Republic of Yemen

Ministry of Water and Environment

Environment Protection Agency

THE NATIONAL STRATEGY FOR ENVIRONMENTAL SUSTAINABILITY 2005-2015 AND NATIONAL ENVIRONMENTAL ACTION PLAN 2005-2010

2005

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Acknowledgements

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DRA	Demand Responsive Approach
ACSAD	Arab Centre for the Studies of Arid Zones and Dry Lands
AFPF	Agricultural Encouragement and Fish Production Fund
AIDS	Acquired Immune Deficiency Syndrome
ARC	Aden Refinery Company
bbl/d	billion (thousand million) barrels per day
BAU	Business As Usual scenario
BC	Before Christ
BOD	Biological Oxygen Dissolved
BOT	Build, Operate and Turnover
CDC	Civil Defence Council
CDIAC	Carbon Dioxide Information Analysis Centre
CGSDI	Consultative Group on Sustainable Development Indicators
CO2	Carbon Dioxide
COD	Chemical Oxygen Dissolved
DO	Dissolved Oxygen
EPA	Environmental Protection Agency
ESI	Environmental Sustainability Index
EZ	Exclusive Economic Zone
FAO	Food and Agricultural Organization of the United Nations
GDP	Gross Domestic Product
ha.	Hectare
HDR	Human Development Report
HIV	The retrovirus that causes AIDS by invading and destroying the helper T cells of the body
hp	horse power
IEA	International Energy Agency
IPP	Independent Power Projects
ISO	International Standards Organization
IUCN	International Union for Conservation of Nature and Natural Resources
km	kilometre
km^2	square kilometre
km^3	cubic kilometre
LNG	Liquefied Natural Gas
m^3	cubic metre
MDG	Millennium Development Goal
MENA	Middle East and North Africa
ml	millilitre
mm	millimetre
MOU	Memoranda of Understanding
MSRRC	Marine Science and Resources Centre
mva	manufacturing value added
MW	megawatt
NEAP	National Environmental Action Plan
NGOs	Non-Governmental Organizations
NO2	Nitrogen Dioxide
NSES	National Strategy for Environmental Sustainability
NWSSIP	National Water Sector Strategy and Investment Program
NY	New York
PEPA	Petroleum Exploration and Production Authority

PPP	Purchasing Power Parity
PSA	Port Singapore Authority
PRSP	Poverty Reduction Strategy Paper
SO2	Sulphur Dioxide
Tcf	trillion cubic feet
TDS	Total Dissolved Salts
TFR	Total Fertility Rates
TPES	Total Primary Energy Supply
TSP	Total Suspended Particulates
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
US$	United States Dollar
VOC	Volatile Organic Compound
WRI	World Resources Institute
WWF	World Wildlife Fund
YFCU	Yemeni Fishers Cooperative Union
YR	Yemeni Riyal

INTRODUCTION

The stakeholders and interested parties that participated in elaborating this National Strategy for Environmental Sustainability (NSES) identified four critical environmental issues that require interventions in the short and medium term. These four issues are: a) water, b) land resources, c) biological diversity and coastal and marine environment,[1] and d) waste management. This NSES and the measures that come with it attempt to link the effect of environmental degradation on poverty, seek to investigate means to achieve the Millennium Development Goals (MDGs).

In the water sector, the most obvious environmental problems are depleting and polluting the water sources for various reasons, of which the most important are the excessive pumping of underground water, insufficient recharge of water aquifers and pollution of underground water because of the permeation of wastes from garbage dumps or polluted wastewater that are returned to underground basins in some of the oil extraction operations.

Scarcity of water adversely affects the poor, as they are compelled in rural areas to use water sparingly, especially the elderly, children and women. Water scarcity also leads to the gradual loss of agricultural land and the extinction of livestock when severe droughts occur. Since women are the gatherers of water for domestic use, they are compelled to cross long distances on foot for this purpose. Women are also responsible for grazing livestock, thus compelling women to go to distant areas during droughts. These are among the reasons for miscarriages among women.

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. In the urban areas where the poor live in communities that do not have potable water and do not have access to proper basic services, they resort to paying large sums of money for water, thus adding to their financial burdens. Poor women, in both urban and rural areas are also compelled to use non-potable water for washing dishes and clothing or even for cooking, which affects the health conditions of their families, and thus decreases their productivity and exposes them to more severe poverty situations.

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 deteriorates due, in part, to numerous factors including, but not limited to, rapid runoff of water in the valleys, sandstorms, depleting underground water, and long successive periods of drought. Desertification of agricultural land ranges from 3-5 per cent annually, whereas the area of deteriorated land due to soil erosion and salinity is estimated to be 12 million hectares and another 3.8 million hectares, respectively. The situation is further worsened as a result of encroachment of sand dunes. The adverse effects of the deterioration of land resources and desertification rural poor are more apparent because of their dependence on the land to sustain their livelihoods. Women who are engaged in gathering wood and grazing are especially affected, and assure their sustenance they are forced to dig their environment through over grazing and deforestation.

[1] Although, from an environmental point of view, marine and coastal environment is different from biodiversity, these two environmental issues are closely linked and were ranked almost of equal importance. Later in the document each issue is discussed independently.

Land area allocated for cultivation of cereals has dwindled from 787 thousands hectares to 671 thousands hectares between 1995 and 2000. Productivity of the hectare has also declined during the same period from 1.68 tons to 1.62 tons for wheat, from 0.96 tons to 0.95 tons for sorghum and millet, from 1.29 tons to 1.14 tons for barley, and finally from 1.3 tons to 1.14 tons for legumes.

With respect to the natural protectorates and biodiversity, the varied topography of the country has helped Yemen to possess a wealth of biodiversity in the mountains, coastal areas and islands spread throughout the Red Sea and the Gulf of Aden. The Socotra Archipelago is matched, in terms of its importance and the diversified vegetation and animal life, by the Galapagos Islands,[2] where an integrated plan has been drawn up for identifying regions and land belts for a number of land and marine biological diversity and wealth. In 2000, the Utama Region was proclaimed a protected natural area. There are two additional projects for declaring Jabal (Mount) Bara'a and the Hawf Forest as protected natural zones, in view of their representation of what remains from ancient tropical rainforests. In addition to two protected marine natural zones at the Island of Sakha and the crater lake of the Khourshouran volcano in the Bir Ali region of Shabwah governorate, and making the Sharmat-Jathmoun Coastline a protected zone for sea turtles.

The marine and coastal environment are accorded among threatened areas since they are subjected to deterioration and pollution from land or marine sources, although most of the components of this environment are 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 thousands tons in 1995 to about 135 thousands tons in 2000, which is an average growth of 9.4 per cent 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 per cent, and for cuttlefish productivity to about 12 per cent. 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 of coral reefs. 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.

The two major environmental issues in the sphere of wild life and biological diversity are: deterioration of areas of wild life and loss of biodiversity as a result of poor environmental awareness and control on one hand, and pressures to sustain livelihoods of the poor. Areas of biological diversity and wild life are subject to overgrazing, especially camel grazing for the Al-Shoura trees, and gathering

[2] Galapagos Islands is a group of volcanic islands lying along the equator in the Pacific Ocean west of the mainland of Ecuador. The islands are famous for their rare species of fauna, including the giant tortoises for which they are named. Charles Darwin visited the islands in 1835 and collected a wealth of scientific data that contributed to his theory of natural selection. Tourism is now strictly regulated to protect the endangered species unknown outside the archipelago. Source: http://www.answers.com/

firewood. also ed by The use of ground dragnets in fishing or the use of explosives or even by land fills of coastal areas, expanded construction, and pollution from chemicals that enter the sea with floodwaters and from the wastes of electric power generating stations threatens the well-being of coral reefs and marine life. The first problem adversely affects the poor in the rural areas more than it does in the urban areas, where the effects are confined to the loss of the aesthetic beauty of the areas of biological wealth, such as the distortion or pollution of the coasts, which, in turn, affects the income of beneficiaries of the environmental resources attractive to tourists. The second problem, although still limited, could however expand and thus make the country lose the benefits of biodiversity and cause significant adverse effects on the environment.

For waste management, there are five environmental problems of high priority:

1. Disposal or treatment of sanitary wastewaters and their adverse effects on rural and urban areas alike.
2. 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.
3. 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.
4. Mismanagement of hospital wastes, mainly in cities that could affect the total population.
5. General abuse of pesticides and chemicals in agriculture 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.

In the last few years, attention was accorded to environmental changes due to the increase of toxic gaseous emissions with the increasing use of different fuels, especially diesel, and the rise in the number of transport vehicles, whereby the consumption of fuels in 1999 reached 3.3 million tons, of which 29 per cent was gasoline, 36 per cent was diesel, and 29 per cent heavy fuel. The emissions from cement plants exceed 90 per cent of all the industrial emissions as local production of cement increased from 1 089 thousand tons in 1995 to 1,494 thousands in 2001, while carbon dioxide constitutes 33.6 per cent of the gaseous heat occlusion arising from agriculture. The gradually increasing temperatures take their toll on agricultural production and give rise to new plant and livestock diseases that increase financial risks in agriculture, especially since Yemeni farmers do not have the appropriate ways of protecting their crops from such changes. This also changes the climate, which, in turn, works to gradually change the attributes of the climatic zones, in keeping with changes stemming from global warming and the degree of displacement to current climatic zones and also causes changes in the types of plants and the vital ecological systems. In Yemen, climatic changes can lead to the displacement of the dry tropical climate prevalent in the coasts tens of kilometres into the interior, and thus have an effect on the climatic features of the western and southern slopes, which will bring about rainfall and push this climate towards the arid desert climate; or the humid tropical region could extend northward, which will increase the amount of torrential rain that falls on these slopes and the other areas, and thus increase the probability of flooding towards the west, while improving the climate in the plateaus and highlands and the eastern regions, due to the increase of rainfall. Consumption of water is expected to increase, due, in part, to the increased

evaporation and the increased human, plant and livestock needs for water, in view of the rising temperatures. The productivity of current agricultural crops will go down because of the rise in temperatures, besides the fact that the present irrigation systems cannot control flooding and thus increase the risk of land erosion by water, which Yemen now faces, due to the increased sloping of the surface.

The purpose of the National Strategy for Environmental Sustainability and the National Environmental Action Plan is to update intended actions and activities in the realm of the transformed world as results of local elements, including liberalization of the economy and new discoveries of oil and natural gas; and global factors, such as globalization.

Problem Identification and Prioritization

The first stage aimed at assessing environmental issues and involving stakeholders to gain their commitment towards the NSES, and finally setting priorities. The output of this phase was an updated Environmental Profile of Yemen. It is a report that brought together readily available information on the state of the environment, problems and opportunities. The document identified the interactions between resources and development needs. It also examined the institutional framework for environmental management and actions in Yemen that were bottlenecks causing the emergence of environmental problems. This information was used as a major resource for facilitating the participatory and decision-making process.

A key event in the first stage was the National Consultation, held during December 2005. The objectives of this national consultation were to:

1. Raise awareness and reach common understanding of the key environmental issues;
2. Confirm the identity of interested parties;
3. Build consensus on the prioritized list of issues;
4. Gather commitments for the planning process; and
5. Establish Working Groups, i.e. participatory structures responsible for plan preparation.

The criterion for prioritization was based on the following elements:

1. What are the impacts of the problem on health?
2. How much loss in labour productivity was a direct result of the problem?
3. How did the problem influence the poor?
4. Did the problem lead to irreversible outcome?
5. To what extent can local actions significantly affect the problem?

Strategy and Plan Formulation

Environmental sustainability is a fundamentally multi-dimensional concept. Some environmental challenges arise from development and industrialization – natural resource depletion (especially of non-renewable resources), pollution, and ecosystem destruction. Other challenges are a function of underdevelopment and poverty-induced short-term thinking – resource depletion (especially of potentially renewable resources such as forests and water) and lack of investment in capacity and infrastructure committed to pollution control and ecosystem protection.

In elaborating this National Strategy for Environmentally Sustainability, “State-Driving forces-Pressure- Impact-Response model”, was used following the input of all stakeholders and interested parties. It is the most widely accepted indicator framework that defines five indicator categories:

- ***State*** indicators show the current condition of the environment. Examples: the concentration of lead in urban areas; the noise levels near main roads; the global mean temperature. Section One attempts to portray the state of the environmental systems of Yemen based on national and international information.
- ***Driving forces*** are underlying factors influencing a variety of relevant variables. Examples: the number of cars per inhabitant; total industrial production; GDP. ***Pressure*** indicators describe the variables which directly cause environmental problems. Examples: toxic emissions, CO_2 emissions, noise etc. caused by road traffic; the parking space required by cars; the amount of waste produced by scrap cars. Section Two presents the causes and consequences of economic activities, and social and institutional frameworks on the sustainability of the Yemeni environment.
- ***Impact*** indicators describe the ultimate effects of changes of state. Example: the percentage of children suffering from lead-induced health problems; the mortality due to noise-induced heart attacks; the number of people starving due, in part, to climate-change induced crop losses. Section Two concludes with special sub-section on the outcomes. This sub-section introduces the reader to the next sections of the document, i.e., intended, planned efforts and activities.
- ***Response*** indicators demonstrate the efforts of society (i.e. politicians, decision-makers) to solve the problems. Examples: the percentage of cars with catalytic converters; maximum allowed noise levels for cars; the price level of gasoline; the revenue coming from pollution levies; the budget spent for solar energy research

Finance and Resource Mobilization

This phase of the National Environmental Sustainability Strategy is an open-ended. It capitalizes on the consultation process employed in the elaboration of this document, which was carefully prepared and managed, to bring together the widest possible spectrum of existing and potential participants and partners, including donors. Representatives of investors, governmental bodies, and potential donors will are invited to participate in implementing the strategy and the updated NEAP. The consultative process is expected to eventually develop full stakeholder ownership and commitment to the National Environmental Sustainability Strategy and NEAP.

BACKGROUND

Yemen falls in the southern area of the Arabian Peninsula between latitude 12 and 20 north and longitude 41 and 54 east. Saudi Arabia and Oman are the neighbours of Yemen from the North and the East, respectively. The Arabian Sea and Gulf of Aden are the southern borders of Yemen, while the Red Sea is the western boarder (Figure 1). The area of Yemen is 455,503 sq. km. most of which is rocky land. The land of Yemen can be divided into the following five major divisions: coastal plains, mountains of Yemen, Eastern plateau, deserts and islands.

Figure 1 Location of Yemen and major human settlements

Climatically, Yemen is divided into 14 climatic zones based on climatic attributes. This climatic classification is one of the criteria developed to elaborate land uses in Yemen in an attempt to increase production or limit environmental degradation.

According to the primary results of the 2004 census, the population of Yemen is 19.7 million distributed among 20 Governorates and the Capital City, Sana'a. The population density is 43.2 persons per sq. km. The natural population growth has declined from 3.7 to 3.02 percent per annum between 1994 and 2004, respectively, which is still high and will accelerate population momentum.

Despite declines in Total Fertility Rates (TFR) from 6.5 to 6.2 per woman in 1997 and 2003, respectively, the current TFR is still high because of widespread of illiteracy between females,[3] and modest participation of females in the labour power.[4]

In 2003, Yemen was ranked as the 148th country out of 175 countries on the human development index. Although Yemen has made good progress in many areas,

[3] An estimated 67.9 per cent of adult females are illiterate.

[4] Total number of working females does not exceed 25 per cent of the labour force.

including basic education[5] and health, access to safe water, roads, and electrification. However, the male-female gap and urban-rural gap still persist. This explains why illiteracy persists where an estimated 49.4 per cent of the population are illiterate; and explains high rates of unemployment and poverty.

Yemen suffered sharp fall in oil prices during 1997-98; and a rapid growth in population. The recovery really began in 1995, with the start of an impressive economic stabilization and adjustment program. The economy grew by an average of 8.3 per cent per year during 1995-97. Output growth decelerated in 1999 to 3.7 percent. High oil prices in 2000, however, improved all macroeconomic indicators (oil accounts for 70 per cent of government revenues and 87 per cent of goods and services exports). Gross Domestic Product (GDP) growth recovered to 5.1 per cent in 2000, the budget noted a record surplus of 8 percent of GDP, and the current account of the balance of payments has gone from a deficit of 4.3 percent of the GDP in 1998 to a record surplus of 24.2 per cent in 2000.[6]

[5] Enrollment in education have increased from 53 to 60 per cent between 1990 and 2000, respectively; where female enrolment in education has increased from 31.5 per cent to 33.1 per cent during the same period.

[6] World Bank, Yemen, Country Brief Series, www.worldbank.org

1. ENVIRONMENTAL ISSUES

The environmental sustainability of Yemen is really questioned. According to the 2005 Environmental Sustainability Index (ESI), Yemen ranked globally the 137th country, with a score of 37.30. Yemen was classified among the fifth, and last group of countries of the world, whose score on the ESI was 46.40. A country is more likely to be environmentally sustainable to the extent that its vital environmental systems are maintained at healthy levels, and to the extent to which levels are improving rather than deteriorating. A country is more likely to be environmentally sustainable to the extent that its vital environmental systems are maintained at healthy levels, and to the extent to which levels are improving rather than deteriorating. Table 1 presents indicators used to assess the sustainability of environmental systems of a country. Based on the variables and indicators exhibited in the table, this section will attempt to assess the quality of the ecological systems of Yemeni people and their prospects for sustainability.

Table 1 Environmental systems sustainability index building blocks, 2005

Number	Indicator	Variable definition
1	Air Quality	Urban population weighted NO2 concentration
		Urban population weighted SO2 concentration
		Urban population weighted TSP concentration
		Indoor air pollution from solid fuel use
2	Biodiversity	Percentage of country's territory in threatened eco-regions
		Threatened bird species as percentage of known breeding bird species in each country
		Threatened mammal species as percentage of known mammal species in each country
		Threatened amphibian species as percentage of known amphibian species in each country
		National Biodiversity Index
3	Land	Percentage of total land area (including inland waters) having very low anthropogenic impact
		Percentage of total land area (including inland waters) having very high anthropogenic impact
4	Water Quality	Dissolved oxygen concentration
		Electrical conductivity
		Phosphorus concentration
		Suspended solids
5	Water Quantity	Freshwater availability per capita
		Internal groundwater availability per capita

Source: Esty, Daniel C., Marc Levy, Tanja Srebotnjak, and Alexander de Sherbinin (2005). 2005 Environmental Sustainability Index: Benchmarking National Environmental Stewardship. New Haven: Yale Center for Environmental Law and Policy. http://www.yale.edu/esi/

The table above shows there are five indicators for ecological sustainability: Air, Biodiversity, land and both water quality and quantity. The scores of Yemen on the Environmental Sustainability Index (ESI) in 2005 are presented in Table 2.

Table 2 Index of the sustainability of the environmental systems of Yemen, 2005

	Environmental Sustainability Index (ESI)	Rank	Per capita GDP (US$)	Environmental systems				
				Air Quality	Biodiversity	Land	Water quality	Water quantity
Yemen	37.30	137	773.00	-0.45	-0.13	0.77	0.01	-0.25
Average value for peer group of countries	46.40			-0.29	0.23	0.30	-0.19	0.02

Source: Esty, Daniel C., Marc Levy, Tanja Srebotnjak, and Alexander de Sherbinin (2005). 2005 Environmental Sustainability Index: Benchmarking National Environmental Stewardship. New Haven: Yale Center for Environmental Law and Policy. http://www.yale.edu/esi/

This section of the document attempts to shed the light on the state of the Yemeni environment by reviewing issues and challenges that threaten the environmental sustainability of country. It attempts to discuss status of environmental systems of Yemen using both national and international sources of information.

1.1 Fresh Water Resources and Water Pollution

1.1.1. Water Quantity

Box 1 The state of agricultural water management

Mean annual precipitation on the mainland gives a volume of 93.6 km³. Yemen can be subdivided into four major drainage basins, regrouping numerous smaller wadis: a) the Red Sea basin, b) the Gulf of Aden basin, c) the Arabian Sea basin, and d) the Rub Al Khali interior basin. Surface water resources have been estimated at two thousands million m³/year, but this quantity corresponds to the runoff from major rivers and does not include the runoff produced within the smaller catchments. Renewable groundwater resources are about l 525 million m³/year. The total dam capacity is estimated at 0.18 km³. There are also many flood control dams that are not intended to store water, but to divert the spate floods immediately to the adjacent irrigation network (spate irrigation). In 1990 total water withdrawal was estimated at 2 932 million m³/year, of which 92 per cent for agricultural purposes. The rates of decline of the groundwater levels are alarmingly high in many zones, especially in the Yemen Highlands, where decline of between 2 and 6 m/year is commonly observed. Spring-fed irrigation has reduced significantly as groundwater tables have dropped. The quantity of desalinated water contributing to the water supply of Aden in 1989 was about ten millions m³/year.

Source "AOUASTAT Countrv Profiles"

There is no water balance available for Yemen. An estimate of the amount of water that country receives each year is not known precisely. However, sources of fresh water are mainly:

- Rain: Rainfall is the basic water resource. An estimated 68 000 million cubic meters falls each year on Yemeni soil, at an annual average estimated at 230 ml. Most of this rain falls on the western heights and the eastern plateau. Rainfall varies from less than 350

mm, which could be considered below the minimal amount needed for rain-fed agriculture, to about 1500 mm per year. The highest and most consistent rainfall occurs in the southern highlands, near Ibb. Spate irrigation rations the occasional floodwaters from storms in the mountainous catchments areas to the coastal and foothill areas. A large portion of the cultivated area relies on spate irrigation. Nearly 70 per cent of agricultural areas depend on rainwater for production of crops and raising livestock. [7]

- Floods: These are the major source of surface water in Yemen. This source of water secures about 1 500 million cubic meters each year.
- Wells: There are various types of hot, warm, cold and mineral water in Yemen.
- Underground water: In Yemen there are about 14 major basins whose total area mounts to 452 thousand sq. km. Wells and springs are important sources for domestic supply and irrigation. These offer farmers more water supply than spate irrigation. However, the large increase in the number of wells, the uncontrolled use of pumped water, and the tendency to neglect the traditional spate system are increasingly causing depletion of wells, low quality of water for irrigation, and salinization of soils.[8]
- Unconventional sources of fresh water: These include water harvesting where the Government constructed almost one thousand structures including, but not limited to, small dams and irrigation canals to collect water resulting from rain. Unconventional sources of fresh water include the reuse of properly treated wastewater and water used in ablution. This option should be considered with extreme caution because there is no clear information on the quality of the treated wastewater and its impact on health. However, treated wastewater could be used in afforestation and irrigating open, green areas around human settlements. There is also a possibility to use brackish, mineral and hot ground water once they are subjected to proper treatment. Another option is the desalination of sea water. However, this option requires expensive technology and has its own serious environmental impacts that need to be properly considered. Last but not least is using water that accompanies the production of oil. This option needs further investigation on its use and the impact on humans and the environment.

Despite these sources of fresh water, Yemen is one of the countries with the scarcest water resources in the world. The calculated score for water quality on the Environmental Sustainability Index (ESI) for Yemen in 2005 was -0.25.[9] This means that the country has gone under the water poverty datum. This is due, in part, to the dry climate prevailing in 90 per cent of Yemen's total area that associates with high rates of evaporation, in addition to the over-utilization and excessive pumping of ground water. The average drop of water levels in most basins ranges between 1-8 meters per year. Water depletion throughout the country stands at approximately 138 per cent of the annual renewable water. Should pumping continue at the same levels, then it is expected that most water basins would be depleted within a period of

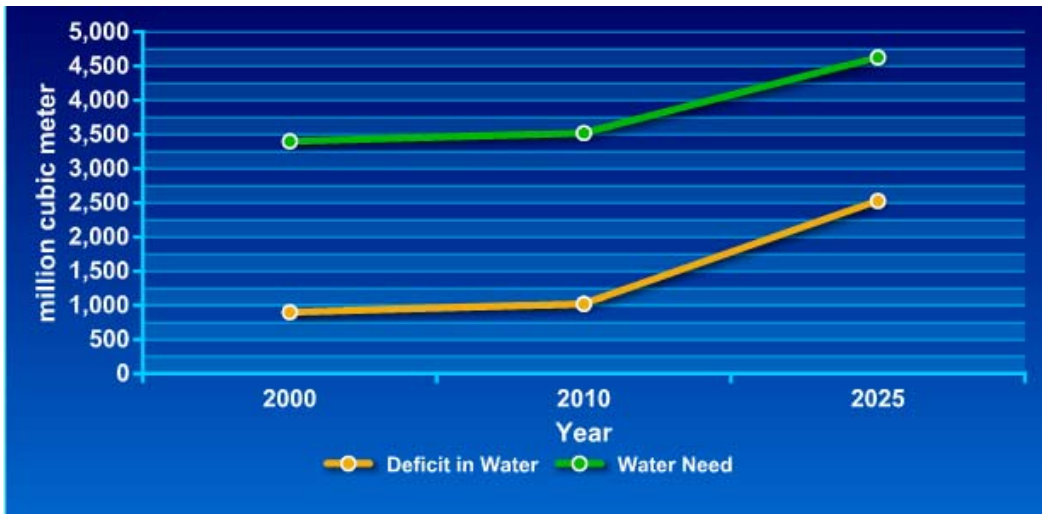
[7] Friedrich Ebert Foundation, Analytical Overview of Yemen Agriculture, Excerpt from Agricultural Research Strategy, January 14, 2002, http://www.fes-yemen.com

[8] Ibid.

[9] Esty, Daniel C., Marc Levy, Tanja Srebotnjak, and Alexander de Sherbinin (2005). 2005 Environmental Sustainability Index: Benchmarking National Environmental Stewardship. New Haven: Yale Centre for Environmental Law and Policy. http://www.yale.edu/esi/

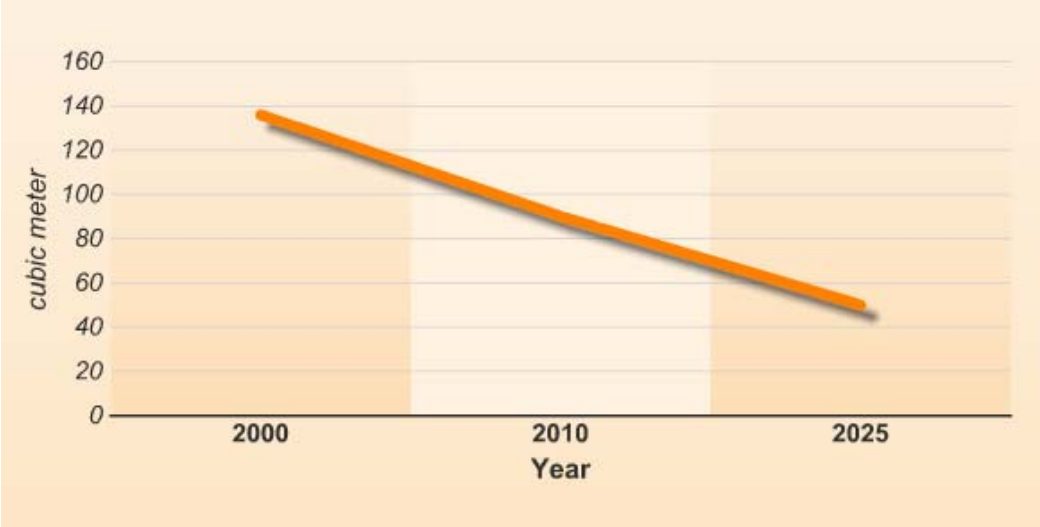
15-50 years.[10] Figure 2 shows the estimated water needs and deficit between 2000 and 2025.

Figure 2 Estimated Water Needs and Deficit, 2000-2025



As the Yemeni economy expands, and the high population growth rates are sustained, the pressures on the resource base are expected to increase. Given that available water resources are almost constant, if not declining as a result of drought, then the gap between available water resources and increasing needs and demands will widen over time, as suggested in Figure 2. This complicated situation is expected to be reflected in the declining per capita share in available water resources. Figure 3 shows that current and projected per capita share of water indicating that Yemen is, and will continue to suffer from water poverty, which means that the likelihood of meeting MDG 7, Target 1, is not possible under the Business As Usual (BAU) scenario. Certainly, limited available water resources hinder the sustainable development of Yemen.

Figure 3 Per Capita Share of Water, 2000-2025



[10] Government of Yemen, Millennium Development Goals: Progress Report for Yemen, 2003, New York, NY: UNDP, 2003, pp.35-36.

1.1.2. Water Uses

The general trend in Yemen suggests that the achievement of MDG-7, Target 2, by the year 2015 will not also be possible for the following reasons:

- Scarcity of water resources in Yemen and weak sources of coverage, thus negatively reflecting on the water distribution system;
- High annual population growth rate of 3.5 per cent and expansion of economic activities, thus increasing the demand and need for water; and
- Water pollution and low quality of water in most basins, aggravated by water salinity in coastal areas.

Water resources in Yemen have reached a critical stage that threatens with a crisis, thus making water security a national challenge requiring enormous efforts. Expectations indicate that water reserves will not be sufficient for the coming few years. Official data shows a deficit of 900 million cubic meters, noting these predictions are based on the present levels of demand, which, in reality, are expected to increase. Consumption of water from municipal sources constitutes only 7 to 10 per cent of water consumption. The average per capita of municipal water is estimated to range between 11 and 30 cubic meters per annum. It is most likely that the consumption rates will further drop as a result of population and economic growth, and rapid urbanization rate of 8 per cent per annum. The general trend for the period 1990–2000 suggests stable access to drinking water at the national level, despite the fluctuations witnessed during this period.[11]

Table 3 shows water withdrawals in 1990 as published by the World Resources Institute in 2005. The table suggests that per capita share, presented in the table and compared to Figure 4, is declining. Alarming information in the table is the amount of withdrawn water exceeds the actual renewable water resources. Finally, the table shows that agriculture is the major consumer of water resources. This requires rethinking cultivating water-demanding crops, and the need for institutionalizing an efficient water management system.

Table 3 Water Withdrawals, 1990

Total withdrawals (cubic km)	2.9
Withdrawals per capita (cubic m)	253.0
Withdrawals as a percentage of actual renewable water resources (%)	122.9
Withdrawals by sector (as a percent of total) {a}	
► Agriculture	92.0
► Industry	1.0
► Domestic	7.0

Note: a. Totals may exceed 100 per cent due to groundwater draw downs, withdrawals from river inflows, and the operation of desalinization plants

Source: World Resources Institute (WRI), 2005, "Forests, Grasslands and Dry lands, Country Profile-Yemen," Earth Trends: Environmental Information Portal, http://earthtrends.wri.org/

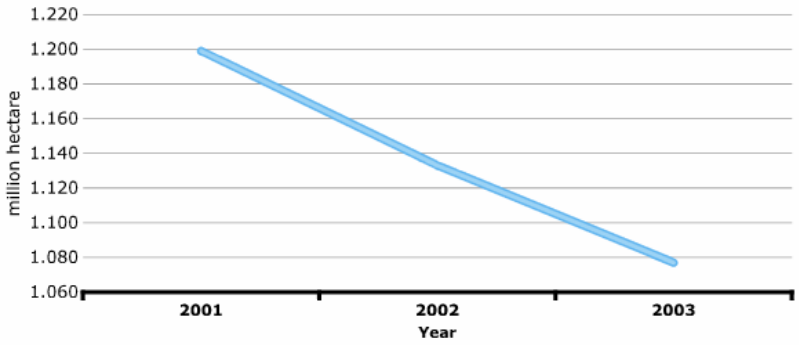
i. Water for Commodity Production

In 2003, 0.485 million hectare of the cultivated areas were rain fed. In the same year, 0.398 million hectares were irrigated by underground water, and another 0.194 million hectares were irrigated using flood water. Figure 4 shows the amount of cultivated land during the period 2001-2003 is declining, and this is the direct result of the arid climate and drought that challenges the agricultural development and food

[11] Ibid.

security in Yemen. The data do not show the consumption of water by agricultural activities, rather the data show cultivated area.

Figure 4 Cultivated Land during 2001-2003



Box 2 Qat and water

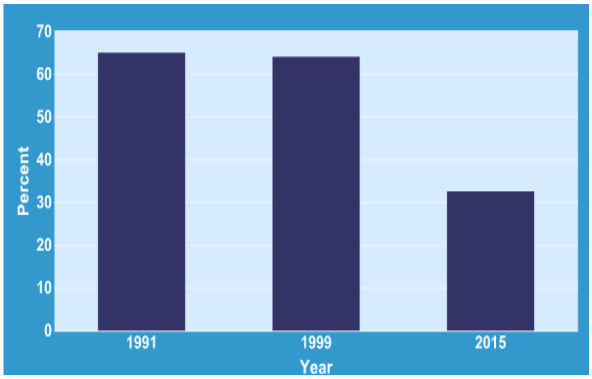
Expansion in Qat cultivated area has directly impacted the use of water resources. Some studies have shown estimates of Qat water requirement that differ under the various climatic conditions of the different regions. The annual estimated requirements of one hectare of Qat are between 600 m^3 and 12 thousands m^3. Despite the uncertainty of the quantity of water required for Qat cultivation, it is apparent that Qat is irrigated with more water than it needs because of water mismanagement and inefficiency of water transmission and irrigation techniques especially in the areas that depend on water for supplemental irrigation.

Source Republic of Yemen, Poverty Reduction Strategy Paper, 2003-2005, May 2002, http://www.mpic-yemen.org/dsp/PRSP2003_2005_2.pdf

Qat is one of the most water consuming agricultural products. The areas cultivated with Qat represent almost 50 per cent of the irrigated areas, and is growing at approximately nine per cent per annum. Despite the economic and social rational of cultivating Qat, but the need to conserve water in Yemen means rethinking the whole issue. One of the options is to import Qat from Ethiopia, and use the available natural resources in developing projects in rural areas that do not depend on intensive use of water. However, this option has to be considered within the overall analysis of trade balance.

ii. Potable Water Supply

Figure 5 Population without sustainable access to safe drinking water



The total amount of safe drinking water that local institutes for water and wastewater have produced in urban settlements in 2003 was about 114.5 million cubic meters, distributed among almost three million persons, almost 15 per cent of the population. Others receive their water from privately run projects for producing drinking water. There is no clear information on the status of delivery of drinking water in rural

areas. [12]

In light of the data and information available, it will be difficult to achieve MDG 7, Target 1, i.e., reducing the proportion of population who does not receive safe drinking water by the year 2015.

Despite the fluctuations experienced during this period, the general trend for the period 1990–2000 suggests stable access to drinking water at the national level. Consumption of water from municipal sources constitutes only 7 to 10 per cent of water consumption. The average per capita share of municipal water ranges between 11 and 30 cubic meters per annum. It is most likely that the consumption rates will further drop as a result of population and economic growth, and rapid urbanization rate of 8 per cent per annum.[13]

The National Poverty Survey has shown that 36 per cent of all Yemeni families receive drinking water from the main water network, while the remaining 64 per cent receive water from other sources, including, in order of priority: water wells (with and without pumps), streams and springs, covered and uncovered pools, dams, etc.

iii. Industrial Water Consumption

There is no clear information on the state of water consumption in the manufacturing sector or the amount of industrial wastewater generated. In 1990, manufacturing activities consumed 31 million cubic meters of water, which represents only one per cent of the water uses in the country at that time. In 1996, according to the results of the survey of the industrial establishments, the volume of treated effluents was estimated at 268 million cubic meters. The difference between both statistics indicates poor quality of data and information that are not conducive for proper decision-making. It is unrealistic that the treated wastewater is more than the consumed waste; and it is also unrealistic that the manufacturing sector expanded exponentially in six years without any evidences in the national or international accounts.

iv. Sanitation

In 2000, only 25 per cent of the urban residents enjoyed sanitary services. An estimated 20 per cent of the rural residents had safe means to dispose their wastewater. According to data at Environmental Protection Agency (EPA), in 2004, less than seven per cent of the Yemenis enjoyed sanitary services. Sludge management is a solid waste problem that associates with proper wastewater treatment, discussed later in sub-section 1.8 Solid Waste Management. Lacking proper sanitation system could negatively affect the quality of the environment and harm human health. Furthermore, these data suggest that the country might not be able to achieve MDG 7, Target 2, which is concerned provision of sanitary services to achieve significant improvement in lives of urban and rural dwellers,

1.1.3. Water Quality

There are no proper accounts on the quality of water in Yemen. There is no information on the various variables indicating the quality of water bodies, such as ammonia, silt, count of e-coli cells, BOD, COD, DO, etc. However, according to the

[12] Government of Yemen, Millennium Development Goals: Progress Report for Yemen, 2003, New York, NY: UNDP, 2003, p. 38.
[13] Ibid.

ESI 2005, the quality of fresh water in Yemen is at border line; where the ESI score was 0.01.[14]

According to the Environmental Profile, 2005 that EPA prepared, dust and other suites of air pollution, resulting from mobile and stationary sources of air pollution, affect the quality of water brought by rain. However, no accounts on the degree of acidity of this rain are made available. As for surface water, the official reports assure its acceptable quality. Yet, these reports point to the possibility of polluting this surface water from human activities including industrial wastewater, sewerage, and municipal solid waste accumulated on the banks of waterways, etc. Records on the quality of ground water are also unclear, which is expected to be inferior in the light of modest efforts in the field of environmental management.

1.2. Air Pollution

1.2.1. Ambient Air Quality

Air pollution continues to be one of the most serious local environmental problems and a continuing threat to human health, and has moved to the forefront of concerns in the past decade. In the wake of increased environmental awareness and encouraged by international movements, multinational corporations and popular opinion, the Government of Yemen supports social demands for the establishment of environmentally safe habitats.

Yemen is not a highly urbanized society. An estimated 75 per cent of the population still resides rural areas. Also, Yemen is not a major industrial country. Aside of oil exports, traditionally, the major source of income was agriculture and fishing. The production and refinery of oil, and the cement industries are the two major heavy industries in Yemen. Also, the number of vehicles on the roads is increasing, and mobile sources of emissions could be among the prime source of air pollution.

The air in Yemeni human settlements is polluted. The score on the ESI index for air quality in 2005 was -0.45. The negative sign indicates inferior air quality that contributes to degraded water resources as presented earlier. All body organs, including liver, blood, kidneys, etc. are affected by polluted air. Nitrous and sulphuric acids hanging in the air will also solidify and may cause the stomach to ache. Under these conditions, the capacity of the blood to carry oxygen to all parts of the body is decreased, if it is not made impossible, thus leading to drowsiness, fatigue and laziness.

According to the ESI 2005, the status of air quality in Yemen is substandard, where the score on the index was -0.45; however, the index shows there are efforts to improve the quality of the air rendered by the positive score of 0.29 on the index for reducing stresses. Earth Trend of the World Resources Institute has put together information on the levels of climatic and atmospheric pollution in Yemen. Table 4 shows records of Yemen. The country is not a major producer of carbon dioxide. Its emission as a per cent of global CO2 production was only 0.1; most of this CO2 is from liquid fuels. However, the table suggests that CO2 production per million dollars of GDP in 1998 was not efficient compared to the world. The table affirms that most of the air pollution is from vehicles, where transportation is the major producer of CO2

[14] Esty, Daniel C., Marc Levy, Tanja Srebotnjak, and Alexander de Sherbinin (2005). 2005 Environmental Sustainability Index: Benchmarking National Environmental Stewardship. New Haven: Yale Centre for Environmental Law and Policy. http://www.yale.edu/esi/

Table 4 Air Pollution, 2005

	Yemen	Middle East and North Africa	World
Carbon Dioxide (CO2) Emissions {a} (in thousand metric tons of CO2)			
Total Emissions, 1998	14 158	1 546 030	24 215 376
Percent change since 1990	X	46 %	8 %
Emissions as a percent of global CO2 production	0.1 %	6.4 %	
Emissions in 1998 from:			
► solid fuels	0	130 585	8 654 368
► liquid fuels	13 560	833 523	10 160 272
► gaseous fuels	0	461 305	4 470 080
► gas flaring	0	50 244	172 208
► cement manufacturing	598	70 373	758 448
Per capita CO2 emissions, 1998			
(thousand metric tons of CO2)	1	4	4
Percent change since 1990	X	18 %	-2 %
CO2 emissions (in metric tons) per million dollars Gross Domestic Product {b}, 1998	3 357	X	773
Percent change since 1990	X	X	-10 %
Cumulative CO2 emissions, 1900-1999 (in billion metric tons)	278	30 843	933 686
CO2 Emissions by Sector, 1999 {c} (in million metric tons of CO2)			
► Public electricity, heat production, and auto producers	2	417	8 693
► Other Energy Industries	0	150	1 205
► Manufacturing Industries and Construction	1	300	4 337
► Transportation	4	242	5 505
► Residential	2	118	1 802
► Other Sectors {d}	X	196	5 640
Total Emissions All Sectors	X	1 423	27 180
CO2 Intensity, 1999			
Emissions per total energy consumption (metric tons CO2 per tera joule energy)	65	62	56
Emissions per Gross Domestic Product {e} (metric tons of CO2/million $PPP)	664	721	582
Non-CO2 Air Pollution, thousand metric tons			
► Sulphur dioxide emissions, 1995	38	7 335	141 875
► Nitrogen oxide emissions, 1995	59	5 071	99 271
► Carbon monoxide emissions, 1995	594	31 879	852 415
► Non-methane VOC emissions {f}, 1995	389	15 711	159 634

Notes: a. Source: Carbon Dioxide Information Analysis Centre (CDIAC); b. Constant US dollars; c. Source: International Energy Agency (IEA); d. Includes the commercial sector, agriculture, the public service sector, and international bunkers; e. GDP is in 1995 international dollars, adjusted for Purchasing Power Parity; f. VOC: Volatile Organic Compounds.

