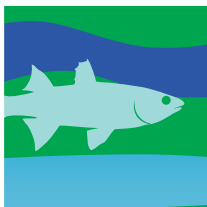
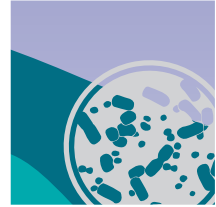


COUNTRY REPORTS



THE STATE OF **YEMEN'S**  
BIODIVERSITY FOR FOOD AND  
AGRICULTURE

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Republic of Yemen  
Ministry of Agriculture and Irrigation  
Agriculture Research and Extension Authority  
National Genetic Resources Center.

# Yemen's Country Report contributing to The State of the World's biodiversity for Food and Agriculture



August 2016

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## List of Abbreviations

ACAP	Agro-Biodiversity and Climate Adaptation Project
ACSAD	The Arab Center for Studies in the Arid Zones and Dry Lands
AFD	French Agency for Development
AOAD	The Arab Organization for Agricultural Development
AREA	The Agricultural Research and Extension Authority
ASL	Above Sea Level
BFA	Biodiversity for Food and Agriculture
CA	Coastal Area
CAMA	Civil Aviation and Meteorology Authority
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanism
CEPF	The Critical Ecosystem Partnership Fund
CFSS	Comprehensive Food Security Survey
CFSS	Comprehensive Food Security Survey
CHM	Clearing House Mechanism
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CN	Country Note
CSO	Central Statistics Office
DGCS	The Italian Directorate for Development Cooperation
DO	Dissolved Oxygen
DPR	Development and Poverty Reduction
DRM	Disaster Risk Management.
EA	Ecosystem Approach
EIA	Environment Impact Assessment
EP	Eastern Plateau
EPA	Environment Protection Authority
EPL	Environment Protection Law
<i>ESDIP</i>	<i>Environment and Sustainable Development Investment Programme</i>
FAO	Food and Agriculture Organization
FRA	Forest Resources Assessment
GDFRDC	The General Directorate for Forestry, Rangelands and Desertification Control
GDP	Gross Domestic Product
GEF	The Global Environment Facility
GIS	Geographical Information System
GIZ	The German International Cooperation
GoY	Government of Yemen
GPA	Global Plan of Action
GSMC	The General Seed Multiplication Corporation
HDI	Human Development Indicators

HES	High Education Strategy
HL	Highlands
IBRD	Climate Information System and PPCR Program Coordination
ICARDA	The International Center for Agricultural Research in the Dry Areas
IMCCC	Inter-Ministerial Committee for Climate Change
INC	Yemen's Initial National Communication
ITK	Indigenous Technology and Knowledge
IUCN	The International Union for Conservation of Nature and Natural Resources
KBAs	Key Biodiversity Areas
LDC	Least Developed Countries
MAI	Ministry of Agriculture and Irrigation
MDG	Millennium Development Goals
MoWE	Ministry of Water and Environment
MPIC	Ministry of Planning and International Cooperation
MSBRA	The Marine Sciences and Biological Research Authority
NAPA	National Adaptation Programme of Action
NAPCD	The National Action Plan to Combat Desertification
NBSAP	The National Biodiversity Strategy and Action Plan
NCSA	National Capacity Self-Assessment
NEAP	<i>National Environmental Action Plan</i>
NFSS	National Fisheries Sector Strategy
NGOs	The Non-Government Organizations
NGRC	The National Genetic Resources Center
NHRC	The National Honeybee Research Center
NLRC	The National Livestock Research Center
NSBAP2	Yemen's Second National Biodiversity Strategic and Action Plan-2
NSES	<i>National Strategy for Environmental Sustainability</i>
PGRFA	<u>Plant Genetic Resources for Food and Agriculture</u>
PPCR	Pilot Program for Climate Resilience
PRSP	<i>Poverty Reduction Strategy Paper</i>
PSC	The Potato Seed Company
RARSs	The Regional Agricultural Research Stations
ROY	Republic of Yemen
SNC	Second National Communication
SPCR	Strategic Programs for Climate Resilience
SSFs	Small-Scale Fisheries
UN	The United Nations
UNCCD	United Nations Convention to Combat Desertification and Drought
UNDP	United Nations Development Program
UNFCCC	The United Nations Fund for the Convention of Climate Change
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
WANA	The West Asia and North Africa
WWF	The World Wide Fund for Nature "an international non-governmental organization"

## EXECUTIVE SUMMARY

This report is on the state of Yemen's biodiversity for food and agriculture prepared as a partial contribution from Yemen towards the preparation of the universal report about the State of the World's Biodiversity for Food and Agriculture (SoWBFA). It aims to document knowledge on the state and trends of the biodiversity in Yemen for food and agriculture; identify major drivers and their impacts on biodiversity in the prevailing production systems, document the state of institutional settings and measures of conservation and sustainable use of biodiversity. The report also sheds lights on the country's policy framework include and extent of implementation of such policy and implications to genetic resources of plants, animals, forests, habitats and the ecosystems in general. The report uncovers the major gaps relating to conservation and use of biodiversity and delineated future action plans.

