through analyzing, present and anticipated marine and land-based activities that harm the transboundary marine environment. Collecting information on habitats, threats to the marine environment and identifying hotspots issues and locations. Site-specific surveys will be conducted to provide more detailed analysis of the situation.

The Protection of Marine Ecosystem of the Red Sea Coast , based in Hodeidah, started in December 1995. The main objective is building the capacity for the Government in sustainable marine resource management through training and technical assistance in analyzing the marine environment and developing resource management strategies, including marine protected areas management, and by creating sharper awareness of environmental issues. Project activities include data collection and interpretation, environmental surveys and monitoring, EIA training and public awareness programme.

7. Future Agenda

7.1 Priority Environmental Programmes for 2002-2007

To translate national policies and NEAP into actions, the government has executed a number of national programmes under its First Five Years Plan (FFYP) for the period 1996 to 2000. In parallel to this, the government has also secured funding for executing a number of additional programmes for the protection and conservation of natural resources in line with NEAP priority actins. These have resulted in significant preservation of biological diversity, examples of these initiatives include the biodiversity conservation and development plan for Socotra islands, the establishment of protected areas, and forest conservation in selected nature reserves, and also the genetic resources databank.

Following the implementation of FFYP and donors funding Programmes, the EPA has undertaken in-depth review and assessment of the implementation of Government and donors initiatives with aim updating the NEAP.

This exercise came to a conclusion that the goals of sustainable development can never be reached through a short-term vision. A new approach was needed to concentrate on long-term vision and solutions since most of Yemen's development challenges require continuous action over a long period of time. Such long-term vision should however be flexible and liable to revision and correction through short to medium-term plans. This exercise has resulted in identifying and adoption of investment programme for 2003-2007 to bridge the gaps between current situation and NEAP targets. This programme has been prepared using a participatory and consultative approach, and is used as a working document for EPA's future activities. Based on the key environmental problems and opportunities 6 program areas were identified as priorities for the coming 5 years (2004-2008):

Summary Budget and Priority actions

Program area	Priority Action	Budget
1. Habitat and Biodiversity conservation	-Socotra Conservation and Development Program Protected area management, village conservation - Costal Zone management - Ecotourism	12 1.6 0.8 4.5
2. Sustainable Land management	- Support traditional and environmentally sound land use practices - Action program for forest restoration and desertification	0.7 1.6
3. Sustainable Water management	- Pollution Control for Fresh Water resources, Water supply and water harvesting systems	1.0
4. Sustainable Waste management	- Develop a waste reduction, reuse and recycling program - Management system for Hazardous waste - Emergency unit for Environmental Pollution	0.5 0.2 1.0
5. Sustainable Energy	Promote renewable energy Develop an energy use and air-quality strategy	1.0 1.0

Management		
6. Institutional Development/ Delivery Mechanisms	- Policy Development - Legal Affairs and Law enforcement - Information and Monitoring - Awareness raising and Education - Community, NGO and Gender participation - Technology Development - Institutional and Capacity Building	0.5 0.5 0.5 1.0 1.2 0.5 0.6
Total		**30.2**

6.2 National Biodiversity Strategy and Action Plan

Given the socio-economic importance of biodiversity in Yemen, the Government developed its National Biodiversity Strategy and Action Plan (NBSAP) & is now in last step to approve it. The NBSAP identifies key issues and threats to country biodiversity resource, propose measures and actions to address them and; and provide strategic framework and action plan to address priority issues. The National Biodiversity Strategy and Action Plan for the Republic of Yemen provides a set of strategic goals and the necessary action plans to achieve them. Its goals and objectives were identified in line with the Islamic vision and principles, which calls for conservation and sustainable use of biological diversity while respecting its biological limits.

NBSAP is therefore the future national agenda for tackling biodiversity issues. It aims to promote the conservation and the sustainable use of biodiversity based on strategic vision, highlighting 21 strategic objectives each of which targeted to one sector or an issue hindering the sustainable use of biological resources. The scope of the strategy is broad and includes the protection, restoration, sustainable use, equitable sharing, and systematic monitoring of Republic of Yemen's biodiversity. It includes a long-term comprehensive plan and a priority action plan. The later includes a set of 7 urgent actions expressed in project concept's format indicating project's title, goals, objectives, main outputs, main activities, timeframe, estimated fund and lead agency and key partners (for more information in this context please see Annex 1).
Again, the NBSAP is the result of the nationwide participatory process among all relevant government agencies & NGOs. The NBSAP addresses a number of environmental thematic areas such as: degradation of natural habitats (forests, wetlands, coastal habitats), loss of biodiversity (extinction of endemic, rare and endangered species), and, lack of management of eco-tourism; and sets some priorities for action within these areas

A National Vision
" To achieve a better quality of life for all Yemeni people through the conservation and sustainable use of biological resources and stabilizing resource consumption in harmony with the limits of the carrying capacity of nature and the integrity of creation."