Source: World Resources Institute (WRI), 2005, “Climate and Atmosphere, Country Profile-Yemen,” Earth Trends: Environmental Information Portal, http://earthtrends.wri.org/

1.2.2. Indoor Air Quality

Indoor air quality is important because people spend at least 40-50 per cent of their time inside buildings. Moreover, young children and housewives spend more than 80 per cent of their time at their homes. Sources of indoor air pollution include outdoor pollution as well as indoor activities, such as cooking and use of insecticides. Research work indicates that in many developing countries, such as Yemen, 40 to 90 per cent of outdoor pollutant concentrations are found indoors.

Indoor pollution arises from smoking, burning of agricultural waste, fuel burning, particularly kitchen and bathroom heaters in poorly ventilated houses, excessive use of domestic insecticides, and static sources, such as building materials including paints. For example aldehydes were found in high concentrations in some Sana'a houses and public buildings where synthetically painted wood and furniture are used. Poor ventilation also plays a major role in the accumulation of indoor air pollution. Other sources of indoor pollution are the radon gas found due to the materials like stones used in the buildings.

The emissions resulting from workshops that have concentrations exceeding the TLV limits are source of air pollution inside the work environment. The inefficient use of air pollution control equipments increase the pollution rates inside the working environment, and accordingly, affect the health of the people inside the place.

Noise is another type of indoor air pollution; for instance domestic appliances, radios, loud speakers, T.V, children's and adult voices, and neighbours' activities can all contribute to noise pollution at unacceptable levels. Air conditioners and traffic accompanied with honking horns also cause noise and discomfort.

1.3. Land

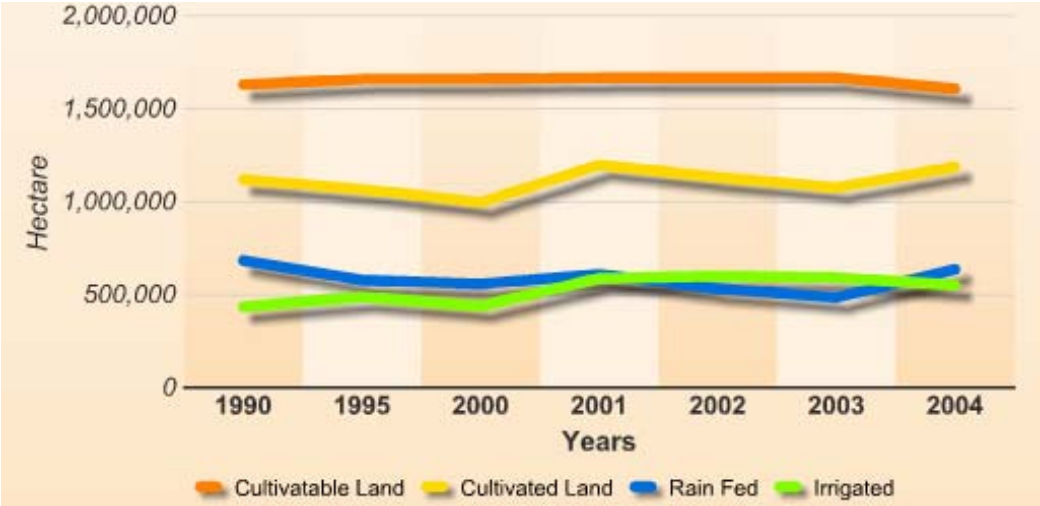
1.3.1. Agriculture

The gross area of Yemen, which is 455 thousand sq. km. can be classified into 58 per cent as rocky, desert and urban land; 39 per cent as forests and rangeland; and finally, 3.5 per cent cultivatable land, which varies according to climatic conditions, particularly amount of rain and precipitation. In 2000, the cultivated area declined to its lowest at 997 thousand hectare, and reached its maximum 1.240 million hectare two years later.

There are two cultivation systems in Yemen: rain fed, which represents 54 per cent of the cultivated land, and the remaining land is cultivated using one of the following three irrigation systems: wells (34 per cent), floods (eight per cent) and dams (four per cent). Yemen, as many countries of the region, suffers from arid climate responsible for drought and desertification.

Due, in part, to population growth, on one hand, and limited amounts of water and land suitable for cultivation on the other, the per capita share of cultivatable land has declined. In 1990, the per capita share was 0.13 hectare; and declined to 0.08 hectare in 2004. However, a closer look to the published data indicates that horizontal expansion is possible if the Yemeni people can efficiently utilize their available land resources. Figure 6 indicates that cultivatable land is almost twice the cultivated land, thus horizontal agricultural expansion is possible, subject to efficient utilization of available water resources.

Figure 6 Cultivated and Cultivatable Land, 2003



Source: The Statistical Year Book, 2003

Yemen's cover of soil resources is extremely limited. Arable land constitutes two per cent of the total area of land. The cultivated land is 1.3 million hectares, i.e. 2.4 per cent of the total area and 68.8 per cent of the arable land. Therefore, the deterioration of soil resources poses a genuine environmental threat, due to high salinity of soil and desertification, which threatens approximately 97 per cent of the land throughout the country and destroys almost three to five per cent of arable land every year.[15]

Degradation of land resources is manifested in the increased rates of desertification, as a result of increased rates of salinity. Degradation of land resources leads to deteriorating traditional systems in agricultural practices, which in turn forces rural settlers to migrate to nearby urban centres in search for a decent living.

A number of reasons are responsible for the degradation of land resources. These include, but not limited to, increased fuel wood cutting and overgrazing contribute to increased erosion of soils by both wind and water (Table 5). Furthermore current sharecropping arrangements are not conducive to increase production.

Table 5 Degraded land classified by type and area, 2003

Degradation Type	Area (hectare)
Water erosion (W), out of:	5 070 608
Slight W	643 960
Moderate W	1 846 813
Severe W	2 579 835
Wind erosion (E)	578 189
Over blowing (E3)	475 246
Sheet erosion (E0)	102 943
Chemical deterioration (Salinity)	37 089
Physical deterioration (Crusting)	12 717
Non-used Wasteland	38 917 984
Desert	4 856 897

[15] Government of Yemen, Millennium Development Goals: Progress Report for Yemen, 2003, New York, NY: UNDP, 2003, pp.35-36.

Degradation Type	Area (hectare)
Sand dunes	5 815 937
Wetland	48 347
Rocks	28 196 804
Total Stable land out of:	933 658
Stable Naturally	272 154
Stable By conservation practices	661 504
Total geographical area of the ROY	45 550 245

Source: Division for Land Studies and Water Uses (ACSAD), Natural and Renewable Resources Research Centre, Land degradation in the Republic of Yemen, 2002, The General Agency for Agricultural Research and Extension, Republic of Yemen.

The overall low productivity of the agricultural sector could be the resultant of land degradation. However, there are a number of issues that also explain the low productivity of the sector including deteriorated traditional seed selection system; conventional crop and resource management practices in rain fed agriculture and increased costs of agricultural production in rain fed areas; inefficient irrigation and drainage systems; weak agricultural extension; and last but not least, lacking proper marketing schemes and infrastructures to support marketing processes. The low productivity of livestock, post-harvest losses, irrational use of chemicals are all symptoms and causes of the problem that result in the underdevelopment of rural areas and persisting widespread of poverty.

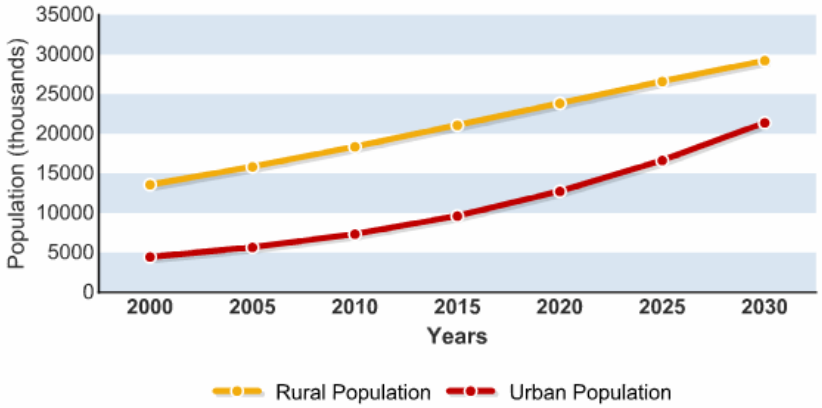
The major problems in the agricultural sector of Yemen, according to priority, are: a) deteriorated land resources that negatively affects the productivity of the sector; b) low returns from agriculture at large, and specifically from rain fed farming, thus forcing the Yemeni peasants to expand in cultivating Qat, which in turn requires more land and water at the expense of strategic, high-value cash crops that Yemeni agriculture can produce.

1.3.2. Human Settlements

According to Figure 7, Yemen is, and will continue to be, a predominately rural country, however, Yemen, as countries of the region, has an extended history of urbanization. Cities of Yemen are noticeably reflecting the impact of Islam, and represent the amalgam of many cultures, that had shown remarkable resiliency to change. Old quarters of these cities are often compact mass of residences, open courtyard houses that create a cellular urban texture. The old quarters often include a permanent central market (*suq*), which consists of small, contiguous stalls located in numerous irregular passageways that are covered with domes or vaults, public baths, mosques that might contain shrines, and often a citadel and surrounded with a large wall. Trade is the major reason for the location of many of these cities. Coastal cities, such as Aden, and in-land cities, Sana'a, are the outcome of complex trade networks, and served as nodes of these networks.

In addition to Sana'a and Aden, other important cities are Hudaydah, Mukalla, Taiz, Ibb, and Abyan. Tables 6, 7 and 8 show the population of urban agglomerations 750 thousands inhabitants or more in 2000 and projections to 2030.

Figure 7 Urban and Rural Population



Source: Data complied from World Urbanization Prospects, 2003, http://esa.un.org/unup/index.asp?panel= 1

Table 6 Population of urban agglomerations with 750 thousands inhabitants or more in 2000 (thousands) 1970-2015

City	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015
Aden	206	246	264	283	326	408	483	584	731	942
Hudaydah	71	90	115	147	212	311	418	547	707	916
Mukalla	39	50	63	79	100	125	149	182	230	299
Dhamar	15	22	31	45	62	86	110	141	182	237
Ibb	14	21	32	47	71	108	149	199	259	339
Sana'a	111	141	238	402	677	965	1 264	1 621	2 068	2 658
Taiz	65	89	122	166	235	328	424	541	692	896

Source: Data complied from World Urbanization Prospects, 2003, http://esa.un.org/unup/index.asp?panel= 1

Table 7 Percentage of the urban population residing in each urban agglomeration with 750,000 inhabitants or more in 2000 (%)1970-2015

City	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015
Aden	24.7	23.9	19.6	15.7	12.8	11.4	10.8	10.3	10.0	9.8
Hudaydah	8.5	8.8	8.6	8.1	8.3	8.7	9.4	9.7	9.7	9.5
Mukalla	4.7	4.8	4.7	4.4	3.9	3.5	3.4	3.2	3.1	3.1
Dhamar	1.8	2.1	2.3	2.5	2.4	2.4	2.5	2.5	2.5	2.5
Ibb	1.7	2.1	2.4	2.6	2.8	3.0	3.3	3.5	3.5	3.5
Sana'a	13.2	13.7	17.7	22.3	26.6	27.1	28.4	28.6	28.2	27.7
Taiz	7.8	8.7	9.0	9.2	9.2	9.2	9.5	9.6	9.5	9.3

Source: Data complied from World Urbanization Prospects, 2003, http://esa.un.org/unup/index.asp?panel= 1

Table 8 Percentage of total population residing in each urban agglomeration with 750,000 inhabitants or more in 2000 (%)1970-2015

City	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015
Aden	3.3	3.6	3.2	2.9	2.7	2.7	2.7	2.7	2.8	3.1
Hudaydah	1.1	1.3	1.4	1.5	1.8	2.1	2.3	2.5	2.8	3.0
Mukalla	0.6	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.9	1.0
Dhamar	0.2	0.3	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8
Ibb	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1
Sana'a	1.8	2.0	2.9	4.1	5.7	6.4	7.0	7.5	8.1	8.7
Taiz	1.0	1.3	1.5	1.7	2.0	2.2	2.4	2.5	2.7	2.9

Source: Data complied from World Urbanization Prospects, 2003, http://esa.un.org/unup/index.asp?panel= 1

The data presented in the tables above and confirmed by Table 9 and 10, suggest that most of the new comers will be in existing cities. This urban growth will be the outcome of both sustaining high rates of natural population growth and continuous rural-urban migration. This urban growth will require extending both physical and social infrastructures.

Table 9 Average annual rate of change of capital cities and urban agglomerations with 750,000 inhabitants or more in 2000 (%)1960-2015

City	1970-1975	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000	2000-2005	2005-2010	2010-2015
Aden	3.49	1.42	1.42	2.81	4.50	3.36	3.81	4.49	5.06
Hudaydah	4.82	4.82	4.82	7.36	7.70	5.93	5.36	5.12	5.19
Mukalla	4.63	4.63	4.63	4.63	4.63	3.50	3.96	4.66	5.23
Dhamar	7.22	7.22	7.22	6.61	6.53	5.03	4.90	5.05	5.34
Ibb	7.96	7.97	7.96	8.26	8.30	6.44	5.73	5.35	5.35
Sana'a	4.80	10.51	10.50	10.45	7.07	5.39	4.98	4.87	5.02
Taiz	6.23	6.23	6.23	6.93	6.69	5.12	4.88	4.93	5.16

Source: Data complied from World Urbanization Prospects, 2003, http://esa.un.org/unup/index.asp?panel=1

Table 10 Spatial distribution analysis of Yemeni urban population, 2005-2015

Year	Number of cities per size class					Percentage of urban population				
	10 mill. or more	5-10 mill.	1-5 mill.	0.5-1 mill.	Few than 0.5 mill.	10 mill. or more	5-10 mill.	1-5 mill.	0.5-1 mill.	Few than 0.5 mill.
2005	--	--	1	3	3	--	--	29	30	9
2015	--	--	1	3	3	--	--	28	29	9

Source: Data complied from World Urbanization Prospects, 2003, http://esa.un.org/unup/index.asp?panel=1

The existence of primate cities[16] reflects wide regional disparities as the population of the two cities of Sana'a, Aden, Hudaydah and Taiz together accounted in 2005 for 58.2 per cent of the total urban population and 12.7 per cent of total population of Yemen. Meanwhile, the population of other cities accounts about 15.2 per cent of the total population of Yemen. Often urban primacy and regional disparities associate with social and economic problems, such as unemployment, poverty, and excessive influx of rural-urban migrants, including denying marginalized sub-populations' access to power and wealth.

The urban environment faces many problems, the most important of which are: first, severe shortage of sanitation which covers only 44 per cent of the urban houses; and second, inefficient systems for solid waste management, where only 70 per cent of such waste is collected. Most often, such waste is dumped in areas that are not too far from the cities. Third, hazardous (poisonous) gas emissions from factories, electricity generation plants, transport vehicles and waste burning are also another important factor contributing to degradation of the Yemeni urban environment.[17]

[16] "In many parts of the Third World there is not only a discontinuity between urban and rural areas but also a sharp discrepancy between the capital city or chief port (either of colonial origin or of renewed importance when the country became linked to international trade) and the remaining cities and towns of the urban hierarchy. Often, this has led to a condition of excessive "primacy" or, as some have termed it, "macrocephaly," in which one city so dominates the remainder of the country that it prevents other parts from developing." (Abu-Lughod and Hay, Third World Urbanization, New York, NY: Methuen, Inc. 1986: 7).

[17] Government of Yemen, Millennium Development Goals: Progress Report for Yemen, 2003, New York, NY: UNDP, 2003, pp.35-36.

1.4. Forests

The annual depletion rate of forest areas during the period 1990-2000 was 1.04 per cent due, in part, to a number of factors, including agricultural activities, over-grazing and wooding. Statistics indicate that 60 per cent of the population is still using wood as fuel, thus alarming that the plant cover is being over depleted. Depletion exceeds tree-planting by far resulting a serious environmental situation.[18]

Table 11 State of Forests, 2005

	Yemen	Middle East and North Africa	World
Forest Area and Change			
Total forest area, 2000 (000 ha)	449	29 104	3 869 455
Natural forest area, 2000 (000 ha)	X	20 448	3 682 722
Plantations area, 2000 (000 ha)	X	6 533	186 733
Total dry land area, 1950-1981 (000 ha) {a}	12,871	552 621	5 059 984
Change in forest area:			
► Total, 1990-2000	-17%	2%	-2%
► Natural, 1990-2000	X	X	-4%
► Plantations, 1990-2000	X	X	3%
Original forest {b} as a percent of total land area {c}	0%	X	48%
Forest area in 2000 as a percent of total land area {c}	1%	2%	29%
Forest Area by Crown Cover (000 ha), 2000 *Note: Crown cover data are gathered using different methodologies than the forest area calculated above. The two estimates may differ substantially.*			
Area of forest with crown cover:			
Greater than 10%	301	33 369	6 537 209
Greater than 25%	34	16 375	4 842 071
Greater than 50%	5	7 686	3 143 720
Greater than 75%	1	4 077	1 945 916
Ecosystem Areas by Type			
Total land area	52 797	1 256 964	13 328 979
Percent of total land area covered by:			
Forests	0%	1%	24%
Shrub lands, savanna, and grasslands	51%	25%	37%
Cropland and crop/natural vegetation mosaic	1%	7%	20%
Urban and built-up areas	0.0%	0.1%	0.2%
Sparse or barren vegetation; snow and ice	48%	66%	16%
Wetlands and water bodies	0%	0%	3%

Source: World Resources Institute (WRI), 2005, "Forests, Grasslands and Dry lands, Country Profile-Yemen," Earth trends: Environmental Information Portal, http://earthtrends.wri.org/

1.5. Cultural Heritage

Yemen is world renowned for its architectural heritage. The unique vernacular architecture of the original "skyscrapers" in the cities of Sana'a and Shibam, the dam at

[18] Government of Yemen, Millennium Development Goals: Progress Report for Yemen, 2003, New York, NY: UNDP, 2003, pp.35-36.

Marib from the fifth century BC, numerous mosques dating back to the days of the Prophet, and the fortified mountain villages all present the fascinating and diverse heritage of Yemen.[19]

Figure 8 Shibam, Yemen

The threats to Yemen's cultural heritage have multiple causes which are mostly related to an increase in the poverty level of the old cities: a) economic decline, caused by shifting patterns of trading and broader global forces; this is the case in Zabid, where the textile industry declined dramatically, leaving a legacy of unused, dilapidated historic buildings; b) pressures of development, lack of adapted urban regulation and inadequate enforcement procedures, which lead to the replacement of the traditional population by immigrants from the rural sector in some areas; while in other areas within cities, such as Sana'a, gentrification could bring about an irreversible change in the city landscape, with the use of non-traditional construction methods, and a definitive evolution in architectural design; c) lack of maintenance, as with some of the mud built architecture in Shibam where the impact can be irreversible to one building and can extent to the neighbouring buildings. Lack of maintenance can have even a more drastic impact when combined with a strong rainy season (Sana'a in 1999). If these issues are not addressed during this a decade or two, the Yemenis and foreigners alike will witness the destruction of Yemen's urban qualities. That destruction will mean that one of the world's most uniquely-built environments and the skills that go along with maintaining it will irreversibly disappear, even though this may happen in progressive and subtle ways.[20]

1.6. Desertification

The issue of desertification has been recognized as a major economic, social and environmental problem of global dimensions. Possible implications range from human malnutrition to social instability involving community dislocation and forced emigration. The high rate of population growth in the dry land associate with poor economic performance, exacerbated by degrading natural resources and, consequently, adding to the causes and effects of the desertification problem.

Yemen is an arid country. Its aridity varies from one region to another, making it prone to desertification. A combination of climatic conditions and fragile ecosystems accentuate wind erosion especially at the fringes of the desert where topsoil is sandy and thin. Desertification results from a complex of inherent fragility of the ecosystem and excessive use that is beyond the productive capacity of the ecosystem itself. The increasing exploitation of the environment in Yemen is mainly the result of population growth and expanding human needs that follows this growth. Yemen faces the following forms of desertification:

- Degradation of irrigated farmland as a result of using low quality water in irrigation,

[19] World Bank, Republic of Yemen, Cultural Heritage Building Block, World Bank Document, August 2000.
[20] Ibid.

- Degradation of rain-fed farmland,
- Degradation of rangeland through overgrazing, degradation of plant cover,
- Encroachment of sand formations.

The growing Yemeni population is spatially ill-distributed. The high population density has placed land resources under serious pressures. Most land is overexploited, with only short periods of being left fallow coupled with high doses of fertilizers used in agricultural production. Other forms of exploitation are overuse of pesticides, and in some cases urban encroachment on productive land. In some places where subsurface drainage facilities are absent or inefficient, water logging, concomitant salinity degrade the soil. These threats point to the urgency of combating desertification, particularly as they increase over time. Furthermore, policies and measures of combating desertification are long-term and costly.

1.7. Marine and Coastal Environment

1.7.1. Status

Threats to coastal environment are multitudes. They include: expansion of coastal cities, demolition of coasts, lack of sanitation facilities, ships' waste, etc. Environmental degradation threatens fisheries, which could be a rich resource if properly preserved.[21] Table 12 summarizes the state of marine and coastal environment. The table shows, first, there is a real deficiency in information reflecting the status of marine and coastal environment. Second is the concentration of population along the coast, and the expected impact on marine and coastal environment. Third is the significant share of Yemen in the area of continental shelf, territorial sea and claimed Exclusive Economic Zone of the MENA region. This suggests the importance of maintaining marine and coastal environment for the sake of the sustainable development of the country, and securing the livelihoods of an estimated 65 per cent of the Yemeni people. For this reason, it is important to examine the reef distribution and coral communities in the country, and identify the threats to marine and coastal environment in this subsection.

Table 12 State of Marine and Coastal Environment, 2005

	Yemen	Middle East and North Africa	World
Coastal Statistics, 2000			
Length of coastline {a} (km)	3 149	47 282	1 634 701
Percent of population within 100 km of the coast	63	X	39
Area of continental shelf (km2) {b}	65 341	786 509	24 285 959
Territorial sea (up to 12 nautical miles) (km2)	82 359	649 740	18 816 919
Claimed Exclusive Economic Zone (km2)	464 966	2 015 990	102 108 403
Coastal Biodiversity and Protected Areas Data, 1990s			
Area of Mangrove Forests (km2)	X	0	169 452
Percent of Mangrove forests protected	X	X	13
Number of Mangrove Species	2	3	70
Number of Seagrass Species	8	13	58
Number of Scleractinia Coral Genera {c}	51	63	X
International Legal Net Trade in Live Coral,	X	2	X

[21] Government of Yemen, Millennium Development Goals: Progress Report for Yemen, 2003, New York, NY: UNDP, 2003, pp.35-36.

	Yemen	Middle East and North Africa	World
1997 (number of pieces) {d}			
Number of Marine or Littoral Protected Areas, 1999	X	126	3 636
Wetlands of International Importance, Extent (km2), 2000	X	17 483	730 116

Notes: a. Figures should be interpreted as approximations. Estimates may differ from other published sources; b. Up to 200 meters depth; c. Reef forming corals (i.e. "true" or stony corals); d. Imports - exports = net trade.

Source: World Resources Institute (WRI), 2005, “Coastal and Marine Ecosystems, Country Profile-Yemen,” Earth trends: Environmental Information Portal, http://earthtrends.wri.org/

1.7.2. Reef Distribution and Coral Communities

Reefs off Yemen’s Red Sea coast are beautiful and in good condition but constantly under the threat of oil pollution and coastal development are increasing here, as everywhere. Live coral cover was generally higher (ca.10 per cent) in the south than at most of the northern and central areas, and there were more large colonies (up to 3 - 4m diameter) at the southern part of Saba Island in the Zubayr group, and Mayun Island in the straits of Bab Al Mandab. There was a long fringing reef from just north of Al Khawthah down the coast to opposite Mayun Island. This reef continued in patches around the rocky headland on the Gulf of Aden coast. The width varied from less < 100m up to > 1 km enclosing a shallow lagoon (0.2 - l.5m depth). The seaward margin typically dropped to around 3m except south of Al Mulbah, where there was a healthy patch of Platygyra colonies on a sandy bottom at 5 - 6m. Acropora spp. was more evident than farther north and formed stands of branching colonies. Porites spp. and Stylophora pistillata colonies were found at all sites. Other common species were Montipora spp., Acropora valida and A. humilis, Porites nodifera, Pavona cactus, Galaxea ascicularis, Acanthastra echinata, Hydnophora spp., Favia favus, Goniastrea retiformis, Platygyra daedelea, Leptastrea purpurea and Echinopora gemmecea. Fringing reefs around the islands were in the form of extensive patches with gradual slopes and intermittent sand areas. Some of the coral patches and ridges were formed by coral rubble accumulations from storm activities. These rubble ridges were often covered with thick mats of Dictyota sp. In addition to Stylophora pistillata and Porites spp., Psammocora contigua was very common on one reef. Most Acropora corals were dead, including numerous tabular colonies. Mayun Island, at the mouth of the straits of Bab al Mandab and subject to the effects of periodic nutrient-rich cold water upwelling from the Indian Ocean, had distinct coral reef formations. The island is of volcanic origin with reef growth on basal volcanic rock. On the northern side, extensive reef flats with diverse and healthy coral growth have developed. The eastern and western sides support predominantly monospecific Stylophora communities, and bays on the southern side have healthy growth of corals dominated by large Porites colonies up to 4 - 5m in diameter. The corals survived the 1997/1998 bleaching event. Although the Yemen Red Sea reefs have proven surprisingly diverse in species composition, the main structural elements are massive corals in the genus Porites. These are by far the most common genus of reef-building coral in Red Sea waters of Yemen and the main reef framework builder of contemporary coral reefs in this region. The other two most

common corals were Stylophora pistillata and Platygyra daedelea, both species found in a wide range of habitats. [22]

Figure 9 Samples of the Coral Reefs in the Red Sea

Until recently, descriptions of coral communities from the northern coast of the Gulf of Aden were sparse. More recent surveys have demonstrated that there are at least six discrete areas where coral communities are developed along the Gulf of Aden coast - concentrated from the entrance to the Red Sea to Aden in the west, and from Belhaf to Al Mukalla in the east. Coral diversity is higher to the west of Al Mukalla where there are approximately 40 genera. East of this point growth is limited to isolated colonies of a few genera, principally the more hardy or massive forms such as Stylophora, Porites and various faviids, a finding echoed by studies in southern Oman. Low sea water temperatures associated with upwelling[23] and competition for light from algae probably limit growth while grazing by urchins and herbivorous fish are important in determining larval settlement rates. Generally, coral communities in the Yemeni Gulf of Aden grow as a veneer over a rocky substrate of inorganic origin, usually discernible between colonies. Thus these are coral communities rather than true reefs. Cold water upwelling and the limited distribution of available habitat are the two principal factors which limit coral diversity and growth in the area, although other factors such as turbidity and scouring also may be important. Along the north-west Gulf of Aden coast, key sites include Khor Umairah; Crater, Aden; Shuara; Belhaf; Bir Ali and Offshore Islands; Broum; Al Mukalla; Ras Fartak and Ras Fanta.[24]

1.7.3. Threats to Maine and Coastal Environment

The use of fertilizers and pesticides to increase agricultural production is widespread throughout the country. These chemicals are introduced into the marine environment by the flow of agricultural run-off and drainage and, to a lesser extent, by atmospheric depositions. Information on this source of pollution with respect to both quantity and quality, which would make it possible to evaluate the magnitude of the problem and its severity for the marine environment, is not available, however. In view of the extensive use of pesticides, insecticides and herbicides for agriculture and other purposes, this area must be considered as a priority issue.[25]

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[22] Pilcher, N. and L. DeVantier, 2000, The Status of Coral Reefs in Yemen. Global Coral Reef Monitoring Network (GCRMN) Reefbase, http://www.reefbase.org/

[23] A process in which cold nutrient-rich water rises to the surface from the ocean depths

[24] Ibid.

[25] United Nations Environment Programme (UNEP), Regional Sea, Red Sea and Gulf of Aden, Threats, http://www.unep.ch/regionalseas/main/persga/redthreat.html

1.8. Solid Waste Management

1.8.1. Municipal Solid Waste

As a result of population growth and improved living standards led to increased rate of solid wastes generation. In the mean time, lack of schemes for solid waste management complicated the matter. Based on the data published in the Environmental Profile 2005 that rendered the amounts of solid wastes collected and transferred to dump sites, the per capita daily generation of municipal solid waste at the national level is almost 0.2 kg. However, within Yemen there is vast variation. The per capita daily generation of municipal wastes in both Al-Muhra and Aden is 0.9 kg and in many cases this rate drops to around 0.2 kg.[26] The collected solid wastes do not exceed maximum 50 per cent of the generated solid wastes. Thus the daily per capita generation rate of municipal solid wastes is almost 0.5 kg at the national level; and in urban areas, this rate could easily increase to exceed 1.5 kg and drops to 0.7 per cent in rural areas. The outcome is piles of accumulated solid wastes on the sidewalks of the streets and in vacant, unused land. Even the facilities used to receive the collected solid wastes are not properly constructed, maintained and managed. For example, Al-Azraqeen dump site that receives the wastes of Sana'a and Omran, an estimated 29.24 per cent of the nationally generated waste in 2004, does not satisfy standard technical specifications to mitigate hygienic and environmental impacts. An estimated 40 per cent of the wastes received in the dump sites of Yemen are burned, thus complicating the issue of air quality in urban areas.[27]

1.8.2. Agricultural Wastes

Although Yemen is a predominantly a rural country, where the sector of agriculture and fisheries are the major employer, there is no clear data on the state of agricultural residues generation and means for disposal. Chapter four of the Environmental Profile does not discuss this issue. There is a need to conduct a study to assess the current status of agricultural residues. Also there is no clear account of the wastes generated from the livestock and poultry, i.e., manure. However, there is an estimate for the wastes generated from slaughterhouses in Yemen, which is 16 tons, calculated based on world standards three kilograms per slaughtered head.[28] No accounts on means of disposing these wastes on one hand, and the amount and quality of effluents discharged from these establishments on the other.

1.8.3. Industrial and Hazardous Waste

Industrial activities in Yemen consist of manufacturing and oil and natural gas production. For this reason, the share of industry in the Gross Domestic Product (GDP) of Yemen in 2003 was 40 per cent and growing at 2.6 per cent per annum,[29] which is equivalent to that of major industrial societies. However, World Bank asserts that manufacturing activities in Yemen for the same year was only 5.2 per cent and declining at an annual rate of -2.0 per cent.[30] The hazardous industrial waste generated in 2002 was estimated at 257 080 ton.[31] This figure does not include wastes generated from oil and gas establishments. The Environmental

[26] EPA, "Chapter Six: Urban and Air Quality," Environmental Profile, Sana'a, Yemen, unpublished report.
[27] Ibid.
[28] Ibid.
[29] World Bank, Yemen, Rep. at a glance, 2005 World Development Indicators CD-ROM, World Bank
[30] Ibid.
[31] EPA, "Chapter Six: Urban and Air Quality," Environmental Profile, Sana'a, Yemen, unpublished report.

Profile asserts that in 2004 Yemen generated 40 thousands tons of oil residues that could be recycled and reused.[32]

The Environmental profile, Chapter Six, shows that electricity power generation stations in Yemen generated 32 890 tons of wastes in 2004. This figure was estimated based on world standards where ten kilograms are generated to produce one million watt.[33]

Another suite of hazardous waste is that generated from hospitals and other medical centres and establishments. These wastes were approximately three thousands tons in 2004. This amount does not include hospital wastes generated from governmental health medical establishments. Another 210 tons result as chemicals and pharmaceutical products that cannot be used after date of expiration.

Finally, the Environmental Profile accounts for 3 948 and 16 thousands tons of hazardous wastes were generated in 2004 from photography development laboratories and hazardous wastes mixed with municipal wastes, respectively. The report also accounts for 284 473 accumulators disposed as wastes in 2004.

1.8.4. Construction Waste

Construction and demolition debris is not MSW because it does not contain organic materials. It degrades air quality on windy days. It is suitable for re-use or it may be crushed into base materials for road building. There is no estimate for annual generation of construction wastes. Construction and demolition waste may be seen disposed randomly on the banks of roadsides and/or vacant land.

1.8.5. Sewage Sludge

In 2004, It was estimated that around 9 977 tons of sludge were produced from sewage treatment facilities, including that of oil companies and the Aden refinery. There is need for plans to construct sewage sludge drying and treatment units to produce organic fertilizers.

1.9. Biological Diversity

1.9.1. Status

Yemen is a country with rich biodiversity. Table 13 shows number and status of species in Yemen according to the records of the World Resources Institute (WRI) in 2005.

Table 13 Number and Status of Species

	Yemen	Middle East and North Africa	World
Higher Plants			
► Total known species (number), 1992-2002	1 650	X	X
► Number of threatened species, 2002	52	X	5 714
Mammals			
► Total known species (number), 1992-2002	66	X	X
► Number of threatened species, 2002	5	X	1 137
Breeding Birds			

[32] Ibid.

[33] Ibid.

	Yemen	Middle East and North Africa	World
► Total known species (number), 1992-2002	93	X	X
► Number of threatened species, 2002	12	X	1 192
Reptiles			
► Number of Total Known Species, 1992-2003	101	X	X
► Number of threatened species, 2002	2	X	293
Amphibians			
► Number of Total Known Species, 1992-2003	7	X	X
► Number of threatened species, 2002	X	X	157
Fish			
► Number of Total Known Species, 1992-2003	130	X	X
► Number of threatened species, 1992-2002	X	X	742

Source: World Resources Institute (WRI), 2005, "Biodiversity and Protected Areas--Yemen," Earth trends: Environmental Information Portal, http://earthtrends.wri.org/

Figure 10 Dotty Back

Yemen hosts, according to WWF Global 2000 analysis, at least 4 globally important eco-regions: a) Read Sea, b) Golf of Aden/ Arabian Sea, c) Arabian woodlands and d) Socotra. These eco-regions are amongst the key areas for global biodiversity and need to be protected from human activities. The Red Sea is home to distinctive coral ecosystems comprising regional centre of endemic fish and invertebrates. It hosts a unique flora and fauna, a number of marine turtles, and several endemic birds and other unique species. Seventeen per cent of fish are endemic; more than 90 per cent of *dottybacks* (Family *Pseudochromidae*) and *triplefins* (Family *Tripterygiidae*) are endemic. The Arabian Sea hosts highly productive habitats that reflect biophysical regimes and endemism among algal communities. It has coral reefs with over 75 per cent cover in selected areas and sea grass beds that provide important breeding and nursery habitats especially for mollusks. It hosts several endemic species of marine fauna, a wide variety of invertebrates and algae as well as characteristic fish species.[34]

Figure 11 Dragon Tree

Socotra hosts a distinctive insular biota with many endemism species. It has a more diverse and exuberant flora and fauna than any other region in Arabia. The island of Socotra is also an important site of local endemism for reptiles, plants, and birds. The islands have more than 250 endemic species of plants, 85 of which are nearly extinct. Socotra houses many unusual plants, including its aloes as well as the endemic dragon tree (Dracaena *cinnabari)* known from its "dragon's blood", a brilliant red resin extracted from this plant. The island is also home to several endemic plant genera, some animals and endemic bird species, including the Island cisticola (*Cisticola haesitatus*) and the Socotra bunting (*Emberiza socotrana*). [35]

Figure 12 Arabian tahr

[34] Republic of Yemen, National Biodiversity Strategy and Action Plan, May 2004
[35] Ibid.

Yemen highlands woodlands and shrub-lands sustain high levels of biodiversity and provide an important stopover site for migrating birds. The highlands support the majority of endemic or near-endemic species of plants and animals. It hosts the endemic Arabian *tahr* (*Hemitragus jayakari*), Arabian gazelle (*Gazella gazella*), Nubian ibex (Capra ibex *nubiana*), striped hyena (Hyaena hyaena), wild cat (*Felis sylvestris*), and leopard (Panthera pardus). Although Arabian oryx (Oryx leucoryx) is extinct in the wild, there are efforts to reintroduce it to the region. Representative bird species include Yellow-vented bulbul (*Pycnonotus xanthopygos*), Graceful warbler (*Prinia gracilis*), Brown woodland warbler (*Phylloscopus umbrovirens*), Yemen linnet (*Carduelis yemenensis*), Gambage dusky flycatcher (*Muscicapa gambagae*), Arabian partridge (*Alectoris melanocephalia*) and Black kite (*Milvus migrans*). [36]

Quick environmental deterioration has resulted in a clear recession of the wild plant cover, thus causing a threat to wild life and bio-diversity in general. This situation has recently pushed the government to declare some forest areas wildlife reserves to protect rare species. The Yemeni government has signed several international agreements, set to safeguard bio-diversity, such as the international agreement for protecting bio-diversity, the agreement on preventing desertification and the agreement on the protection of threatened plants and animal species. [37]

1.9.2. Major threats to biodiversity in Yemen

As a result of extensive agricultural development over the last four decades, many natural landscapes in Yemen have been severely degraded. In 2001 around 72 per cent of cultivable area was under cultivation, and a further 0.8 million ha was covered by pasture and grazing lands. The use and conversion of land for agriculture has resulted in degradation, and even loss, of certain natural habitats, as well as causing large-scale pollution. [38]

In recent years, agricultural practice in the Republic of Yemen has been characterized by a significant increase in the use of mechanization, fertilizers and pesticides; bad soil fertility management; poor plant nutrition; and overgrazing. These inappropriate practices impact directly on the quality of land resources limiting the options for other land use needs. The continued application of chemicals would likely result in some change of the soil structure. This results from the continued increase in amounts of fertilizers as the soil loses its nutrients. One of the long-term consequences of this is desertification. As the soil becomes less fertile, and costs rise in using the area, it may often be abandoned. [39]

Inadequate agricultural practices, such as the application of an often mechanized and repeated single or double crop system in the rainfed areas, has led to soil loss through wind and water erosion, decrease in soil fertility and subsequently decline in crop yields. More marginal lands being put under cultivation, even during years with rainfall deficits, fail to produce crops and are abandoned barren, ready to contribute to desertification, while new marginal land is waiting to be cultivated. The result of

[36] Ibid.
[37] Government of Yemen, Millennium Development Goals: Progress Report for Yemen, 2003, New York, NY: UNDP, 2003, pp.35-36.
[38] Ibid.
[39] Ibid.

such practices in the coastal plains and in Ma'arib is that wind erosion takes place on formerly more or less stabilized dunes, which, are put under a continuous process of drifting thus increasing desertification by encroachment on productive lands and infrastructures. Elsewhere in Yemen, this leads to water erosion, which affects all lands downstream and ultimately results in widespread degradation and desertification. [40]

In short, Yemen's vegetation cover is being drastically reduced by rapid degradation of the environment, a direct result of desertification and droughts, and as a result of the following causes: [41]

- Inadequate cultivation and poor agricultural practices;
- Wood cutting for firewood, timber and charcoal;
- Over grazing;
- Soil salination;
- Water and wind erosion and sand dune encroachment; and
- Encroachment due to housing and infrastructure development around cities and villages.

Threats to terrestrial fauna in Yemen are common to many countries in the region and include:[42]

- Destruction, degradation and loss of natural habitats;
- Over-hunting and proliferation of firearms; and
- Road construction paving avenues into the hinterland.

1.10. Disasters Risk Reduction

Natural disasters known in Yemen are: flash floods, dust and sandy storms, and earthquakes. Yemen experienced a major earthquake in 1982 that hit Zamar, near Sana'a. Another two earthquakes hit the country in the 1990s. Yemen has many islands that are subject to tide and turbulent waters. For example, Socotra Island, in the Arabian Sea, experience turbulent sea to the extent that no ship or vessel is able to berth for six months.

Environmental degradation is responsible for a set of hazards considered as 'slow-onset disasters', i.e., activities that cause localized incidents or pass un-noticed at the time but their negative impacts accumulate to reach a full-scale disaster. Today the exploration of petroleum is an opportunity but also brings with it threats to the environment, such as oil spills, accompanied with risks and potentials for major disasters, such as fires.