The report was prepared in accordance to the guideline advanced by the Food and Agriculture Organization of the United Nation (FAO), which aims to facilitate the integration of reports from various member states into one report on SoWBFA

Yemen enjoys a diverse physical and topographic features and hence its climate ranges from tropical, sub-tropical and temperate starting at its long coastal line (2250 km) towards the highest mountainous northern highlands areas (about 2700 m asl). Located at the cross-roads of the African, Asian, and Palearctic ecological zones, and with a wide range of terrestrial, coastal, and marine landforms, Yemen is characterized by a rich variety of natural habitats, species and genetic diversity, including many endemic species. These Resources are of major economic importance because of their potential for tourism and the wildlife and fisheries they support.

The country is divided into 5 main agro-climatic zones and includes 14 sub-zones that vary in their local climatic conditions. The population of the country reached about 24 million in 2004 and growing at an annual rate of about 3% which is one of the highest in the world. This, by itself constitutes a great pressure on the originally limited resources of the country including the biodiversity. Majority of the population (about 70%) live in the rural areas and rely on agriculture as a source of living. About 45% of the Yemeni labor force work in the agriculture sector which contribute about (17%) of the country's GDP. However, out of the total land area of Yemen only (1.6 million ha) is arable, which form about (3 %). The main crops grown in Yemen include: cereals (sorghum, maize, barley, wheat and millet), legumes and many fruit and vegetable crops including coffee and Qat with the latter as one of the most competitive crop for its higher market demand and high profitability as compared to other crops. Therefore, its cultivation expanded rapidly to occupy more land at the expense of other strategic food crops especially those, which are more economically feasible to import from other countries. The Qat crop has also demonstrated some negative impact on biodiversity along with some other positive ones as explained in this report. Qat is mainly produced for local market and has no export value. Goat, sheep, cattle, camel and donkeys are the most common animals forming the Yemeni livestock wealth (about 20.9 million heads) besides poultry.

Yemeni male and female farmers possess a vast experience and knowledge on plant cultivation, soil conservation, water harvesting, animals rearing, honeybee rearing and honey production and other varied agro-techniques that made biodiversity an important element of household and community life.

In view of the accelerating population growth, the limited land, scarcity of water and other climatic factors influencing farming, the prevailing traditional practices and the low crop productivity, the government through its research agency (AREA) tried to find some solutions to overcome farming and productivity problems. More research work focusing on genetic enhancement has been conducted and led to the development and release of many high-yielding, pest-resistant and stresses tolerating varieties.

Thus, the yield of some crops has increased especially sorghum, maize and wheat. But, Wheat production covers about 7-9% of the country's need. The production of fruits and



vegetables has rapidly improved leading to an increase in self-sufficiency in some items to 90-100% and to an export quantities of some other commodities.

Forest biodiversity in Yemen though are limited (mainly Houf in Almahah and Bura'a in Hohdiedah which are declared as PAs), but agroforestry practices in Yemen is a long standing expression of the importance of complementarity of various biodiversity elements. Varied forests resources including rangeland provide timber, grazing, medicinal and medicinal and other non-woody products as well as food items.

About 2871 plant species were recorded in Yemen, 15% of them are endemic. Socotra Archipelago is unique in its flora and like many oceanic islands has a high level of endemism. The latest study reported that Socotra Archipelago contains approximately 825 plant species, 307 (about 37%) of which are endemic. However, the number of invasive alien plant species is gradually increasing. Additionally, the country's biodiversity as a whole is faced with a number of threats be they natural or human-made interventions and factors, most important of which are: the high population growth, increasing poverty, modernization and construction of infrastructure, urbanization, socio-political and armed conflicts as well as climate change and natural calamities.

In response to the deterioration of local genetic resources, the National Genetic Resources Center was created, and by now it has collected, documented and preserved seeds of crops and other plants for about ( 6000 accession). The government also declared 7 biodiversity rich locations as protected areas (PAs). Yemen has already signed and ratified a number of conventions, treaties and agreements relating to biodiversity, climate change, endangered species and other relevant pacts. Many other interventions have also been made in cooperation with world organizations and governments. This is represented in numerous projects and programs throughout the country.

However, only meager work has ever been done in terms of animal genetic resources and the other components of associated biodiversity in general especially macro organisms, which are essential in the provision of supporting ecosystem services critically important in agricultural production, such as water purification, waste treatment, nutrient cycling, soil formation and gas regulation.