Strategic Goals:

Goal 1. Conservation of Natural Resource
Strategic Goal 2. Sustainable Use of Natural Resources
Strategic Goal 3. Integration of Biodiversity in Sectoral Development Plans
Strategic Goal 4. Implementation of Enabling Mechanisms

Specific objectives include:

1. Protected Areas

Conservation of Yemen's eco-systems through developing and maintaining a comprehensive and adequate network of protected areas, supported by effective co-ordinating management mechanism, adequately funded management plans and improved information system.

2. Endemic and Endangered Species

Conservation and rehabilitation of key endangered species through law enforcement, information gathering and implementation of community-base in-situ conservation programs of key endangered flora and fauna.

3.Ex-situ Conservation

Ex-situ conservation of rare and endangered native taxonomic groups of plants species by improving knowledge and understanding of species and ecosystems, and through the establishment and strengthening of gene banks, seed banks, green belts, botanical gardens and public gardens.

4. Alien Invasive Species

Establishment of an effective control and monitoring system backed up with information system and legislative framework for the trade, use, and control of alien invasive species.

5. Terrestrial Wildlife Resources

Strengthening the sustainable utilization of terrestrial wildlife resources through developing legislations and policies prohibiting hunting and capturing wildlife and expanding programs on rangelands, forest restoration and abatement of desertification.

6. Coastal/Marine Life and Fisheries

Conservation and sustainable use of marine and fishery resources through the development and strict implementation of policy, legislation and management tools that ensure harvest level of biological resources are maintained within the biological limits. Examples are the development of costal zone management plans, establishment of marine protected areas, control hazard, illegal and unsustainable fishing, etc.

7. Agro-biodiversity

Conservation of biological resources through the adoption of ecologically sustainable agricultural and pastoral management practices, including control of fertilizer and pesticides, terrace management, traditional land use and water management systems, introduction of modern irrigation systems, etc.

8. Infrastructures and Industry

Reducing infrastructures and industry adverse impacts on habitats and ecosystems through eco-tech introduction, EIA enforcement and effective regulating policy.

9. Biotechnology and Biosafety

Mitigating the potential risks associated with the use and release of living modified organisms (LMOs) and the introduction of biotechnology on human and biological diversity through development and implementation of biosafety frameworks, developing biosafety guidelines and creating an entity to manage and control biotechnology and biosafety issues.

10. Tourism and Eco-tourism

Achieving the conservation of biological resources through the adoption of ecologically sustainable management practices for tourism and recreation.

11. Urban, Rural Development and Land- Planning

Minimize uncontrolled urbanization through developing and implementing land use management plans and enforcing land use regulations.

12. Waste Management

Reducing adverse waste impact on ecosystems through the adoption of ecological policy and the introduction of new techniques such as recycling and treatment and green technology.

13. Water Management

Protecting the country limited water resources from over-exploitation and quality deterioration through optimal allocations of water resources and the use of improved quality control techniques.

14.Climate Change and Energy

Mitigate the impacts of energy GHG emissions and the subsequent climate change on biodiversity and desertification through energy mitigation strategy and a National Adaptation Program of Action (NAPA).

15. Public Awareness and Participation

Rising environmental awareness of Yemeni society through integrating environmental themes into university and school curricula, promoting green media, and supporting youth clubs and eco-industry.

16. Indigenous Knowledge and Traditions

Reviving traditional biological knowledge, innovations and techniques in conserving biological resources.

17. Capacity Building

Strengthening productive capacities and potential of individuals, agencies, and communities in the planning, implementation, monitoring and evaluating of biodiversity conservation programs.

18. Equitable Sharing of Biodiversity Benefits

Enabling communities and individuals to conserve and sustainably use biological resources by facilitating their participation in the planning and management of natural resources and providing them with secure access to biological resources and sufficient financial and technical funding for community-based environmental programs.

19. Policy, Legislation and Institutional Structure

Developing an integrated legislative and institutional framework composed of: 1) Updated environmental laws complete with regulations, implementation and enforcement mechanisms; 2) mandated and empowered national institutions and mechanisms for coordinating and effecting policies, legislations and strategies; 3) national policy advocating incorporation of biodiversity issues in the national fiscal policy.

20. Monitoring and Reporting

Establishing a nationwide inter-agency mechanism for monitoring the implementation and results of the NBSAP and other biodiversity related programs.

21. International and Regional Cooperation

Maintaining and strengthening Yemen's relations and cooperation with international and regional partners in the field of biodiversity.

The Action plan

The NBSAP sets priority activities into seven programmes, setting timelines and identifying responsible parties. It covers a range of actions from large-scale infrastructure to strategic policy making and human resource development. Key Programmes contained in the action plan of the strategy are:

8. Establishment and development of comprehensive National Integrated Protected Areas System (NIPAS) in Yemen
9. Development & implementation of an Integrated Coastal Zone Management Plan (ICZMP)
10. Developing and Implementing Specific Policy, Legislation and Regulations on Biodiversity
11. Essentials Measures for the Conservation of Agro-biodiversity in Yemen
12. Reviewing Traditional & indigenous Knowledge in Natural Resources Management Systems
13. National biodiversity education & awareness
14. Programme Regulation and guidelines for Bio-safety

More details on these projects are briefly presented in annex1 in the form of project concepts outlining project title, lead agency and key partners, goals, objectives, outputs, main activities, timeframe, and estimated cost.