Human activities are responsible for air pollution brought by emissions released from power generating plants, vehicles, and so forth. Major human settlements lack an integrated scheme for solid waste management. None of these settlements has a sanitary landfill. Hospital wastes, which include hazardous wastes, such as needles, are mixed with municipal solid wastes and not properly disposed. For this reason, many diseases are epidemic, such as Malaria. Head and Foot diseases that infect cows and sheep exist in Yemen, and affect the Yemeni exports.

The 26th December 2004 tsunami wave and subsequent sea surges hit the coast of Yemen between 11:40 a.m. and 8:30 pm., causing damage to Yemen's mainland and associated islands facing the Indian Ocean. Relative to the countries of Southeast Asia, damage in Yemen was much less, mainly because of its distance

[40] Ibid.
[41] Ibid.
[42] Ibid.

from the epicentre of the earthquake, and the protection it receives from the Indian Peninsula and Horn of Africa. Nevertheless, the impacts on the livelihoods of local people, especially fishermen, were significant, as many of them lost their main form of income. The two main areas identified as the most affected include Socotra Island and the coastline of Al Mahra Governorate, especially the area extending from Saihut to Wadi Hauf.[43]

The tsunami had had its impact on the environment of Yemen. The marine environment of Socotra and the coast of mainland Yemen are influenced by the monsoon winds. As a result of the strong up-welling, the inter-tidal and sub-tidal ecosystems are subjected to drastic changes of the physical and chemical parameters evolving a rare ecosystem with a large diversity, particularly among algal/seaweed species. There is a high abundance of fish, particularly in the Gulf of Aden, which sustains local livelihoods. Reports from villagers along the southeast coast mentioned increased salinity in groundwater wells as a problem. Wells on the coast initially had a low level of salinity and the water from the wells was used for washing, bathing, watering planted palm trees, and to a very limited extent for drinking. This water now has a high level of salinity and cannot be used at all. The number of wells affected could not be established but is believed to exceed ten wells. However, considering the fact that the tsunami penetrated up to 400 metres inland, groundwater reservoirs may have been affected and this may render some wells unusable for coastal communities for some time. There is some evidence of damage to the coastline. For example, in Dabut fishing centre, areas originally covered with sand have been exposed and are now stony surfaces. This is attributed to the tsunami and earlier coastal erosion. The total value of the damages in Al Mahrah (excluding automobiles) and Socotra has been estimated by the authorities at approximately 170 millions YR ($935 thousands) and ($175 thousands) respectively. Two agricultural farms on the coast (area not established) were completely lost. These were involved in growing crops and palm trees. Table 14 is a summary of the damage to the fisheries sector.[44]

Table 14 Summary of damage to fisheries sector

	Al Mahrah	**Socotra**
Fishing nets and long lines	500 nets	174 nets 37 hook lines
Fishing traps	9 500	486
Fishing boats	33 (totally destroyed) 108 (partly destroyed)	16 boats 143 ropes 260 anchors, buoys and other equipment
Outboard engines	33 (totally destroyed) 106 (partly destroyed)	36 engines 10 fuel tanks
Fisheries facilities	Fish market stands and a 146 m long wall, ice plant, Fisheries Cooperative storage area	23 petrol drums, 45 sacks of salt
Other buildings	Masjid, gas station,	
Vehicles	5 cars, motorcycles	

Source: UNEP, National Rapid Environmental Assessment – Yemen, www.unep.org/tsunami/reports/TSUNAMI_YEMEN_LAYOUT.pdf

[43] UNEP, National Rapid Environmental Assessment – Yemen, www.unep.org/tsunami/reports/TSUNAMI_YEMEN_LAYOUT.pdf

[44] Ibid.

Figure 13 Impact of tsunami on Yemeni fishing community

Dabut, Yemen (28 December 2004). Relative to the countries of Southeast Asia, damage in Yemen was much less, mainly because of its distance from the epicenter of the earthquake, and the protection it receives from the Indian Peninsula and Horn of Africa. Nevertheless, the impacts on the livelihoods of local people, especially fishermen, were significant, as many of them lost their main form of income. © Al Mahra Rural Development Project

Source: UNEP, National Rapid Environmental Assessment – Yemen, www.unep.org/tsunami/reports/TSUNAMI_YEMEN_LAYOUT.pdf

Tsunami-generated debris is strewn all over the coastline especially within the fishing centres. The waste mainly consists of damaged nets, beached boats and canoes, lobster and octopus traps, concrete slabs, wood, dead fish, plastic bottles and diesel containers and other materials. The local authorities have tried their best to collect this debris and pile it, but proper disposal is needed. This can be done with limited guidance. A number of barrels of fuel (petrol and diesel), tins of paint and other chemicals were washed out to sea. In Mahaifif alone, it is estimated that ten 200-litre barrels of fuel and about 350 litres of paint were washed out to sea. These are believed to have been naturally dispersed. [45]

In addition to the tsunami disaster, Yemen has experienced different types of disasters that also had severe impacts, including flash floods, earthquakes, drought, locusts, oil spills, red tides, civil war, and epidemics of communicable diseases. In 1999 alone, it is estimated that about 19 782 persons were affected by disasters in Yemen.

No policy or legislation on a national level has been implemented to address disaster risk reduction. However, since 1996, the issue of strengthening and establishing a policy for disaster risk management and responsible entity received greater attention from the Government. In this direction, the Government took many steps including decrees on civil defence law for effective disaster management, forming a committee to prepare a national approach for disaster risk reductiont, and issuing the Civil Defence By-Law. This is in addition to many other related laws. Yemen also established a national body for multi-sectoral coordination and collaboration in disaster risk reduction, known as the Civil Defence Council (CDC). The CDC includes the key ministries concerned.

[45] Ibid.

2. PRESSURES AND DRIVING FORCES

2.1. Population Growth

Yemen is the most populous country on the Arabian Peninsula. The tribal social structure is still prevalent in the country. Tables 15 and 16 illustrate information pertaining to demographic, health and human resources indicators. Juxtaposing the data presented in the table against Figures 14, 15 and 16 suggest that Yemeni human resources have progressed, and are expected to continue, to improve. Population continues to grow, but at lowers rates and dependency ratios decline over time.

Table 15 Demographic and Health Indicators

	Yemen	Middle East& North Africa	World
Total Population (in thousands of people)			
► 1950	4 316	111 647	2 519 495
► 2002	19 912	423 296	6 211 082
► 2025 (projected)	48 206	631 320	7 936 741
Population Density (people per square km), 2000:	34.8	31.3	45.1
Average Annual Population Growth Rate (per cent), 1980-2000			
► Total	0.6	2.5	1.6
► In rural areas	0.0	1.0	0.9
► In urban areas	1.2	3.9	2.4
Percentage of Population:			
► Under age 15, 2002	51.0	35.0	29.0
► Over age 65, 2002	2.0	4.0	7.0
► Living in Urban Areas, 2000	25.0	61.0	47.0
Average Total Fertility Rate {a}			
► 1975-1980	7.6	5.9	3.9
► 2000-2005	7.6	3.5	2.7
Infant Mortality Rate {b}, 2000-2005	62.0	52.0	55.0
Under-Five Mortality Rate {b}, 2000	117.0	64.0	83.0
Life Expectancy at birth (years), 2000-05			
► Female	62.9	69.6	68.1
► Male	60.7	66.5	63.9
Births Attended by Trained Personnel, 1994-2000 {c}	22.0	67.0	57.0
Adults and Children Infected with HIV/AIDS, 2001 (number)	9 900	500 000	40 000 000
Per cent of Adults Ages 15-49 infected with HIV or AIDS, 2001	0.1	X	1.2
Number of Children Orphaned by AIDS since the beginning of epidemic, 2001	X	65 000	14 000 000

Note: a). Total fertility rate is an estimate of the number of children an average woman would have if current age-specific fertility rates remain constant during her reproductive years; b) In deaths per 1,000 live births. Infant mortality rate refers to children less than one year of age; c) Data are for the most recent year within the range specified.

Source: World Resources Institute (WRI), 2005, "Population, Health, and Human Well-Being, Yemen," Earth trends: Environmental Information Portal, http://earthtrends.wri.org/

Table 16 School Enrollment and Literacy

	Yemen	Middle East & North Africa	World
Net Primary School Enrollment, both sexes			
► 1980	X	X	X
► 1997-1999 {c}	61%	X	X
Net Secondary School Enrollment, 1997-1999 {a}			
► Female	20%	X	X
► Male	50%	X	X
Gross Tertiary School Enrollment, 1996-99 {a}	10%	X	X
Adult Literacy Rate, 2002			
► Female	29%	61%	75%
► Male	70%	80%	86%
Youth Literacy Rate (ages 15-24), both sexes			
► 1980	31%	67%	80%
► 2002	68%	86%	87%

Note: a). Data are for the most recent year within the range specified.

Source: World Resources Institute (WRI), 2005, "Population, Health, and Human Well-Being, Yemen," Earth trends: Environmental Information Portal, http://earthtrends.wri.org/

According to World Bank records, between 2000 and 2005, birth rate per 1000 people was 40.8, and is expected to decline to 23.9 between 2025 and 2030. In the mean time, death rate in 2000-2005 was 10.2 and is expected to decline to 6.3 between 2025 and 2030, thus indicating improved health conditions. Infant and under-5 mortality rate are expected to decline to 34.9 and 44.2, respectively. Life expectancy at birth is expected to improve by 2025-2030 to be 64.9; population growth rate (average annual percentage), therefore, is expected to decline from 3.0 per cent in the period 2000-2005 to be 1.8 in the period of 2025-2030.

Figure 14 Population Projection and dependency ratio, 2000-2030

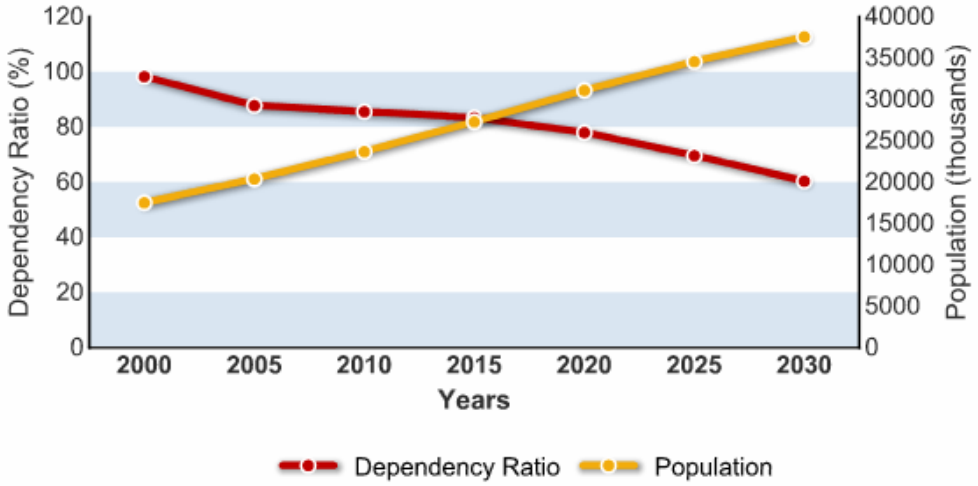
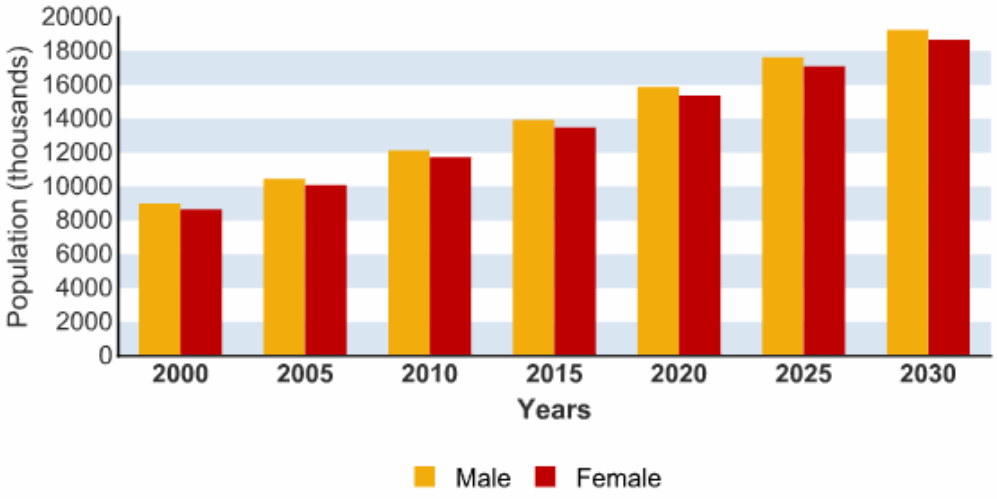
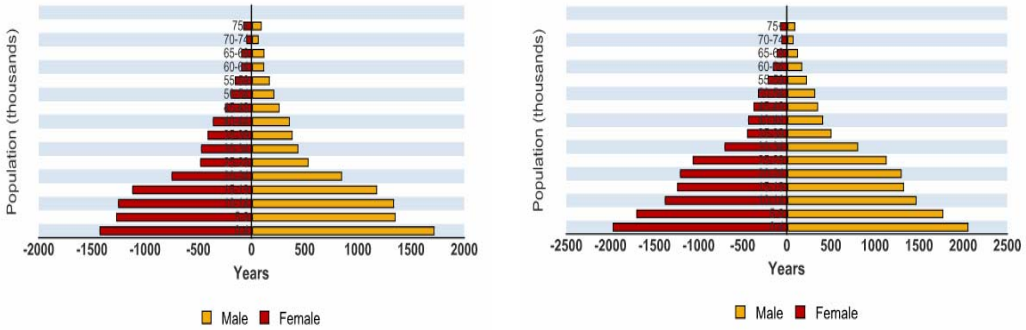


Figure 15 Population stratified by gender, 2000-2030



Improved health services are not the only reason for sustaining high rates of population growth. The population of Yemen is young, as presented in Figure 16. Despite declining TFR, but the population momentum, i.e., the period needed for the population to double, in the case of Yemen is short. The population in young cohorts indicates that high population growth rates are not expected to be curbed in the near future.

Figure 16 Population Histogram, 2000 (left) and 2010 (right)



Source: World Bank, World Development Indicators, 2005, International Bank for Development and Reconstruction, CD-Rom, Washington D.C.

A closer look at the social dimension of the pattern of population distribution, especially in low-income areas and informal settlements, indicates that residents of such areas suffer from harsh economic and environmental conditions. Many of the daily activities in low-income communities depend on using and managing environmental resources, such as water and fuel. These communities are not expected to solve their environmental problems alone; and therefore, certain interventions to improve their environment should be taken.

Environment has become a major issue and a vital component in the structure of the Yemeni society. It affects directly some of the social strata because of their relationship to nature, their age, and/or certain cultural aspects. Accordingly, it is important to focus on six sub-population groups: children, youth, women, the elderly, and the physically disabled and marginalized population.

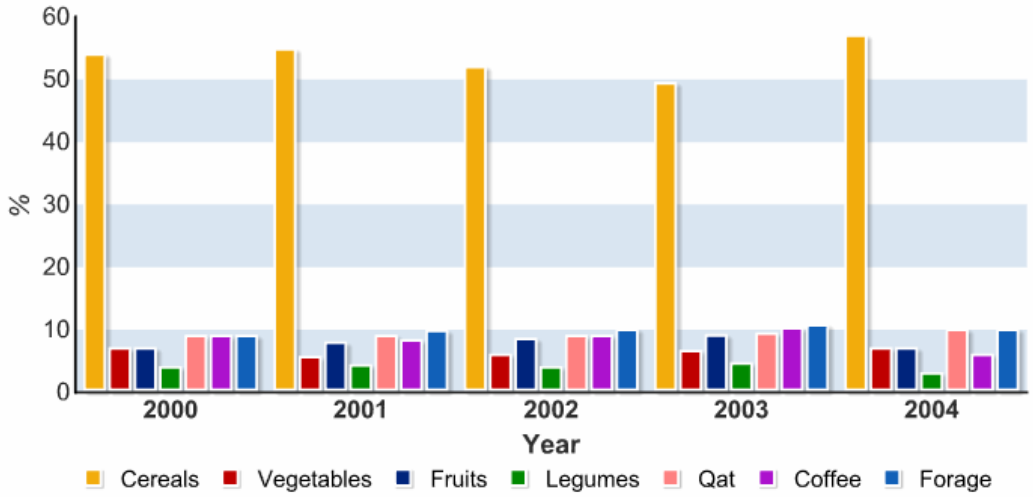
2.2. Agriculture

2.2.1. Agriculture

Yemen is one of the eldest agricultural civilizations as evidenced by archaeological excavations, remnants of irrigation structures and terraces. Agriculture was and still is the main stay of the economy. It contributes nearly 18 per cent to the gross national product (GNP), provides employment to over 16 per cent of the country's workforce and livelihood for all the rural residents - who constitute nearly 76 per cent of the total population.[46]

Statistics show that the total cultivated land is estimated to be about three per cent of the total land area of the country; and another 39 per cent of the land is rangeland and forests.[47] However, the cropped area varies from one year to another depending on the amount of precipitation. On average, it is about 1.1 million hectares (ha); but in a year of ample and well-distributed rainfall it could reach 3.5 million ha. Figure 17 shows cultivated land stratified by crops in 2000-2004. According to the information presented in the figure, cultivated areas of all crops have been fluctuating, except Qat that is steadily increasing.

Figure 17 Cultivated land stratified by crops, 2000-2004



Source: Environmental Protection Agency, "Chapter Four: Land Resources and Agriculture," Environmental Profile, Sana'a, Yemen, 2005, unpublished report, based on Annual Statistical Year Book, 2003.

According to World Bank indicators, in 2003, agriculture contributed 15 per cent of the GDP of Yemen, and expanded at 6.9 per cent.[48] Figure 18 shows that Qat has the highest contribution compared to other products. The data presented in the figure suggest the share of rain-fed crops is declining, thus exerting more pressures on underground water resources.

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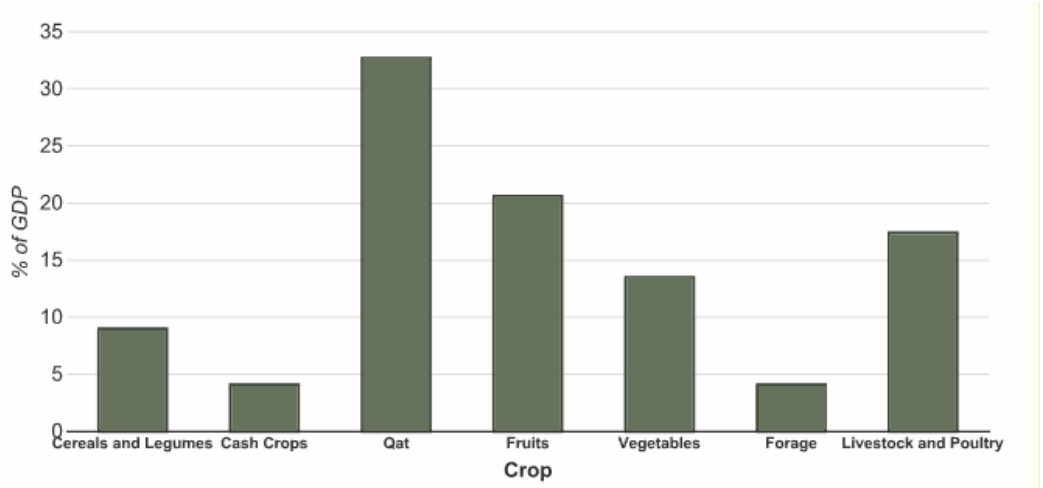
[46] Friedrich Ebert Foundation, Analytical Overview of Yemen Agriculture, Excerpt from Agricultural Research Strategy, January 14, 2002, http://www.fes-yemen.com

[47] EPA, "Chapter Four: Land Resources," Environmental Profile, Sana'a, Yemen, 2005, unpublished report.

[48] World Bank, Yemen, Rep. at a glance, 2005 World Development Indicators CD-ROM, World Bank

Figure 18 Conttibution of Agricultural Products to the GDP, 2003-2004



Source: EPA, "Chapter Four: Land Resources and Agriculture," Environmental Profile, Sana'a, Yemen, 2005, unpublished report, based on Annual Statistical Year Book, 2003.

2.2.2. Livestock and Poultry

Livestock contributes about 17 to 20 per cent of the returns of the agricultural sector in the period 2000-2004.[49] The national livestock population is estimated at 3.2 million goats, three million sheep, 1.1 million cattle, 0.05 million donkeys and 0.17 million camels. Sheep and goats are reared in the Eastern Plateau Region while cattle and sheep dominate the highland and Coastal Plain Regions. Livestock numbers have declined in the 1980's and early 1990's due to drought, shortages of food and break down in animal health services. In spite of this decline, livestock is considered as the main source for farmers' income and provides reasonable opportunities for many rural people to work. Yemeni farmers practice an integrated crop animal system in which they produce cereal summer crops to feed their animals and use the cow manure to improve the soil fertility of their land.[50]

Recent avian influenza outbreaks in the Middle East and Africa have caused dramatic swings in poultry consumption, increased trade bans and sharp price declines. Around 200 million chickens have been culled or have died of the disease since the onset of the crisis in late 2003. This crisis affects the livelihoods of petit peasants, and Yemen, as other countries of the region, is prone to be affected by this threat. There is no available information on the poultry industry in Yemen. The problem associated with this crisis is contingency plans for immunization and securing drugs to treat infected humans, and also capabilities to handle infected and dead birds.

Livestock and poultry as part of the agriculture activity not only consume environmental resources but also produce waste in such quantities of a significant negative impact on the environment. Peasants store the manure to use it as a fertilizer and soil conditioner. During storage methane and other green house gases, which pollute the atmosphere, are released. Piles of manure are also a fertile ground for breeding rodents and pests that

[49] EPA, "Chapter Four: Land Resources and Agriculture," Environmental Profile, Sana'a, Yemen, 2005, unpublished report
[50] Ibid.

constitute an economic and health hazards. Most peasants keep their livestock and poultry inside the house, thus increasing the possibility of transfer of diseases from animals to human beings.

Slaughterhouses are often a source of pollution in urban settlements. Liquid and solid waste generated from these establishments, contain considerable amounts of hazardous wastes. Some of these wastes are used as inputs for other industries, while others are mixed with municipal solid waste and wastewater.

2.2.3. Issues and Consequences

i. Water and land resources

The limited amount of water and land is the challenge to the Yemeni people to achieve any possible horizontal expansion. An estimated 57 per cent of the land is rocky and mountainous; and in the mean time, the available water resources are not adequate for horizontal expansion. Since rains and flash floods are among the major sources of fresh water in the country, then vertical expansion might not be possible since rains and floods are seasonal. The country has to elaborate a cropping pattern that makes use of available land and water resources effectively and efficiently without jeopardizing environmental sustainability and social stability.

ii. Land holdings

Land holdings declined from an average of 1.03 ha to 0.99 ha between 2000 and 2004, respectively, indicating the subdivision of parcels for various reasons. The impacts of this subdivision on the agricultural production processes are numerous and negative. Available information indicates that micro and small land holdings in rain fed agricultural systems is not enough to support the needs of the families.[51] Micro and small land holding is a constraint to mechanisation of the production processes, and thus the agricultural processes experience diseconomies of scale. In other words, the marginal productivity of land declines as a result of land subdivision.

iii. Pesticides and chemical fertilizers

Yemen does not have clear system for managing the use of pesticides and herbicides. However, the use of biological control as a component of pest management is increasing. Chemical fertilizers are used in association with irrigated agricultural production processes. The expansion in consumption of fertilizers has associated with excessive and inefficient application, with consequent economic losses and increased environmental damage.

2.3. Fisheries

Fisheries constitute the third most important natural resource for Yemen after oil and water. With a coastline of 2 230 km and shelf area (fishing grounds) that mounts to about 41 thousands sq. km.,[52] Yemen benefits substantially from its wealthy fisheries resources in its Exclusive Economic Zone (EZ). The fishing activity represents a main source of employment and income generation in the poorest rural areas and has the potential to contribute in alleviating poverty. Furthermore, fish has become an increasingly important source of protein nutrition, contributing substantially to local food security. Fisheries export has become an important source of non-oil foreign

[51] Ibid.

[52] Food and Agriculture Organization of the United Nations , Fishery Country Profile, February 2002, http://www.fao.org/fi/fcp/en/YEM/profile.htm

exchange with export earnings totalling an estimated US$ 35-45 million in 2002.[53] Table 17 shows fisheries production 1997-2000, and Table 18 shows fish consumption and trade. It is noticeable from Table 18 the decline of imported fish, and significant growth in fish exports.

Table 17 Fisheries Production, 1997-2000

	Yemen	Middle East and North Africa	World
Average Annual Capture (excludes aquaculture) in metric tons:			
► Marine Fish, 2000	114 751	2 461 334	84 411 066
► Mulluscs and Crustaceans, 1997	9 740	175 995	12 055 801

Source: World Resources Institute (WRI), 2005, "Coastal and Marine Ecosystems, Country Profile-Yemen," Earth trends: Environmental Information Portal, http://earthtrends.wri.org/

Table 18 Fish Consumption and Trade, 2000

	Yemen	Middle East and North Africa	World
Per Capita Food Supply from Fish and Fishery Products (kg/person)	6	8	16
Fish Protein as a % of Total Protein Supply	4	3	6
Annual Trade in Fish and Fisheries Products			
► Imports (thousand $US)	6,143	718 161	60 008 337
Per cent change since 1980	-23	134	275
► Exports (thousand $US)	40 907	1 406 134	54 570 489
Per cent change since 1980	113	X	258
Fishing Effort, both freshwater and marine			
People Employed in Fishing and Aquaculture, 2000 (number)	12 200	824 800	36 116 329
Docked Fishery Vessels, 1995-98 (number) {a}	144	16 466	1 297 017

Note: a. Data are for the most recent available year in the listed range of years.
Source: World Resources Institute (WRI), 2005, "Coastal and Marine Ecosystems, Country Profile-Yemen," Earth trends: Environmental Information Portal, http://earthtrends.wri.org/

2.3.1. Marine fisheries

The fisheries activities in Yemen include Artisan and Industrial.

i. Artisanal

It is estimated that artisan fisheries sector has 41 322 fishermen utilizing 9 157 boats (8 475 boats with outboard engines, 682 with inboard engines).The boats used by the traditional fisheries are of 3 types: Arbi (large sanbouks 12 - 15m long with 150 - 250 hp diesel engines); ghadifa (10m long) and Hori (6 - 8m long) with 15 - 75 hp outboard engines. The arbi (sanbouks) are built of either wood or fiberglass. The ghadifa and hori are built of fiberglass. The purchase of new boats, fishing gear and engines is frequently subsidized by the Agriculture Encouragement and Fishing Production Fund (AFPF), or by loans from the Cooperative Credit Bank. The artisan

[53] YEMEN - FISHERIES RESOURCE MANAGEMENT AND CONSERVATION PROJECT, HTTP://WWW-WDS.WORLDBANK.ORG/SERVLET/WDSCONTENTSERVER/WDSP/IB/2004/07/07/000104615_20040712105348/RENDERED/PDF/PROJECT0INFORM1MENT010CONCEPT0STAGE.PDF

fishermen use different fishing methods depending upon the target species and season. These include seines, handlines, gillnet and trap. The total catch of the traditional sector in 1998 was 108 205 tons. The most important species included tunas, large jacks, sardines, mackerel, barracuda, snappers, solefish, shrimp, lobster and cuttlefish. [54]

ii. Industrial

There are 23 fishing companies in the industrial sector working in Yemen waters, 11 in the Red Sea and 12 in the Aden Gulf and the Arabian Sea. These companies caught 17 858 tons of fish in 1998, principally demersal fish and cuttlefish. In 1998 the industrial fishing fleet included 131 boats, 63 in the Red Sea and 68 in the Gulf of Aden and the Arabian Sea. The total catch was 17 855 tons, 4 186 in the Red Sea and 13 669 in the Gulf of Aden and the Arabian Sea. These boats are allowed to operate in the Red Sea beyond six miles from shore, and five miles from shore in the Gulf of Aden and the Arabian Sea. These fishing companies are all privately-owned, and are both foreign and local. The Government has developed two fishing ports, and built a considerable number of fisheries facilities along the coast, including cold storage facilities, ice plants, workshops, fuel depots, processing and packaging facilities and fishing gear stores. The private sector is now contributing to the development of the fisheries sector, and some investors have built ice plants, cold storage facilities, fish markets, canning factories, processing facilities, etc. [55]

2.3.2. Utilizing the catch

The fish products that are caught by the industrial fishing fleet are frozen at sea in whole form. These products are usually transhipped to the Chinese and European markets, and some are also sold to Arab countries. The artisan fish products are sold fresh or frozen in the local markets. Shark meat is usually salted and dried for sale in the interior region in the country. Significant quantities of fresh fish are transported in refrigerated trucks or packed in ice and trucked to Saudi Arabia, Egypt and Jordan. Some sardines are sold locally in Hadramout but most of the catch (approximately 30 thousands tons) are dried on the beach and used as cattle feed. A number of private sector companies export live lobsters to Dubai. Cuttlefish caught by local fishermen are sold fresh to private companies that process them and export them frozen to European countries. [56]

i. State

The Yemeni fishing industry has made significant progress during the past twenty years. Fish production from the artisan sector has been improved through government subsidy programmes funded by the Fisheries Development Projects and the Agriculture Encouragement and Fisheries Production Fund (AEFPF), which have provided subsidies for fishermen for the purchase of modern fishing boats, fishing gear and equipment including winches, traps, fish preservation boxes and high-powered engines. The development of the industry has been supported by the Government's construction of ports, roads, radio communications networks, ice plants, workshops and cold storage and other necessary facilities throughout Yemen. About 85 per cent of the country's fish resources are being exploited by the artisan sector, while 15 per cent are being exploited by the industrial sector. The fisheries sector is considered to be the third in order of importance in Yemen's economy. Its total contribution to the country's GDP is approximately 15 per cent. It is estimated

[54] Ibid.
[55] Ibid.
[56] Ibid.

that more than 220 thousands people depend on fishing as their principal source of income. Fish is a major and growing food item in Yemen. Inasmuch as fisheries resources are renewable, they can be exploited to a far greater degree in order to meet both local and export market demand. In addition, the fisheries sector is expected to absorb a greater proportion of the national workforce in the future.

ii. Demand

Yemen, with its large population, understands the importance of increasing the annual fishing catch to help guarantee food security for its people. This can be achieved in two ways; first, by renewing the stock assessment studies to know what stocks are available at present; second, by studying the offshore fish species in the EZ, particularly migratory fish such as tuna, mackerel and marlin and by exploiting mesopelagic fish. Subsequently, the exploitation of the country's fish resources must be both rational and sustainable.

2.3.3. Research

Fisheries research in Yemen is carried out by the Marine Science and Resources Centre (MSRRC), which was established in Aden in 1983. The MSRRC research programmes have been designed to provide the data and information needed for decisions with regard to the development and management of marine resources in Yemen. This information will also serve the private sector companies involved in fishery production, aquaculture and other fishing activities. The MSRRC has been assigned the role of providing this research, and it has already carried out a number of fisheries research projects and programmes covering different areas, such as fisheries resources assessment and surveys, marine biology, environment and aquaculture. The MSRRC research projects and programmes have recently undergone some changes, given the urgent need of studying the problems facing both the industrial and artisan fisheries sectors. Important results in the aquaculture sector have been achieved by the Agriculture Encouragement and Fisheries Production Fund (AFPF). In 2001, AFPF supported the MSRRC by providing it with 31 million Yemen rails for its Aquaculture Research Centre, in order to be able to carry out experiments in shrimp aquaculture.[57]

2.3.4. Development Prospects

In 1973 and 1975, two stock assessment surveys in Yemen waters in the Aden Gulf and the Arabian Sea, and he estimated the biomass of the fish at 2 230 thousands tons (in 1973) and 754 thousands tons (in 1975). In 1989-1990 however, the Marine Sciences and Resources Research Centre (MSRRC) carried out a stock assessment survey in the three-mile zone of Yemen's territorial waters in the Gulf of Aden and Arabian Sea , and estimated the biomass of small pelagic fish (sardines, small mackerels and anchovies at 450 thousands tons, mainly distributed in the Hadramout, Almahara and Aden regions. The biomass of demersal fish was estimated at 458 000 tons, while the biomass of fish that were not intended for the local market, or of fish to be used for fishmeal (lizard fish, catfish, butterfish, ribbon fish etc.) was approximately 247 thousands tons, and the biomass of shrimp, lobster and cuttlefish was estimated at 20 thousands tons. [58]

No complete stock assessment studies have been carried out in the Red Sea. Some figures are available however with regard to the stock of certain fish species. The MSRRC estimated the annual catch of demersal fish in the Red Sea at about 45

[57] Ibid.
[58] Ibid.

thousands tons. Certain reports have indicated that there are abundant stocks of mesopelagic fish in Yemen waters, but no figure was given. The Beach Pollution Study on the North Coast of the Gulf of Aden, 1996,[59] indicated that five species of marine turtles inhabit this area. These are: the green turtle, leatherback, hawksbill, loggerhead and ridley turtles. The West Aden region is considered to be a feeding area, while the Sharma region, (Hadramout Gov.) is considered to be a hatching area. Seven species of sea cucumber inhabit Yemen waters. The commercial species, the sandfish (Holothuria sabra), is mainly caught in the west area of the Aden Gov. (in Rasalara and Khor Umera).[60]

The Government of Yemen has declared the development of fisheries to be a major priority. It intends to place particular emphasis on improving the capabilities of the artisan fisheries sector and modernising it by providing the most advanced fishing gear and technology, as well as by offering young people the training they need to work in this sector.

2.3.5. Impact on the Environment

Applied fishing techniques have adverse impact on fish production. They have affected the aquatic environment in many ways. Fishermen use inappropriate techniques to increase their catch. This has caused the killing the small traits, and hence decreased production. The use of illegal nets causes the death of large numbers of non-target species through habitat destruction and being accidentally engulfed by the net.

Box 3 Ghost nets

Grey reef shark, Andaman Sea (undated file picture). Fishing nets that have been abandoned in the marine environment, known as ghost nets, kill fish, marine mammals and seabirds, and destroy habitat. In Yemen alone, hundreds of nets and octopus and lobster traps were washed out to sea, where they could continue to harm the environment for years to come. © Fred Bavendam/Still Pictures

Source: UNEP, National Rapid Environmental Assessment – Yemen

Ghost nets, another negative impact of the fishing industry on marine environment, are fishing nets that have been abandoned in the marine environment and which continue to harm marine life. They kill fish, marine mammals, and seabirds as well as destroy habitat. Lost gill nets are extremely lethal because of the ease with which organisms become entangled in them. Entangled organisms then become bait for predators which also get caught in the nets. The nets become a perpetual killing machine, and only stop once their structural integrity begins to disintegrate. With new synthetic materials, this could take decades, and the fish mortality caused over the lifetime of a single net could be in the hundreds of thousands. In addition, the lead lines associated with nets are pushed by the tide and scrape away sea grass beds and other marine habitat causing additional damage.

[59] MSRRC, Sana'a and Aden Universities carried out this study.
[60] Ibid.

In the Governorate of Al Mahra alone, 500 fishing nets, 1,500 octopus traps and 8,000 lobster traps were lost to sea. Fishermen on the Island of Socotra also lost approximately 174 fishing nets and 37 hook lines. However, the largest possible source of ghost nets will most likely come from Sri Lanka and Indonesia where tens of thousands of nets may have been swept out to sea.[61]

2.4. Manufacturing and Mining

The manufacturing sector, which includes extracting industries except oil, the private sector owns 97 per cent of its establishments (around 33 966) providing 115 529 job opportunities. Most of these establishments, about 95 per cent of manufacturing establishments in Yemen, are of small size nature employing between 1-4 workers providing a total of 54.7 per cent of job opportunities and contributing around 24.4 per cent of the manufacturing value added (mva). Medium size manufacturing establishments employ between 5-9 workers. They constitute around 3.7 per cent of the total manufacturing establishments contributing around 7 per cent of job opportunities and 5.2 per cent of mva. Larger establishments constitute only 1.2 per cent employing more than 10 workers. They contribute around 38.3 per cent of job opportunities and contribute around 70.4 per cent of mva.[62]

2.4.1. Need for Resources

Manufacturing activities are among the major users of both renewable and non-renewable natural resources to obtain raw materials and energy. Manufacturing activities are among the major contributors to pollution of water, air and soil. The production pattern may differ seasonally or in production type. Variable conditions may be encountered as upgrading and expansion of some production lines, closure of lines causing environmental pollution problems, or converting/substituting open systems to semi-closed or closed systems with regard to water consumption.

2.4.2. Pollution

i. Air Pollution

Industrial activity is a major source of air pollution in Yemen. Industry emits common air pollutants, such as sulphur dioxide, particulate matters, hydrocarbons, nitrogen oxides, ammonia, hydrogen sulphides, carbon monoxide, fluorides, chlorine, lead, nickel and beryllium as well as other specific pollutants relating to raw materials, processes and products. Medium and small size industrial activities, such as foundries, secondary smelters pottery, brick industry, workshops, lime crusher, charcoal ...etc are scattered within and close to urban areas. Most of these activities are using old technologies and do not have any air pollution control precautions. As a result, air pollution causes very serious damaging effects on health, material, monuments and tourist activities.

ii. Water Pollution

Industrial wastewater is a major source of non-biodegradable organic and inorganic compounds. Once discharged to water ways, the compounds attach to sediment particles from where they are taken up by bottom-dwelling organisms. The subsequent consumption of these organisms by other organisms produces successively higher concentrations so that they are sufficiently high to cause toxicity at the top of the food chain. Crops irrigated with contaminated water may take up

[61] UNEP, National Rapid Environmental Assessment – Yemen, www.unep.org/tsunami/reports/TSUNAMI_YEMEN_LAYOUT.pdf

[62] Ministry of Planning and International Cooperation, http://www.mpic-yemen.org/

contaminants through the soil and roots, or may retain the contaminants on the crop surface after contract with irrigation water that subsequently evaporates.

iii. Solid Waste

Effective control of the generation, storage, treatment, recycle and reuse, transport, recovery and disposal of industrial solid wastes is of paramount importance for health and environmental protection, natural resource management and sustainable development. This will require the active cooperation and participation of governmental authorities and industry.

2.5. Energy

Compared to the region and the world, Yemen has witnessed a major, significant growth in total energy production as presented in Table 19. The table suggests that Yemen is a net exporter of energy. The table also shows that the per capita share of energy consumption has declined in the last two decades of the last century. Unlike the MENA region where energy consumption per capita increased by 20 per cent between 1997 and 1999, the Yemeni's consumption declined by-9 per cent for the same period. This finding is affirmed by the change in energy consumption per GDP, as the table suggests. This comes as a natural result to exporting oil and other petroleum products. This finding is supported once more by Figure 20, where the curve for production is increasing between 1980 and 2005, while the curve for consumption is almost constant for the same period.