In this regard, the report revealed a serious lack of information and information databases, a scarcity of studies, research, surveys, a weak institutions performance and coordination among different public and civil sectors stakeholders.

The report made a reference to the NBSAP2 which included numerous actions planned for future improvement of biodiversity conservation and use in the country, the implementation of which is envisioned as remedial counter measures to various problems, and threats.

## Preparation of the Country Report

Following AREA's nomination of the focal point or the Coordinator of the report preparation, Dr. Maeen Ali ALjarmouzi, the DG of the National Genetic Resources Center (NGRC), a letter was sent on this issue to various related agencies requesting the assignment of their representative in the report preparation team. On the other hand, visit were made to some agencies and meeting were held with officials and specialists to discuss their contributions. However, some of suggested specialists and scientist have declined from joining the team and apologized either due to the time constraints, the pre-determined engagements, leave outside the country or in their home villages in rural areas, or for some other cases due to not being able to accept the task given the current circumstances in the country (problems of security and difficult mobility, lack of power supply and the like). After negotiations and repeated contact and exchanging views and opinions with concerned officials within AREA and with other institutions the team was formed (List of team member in the Annex).

The Coordinator exerted great efforts to collect relevant documents from different resources. He made paper and electronic copies and circulated to team member alongside with report preparation guideline's. A number of formal and informal meetings were also held with some or most of the accessible team members where questions were answered, clarifications made and fruitful discussions were undertaken.

An initial deadline was made to receive contributions form members. Received inputs of members were integrated into a pre-draft file, which was also circulated to all members to solicit feedback, corrections and additions.

For the purpose of keeping in touch and motivating the team, at least two email and whatsapp groups were created and managed. Exchange of ideas, material and drafts was a very active throughout the mission. The whole process demanded a great deal of follow up efforts to be exerted using personal visit, phone contact, email, watsapp, the use of some social media network among others.

The Draft copy was finally dispatched to FAO, Mrs. Belanger who kindly made some important reactions and remarks, which were turned back to the team members for additional work and extra development and fine-tuning.

At this juncture, a series of meetings that brought together team members and other invited specialists from different agencies were organized in the training rooms of the national agricultural training center (NATC) located within the premises of AREA-HQ. More than 20 participants took part in these meetings, during which an introductory sessions about the report, followed by discussions were organized. Participants then were distributed to 4-5 working groups that were formed to work out some of the issues raised in the report and that demand some discussion and agreements among experts and specialized persons. Each group selected a group head to organize and manage the group discussion and a secretary to write down notes on the discussion and make a report. Each group's head reports the output at the end of the session. These were really very vivid and fruitful group discussions that provided the report with solid and meaningful portions.

The 1st draft copy, accordingly, was further enriched by all team members and the gathered additions and new contributions were again incorporated into a 2nd draft of the report, which was also re-sent this time not only to team members themselves but also to all workshops participants through email alongside with the workshop agenda and invitation letter.

At least 2 main workshops were conducted on the report attended by more than 60 persons representing different public and civil organizations from different parts of the country. The 1st workshop was conducted in Dhamar in 9th August 2016 and attended by the Acting Minister of Agriculture and Irrigation Mr. Ali Alfadheel, a representative of the Governor of Dhamar Province and more than 40 participants. The 2nd workshop was conducted in Sana'a AREA office in 10th August and attended by AREA Chairman, Assistant FAO Representative in Yemen, officials from MAI and more than 15 participant representing different government and civil organizations (names of participants in both workshops are listed in annex.

Each workshop started with a data show presentation of the report made by the focal point/national coordinator, followed by a general discussion session, a short tea break and another longer session of group discussion. Interaction, remarks and comments made by participants were documented in reports by assigned members. Reports of general sessions and group discussion sessions of the organized meetings and workshops were then collected and used to improve the 3rd and final draft of the report to be submitted to the office of the genetic resources authority of FAO, Rome, Italy.

The whole process of the report preparation took place during the period June-August 2016 with participation of many relevant agencies to biodiversity for food and agriculture include AREA, and its branches (8 regional research stations and 5 specialized research center), MAI and main departments (Forestry, animal, rural women, plant production), Universities (Dhamar, Sana'a, ALbaidah and Hadhramout), faculties of agricultural, science, Ecologies and Marine Biology, The Environment Protection Authority (EPA), The Marine Science and Biological Research Authority (MSBRA), other government institutions, NGOs among others (full list of workshops' participants and their agencies/disciplines are provided in report's annex)