Annex 1: Action Plan

Project 1. Establishment and Development of a Comprehensive National Integrated Protected Areas System in Yemen (NIPASY)

Lead agency and key partners: Ministry of Water and Environment, Environment Protection Authority, Ministry of Planning and Development, Ministry of Agriculture and Irrigation, Ministry of Fisheries and Navy (for marine PA), NGOs, IUCN, and local stakeholders and communities, General Authority for Tourism, MFW and surroundings, WB, UNDP and other Donors/Funding Agencies (to be identified).

Goal: Identify, establish and develop a comprehensive National Integrated Protected Areas System for Yemen (NIPASY), which will include the terrestrial, wetland and marine environments to strengthen community livelihood.

Objectives:

- Identification and design of the NIPASY.
- Establishment and management of 7 selected priority protected areas (Socotra, Jable Bura, Hauf, Sharma/ Jathmoon, Bir Ali, Autma and one Red Sea ecosystem
- Enable 20 small scale community conservation initiatives.

Main Outputs:

- Integrated and comprehensive database and relational GIS system for biodiversity established and functional.
- Comprehensive protected areas system design complete with initial PA site boundaries, supportive information, map and justification for each site developed and adopted by the government.
- Proposals, including budget estimates for all priority reserves prepared and implemented.
- Protected Area Management Plans for the priority areas prepared and implemented (potentials protected areas may include Socotra, Jable Bura, Hauf, Sharma/ Jathmoon, Bir Ali, Autma and one Red Sea ecosystem)
- Institutional, technical and human resource capacity needs for protected area management and community conservation identified and supported.

Main Activities

- Data gathering and analysis (including Gap assessment and priority listing) and integration in existing functioning GIS systems
- Develop and complete Protected Area Management Plans
- Resource mobilization for protected area management and small scale community conservation initiatives.
- Protected Area Management activities
- Training and capacity building

Timeframe: 5 years

Estimated Cost (excluding the secured funds): **6** millions $US + Socotra ? million US$

Project 2. Development and Implementation of an Integrated Coastal Zone Management Plan (ICZMP)

Lead agency and key partners: Ministry of Water and Environment, Environment Protection Authority, Ministry of Fisheries, Ministry of Public Works, MAA, Marine Research Centers and Universities, NGOs, IUCN, local stakeholders, private sector, PERSGA, WB, UNDP and other potential donors (to be identified).

Goals: Conservation of coastal zone biodiversity of Yemen.

Objectives:

- Development and implementation of ICZMPs and creation of an effective national capacity to manage Yemen's marine and costal resources.
- Protection of aquatic habitats, fisheries, rare and endangered marine species through formulation, implementation and enforcement of effective policies for conservation of the marine environment and regulations for fishing and harvesting marine organisms.
- Integration of biodiversity conservation in the development of costal zones.

Main Outputs:

- Biodiversity information integrated into coastal zone maps and database systems of Yemen.
- Four management plans for Balhaf-Bir Ali Area (Sharma) and Jethmun-Sharma (Hadhramut), Aden and a Red Sea Ecosystem Prepared and implemented.
- Institutional capacity needs to mange and control illegal fishing practices, costal development, infrastructure, illegal logging of mangroves and tourism development identified and secured.
- Local branches for EPA in Al-Hudaidah, Al Mukallah established and functional.
- EPA local branches, community representatives, local administration, private sector and NGOs organized under appropriate mechanism for implementing ICZMPs and for the periodical revision of the plans.
- EPA staff adequately trained and equipped to efficiently implement, update and enforce ICZM policies, legislation, regulations and guidelines.
- Adequate infrastructure, land and sea transportation and communications means are available to staff responsible for implementation of ICZM plans.
- Awareness of public, decision makers, local community, private sector and other target group on ICZMP adequately promoted.
- Major coast pollution from land sources identified and pilot projects to minimize such pollution prepared and implemented.

Main Activities:

- Data gathering and analysis (including Gap assessment and priority listing) and integration in existing functioning GIS systems
- Monitoring programs
- Management plan development and implemented including, Public consultation
- Policy , legislation, guidelines preparation, review and enforcement
- Technical training and public awareness programs
- Equipment acquisition
- Protected area management
- Development of eco-tourism for the areas

Timeframe: 5 years

Estimated Costs: to be determined

Project 3. Development, Implementation and Enforcement of Policies, Legislation and Regulations on Biodiversity Issues in Yemen

Lead agency and key partners: Ministry of Water and Environment**,** Environmental Protection Council, Ministry of Agriculture, Ministry of Legal Affairs, Ministry of Public Works, General Cooperation of Roads and Bridges, Ministry of Culture and Tourism, Ministry of Trade and Industry, Ministry of Defence, Ministry of Interior, Standard Authority, governorates, private sector, NGOs, IUCN, Legal Specialists, coast guards, police, military, local judges, sheiks and WB, UNDP, UNEP; other Donors (to be identified).