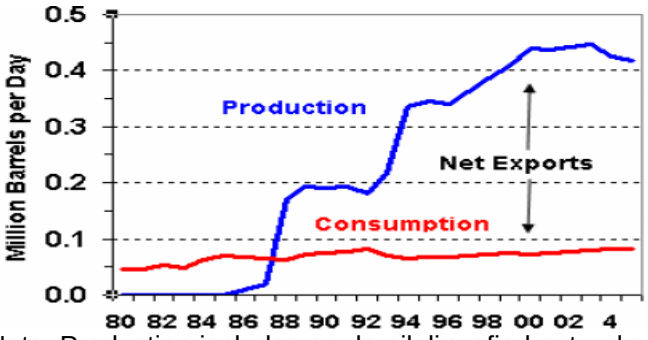
Table 19 Energy Production and Consumption (in thousand metric tons of oil equivalent) {a}

	Yemen	Middle East & North Africa	World
Total energy production, 2000	22 046	1 615 471	10 077 984
► % change since 1980	36 534	33	37
Energy imports, 1997	1	129 890	9 521 506
Energy exports, 1997	13 785	1 075 597	3 419 104
Total energy consumption {b}, 1999	3 139	518 436	9 702 786
Electricity consumption, 1999	162	48 289	1 040 770
Energy consumption per capita, 1997	0.21	1.39	1.64
► % change since 1990	-9	20	0
Energy consumption per GDP {c}, 1999:	242	279	244
► % change since 1990	-8	10	-13

Note: (a) One metric ton of oil equivalent (toe) is defined as 10 Exp. 7 kilocalories or 41.868 gigajoules, equal to the amount of energy contained in 1 metric ton of crude oil; (b) In metric tons of oil equivalent per million constant 1995 international dollars; The International Energy Agency (IEA) calls this value Total Primary Energy Supply (TPES)
TPES = Energy Production + Imports - Exports - Stock Changes - Consumption by International Marine Bunkers (c) In metric tons of oil equivalent per million constant 1995 international dollars.
Source: World Resources Institute (WRI), 2005, "Coastal and Marine Ecosystems, Country Profile-Yemen," Earth trends: Environmental Information Portal, http://earthtrends.wri.org/

2.5.1. Oil

Figure 19 Oil Production and Consumption, 1980-2005



Note: Production includes crude oil, liquefied natural gas, other liquids and refinery gain
Source: Source: Energy Information Administration, Official Energy Statistics from the US Government, Country Analysis Brief: Yemen, October 2005, http://www.eia.doe.gov/emeu/cabs/Yemen/Oil.html

Oil income makes up an estimated 65-70 percent of total Yemeni government revenue, Overall, Yemen's economy benefits from high oil prices, which increase the country's hard currency receipts and remittances from Yemeni workers in the wealthier Gulf countries.[63]

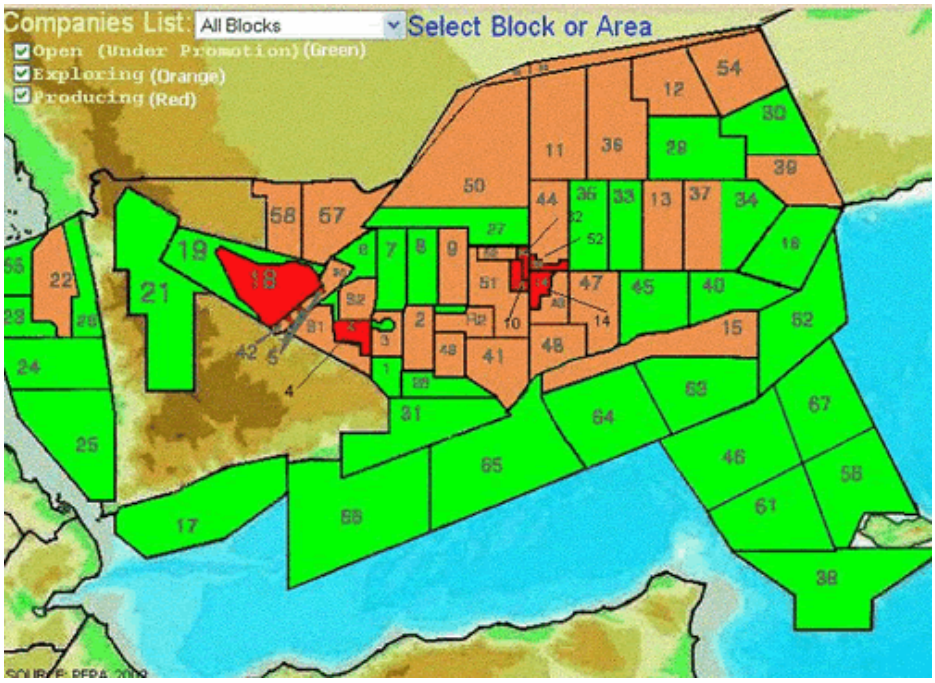
Yemen is a small, non-OPEC oil producer. To date, Yemen's territory has been divided into 84 blocks, only 11 of which actually produce oil. Around half of the blocks have been licensed for exploration and possible production of oil and/or natural gas, Figure 20.[64]

According to Oil and Gas Journal, the country contains proven crude oil reserves of 4 billion barrels, concentrated in five areas: Marib-Jawf Block 18 (estimated 800 million barrels) in the north; Masila -Block 14 (estimated 800+ million barrels) in the south; East Shabwa - Block 10A (estimated 180 million barrels); Jannah - Block 5 (estimated 345 million barrels) and Iyad - Block 4 (estimated 135 million barrels) in central Yemen. In 2004, Yemen's crude oil output averaged 423 743 bbl/d, down from 448,288 bbl/d in 2003. For the first nine months of 2005, Yemeni crude production was down again, to 416 656 bbl/d. In part, according to Yemen's Petroleum Exploration and Production Authority (PEPA), this is due, in part, to declining production in Masila and Marib, the country's two largest fields.[65]

Oil exploration activity in Yemen has accelerated since 1997. In June 2000, Yemen and Saudi Arabia signed the Treaty of Jeddah, resolving a longstanding border dispute. The agreement opened up opportunities for increased Saudi trade and investment in Yemen, and made possible the award of oil and gas exploration rights for areas in Yemen, adjacent to the border. In 2000, four new blocks were demarcated in this area, and several companies have signed memoranda of understanding (MOU) for exploration rights. In July 2005, Yemen completed an upstream bidding round with the award of seven blocks, six onshore and one offshore.[66]

[63] Energy Information Administration, Official Energy Statistics from the US Government, Country Analysis Brief: Yemen, October 2005, http://www.eia.doe.gov/emeu/cabs/Yemen/Oil.html
[64] Ibid.
[65] Ibid.
[66] Ibid.

Figure 20 Blocks for Production, Possible Production and Exploration of Oil and/or Natural Gas



Source: Energy Information Administration, Official Energy Statistics from the US Government, Country Analysis Brief: Yemen, October 2005, http://www.eia.doe.gov/emeu/cabs/Yemen/Oil.html

Yemen has an integrated network of pipelines for transport of the crude oil and natural gas produced in three central areas. This 560-mile network connects with four longer pipelines that transport oil to several major export terminals.[67]

Yemen currently has a crude refining capacity of 130 thousands bbl/d from two aging refineries. The refinery in Aden, operated by Aden Refinery Company (ARC), has a capacity of 120 thousands bbl/d, while capacity at the Marib refinery is ten thousands bbl/d.[68]

2.5.2. Natural Gas

With reserves of 16.9 trillion cubic feet (Tcf), Yemen has the potential to become a commercial producer and exporter of natural gas. The bulk of Yemen's gas reserves are concentrated in the Marib-Jawf fields (Block 18). In 2003, there was no production of natural gas in Yemen, despite longstanding plans to develop an export-based natural gas industry. Currently, the gas extracted as by-product of oil production is re-injected.[69]

In August 2005, the Yemeni Government approved three LNG supply agreements. In early September 2005, the government awarded an engineering, procurement and construction contract for the project. First shipments of LNG could be made available by late 2008, with gas likely to flow to the United States and South Korea. Gas for the LNG project will come from the Marib-Jawf field includes three pipelines from the

[67] Ibid.
[68] Ibid.
[69] Ibid.

fields at Marib and a two-train liquefaction plant at the Arabian Sea port of Balhaf, south of Al Mukalla.[70]

In 2002, in order to encourage investment in commercial natural gas development, the government began offering 25-year purchase price agreements that lowered the price of natural gas to $0.50 per million Btu. Facing slow progress in export-oriented production, the Yemeni government is now considering developing natural gas for domestic electricity generation and petrochemical production. [71]

2.5.3. Electricity

Yemen's state-owned Public Corporation for Electricity (PCE) operates an estimated 80 per cent of the country's generating capacity as well as the national power grid. The remainder of Yemen's electricity is generated by small off-grid suppliers and privately-owned generators in rural areas. PEC distributes electricity in the national grid through two 132Kv transmission systems, one serving the northern region of Sanaa-Hodeidah-Aden, the other serving Mukalla and Hadramout. Plans to restructure PEC, laid out in the 1997 Power Sector Strategy, have been making slow progress at best due to financing and other problems.

In 2003, Yemen's diesel-fired power plants generated 3.9 billion kilowatthours of electricity. According to Yemen's PCE, the country's generating capacity (810-900 MW) and electricity distribution network is inadequate. Currently, it is estimated that only about 5 percent of rural households and 30 percent of urban households in Yemen have access to electricity from the national power grid. Even for those connected to the grid, electricity supply is intermittent, with rolling blackout schedules maintained in most cities. According to the World Bank, Yemen's electricity shortage is one of the major restraints on economic growth, thus limiting industrial production and depressing standards of living. In order to meet growing demand (up 20 per cent between 2000 and 2003) and to avert an energy crisis in the medium term, the Government of Yemen has plans to increase the country's power generating capacity to 1 400 MW by 2010.

Over the past decade, the Government has taken steps toward alleviating Yemen's electricity shortage, including reform, expansion and integration of the country's power sector through small-scale privatization and independent (private) power projects (IPPs). Currently, Yemen's two largest power plants are the 165-MW power station at Ra's Kanatib, near Al Hodeidah, and the 160-MW station in Al Mukha, south of Al Hodeidah.

Long term development of Yemen's power sector includes a reduction in oil dependence, thus maximizing oil for export. Yemen's plans include the construction of several gas-fired power stations, expansion of the national power grid, and the introduction of renewables, such as solar energy, to rural areas. In the immediate term, the Government is promoting large-scale IPPs to increase generation capacity over the next few years. Achieving this goal require natural gas infrastructure development.

In late 1999, the Yemeni government took the necessary steps for developing the first IPP, a 400-MW capacity, gas-fired power complex, transmission line, and substation near the Marib oil and gas field, east of Sana'a. However, lack of development of a natural gas production and distribution network from the nearby Safar fields is delaying progress of the project. Another possible gas-fired power plant is planned for Safar. The plant is to have a generating capacity of 2 800 MW.

[70] Ibid.
[71] Ibid.

In March 2005, the Government awarded a contract to build a 340-MW gas-fired power plant for $160 million. The plant will be fuelled by natural gas from the Marib field, and is to begin commercial operations in the summer of 2007. Ultimately, a total of 1 000 MW in generating capacity is to be built at the Marib site.

While large-scale power development has mostly stalled, efforts by the Yemeni government to encourage interest in IPP ventures, including the long terms gas-purchase agreements, have resulted in several smaller-scale projects. In 1998, the Mukalla power project was completed. The project included the construction of a 40-MW diesel-fired plant, six substations, and the laying of 62 miles of transmission lines. Recently the Aden power project was completed, which involved building a 30-MW plant and repairing the Al Hiswa power plant to serve the city's port. The Al Hiswa plant is currently under consideration for expansion by 60 MW of generation capacity as part of the redevelopment of Aden.

2.5.4. Energy Consumption

Most of the energy consumption, as presented earlier, and showed in Table 20 is crude oil and natural gas liquids. Primary solid biomass and renewable, excluding hydro power, are not the major source of energy. Depending on fossil fuels threatens the environmental sustainability of the country and its development at large.

Table 20 Energy Consumption by Source, 1999 (in thousand metric tons oil equivalent)

	Yemen	Middle East & North Africa	World
Total Fossil Fuels	3 061	500 461	7 689 047
Coal and coal products	0	30 956	2 278 524
Crude oil and natural gas liquids	4 469	412 549	3 563,084
Natural gas	0	205 143	2 012 559
Nuclear	0	0	661 901
Hydroelectric	0	5 694	222 223
Renewables, excluding hydroelectric:	77	11 939	1 097 889
Primary solid biomass (includes fuel wood)	77	10 976	1 035 139
Biogas and liquid biomass	0	3	14 931
Geothermal	0	202	43 802
Solar	0	756	2 217
Wind	0	2	1 748
Tide, wave, and ocean	0	0	53

Source: World Resources Institute (WRI), 2005, “Coastal and Marine Ecosystems, Country Profile-Yemen,” Earth trends: Environmental Information Portal, http://earthtrends.wri.org/

Transportation is the major consumer of energy, Table 21. Transportation is not a basic industry, and for this reason the energy consumed in Yemen has little economic returns as presented earlier. Table 22 presents the resource consumption.

Table 21 Energy Consumption by Sector, 1999(in thousand metric tons of oil equivalent)

	Yemen	Middle East & North Africa	World
Industry	169	121 118	2 140 474
Transportation	1 441	90 483	1 755 505
Agriculture	0	8 152	166 287
Commercial & public services	0	14 322	511 555
Residential	602	72 480	1 845 475
Non-energy uses and "other" consumption	237	60 618	333 981
Total final energy consumption {a}	2 449	367 173	6 753 276

Note (a) "Total final consumption" is calculated as the sum of energy consumption by sectors.
Source: World Resources Institute (WRI), 2005, "Coastal and Marine Ecosystems, Country Profile-Yemen," Earth trends: Environmental Information Portal, http://earthtrends.wri.org/

Table 22 Resource Consumption, 1999

	Yemen	Middle East & North Africa	World
Passenger cars per 1000 people, 1998	X	X	109
Annual motor gasoline consumption, 2000 (liters per person)	79	X	179
Annual meat consumption, 1998 (kg per person)	10	22	38
Annual paper consumption, 2000 (kg per person)	X	X	53
Annual coffee consumption, 2001 (kg per person)	X	X	X

Source: World Resources Institute (WRI), 2005, "Coastal and Marine Ecosystems, Country Profile-Yemen," Earth trends: Environmental Information Portal, http://earthtrends.wri.org/

2.6. Transport

Yemen enjoys a broad air, land and sea network linking up its regions, neighbouring countries and the world. The last ten years have witnessed an improvement of transport infrastructure of ports, airports and roads. The volume of public expenditures on the sector clearly reflects such development. Investment expenditures on transport reached 24 700 million YR during 1990-1999, of which around 8 800 million went towards the maintenance and overlay of airports and ports and another 15 800 million approximately spent on equipment and hardware including airplanes and boats.[72]

2.6.1. Sea Ports and Transport

Yemen enjoys a long coastal strip extending from the Red Sea to the Arabian Sea with a number of scattered islands. Yemen has six main ports along this strip (Aden, Hodieda, Mukala, Mokha, Al Saleef and Nashtoon). The ports are equipped for servicing cargo, vessels and container handling. In 1999, the first phase of the Aden Container Terminal was implemented at a cost of $187 million. The Aden Container

[72] Ministry of Planning and International Cooperation, Transport, Sector Background Info. http://www.mpic-yemen.org/new1/strategies.asp?contantmain=6&key=17&stratigy=75

Terminal has been in operation. The Terminal maintains two quays of 16 meters in depth and 680 meters in length with four cranes capable of handling 50 tons each. The Port Singapore Authority (PSA) is managing and operating the Aden Container Terminal. Container handling has grown and around 300,000 containers are expected to be handled in 2000. The project is vital in regaining Aden's trading status as a hub and transshipment port.[73]

A new port in Al Saleef was officially opened in May of 1997. Facilities include a quay of 350 meters in length and 14 meters in depth capable of receiving large vessels of 50 thousands tons. The new port is meant to reduce traffic on the port of Hodieda and to specialize on loading and unloading salt, wheat, cement and asphalt cargo, etc. The government is also working on the establishment of a port on the Island of Socotra to facilitate the transfer of food supplies to islanders. The Government plans also include the establishment of two other ports in Beroom in Hadhramout and Khalfoot in Al Mahara once feasibility studies are completed. The two projects will be given to potential investors on BOT basis. Other ports have seen further developments in the form of dredging activities, introduction of new facilities like quays, workshops, warehouses, handling equipment and guidance and tacking boats. This development brought about an increase in the number of calling vessels and cargo handling. Calling vessels numbered 3,180 in 1999 with a cargo handling of 5.5 million tons and container handling of 95,100. Three government owned shipping companies work in the transport sector including the Yemeni Sea Lines Co. (for national sea transport) , the National Shipping Co. (for shipping and cargo handling) and the National Dock Yards Co. (dealing with ship maintenance and services).[74]

The Government has maintained its effort to promote private sector activities in the transport sector, and has initiated privatization promotion in the field of shipping and maintenance services. Consequently, the number of private companies working in shipping, cargo handling and ship servicing and supplies has reached 40 companies. The two main shipping chambers in Hodieda and Aden coordinate their activities ensuring the well-being of their members and propose recommendations on sustaining smooth work and higher work performance efficiency at the ports. Efforts have continued to attract foreign investors to co-manage sea transport and maintenance. The Government has also signed a number of cooperation protocols on establishing sea transport joint companies.[75]

The environmental problems associated with marine transport emerge from land-based sources of pollution, such as industrial activities, or water-based sources of pollution, such as oil spills. The construction of ports and other berthing facilities affect the quality of water and usually are the site of solid wastes. If the planned expansions are not implemented abiding with environmental standards, the problems that associate with marine and inland water transport will intensify.

2.6.2. Road Transport

Land passenger and cargo traffic has seen an increase leading to ambitious expansion of the nation's road network. The public and private sectors are active in land transport services. Both sectors provide regular bus services nationwide. The Public Corp for Land Transport has a fleet of 203 buses and 151 trucks transporting

[73] Ibid.
[74] Ibid.
[75] Ibid.

4.4 million passengers and 164 thousands tons of cargo in 1998. The Corp is introducing 80 buses to boost its land transport fleet.[76]

The private sector has also developed its land transport activity. The private sector runs around 423 thousands land transport cargo vehicles and trucks compared to 205 thousands in 1990. The number of taxis reached 99 thousands compared to 28 thousands in 1990. Private sector run vehicles have transported about 143.5 million in 1998 compared to 40 million in 1990. Total cargo registered 100.6 million tons in 1998 compared to 44.8 million tons in 1990.[77]

The Government has regulated the introduction of private sector activity in the land transport sector through adopting appropriate legislation that allows the competitive involvement in the sector and setting out transport fares in accordance with market mechanisms. Yemen has joined the Arab Transit and Triptick agreement and signed an agreement with Saudi Arabia on the movement of land passengers and cargo. Yemen signed similar agreements with Jordan and Syria and plans to sign further agreements with other countries.[78]

Environmental impacts of land transport are numerous. Often informal developments grow nearby major routes. Constructing elevated routes and bridges are another visual blight that damages the image of the city and add to her degraded air quality.

2.6.3. Airports and Air Transport

The number of airports in operation in Yemen is 13, five of which are international (Sana'a, Aden, Taiz, Al Rayan in Mukala and Hodieda) and eight local (Sayun, Attaq, Al Ghaidha, Mareb, Al Buqa'a, Al Biedha, Sa'ada and Socotra). These airports provide adequate levels of efficiency and safety. The state has allocated resources to modernize airports and provide navigation equipment ensuring air transport safety including ongoing rehabilitation works on the Aden International Airport. The final phase of the construction of Socotra International Airport enabling linking the Island to the motherland and the rest of the world is under implementation. In addition to these two strategic projects, the government is asphalting the runway of Sayun Airport, constructing the Attaq Airport building, re-paving Taiz Airport, walling the Airports of Hodieda and Al Rayan and paving the Airport road in Al Ghaidha. Maintenance of Sana'a International Airport continues with the expansion of the runway. A government plan for the airport includes a study on the construction of a new passenger departure building. The Government has also opened up for private investment in airport services (catering, supplies, cleaning, restaurants and duty free markets, etc.) at Sana'a Airport and other airports around the country.[79]

Airport traffic has witnessed an increase in the last ten years. The number of local and international passengers reached 1.1 million in 1999 compared to 956 thousands in 1991. Local travellers numbered 251 thousands. Cargo handling increased to 12.1 thousand tons. International air traffic is represented by a number of Arab and foreign airline companies. Twenty-three international airline companies fly regularly over Yemen's air space. Yemen has signed bilateral air transport agreements with 41 countries.[80]

The former two national airline carriers in Yemen (Yemenia and Al Yemda) merged in 1996. In 1997, the national fleet saw the introduction of two new Airbus planes, a

[76] Ibid.
[77] Ibid.
[78] Ibid.
[79] Ibid.
[80] Ibid.

third one in 1999 and a fourth in 2000. The move is part of plans to substitute the old fleet with modern airplanes. The National Airline Carrier (Yemen Airlines) has expanded its international destinations with new routes in 2000 covering 25 destinations in Asia, Europe and Africa. Local flights have expanded to include 8 cities. The share of the Yemeni Airlines in international air transport to and from Yemen registered 70 per cent of the total passengers and 78.6 per cent of cargo.[81]

Air pollution is among the major environmental costs of air transport. Land allocated for airports and buffer zones is another environmental cost that must be paid for the advance of this vital sector of the economy. Noise is another environmental hazard associated with air transport. There is a need for a sound contour map of the areas around airports and to use that in developing a system for fining planes that are over 25 years old and exceed permissible sound levels. The development of new airports, particularly at tourist attractions, should be carefully planned and developed to avoid harmful impact on wild life and natural habitat.

2.7. Tourism

Yemen boasts a long coastline and a large number of islands of unique flora and fauna. Yemen's deep waters contain colourful and rare marine life, coral reefs and rare precious stones. Yemen's coasts and islands are suitable for different water sports including scuba diving and fishing. Yemen also maintains natural ground hot and cold steam baths that number more than 50 baths scattered all over the country. Baths are sought for treatment.[82]

Aside from the natural characteristics, Yemen enjoys cultural tourism prospects in terms of its cultural heritage, unique architecture of old and historic towns, scattered archaeological sites, traditional handicrafts and diversity of cities and commercial sea ports. [83]

The Government has approved a tourism policy in February 1997. The policy takes into consideration Yemen's ambitions and potential in the utilization and development of tourism. In March of 1997, an international press conference in Berlin declared Yemen as a tourist destination paving the way to enlist Yemen among the most favoured tourism destinations by international tour operators.

The generated income from tourism can assist in the development and improvements of facilities for protecting and regenerating environmental resources that benefits both the residents and tourists as well. However, to reap these benefits better management of tourism is needed and the industry should operate within an overall plan that preserves the natural and cultural heritage of Yemen, upon which the tourist industry depends.

The quality of the environment is frequently the primary attraction of tourists. However, the presence of tourists in increasing numbers accelerates problems that human activities cause. This can lead to a considerable pressure on the environment that attracted tourists in the first place and in particular on the local environment where tourists visit.

The phenomenal coral reef formation is vulnerable to environmental changes, such as climate change. Harmful activities also threaten the existence of coral reefs, such as sewage discharge, spillage and human handling. In addition, tourism development means building more hotels to accommodate for the increase in number of local and international tourists. This will put more pressure on the fragile eco-systems in these

[81] Ibid.

[82] Ministry of Planning and International Cooperation, Tourism, Sector Background Info. http://www.mpic-yemen.org/new1/strategies.asp?contantmain=6&key=17&stratigy=75

[83] Ibid.

areas. Thus, there is a threat to Yemen's coral reefs and other environmental assets as well; and therefore immediate action is required to protect this precious natural gift.

2.8. Human Settlements

Yemeni human settlements are suffering from many interrelated problems: population growth, housing problems, growing informal areas, traffic congestion, inadequate provision of social services and utilities, inadequate urban and regional planning systems and degrading sites of cultural heritage.

2.8.1. Causes

i. Natural Population Growth

Yemen has one of the highest rates of population growth. An estimated 73.5 per cent of its population live in rural areas; more than 80 per cent are scattered in villages of less than 500 inhabitants; and 50 per cent of its population are under 15 years of age. These dynamics represent an expensive and a major challenge in providing basis services and infrastructures.

ii. Rural-Urban Migration

Waves of rural migrants move to urban centres due, in part, to disparities in income and physical and social services. Rural to urban migration coupled with the natural population growth led to rates of very rapid urban growth in population size and spatially as well without a proportionate increase in the growth rate of jobs, social services and utilities. The rapidly increasing urban population requires an increase in the number of jobs. However, the manufacturing sector has lagged behind population growth.

2.8.2. Consequences

i. Informal Areas

The need for housing is one of the most pressing problems in urban areas. The housing shortage has reached a critical point, especially in the low-income category. Informal settlements came into existence as the inevitable outcome of the housing needs of low-income groups. These areas lack physical and social infrastructures. Successive influx of rural migrants to urban centres complicates the matter. For the residents of these informal areas**,** informality is the only way to secure jobs for the poor that meets their housing needs at an adequate price.

ii. Inadequate Provision of Social and Physical Infrastructures

Rapid population growth strains both physical and social infrastructures. Densities build up in existing housing and cause rapid deterioration to the built environment. The relationship between physical infrastructures and social services on one hand, and the environment on the other is critical. Inadequate provision of social services leads to poor environmental behaviour and continuous environmental degradation.

Health and education serves are stressed, and not enough. Severe scarcity of water (137m^3 per head per year); shortage of sanitation coverage (6.2 per cent of population); high poverty rates (30 per cent of population) insufficient government spending on health (4.7 per cent), low health coverage (50 per cent of population) can only contribute to the multiplication of illnesses and diseases and the deterioration of the environment. Government spending on education exceeded 20

per cent of total public expenditure during 1995-2000. Illiteracy amongst population 15 years and over is still considered very high and exceeds 55.7 per cent; 38.6 per cent of children aged 6–14 years are still out of schools; 56 per cent of girls aged 6–14 years are still out of schools; in addition, Yemen experiences a significant drop-out from basic education.

iii. Noise

Noise pollution is an increasing feature of urban life and has received growing attention in recent years. The major sources of noise pollution are road traffic, general neighbourhood noise, and social, cultural and leisure activities. Other significant sources of noise include manufacturing and handicraft activities, construction work, railway traffic, and aircrafts. Noise pollution can have an effect over human health and welfare. Long-term exposure to noise may result in the permanent impairment of hearing ability.

2.9. Poverty

2.9.1. Status

Poverty is considered the result of a set of natural and human factors, domestic policies and external factors that come together to create an environment conducive to the occurrence and spread of poverty and its increase in severity. The 1998 Household Budget Survey (HBS) showed that 17.6 per cent of the Yemeni population live under the food poverty line, whereas the percentage of the population who are incapable of obtaining all their food and non-food requirements (represented in food, clothing, shelter, health, education and transport) is 41.8 per cent. These percentages reflect the gravity of the situation and living conditions of approximately 6.9 million people, who are suffering from the different dimensions of poverty, not to mention the other large numbers that are living close to the poverty line and are vulnerable to being dragged in to below the poverty line, besides the high poverty gap, which is estimated at about 13.2 per cent and the severity of poverty, which amounts to 5.8 per cent.[84]

Poverty in Yemen takes on a rural attribute, Table 23, especially as the Yemeni people are, to a large extent, mostly rural dwellers, despite the rapid growth of urbanization. The rural areas of Yemen embrace about 83 per cent of the poor and 87 per cent of those who suffer from food poverty, whereas 3/4 of the population in 1998 were rural dwellers. The percentage of the rural population who are poor amounts to 45 per cent, as compared to 30.8 per cent for the urban population, in addition to the wide gap and severity of poverty among the rural population, compared to that of the urban population. This attribute also shows that, according to the 1998 HBS, spending on food comes to about 54 per cent of income in the urban areas, whereas it climbed to 67 per cent in the rural areas, which reflects low incomes in the rural areas on one hand, and an even lower degree of spending on non-food requirements there on the other. [85]

Table 23 Poverty Indicators In Yemen

	Total	Rural	Urban
Food Poverty Line (YR/per capita/ per month)	2 101.0	2 103.0	2 093.0
Percentage of the Poor	17.6	19.9	10.0

[84] Republic of Yemen, Poverty Reduction Strategy Paper, 2003-2005, May 2002, http://www.mpic-yemen.org/dsp/PRSP2003_2005_2.pdf

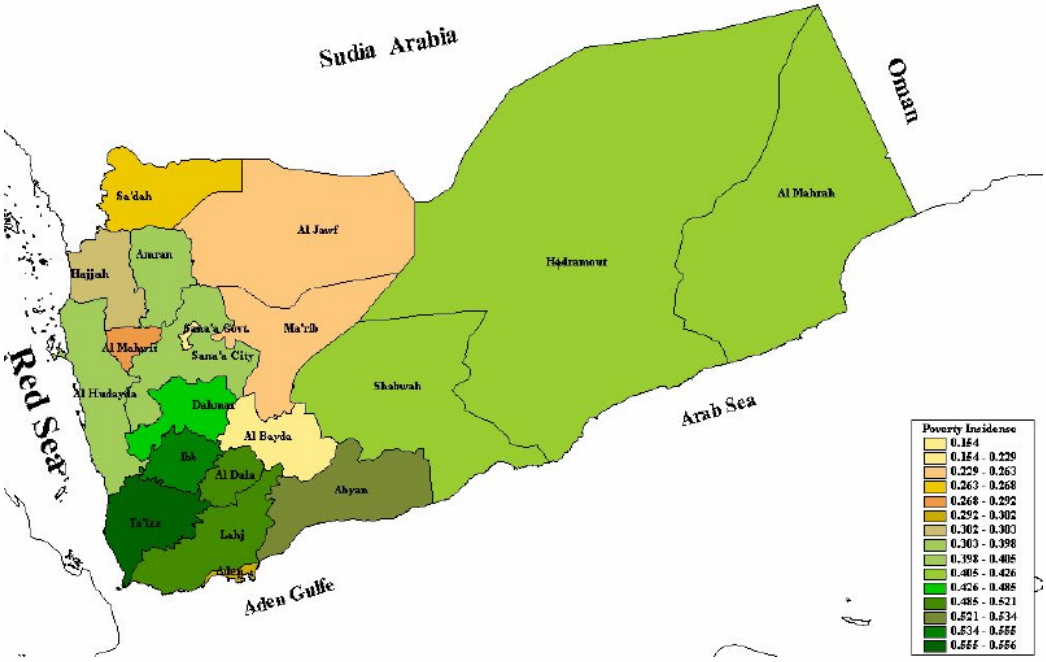
[85] Ibid.

	Total	Rural	Urban
Number of Poor People (millions)	2.9	2.5	0.4
Poverty Gap	4.5	5.2	2.1
Severity of Poverty	1.7	2.0	0.7
Upper Poverty Line (YR/per capita/ per month)	3 210	3 215	3 195
Percentage of the Poor	41.8	45.0	30.8
Number of Poor People (millions)	6.9	5.8	1.2
Poverty Gap	31.2	14.7	8.2
Severity of Poverty	5.8	6.7	3.2

Source: Republic of Yemen, Poverty Reduction Strategy Paper, 2003-2005, May 2002, http://www.mpic-yemen.org/dsp/PRSP2003_2005_2.pdf

In the same way that poverty is inequitably distributed between rural and urban areas, there is also an obvious disparity among the different governorates of Yemen, Figure 21, whereby half of the poor are concentrated in four governorates: Taiz, which has 18.7 per cent of the total poor population; Ibb (with 16.2 per cent); Sana'a governorate (with 11.9 per cent); and Hodeidah (with 10.2 per cent).[86]

Figure 21 Poverty Map in Yemen



Source: Republic of Yemen, Poverty Reduction Strategy Paper, 2003-2005, May 2002, http://www.mpic-yemen.org/dsp/PRSP2003_2005_2.pdf

2.9.2. Causes of Poverty

The Poverty Reduction Strategy Paper identified the following elements as the significant causes of poverty in Yemen:

1. Large family size raises the probability of falling under poverty. Families with a large number of infants and children have a higher probability of being poor whether it is located in rural or urban areas. The probability of falling into poverty is reduced, with the head of the household being of an older age,

[86] Ibid.

which is even more apparent in the urban areas, whereas the probability increases in families headed by a widower or a widow.

2. Returns of education are high, whereby an assumed scenario shows that the elimination of illiteracy from the heads of households leads to the reduction in the poverty incidence by about 5.8 per cent at the national level, by 6.4 per cent in rural areas and by 3.7 per cent in urban areas. Completion of secondary school education leads to gains reaching 25 per cent in rural areas and 42 per cent in urban areas. The differences in such gains are attributed to the availability of greater opportunities in urban areas for skilled labor. There are also advantages that arise from a husband/wife that can read and write, compared to one who is illiterate, which can go up to 12 per cent in the rural areas and 6 per cent in the urban areas.
3. The employment situation highly affects the probability of falling into poverty, as the linear regression equation shows that the incidence of poverty is lower in families that are headed by a businessman or self employed person. Similarly, there are really no systematic advantages for employment with the private sector in urban areas. The probability of being poor increases in families that are headed by a worker in the private sector compared with those headed by a worker in the public sector. Current transfers help in avoiding poverty.
4. The equation shows that manifest unemployment is not considered an important factor affecting the probability of being poor in Yemen in both rural and urban areas. People in the rural areas cannot stay without work, although many of them face underemployment. Underemployment is considered more important, as the 1999 Labour Force Survey shows a rise in manifest unemployment to 11.5 per cent, compared to underemployment of about 25.1 per cent of the labour force. Underemployment is noticeable in the rural areas at 27.5 per cent compared to 19.7 per cent in the urban areas, and among males who represent 78 per cent of those who are facing underemployment. Analysis also shows that underemployment in the agricultural sector turns into manifest unemployment in urban areas, through migration out of the rural areas and over a number of years.
5. Geographical location is an influential factor in raising the probability of being poor, where there are significant variances in the per capita share of expenditures among governorates, although numerous attributes of the household were isolated.

2.9.3. Poverty and Environment

The relationship between poverty and the environment is complicated, due, in part, to fact that the poor are essentially reliant on the environment for their livelihood. At the same time, they are affected by the methods by which natural resources are exploited. Since most natural resources are usually limited and susceptible to deterioration, the improvement of environmental management and regulation of the management of natural resources leads to benefits for the population and to the poor in particular. It must be emphasized that poverty does not necessarily lead to environmental deterioration, since the linkage between both of them is complex and requires an accurate assessment. Population growth also does not necessarily lead to environmental deterioration. Although this might be so in the beginning, what happens after that is more subject to policies.[87]

[87] Republic of Yemen, Poverty Reduction Strategy Paper, 2003-2005, May 2002, http://www.mpic-yemen.org/dsp/PRSP2003_2005_2.pdf

The number of illnesses increased due, in part, to the diseases that are communicated by polluted, swampy, or stagnant waters, and also as a result of the accumulation of solid wastes. The number of reported typhoid cases have increased throughout Yemen, except in Taiz, Hajjah and Amran governorates, from 7 811 cases in 1998 to 8 287 cases in 2000, with the continuation of the spread of schistosomiasis, with 17 thousands reported cases in 2000. [88]

2.10. Social and Institutional Capacities

The Environmental Sustainability Index (ESI) benchmarks the ability of nations to protect the environment over the next several decades. It does so by integrating 76 data sets – tracking natural resource endowments, past and present pollution levels, environmental management efforts, and the capacity of a society to improve its environmental performance –into 21 indicators of environmental sustainability.

A country is more likely to be environmentally sustainable to the extent that it has in place institutions and underlying social patterns of skills, attitudes, and networks that foster effective responses to environmental challenges. The social and institutional capacities of Yemen are comparable to average value of peer group of countries. Environmental governance is measured as an index consisting of the following variables: ratio of gasoline price to world average; corruption measure; Government effectiveness; percentage of total land area under protected status World Economic Forum Survey on environmental governance; rule of law; Local Agenda 21 initiatives per million people; civil and political liberties; percentage of variables missing from the CGSDI "Rio to Johannesburg Dashboard;" IUCN member organizations per million population; knowledge creation in environmental science, technology, and policy, and finally democracy measure. The score of Yemen is much more negative compared to other countries member of the group, as presented by the table. The data in the table suggests that eco-efficiency is Yemen is better than that of other countries; but still with negative scores. If Yemen seeks cleaner and/or renewable sources of energy, then this score is bound to improve and induce economic, social and environmental benefits. The private sector needs encouragement to acquire ISO 14001 and other accreditation certificates; thus it is expected to improve competitiveness of Yemeni firms and economy at large. Improvements in education and investments in research and development will improve Yemen's social and institutional capacities, and therefore, will enhance the score on Science and Technology. Expected improvements will be in the fields of monitoring and information, and proper environmental management, which will eventually lead to the sustainability of the development of the nation.

Table 24 Social and institutional capacity

	Environmental governance	Eco-efficiency	Private sector responsiveness	Science and technology
Yemen	-0.86	-0.42	-0.74	-0.87
Average value for peer group	-0.47	0.47	-0.62	-0.95

Source: Esty, Daniel C., Marc Levy, Tanja Srebotnjak, and Alexander de Sherbinin (2005). 2005 Environmental Sustainability Index: Benchmarking National Environmental Stewardship. New Haven: Yale Center for Environmental Law and Policy. http://www.yale.edu/esi/

[88] Ibid.

Based on the above, the document examines several dimensions of the social and institutional framework that govern environmental management and planning, and general policy making.

2.10.1. State

The institutional setup within which environmental policy is elaborated and executed in Yemen faces a number of difficulties. The major problem is inflated, distorted public administration, which is the rot cause of the multiplicity of implementing organizations that require coordination to achieve effective delivery of environmental policy. The second major barrier is lack of comprehensive data and up-to-date information is a severe limitation on decision-making and monitoring. Furthermore, there are cultural constraints. Another barrier is that human resources are weak in terms of environmental expertise, thus posing another difficulty for implementation of environmental policy.

i. Inflated, distorted public administration

The administrative apparatus of the Government of Yemen is inflated and distorted. Erroneous employment policies continued and resulted in doubling of the numbers of employees in the administrative apparatus and in the public and mixed sectors over the first five years of the 1990s until the number of employees grew from 191 thousands to 348 thousands employees. The wage bill also inflated to reach about 10.3 per cent in 2000 of the GDP and 27.9 per cent of total public expenditures despite the average real wage of an employee in the government administrative apparatus that declined from YR 4 385 per month in 1990 to YR 1 387 in 1995, losing about two-thirds of its value, in addition to the high pressure between the maximum and the minimum values.[89]

The situation of the administrative apparatus of the government is exacerbated in view of the administrative deficiencies summarized as follows:[90]

- Inflated organizational and functional structure of the government.
- Misallocation of human resources.
- The principle of suitability and competence is absent in the selection and appointment to public employment.
- The failure of a large number of public and mixed sector enterprises.
- Conflicting and intertwining responsibilities among the ministries and the respective authorities and corporations affiliated with them, and poor coordination among them.
- Duplicity of functions between the governorate leadership and the ministry branches in the ministries and districts.
- Multiplicity and extension of lines of authority.
- Absence of employee files.
- Absence of the clear delineation of the government employment and distribution according to their organizational formations.
- Lack of statistical data on government employees, their geographical distribution and employment and qualification particulars.

[89] Republic of Yemen, Poverty Reduction Strategy Paper, 2003-2005, May 2002, http://www.mpic-yemen.org/dsp/PRSP2003_2005_2.pdf

[90] [90] Ibid.

- Redundancy, excessive employment, and ghost workers.

The civil service suffers from the geographical misallocation of employees, or in terms of government functions and services, whereby employees were concentrated in the major cities. The civil service is faced with poor capacities and a severe shortage in qualified personnel. The Employment Survey of 1998 shows that the employees having university degrees represent 16.3 per cent of the total employees, while the employees without any educational qualification rose to 26.6 per cent of the total number of 404 522 employees.[91]

ii. Corruption

Administrative conditions became worse as a result of the augmentation of the various forms of corruption in the shade of the poor application of the law, the absence of an integrated public administrative system, poor managerial competence, low wages, salaries and incentives, rigid centralization and redundant administrative procedures, the lack of employment classification and sorting system and the absence of reward and punishment and accountability, which led to making the administrative apparatus incapable of keeping pace with domestic and external developments. Obtaining public employment has become, to a certain extent, associated with corruption and nepotism, time-consumption, connections, and sometimes money and bribery, not to mention treating public employment as though it was a right and a privilege.[92]

iii. Weak judicial system

The deficiencies in the functions of the government were not confined to the administrative aspects, but rather extended beyond it to include the control function, as seen in the immobilization of the effective monitoring regulations for the prevention of corruption and for revealing it and tightening the noose around it. The organizational environment in the units having control mechanisms were also subjected to the very same deficiencies and weaknesses, and therefore lost the ability and the means of exposing violations and corruption, for taking the needed internal enforcement measures in the administrative units, and for determining the negative impacts that arose accordingly, so as to help make the necessary reforms and to ensure that errors and excesses are staved off and prevented from recurring.

Factors behind weak judicial system include:

- Poor qualifications of some judges and members of the general prosecution and the lack of judicial training.
- Poor control of the courts and the general prosecution. • The lack of full adherence to the application of the provisions of the Laws for Litigation, for Punitive Procedures and for Corroboration and Civil Execution.
- The spread of misconceptions and the improper mechanisms for the relations between the courts and the general prosecution.
- Lack of judicial police force and adequate protection for members of the judiciary.

[91] [91] Ibid.

[92] Republic of Yemen, Poverty Reduction Strategy Paper, 2003-2005, May 2002, http://www.mpic-yemen.org/dsp/PRSP2003_2005_2.pdf

iv. Civil society

Civil society and the private sector have a vital role to play in conserving the environment as well as degrading the environmental resources. NGOs are among the civil society organizations that play a major role in the Yemeni society. As for the labour unions and syndicates, it is crucial to strengthen the role of workers and labour unions through training, enhanced information flow and exchange, and increased participation to realize improved environmental management and sustainability in Yemen. Research institutes have a vital role to play in addressing environmental and development issues. Their role effectively depends upon a suitable set of technical and legal standards. Table 25 shows a profile of the Yemeni civil society.