# Chapter 1: Introduction

## 1.1 General overview of the country

**Question 2. In a few paragraphs, provide a synthetic overview of your country, including the size, location, and main physiographic and climatic features. Include a section on human population, providing disaggregated data on women and men's contribution and involvement in agriculture. Briefly discuss as well the overall nature and characteristics of the economy, including the contribution of the different sectors. You may wish to draw upon the country overviews provided in the first chapters of previous and ongoing Country Reports on Forest, Aquatic, Animal or Plant Genetic Resources.**

The Republic of Yemen (ROY), which covers a total land area of 527970 km<sup>2</sup>, is located at the Southwestern edge of the Arabian Peninsula between 12° and 20° north of the Equator and between 41° and 54° east of Greenwich. The ROY includes more than 180 islands, the largest of which are Socotra in the Arabian Sea and Zoqar & Kamaran in the Red Sea. The country is bordered by Saudi Arabia to the north, Oman to the east, the Arabian Sea and the Gulf of Aden to the south, and the Red Sea to the west. Apart from the broad and flat coastal plains which border the Red Sea (Tihama) and the Gulf of Aden, the rest of the country reveals a very dissected and pronounced topography to the west and south and a more gentle, less pronounced topographic expression to the east of the country. It has a 2,250-kilometer coastline along the Gulf of Aden and the Red Sea.

The topographic characteristics of the country reveal a large contrast in elevation, especially in the western part of Yemen. Broad and flat coastal plains border the Red Sea (Tihama) and the Gulf of Aden. They frame the strongly dissected mountain massif of western Yemen, where elevations range from few hundred meters to about 3760 meters above sea level. The eastern slopes are more gradual than the steep western and southern slopes; they range gradually into the depression of Ramlat As-Sabatayn desert in the Empty Quarter. The topographic appearance of the eastern part of the country is somewhat less pronounced, but noteworthy are the topographically elevated belt parallel to Wadi Hadramaout (northern and southern Hadramaout Arcs), the broad and steep-side Wadi Hadramaout canyon and the topographic depression of Al – Ghaydah of Almahra province

Based on Van der Gun and Abdul Aziz (1995) and Robertson (1991), Yemen could be divided into five main physiographical regions 1) the Coastal Plains, 2) the Yemen Mountain, 3) the Eastern Plateau Region, 4) the Desert, 5) the island.

Some of Yemen's ecological zones are confined to small areas (e.g., islands & forests, ...), with human communities, flora and fauna highly adapted to subsist within them. Other zones are much larger (e.g., Highlands & coastal plains) and support the majority of the country's agricultural production, and unique biodiversity of exuberant fauna and flora. (EPA, 2015a)

The Socotra Archipelago (Yemen) is globally recognized for its outstanding biodiversity and endemism, designated on this basis a UNESCO World Heritage Site in 2008. The island underwent long geological and political isolation, ensuring preservation of unique ecosystems until the start of the new millennium. Now, Socotra Island is undergoing rapid development, out of balance with conservation.

Yemen is characterized by diverse physical and topographical features, which are composed of mountain chains, plateaus, and plains. This variation has resulted in wide differences in climatic conditions and consequently, the formation of different agro-climatic zones. The climate ranges from hot sub-tropical climate in the lowland region to a temperate climate in the central mountain region. The maximum temperature in the summer may rise up to 40°C in the lowland with high humidity and the desert region being dry. In the winter, the temperature may decrease below zero in the high mountain region. The mean annual temperature ranges from 11°C in the highlands to 30°C in the lowlands. Detailed records, summaries and analysis of climatic data for the whole country is presented in the study carried out by Bruggeman (1997), which divides the country into 14 agro-climatic zones based mainly on climatic characteristics .

With regard to food crops, the selection of priority crops in the main Agro-ecological zones was presented and discussed during a workshop in Dhamar (in April 1998) with experts from AREA. As a result of this workshop and the preceding analysis, the following priority crops have been selected:

- Coastal Area (CA): (Al-Hodeidah, Lahj, Abyan, Al-Mahara and Aden); Millet, Sorghum, Tomatoes, Onion, Banana, Oranges, Cotton and Sesame
- Highlands (HL): (Sana'a, Hajjah, Sadah, Al-Mahwit, Dhamar, Ibb, Taiz and Al- Beida): Maize, Millet, Sorghum, Wheat, Grapes, Tomatoes, Potatoes, Onion, Cow Peas, Qat\*, Coffee\* and Alfalfa
- Eastern Plateau (EP): (Mareb, Hadramawt, Al-Jawf and Shabwa): Sorghum, Wheat, Dates, Tomatoes, Potatoes, Onion and Alfalfa. (Schlund et. al., 2013).