Goal: Ensuring that adequate and effective policy, legislation and regulations and support systems are in place and enforced for the management and sustainable use of biodiversity and for the preservation and rehabilitation of the environment.

Objectives:

- Identification and review of existing policies, legislation and regulations for biodiversity, related natural resources and environmental issues and development of required supplementary policies, laws and regulations to fill gaps.
- Build the capacities and institutional structures and support systems to coordinate, integrate, implement and enforce biodiversity, natural resource and environmental policies, laws, regulations and by-laws.
- Develop, enforce and follow up EIA including recommended mitigation measures in priority sectors, such as infrastructure and industry, tourism and urban development, waste management and water treatment.

Main Outputs

- An integrated participatory assessment of current biodiversity legislations and regulatory framework for meeting the goals of the CBD, sustainable use and management of biological resources completed, and legislative gaps identified.
- ICZM policies, legislation, regulations and guidelines on critical habitats, resource species, fisheries, plankton, and rare or threatened species reviewed, updated and enforced.
- Legislations, regulations and guidelines on agro-chemicals import, plant quarantine, water use and harvesting, and protected areas prepared and enforced.
- Based on results of the assessment, existing biodiversity laws, by-laws, norms, standards and regulations reformulated, enacted and enforced.
- Recommended policies, legislation and regulations to legalize and guide protected areas management and development completed.
- An overall review and assessment of mandates and management responsibility over biological resources developed, the adequacy of mandates and management responsibility identified and clarified in harmony with EPL; appropriate institutional and organizational structure is established, and strengthened.
- Development and implementation of by-laws and guidelines for approved legal documents, drafted, endorsed and in place. .
- A nationwide management and coordination mechanism, such as an "Interagency implementation task force" for biodiversity conservation with appropriate role of NGOs, private sector and local community created and functional.

- National and local training to meet CBD and other Rio Conventions commitments for government, non-government, local administrators and other partners.
- Legal experts and relevant governmental and non governmental staff conversant with the policies, laws and rules for the conservation and sustainable use of biodiversity, natural resources and environment in Yemen are designated with specified capacity and responsibility to apply and enforce policies, laws and regulations with respect to biodiversity, natural resources and environment.
- EIAs and recommended mitigation measure have been implemented in major sector developments.

Main Activities

- Experts' consultation in legal issues related to biodiversity.
- Compilation, review, assessment and development Laws, policies and regulations.
- Preparation of policies, legislation and regulation for protected areas.
- Training programs for different target groups e.g. coast guards, police, military, judges,
- Programs development, implementation and monitoring.
- Public and target group oriented awareness programs on legal and policy issues.
- Inter-agency consultations and task force (workshops and seminars).
- Legislation Development and enforcement
- Policy harmonization

Timeframe: **5** years

Estimated Costs: US$ 2 300 000

Project 4.General Measures for the Conservation of Agro-Biodiversity in Yemen

Goal: To protect Yemen's agricultural diversity from degradation, maintain agricultural resources and develop sustainable agricultural programmes.

Lead agency and key partners: Ministry of Water and Environment, Ministry of Agriculture and Irrigation, Sana'a and Aden Universities, Environment Protection Authority and local communities.

Objectives:

- Improve AREA to include national agriculture biodiversity data .

Maintain agricultural and pastoral ecosystems and indigenous agro-biodiversity and promote their rational and sustainable use., though pilot projects and awareness campaigns.

Main Outputs:

- A computerized system for storage, processing, retrieval, dissemination and publication of agro-biodiversity information established, functional and accessible by various data-end users.
- A GIS-based information system for environmental application and land-use planning introduced to the Agriculture Biodiversity Center (ABC) and made operational.
- A library building for housing, scientific journals, research papers, technical reports, documents, the GIS and database systems in place and functioning.

- Research and pilot projects on land use management, terrace management, desertification, and in situ conservation of rangeland prepared and implemented.
- Pilot projects and awareness raising in propagation of local and crop varieties and replacing Qat plantations with cash crops, coffee, almonts, grapes and other environmentally friendly systems prepared and implemented.
- Set quotas for indigenous plants in public and private forest and garden projects.
- A comprehensive training program including overseas training, special courses for women, upgraded courses in agricultural biodiversity and forestry for technicians and specialists is developed and implemented.
- Capacity of local communities and extension staff in implementing conservation friendly agro-pastoral and agro-forestry programs and systems sufficiently strengthened.
- Local communities and general public more aware and supportive of programs.