Table 25 Civil Society

	Yemen	Middle East and North Africa
Number of international non-governmental organizations (NGOs), 2000	318	20 519
NGOs per million population, 2000	18	49
Number of formally committed municipalities to Local Agenda 21, 2001	2	98

Source: World Resources Institute (WRI), 2005, "Environmental Institutions and Governance-- Yemen," Earth trends: Environmental Information Portal, http://earthtrends.wri.org/

2.10.2. Coordination Overload

The amount of coordination that is required to attain comprehensive and integrated environmental activities is enormous because of the cross-sectoral nature of environmental issues. Three layers of government are involved (central ministerial departments, Governorate level authorities, and local level public administration), and numerous governmental agencies. In addition, the private sector has a role to play, as does academia, NGOs and donor agencies.

i. Policy Coordination

The nature of decision-making varies according to its level. Once government policy is set at the Cabinet level, EPA still faces considerable obstacles to coordinating national environmental policy. Environmental policy often generates contentious policy questions. These conflicts manifest the property contradiction of environmental assets i.e. the contradiction between the use value of the resource, which the society appreciates, and the market value of the natural resource. The market value is often the basis for evaluating alternative policy, strategic, planning and project options.

ii. Coordination of Implementation

Practical difficulties with coordination emerge at lower levels of decision-making due, in part, to the large number of implementation bodies that are named as 'responsible' by the many laws and decrees that have environmental implications. Addressing inadequate coordination by asking for more coordination adds another layer of coordination and makes matters worse. Better solutions are likely to emerge from new ways of addressing the planning process, such as by encouraging more involvement by local stakeholders, by giving them rights in local implementation decisions.

iii. Coordination and Data Sharing for Monitoring

A prime constraint on environmental decision-making is the quality and coverage of data. Some environmental data is collected regularly and accurately, but may not be available to EPA. Some other data collection processes were developed with project funding and are widely available but the data sets cease when project funding is terminated. These and numerous other problems with availability of data for environmental analysis and decision-making are hampering the national capability for optimum use of its natural resources.

2.10.3. Knowledge Gaps

Markets and monitoring both depend on reliable and regularly collected data and information. Market mechanisms operate best when property rights are well defined, exclusive, secure, transferable and enforceable and are attached to all resources, goods and services. Currently environmental resources do not meet these criteria.

i. Pricing Environmental Resources

Natural resources need to be priced for their social value not for their market value. Currently those resources that have a market price are carrying a distorted price, usually much undervalued. The question of how to price natural resources is the subject of an extensive debate in the economics literature, and Yemen must necessarily move into social pricing of environmental resources with care.

ii. Data Deficiencies that Hinder Monitoring

The essential components for effective environmental monitoring are consistency and continuity. If the database or collection system from one source is inconsistent with the base or system used by another source of data, conclusions cannot (or should not) be made based on comparison of the two data sets.

Environmental data need consistency and continuity over time because it is generally changes, deterioration or improvement that is of interest. Many data sets have begun as part of a development project supported by donor funds. Unfortunately many lapses once the foreign-assisted project is finished. For decision-making purposes, monitoring the state of the environment over time needs to be supplemented with information concerning violations of the laws. Data concerning violations is not available because of lack of enforcement of existing laws. Insufficient personnel devoted to enforcement are the primary cause of this situation. The precondition for having sufficient people engaged in enforcement activities is that funds are available to pay their salaries and transport and equipment costs. The post-hiring requirement is that good training is given, which is far easier to deal with than the precondition.

2.10.4. Legal Problems

i. Rationalizing Environmental Legislation

There is much duplication and overlap in legislation related to environment. The first step is to conduct a study of international experience in coordination and rationalization of environmental legislation. Furthermore, new issues, such as genetic engineering and information technology, need to ne introduced in the law by updating of environmental legislation.

ii. Style and Standards

Traditionally the Yemeni law for protecting the environment has provided command and control style of regulations dealing with end-of-pipe situations. Nowadays economic instruments are seen to be a more flexible and effective means of attaining environmentally desirable ends. Thus the environmental legislation needs to provide

more scope for the introduction of economic instruments. Also the standards that have been nominated in executive regulations accompanying various laws are sometimes outdated and need to be brought into line with current conditions.

2.11. Results and Outcomes

The analysis of ESI scores of Yemen, and in the light of the review and analysis of available information, the environment of Yemen can be classified as a system with moderate stress scores. It is highly vulnerable and attributed by low capacities. Compared to other less developed countries, Yemen has scores that are above average stewardship. Yemen as other less developed countries experience relatively low environmental stress, but have very weak institutional capacity and are particular vulnerable to natural disasters, under nourishment, and lack of sanitation and safe water supply.

A country is more likely to be environmentally sustainable if the levels of anthropogenic stress are low enough to engender no demonstrable harm to its environmental systems. Table 26 presents moderate scores on attempts to reduce stresses, particularly those driven by population that reached -2.23 compared to the average value for peer group of countries.

Table 26 Reducing Stresses

	Reducing air pollution	Reducing ecosystem stress	Reducing population stress	Reducing waste and consumption pressures	Reducing water stress	Natural resource management
Yemen	0.29	-0.31	-2.23	0.43	0.06	0.51
Average value for peer group	0.67	-0.16	-1.22	0.40	0.68	0.22

Source: Esty, Daniel C., Marc Levy, Tanja Srebotnjak, and Alexander de Sherbinin (2005). 2005 Environmental Sustainability Index: Benchmarking National Environmental Stewardship. New Haven: Yale Centre for Environmental Law and Policy. http://www.yale.edu/esi/

A country is more likely to be environmentally sustainable to the extent that people and social systems are not vulnerable to environmental disturbances that affect basic human wellbeing; becoming less vulnerable is a sign that a society is on a track to greater sustainability. Unfortunately this is not the case of Yemen and many developing countries. All ESI scores in Table 27 are negative, which is not a promising sign. The environmental health is not good. This confirms the information that the Poverty Reduction Strategy Paper (PRSP) presented earlier in sub section 2.9.3 Poverty and Environment. Also signs for basic human sustenance, which are computed according to percentage of undernourished in total population, percentage of population with access to improved drinking water source, are not positive for both Yemen and the peer group of countries. Last but not least, reducing environmental related natural disaster vulnerability, which is based on average number of deaths per million inhabitants from floods, tropical cyclones, and droughts and Environmental Hazard Exposure Index as well, are not expressing positive signs for Yemen and the peer group of countries. This confirms the information presented in subsection 1.10 Disaster Risk Reduction. Improvements in this sphere are expected to induce improvements in the human development index and make meeting the targets of MDGs possible.

Table 27 Reducing human vulnerability

	Environmental health	Basic human sustenance	Reducing environmental related natural disaster vulnerability
Yemen	-1.15	-0.88	-0.12
Average value for peer group	-0.96	-1.17	-0.05

Source: Esty, Daniel C., Marc Levy, Tanja Srebotnjak, and Alexander de Sherbinin (2005). 2005 Environmental Sustainability Index: Benchmarking National Environmental Stewardship. New Haven: Yale Centre for Environmental Law and Policy. http://www.yale.edu/esi/

A country is more likely to be environmentally sustainable if it cooperates with other countries to manage common environmental problems, and if it reduces negative transboundary environmental impacts on other countries to levels that cause no serious harm. The index consists of number of memberships in environmental intergovernmental organizations; contribution to international and bilateral funding of environmental projects and development aid; participation in international environmental agreements; carbon emissions per million US dollars GDP; carbon emissions per capita; SO2 exports; import of polluting goods and raw materials as percentage of total imports of goods and services

Table 28 Global stewardship

	International collaborative efforts	Greenhouse gas emissions	Reducing transboundary environmental pressures
Yemen	-0.70	0.09	0.04
Average value for peer group	-0.27	0.82	0.55

Source: Esty, Daniel C., Marc Levy, Tanja Srebotnjak, and Alexander de Sherbinin (2005). 2005 Environmental Sustainability Index: Benchmarking National Environmental Stewardship. New Haven: Yale Centre for Environmental Law and Policy. http://www.yale.edu/esi/

3. PART THREE: AGENDA FOR ACTION

3.1. Framework of Action

Having presented the issues and concerns, and the pressures and driving forces, the document in this section presents the recommended responses to which the stakeholders and interested parties had agreed through the consultative planning process that EPA administered. These proposed responses are rooted in:

1. The legislation that acknowledges concern to both national and global environmental issues and calls upon national contribution to global efforts undertaken towards such issues;
2. The environmental policy that aims to protecting natural resources from irrational, exploitative use on one hand, and from pollution and wastes on the other, by integrating environmental dimensions in the development plans;
3. Building and capitalizing on the successes of the 1996 National Environmental Action Plan, and continuing from where it ended, and completing unfinished businesses;
4. Poverty Reduction Strategy Paper, which aims to reinforce sustainable management of natural resources, mobilize beneficiaries, involve the poor and support the role of women and youth in environmental conservation through:
    i. Enhancing technical capacities of relevant institutions to develop comprehensive environment and development programmes based on community participation
    ii. Improving the legal framework, and empowering local organizations
    iii. Raising environmental awareness
    iv. Financial support to environmental projects by providing soft loans thus generating job opportunities
    v. Reinforcing institutions responsible for water resources management by enactment of laws and regulations relating to water rights and use, and developing and protecting water resources that will eventually lead to improvements of water uses efficiency
    vi. Expanding sanitation networks and waste treatment facilities to protect natural resources from wastes, and examining potentials for the possible reuse of treated waste water and inducing improvements to water harvesting techniques as well to close the gap between the supply of water and growing uses.
5. Vision 2025 that supports environmental and poverty reduction actions, where it noted that environmental degradation affects the poor and development. It embraced the following environmental interventions and measures:
    i. Developing and implementing sustainable management and monitoring programmes for water and land resources, agriculture, coastal zone, biodiversity and waste management.
    ii. Developing desertification control programme.
    iii. Providing energy substitutes.
    iv. Adopting environment-friendly technologies and enhancing renewable energy resources.
    v. Enhancement of environmental awareness activities aiming to induce behavioural changes.

6. Environment and Sustainable Development Investment Programme 2003 – 2008 that outlined a strategy and priority interventions aimed at controlling and gradually reversing environmental impacts. It also aims at supporting sustainable human development for the people of Yemen. Six main areas of interventions were identified in the plan. The total proposed investment budget is estimated to be US $ 30.2 million. The six main areas of interventions are:
    i. Habitat and biodiversity conservation
    ii. Sustainable land management
    iii. Sustainable water resources management
    iv. Sustainable waste management
    v. Sustainable climate change and energy management
    vi. Institutional development / capacity building

3.2. Managing Fresh Water Resources

3.2.1. Basis of Action

Water scarcity is a major problem and hindrance to the sustainable development of a predominantly rural, agrarian country, such as Yemen. The other problem is degraded water quality, which complicates the matter. The Government of Yemen elaborated National Water Sector Strategy and Investment Program (NWSSIP) using a multi-stakeholder process of preparing a consolidated strategy, action plan and investment program.

3.2.2. Objectives

The objectives of NWSSIP is, first, to explore means to increase water resources to meet growing demands and needs; second is to efficiently use available water resources; third, is to protect water resources from pollution and wastes; and to contribute to the equitable distribution of water among the various users both socially and spatially.

3.2.3. Targets

The targets of the NWSSIP are:

i. To ensure coordination among all partners working in urban and rural water supply and sanitation sub-sectors, within and outside the Ministry of Water and Environment,
ii. To ascertain that policies in these two sub-sectors are unified and that investments are equitably allocated among governorates according to unified rules and that no projects are duplicated, especially in rural areas, so as to ensure that investments complement each other,
iii. To ascertain integration of water policies and national policies of sustainable growth and poverty reduction,
iv. To ensure that sector financing effectively supports sector goals, and
v. To monitor and evaluate performance.

3.2.4. Water Quantity

NWSSIP identified the following water resources management objectives namely:

i. To ensure greater degree of sustainability;
ii. Giving priority to domestic needs of rural and urban populations;
iii. Improved water allocation, while mindful of equity, social norms, meeting the domestic needs and maximizing economic benefits;
iv. Elaborating a realistic and holistic water vision among the general population; and contributing to poverty alleviation by promoting efficient water use and equity in water allocation.

To implement these objectives, NWSSIP adopted a set of policies, bringing into attention that the depletion and pollution of aquifers beyond possibility of recovery, will amplify (among an increasing numbers of the population) the feeling of inequity in access to water. This may potentially lead to intensified social tensions. Hence, the Government has to provide suitable institutional interventions, particularly through forging of partnerships with local communities for co-management of water basins.

The proposed approaches to implement water resources management policies include consolidating the basin co-management partnership with local communities. For its part, the Government assumes the responsibilities of creating an enabling institutional framework, providing information, raising awareness and creating a water management vision; providing water related public infrastructure; protecting water rights, implementing the water law, and creating a conducive macroeconomic environment. The Strategy also adopted the implementation of integrated water management plans for water basins based on this co-management approach with local communities to assist them in solving their water management problems.

According to the NWSSIP and the discussions of the stakeholder groups, Yemen considers the following responses to ease the current tensioned shortage in supply of fresh water:

1. Information and Monitoring

It is evident from Sections One and Two, that Yemen needs proper system and mechanisms for information generation and dissemination. Yemen does not have a water balance, and hence there is a need for:

- ► Strengthening water resources information base through water resources assessment
- ► Starting well inventory for all basins that will eventually lead to a National water well census
- ► Monitoring the implementation of IWRM plans

2. Optimal use of available water resources

The optimum use of all available water resources can be achieved through an integrated future plan at both national and local levels. This plan should translate the overall policy targets into long-term programs. These include:

- ► Centre of excellence for resource economics
- ► Decentralize to the water basin committees (within basin plans)
- ► NWRA to make necessary coordination to improve water law enforcement, including local authorities
- ► Carry out a study on a structure for economic incentives for water use in various sectors
- ► Elaborate and execute a strategy for rational use of groundwater
- ► Stakeholder symposium to identify further actions
- ► Pilot projects, including a test of tradable water rights in Taiz.

3. Minimize water losses

The main proposed actions to minimize water losses include, but not limited to:

- ► Use of pipelines to transfer water, especially at the locations of high porosity soils.
- ► Replacement of the level-based water distribution system to the flow-based water distribution system through calibration of control structures.
- ► Introduction of new technologies for canal maintenance and weed resistance.

4. Irrigation improvement project

Irrigation improvements entail enhancements to the efficiency of water use at farm levels. It also initiates user participation in the operation and maintenance of the irrigation system. The framework of the irrigation improvement includes rehabilitation and renewal of water structures, use of pipeline, use of one point collective pumping, and land levelling using modern techniques. Other actions include redesign of the field irrigation systems. It is crucial in that regard to consider the formulation of water user associations that reflects the new vision for the water distribution management process.

5. Cost recovery

The Government is responsible for allocating the required financial budget to operate, maintain, and rehabilitate the irrigation and drainage systems. Increasing demands for water by all users will need continuous improvements and rehabilitation of the water system, which adds more burdens to the Government budget. Therefore, it is essential to set up a mechanism to enhance the farmers' participation in the operation and maintenance of the water system. Furthermore, the participation of the private sector is also crucial for system management.

6. Cropping pattern shifts

Economic analysis demonstrated there are substantial differences in the total economic returns of different crops cultivated in Yemen, as presented in Section One and Two. It also indicated that water productivity in some areas is low because of cultivating high water consumptive crops that have low value. There is to reconsider the use of limited water to produce animal fodder and vegetables. Instead, Yemen should start considering the production of high value cash crops that do not use excessive amounts of water. The production of Qat is another issue. To prohibit its production in Yemen and import it from neighbouring countries is an option that needs to be examined within the framework of trade balance and foreign currency reserves. All evidences indicate the need to trim down the amount of land cultivated with Qat. However, social and cultural aspects need to be weight against economic and financial decisions to reach an agreement that is both feasible and doable.

7. Groundwater development strategies

Yemen plans to protect groundwater and use this resource efficiently. Yemen plans to utilize some aquifers as a storage reservoir used to supplement surface water supply during peak periods and recharged during the minimum demand periods. Also using modern irrigation and water harvesting techniques is to regenerate groundwater resources.

8. Reuse of agricultural drainage water

Drainage water reuse is an option to meet part of the irrigation water demands. The reuse of drainage water increases the overall efficiency of the water system; but it must be regulated to prevent negative environmental impacts.

9. Development of other water resources

In addition to efficiently and equitably using available water resources, Yemen is investigating the possibilities of developing new water resources or increasing the availability of existing resources to meet future increasing demands. Desalination of brackish water, desalination of sea water and harvesting rainfall and flash floods water are among these options to close the gap between the available amounts of fresh water and the growing needs.

3.2.5. Water Quality

To achieve better water quality, protecting water resources from pollution is a must, and thus pollution abatement programmes are currently adopted. The preventive measures are carried out through the regular assessment of the water quality status and suitability for various uses. Moreover preventive measures include enforcement of laws to protect water resources from pollution through:

- Implementing a long-term strategy for preventing pollutants from discharging to water bodies. The implementation of this strategy requires a comprehensive database that includes maps, and also an electronic database, a design for landfill sites based on sound hydro-geologic information and impact assessment. This will require:
  - Strengthening water resources monitoring system
  - Establishing drinking water wells protection zones (2006-2008)
  - Build the capacity of HRD to manage for water quality control and monitoring networks (2006-2009)
- Raise environmental awareness through organized campaigns, media particularly TV and radio, organizing festivals, etc.
- Consider the use of economic incentives aside command and control regimes. Using economic instruments is a powerful tool for proper utilization of water resources. Some implemented and suggested economic instruments include:
  - Encouraging private sector participation in the environmental management through financial packages for industrial compliance.
  - Adopting the polluter pay principle.
  - Introducing incentives and tax exemption for promoting the adoption of clean technologies.
  - Removing subsidies for agrochemicals.
  - Encouraging recycling efforts through the deposit recycling schemes, tax incentives for recycled material, grants and loans for recycling industries and reduction of custom tariffs on recycled raw material.
  - Reducing fresh water pollution resulting from industrial effluents through effluent charges, soft loans, and grants to finance the purchase of wastewater treatment equipment and tradable emission permits.
- Balance development and protection to reduce or eliminate negative human activity impact on water (2007-2010).

3.2.6. Drinking Water and Sanitation for Urban Areas

NWSSIP adopted the same objectives as those of the WSS Sector Reform Program set out in Cabinet resolution (237/ 1999), namely: to increase coverage by WSS services (the goal here is to meet the MDGs, which translates to providing services to more than 4 million inhabitants by 2015); financial sustainability of WSS utilities; separation of sector regulatory and executive functions; decentralization of WSS service provision; knowledge and skills development; and involvement of the private sector.

To achieve these objectives, NWSSIP adopted the policy of progressively decentralizing responsibility for service provision, by continuing the current WSS Sector Reform Program, transforming more of NWSA branches to autonomous local corporations (at the governorate level), consolidating the autonomy of existing local corporations, reformulating the role of NWSA to progressively undertake a regulatory, monitoring, supporting and policy making role, and promoting a wider private sector and community role in sector funding and management.

The proposed approach to implement these urban WSS objectives and policies includes: expanding coverage; continuing and deepening the reform program after evaluating it; developing regulatory, monitoring, support and policy functions; achieving financial sustainability of water utilities, giving due consideration to the low income segment of the population; promoting private investment and public private partnerships; continuing capacity building, and performance improvement; enhancing community participation; securing additional water sources for cities; and formulating a policy for sea water or brackish groundwater desalination. Specifically the Governmetn o fYemen intends to:

- **Expand coverage:** To achieve the MDGs in urban water, an annual investment rate of $150 million is required. Furthermore, additional quantities of groundwater will be needed each year such that an additional 100 million m3 per year will be needed by 2015.[93] As much as possible coverage will be expanded to poorer sections of the society. At the same time additional financing has to be absorbed. Measures such as staff and contractor training will be introduced to increase absorptive capacity of investment financing,[94] and criteria will be set to ascertain that priority will be accorded to pro-poor investments.
- **Continue and expand the institutional reform program:** The reform program, which was launched in the beginning of 2000 with the restructuring of NWSA's Sana'a Branch, is generally recognized as successful. Its essence is the decentralization and restructuring of NWSA's branches and transforming them into autonomous local WSS corporations at governorate level.[95]
- **Develop regulation, monitoring, support and policy-formulation functions:** Critical to the reform program is the establishment of a regulatory entity to ensure compatibility between water and service quality on the one side and tariffs on the other. This is essential to protect the public and to attract the private sector. A study will be carried out in 2005 to define these regulatory functions and the entity, which will undertake them. A performance benchmarking and monitoring system will also be set up.
- **Financial sustainability and poverty orientation:** Full recovery of service cost remains the over-riding objective of the tariff policy. At present, cost recovery practice varies according to local situation. The accepted norm is for the tariff to be set such that at least the cost of operation, maintenance and depreciation of electro-mechanical equipment are recovered. The government pays for new schemes, replacements and expansions, with these costs added to the assets. The tariff is expected to move to full cost recovery over time.
- **Promoting private investment and public private partnerships:** Current policy is to encourage gradual phase-in of public-private-partnerships, through management contracts and "utility support programs", and by developing outsourcing. In addition, the MWE will review the possibility of improving the enabling environment for the local private sector to consolidate and expand their urban water supply and sanitation investments, which are currently constrained by an uncertain investment environment.
- **Building capacity and improving performance:** Performance indicators in the decentralized utilities are improving, but are still well short of international norms. Capacity building programs are underway to improve performance. Topics include loss reduction, improved operation and maintenance, improved financial

[93] In 2003, the total pumped groundwater for urban water use was about 75 million m^3.

[94] Lengthy disbursement routines and double review and approval of disbursement requests at both the MoF and the MoPIC, in addition to poor working conditions of technical and administrative staff in the sector, constitute serious obstacles to increase absorption capacity of investments.

[95] There are seven local WSS corporations (Sana'a, Aden, Ta'iz, Hodiedah, Ibb, Mukalla, and Seiyun). Each LC undertakes the responsibility for WSS services in its governorate.

management, senior management programs, project management and project implementation.

- **Enhancing community participation:** Community participation in the choice of technology and in selecting the level of service it can afford, is a possible means to reduce costs and, hence, to expand coverage to a larger population. This approach is being adopted systematically in the rural water sector. However, other community participation measures, which apply to both urban and rural communities, include public awareness campaigns on such issues as water conservation and the basis and importance of tariff setting in sustaining the utility/service.
- **Sourcing the required quantities of water:** To achieve the MDGs will require additional quantities of water, which will increase annually to reach 100 MCM by 2015. Recent water supply projects (e.g. Taiz project) have faced extraordinary problems in sourcing water. Furthermore, as virtually all known water sources are harnessed and the scope for water supply augmentation by reducing distribution system losses is modest, securing these additional quantities of water will have to be through transfer from agricultural use in the rural areas to the towns.

  On the other hand, large quantities of water could be saved by irrigation efficiency improvements. However, institutional mechanisms for water rights trading that facilitate inter-sectoral transfers are missing. Pilot programs in water transfer and water markets are proposed (see Chapter 4 of NWSSIP). These programs will succeed if properly designed, as higher urban prices of water already encourage well owners in rural areas around many towns to supply water to the city instead of using it for irrigation.

  An innovation being piloted currently in the Sana'a basin is swapping deep groundwater with surface water or shallow groundwater from additional dams. In addition, innovations are proposed to pilot the desalination of brackish water (Taiz) and swapping treated sewage effluent for fresh water. These market based systems, which implicitly recognize farmers' water rights and reward them at scarcity prices, should be complemented with regulatory programs to stop further drilling in critical basins and to control abstractions.

3.2.7. Drinking Water and Sanitation for Rural Areas

NWSSIP adopted an overall objective for rural WSS sector, namely: the rapid expansion in WSS services in rural areas--a realistic and more modest objective of achieving 50 per cent of what the MDG has set. This means providing services to more than five million inhabitants by 2015. Given the physical and economic conditions, ensuring the sustainability of implemented schemes is major concern.

The main policy issues of this sector include adoption of decentralized implementation mechanisms, enhancement of beneficiary community role, adopting a demand responsive approach (DRA) to identify targeted communities and making this approach the standard practice, and targeting and cost effectiveness, by identifying means to implement projects that meet the needs at lower cost.

The approach proposed to achieve the general objective of this sector, includes: setting up sector strategy and coordination of its activities; improving project/ scheme implementation; broadening the range of partners; broadening technology choices and adapting appropriate ones; integrating sanitation and hygiene in rural water schemes; ensuring and protecting water resources and their quality; improving targeting and sustainability by adopting bottom-up approaches throughout and mainstreaming gender issues; promoting sustainability through broadening the range

of partners so as to include, for instance, more NGOs and community institutions; and directing available finance to the greatest need (targeting).

- **Increasing coverage and implementation capacity** through setting up sector strategy and coordination by expanding rural water supply and sanitation coverage is a national priority. Forceful new departures are underway with decentralized approaches, participation and demand responsive approach (DRA), low cost appropriate technology, and the involvement of efficient and flexible field partners like SFD, PWP and NGOs.
- **Building capacities on project implementation** because the capacity[96] of institutions to utilize available investment financing is a major issue for the rural water supply sector. Current modality for project implementation is expected to produce "success stories" that can serve as a model to solve this problem of absorptive capacity. In addition to the current innovations produced by the approaches described above, other measures will be introduced, such as:
  - Measures to develop and adopt a common methodology or approach for project implementation, through pooling of experiences of different agencies,
  - Measures to intensify training and social and environmental awareness raising,
  - Building capacities at branches, especially "soft skills" (non-technical skills) for DRA, and
  - Making greater use of (and reliance on) local knowledge and skills, including community contracting.
- **Broadening the range of partners** Absorptive capacity for investment financing can be increased by decentralization of GARWSP and through partnerships with non-governmental entities (NGOs, CBOs, private sector) for project implementation using participatory implementation methods, and by enhanced implementation through greater coordination and integration with SFD and PWP.
- **Improving technology choices through:**
  - Broadening and adapting technology choices to increase coverage and promote sustainability, research and experience will be used to develop technical advice material, and field programs will offer a broad range of technological options, explaining to communities the capital and operation and maintenance cost and sustainability implications of each. This approach will give priority to simple low cost solutions.
  - Factoring in sanitation and hygiene where sanitation will be obligatory on the beneficiaries and hygiene education that targets women will be an integral part of each project/scheme.
- **Ensuring water resources and their quality:** In the coming years, central and local authorities will play a role, within the basin plans, in ensuring the quantity of water required, and in ensuring source protection from depletion and quality from pollution.
- **Improving targeting of the communities and sustainability of the schemes through:**

[96] the ability to implement projects or schemes expeditiously so as to make full use of available financing

- Adopting bottom up approaches throughout and ensures that gender is mainstreamed by adopting the demand responsive approach and work through community-based organizations be adopted as standard practice for identifying projects to implement. In addition, although women are recognized as key managers of household water and the guardians of family health and education, they are not yet systematically involved in decision-making or project management. Thus, gender inclusiveness is to be mainstreamed.
- Promoting sustainability through strengthening the role of community-based institutions where early participation of beneficiaries is a major thrust of the DRA, thus choosing the right technology for community needs and affordability in terms of capital as well as operation and maintenance, It also helps in identification of training and capacity building needs of the community. Early involvement of the beneficiaries also ensures that the chosen committee to operate and maintain the scheme is capable of running a self-sustaining financially independent scheme. Future rural water programs will allocate more investment for the needed "social mobilization" and for community capacity building.
- Target finance to the greatest need as part of the upcoming rural reform strategy, eligibility criteria that favour poorer communities, a transparent bottom up application process and a decentralized approval system will be established.

3.3. Protecting Coastal Zones and Marine Environment

3.3.1. Basis of action

Current management of fisheries resources are weak and not conducive to the sustainable development of this important sector of the economy. Expected impacts: if the Business As Usual scenario, such as no actions with respect to rock lobsters, prevails include, but not limited to, low quality of fish and fishery products; over fishing of key commercial species, such as sharks; increase of numbers of fishing boats and fishers in the artisanal fisheries.

There is a need for an Integrated Coastal Zones Management programmes to avoid and minimize overgrazing of mangroves, ballast water, sea-based pollution oil, destruction of coral reefs and coral reefs bleaching

3.3.2. Objectives and targets

Goal 1: Fisheries Management Programmes elaborated and executed

- Socotra Fisheries Management Programmes (FMP) updated and implemented by 2007
- Management measures for rock lobsters in Mukalla and Coastal Hadhramut implemented by 2007/2008
- Registration of artisanal fishing boats according to FMP requirements (boat, crew, gear, target species) fully made in Shabwa, Hadhramut, Socotra and Mahra in 2007

- An extension and awareness program involving the Yemeni Fishers Cooperative Union (YFCU) on fisheries management starting Sept. 2006 developed by June 2007
- A program launched to replace 75 per cent of gill nets used in sharks fishing and rock lobsters fishing by longlines and traps, respectively, by 2007/2008 season
- Illustrated guidelines on improving fish and fishery products quality is prepared by end of 2006.

Goal 2: Plans for Integrated Coastal Zones Management (ICZM) elaborated

- Zoning of coastal areas for different users according to ICZM plans completed by 2012. Based on master plans and ICAM plans for land use completed around mid 2010 including upgrading and informal settlements along coastal areas and port cities by 2007
- Establish ICZM plans and programmes at Governorate level by 2008
- Marine turtles protected and managed by 2010. Main turtle nesting beaches are protected by end of 2008 where
  - A management unit of Sherma-Jethmun green turtle nesting ground is established by mid 2006
  - Fingerlings of green turtles are collected from nesting grounds to Khor Umeira protected feeding lagoon is started in mid 2008
- Natural and artificial reefs flourishing by 2015
  - Coral reefs monitoring plan implemented in the Red Sea Yemeni waters by beginning of 2008
  - Monitoring coral reefs plans are completed by end of 2007
  - Placing artificial reefs completed by the end of 2006 and construction of reefs in areas in the Gulf of Aden is made in 2007-2008
- An assessment of mangroves loss in different areas and causes by the end of 2007.
- Potential sites for bird sanctuaries identified by mid 2007
- Reclamation of sea areas regulated by mid 2008
  - Green coverage through use of treated wastewater increased by 40 pre cent by 2012
  - Prohibiting dumping solid and liquid wastes
  - Prohibition of dumping solid waste along coastal areas or into the sea is effective by mid 2007. No landfills allowed on the beaches by end of 2006. Studies for recycling solid waste in major cities and secondary towns are completed in 10 governorates by end of 2007.
  - Dumping of untreated wastewater into the sea is forbidden by mid 2008
  - Establishing receptor points for ships ' wastes are completed by mid 2007
  - Oil spills and pollution combating units established in the main port cities are established by the end of 2006
  - Expanding wastewater treatment plants and reuse are completed by mid 2007 in 10 governorates
  - Wastewater treatment plants up to tertiary levels are built in 2008-2010 and reuse of treated water is spread in 10 governorates by 2010
  - Standards for landfill sites are set in 2007 and implementation of recycling solid waste starts in 2008 in 10 governorates
  - Oil spills and sea-based pollution controlled by 2010 and Yemeni waters recognized as a closed area for dumping ship waste and penalties implemented for non compliance where oil pollution combating units are well equipped and staff trained by end of 2008Receptor stations are established in all port cities by 2009

- Ecotourism and diving tourism well regulated and contributes 20 per cent to the foreign exchange earnings apart from the oil sector

3.3.3. Activities

1. Monitoring and Information

- Information is collected in 2007 on traditional management used, and traditional knowledge of breeding and fishing grounds Team of 1 consultant and 2 national scientists to update Socotra FMP End Sept 2006
- A team of one international consultant (FAO) and local consultant/s is hired to prepare Hadhramut FMP and submit it in July/August 2006
- Prepare designs for modern hygienic auction sheds in 2006/2007
- Prepare designs for a well-studied prototype near shore multipurpose fishing boat in 2007 capable of landing at Yemeni landing sites and with hold capacity adequate to use ice at sea and preserve gutted fresh fish in ice
- Disseminate details of the prototype (blueprints) to the local boat building yards
- Ministry of Interior(Coast Guards)to register plate numbers and types of the fishing boat
- Details of the boat, engine, fishing gear, fish landing site, number of crew and target species is to be registered by the committee formed of MFW, fishers' cooperative in the area, and local council representatives'. MFW keeps original records
- Collect data in the governorates mentioned to formulate FMPs based on Socotra experience
- Exchange of information and networking established between fisheries councils, MFW and its branches, the YFCU, fishers' cooperatives and fisheries businesses by 2012
- Fisheries statistics well established by 2011 for different users

Necessary information measures for insitutionalizing ICZM include:

- Develop a coral reefs monitoring plan for all coastal areas by local specialists and with support from regional and global organizations concerned by end of 2006
- Launch a tagging program for green turtles by local specialists and with support from regional/ global organizations concerned
- Identify illegal settlements and make an inventory; and propose alternatives for resettling previous residents after demolishing these settlements
- Develop a plan for the management of green turtles and transfer of hatched turtles in Sharma-Jethmun beach to Khor Umeira feeding grounds for growth by mid 2008
- Identify illegal settlements and make an inventory; and propose alternatives for resettling previous residents after demolishing these settlements
- Launch a tagging program for green turtles by local specialists and with support from regional/ global organizations concerned

2. Corrective and/or Preventive Measures

a. Strengthen management of fisheries

- Continue registration of artisanal fishing boats in Abyan ,Aden, Taiz, Hodeidah and Hajjah till end of 2008
- Ban use of gill nets to catch rock lobsters by end of 2007 and sharks fishing by end of 2009

- Launch applied research programs to assess stocks of main commercial species in the Yemeni EEZ waters. 2006-2008
- Make use of results of surveys , stock assessment studies and socioeconomic studies in the FMP in allocating catches to different users and stakeholders
- Develop FMP in other governorates especially in Shabwa Hodeidah, Mahra and Aden by mid 2008
- Train local fisheries scientists on fish population dynamics and stock assessment 2007-2009
- Develop improved prototype fishing boats for artisanal fishers to use ice at sea and improve quality of their products 2007-2010
- Develop auction sheds and transfer to at least 75% of fishers' cooperatives by end of 2007
- Progress of FMP assessed in 2008
- New FMP elaborated in each governorate based on results achieved and lessons learnt by 2009
- Universities are in fisheries research, stock assessments, improved quality and marketing studies during 2007-2010
- MCS system developed to eliminate illegal fishing and poaching and assist in proper formulation of FMP
- An electronic network among fisheries offices in the governorates and MFW in Sana'a developed Networking among YFCU branches and HQ in Sana'a developed by 2010
- Design and implement
- Developed landing sites to accommodate new entrees of improved fishing boats of the artisanal fishers are designed and constructed
- Recovery of main commercial species witnessed in terms of catches, sizes and sustainability by 2015. Quality of fish and fishery products are of high international standards
- Increased contribution of the fisheries sector to the economy reflected in increased earnings from exports. Per capita consumption per annum of fish and fishery products increased to 20 kg by 2015
- Registration of artisanal fishing boats according to FMP requirements (boat, crew, gear, target species) fully made in Shabwa, Hadhramut, Socotra and Mahra in mid 2006 –end 2007
- An extension and awareness program involving the YFCU on fisheries management starting in Sept. 2006 developed by June 2006
- A program is launched to replace 75% of gill nets used in sharks fishing and rock lobsters fishing by longlines and traps respectively by 2007/2008 season
- Catch and effort data on main commercial species targeted in FMP collected starting in Sept.2006
- An FMP Council at the governorate level in Hadhramut and involve fishers' Cooperatives in fisheries management of main commercial species is established by the end of 2006
- Illustrated guidelines on improving fish and fishery products quality is prepared by end of 2006.
- Empower coastal women to be involved in different fisheries activities and work opportunities through programs established in 2006
- Establish fisheries extension services at MFW and branches in 2007. Introduce at pilot scale improved non destructive fishing gear in mid 2007
- Information is collected on traditional management used, and traditional knowledge of breeding and fishing grounds in 2007
- Full registration of artisanal boats, gear, engine, fishers and target species is made in March- May and Sept- Dec 2006 in Socotra
- Local FMP Council established in Dec.2006. FMP implemented in Jan. 2007

- Selection of a team of local expertise and members of staff of YFCU to prepare training awareness program is made in March 2006. Program is ready by July 2006
- Study ways for shifting cooperatives to fisheries business oriented cooperatives in selected areas
- A team of local fisheries experts and YFCU staff is selected to launch in April and Sept. 2006 an awareness campaign to replace destructive fishing gear. Funds are made available for pilot gear replacement and implementation in October 2006
- A team of one international consultant (FAO) and local consultant/s is hired to prepare Hadhramut FMP and submit it in July/August 2006
- A team of national consultants and experts is selected to prepare a study on training needs in stock assessment, fisheries management concepts and practices and submit it in June 2006
- A team of one international consultant and local consultant/s is hired to prepare an assessment of training needs in MCS and submit it in Sept. 2006. Local specialists on fish quality control, fish processing, handling and transportation are assigned to prepare detailed illustrated guidelines easily comprehended by local fishers and submit them in Nov//Dec 2006
- In 2006 local committees are formed in each governorate. Forms of registration of Socotra FMP must be used. Ministry of Interior (Coast Guards) to register plate numbers and types of the fishing boat. Details of the boat, engine, fishing gear, fish landing site, number of crew and target species is to be registered by the committee formed of MFW, fishers' cooperative in the area, and local council representative. MFW keeps original records. Introduce improved fishing and processing technologies for value added products
- Launch applied research programs to assess stocks of main commercial species in the Yemeni EEZ waters. 2007-2008/2009
- Enact ministerial resolutions to ban destructive gear in 2007 for rock lobster fishing and in 2009 for sharks fishing by gill nets
- Members of fishers' cooperatives are trained to collect data at landing sites and auction sites which is suitable for use in stock assessment. Investment is needed in chartering (or purchase of) a research vessel for fishery surveys and stock assessment studies for200 7-2009. Establish fully equipped fisheries/marine environment research centers in Mukalla and Al Ghaidha in 2007/2008
- Collect data in the governorates mentioned to formulate FMPs based on Socotra experience. Establish fisheries councils to decide on FMPs and involve all stakeholders by the end of 2007. Invest in the establishment of 7 fish quality control laboratories in the main fisheries centers Hodeidah, Mokha, Aden, Shuqra, Bir Ali, Mukalla, Al Ghaidha and 1 in Socotra. Train qualified fishers on fish quality control using laboratory techniques Research and stock assessment studies continues in 2008
- Prepare designs for modern hygienic auction sheds in 2006/2007. Construct the sheds and transfer ownership to fishers' cooperatives at cost during 2007-2009
- Prepare designs for a well-studied prototype near shore multipurpose fishing boat in 2007 capable of landing at Yemeni landing sites and with hold capacity adequate to use ice at sea and preserve gutted fresh fish in ice. After successful trials, construct more boats and disseminate details of the prototype (blueprints) to the local boat building yards. Expand investment of ice making plants along the coastline with full EIA studies and full consideration to availability of fresh water and/or brackish or saline water.