**\*Qat and Coffee:**

Qat or Khat,( *Catha edulis* Forsk) a stimulant plant, is one of the important aspects of the Yemeni life. It is grown as a cash crop mainly in the highlands areas but widely consumed (fresh leaves and shoots are chewed) in different parts of the country. Its cultivation has jumped from about 45,000 ha in the 1980s to more than 140,000 ha in the 2000s. It is accused not only of consuming most of the already scarce water resources (mainly underground water) in the country, but also of the farmer's abandoning of other food and cash crops cultivation such as sorghum, maize, wheat, barley and coffee.

In fact, Coffee crop was one of the historic well-known crops in Yemen from the ancient time by "Moca" or "Arabica coffee". However, Qat cultivation dramatically expanded at the expense of other crops mainly due to its relatively low-water needs, the widening demand and local market absorbability, and the higher profitability for growers. Therefore, qat crop is reckoned as a major threat to biodiversity and degradation of some local species and cultivars. (Ward and Gatter, 2000: pp. 108).

Yemen's wetlands can be divided into natural and man-managed systems. The former includes four subdivisions: a) Marshes and lagoons, around Aden, which form a suitable refuge for several species of birds; b) Mangrove sites in the Tehama "west coast of Yemen" and Bir Ali on the southern coast, c) Valleys and permanent streams all over the country

which support all kinds of freshwater biodiversity, including microorganisms, various invertebrates, fish, amphibians, birds, and many plant species, d) The swamps of Taiz, the only known site in Yemen for the globally threatened Bald Ibis *Geronticus eremicus*. The man-managed systems, on the other hand include the lake of Marib Dam which is the largest freshwater body within the Arabian Peninsula. This lake can play an important role in the conservation of large numbers of freshwater species.

Over 186 islands lie in the seawater of Yemen with distinct climatic and natural characteristics. More than 151 of these islands lie in the Red Sea region. Among those located in this region: Kamaran Island is the largest, and Mayoon Island, located in the Bab Mandab Strait, has a strategic importance. Most corals and coral habitats exist around the Yemeni islands, but with different species communities. (AL-Gunaid, 2005).

The percent of the population is expected to be 31.6 million inhabitants by 2020. The high rate of annual population growth (3.01%) is attributed to the high fertility rate, caused by low female education and employment. Between 2000 and 2012, the percentage of urban population rose from 26% to 32% percent. In rural areas the percentage decreased from 74% in 2000 to reach 68% in 2010 and this is caused by an increased immigration to urban cities. High urbanization caused a proliferation of unplanned settlements and accompanying environmental degradation in cities, resulting in inability of Yemen's municipalities to provide the necessary land, service, and facilities which in turn caused significant threats to human health, biological resources, and ecosystems productivity. The growing population at the current rate increases the pressures on natural resources and the corresponding ecosystems capacity to survive and deliver their services sustainably. It increases the demands on foodstuff, scarce water resources, urban space, etc., causing significant increase of waste & pollution, which in turn, puts additional pressure on social services, and contributes to loss of biodiversity and agricultural land.

The increasing population of Yemen combined with unbalanced socio-economic development is the underlying cause of migration of rural population and hence the loss of farmlands to meet imbalanced population increase in urban areas. The migration from rural areas has adversely affected agricultural production on the one hand and has caused concentration of population in a few big cities on the other. Such unabated increase of population & migration causes higher pressures on limited resources & services, such as food, energy, water and timber in both rural and urban areas.

Poverty in Yemen is also more pronounced in rural areas. The rural areas forming 68% of the total population, accounts for 84% of the poor in the country. Therefore, rural poor adds more pressure on natural resources to meet their daily needs of livestock, fuel wood, crops and fodders. The poor are one of the population groups most reliant on environment for their livelihood. At the same time, this group is the most affected by environmental problems and the way natural resources are exploited. Yemen's gross domestic products (GDP) per capita was about 1,100 US\$ in 2009 and about 40 percent of the population lives in poverty.

In 2013, Yemen ranked 154 according to the human development Indicators (HDI). As one of the least developing countries (LDC), Yemen experiences numerous development challenges which include high population growth rate and poverty, inadequate access to basic social services, limited infrastructure, high illiteracy rate, low per capita income, slow economic growth and environmental degradation. There are also large gender disparities, with significant gaps in women's access to economic, social and political opportunities.

Biodiversity is an important issue that does not only refer to the environmental challenges, which affect natural resources and its life; but it affects also the quality of life, especially the vulnerable groups such as the poor, women and children. Since the majority of the Yemen population are rural dwellers whose main livelihoods depends on access to natural resources, poverty will tend to rise when biodiversity declines and vice versa. As such, any efforts to reduce poverty in Yemen, must constantly be accompanied by proper biodiversity conservation measures. The Poverty Reduction Steerage Paper (PRSP) acknowledges the relationship and linkages between poverty issues and environment protection.