Main Activities

- Information management, Technical exchanges and information sharing, Networking, consensus building, community partnership and inter-agency coordination
- Pilot projects and Programs development, implementation and monitoring
- Broad-based capacity building and training programs
- Public awareness raising, Eco-practices propagation

Timeframe: 3-5 Years

Estimated Cost: to be determined

Project 5. Reviving Traditional Indigenous Natural Resource Management Systems

Lead agency and key partners: Ministry of Water and Environment**,** Environment Protection Authority, Ministry of Agriculture, Universities, NGOs, and local communities; donor and funding agencies to be identified.

Goal: Apply appropriate and effective traditional and indigenous natural resource management systems for biodiversity conservation and sustainable use of natural resources.

Objectives:

- Secure and assess all available information on traditional and indigenous natural resource management systems in Yemen.
- Re-deploy and reinforce appropriate traditional and indigenous management systems as part of government's overall strategy to improve biodiversity conservation, combat desertification and agricultural pests and increase natural productivity.

Main Outputs

- Traditional knowledge including systems, techniques, practices, skills and methods studied, documented, and made available and is used for extension services for sustainable use and management of biodiversity resources.
- Widespread adoption and/or adaptation of appropriate traditional and indigenous technologies and management systems by agricultural, pastoral and fishing communities.

- Good examples of traditional systems and practices such as water harvesting, rangeland use, terrace maintenance, fertilizer use revived and replicated among agricultural, pastoral and fishing communities throughout the country.
- Incentive and technical and financial support provided to farmers for rehabilitating and repairing terraces.
- Public awareness on acceptance of indigenous natural resource management systems strengthened through government sponsored cross-visits to case study and demonstration sites, extension services, and incentives.
- Nurseries, seed banks, fingerling supplies, etc. developed as/if necessary by appropriate line agencies to provide supplies of 'starter materials' to the public
- Pilot projects in and around protected areas

Main Activities

- Gathering of traditional information
- Identification of resources persons on traditional knowledge
- Data verification.
- Consultations with knowledgeable people on traditional knowledge
- Systems identification for investigation and revival
- Documentation and reporting
- Public awareness campaign
- Experts' consultation to investigate feasibility of replicating traditional management systems
- Provision communications equipment and public awareness campaign
- Incentives provision for expanding use of indigenous systems
- Pilot projects

Timeframe: 3-5 years
Estimated costs: to be determined

Project 6. National Biodiversity Education and Awareness Program

Lead agency and key partners: Ministry of Water and Environment**,** Environmental Protection Authority (lead agency), Ministry of Education, Universities, Research Centers, NGOs, Local Communities, World Wide Fund for Nature, IUCN; WB, UNDP and other Donors and Funding Agencies (to be identified).

Goal: Enhance the level of education and awareness for environmental conservation, and suatinable management to increase the scope and capacity for stakeholder and public participation in effecting positive changes in Yemen's biodiversity .

Objective:

- Promote public appreciation for biodiversity conservation and the protected areas program and a positive change in attitudes and behavior towards Yemen's environment through conservation promotion interventions.

Main Outputs

- Increased public collaboration, including government authorities NGOs, private sector, university and others parties concerned in knowledge improvement and conservation of Yemen's natural environment, protected areas and conservation of their benefits.

- Greater public role in planning, executing and monitoring of village/community development projects.
- A clearly defined local community, NGO and private sector role and partnership in the country's conservation program and protected areas management.
    - Advocacy groups for the protection of nature and the environment such as Youth organizations, conservation clubs, wildlife and nature clubs, and NGOs established and expanded.
    - Biodiversity awareness and traditional knowledge enhanced among youth through curriculum reform and improved facilities of educational institutions.
    - Several environmental themes introduced into the curricula of key schools and universities.
- Functional capabilities of government agencies, NGOs and private sector in the design and implementation of conservation programs.
- Increased local government awareness on the interrelationship of conservation and sustainable development.
- Regional and national press and broadcast media fully employed in nature conservation and protected areas programs.
- Increased local youth awareness and appreciation for nature conservation and participation in protected areas educational programs.
- Targeted campaigns on key environmental threats
- Islam and Environment campaign

Main Activities

- Conservation clubs establishment and strengthening
- Workshops
- Public information and mass media campaigns
- Training activities for various target groups
- Program development for newspapers, radio and television
- Ecotourism promotion at national and international level
- Production of educational/awareness materials, extension materials, learning modules and programs for various target groups
- Inter-agencies efforts to integrate biodiversity-related issues into the curriculum of schools and universities
- Mobilize key stakeholder e.g. imams, private sector political leaders to support publicly environmental issues
- Curricula development for school and universities.

Timeframe: 5 years with an additional phase of fife years

Estimated Costs: US$ 4 000 000

Project 7: Preparation and implementation of National Biotechnology/Biosafety Frameworks

Goals: To minimize health and environmental hazards from developing and introducing genetically modified organisms.

Lead agency and key partners: Ministry of Water and Environment, Environmental Protection Authority, Universities, Research Centers, Custom Authority, Ministry of Trade and Industry, Donors e.g. related to Food Aid.

Objectives:

- To promote safe development and application of biotechnology for conservation and sustainable use of genetic diversity.