- Based on catch and effort data and FMP allocations limit new entrants to the relevant critical fishery beginning from 2008. Train locals (from MFW, Coast Guards, EPA and other concerned agencies) in MCS procedures, Law of the Sea, maritime law, fisheries laws and regulations and MCS equipment use and maintenance
- Invest in establishing an MCS system for all Yemeni waters
- Progress of FMP assessed in 2008 then 2012 and 2015 in terms of applicability, involvement of stakeholders and empowerment of coastal women in joining in decision making
- Stock assessment studies continued. Fisheries statistics well established by 2011 for different users. Exchange of information and networking established between fisheries councils, MFW and its branches, the YFCU, fishers' cooperatives and fisheries businesses by 2012
- FMPs made for all species landed are made by 2015
- All fish mollusks and crustaceans landed are in ice by 2012
- Standards for good quality fish and fishery resources are in place and implemented by 2015
- Training is continued for decision makers, scientists and fishers after 2015
- More advanced fisheries research is undertaken for various uses of fish and fishery products by 2014
- MCS well enforced minimizing illegal fishing in the EEZ by 2015
- Landing sites equipped with all necessary facilities for fishing boats, reefers, and shore facilities for integrated activities in the fisheries sector by 2015
- Improved cost effective and environmentally friendly technologies are introduced and increasingly used from 2013

3. Supportive Measures

a. Legislative

- Socotra FMP declared by resolution of local fisheries council. Fisheries councils are established through resolution of local governorates' councils
- Enact ministerial resolutions to ban destructive gear in 2007 for rock lobster fishing and in 2009 for sharks fishing by gill nets
- Based on catch and effort data and FMP allocations limit new entrants to the relevant critical fishery beginning from 2008 MCS well enforced minimizing illegal fishing in the EEZ by 2015
- Control number of artisanal and industrial boats entering the fishery according to FMP starting from 2007/2008 fishing season
- Control quality of fish targeted for domestic and foreign markets starting from 2007/2008 season in at least 15 main landing and marketing sites
- Legislation for compulsory use of ice at sea enacted and implemented by 2010
- Enact legislation on quality of fish and fishery products for domestic and foreign markets by 2012

Yemen also plans to:

- Establish by local technical and legal specialists technical details fore regulations for reclamation of sea by end of 2007 and for prevention of dumping untreated wastewater by mid 2007
- Oil spills combating units in all ports are established, and mandated
- Local technical and environmental laws specialists are formed in 2007 to propose regulations for ecotourism and diving tourism.
- Law enacted in 2009

b. Capacity Buildings

- Train local decision makers, fisheries scientists, technicians and fishers on fisheries management during 2007-2008
- Train fishers on fish quality and traceability requirements during 2006-2009
- Train local fisheries scientists on coastal/marine habitats, ecosystems and biota 2007-2008
- Train fishers' cooperatives staff on methods to develop cooperatives into business oriented cooperatives by end of 2008
- Train locals on MCS 2007-2010
- Training needs in stock assessment, fisheries management concepts and implementation is finalized by June 2006
- Training needs in MCS assessed by Sept.2006
- Training on fish handling , storage and transportation for domestic and international markets by end of March 2007 is made for at least 75% of fishers and other workers involved in such activities
- Selection of a team of local expertise and members of staff of YFCU to prepare training awareness program is made in March 2006
- Program is ready by July 2006
- Training on fish handling , storage and transportation for domestic and international markets by end of March 2007 is made for at least 75 per cent of fishers and other workers involved in such activities
- Training needs in stock assessment, fisheries management concepts and implementation is finalized by June 2006
- Training needs of MCS assessed by Sept.2006
- Train locals (from MFW, Coast Guards, EPA and other concerned agencies) in MCS procedures, Law of the Sea, maritime law, fisheries laws and regulations and MCS equipment use and maintenance
- Train qualified fishers on fish quality control using laboratory techniques
- Members of fishers' cooperatives are trained to collect data at landing sites and auction sites which is suitable for use in stock assessment
- Training is continued for decision makers, scientists and fishers after 2015

To achieve the second goal, Yemen intends to:

- Technical local teams prepare standards for landfill sites in early 2007 and implementation of recycling solid waste starts and reuse in 2008 in 10 governorates
- Training of local staff for oil pollution combating units is started in 2007. Oil spills combating equipment and boats specifications and tender documents are completed in 2008
- Receptor points are well equipped and staff trained by end of 2008 and receptor stations are established in all port cities by 2009
- Local municipalities establish specialized well trained and fully equipped units for increasing green coverage through use of treated wastewater
- Oil spills combating units are trained to operate ships and equipment and well equipped by 2009
- Judges are made familiar with cases pertaining to non compliance of regulations, oil spills and sea-based pollutants

c. Institutional

Institutional supportive measures to achieve the first goal are:

- Full registration of artisanal boats, gear, engine, fishers and target species is made in March- May and Sept- Dec 2006 in Socotra
- Local FMP Council established in Dec.2006. FMP implemented in Jan. 2007
- Establish fisheries extension services at MFW and branches in 2007

- Establish fisheries councils to decide on FMPs and involve all stakeholders by the end of 2007
- FMPs made for all species landed are made by 2015

Institutional supportive measures to achieve the second goal include:

- Develop a plan for the management of green turtles and transfer of hatched turtles in Sharma-Jethmun beach to Khor Umeira feeding grounds for growth by mid 2008
- TOR , tender documents and contracts are made for wastewater treatment plants up to tertiary levels are made in 2007 and the plants are constructed in 2008-2010 and reuse of treated water is spread in 10 governorates by 2010
- A management entity involving trained representatives of local communities is established, well equipped and legally mandated to protect marine turtles by 2010
- Monitoring units for coral reefs are established; trained , mandated and well equipped throughout the coastal areas in 2009

d. Science and Technology

- Prepare fisheries research programs in 2006 for the period 2007-2009
- Introduce at pilot scale improved non destructive fishing gear in mid 2007
- Launch applied research programs to assess stocks of main commercial species in the Yemeni EEZ waters. 2007-2008/2009
- Research stocks studies continues in 2008 for assessing their conditions for FMP decisions
- Introduce improved fishing and processing technologies for value added products
- Stock assessment studies continued
- More advanced fisheries research is undertaken for various uses of fish and fishery products by 2014
- Improved cost effective and environmentally friendly technologies are introduced and increasingly used from 2013

Research activities that support corrective and preventive measures for to attain the second goal include:

- Update previous studies for solid waste management made in 1997 for 48 secondary towns and make studies for recycling and reuse by end of 2006
- Prepare TOR and implement studies for placing artificial reefs to be completed by the end of 2006 and construction of reefs in areas in the Gulf of Aden is made in 2007-2008 and 2009
- Fingerlings of green turtles are collected from nesting grounds to Khor Umeira protected feeding lagoon is started in mid 2008
- Develop a coral reefs monitoring plan for all coastal areas by local specialists and with support from regional and global organizations concerned by end of 2006
- Designs of suitable ships and equipment for combating oil spills are prepared by 2008
- Special ships for combating oil sp[ills are procured

e. Economic and Financial

- Funds are made available for pilot gear replacement and implementation in October 2006
- Study ways for shifting cooperatives to fisheries business oriented cooperatives in selected areas
- Empower coastal women to be involved in different fisheries activities and work opportunities through programs established in 2006 Investment is

needed in chartering) or purchase of) a research vessel for fishery surveys and stock assessment studies for 2007-2009

- Establish fully equipped fisheries/marine environment research centres in Mukalla and Al Ghaidha in 2007/2008
- Invest in the establishment of 7 fish quality control laboratories in the main fisheries centres Hodeidah, Mokha, Aden, Shuqra, Bir Ali, Mukalla, Al Ghaidha and 1 in Socotra.
- Expand investment of ice making plants along the coastline with full EIA studies and full consideration to availability of fresh water and/or brackish or saline water... Invest in establishing an MCS system for all Yemeni waters
- Construct the sheds and transfer ownership to fishers' cooperatives at cost during 2007-2009
- After successful trials, construct more boats for local fishers and fisheries
- Community participation
- In 2006 local committees are formed in each governorate. Forms of registration of Socotra FMP must be used
- Landing sites equipped with all necessary facilities for fishing boats, reefers, and shore facilities for integrated activities in the fisheries sector by 2015
- All fish mollusks and crustaceans landed are in ice by 2012

Economic tools and financial incentives to support achieving the second goal are:

- Fence the breeding grounds in Sharma Jethmun and feeding grounds of green turtles in Khor Umeira lagoon by end of 2006
- Prepare TOR for the receptor points facilities study by mid 2006 and form technical teams to undertake the study and finish it by mid 2007
- Prepare TOR for the study of expanding wastewater treatment plants by mid 2006 and form technical teams to undertake the study and finish it by mid 2007
- Provide facilities for ICAM offices, Start making master plans and land use plans
- Implement the coral reefs plan in first quarter of 2007
- Coral reefs monitoring plan implemented in the Red Sea Yemeni waters by beginning of 2008
- Prepare TOR for the study of expanding wastewater treatment plants by mid 2006 and form technical teams to undertake the study and finish it by mid 2007
- Prepare TOR for the receptor points facilities study by mid 2006 and form technical teams to undertake the study and finish it by mid 2007
- Local teams of specialists complete zoning of coastal areas for different users according to ICAM plans by 2012
- Well trained and fully equipped units for increasing green coverage through use of treated wastewater;
- Environmental economists are trained in costing oil spills and other pollutions impacts in2009

f. Community Participation

- Local fisheries experts and YFCU staff is selected to launch in April and Sept. 2006 an awareness campaign to replace destructive fishing gear;
- Local specialists on fish quality control, fish processing, handling and transportation are assigned to prepare detailed illustrated guidelines easily comprehended by local fishers and submit them in Nov//Dec 2006;
- Standards for good quality fish and fishery resources are in place and implemented by 2015;

- Progress of FMP assessed in 2008, 2012 and 2015 in terms of applicability, involvement of stakeholders and empowerment of coastal women in joining in decision making;
- Communities involved in deciding on zoning plans

3.4. Improving Air Quality

3.4.1. Basis of Action

According to international sources, air quality in Yemen is not a major problem. However, with an economy expanding and population growing, the situation is expected to be complicated. There is no clear account of the status of air quality or atmospheric pollutants in general.

The major identified source of atmospheric pollution is vehicles. However, the contribution of other sources of atmospheric pollution is not well measured. An assessment of the contribution of other anthropogenic activities on the atmosphere is not well documented.

3.4.2. Objectives and Targets

Goal 1: An inventory of "pollution sources" for human settlements established

Existing data is not comprehensive. Additional efforts are needed to improve data coverage and comparability. The additional data will help in forming a comprehensive strategy to control air pollution in Yemen that would, in turn, protect the existing and newly developed urban and rural areas.

Goal 2: A strategy for air pollution abatement formulated and enacted

There is a need to emission reduction, control equipment, upgrading of industrial processes, using energy efficiently, fuel change and procedures for choosing alternatives

3.4.3. Actions

ii. Ambient Air Quality

1. Information, Monitoring and Assessment

Establishing and operating a nationwide network for monitoring air quality is a must to collect information pertaining proper decision-making.

2. Preventive and Corrective Actions

Among the recommended corrective measures is the formulation of a Strategy for Controlling Pollution and Episode. The main objectives of these activities are to formulate a comprehensive air pollution control and air quality improvement projects through strengthening the capabilities of Governorates and EPA in the field of air quality management.

Other suggested activities to be implemented at the national level include:

- Impose self-monitoring programs for air quality around large sources of pollution by applying the law, such as having an environmental registry, for example.
- Establish technical agencies at regional and central levels.

- Use available funds, such as the Global Environment Facility (GEF), to encourage the use of control technologies.
- Implement public awareness and education modules.
- Follow up the improvement in air quality and form action plans for air pollution control.

3. Supportive Measures

Strengthening the capacity of experts in air pollution, control advisors, industrial experts, planners, engineers, chemists, programmers and technicians would help in completing the execution of this program.

iii. Managing Auto Exhausts in Urban and Rural Areas

1. Information, Monitoring and Assessment

Available information on emissions from vehicles indicates the need for this program. These emissions are among the major threats for the air quality in Yemen. There is a need for detailed, updated, reliable, verified information on the types of vehicles, trips, congestion on roads and routes. The data have to reflect type of fuels used and emitted pollutants.

2. Preventive and Corrective Actions

Since Yemen is blessed with reserves of natural gas, then there should be efforts to encourage the use of Compressed Natural Gas (CNG).

3. Supportive Measures

There is also a need to encourage research and surveys that reflect the intensity of this problem and means to solve it. The solution has to be doable, feasible and both socially and politically acceptable.

iv. Protection of Air Quality in Rural Areas

1. Information, Monitoring and Assessment

Rural areas are exposed to air pollution resulting from motor vehicles and industrial activities. Rural inhabitants are also exposed to air pollutants due to agricultural activities and processing agricultural products. Increasing research, studies and data collection regarding these types of pollutants and the intensity of the problem is crucial for undertaking the program activities.

2. Preventive and Corrective Actions

The major objective of this program is formulating air quality management programmes in rural areas. This programme will design a control program and implement control methods to reduce air pollutants resulting from agricultural production processes, and developing a strategy for air managing pollution episodes in rural areas. Other activities proposed to be executed at the national level include:

- Set and apply a management program to reduce exposure to pesticides and herbicides.
- Set a program for solid waste recycling and minimize open incineration of agricultural waste.
- Set episode control planning for processing agricultural products

3. Supportive Measures

- The Government, at both local and central levels, along with local NGOs will support the processes of recycling, reusing and recovering agricultural wastes, and promote the processes of waste recycling to produce biogas products.
- The Government will continue supporting efforts of the rural communities in using biological means for pest control.
- Impose taxes, based on polluter pays principle, on the use of pesticides, herbicides and chemical fertilizers.

v. Reducing Pollution from workshops within human settlements

1. Information, Monitoring and Assessment

Workshops within human settlements are among the major sources of air pollution. Human settlements suffer from the air pollutants emitted from small factories and workshops that lack precautions for air pollution control. Therefore, residents of these settlements suffer from serious damaging effects on health. Accurate and reliable measures of these emissions are required to effectively control the negative impact of industrial activities. This data can be used to encourage these establishments to abandon old technologies and encourage investors to relocate their establishments away from human settlements. Environmental Impact Assessment (EIAs) should be conducted on the sites proposed for relocating these establishments. These zones could be supplied with the necessary infrastructure once old land is put on the market. The proceedings of these sales can be used towards cost-recovery.

2. Preventive and Corrective Actions

Activities for executing this program include:

- Use efficient control technologies and cleaner fuel to reduce the rates of emitted pollutants from small and medium establishments.
- Develop criteria for locating, planning, erecting and managing industrial zones.
- Prepare these zones and supply them with all needed infrastructure.
- Remove all scattered industries within urban areas and relocate them in the defined industrial zones after upgrading and adopting pollution control measures.
- Complete the initiated activity of upgrading and relocating the lead smelters, foundries and similar activities outside residential areas.
- Rehabilitate the evacuated location to provide the community with needed social and physical infrastructures, such as develop parks to protect the environment and enhance the quality of life.

Line ministries and local administration concerned with the issue of air pollution will act to relocate all scattered medium-and small-size industrial activities, such as foundries, secondary smelters, pottery workshops, brick industry, lime crushers, charcoal production, etc; and in defined industrial zones after upgrading and imposing pollution control measures.

3. Supportive Measures

- Introducing public awareness campaigns through issuing booklets, seminars, and conferences. This would help the execution of the whole program. The NGOs activities would play a positive role in these campaigns.
- Building the capacities of urban planners at local levels. This will be achieved through the cooperation of EPA, local administrations and research institutes in supporting EIA studies, planning, innovation of control technologies, energy

conservation, adopting new and renewable energy sources and promoting the process of monitoring.

vi. Conserving Indoor Air Quality

1. Information, Monitoring and Assessment

Indoor air quality affects the major proportion of the population. Poor ventilation of indoor spaces also plays a major role in the accumulation of air pollution inside houses and public buildings. The misuse of pesticides and other sprays can cause indoor pollution problems as well as malfunctioning air conditioning systems. Outdoor pollutant concentrations were found indoors.

There is a need to undertake research on this issue. Better data and information would help in detecting causes of pollution and appropriate ways of dealing with their environmental and health consequences.

2. Preventive and Corrective Actions

Conserving Indoor Air Quality is a program that aims to formulate a comprehensive program to protect indoor air quality, develop planning and build criteria for protecting indoor air quality and public health, and strengthening public awareness regarding causes of indoor air pollution and ways of conserving indoor air quality.

The main activities of this program include improving air quality of closed residential spaces in houses in the inner city, expanding green areas in residential settlements, encouraging the use of renewable sources of energy, such as solar heaters and locating informally developed residential settlements in properly planned areas.

3.5. Maintaining Forests

3.5.1. Basis of Action

The annual depletion rate of forest areas during the period 1990-2000 was 1.04 per cent. An estimated 60 per cent of the population use wood as fuel. Agricultural activities, over-grazing and wooding are among the reasons for this process of deforestation. Of course, poverty widespread and population growth will accelerate this trend. Signs from international sources of information, as presented earlier, warn that depletion exceeds tree-planting.

Forests are renewable. When properly managed, they can produce goods and services to assist development. The survival of Yemeni forests depends on people's recognition and protection of forests as a fragile ecosystem on one hand, and economic and social values on the other.

3.5.2. Objectives and Targets

Goal 1: A national action plan for sustainable forestry development

There is a need to elaborate a National Action Plan (NAP) to sustain the Yemeni forestry development. This will require information generation and dissemination, and then a national dialogue to define a common vision, identify both stakeholders and actions, and finally gather commitments for implementation.

3.5.3. Actions

1. Information, Monitoring and Assessment

To prepare and execute the NAP there is a need to:

- Compile all existing studies and research findings on Yemeni forestry
- Identify hotspots and both crucial and fragile areas of forests, and then collect relevant data and information using satellite images, aerial photos, etc. and information on the type of trees, socioeconomic data, etc.
- Install at EPA and Ministry of Agriculture a Geographic Information System (GIS) to analyze data and generate information conducive to set a vision and identify actions

2. Preventive and Corrective Actions

- Plant more forests to reduce pressure on primary and old-growth forests. Plant valuable crops among the trees to further increase the value of managed forests
- Breed productive trees that are more resistant to environmental stresses
- Protect forests from fires, pests, and other sorts of harmful factors including air pollution
- Address social and ecological factors that cause destructive shifting cultivation
- Minimize woods waste
- Promote small-scale forest-based Small and Micro Enterprises (SMEs) to support rural development at large.
- Generate employment opportunities and increase revenue for each harvested tree by Increasing value added to forest products through secondary processing
- Encourage urban agriculture and forestry to green Yemeni cities
- Promote indigenous medical practices as means of protecting wild life and forests
- Encourage eco-tourism and other sorts of low-impact forest uses
- Promote sustainable management of trees in hinterlands surrounding forests to reduce damage of forests themselves

3. 3. Supportive Measures

a. Legislative and institutional

- Institute public-private organizations at the local level for NAP elaboration and executions
- Review current legislation and amend necessary modification to establish an environment conducive to sound environmental management of Yemeni forestry, including the use of economic instruments to encourage preservation of forests
- Establish a specialized police forces and empower rangers to strictly apply law and order

b. Capacity Buildings

- Arrange for public awareness campaigns concerning the importance of forests for the livelihoods of the poor
- Arrange programmes for training rangers, local administrators, and members of community based organizations

c. International Support

- Contact international community, to advice and finance the use of modern technologies
- Start negotiations with trade partners on the use of fair terms of trade of forestry products

3.6. Sustainable Mountain Development

3.6.1. Basis of Action

Mountains represent a significant share of Yemen. Mountains are important source of water, energy, mineral, forests and agricultural products. The fate of mountains affects the population of Yemen. Mountainous ecosystems are prone to soil erosion and rapid loss of habitat. Most mountain areas experience environmental threats.

3.6.2. Objectives and Targets

Goal 1: Proper management of mountain resources

Environmentally sound management of mountain resources is crucial to the environmental sustainability of the country at large. There is a need for services to the inhabitants of these areas to support their livelihoods.

3.6.3. Actions

1. Information, Monitoring and Assessment

- Generate and disseminate information on alternative livelihoods involving agricultural production, beekeeping and livestock raising in mountainous areas of Yemen

2. Preventive and Corrective Actions

There is a need for elaborating schemes for land uses that can:

- Identify protected areas to save wild life
- Identify areas prone to erosion, floods and those threatened by atmospheric pollution
- Promote erosion control measures in mountainous areas of Yemen
- Offer residents of these areas with incentives to conserve resources

3. Supportive Measures

a. Legislative and institutional

- Institute public-private organizations at the local level for land use elaboration and execution
- Review current legislation and amend necessary modification to establish an environment conducive to sound environmental management of Yemeni forestry, including the use of economic instruments to encourage preservation of forests
- Establish a specialized police forces and empower rangers to strictly apply law and order

b. Capacity Buildings

- Establish centres of information on mountains ecosystems

- Arrange programmes for training rangers, local administrators, and members of community based organizations

3.7. Environmentally Land Management

3.7.1. Basis of Action

Population growth and an expanding economy create competition for land uses and tensions between various interests. The sustainable use of land means finding a balance that attains the greatest benefits for social and economic development whilst still protecting and enhancing the environment

Proper land management is necessary to protect biological diversity and to utilize the land in a sustainable way. Securing property rights, accounting for protected areas and habitats, and the rights of local communities including the local indigenous groups, such nomads, is a necessary part of the process of reaching sustainable uses of land.

Degradation of land resources and increased rate of desertification manifested as:

- Increased rates of salinity
- Fuel wood cutting and overgrazing is on the rise
- Increased wind and water erosion of soils
- Deterioration of traditional systems in agricultural practices

Sharecropping arrangements, which is among the reasons for land degradation, are not conducive to increased production. Other factors include, but not limited to, irrational use of irrigation water in irrigated areas; weak agricultural extension and limited research outputs. The resultant is the low productivity of both soil and livestock that accelerates the processes of impoverishment, thus pushing excessive influx of migration from rural areas to urban centres.

3.7.2. Objectives and Targets

The formulation of the United Nations Convention to Combat Desertification (UNCCD), adopted in Paris in 1994 and ratified in 1996 gave emphasis to combating the major threats to sustainability in countries of dry land. The Convention defined desertification as "land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities." 'Land' in this context means the terrestrial bio-productive system with all its components. The Convention also defined combating desertification as "activities, which are part of the integrated development of land in arid, semi-arid and dry sub-humid areas for sustainable development."

Productivity of agricultural land for food production in Yemen has to increase to meet escalating demands for food, fibre and fuel. There is a need to consider the land allocated for the production of Qat as a step towards securing food for the Yemeni people. There is also a need to protect agricultural land from sprawl of human settlements.

Specifically, Yemen has to achieve the following goals:

Goal 1: (a) Prevent and/or reduce land degradation; (b) Rehabilitate partly degraded land; and (c) Reclaim desert land.

According to the convention, a National Action Plan (NAP) should identify the factors contributing to desertification and prescribes practical measures to combat it. This implies the adoption of an integrated approach that affords the proper identification, assessment and monitoring of factors and processes of desertification and their adverse impacts on the nation's resource base and socio-economic aspects, as well as describing present

feasible and environmentally sound measures to combat factors and processes of desertification.

Goal 2: Environmentally sound management of agricultural and rural development

Major adjustments in agricultural, environmental and economic policies are required for Yemeni agricultural and rural development to be sustainable. These requirements include cooperation involving rural people, the central and local governments, private sector, and of course the international community.

3.7.3. Actions

1. Information, Monitoring and Assessment

Ample considerations and attention should be given to the documentation and compilation of indigenous knowledge and experiences, which are a wealth in itself in addition to its great value for appropriate planning of activities of NAP.

There is a need to collect, compile and categorize all available research findings in the field of soil survey, desertification and management of drought in Yemen. The sporadic findings need to be within a single framework conducive to generation and dissemination of information essential for the elaboration of NAP and its proper execution.

There is a need to setup a modality to collect data on human and natural resources in rural areas to ease monitoring and decision-making concerning land uses for agricultural and rural development. Specifically, activities will include:

- Data base on traditional systems in agriculture established
- Land affected with salinity assessed in terms of area, locations, and types of salinity
- Level and magnitude of degradation in rangelands measured
- Magnitude of migration to urban centres assessed, and then reduced in targeted areas.

2. Preventive and Corrective Actions

- Prepare a master plan to protect coastal areas to:
  - Halt or minimize the degradation factors active in the marginal land of the coastal areas, such as rangeland and cultivated rain-fed areas outlined in the previous section, and
  - Formulate meaningful options to ensure that the introduction of cultivation systems into the area does not threaten the sustainable use of the marginal land or the livelihoods of the present local population.
- Formulate integrated measures for the conservation and sustainable use of land and water resources of fragile agricultural areas. These measures would halt erosion inr this resource base.

3. Supportive Measures

a. Legislative and institutional

b. Capacity Buildings

- The successful outreach program on improving traditional seed selection disseminated in Sana'a , Hajja and Al-Hudaida

- The successful outreach program on improving traditional seed selection disseminated in other ten governorates
- The successful outreach program on improving traditional seed selection disseminated in remaining governorates.

c. Data and Information

- Compile, document and process data and outcomes of previous research activities in Yemen, particularly coastal areas,
- Establish a GIS data system utilizing the available basic equipment, facilities
- Organize and standardize the available data and its entry in the established GIS data system.
- Assess the integrated impacts of present land use activities on desertification processes using indicators and modelling appropriate for the environmental conditions of study areas.
- Use the established data system to identify hotspots and assign priorities for actions to combat ongoing desertification processes.
- Use the established data system to formulate options and scenarios for future land use activities with the participation of the relevant stakeholders.
- Periodical reporting every six months on the implemented activities.
- Convene a national workshop for all-collaborating institutions, and relevant stakeholders to review the outcomes

d. Financial

3.8. Management of Human Settlements

3.8.1. Basis for Action

The Yemeni urban system has already started to experience regional disparities. These disparities will increase as urban population will concentrate in Sana'a and Aden and the second tier of major cities: Hudaydah, Mukalla, Taiz, Ibb, and Abyan. As developing economies grow, the importance of primate cities increases, until the economy enters a stage of maturity, and a process of polarization reversal starts. At this moment, current distortions in the urban system are not alarming, however, in the future; these distortions could trigger many environmental predicaments, social ills, economic and financial losses, and probably political unrest. In short, could easily pose serious threats to the sustainable development of Yemen.

Urbanization in Yemen is not the outcome of expansion in manufacturing sector, rather the growth of service sector, lack of physical and social infrastructures in rural areas, and chances for sustenance, thus pushing rural migrants to abandon their land and move to the city in search for a better living. The other reason for urbanization in Yemen is sustaining considerably high rates of natural population growth. Despite that rates of natural population growth are declining, the population momentum is still high.

3.8.2. Objectives and targets

Goal 1: EPM modalities developed and institutionalized in all Yemeni urban centres

Based on the major recommendations of the Second UN Conference on Human Settlements (Habitat II, Istanbul, Turkey, June 1996), the concept of "Partnership in Development" represents the key approach to institutionalizing Environmental Planning and Management (EPM) as the modality for urban planning and management of Yemeni urban areas. This concept is well articulated within the process of Environmental Planning and Management of the Sustainable Cities Programme (SCP). All parties doing, contributing, interested and impacted by the development process should have an active, effective and balanced role in both decision-making and implementation of development actions, programmes and projects.

Goal 2: Trends of Rural-Urban Migration declined

It is of utmost importance to warn that the real exploitation in a poor, largely rural country such as Yemen might become that of the town-dwellers exploiting the peasants. Urban bias provides explains why poor people stay poor. Accordingly, because of neglect, peasants have one of three choices: to revolute, withdraw from the market and revert to subsistence farming, or opt to join the urban sector by moving to the city, i.e., rural-urban migration. Therefore, rural-urban linkages have to be considered if urban ill are to be resolved.

3.8.3. Actions

1. Information, Monitoring, and Assessment

Box 4 Urban Observatories

Local and National Urban Observatories are governmental agencies, research centres or educational institutions that are designated as the "workshops" where monitoring tools are developed and used for policy-making through consultative processes. A Local Urban Observatory for a city or town is the focal point for urban policy development and planning where collaboration among policy makers, technical experts and representatives of partners groups is fostered. Networks of Local Urban Observatories are facilitated by National Urban Observatories where necessary. National Urban Observatories co-ordinate capacity building assistance and compile and analyze urban data for national policy development.

Developing national and local urban observatories is a necessity to keep record of the major environmental parameters. The purpose of these observatories is to use trained cadres to monitor selected environmental information, and to identify common pollutants and contaminants within the study area. Compiling these data and transforming them into information and knowledge will facilitate the policy dialogue and the processes of decision-making and implementation of corrective measures.

3. Corrective Actions

Aden, through the support of World Bank, was able to develop a City Development Strategy (CDS).[97] Other Yemeni cities have to start emulating Aden and develop their

[97] A City Development Strategy (CDS) is an action-plan for equitable growth in cities and their surrounding regions, developed and sustained through participation, to improve the quality of life for all citizens. The output of a typical CDS includes a collective city vision and a strategic action plan aimed

own CDS. Also, all Yemeni cities have to start adopting EPM as a modality for urban planning and management. EPM,[98] the central concept of SCP[99] work, aims to: clarify environmental issues, identify interested parties, set priorities, negotiate issue-specific strategies, coordinate overall environmental management strategies and action plans, initiate priority bankable investment projects, and strengthen local planning and management capacities. Several benefits can be attained through EPM including:

- Adopting the EPM process brings environmental concerns on the development agenda and sharpens the focus on managing natural resources. The process clearly shows the success of, and the need to continue cross sectoral coordination and interested parties' participation.
- The EPM process stimulates local players representing different interests to share information. Preparing city profile and disseminating it among local actors, circulating research results among interested parties, and discussing specific issues in working groups made sharing information easy. EPM process, in cities that adopted such as Ismailia, Egypt and Dar El Salaam, Tanzania, emerged as a mechanism that is *sine qua non* for existing development arrangements to be effective.
- EPM is participatory processes that seeks development of partnerships and enables stakeholders thus causing institutional transformations.
- EPM processes build technical capacities because it enables development partners to prioritize and develop fundable strategic programmes and projects. Participation of interested parties in decision making results in discussing ideas, investing time and effort in technical inputs, and mobilizing resources for implementation. Participants will learn to discuss, debate and resolve issues.

To control the growth of primate cities, the Government has to develop secondary cities. This is possible by allocating investments to develop new industrial estates and develop social and physical infrastructures of these medium-size cities to generate employment opportunities and secure housing. Furthermore, sound management of medium-size cities will prevent urban sprawl onto agricultural land and environmentally fragile areas, such as coastal zones. Providing these cities with the essential infrastructure and social services will decrease its dependence on primary cities. Increasing the green areas in these cities is a considered option.

Securing property rights

Property trade-off program is for managing the growth of human settlements by trading valuable cultivated small plots of land for developed desert land at market prices. If resources are earmarked, local administrators will able to implement this program. The result would be saving much agricultural land from the sprawl of human settlements.

Upgrading informal urban areas

Another means of making Yemeni urban settlements sustainable is to upgrade informal settlements in and outside the urban areas. The Government has to provide the dwellers

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at policy and institutional reforms, increased economic growth and employment, and implementation and accountability mechanisms to ensure systematic and sustained reductions in urban poverty. For more information check http://www.citiesalliance.org/

[98] EPM is a systematic process that features participatory planning as its *modus operandi*.

[99] Sustainable Cities Programme (SCP) is a joint UN-HABITAT/UNEP facility established in the early 1990s to build capacities in urban environmental planning and management. The programme targets urban local authorities and their partners. It is founded on broad-based stakeholder participatory approaches. Currently the SCP and its sister programme Localising Agenda 21 operate in over 30 countries worldwide. http://www.unhabitat.org/programmes/sustainablecities/

with access to land, credit and low-cost building materials. Securing tenure and legal protection against unfair eviction are also part of this effort. The Government has to upgrade these slums and squatter settlements to close the deficit in urban shelter. Upgrading these settlements includes providing them with clean water, sanitation, and waste collection. Adding the solid waste collection fees to the electricity bill is a means to raise funds necessary for providing the services to poor settlers. These efforts will have a positive impact on alleviating poverty. Putting credit at the disposal of the poor will improve their financial and economic status, lower inflation and improve macroeconomic measures as well.

Emphasizing the use of local building materials, particularly those that do not harm human health and the environment, and energy efficient designs are another way of making human settlements in Yemen sustainable. The architectural legacy of Hadramout and Yemeni architecture at large has to inspire the development of architectural prototype designs for urban settlements to avoid eye-soars and visual blight brought by western, international architecture.

Resolving land uses conflicts will have a positive impact on the amount of time that people spend travelling if the various land uses are logically related and the network of routes and modes of transportation are well planned. Better management of land uses will minimize congestion that will decrease the use of energy, improve air quality and minimize the impact on systemic global environmental issues, such as climate change and depleting the ozone layer.

Attention to rural areas

The solution for urban ills is to abandon rural-urban dichotomy. There is a need for a holistic planning approach that is participatory, conducive to the development of partnerships and enables interested parties to own the plans and their projects; monitor and evaluate; and operate and maintain developed projects beyond plan execution.

The solution is to industrialize rural areas in distressed regions of Yemen by introducing cottage industries in the form of Small and Micro Enterprises (SMEs). This policy option aims to slow down the rural-urban migration rate, and to avoid rural-urban disparities. Once the development of both Sana'a and Aden is managed, then there is an opportunity to develop medium size, secondary cities within these depressed regions by encouraging the relocation of manufacturing activities in these cities.

3. Supportive Measures

There is a need to build the capacities of local administrations to be able to formulate and implement Local Agenda 21 for their settlements. This will require training administrators, developing new cadres capable of planning and updating plans for the sustainable development of their communities. Capacity development will also encompass institutionalizing participatory structures for decision-making, building partnerships between stakeholders and enabling the locals to control their destiny.

Supportive measures also include enforcing, laws and regulations to avoid noise pollution and visual blight. Another supportive measure is economic and financial. There is a need to examine applying location taxes. If someone applied to locate a business in a primate city, such as Sana'a, a fee could be added to the cost of the permit. These additional amounts could be a means for raising funds for financing projects that intends to support the environmental sustainability of Yemen at large. Alternatively, if people did not wish to pay the location tax, they could relocate their businesses in secondary cities.

Specific supportive measures are as follows:

a. Legislative and institutional

In most Yemeni communities, the existing governmental structures that manage local development and provide services are antiquated and fail to meet present-day challenges and needs. Many development and service problems arise from the inflexibilities that antiquated jurisdictional boundaries impose. Urban areas now sprawl beyond the jurisdictional boundaries of the municipalities that are charged with managing urban growth, development, and service provision. Ecosystems themselves often extend across multiple jurisdictions, making protection efforts from a single jurisdiction impossible.

Promoting rural-urban synergies is the solution. This is possible through better planning and management through improved communication and information generation and exchange; resource mobilization and efficient use, and development of stakeholders' capacities.

There is a need to institutionalize regional environmental planning and management commissions that can initiate rural-urban synergies by serving as a middle planning level between local and national plans. These commissions should be developed along the lines of public-private partnerships as a forum for decision making and monitoring activities toward sustainable urban and regional development. A policy for regional and urban development is only as good as the structures put in place to implement it.

Different municipal, provincial and private agencies have conflicting jurisdictions and compete with each other for resources and customers. Decentralization that is often recommended as a solution, need these regional commissions to facilitate inter-departmental cooperation. Effective issue analysis and action planning will produce strategies that address systemic problems.

- ► Develop and elaborate the CDS, and adopt EPM as a modality for urban planning and management
- ► Develop and institutionalize national and local observatories
- ► Institutionalize a modality for Public Private Partnerships (PPP) in Sana'a, Aden, Taiz, and Mukalla to facilitate management of the urban environment
- ► Enforce the law of planning, prime minister resolutions, ministerial resolutions for city planning and observe any illegal violations

b. Capacity Buildings

- ► Training for cadres on urban planning technologies including, but not limited to, Geographic Information Systems (GIS), the use of market simulation operational models for decision-making, the use of transportation and land use models, etc.
- ► Training workshops in city planning for city officials in different departments
- ► Training is continued for decision maker, city planners and governorate officials

c. Data and Information

- ► Carrying out survey of the roads and streets to be paved or asphalt covered
- ► Construct the network in Sana'a city and in other 5 main cities
- ► Maintain the network and upgrade it
- ► Activate the IUPM units in all cities and equip them with all necessary facilities

e. Financial

- ► Allocate budget for establishing the EPM process in 50 per cent of governorate cities
- ► Finance should be sought from local and international funding
- ► Finance this project for local and international funding agencies

3.9. Management of Solid Wastes

3.9.1. Basis of Action

Solid wastes include all domestic refuse and non-hazardous wastes, such as commercial and institutional wastes, street sweepings and construction debris. The rapidly growing quantity of solid wastes is a threat to human health and the environment.

Unsustainable consumption is increasing the amount and variety of produced wastes. Consequently, waste disposal costs will increase as stricter environmental controls are imposed. Waste management charges should ensure those who generate wastes must pay the full cost of environmentally safe disposal. This will make waste recycling and resource recovery cost effective. Large part of waste accumulated in rural and urban areas result from the lack of clear policies, shortage of human and financial resources and the shortage of landfill sites for final waste disposal.

There is no proper account of the amount and quality of generated wastes in Yemen. According to official estimates, the collected solid wastes do not exceed maximum 50 per cent of the generated solid wastes. The outcome is piles of accumulated solid wastes on the sidewalks of the streets and in vacant, unused land. Even the facilities used to receive the collected solid wastes are not properly constructed, maintained and managed. There is a need to conduct a study to assess the current status of solid wastes.

3.9.2. Objectives and Targets

Goal 1: Environmentally sound management of solid wastes

The best way to cope with waste problems is via a waste-prevention approach, focused on changes in life styles and in production and consumption patterns.

3.9.3. Actions

1. Information, Monitoring and Assessment

Prepare an inventory list of sources of waste generation in both qualitative and quantitative terms.

2. Preventive and Corrective Actions

3. Supportive Measures

a. Institutional

- ► Establish guidelines for the safe re-use of waste
- ►

b. Financial and economic

- ► Provide incentives to recycling
- ► Encourage markets for recycled and re-used products

- Fund pilot programmes, such as small-scale and cottage-recycling industries. Compost production, irrigation using treated waster and recovery of energy from wastes
-

b. Capacity Buildings

3.10. Biological Diversity

In 2004, Yemen elaborated a strategy for biodiversity. This strategy aims 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.

On the basis of a detailed situation analysis of biodiversity in Yemen, specific goals and objectives were identified to govern the thrust of the action plan outlined in this document. These goals spell out the pathways to preserve and use in a sustainable way the irreplaceable biodiversity and natural resources of Yemen. Such pathways are guiding principles, which represent the broad consensus of all the partners, who developed the strategy. The principles include, first and foremost, striving to maintain the integrity of Yemen's land and marine resources and their biotic wealth. They include respect for the intrinsic value of all forms of life, while uses need to be made both sustainable and equitable. They include also, the pursuit of collaborative management agreements and institutions. All affected communities and groups shall participate in policy actions that affect their right entitlements for the biotic resource.

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

The strategy is illustrated according to its strategic goals; which are broken down into sub-goals, each targeted to a strategic area and complemented with a number of priority objectives requiring immediate, medium or long-term attention. Some highlights of the agenda for each goal are presented below:

Strategic Goal 1: Conservation of Natural Resource

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.

Strategic Goal 2: Sustainable Use of Natural Resources

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.

Strategic Goal 3: Integration of Biodiversity in Sectoral Development Plans

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).

Strategic Goal 4: Implementation of Enabling Mechanisms

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.

In order to develop the action plan that translate the strategy vision, goals and priority objectives into implementable actions, a long list of options composed of forty broad actions were first identified and then they were short listed into seven priority initiatives (project concepts) based on the following priority criteria: (1) Geographic Impact, (2) Consistency with Convention Objectives, (3) Urgency, (4) Sequence (5) Country-driven, (6) Attainable and Resourceable, and (7) Multisectoral Implications to the objectives of this strategy. These priority project concepts form the Action Plan of this Strategy and are considered of immediate importance and require urgent action and attention to meet pressing biodiversity conservation needs.

4. INSTITUTIONAL DEVELOPMENT

4.1. Prior and On-Going Activities

Environment protection and concern for sustainable use of natural resources grew gradually since late eighties, both on the part of the government and the public. The government has been undertaking active roles in environmental management and institutionalized environmental work. Growing public interest resulted in establishment of a number of non-governmental organizations and increasing involvement of media in environmental issues. The academic institutions and scientific communities also got more involved in environmental research.

Fundamental steps have been initiated to integrate environmental, social and economical factors at policy and legal levels. Overall regulatory and policy frameworks have been developed. Environmental protection as religious, national, and individual responsibility has been included in the constitutional amendment in 2000. Provisions have been made in the Environmental Protection Law (EPL) No. 26 for the year 1995, to enable incorporation of environmental aspects at all stages of developmental planning. The National Environmental Plan (NEAP), 1996 acknowledges the inter-relationships of socio-economic development and sound environmental management. The Poverty Reduction Strategy Paper (PRSP) 2002 reflects linkages between poverty eradication and environment protection.

In 1998 the Consultative Council discussed environmental issues in a three days meeting. This high advisory forum reviewed environmental situation and trends, environmental management experiences and future expectations. The recommendations of the seminar were submitted to HE the President of the Republic who instructed the government to implement them.

Eco-tourism department has been set up. Focal points have been established in a number of line ministries such as in the Ministry of Oil and Mineral Resources and the General Investment Authority. Environmental research centers have been introduced in Aden, Sana'a, Hadramout and Hodeida universities.

Further more government commitment to integrate economic concerns with environmental protection is reflected in Socotra initiative. A zoning plan has been prepared and approved identifying resource use reserve, general use zone, national parks, and areas of special botanical interest and nature sanctuary. A draft Master plan has been prepared aiming to achieve socio-economical development in the island and preserve its unique biodiversity.

The national environmental legislation acknowledges concern to global environmental issues and calls upon national contribution to global efforts undertaken towards such issues. The government reflected its commitments to global efforts by ratification of major international conventions on environmental issues of global concern in 1995/96. These conventions deal with climate change, biodiversity, ozone layer protection, transboundary movement of hazardous waste and desertification control. Activities have been initiated to fulfil national obligations towards some of these conventions. A survey had been carried out on ozone depleting substances, national ozone country program prepared and projects are being developed to support introduction of ozone friendly technologies in the private sector. The First National Communication on Climate Change and a draft Strategy and Action Plan on Biodiversity have been prepared.

4.1.1. Environmental Policy

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

4.1.2. National Environmental Action Plan

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

Environmental issues of national concern were identified and environmental analyses were carried out on the major resource assets and economic sectors; particularly on water, land, marine and coastal resources, urban environment, cultural heritage, biodiversity and natural habitats, oil and energy sector, mining sector and the industrial sectors. Consensus on priority issues were reached based on analyses of the problems according to the urgency, reversibility, effects on human health and economic productivity.