The current trends in socio-economic development and natural resource's use pose significant threats to biodiversity & ecosystem loss. Poor economic growth and continued imbalances characterized the structure of the GDP and reduced the potential for job creation. Hence, unemployment rose from 12 % in 2000 to 29 % in 2011. Although, Yemen economically depends mostly on declining oil resources, the opportunities offered by oil revenues have not been adequately exploited to transform the structure of the economy and achieve adequate socio-economic development. However, the weak governance and absence of a culture of rule of law is also a major challenge on the way ahead to achieve adequate socio-economic development. (EPA, 2015a).

## ***1.2 Role of biodiversity for food and agriculture***

***Question 3. Provide a summary of the role of biodiversity for food and agriculture in improving food security and nutrition, the livelihoods of farmers, pastoralists, forest dwellers and fisher folk, ecosystem health and sustainability of production systems in your country. Specific attention should be given to associated biodiversity, ecosystem services and to wild foods. The summary should also draw attention to the ex situ and in situ conservation of biodiversity for food and agriculture, the most significant aspects of use to improve food security and nutrition in the country, major changes observed in the last 10 years and the main factors causing changes. Significant risks or dangers to the conservation and use of biodiversity for food and agriculture may also be highlighted.***

In Yemen, biodiversity resources are of major economic importance because of their potential for tourism, the wildlife and fisheries they support. Also, numerous plants are used in traditional medicine, in local industries, for grazing and fuel wood. In other words, Yemen biological resources are an integral part of its natural heritage with the potential for yielding long term benefits for the Yemen people and as a foundation for economic growth, poverty reduction, and sustainable development.

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

- Yemen, is located at the junction of several biogeographic zones. Situated at the heart of major flyway, provides an important habitats for migratory birds and marine resources.
- Five main geographic regions are represented across Yemen mainland and islands
- Yemen is an important center of endemism for wild relatives of domestic crops and has long been a center for breeding and selection of cultivated plants and livestock.
- Most components of social and economic development in Yemen can be related, directly or indirectly, to biodiversity. Biodiversity is related to various socio-economic aspects of life including professions, food, health, housing, clothing, recreation and tourism, and beliefs and norms such as social occasions and festivals rituals in sorrows and joys alike. It is linked to environment, ecosystems, climate, maintenance and management of natural resources such as soil and landscapes. Rural inhabitants forming majority of the population, still rely on plants and livestock wealth (including honeybee) for their income and livelihood. Similarly, quite considerable segment of urban population depend on biodiversity as a main source of living especially those working as middlemen, merchants, sellers and other some services

providers. Yemenites have hunted, fished, gathered and nurtured the plants and animals of Yemen for centuries and their uses of natural resources are continuing today.

- Plant biodiversity products provides important natural raw materials like leaves, fruits, and grain as feed and in food industry.
- Livestock breeds are diverse and provide wide genetic pool for improvement.
- Large number of Yemen flora are extremely important sources of natural and commercial medicine that are widely used as healing material in traditional medicine (aloe, dragon plant, euphorbia, succulents etc.)
- Landscapes have important aesthetic and recreational value and provide tourism attraction.
- Coastal areas and islands have provided the seafood for local people and export
- Yemen's forests, woodlands, agro-forestry and rangelands biodiversity deliver a wide range of direct & indirect benefits to Yemeni peoples & to environment. The direct benefits are derived in the form of fuel wood, fodder, fruits, medicinal plants and honey products among others. Indirect benefits are provided by services for retaining ecosystems functions such as pollination and protection of agricultural products, and prevention of water and soil erosion (EPA, 2015a).

### ***1.3 Production systems in the country***

***Question 4. Indicate, for each of the production systems listed in Table 1 below, whether it is found in your country or not (Y: yes, N: no), regardless of its importance.***

Table 1. Production systems present in the country.

<b>Sector</b>	<b>Code</b>	<b>Production system names</b>	<b>Present (Y/N)</b>
Livestock	L1	Livestock grassland-based systems(tropical)	Y
Livestock	L5	Livestock landless systems(tropical)	Y
Forests	F1	Naturally regenerated forests(tropical)	Y
Aquaculture and Fisheries	A1	Self-recruiting capture fisheries(tropical)	Y
Aquaculture and Fisheries	A9	Fed aquaculture (tropical)	Y
Crops	C5	Irrigated crops (tropical)	Y
Crops	C9	Rainfed crops(tropical)	Y
Mixed	M1	Mixed systems (livestock, crop, forest and /or aquatic and fisheries): tropical	Y

***Question 5. List in Table 2 the production systems that have been identified as occurring in your country in Table 1, indicating the codes***

**and/or the names of the production systems as provided. Provide a description for each production system.**

Table 2. Description or characterization of production systems within the country Production system Description