Main Outputs:

- The risks associated with the use and release of living modified organisms (LMOs) and the introduction of biotechnology controlled through development and enforcement of adequate legislation
- Guidelines for introductions, research and use of living modified organisms produced
- An appropriate and authorized entity responsible for the management and control of biotechnology and biosafety issues created and functioning
- Feasibility studies and researches on the potential use of genetically engineered seed stocks for introducing drought resistant varieties of fruits and vegetables in replacement of those currently in cultivation completed and available for applications
- A national biotechnology policy and biosafety frameworks prepared and approved
- Institutional and national capacity on biosafety monitoring developed and strengthened
- Stock-taking and assessment of existing biotechnologies and state of safety in their application completed
- Priority activities and information exchange implemented
- Ban for GM living organisms for Socotra archipelago e.g. seeds

Main Activities:

- Stock-taking and assessment of state of imported and used safety/ biotechnologies
- Options analysis and tracking biotechnology applications
- Policy preparation for biotechnology/ biosafety
- Implementation of priority activities and national capacity building programs
- Institutional capacity building on biosafety
- Data-base and national infrastructure establishment
- Public awareness activities
- Decree to ban the import of GM living organisms for Socotra archipelago

Timeframe: 3 years
Estimated Costs: US $1-4,000,000.

Annex 2: A: Joint Government/ Donors' Projects

Joint Government/ Donors' Projects: Institutional and Capacity Building Projects

Project name	Objectives	Donor	Period
Support to the Technical Secretariat of EPC, phase 1 and 2	A strengthened position of EPC as a steering and controlling institution with an effective data collection system, effective and efficient procedures for the scrutiny and approval of investment, development projects and projects aimed at reducing or eliminating adverse effects of the environment and guidelines and criteria pertaining to environmental issues	The Netherlands	1989-96
Capacity building of EPC and it's Technical Secretariat of EPC, phase 3		The Netherlands	1997-2001
Sustainable environmental management, YEM/97/100-sp1 coordination of support to environmental management,	Enable EPC to better coordinate and facilitate information sharing between relevant partners supporting environmental interventions and to work jointly with MPD to secure appropriate financial resources directly to national agencies or to the Environment Fund once set up	UNDP/GEF /The Netherlands	1997-2003

Joint Government/ Donors' Projects: Water Land Resources Projects

Project name	Objectives	Donor	Period
Regional Network for Supplementary Irrigation Improved Water Management at the Farm Level	To enable participating countries to expand their capacities for increased food production through improved management of available water resources	UNDP /IPF	1991-1996
Watershed Management and Wastewater Reuse in Per-urban Areas	To assist Yemeni families living in the pre-urban areas of fast increasing cities, to rehabilitate and maintain the environmental balance	Dutch	1997-2000
Strengthening Capacity for Policy Formulation for Irrigation Sub-sector	To assist the Government and MA WR to prepare for a national irrigation policy and review the structure and establish capacity for managing irrigation efficiency and planning, design and supervision of investment projects in the irrigation sub-sector, with special emphasis on the	FAO	1997-1998

	nationwide, immediate term prograнlll1e' for rehabilitation and development of dam reservoirs		

Joint Government/ Donors' Projects: Land Resources Projects

Project name	Objectives	Donor	Period
Land and Water Conservation Project	To strengthen sustainable agriculture through: (I) Institutional and Technical development in irrigation and forestry (ii) initiating a program of water resources monitoring & regulation in the agriculture sector, (iii) Improving water use efficiency in irrigated agriculture; (iv) Conserving key indigenous forest areas, accelerating tree planning and extending soil and water conservation; and (v) Establishing approaches for water shed management and terrace stabilization To strengthen sustainable agriculture through irrigation and forestry.	The World Bank	1995- 1999
Forestry Development, Phase IV	To have appropriate support structures to increase tree and forest cover in order to maintain the ecological stability upon which food production and producers depend.	Switzerland	1993-1997
Environment Resource Assessment for ural Land Use Planning	To create a sound basis for rural land use planning in order to achieve an increased degree of self-sufficiency of food production and improved living standards for the rural population through a rational, efficient and sustainable use of natural resources	The Netherlands	1994-1999
Tehama Environment Protection Project	To identify and prove, by implementation on a limited scale in the Tehama, appropriate and replicable methods for the management of natural resources to support sustained and increased agricultural production	IFAD	1996-2003
Wadi Hadhramout Agricultural Development	To consolidate, expand and ensure sustained development of land and water resources in the Wadi Hadhramout area	WP	1990-1997
Sustainable environmental	To implement Priority Projects in desertification control	UNDP/GEF / The	1997-2003

management, YEM/97/100-sp4: Planning for Desertification Control	To prepare national desertification map and land degradation maps and land use assessment of critical areas To Prepare forest policy and law	Netherlands	