Priority environmental issues and areas of concerned as identified in NEAP are as follows:

- ► Water depletion, pollution and supply
- Over extraction of ground water
- Lack of water allocation and conservation systems
- Water pollution
- Inadequate water supply services
  - ► Land degradation
- Soil erosion
- Deforestation
- Agricultural and range land deterioration
- Loss of farm land due to urban encroachment
  - ► Habitat degradation
- Degradation of natural habitats (forests, wetlands, coastal habitats)
- Loss of biodiversity (extinction of endemic, rare and endangered species)
- Lack of management of ecotourism
  - ► Waste management
- Solid waste management
- Hazardous waste management
- Pesticide management

The NEAP promotes sustainable use of natural resources through a set of policy options addressing priority issues. These policy options deal with legislative, institutional, economic and financial measures in addition to information and community involvement. The fundamental strategy used to address priority issues is in the selection and application of appropriate policy options. Following are the outlines of measures selected:

- Legislative measures include development and redrafting of laws, regulations and standards for environmental quality.
- Institutional measures include capacity building of government institutions, universities, NGOs, community and private sector.
- Economic instruments include policies for licensing, incentives, prices, import restrictions, user charges, subsidies, penalties and taxation which favor sound resource use.
- Financial measure includes investments in environmental infrastructure and technology. The private sector and local communities are encouraged to gradually increase their involvement.
- Information instruments involve environmental information management, awareness, research and monitoring. Public institutions, universities, NGOs and the public are encouraged to play active roles in collection, analysis and dissemination of data.

NEAP formed the basis for the environmental chapters in the national population and development plans. It is used as one of the main reference document by national agencies in planning their environmental work.

4.1.3. Second Five-Year Developmental Plan:

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

- Environment protection and maintenance of ecological balance.
- Pollution control at source rather than solving pollution problems.
- Promotion of sustainable use of natural resources, use of renewable resources and recycled items.
- Consideration of environmental aspects at all levels of planning and decision-making.
- Preservation of the nation's cultural and historical heritage.
- Polluter pays for damages caused and bears mitigation, removal and compensation cost.
- Enhancement of environmental awareness and education and encouragement of civil and local community participation in environmental work.
- National commitment to address environmental issues having regional and global implications within available resources.

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

- Restructure environmental agencies and strengthen working relationships among them.

- Complete the legal framework and regulations relating to environmental protection, maintenance of ecological systems and environmental impact assessment.
- Enhance and up-grade of human resources capacities in environmental protection techniques and management
- Update and implement environmental policies and action plans.
- Prepare management plans and manage protected areas.
- Enhance environmental education and awareness and involve the private sector, women, NGOs and local council to participate in environmental protection activities and to provide environmental safety needs.
- Undertake surveys and studies to assess and monitor environmental impacts caused by production and consumption activities.
- Enhance relevant units dealing with efforts to fulfill national obligations under international environmental conventions and within available resources.
- Develop adequate resource mobilization mechanisms to finance environmental protection and pollution control programs.

4.1.4. Poverty Reduction Strategy Paper 2003 – 2005

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

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

PRSP aims to reinforce sustainable management of natural resources, mobilize beneficiaries, involve the poor and support the role of women and youth in environmental conservation. Following are priority programmes and projects proposed in the PRSP:

- Sustainable environmental management
- Update and activate of Environment Protection Law
- Monitoring environmental impact of agriculture
- Comprehensive development of Socotra
- Water and agricultural surveillance network
- Integrated management of water and underground basins
- Improvement of wastewater use in agriculture

PRSP proposed a number of measures to strengthen environmental policies and actions such as:

- Enhancement of technical capacities of relevant institutions to develop comprehensive environment and development programmes based on community participation
- Enhancement of legal framework

- Empowerment of local organizations
- Assessment of environmental conditions
- Enhancement of environmental awareness
- Provision of job opportunities through environmental projects
- Environmental impact assessment of developmental projects
- Financial support to projects providing soft loans to the poor
- Reinforcement of water resources institutions
- Enactment of laws and regulations relating to water rights and exploitation, development and protection of water resources
- Improvement of water uses efficiency
- Expand sanitation and waste treatment facilities
- Suitable use of treated waste water
- Improvement of water harvesting

4.1.5. Vision 2025

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

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

4.1.6. Environment and Sustainable Development Investment Programme 2003 – 2008

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

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

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

4.1.7. Regulatory Framework

The Environment Protection Law embodied the main principles of Rio Declaration, 1992 on sustainable development. Among others, the law is based on the principles calling for environment protection, maintenance of balance in the ecosystem and

rational utilization of the natural resources for the benefit of the present generation without affecting the ability of the future generation to utilize these resources. The law gives the responsibility of environment protection to all parties, empathizes the incorporation of environmental consideration at all planning levels and the undertaking of environmental impact assessment for developmental projects. The Executing Regulation of the law has been issued in 2000. Other main environment & environment related legislation:

- Protection of Marine Environment from Pollution Law, No. 11/1993.
- Regulate Fishing, Protection and Exploitation of Aquatic Resources Law, 42/1991.
- General Cleanliness Law, 39/1999.
- Urban Planning Law, 20/1999.
- Regulate Handling and Food Control Law, 38/1992.
- Water Law, 33/2002

Within the Dutch Support Project to EPC, Phase III a survey was carried out on environment and environment related laws and regulations. A list of these legislation and regulations at the level of each relevant agency is attached to the report of the working group.

4.1.8. Institutional Framework

The issue of environment is a multi-sectoral issue by nature. Almost, most of government agencies are involved in different forms and activity level. Focus of environmental work and management evolved with institutional development from a stage focusing on combating environmental degradation and pollution to a stage focusing more on sustainable use of the natural resources. The draft mandates of MoWE and EPA include the responsibilities to coordinate development of general environmental policy, environmental laws and standards, in addition to enhancing environmental awareness, dissemination of environmental information and development of national capacities. EPA reports directly to the MoWE. The EPA is also expected to meet the additional tasks mandated by the Environment Protection Law, particularly in environmental monitoring and impact assessment. Environmental management at sectoral levels including sectoral policy and legislation development is the responsibility of each relevant line ministry or agency in coordination with MoWE/EPA. The line ministries and agencies are also responsible for implementation of environmental activities to the limit of their area of concern. There are also other support government ministries and agencies. These agencies support and facilitate realization and implementation of environmental activities and management tools. The public too contributes in environmental work either in an organized form i.e. NGOs or through community participation at local levels.

Little coordination is done during the preparation phase of regulations/mandates and by-laws. However, personal interpretation had more influence on overlap of responsibilities and tasks among various agencies. In some cases such as coastal zone management, there are potentials for involvement of several actors but still there is no clarity on the key actor.

4.1.9. International Commitments

The national environment legislation acknowledges the concern to global environmental issues and calls for national contribution to global efforts undertaken towards these issues. The government reflected its commitment to global efforts by ratification of major international conventions on environmental issues of global concern in 1995/6. These conventions deal with climate change, biodiversity, ozone layer protection, transboundary movement of hazardous waste, desertification,

control and persistent organic pollutants. Following is a list of the main environment conventions to which Yemen is party:

- Basel Convention on Transboundary Movement of Hazardous Waste.
- Convention on Biodiversity Convention.
- United Nations Framework Convention on Climate Change.
- Vienna Convention on Protection of Ozone Layer.
- Desertification Control Convention.
- Convention on International Trade on Endangered Species.
- Stockholm Convention on Persistent Organic Pollutants (POPs).

Activities have been initiated to fulfil national obligations towards some of these conventions. A survey had been carried out on ozone depleting substances. The country program on ozone depleting substances had been prepared and submitted to the convention secretariat. Projects are being developed to support introduction of ozone friendly technologies in private sector. The national communication on climate change has been prepared and submitted to the COP and process has been initiated to an adaptation programme. National Desertification Action Plan has been prepared. The Biodiversity Strategy and Action Plan is in advance stage of preparation. Process has been initiated to prepare a national implementing plan to reduction or eliminated on POPs in the country.

4.2. Building Capacities

4.2.1. Building the Institutional Capacities of EPA

There are three interdependent clusters of functions that EPA needs to perform as prescribed by Law 26/1995:

1. Policy/Planning functions, including identifying problems, making strategic choices and so forth;
2. Executing functions, such as approving licenses, protecting nature, monitoring…etc.; and
3. Capacity development, such as training, establishing synergies between interested parties, encouraging research, and information dissemination.

EPA has its own powers for enforcement and a budget for proactive interventions. Nevertheless, its primary influence derives from the persuasive impact of information that it disseminates in various ways. Therefore, it is very important that a good range and quality of factual information and analyses are provided by EPA to all other participants in NSES and NEAP implementation.

- Draft a strategic action plan that sets out three streams of action over a five-year period, i.e.
    a. Plans for conforming with mandated participation in national and international forums,
    b. How the advisory role of EPA will be met with respect to all key players in the environment, and
    c. Plans for project activities.
- Prepare staffing plans commensurate with the needs of the strategic action plan, including an integrated set of job descriptions, staffing policies, and statement of career development opportunities.

In advance of, or concurrently with, development of the strategic plan, certain environmental policy issues need urgent refinement, authorization and dissemination including:

- Finalize policy statements on:
    a. Polluter pays principle,

b. Government to government pricing when related to environmental issues,
c. EIAs for policies and regulations, not just projects,
d. Incentives for small investors, and
e. Licensing of inspection bodies.

- Investigate methods for compelling various existing monitoring institutions to work with EPA, i.e., makes their data and results available to EPA as a central authority.

The current environmental law focuses on end-of-pipe controls via command and control regulations. Appropriate methodologies need to be developed for pricing of environmental resources to reflect their real value to society. Crisis management should be only one component of environmental management. The long-term direction is to institutionalize the participatory process to form partnerships and enable stakeholders to own the process.

EPA is depended on development assistance organizations-supported projects, which is not a sustainable source of funding, to meet its mandate. There must be more financial commitment to allow EPA to carry out its assigned role.

4.2.2. Strengthening the Role of Major Groups

i. Civil Services

Civil service modernization is an integral part any reform program. It is top priority due to the fact that no economic development can be achieved with a modern government administration. In 1998, the Civil Service Modernization Strategy was put for debate and later developed in a national conference. The Strategy aspires to develop a modern administration apparatus complementing economic reforms and assisting in accelerating growth and economic development in addition to the promotion and support for the private sector and civil society organizations (CSOs).

Specific Goal:

Providing efficient, effective and transparent government services under which performance and incentive are criteria that are applied in actual practice.

Policies

- The completion of the process of job description in the civil service and getting rid of imaginary and excess labour force as soon as possible;
- The restructuring of government agencies starting with the main selected agencies;
- Focus on measures that enhance the efficiency of government agencies and the improvement of procedures for control and transparency;
- Preparation of a general policy on wages to ensure satisfactory levels of living, ensure incremental increase in wages according to mechanisms that correlate with the movement of the national economy and world economic changes and taking into consideration the outcome and its impact on economic stability and the civil service system.

Priority Programs and Projects

Provision of high quality and cost effective government services through:

- Restructuring of government agencies,
- Termination of duplication,
- Enhancement of transparent procedures,
- Guarantee of practical application,
- Improvement in budget preparation and financial administration systems,
- Establishing effective control on hiring and redistribution,
- Terminating the services of the excess labour force fairly, and

- Improving the wages system.

ii. Enhancing and Strengthening of Democracy

Democracy is considered the guarantee that would make the poor and rich and the governor and the governed alike a voice that is heard in all issues and conditions including those of the poor themselves. The poor, like any other segment of society, are partners in decision-making.

This would require the support for and strengthening of democracy in Yemen and the continuation of democratic policies that have become an integral part of the life of society.

Specific Goal:

Maintaining democratic practices until they become part of each citizen's life.

Policies:

- Work and commitment to transparency in all affairs of governance and administration which would keep society away from ill use and personal interest and would also make work free from oppression, deprivation and the control of the powerful;
- The promotion of participation away from conflict, tension, and hesitation which in most cases gets mixed up with and hampers participation;
- Public education and awareness on individual rights and duties so as to ensure public response based on knowledge which will promote and allow political parties and CSOs to carry out their role in society;
- Safeguarding the freedom of the press and freedom of expression and making the clear distinction among the three authorities;

Priority Programs and Projects:

The provision of expertise and technical support for the Supreme Electoral Commission especially in areas like voter registration, professional development and decentralization within the Commission, the expansion of the democratic participation by less fortunate segments including women, raising public awareness on the importance of elections and participation.

iii. Local administrations

The Government of Yemen (GOY) has initiated the preparation of a rural/local development strategy (RLDS) to address the implementation issues of the country's poverty reduction strategy in rural areas. The strategy provides a mechanism to prioritize projects and programs identified in the Poverty Reduction Strategy Paper (PRSP) and to organize their implementation at the local level, through the new institutional environment created by Law No. 4 of 2000 concerning the Local Authority.

This emphasis on rural development reflects the GOY's goal, as outlined in "Yemen's Strategic Vision 2025 and the Second Five-Year Plan (SFYP)," of fostering sustainable, decentralized, holistic development of rural areas, so they may contribute and participate more effectively to the country's overall development and to poverty alleviation. Rural/local development is therefore an important dimension of the PSRP prepared by GOY in consultation with the civil society and endorsed by IMF and the Bank's Boards in July/August 2002.

This report, "Rural/Local Development Strategy" (the Strategy), builds upon the Agricultural Strategy Note, the Fisheries Strategy Note and the Yemen-Towards a Water Strategy-An Agenda for Action. It also complements the Urban Sector Strategy recently prepared by MNSIF and the Rural Energy Strategy for Yemen currently under preparation with the support of ESMAP, as well as the ongoing Poverty Update and the Public

Expenditure Management work carried out by MNSED, the Education Strategy Note and the Rural Access Strategy supported by the Rural Access Program.

To prepare an action-oriented strategy and ensure synergy with other ongoing initiatives, the GOY has established a Supervisory Committee chaired by the Minister of Planning and Development (MOPD), with representatives from the MOPD, Ministry of Local Administration (MOLA), Ministry of Agriculture and Irrigation, Ministry of Fisheries Wealth, and Ministry of Finance, as well as an inter-ministerial Technical Committee chaired by MOPD's Deputy Minister for Macroeconomic Affairs, which includes representatives of the MOPD's various sector General Managers and key line ministries.

The local authority contributes better and more precisely than the central government in the identification of needs of local communities. It also works in addressing and answering to such needs swifter. The local authorities in many countries have proved their effectiveness due to closeness to the people especially the poor. Therefore, the state will work on maintaining support for local councils as the main local vehicle for democracy, which play a substantial role in feeling the needs of the poor and support for poverty reduction programs at the local level.

Specific Goal:

The authorities mandate administrative units to take charge of tasks that enable them to improve the livelihood of the people in their local communities and addressing their problems and encouraging their participation in accountability and decisionmaking.

Policies:

- Strengthening the capacities of local authorities and their role in decision-making especially in issues related to the basic needs of local communities;
- Spreading awareness among the public and conducting general referendums on all important issues;
- Improving monitoring and follow-up to ensure a local authority that is strongly in favor of the poor and their programs.

Priority Programs and Projects:

- Basic Infrastructure and Human Capacity for Local Authorities: Strengthening the role of local authorities, making available the necessary financial and human requirements in line with the Local Authority Law most importantly the construction and equipping of local council headquarters and training for the local authority cadre. Staff and officials of the local administrations, primarily middle management staff at the Governorate level need to acquire a working knowledge of the changed economic environment that Yemen is now operating in, and to become sensitized to the problems they will face if environmental concerns continue to be ignored in their work. Furthermore, these officials are key personnel in developing and supervising the updating and maintenance of a database on local resources and environmental conditions. Specific needs are:

- To enhance the capability of local administration in improving the management of infrastructures and services for which municipal authorities are responsible.
- To encourage greater private sector participation in service production and/or delivery whenever it can improve environmental accountability and save expenses.
- To improve information infrastructures. Meaningful information is generated only after data has been collected, categorized and analyzed, for which equipment and relevant skills must be available in the right quantities in the right place.
- To establish a culture of information sharing, Government officials at levels other than those responsible for its collection need to have access to information to improve policymaking processes that enhance environmental management.

Current planning procedures entail multiple amendments to plans and budgets, each requiring another round of negotiations. A better planning process, rooted in realistic economic and social analyses, could save resources. These analyses require an improved information system and a mechanism for regular updates. Criteria for evaluation and prioritization are also needed, as are new cadres who are capable of utilizing modern technologies, such as Geographic Information Systems (GIS), in the planning process. Ideally the local level administrators would also be trained in strategic thinking and be able to develop a constructive discourse with the private sector and non-government entities.

The financial and technical capacity of municipal institutions also need to be upgraded as raising and allocating funds requires negotiation skills to be employed at several different levels of administration. In the process of delegating authority to the lower levels of management, it becomes essential to grant local administration the right to access credit and capital markets to finance their investment projects. It is also essential to provide them with the necessary management tools to make proper use of these resources. This should especially include, familiarizing local administrators with the banking system in Yemen and providing them with skills in finance as well as cost-benefit analysis of projects. Finally, with a growing stock market, local administrators should understand the mechanisms of the stock market. Given Yemen's efforts to alleviate poverty, local administrators should be trained on how to evaluate income generating projects and the means to develop an enabling environment for the growth of such projects in their community.

iv. Judicial system

The courts are expected to play a more effective role once proposed legislation and the stricter rules and penalties established in Law 26/1995 are adopted and enforced. There is a need to develop the capacity of the judicial system to enforce and uphold respect for environmental laws. Otherwise, laws become meaningless and government loses credibility.

The precise and accurate application of the law away from favoritism and serves all citizens particularly the poor who would be able to obtain their rights and safeguard their dignity. It would also ensure the application of the laws and regulations and fight against corruption and further strengthen the solidarity and unity in society.

Specific Goal:

Establishing a state of law and order in which everybody is equal before the law and bears his/her responsibility and obtains his/her rights.

Policies:

- Consolidate respect for the law, commitment to observing it fully and the appearance of role models in state leaders;
- Identification of fields and sectors that face legislative weakness or deficiency, addressing these flaws, the removal of contradiction in legislation and laws especially those related to the poor and poverty reduction programs;
- Improve performance of the judiciary system, general prosecutors and courts and enhancement of the role of inspection and financial control units in government agencies;
- Swift implementation of court rulings.

Priority Programs and Projects:

- Basic Infrastructure for the Judiciary: Creation of suitable working conditions for the organs of the judicial authority mainly by construction and equipping of courts;

- Training for Members of the Judicial Authority: Enhancement of capacity of performance for members of the judicial authority through regular training programs and workshops so as to assist in speedy actions and rulings on matters of conflict.

v. Civil Society Organizations

Civil Society Organizations are Non-Government Organizations and include private sector corporations, labour unions, political parties, research institutions and universities, and so forth, in addition to community-based organizations and charitable organizations.

- ***Environmentally Non-Government need:***
  - ✓ An institutional framework that encourages the developing of environmental NGOs geographically.
  - ✓ Establishing a channel for mutual dialogue between the NGOs and the Government.
  - ✓ Participation of NGOs in evaluation of the official mechanisms and formal procedures designed to review the implementation of the NSES and the NEAP.
- ***Labour Unions need to:***
  - ✓ Strengthen the ability of labour unions to involve workers in environmental audits and keep registry at the workplace;
  - ✓ Participate in environmental and development activities within the local community and promote joint action on potential problems of common concern;
  - ✓ Participate in environmental management activities of national, regional and international organizations; and
  - ✓ Provide adequate training and retraining opportunities to workers in promotion of sustainable livelihoods.
- ***In the mean time, research institutes and universities need to:***
  - ✓ A more open climate for research institutions.
  - ✓ An increased dialogue and cooperation between research institutions and the Government.
  - ✓ Improving knowledge and information exchange among the research community, as well as to the general public in order to enhance understanding and support, and enable better policy and program development.
  - ✓ Establishing markets where information demand and supply meet.
  - ✓ Reviewing national scientific and technological activities and prioritize/assess what contributions can better respond to interests and concerns of environmental management and sustainability.
  - ✓ Developing a code of ethics and practices to act as guidelines for the special responsibilities that face researchers, scientists and technologists.
- ✓
- ✓ Promote:
  - i. Regard for the maintenance and enhancement of life-support systems for their own sake;
  - ii. Spatial and temporal concerns; and
  - iii. The accountability of R&D and science and technology.
- ✓ Promoting regional cooperative mechanisms to address issues that face various parts of Yemen. These mechanisms will facilitate by public and private partnerships and funding.
- ✓ Developing and improving mechanisms for disseminating information to decision makers and the general public; and
- ✓ Promoting the role of women as full partners in science and technology discipline.

4.2.3. The Use of Economic Instruments

Environmental laws and regulations alone cannot resolve the challenges that environmental and developmental issues pose. An innovative mix of policies, economic instruments and market-based measures, which will induce changes in production and consumption behaviour and thereby support sustainable development, is needed.

Economic instruments are used increasingly in many countries as part of the policy mix to achieve their environmental and sustainable development objectives. Most developing countries are inclined to adopt the same regulations that apply in industrialized countries, regardless of their particular circumstances. Command-And-Control (CAC) instruments that are not always successful in some developing countries due to inadequate resources allocated to monitoring and regulatory enforcement. Even if monitoring may be technically feasible, this is impeded by economic and cultural factors, such as limited budget, labour and administrative constraints, centralization, etc. In many cases, especially in developing countries, both fines and penalties are inadequate and/or are easily circumvented.

Specific environmental problems are usually addressed by employing a policy mix consisting of various command and control instruments, economic instruments and persuasive instruments. The effectiveness and efficiency of economic instruments always depends also on the overall policy mix. The optimal instrument must achieve its purpose at the lowest cost possible and simultaneously help improve the efficiency of resource use, increase productivity and economize on scarce resources (e.g., capital, skills and management). It is also desirable that the instrument promotes change towards the development and adoption of more efficient, less wasteful production technologies. In this sense, transition country priorities clearly favour the cost-efficiency and flexibility of economic instruments over the rigidity and cost-intensity of command-and-control instruments.

4.3. Environmental Statistics

Policy makers need environmental information to prioritize problems and take necessary actions. Most environmental problems are complex and decisions are often made with great uncertainty. No effective planning and decision-making can be achieved and implemented without a solid and dynamic information base that is based on monitoring.

There are a number of constraints to effective policy making, planning and environmental management in Yemen. First is the lacking reliable and timely information on the impact of human activities on the environment and natural resources, and in the mean time, the outcome of the environmental degradation and irrational use of natural resources on the processes of impoverishment and the sustainable development of Yemen at large. The second constraint is improper management of data and information as a result of a complex of factors including, but not limited to, the lack of financial resources, trained workforce, awareness and availability of information and/or institutional setup. Other constraints related to the processes of environmental information collection, production, and dissemination are evident in Yemen. Furthermore, the monitoring organizations do not feed their results into a common information system; and there is an absence of a comprehensive methodological.

Accordingly establishing effective monitoring systems is a major condition for environmental quality assessment and pollution control. The design of environmental monitoring systems should be systematic and compatible with the planning and decision making process. It should be based on a unified methodological framework

that facilitates the development of environmental quality objectives and targets for the various media and sectors of the economy, and the development of both regulatory and non-regulatory policy instruments.

There are substantial inventories of statistics in Yemen but they are not shared and they are not comparable. However, it is also the case that additional data of different types is required for collection at the local, regional, national and international level to elucidate a more detailed, accurate story of the Yemeni environment and development issues. Furthermore, there is a need for standardizing data collection and storage, and making it accessible to technical and managerial levels. Reports and related information tend to be located in different bodies between, which there is little or no coordination, cooperation or exchange, resulting in gaps, duplication, incompatibility and limited utilization of data. This hinders policy development, planning, implementation and follow-up. It is imperative for improved decision-making that enhancements are made in data collection and analysis.

The proposed program of establishing Environmental Information Management Systems has two main objectives: (a) strengthening local, regional, and national capacity to collect, analyze and use multi-sectoral information for decision making by better identification of users, both public and private, and of their information needs at the local, regional and national levels; and (b) improving overall quality, i.e., validity and reliability, coverage and timeliness of and access to environmental information. The required activities include:

- Carryout inventories of environmental, resource and development data for determining gaps and organizing activities to fill those gaps.
- Develop a coordinated, standardized data collection and assessment framework:
- Establish systems to verify quality of data gathered, i.e., a source check;
- Establish procedures for measurement and evaluation;
- Organize continuous and accurate data-collection systems, making use of GIS, databases, expert systems, models, and the like; and
- Cooperate with the private sector and international bodies to facilitate transfer of technology and technical know-how.

Improving the quality of environmental data and statistics requires strengthening institutional capacities, promoting ongoing education, awareness, and training while ensuring financial commitment as well. There are many sources for statistical information, including Government archives, academic institutions, UN documents and the World Bank as well as other international bodies. Efforts should be made to gather together information from various sources to form a more complete profile of Yemen and be the base for better decision-making process.

4.4. Education, Training and Awareness

4.4.1. Integrating Environment into Education

Basis for Action

Education is at the crux of reform. Basic education is the raison d' etre for social, economic and ecological betterment cannot be achieved. There is a need for a program that

- Integrates environmental concerns into all levels of school/university curricula,

- Promote environment and development concepts in all educational programs, confirm and deepen the concepts of and establish mechanisms for environmental protection among young children; and
- Increase overall quality and access to education, formally and informally, for all society including marginalized sectors, such as women, youth, children, the elderly, and the physically disabled.

Activities

- Prepare national strategies and actions for meeting basic learning needs, enhancing access, promoting equity, broadening means and scope of education, and mobilizing resources. Also, recognize the contributions that NGOs can make in developing and implementing educational programs;
- Prepare strategies for integrating environment and development as a cross-cutting issue into educational curricula at all levels;
- Review curricula to ensure a multidisciplinary approach to environment and development issues and their socio-cultural and socio-economic linkages, with attention to community-defined needs and knowledge systems;
- Prepare and document an educational supplement addressing the specific nature of each region;
- Establish a national advisory environmental education coordinating board or round table, representative of various environmental, developmental, educational, gender, and other non-governmental interests, to mobilize funding and encourage partnerships and information exchange;
- Through the coordinated efforts of educational authorities, together with assistance from local administrations, communities and NGOs, develop training programs for teachers, administrators, educational planners, as well as non-formal educators, to address the nature and preferred methods of incorporating environment and development in education;
- Involve school children in local and regional studies on environmental health, including safe drinking water, sanitation, food and ecosystems. Also, sponsor field trips to key environmental sites in Yemen;
- Establish scientific environmental clubs among various Governorates in collaboration with the Academy of Scientific Research and Technology, outfitted with scientific and monitoring equipment, stationary and halls for viewing and listening;
- Develop environmental educational programs in places, such as Socorta, which will host groups from university and schools' and educate them about Eco-tourism;
- Enhance and support environmental science, biodiversity conservation, sustainable environmental management and similar cross-disciplinary programs in universities and other tertiary institutions. These university programs should be designed to deal with local and regional phenomena (e.g., indiscriminate, unmanaged hunting, over-grazing, incompatible agricultural practices, etc.);
- Promote non-formal environmental education through TV programmes, especially for marginalized sectors (women, youth, children, the elderly and the disabled), which uses an innovate range of teaching methods and settings and is developed and implemented by educational authorities as well as NGOs, such as women's groups, youth groups, and other community-based organizations;

- Enhance the capacities of the media personnel working on the implementation of the program. This is included in the training activities; and
- Develop radio and television programs with new environmental concepts that depend on the specialties in certain subjects.

The contribution of increased education to well-being cannot be overstated. Funding, training, technology and technical know-how must be provided to all sectors, continuously, if overall literacy rates are to be increased. An informed, educated society is imperative for the realization of sustainable development.

4.4.2. Environmental Training

Training is a fundamental tool for the development of human resource. It is a two-way learning process that fills gaps in knowledge and builds skill, enables individuals to find meaningful employment, and facilitates the transition to greater overall sustainability. To prepare a training program, there should be enough information available for those who are going to implement the program, on one hand, and for satisfying their need to build their capacities on the other hand.

Training the trainers of environmental awareness should be a quality-targeted training that will enable those trainers to convey the message in an easily, understood and acceptable manner to the potential trainees. High communicational and participatory skills are essential to mobilize the recipients so that they view the environment differently. Starting this process as soon as possible is imperative for fulfilling Yemen's environmental and development objectives. The Government of Yemen with the private sector, NGOs and international assistance has to establish a program that aims to:

1. Establish technical training programs, which meet the needs of environment and development, and make them available to all, sensitive to social status, age, gender, race or religion;
2. Promote a flexible, informed workforce equipped with the tools that meet the challenges arising from the transition to a sustainable society;
3. Strengthen the capacities of Government employers to meet environmental and development challenges to facilitate the transfer of new environmentally sound and appropriate technology;
4. Assert on the integrated relationship between environmental issues and the concerns of the local environments. This to be done at the administrative levels that encompass various jobs, such as production, marketing and financing.

Activities

- Identifying training needs of both trainers and trainees, and then assess measures required to meet those needs, including a periodic review of progress in this field;
- Identifying the needs for training required by people in remote areas, to enable them to participate in more sustainable work practices and lifestyles;
- Establishing "community-based" local training centres addressing the specific problem issues and reflecting the characteristics of the region or locality. These centres would not only deliver practical training on relevant issues, but would also encourage the development of a stakeholder participatory approach to issue definition of interests and problem solving techniques, thereby increasing the communication and participatory skills of the trained individuals responsible for raising public awareness;

- Encouraging business and industry, along with other professional organizations, to develop and review their environmental codes of conduct to strengthen environmental commitments;
- Integrating environmental and development issues, which educational institutions promote, into existing training curricula and promote the exchange of methodologies and evaluations.
- Encouraging all sectors of society (Government, private sector, academia and NGOs, etc.) to include an environmental management activity in all relevant training courses;
- Supporting training programs for business, especially SMEs, to build capacity/skills pertaining to environmental auditing, technology, Best Practices, and environmental services markets;
- Establishing practical training programs for graduates from vocational schools, high schools, and universities, enabling them to achieve sustainable livelihoods;
- Organizing programs for overseas training. These programs will be based on the specialization and successful completion of the local programs. This includes using training centres located outside Yemen, such as biodiversity training centres in Kenya, and International Academy for Environment in Geneva…etc;
- Developing advanced environmental technical training courses, such as GIS applications and remote sensing technologies; and
- Developing updateable national and regional environmental labour-market information systems and resource guides that would supply, on a continuous basis, data on environmental job and training opportunities.

4.4.3. Raising Public Awareness

General awareness of global and national environmental issues in Yemen remains low, despite the explicit link between nature and the predominance of rural/agrarian livelihoods. This lack of awareness is compounded with problems of inaccurate and insufficient information. For positive change to occur awareness needs to increase, and information generated regarding Yemen's environmental conditions must be disseminated by all means to reach most people. This requires increasing the use of the media, particularly radio, and television. Furthermore, there is a need to foster a sense of personal environmental responsibility, and greater motivation and commitment towards involvement in sustainable development problems and solutions; i.e., a feeling of "owning" the problem and the means to improve understanding of the issue at hand will contribute to mobilization resources to implement proposed actions to resolve it. This commitment comes from stakeholder participation in defining the issues, identifying solutions to the problems and being actively involved in implementing those solutions.

The suggested program aims to:

- Stress the role of the media and the press.
- Air programmes to inform the Yemeni public on current environmental issues.
- Publish booklets and brochures that focus on environmental issues.

Supporting measures include programs for promoting broad awareness of and understanding among all sectors and levels of society of environmental issues and environment-society relationships; and stressing accountability and the principle of delegating authority and responsibility to the most appropriate level, with preference given to local authorities and control over awareness-building activities that include:

- Utilize the mass media, such as newspapers, magazines, posters and other print media, as well as local media, and entertainment and advertising industries, to broaden the reach of sustainability messages and shape popular opinion;
- Produce press releases and information kits on current environmental conditions and actions;
- Utilize innovative, indigenous, multimedia approaches, such as theatre and popular education, to document and communicate sustainable development principles, strategies, and approaches;
- Develop and employ modern communication technologies for effective public outreach, such as:
    - Mobile audio-visual methods, especially in rural areas;
    - Local, regional, and national television and radio programs; and
    - Web sites with appropriate links and coverage of major issues, including also e-mail connectivity;
- Enhance the capacities of the media personnel working on the implementation of this program through organizing training courses, workshops and lectures. Establishing an environmental information bank would support this activity;
- Organize forum for disseminating information and discussing policy development and implementation through:
    - Organizing large-scale symposia for national level awareness raising;
    - Organizing information workshops in major cities for regional level awareness raising;
    - Organizing public hearings and open houses for community level awareness raising, as well as consultations and council meetings for local administrations;
    - Organizing forum for sub-population groups, such as women, youth, children, the elderly, and the physically disabled, to enhance participation of traditionally marginalized sectors; and
    - Organize roundtables for business, NGOs, religious authorities, academic institutions, trade unions, professional associations, local press, and other interested stakeholders;
- Ensure follow-up and evaluation of workshops and other awareness campaigns to assess effectiveness by disseminating publications and newsletters addressing challenges, issues, and outcomes to workshop participants, collaborating agencies, donor agencies, environmental institutions, national and local Government and individual consultants;
- Develop an enabling climate for environmental advocacy by:
    - Providing trade unions, professional memberships, women's groups, youth groups, volunteer organizations, and other non-governmental entities venues to meet and gather, as well as funding for equipment, training and technical know-how to encourage broader citizen mobilization; and
    - Encouraging NGOs to increase their involvement in environment and development issues through joint awareness initiatives; and
- Establishing a system for environmental information to enhance the capacities of the media personnel concerned with the environment so that they could make best use of information technology in environmental management. This aims to:
    - Complete the information structure of the EPA.

- Establishing an environmental Geographic Information System at the EPA.
- Use pictures of satellites and remote sensors systems in environmental monitoring;

The importance of energetic, high profile, awareness-raising campaigns cannot be understated. These events are crucial in “spreading the word,” garnering support, attracting aid, and institutionalizing a common vision around which people with divergent backgrounds can rally. There is an opportunity here to be innovative, and also to explore new avenues for employment.

5. SOCIAL AND ECONOMIC DIMENSIONS

5.1. Alleviating Poverty

5.1.1. Basis of Action

Three major sets of factors lead to poverty in Yemen, which are as follows:

- Decline in income and its association with the nature and extent of economic growth.
- High population growth and the poor development of human resources and infrastructure.
- Weak levels of social protection.

The Poverty Reduction Strategy (PRS), formulated in 2003, aims to achieve, through the adoption of interlinked and well-designed policies, measures, activities, and mechanisms, to create an environment which is conducive for poverty reduction and the realization of specific and prioritized objectives including the achievement of economic growth, creation of job opportunities, provision of better basic services, and securing an effective social safety net for the poor. This goal is to realized under a responsible management characterized by efficiency and honesty and a mechanism that encourages participation and collaboration. In this strategy, the private sector is essentially charged with the task of achieving economic growth, while the government undertakes the provision of the physical and institutional structure in addition to the continuous expansion and improvement of social services.

5.1.2. Objectives and Goals

The Government of Yemen has set for itself, as part of its commitments with the international community and partners in development, a number of goals as reflected in the Second Fiscal Year Plan (SFYP) and the Strategic Vision 2025. The PRS targets reduction of poverty by 13.1 per cent during the period 2003-2005, to decline to 35.9 per cent in 2005. This may be achievable through appropriate economic growth that will lead to increasing real GDP by about 4.7 per cent, depending on the growth of the non-oil sectors by an annual average rate of 6.3 per cent to ensure increases in GDP per capita and improvements in living standards. This growth is expected to keep pace with effects of the population policies that seek to reduce the annual population growth rate to three per cent by 2005. The strategy also seeks to achieve a number of sectoral objectives leading to overall poverty reduction.

5.1.3. Means

The means and interventions to achieve the aforementioned goals and targets are through:

- Achieving Economic Growth
- Human Resources Development
- Improving Infrastructure
- Ensuring Social Protection

To ensure achieving the objectives through the policies, measures, and actions plans, the proper execution, supervision and monitoring require an approach that supports the four axes, which is a precondition and a proper environment for achieving the success desired and to sustain its results. This approach is the reinforcement of governance and prudent management, in addition to broadening the scope of participation and collaboration.

Poverty reduction policies are distinguished by the fact that they proceed concurrently within a broad consistent and harmonious front according to the order of priorities for intervention and the urgent measures in the middle period (2003-2005) and also takes into consideration the long-term period of the Strategic Vision 2025.

5.1.4. Work Plan

The PRS was based on the directions of the SFYP regarding priorities with a special focus towards poverty reduction efforts. Public expenditures during the three years of the PRS were prepared under the macroeconomic framework of the strategy that strives to achieve high and increasing economic growth rates within a sustainable fiscal policy in the medium and long-terms and in the light of estimated external financing and the absorptive capacity of the economy. Furthermore, the need to increase expenditure allocations for the social sectors and infrastructure was taken into consideration to contribute towards poverty reduction. The forecasts of the PRS are built on an expected decline in oil revenues, increased non-oil revenues and rationalization of public expenditures to minimum growth levels to ensure containment of the fiscal deficit. Total current government revenues (including grants) are expected to decline in the coming three years to reach 29.5 per cent of GDP by the end of the PRS period as a result of the expected decline in oil and gas revenues from 20.3 per cent of GDP in 2003 to 16.2 per cent by 2005. The policy of the Government of Yemen for revenue mobilization and development, particularly for non-oil revenues, is based on the most efficient utilization of available economic resources and adjustment of the tariffs for public services using economic foundations. The Government worked developing the tax system through the applying the Generalized Sales Tax (GST) and raising the efficiency of tax administration and collection. On the public expenditure side, the medium-term expenditure framework reflects the adoption of the policy of expenditure restraints in the light of expected decline in government revenues. In particular, current expenditures are projected to decline from 28.2 per cent of GDP in 2003 to 25.4 per cent in 2005 despite the expected increases in wages and salaries, goods and services, maintenance and operations, and debt services, while transfers and subsidy allocations are expected to decline sharply. These indicators reflect government effort to raise the efficiency of the civil service, retrenchment of excess public sector employees, reducing masked unemployment while raising salaries and wages for employees in the administrative apparatus of the State in addition to rationalization of spending on non-developmental activities. It is expected that, given the above-projected expenditures and revenues, a fiscal deficit will be realized throughout the three years of the PRS being careful that it not reach unsafe limits, i.e., not more than 4 per cent of GDP in 2004. The budget was also based on the fact the deficit will be financed from real sources to avoid any inflationary pressures caused by deficit financing. The fiscal framework includes a continuous increase in development expenditure reaching 7.8 per cent of GDP in 2005. Development expenditure targets sectors relevant to poverty reduction and improving the livelihood of the population especially in rural areas and providing them with basic social services. Social spending, including education, health and social welfare, is projected to reach around 13.2 per cent of GDP in 2005.

The PRS includes the preparation of lists of investment programs and projects that are necessary for realizing the objectives outlined in the strategy. These programs and projects have been identified at the sectoral level as either ongoing or new projects with investment costs taking into consideration the impact of these programs and projects on either job 19 creation or the increase in the number of beneficiaries, and the measurement of such as a ratio of the primary objective. Implementation duration for each project or program and the breakdown of the expected investment for the period has been estimated during the period before the implementation of the strategy (pre-2003) and broken down by the three years of the implementation of the strategy i.e., 2003, 2004, 2005 consecutively. In case project implementation exceeds the period of the strategy implementation, the remaining total sum is also calculated.

The total cost of projects under the PRS amounts to YR 413 400 million during the next three years of which only YR 18 891 million will cover the cost of new projects representing 4.6 per cent, compared to YR 394 700 million for ongoing programs and projects. Local financing is estimated at 73 per cent of the total. The remaining cost will be covered from foreign financing sources, of which most has been secured. Furthermore, since the Government of Yemen is seeking to realize the MDGs without which Yemen would lag behind in development, it is necessary to secure financing from donors for new projects that still lack funding as well as assistance in additional programs and projects that would help reduce the gap between the current situation and the MDGs.

5.1.5. International Aid

Yemen has relied on bilateral donors and regional and international multilateral donor agencies on the basic human services that have a direct impact on the daily life and activity of the people. Such priorities match up to a large extent with those of the donor countries and financing institutions, which target the contribution in the improvement of the livelihood and strengthening the capacities of individuals in all fields that are essential to poverty reduction. Due to insufficient domestic resources the Government of Yemen will remain incapable of financing strategic projects related to basic infrastructure and social services let alone the implementation of the PRS, which should eventually realize the objectives for prospective human development. Dependency on grants and loans in addition to technical assistance will largely remain. In addition, the Government, in collaboration with the donor community, seeks to optimize the financial resources effectively and its distribution to ensure maximum benefits for human development programs and poverty reduction.