Code	Name	Description
L1	Livestock grassland-based systems	<p>Rangelands constitute major land area ca. 42.8% of the country land area being 22600 thousand ha. It plays major role supporting the livelihood of rural communities around Yemen through providing fodder for animals, fuel wood and timber, medicinal plants, recreational value and watershed management and wildlife, biodiversity storage and ecosystem services (UNCCD, UNDP, 2000).</p> <p>This system includes almost all cattle bred to produce milk in addition to about 90% of sheep and 5% of camels and goats. This system is dominant in Yemen.</p>
L5	Livestock landless systems	<p>These systems are limited and confined to government, cooperative and private sectors farms mainly for milk production or fattening both sheep and cattle. The estimated number of animals kept under these systems is less than 5% of total domestic animals. All cattle bred for milk production are of exotic breed of European cattle (Friesian). Also there are cooperative farms producing milk from local breed and cross bred animals in the form of flying flock at the outskirts of some cities e.g. Hodiedah and Lahj governorates. Also this system includes poultry sector that is well developed to cover most of country need from eggs and meat. There is also traditional poultry sector that prevails in coastal area and rare under traditional and low productivity management.</p>
F1	Naturally regenerated forests	<p>Forests and woodlands are an important Production systems, extending along the coastal line, valleys and high mountains, Forests area 549 thousand hectare, woodlands area 1406 thousand hectare, Total Ratio to total land area 3.7%. <a href="#">FAO (FRA 2010)</a>.</p> <p>Forests and woodlands characterized with wide plant diversity play a significant socio-economic role in achieving food security &amp; poverty alleviation for livelihoods of rural communities and supports more than million small holders. Some of the products included timber, fuel wood including charcoal, fodder, medicinal plants, honey production, fruits, wild meat and provided important raw materials for the industry the utensils and handicrafts, and multi-functional as habitat for wild animals, pollinators, also protect the soil ; water and crops for Production systems (Rainfed crops and Irrigated crops).The remnant natural forest and woodlands provide essential habitats and refuge for wildlife.</p>
A1	Self-recruiting capture fisheries	<p>Yemen is located in the southwest corner of the Arabian Peninsula and is bounded by 2520km of coast line that extends along the Red Sea, the Gulf of Aden ,and the Arabian Sea .Yemen's fisheries sector is exclusively marine, with no inland or freshwater fisheries.The fisheries sector is considered to be particularly important due to the social and economic benefits it provides to coastal communities and the wider community. At both national and local levels, fisheries contribute to food security, employment, domestic income, foreign exchange earnings, and fiscal revenues.</p> <p>The fishing industry is dominated by the small-scale sector,</p>