Cont: Joint Government/ Donors' Projects: Land Resources Projects

Project name	Objectives	Donor	Period
Establishment of windbreaks in farming areas in Hadhramawt Sand dune stabilization, west of Wadi Sihamm	To identify and implement on a limited scale in the Hadramout/ Shabwah regions, appropriate and replaceable methods of management of natural resources to support sustained and increased agriculture. - Land conservation, which would control the encroachment of sand dunes onto the productive and settlement lands. - Water conservation, which would introduce initial measures to increase water use efficiency.	World Bank	
Sustainable environmental management, YEM/97/100- sp2: Information and Advice on Land Resource Utilization	To establish an Environmental Information System for the collection, analysis and evaluation of natural resources in Yemen, as well as to identify indicators to monitor their temporal and spatial evolution	UNDP/GEF / The Netherlands	1997-2003
Southern Govornorate Agricultural Development	To raise the incomes of dispossessed tan ants and other very poor people in a way that is sustainable in the difficult economic and social conditions of the southern govornorate	lDA credit	1 977
Sustainable environmental management, YEM/97/100- sp3: Community Participation in Land Resource	Testing some land resources management techniques in four Govornorates based on and drawing from traditional managements systems deeply rooted in the social fabric.	UNDP/GEF / The Netherlands	1997-2003

Management			
Socio-Economic Development and Master Plan for Socotra Surrounding Islands	Development of a coherent Master Plan for the development of Socotra Archipelago	Gov/EU	1997 - 2001

Cont: Joint Government/ Donors' Projects: Land Resources Projects

Project name	Objectives	Donor	Period
Protected area and Coastal zone management Project (PAM &CZM Project)	Establishment of four coastal and in-;and Protected Areas.(Bura'a, Hawf, Jathmoon-Sharam, and Bir Ali)	GEF-World Bank	On-going project
Socotra Conservation Development Project	Establishment of a national Protected Area on Socotra, including Zoning plan of Socotra Archipelago	Italian Gov/UNDP	On-going project
Conservation and Sustainable Use of the Biodiversity of Socotra Archipelago	Establishment of a national Protected Area on Socotra, including Zoning plan of Socotra Archipelago	GEF-UNDP	
Environment, Natural Resources and Poverty alleviation for the population of Socotra Archipelago	To alleviate the Poverty of population of Socotra Archipelago through improvement of health and the implementation of an integrated water management system.	UNDP, Italian Gov. and Poland Government	1999-2001
Biodiversity strategy & action plan	To prepare National Biodiversity strategy & action plan (NBSAP), and National inventory and data base of fauna and flora,	GEF-UNDP, YEM/96/G1	1997-2003
Strategy Action Plan for the Red Sea and Gulf of Aden	To prepare National Regional strategy & action plan for the Protection of Biodiversity of the Red Sea and Gulf of Aden	UNDP/GEF RAB/97/G33	1997-1999

Joint Government/ Donors' Projects: Waste management Projects

Project name	Objectives	Donor	Period
TAIZ Flood Disaster Prevention and Municipal Development Project	To provide most needed flood control structures to protect private and public buildings and infrastructures. To implement a project cost recovery mechanism at a municipal level, and to promote	Gov/IDA	992-1996

	implementation of a national municipal resource mobilization policy. -To strengthen the urban management capabilities. -To strengthen the institutional capacity to address urban problems more effectively.		

Cont. Joint Government/ Donors' Projects: Habitat Conservation Projects

Project name	Objectives	Donor	Period
Protection of Marine Ecosystems of the Red Sea Coast	The main objective of YEMJ92/G31 is building the capacity for the Government in sustainable marine resource management through training and technical assistance in analyzing the marine environment and developing resource management strategies, including marine protected areas management The YEM/97/G32 project aims to protect marine ecosystems of the Yemen Red Sea coast, including coral reefs and other critical habitats, by assisting Yemen to develop the sustainable use of its marine resources, and to reinforce regional efforts to manage the marine resources of the Red Sea.	GEF/UNDP /Gov. YEM/97/G31 and G32	1996-1999
Basic Needs of Socotra Assistance for the People Socotra Archipelago	To prepare a comprehensive basic needs assessment covering the health, water, alternative energy and education sectors. To strengthen the local governance institutions as well as the existing community based organizations. To provide urgent basic needs in terms of health, water and food aid..	UNDP, British Government	1996 - 1997
Sustainable environmental management, subprogram5: promotion of eco-tourism	To establish and strengthen Eco-tourism Department	UNDP/GEF / The Netherlands	1997-2003
Fishery Development Project	-Increase fish catch and improve processing for both local consumption and export improve the efficacy of domestic and export marketing of fish. -Improve the assessment and management	***IDA, IFAD & EU***	***1992-1998***

	of the fisheries resources in Yemen waters. Help improve the position of fishing communities		
Agricultural Seeds and Services Project	To make improved, quality-controlled seeds and other inputs available to farmers through creating an independent and self-sustaining seed sub sector with optimum private sector participation	IDA credit	1997
Improvements of Sorghum and Millet	To increase the production of sorghum and millet in participating countries	UNDP/IPF	1990-1996