5.1.6. Risk Factors

The set of economic, financial and administrative reform measures adopted by Yemen since 1995 has led to positive results. These were clearly reflected in the improvement in macroeconomic indicators and the stabilization and opening up of the national economy, although the economic base remains weak and prone to risk. Therefore, it becomes rather difficult to control all circumstances and factors that could accompany the implementation of the PRS especially since Yemen is prone to internal shocks such as drought and flooding in addition to external factors, particularly the fluctuation of oil prices and holdup of foreign assistance.

5.1.7. Monitoring and Follow-Up

The program for the preparation of the PRS included a review and an evaluation of the Poverty Information and Monitoring System (PIMS) established in 1998 in collaboration with UNDP aimed at strengthening the poverty information infrastructure, provision of a comprehensive, precise and modern information system on poverty through data collection and analysis to help in placing policies and remedies.

During the last three years the project completed the first and second stages in addition to the completion of the 1999 Poverty Survey and the building of capacities in the design of questionnaires, systems, data collection and analysis. The PRS contains a proposal to 20 restructure the duties and roles of the various government agencies involved in poverty analysis and monitoring in the framework of a database system and comprehensive monitoring and the use of the aid and assistance provided by donors. At the same time, the proposal calls for remedying the lack of coordination between those agencies and the linking of various activities of the SFYP and the PRS as the need arises.

Similarly, as an important part of the preparation and implementation of the PRS requires coordination of policies, objectives, programs and projects related to the strategy though an effective and suitable mechanism, the National Committee for the Social Safety Net is

proposed to remain as a supreme coordination committee while the tasks of coordination, follow-up, evaluation of policies and programs are proposed to be allocated to the PRS Committee and the Information and Follow-up System of the Ministry of Planning and Development to ensure linkages of the various database system and the monitoring of poverty with a technical mechanism for the Social Safety Net along a detailed program and an action plan that will be formulated in due course.

5.2. Population and Sustainability

5.2.1. Basis of Action

Yemen is the most populous country on the Arabian Peninsula. The tribal social structure is still prevalent in the country. Yemeni human resources have progressed, and are expected to continue, to improve. Population continues to grow, but at lowers rates and dependency ratios decline over time. Birth rate per 1000 people is expected to decline. In the mean time, death rate is expected to decline indicating improved health conditions. Infant and under-5 mortality rate are expected to decline. Life expectancy at birth is expected to improve by 2025-2030. Population growth rate (average annual percentage), therefore, is expected to decline.

Improved health services are not the only reason for sustaining high rates of population growth. The population of Yemen is young. The population momentum is short. The population in young cohorts indicates that high population growth rates are not expected to be curbed in the near future.

A closer look at the social dimension of the pattern of population distribution, especially in low-income areas and informal settlements, indicates that residents of such areas suffer from harsh economic and environmental conditions. Many of the daily activities in low-income communities depend on using and managing environmental resources, such as water and fuel. These communities are not expected to solve their environmental problems alone; and therefore, certain interventions to improve their environment should be taken.

5.2.2. Goals

Yemen's growing population and production, combined with unsustainable consumption patterns, is putting increasing stress on natural resources. Development strategies will have to deal with the combination of population growth, health of ecosystem, technology and access to resources.

The major goals of development include poverty alleviation, secure livelihoods, good health and quality of life, including improvement in the status of women. Certain issues need specific attention including: food security, basic shelter, essential services, such as education and primary health. Among the crucial aim to be achieved is how the Yemeni population will develop future demands for resources. This will require building and developing population-carrying capacities, particularly, water resources, biodiversity, marine and coastal environments, wastes and land.

5.2.3. Action

Population concerns are part of the National Strategy for Environmental Sustainability (NSES). For this reason, Yemeni institutions specialized in demography and human resources development to improve population projection techniques, and forecast possible outcomes of current human activities. One possible outcome is major migrations as a result of climate change and the cumulative environmental transformations that impact locals' livelihoods.

The environmental sustainability of Yemen requires specifically the following:

- Primary education to all Yemeni children by 2025 and providing wider access to women for secondary and higher level education as well as vocational and technical training.
- Reducing infant and child mortality rates by 2015 Yemen should aim to achieve a rate below 35 per 1 000 live births and under-five mortality rate below 45 per 1 000.
- Reduction of maternal mortality by ½ the 2000 by 2015. Disparities in maternal mortality between geographical regions, socio-economic and ethnic groups should be narrowed.
- Access to reproductive and health services including family planning secured and availed. Family-planning counseling, pre-natal care, safe delivery and post-natal care, prevention and appropriate treatment of infertility, treatment of reproductive tract infections, sexually transmitted diseases and other reproductive health conditions; and education, counseling, as appropriate, on human sexuality, reproductive health and responsible parenthood. Services regarding HIV/AIDS, breast cancer, infertility, delivery and abortion should be made available.

►

6. NEAP 2005-2010

6.1. Water

Table 29 presents the activities planning and executed in NEAP 1996, the remaining tables under this heading, i.e., Tables 30-35 are driven from the sector strategy.

Table 29 Water depletion, pollution and supply

NEAP Priorities	Projects/ Activities undertaken/ Status	Key-Results	Budget	Donor
Strengthening of NWRA	Sustainable water Resources Management Program, YEM/97/200	national water resources strategy & policy, water law, water resources management action plan for Taiz, work in progress on preparation of 4 water resources management action plans for Tuban-Abyan, Saadah and Hadhramout, watershed management policy, opening of two NWRA branches in Taiz and Sana'a, awareness activities, several technical studies, water assessment studies, establishment of information system including, documentation of information, adoption specification of drinking, reuse of waste water for irrigation water, industrial, water and waste water standards, irrigation policy	5.5	UNDP, NL, WB
Dev. of a National Water Resources Information System			4.6	UNDP
Design of a comprehensive Water Law			0.1	NL, UNDP
	Integrated water resources management proggramme (on-going and currently being re-planned)	Capacity development (NWRA and MoWE), water basin planning and implementation, strategic planning, water monitoring, awareness, information management	3.15	UNDP Govt
	Dutch Direct Budget support to NWRA (on-going)	Capacity & institutional building, strategic planning, basin level water governance & co management, Financial audit and value for money audit	2.3 (2005)	NL
	Sadda water basin management project(on-going)	Water basin management plan for Sadda, water supply		KWF
	Sana'a Water Basin project(on-going)		30	WB
	Support to the technical secretariat of the High Water Council	Technical studies, Capacity building		UNDP
Improvement of rural and urban water supply services	Govt WB Rural Water Supply project SFD, PWP, UNDP-Nexen Masila project Rada water supply and sanitation model-project,	NWSSIP Urban water supply Rural water supply Reform of water sector	WB 29.4 Masila 2	Govt, KFW, GTZ, WB, UNDP, Nexen, CIDA
	Watershed management and waste water management	Capacity building, Pilot intervention Awareness raising	4.0	NL MoA
	Regional Network for	Capacity building for increased food production through improved management of available	2.5	UNDP

NEAP Priorities	Projects/ Activities undertaken/ Status	Key-Results	Budget	Donor
	Supplementary Irrigation and Improved Water Management at the Farm Level	water resources		
Economic control of water waste and water pollution		Water pricing, still needs improvement	0.1	Govt
Institutional issues related to urban water supply and sanitation	Technical Secretariat for WSS Sector Reform	WSS projects under implementation and/or preparation (all include EIA): - ISSNB III (RNE) - IS Aden braches (EU) - Adaptable Lending Program (WB) - PTP I and II (KfW) awareness raising check Hans Mayer - other studies Establishment of new corporations and autonomous utilities with community representation Re-organize national institutions: establishment of regulator (quality standards) Establishment of sector benchmarking PSP for Sana'a Corporation Investment planning for sector Preparation of by-laws and regulations to ensure autonomy of utilities Donor co-ordination activities Development and monitoring HRD-project Public awareness	Budget TSW/GTZ is 1.5 mil $ Budget of all donors committed to WSS sector is 400 mil $	GTZ WB NL Arab Fund, Islamic Bank

Table 30 Action plan for sector management and coordination

Issues and strategies	Action
Consolidating sector institutions	► MWE by-law and organizational chart in mid-2004 ► Outsourcing to private sector and NGOs ► Staff incentive scheme
Improving the quality of sector investment and of financing through AFPPF	► Financial planning to improve utilization of available funds ► MWE to join the Board of AFPPF ► AFPPF to finance some water resources management activities and water use efficiency programs ► Encouraging the donors to contribute to the financing of the AFPPF
Managing water quality	► Establish a water quality coordination group
Recovering control over groundwater	► Decentralize to the water basin committees within basin plans ► NWRA to make necessary coordination to improve water law enforcement, including local authorities ► Implement the water plans of Taiz, and Sa'adah Basins, monitor and scale up lessons ► Carry out a study on the economic incentive structure for water use in various sectors ► Pilot projects including a test of tradable water rights in Taiz ► Stakeholder symposium to identify further actions ► Prepare strategy on "policy for rational use of groundwater

Table 31 Action plan for water resources management

Issues and strategies	Actions
The institutional framework needs to be strengthened to enable NWRA to carry out its mandate	
Institutional strengthening and sector coordination	► Water Forum ► Delegation of authority to local authorities / Councils

Issues and strategies	Actions
Strengthening community-based organizations	► Providing support to local communities for basin co-management
Water resources management planning	► Preparation of IWRM plans for selected basins ► Monitoring implementation of IWRM plans
Strategic initiative for human resource development	► Degree oriented training program (Diploma and Masters degrees) ► Skills development (short term training) ► Study tours ► Centre of Excellence for resource economics
Information, awareness, and vision are needed to improve sector governance	
Strengthening water resources information base	► National water well census ► Water resources assessment ► Decision support system
Strengthening water resources monitoring system	► National hydro-meteorological monitoring network ► National observations wells grid ► Strengthening NWRIC ► Water quality lab
National and regional information campaigns	► Water education program ► Awareness campaigns
Water sector investments and public goods need to be rationalized	
Providing water resources management infrastructure	► Terrace rehabilitation ► Recharge structures ► Water harvesting pilots ► Wastewater re-use pilots
Property rights need to be secured and a conducive macroeconomic environment created	
Monitoring, implementation and enforcement	► Expansion of NWRA branches network ► Establishment of more community mobilization teams ► Implementation of Taiz IWRM plan ► Monitoring implementation of IWRM plans ► Implementing licensing, registration & other provisions of water law ► Pilot project for establishing groundwater rights ► Pilot project for rights-based water transfer (rural/urban, inter-basin) ► Project for industrial pollution prevention ► Project for promotion of water saving devices

Table 32 Action plan for urban water supply and sanitation

Issues and strategies	Actions
Need to expand coverage	
Expand the investment program to meet the MDGs.	► Program and finance investment 2005-9 ($750 mn) ► Increase absorptive capacity (staff and contractor training) ► Criteria given to prioritize investments for the poor etc.
Continuation and deepening of reform program	
Continue reform program after evaluation	► Define relations between LCs and PUs in a by-law ► Pilot the idea of a governorate water office in Hudeida ► Complete decentralization of remaining NWSA-branches
Develop regulation, monitoring, support and policy functions	► Study, then establish regulatory function for WSS ► Redefine and revise NWSA tasks ► Set up performance indicator system
Improved orientation of policies towards poverty reduction and financial sustainability	► Cost recovery (only for O&M and depreciation of electro-mechanical equipment) ► Government pays for new schemes, replacements,

Issues and strategies	Actions
	extensions ► Lower cost technology to be introduced ► Study block tariff system and revise it with a pro-poor view ► Poorest of the poor to be dealt with by charity and social safety nets
Promote private investment and public private partnership (PPP)	► Phase in PPP at the operation stage through management contracts and "Utility Support Programs" ► Develop outsourcing, to reduce over-staffing
Improve utility performance	
Building capacity and improving performance	► Capacity building to improve performance: loss reduction, O&M, financial management, senior management, project implementation and management ► Project management and contractor training to improve absorptive capacity
Enhance community participation	► Choice of methodology in small towns, plus public awareness
Sourcing water	► Pilot projects in desalinization of brackish water and swapping treated effluent for fresh water

Table 33 Action plan for rural water supply and sanitation

Issues and strategies	Actions
Increasing coverage and project (scheme) implementation capacity	
Setting up sector strategy and coordination	► Sector strategy and investment program to be further developed and finalized ► Central office for sector reform to be set up ► Decentralization of GARWSP to governorate branches
Improve implementation	► Develop common approach to be followed by all entities operating in the sector ► Capacity building ► Community contracting
Broaden (diversify) the range of partners	► Give NGOs access to finance ► Establish fast track procedures for small projects ► Encourage low-cost technology
Improve technology choices	
Technology choice is limited, and may not be always appropriate	► Develop technical advice material ► Priority to simple low-cost solutions
Factor in sanitation and hygiene	► Sanitation to be obligatory ► Hygiene education to be systematic in GARWSP work program
Sourcing the water	
Ensure water resources and quality	► Work with NWRA and EPA within basin plans ► Local education and awareness also needed
Improve targeting and sustainability	
Adopt bottom-up approaches throughout and mainstream gender	► Demand responsive approach and community based organizations to be standard
Maintain sustainability through closer work with community institutions	► User associations/committees to be self sustaining financially
Target finance to greatest need	► Establish transparent bottom-up application process and decentralized approval system for allocation of investments

Table 34 Action plan for irrigation and watershed management

Issues and strategies	Actions
Sustainability through water resources protection and allocation	

Issues and strategies	Actions
Reduce groundwater mining	► Revise incentive structure, support WUE and user self-management ► Support water-saving technology ► Pilot projects in community groundwater management
Securing farmers' water rights	► Implement water law ► Recognize farmers' use rights ► Promote awareness regarding water rights
Getting the incentive framework right	► Carry out a study leading to review of the incentive framework
Increasing farmers' incomes through increased water use efficiency	
Refocus agriculture research and extension	► Revitalize research based on economic returns and comparative advantage, with emphasis on water use efficiency and rain-fed agriculture, using participatory techniques and integrating socio-economic factors ► Reinforce extension, with national coordination and focusing on WUE
Cost recovery on public irrigation schemes	► Implement full cost recovery progressively
Developing water user associations (WUAs)	► Develop WUAs in spate areas and ultimately hand-over schemes to them
Treat Qat as a crop	► Implement the program on Qat agreed at National Conference on Qat
Enhancing resource sustainability and quality through watershed management	
Revive watershed management with an integrated approach	► Implement A21A ► Support integrated programs and research on rain-fed systems
Review and revise the dams program	► Review and evaluate the experience gained so far, establish guidelines and planning, involve beneficiaries and local councils
Strengthening the institutions for a better role in realizing efficient agricultural water use	
Repositioning MAI	► Implement "A21A", starting with pilot
Enhancing institutional coordination on agricultural water use	► MAI/MWE coordination ► Dams etc. screened by MWE/NWRA, according to the law ► Decentralize NWRA; establish field presence, awareness and education.
Improving effectiveness of AFPPF	► See the action plan on sector management and coordination
Increase community organization and civil society role	► Monitor current WUA pilots, learn and scale up ► NGOs to be service delivery partners

Table 35 Sector Investment Indicators ($ millions) –(see NWSSIP 2005-2009)

Sub-sector		Total required 2005-9	Donor funds committed pipelined	Local financing Expected	Net required finance	Per cent of total sector investments
Water resources management		47	20	7	20	3
UWSS	Hardware	750	355	265	130	49
	Software	48	25	--	23	3
RWSS	Hardware	454	78	101	275	30
	Software	28	6	--	22	2

Irrigation		190	64	56	70	12
Environment		21	2	--	19	1
Sector Funds 2005-9	Total	1 538	550	429	559	100
	Per cent	100	36	28	36	

6.2. Biodiversity

Table 36 Action Plan 1996 for Biodiversity

NEAP Priorities	Projects/ Activities undertaken/ Status	Key-Results	Budget	Donor
1 Habitat Degradation	Conservation and sustainable use of biodiversity, Project I (1997-2001)	Zoning Plan for Socotra, team of 70 nationals is fully in charge of programme unit in Socotra, local communities sensitized and trained on sustainable biodiversity conservation, technical studies made on the island and its biodiversity.	5.0	GEF UNDP
	Conservation and sustainable use of biodiversity project, Phase II (2001-2003)	Capacity building Pilot protected areas Coordination unit	1.14	NL UNDP
	Socotra Masterplan (2000-2002)	Development of a coherent Master Plan, 69 project concepts 7 project proposals	1	EU
	Water health and environment (2001-2002)	improved watershed database, maps watershed infrastructure restructuring of the peripheral health units, training	0.9	UNDP, I
	Basic needs support	Preparatory assistance, baseline data collection on health, gender Basic health services equipment	0.6	UNDP
	Forestry Development Phase IV Implementation of Socotra Conservation zoning plan (on-going)	Capcity development, Extension services Information collection system Development of project document for implementation of Socotra zoning plan	3.2	Switzerland
2 National inventory and database development of fauna and flora	SP 2: Advice to land resources management,	GIS system at AREA	0.31	UNDP
3 Preparation of a Costal Zone management plan	CZM project	Balhaf CZMP, Aden CZMP	1.0	GEF WB
	Protection of the Red Sea & Gulf of Aden Program SAP	Habitat surveys, Demonstration activities, EIA		WB, GEF-UNDP UNOPS, UNEP, Islamic

NEAP Priorities	Projects/ Activities undertaken/ Status	Key-Results	Budget	Donor
	Protection of Marine Ecosystem of the Red sea coast of Yemen	Surveys of marine habitats & resources Training of national counterparts, including EIA Initial monitoring program GIS system Awareness	2.8	Bank GEF, UNDP
	Protection of Marine environment from land based pollutions	Assessment and studies on pollution from land based pollution, awareness raising	0.06	Belgium / UNEP
4 Constitution of Eco-tourism dept. at GTA	SP 5: Sustainable Environmental management: Promotion of Eco-Tourism Fisheries Development Project Phase Four	Ecotourism department established Eco-tourism strategy Report about potential of Ecotourism in Yemen Training in Eco-tourism disciplines Publications: guidelines on ecologies …	0.2	SP5 UNDP WB, EEC
General:	Biodiversity Strategy & Action Plan	Technical studies flora and fauna, coastal habitat, agro-biodiversity, socio-economic, traditional practices, Strategy and action plan, national report to CoP of biodiversity convention.	0.4	GEF-UNDP
	PAM project	Technical and socio-economic studies, PAM plans for Hawf and Gabal Bura	0.7	GEF-WB

The current Strategy for Biodiversity included the following projects as part of the action plan:

- Establishment and Development of a Comprehensive National Integrated Protected Areas System in Yemen (NIPASY)
- Development and Implementation of an Integrated Coastal Zone Management Plan (ICZMP)
- Development and Implementation of Policies, Legislation and Regulations on Biodiversity Issues in Yemen
- Essential Measures for the Conservation of Agrobiodiversity in Yemen
- Reviving Traditional and Indigenous Knowledge in Natural Resource Management Systems
- National Biodiversity Education and Awareness Program
- Regulations and Guidelines for Biosafety

6.3. Land degradation

Table 37 Action Plan to Manage Land Degradation

NEAP Priorities	Projects/ Activities undertaken/ Status	Key-Results	Bud-get	Donor
Establishment of land use planning center to promote land zoning and registration	SP 2: Information & Advise on land resources management	Capitalize on Dutch support to build the natural resource center, institutional development, GIS system, soil classification & mapping, training and capacity building	1.3	SP2/ UNDP Gov.

NEAP Priorities	Projects/ Activities undertaken/ Status	Key-Results	Bud-get	Donor
	Environment Resource assessment for Rural land use planning	Establishment national land resource data base, Land use advisory service Training and capacity building Land use survey, land evaluation , agro-economic and agro –sociologic analysis, l and use planning techniques	4.9	NL
Implementation of priority projects for desertification control:	SP 3: Planning for desertification control: Desertification Control action plan Wadi Hadramoud Agricultural development Project Tehama Environment protection project	National Desertification Control Action Plan, training and capacity building Evaluation of desertification and preparation of desertification maps Sand dune stabilization, west of Wadi Shihamm Establishment of windbreaks in farming areas in Hadramout Environment Protection in Tihama/ green belt Windbreaks and sand dune stabilization	2.0	UNDP Gov. IFAD Gov. WB
	Land & Water Conservation Project Ground water and soil conservation project (on-going) Taiz Municipal Development and flood Protection Project	Water conservation, Rehabilitation and construction of dams Flood control Capacity building and training Water harvesting Irrigation efficiency	40 53 50	WB
Promotion of traditional grazing reserves and modern pest management	IDAS	Awareness, income generating initiatives		GTZ

6.4. Waste management

Table 38 Action Plan for Waste Management

NEAP Priorities	Projects/ Activities undertaken/ Status	Key-Results	Budget	Donor
Waste Management	GTZ waste management project in the MoPWUD Ibb rehabilitation project	Guidelines for landfill identification and operation National waste management Principles Working in 6 districts including Socotra Waste treatment plant	2 mill Euro	GTZ GTZ
Closure/	Study for new	Study for new sides, criteria for selection		GTZ

NEAP Priorities	Projects/ Activities undertaken/ Status	Key-Results	Budget	Donor
replacement of waste disposal site Sana'a & elsewhere	sides, criteria for selection	Identified potential sides for Sanaa, Ibb Selection of new side in Aden, EIA made		
	Waste Treatment plants	Sewage waste Treatment plants: Sana'a, Ibb, dhamar		Loan from the Islamic Bank
Privatization of solid waste collection & recycling	Private sector involvement in solid waste collection in Sanaa, Hodeida, Hadhamout	No clear policy, contracts cancelled Private sector initiatives of recycling of Plastic, glass, shoes, carton, metal		Govt Private
Privatization of treatment storage & disposal of hazardous waste	Develop a strategy for hazardous waste	Draft strategy for hazardous waste management	0.02	UNEP
Regulation of hospital waste treatment and disposal				

6.5. Institutional

Table 39 Action Plan for Institutional Capacity Development

NEAP Priorities	Projects/ Activities undertaken/ Status	Key-Results	Budget ($ mill)	Donor
Institutional		Institutional/policy and legal framework Development: 1990: Environment Protection Council (EPC) 1995: National Water Resources Authority; Environment Protection Law 1996: National Environment Action Plan (NEAP) 1999: Water policy 2000: Constitutional amendment introducing an article stating that environment protection is the responsibility of all and a national and religious duty. 2001: Ministry of Tourism and Environment, Environment Protection Authority 2002: Water Law, Desertification Control Action Plan, Environment Investment Plan 2003: Ministry of Water & Environment 2005: NWSSIP and Biodiversity Strategy and Action Plan approved		
National level: Capacity	Dutch III Partially	Analysis of environmental legislation Training & study tours	2,0	NL

NEAP Priorities	Projects/ Activities undertaken/ Status	Key-Results	Budget ($ mill)	Donor
building of EPC and it's TS	successful (25%)	Equipment Environment information management systems		
	Dutch II	Human resources development plan for EPC, Training Water & waste water standards EIA policy Support to Environment Library, First Annual report on the status of Environment 1995 Environmental awareness: Environment Magazine, workshops, Environment Clubs in schools, summer camps, cooperation with media (TV, newspaper), information material, school curricula Studies: Hodeidah fish kill study, Ground water pollution in Sanaa Basin, Beach pollution study, Pesticides on Quat, Traditional irrigation systems in Shabwa and Hadhramaut; environmental effects on Marib Dam Equipment	2,0 (5.8 Dfl)	NL
	Dutch I	Studies on environmental issues: waste oil, plastic waste, land fills, industrial impact soil erosion, Sanaa water basin, environment profile in 3 provinces, vegetation maps Environmental awareness, weekly newspaper page, bulletin, seminars, TV spots Training, study tours Equipment Analysis of environmental problems & drafting recommendations for implementation	1	NL
	Sustainable Environmental Management, SP1: Coordination of Support to Environmental Management	Identification of priority needs Preparation of 10 project proposals (one funded: trans-boundary movement, Basel Convention, waste management UNEP see below) Training in environmental fields Guidelines for environmental management Program for environmental information system Setting up the donor data base Environmental indicators	0,29 0.35	UNDP Gov.
	Strengthening Coordination Capacity of EPA (PMU)	Donor information system Training on project proposals and external support requirements	1.3	UNDP
	Strengthening environmental planning and management 1992-96	Development of Sustainable environmental management and program Reports Traditional practices of environmental practices (4governerates) Awareness raising Support to data management Equipment Training	0.2	UNDP
	Sustainable natural Resources Mgt program	Capacity building, information system, education, legal framework, Protected Area management with livelihood improvement approach	1.9	UNDP Govt

NEAP Priorities	Projects/ Activities undertaken/ Status	Key-Results	Budget ($ mill)	Donor
	(ongoing)			
	Air pollution station	equipment		Japan
	EIA Environmental Information system (GIS)	Industrial zoning Mukalla Equipment Expert consultancies Training	0.4	Escwa FAO Japan
	Environmental awareness raising in schools (MoE)	Improvement of sanitation services at schools		GTZ
Regional level: Disaster preparedness at Aden and Hodeidah ports for oil spills	No activities		3.0	
Local level: Pilot program for improvement of env. Conditions	SP 4 Community participation in land resources management GEF Small Grant Porgarmme (on going) Coastal women intervention under Sustainable Environment Management program Dutch support to Environment NGOs	SP4: 172 rural interventions including rehabilitation of traditional water harvesting systems, wadi protection, water schemes; documentation of traditional practices SFD, PWP: sanitation projects, waste management projects, rural roads GEF SGP: strategy, proposal collection 4 communities at the red sea: Kokah, Tuhita, Luhia, Kubah Training centers, training centers Awareness raising for women using local resources to improve family income	SP$: 2.7 SGP: 0.2 (for 2005) Coastal Women 0.3 NL: 0.07	UNDP, GEF-UNDP NL

6.6. Systemic Issues

Table 40 Action Plan for Systemic Issues

Projects/ Activities undertaken/ Status	Key-Results	Budget	Donor
Enabling activity climate Change	National Communication Climate Change Studies (finished 2001) 7 working groups 3 national workshops establishment of a Climate Change Expert Technical Team (CCETT) 5 technical reports	0.3	GEF-UNDP
National Adaptation Prrogramme of Action	Technical studies on the impact of climate change on agricultural crops, fisheries, water resources Regional consultation Development of NAPA document	0.2	GEF-UNDP
Second National Communication	Preparation of a project to support development of the Second national communication to the CoP of the UNCCCF	0.02	GEF-UNDP

Projects/ Activities undertaken/ Status	Key-Results	Budget	Donor
Ozone Depleting Substances Program, private sector	Capacity development, ozone depleting programme of action support to private sector to replace ozone friendly technologies	0.12	GEF UNEP
National Recovery and Recycling program for refrigerants in the commercial and MAC Sectors	Provision of materials and equipment training	1.4	GEF- UNDP
POPs	Persistent Organic pollutant programme on action	0.4	GEF/ UNEP
Renewable energy project	Wind energy atlas Rural energy Renewable energy strategy Solar panel piloting Capacity building	GTZ: 1 GEF: 2	GTZ GEF- WB

ANNEX 1: MONITORING AND EVALUATION

Basic Elements of an M&E Framework

Monitoring, evaluation, and other feedback generating activities play important roles in assessing program performance, achievements, and shortcomings[100]. See Box (12). Information gathered under the auspices of monitoring and evaluation is key to regulatory and legislative modification.

Monitoring begins during the implementation phase, not after as regular documentation of both implementation activities and effects allows for comparison and evaluation of action strategies, approaches and impacts on local conditions for use in future performance evaluation. Certain programs, such as biodiversity protection, depend heavily upon diligent monitoring activities to gauge and maintain system health.

Generally, monitoring is required for internal management purposes, whereas evaluation and feedback activities have both external and internal applications and are important for guiding planning and resource allocation, maintaining accountability to stakeholders, informing the public, and signalling when plans must be altered.

Box 5 Monitoring, evaluation and reporting

Monitoring is a continuous process of collecting and analyzing information to measure the progress of a project toward expected results. Monitoring provides project managers and participants with regular feedback that can help determine whether a project is progressing as planned.

Evaluations are periodic assessments of project performance and impact. Evaluations also document what lessons are being learnt from experience. Generally, individuals involved in managing a project are charged with monitoring. By contrast, individuals independent of project operations conduct evaluations.

Reporting is the systematic and timely provision of essential information. It is an integral part of the monitoring and evaluation function. Monitoring, reporting and evaluation are management functions, which could also be described as observing project progress (monitoring), documenting the observed information (reporting) and assessing on the basis of the above (evaluating).

Evaluation is strongly recommended, particularly for smaller projects that are innovative or strategic i.e. experimental, pilot or demonstration projects; or projects that could have major repercussions on development policies. Moreover, an evaluation is a combination of learning and accountability, and in this sense, can be differentiated from an audit (just accountability) or research (just learning). Though they vary in the scope of their application, it is important to keep in mind that monitoring and evaluation work together to achieve the same purpose. M&E supports accountability, informed decision-making, and learning from experience.

i. Project Document

A project document is a legally binding contract and it is an important record of what the project sets out to accomplish and should be used as a constant point of reference. The project document frequently referred to as prodoc, forms the basis of M&E. Project managers and independent evaluators verify results against what is written in the project document. The project document is the master document that contains most of the pieces necessary for an M&E framework (logframe, timetables, TORs, etc.).

However, the project document should not be regarded as a rigid framework. An integral part of the M&E exercise is to appraise the validity of the project document in the context of new or changing environments. If necessary, a substantive revision can be proposed to recuperate its relevance.

[100] This section is drawn from GEF/UNDP manuals on M&E that are applicable to NEAP projects.

ii. Logical Framework Approach

The logical framework (log frame) approach is now being widely adopted. Developed in the 1970s, the log frame has been used by a variety of development agencies. Its purpose is to provide a clear, rational framework for planning the envisioned activities and determining how to measure a project's success, while taking external factors into account. It encompasses the systematic analysis of stakeholders, problems, objectives, and helps to identify indicators and assumptions.

The strength of the log frame is in the analysis. Analysis of problems and objectives can be done through drawing problem and objectives trees. The tree, which is an analytical tool, determines cause and effect relationships and sheds light on the root causes of the deeper threat to environment. A log frame workshop should be carried out during a project's development stage. The Project Planning Matrix (PPM) is a one-page summary of a project's log frame and should be attached to the project brief.

iii. The 9-Step Logframe Process

1. Analysis of Stakeholders clarifies the views and interests of the major actors.
2. Problem Analysis compares the different viewpoints to identify and build consensus on the central problems and their underlying causes and effects.
3. Objective Analysis examines the possible objectives of the project in view of the resources available, and the expectations, interests and motivations of the stakeholders.
4. Analysis of Alternatives systematically identifies and selects the most realistic measures that will lead to achievement of the objectives.
5. Project Planning Matrix provides an overview of the project's goals, purpose, outputs, assumptions, indicators and means of verification.
6. Intervention Strategy is a descriptive summary of the Project Planning Matrix.
7. Verifiable Indicators are performance parameters that translate objectives into measurable indicators for monitoring and evaluation.
8. Means of Verification detail the methods for acquiring evidence that objectives are being met.
9. Assumptions/Risks identify important conditions that are outside the direct control of the project but which must hold true for the project to achieve its objectives.

Below Table 38 is the five-by-four Project Planning Matrix (PPM).

Table 41 Log frame Matrix (Project Planning Matrix)

		Project Strategy	Indicators	Means of Verification	Assumptions/ Risks
1	Global Environmental Objective				
2	Immediate Objectives				
3	Outputs				
4	Activities				
5	Outcomes				

As can be seen in the diagram above, the log frame lays out the project's strategy (first column) and the causal relationships between the components (vertical logic), indicates how to check whether these components have been achieved (second and third columns) and establishes what assumptions outside the scope of the project may

influence its success (fourth column). The logical framework is used for preparing, implementing, and evaluating a project.

This matrix should result from a participatory process by all stakeholder representatives. Before a project starts, the log frame builds a sense of communication and cooperation among stakeholders. Another distinctive feature of the logical framework is the emphasis given to underlying risks and assumptions. On the other hand, it is neither a cure-all nor does it ensure project success. The importance of the log frame should not be exaggerated. After all, it is simply a planning tool that can help those who prepare and implement projects to structure their ideas in a clear, standardized form.

iv. Objectively Verifiable Indicators

Clearly, under the log frame approach to project management, objectively verifiable indicators are an important element of project design, implementation, and evaluation. Therefore, one of the most important aspects of M&E is the choice of suitable and meaningful indicators. An indicator is a qualified/quantified parameter that details the extent to which a project objective has been achieved within a given timeframe and in a specified location. For instance, an indicator measuring conservation of biodiversity might look at the change in the area (km^2) of habitat protected.

Above all, indicators must be practical and realistic and should, whenever possible, be meaningful and consistent with the main objectives of the project. In discussing indicators, a useful acronym to remember is: SMART (Specific, Measurable, Attainable, Relevant and Trackable).

An indicator can also be considered a signal that shows the change in a parameter compared to a baseline or a future target. Due to the empirical nature of indicators, a project proponent and an external observer will both reach the same conclusion about the project's progress. By specifying project objectives in more concrete and verifiable terms, indicators allow an impartial and indisputable assessment of whether a particular objective has been achieved. The project team should go one step further and interpret what the indicator means in the context of the project.

M&E methodologies are dependent on well-developed sets of indicators. Indicators provide the basis for before and after analysis and describe the effects of project interventions, positive and negative, anticipated and unanticipated, intended and unintended. They can be grouped into two categories:

a. Indicators of implementation progress, that is the delivery of technical services, capital inputs with related disbursements and the resulting outputs generated (facilities created, activities and participatory processes organized, people trained, etc.);

b. Indicators of environmental impact in local and global terms that demonstrate the environmental accomplishments.

The choice of indicators and their source of verification are governed, among other things, by considerations of the costs involved in collecting the relevant data. Excessively complex or numerous indicators lead to high costs, which could be a reason to seek other, more indirect indicators, for which the data are easier to obtain, so requiring less research and entailing less expense. For example, instead of conducting a survey on income, the number of bicycles sold in the village might be counted.

When in doubt, a "common sense" approach should be used. Never should the choice of indicators take up so much time that project managers lose sight of why they are establishing the indicators in the first place. It is far more important to direct resources toward project implementation than to come up with scientifically precise, detailed

indicators. In other words, the project should not be driven by the indicators but rather by its objectives.

That said, indicators direct attention to whether the objectives and intended impacts of the project have been achieved, whereas previously the emphasis was mostly on the provision of inputs, and simply ensuring those inputs yielded the planned outputs. Until the advent of indicators little attempt was made to assess impact, yet it is the eventual impact that is the true criterion of project success.

While it is not possible to establish a particular set of indicators for all projects, it is possible to provide general guidelines on how to formulate indicators during the planning stage of a project. In particular, the following questions should be answered as part of the process of establishing indicators:

- ✓ Are the objectives and outputs clearly stated?
- ✓ What changes are anticipated as a result of achieving the project objectives and outputs?
- ✓ What are the criteria for judging the success of the project?
- ✓ Anticipating the end of the project, how would one know if the objectives have been achieved?
- ✓ Are the key stakeholders participating in the establishment of indicators?
- ✓ Are the data, which are necessary to measure change against a baseline or target, available at reasonable costs?

An ideal set of indicators would include indicators of implementation progress and impact. One must make sure that changes in an indicator are attributable to project activities and not an external factor.

v. Assumptions

Assumptions are conditions that are outside the direct control of the project, but which are so important that they will have to be met or have to hold true if the project is to achieve its objectives. In formulating assumptions, one should ask the following three questions, as detailed in Figure (6).

vi. Standard Section on M&E for Project Brief and Documents

The Monitoring and Evaluation section of the Project Brief and Project Document should include the following:

(a) Brief description of standard M&E procedures such as APR, PIR, mid-term and final evaluation, inception report, financial reports, updating and revising work plan and budget, terminal report and terminal reviews.

(b) Brief description of specific M&E procedures such as substantive review or steering committee meetings, submission of progress reports and technical reports, and so on.

(c) An M&E plan should be developed outlining in detail the following:

- ✓ Timetable: When are the crucial M&E activities supposed to take place during the lifetime of the project (APR, PIR, audit, evaluations)?
- ✓ Reporting requirements: What are the formats and frequency of reporting?
- ✓ Data collection: What kind of data will be collected, when, by whom and where?
- ✓ Responsibilities: Who will be responsible for the M&E tasks?
- ✓ Budget: What are the costs for each of the M&E tasks?

Compliance with the tasks specified in the M&E plan should be monitored and adjustments should be made as appropriate.

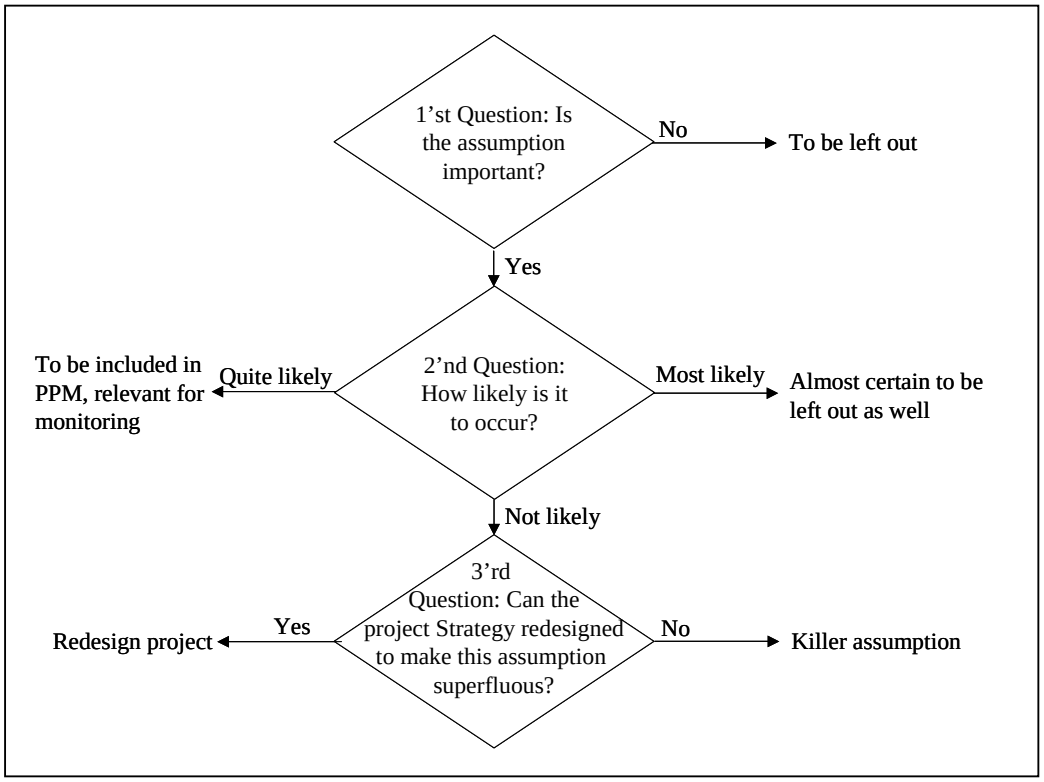
For each of the standard and specific procedures the following issues should be addressed:

- ✓ Mechanisms and tools that will be used;
- ✓ Schedule and responsibility (who is preparing reports and convening meetings, composition of the steering committee, identification of target groups); and
- ✓ Resources allocated for each M&E task.

Furthermore, the M&E section should refer to the indicators and benchmarks documented in the log frame matrix and specifically address the question of provisions, costs and methodologies for baseline data collection, data collection at regular intervals during implementation, and ex-post data collection and monitoring.

Last but not least, some insights should be given on how lessons that have been learnt elsewhere are incorporated into the project design and how the project is going to extract, document and disseminate its own lessons learnt. Learning and feeding back lessons are crucial to "close the loop" of the project cycle. In turn, these lessons will be applied to the next project.

Figure 22: Formulating assumptions



vii. Costs

It is necessary to allow adequate provision at the outset of the project for baseline data collection, independent evaluations, and all other M&E activities. Costs should be broken down by component and by type of input. They should be expressed in local currency and foreign exchange, specifying the source of financing and, where applicable, to financing arrangements.

Typically, M&E costs comprise 10-15 percent of a project's total budget. These costs should be included in the project budget on the respective budget line. Standard costs (APR, PIR, mid-term evaluation, final evaluation and terminal report) and project-specific costs (surveys to collect baseline data, workshops, M&E specialists, etc.) should be taken into account.

viii. Inception Report and Work Plans

The inception report constitutes the finalization of project design and presents the overarching work plan as well as the first detailed annual work plan. Project managers are required to prepare work plans at the beginning of project implementation and then annually thereafter. Work plans put the project document into operational terms by describing in detail the provision of inputs, activities, and expected results for the project in a given year or for the life of the project. Moreover, they clearly indicate schedules and the persons or institutions responsible for providing the inputs and producing results. In conjunction with the PIR, APR, and other evaluations, these work plans constitute an important basis for monitoring the progress of a project.