Annex 2: B: Government's Funded Projects

Government's Funded Projects: Land Conservations Project

Project Title	Project Goals	Est. Cost (YR)	Period
Safeguarding Water and Land Project	To strengthen sustainable agriculture through preservation of land, forest and water in eleven govornorate.	4.8 thousand million.	1992 to 1998.
Tihama Environment Project	To improve the standard of living of rural area by appropriate practices and management of agricultural resources	1.2 thousand million	1996-2003
Agricultural Development Project of Southern Govornorates	To raise the income of 20,000 rural poor families adversely affected by new policies and procedures re-privatization of agricultural land in southerner Govornorates.	3 thousand million.	1998-2006
Seed Propagation and Agricultural Services Project	a- Raise agricultural productivities and income. b- Improve institutional activities in seed propagation. c- Encourage the private sector in seed production and agricultural services. d- Create an independent sector producing seeds with the participation of the private sector in the long run.	1.5 thousand million.	seven years
Raima Rural Development Project	It intends to increase agricultural production and raise the standard of living of small farmers in Raima area of Sana'a.	1.2 thousand million.	Six Years

Government's Funded Projects: Agricultural Projects

Project Title	Project Goals	Est. Cost (YR)	Period
Development of Animal Products Project	a. Improve animal health and feed. b. Improve communications between the farmers and agricultural institutions. c. Enhance female work capabilities in profitable animal	2 thousand million.	eight years

	production. d. Establish institutional capabilities responsible for provision of animal services.		
Agricultural Development Project in Northern Area (Second Phase)	a. Raise production, productivity and income. b. Improve agricultural services. c. Raise the efficiency of water usage. d. Raise the standard of public health and living in Sana'a, Sa'ada and Hajah.	3 thousand million.	Eight years.
Complementary Development Project in Abyan	To execute a complementary rural development programme to increase agricultural production and improve the farmers' incomes.	2.3 thousand million.	Six years.
Enhancing Management in the Agricultural Sector	a. Development management bases for a modem agricultural sector. b. Enhance management capabilities of agricultural research and guidance commission and speed up the development of appropriate and suitable techniques for the farmers.	1.7 thousand million.	1992-2000

Government's Projects: Fishing Projects

Project Title	Project Goals	Fund	Period
Renovation and Maintenance of Traditional Fishing in the North	It aims to maintain and improve the existing traditional fishing techniques to realize better economic benefits.	80 millions.	1998-1999.
Development of Fishery Cooperatives in the Eastern Area of the Republic (Fisheries – Fourth)	a. Expansion of fisheries. b. Improvement the efficiency of fisheries marketing locally and for export c. Assist to improve sources of fisheries' wealth. d. Assist to improve the status of females in fishery establishments.	4 thousand million.	1992-1999

Modernization of Fish Canning in Mukalla	To increase fishing harvest to meet local demand and export.	145 million	1996-1997
Development of Shore-Fishing on Red Sea	To improve the quality of fish and its marketing, improve the standard of living of fishermen.	550 million	1997-1999

Government's Projects: Tourism Projects

Project Title	Project Goals	Est. Cost (YR)	Period
Completion and Development of the Institute of Tourism and Hotels	To prepare and trains professionals working in hotels, tourist offices and other tourist activities.	YR 179 million	1996 – 2000
Tourism Promotion and Marketing	The project intends to take the initiative for wide media coverage to promote internal tourism.	225 million	1996 – 2000
Completion of Tourism Survey	It intends to undertake a comprehensive survey of all tourist attractions. It will prepare the tourism management plans based on studies.	20 million	Two years.
Preparation and Training in Tourism	To train officials on tourism nationally and in addition to out-country training.	125 million.	1996 – 2000
Environmental Safety Projects (All Govornorates) Enhancing Capabilities of Water Resources General Authority	To improve sustainable and rational use of water resources through improving the management efficiency of water resources.	200 million.	
Creation and Development of Information and Data System of Water Resources	To develop a system for observing over ground and underground water and collect information on the state of water resources by use of modem technological means.	500 million.	

Government's Projects: Water Supply and Sanitation Projects

Project Title	Project Goals	Est. Cost (YR)	Period
Modernization of Urban Development in major cities (Sana'a, Aden, Taiz, Mukalla, Hudaidah)	To safeguard urban environment by establishing infrastructure and enhance public services on provision of water and sanitation.	383 million.	1996 - 2000.
Housing and Urban Planning Development of Housing Estate for Low Income Groups in Aden	To alleviate housing shortages of low income groups	2 thousand million.	1996 - 2000.
Enhancing Environmental Management Capabilities	To improve the current utilization of natural resources and safeguard the environment from misuse by improving Management Capabilities of National environmental agencies	410 million.	
Economic Control of Water Wastage and Pollution (Study)	To examine the water tariff in cities and provide economic and financial incentives to rationalize the use of water and control underground water usage.	YR 20 million.	
Improving of Water Supply Services in Urban and Rural Areas	To improve the network of water supply and to reduce water pollution of portable water throughout the country.	300 million	