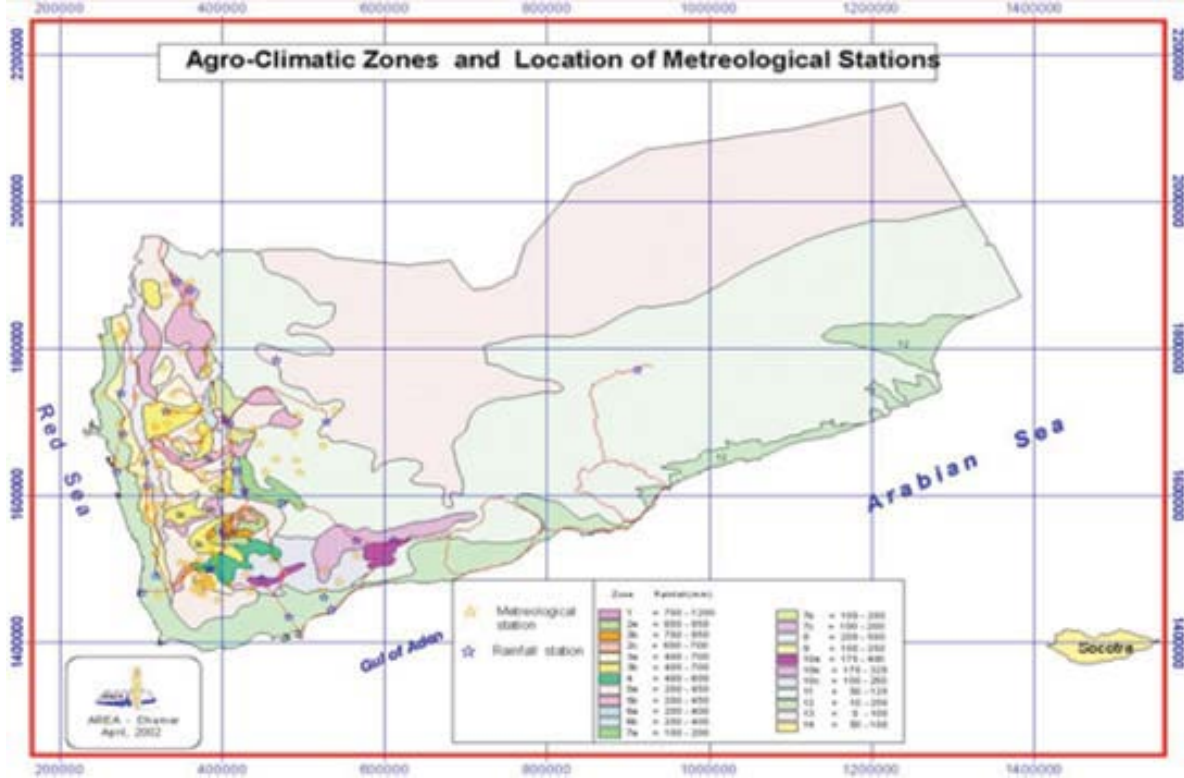


		<p>which currently supports the livelihoods of an estimated 83,157 small-scale fishermen and 583,625 of their dependents, for a total of about 667,000 people.</p> <p>In addition, an unknown but relatively a large number of people are also engaged in post-harvest processing, marketing, and value addition. The fisheries sector contributed 1.9% of Yemen's \$26.24 billion gross domestic product in 2009. After oil exports, fisheries constitute the second largest export earner and account for 1.5% of the national labor force, supporting the livelihoods of 3.2% of the national population. The fisheries industry, with its largely rural location, remains the largest if not the sole source of income for coastal communities. (Alabsi, and Komatsu 2014).</p> <p><b>Major fishing methods of artisanal fishers.</b></p> <ul style="list-style-type: none"> <li>- Hand lining</li> <li>- Surface long lines</li> <li>- Cast nets</li> <li>- Gill nets</li> <li>- Round-haul</li> <li>- Trolling (Trolling lines are used to catch large pelagic fish)</li> <li>- Shrimp trawling</li> </ul> <p><b>Major species of fish caught in Yemeni waters :</b></p> <p><b>Pelagic</b>  Sardines                      <i>Sardinella longiceps</i>  Ind. Mackerels  Tunas  Kingfish  Sharks  Emperors  Cuttlefishes</p> <p>Despite the lack of reliable statistics, current landings are falling in the Red Sea from around 46300 t. in 2014 to 15782 t. in 2015. for SSFs Small-scale fisheries</p>
A9	Fed aquaculture	<p>Aquaculture is not yet a major contributor to fish production and no information is available about feeding.</p> <p>Yemen's first and the only commercial shrimp farm called 'Musallam Aquatic Farms' has set up on the Red Sea coast at Al-Luhayyah 170 km north of Hodeidah city. This facility consists of a hatchery of 40 million seed capacity and 50 grow-out ponds (50 hectares) to produce 400 t/ yr. (6-8 t/ha)</p> <p>The farm produced 380 t. of Indian white shrimp (<i>Penaeus indicus</i>) in its first year (2005). But the production output scaled down gradually in the following years. Poor water quality (large amounts of contaminated water or poor circulation in large coastal lagoon), and abiotic factors like heavy organic load in pond bottom, presence of pollutants, low DO problems and high stocking densities. These environmental factors negatively influenced the sustainability of the shrimp farm at Al-Luhayyah and directly affected the growth rate and survival in the grow-out ponds, but the production from this farm continued and sold in both the local and regional markets, but there has been no production after</p>

		<p>it was hit by a Saudi-led coalition airstrikes in Oct 8, 2015. The Government operated Aquaculture Research Centre (ARC) that carries out marine shrimp and finfish aquaculture development research and demonstration in the country under Marine Science and Biological Research Authority (MSBRA) its currently in the condition that needs complete repair of its facilities</p> <p>The Aquaculture Research Centre in Aden, established in 1988, and the privately owned Musallam Farm, established in 2004, are the only two operational aquaculture facilities in the country. At the Aquaculture Research Centre the main species currently studied as suitable aquaculture candidates are the Indian white shrimp (<i>Penaeus indicus</i>), the green tiger shrimp (<i>Penaeus semisulcatus</i>) and the goldlined seabream (<i>Rhabdosargus sarba</i>).</p> <p>Production from the ARC is still only on an experimental scale, with an annual production of about one tonne of shrimp.</p> <p>Shrimp is the main product from aquaculture and while there is a good domestic market, especially in hotels and restaurants, the markets in European, East Asia and the USA are the most lucrative.</p> <p>To date there is still no measurable contribution from aquaculture to the Yemeni economy since the sector has yet to develop operations of significant commercial scale.</p>
C5	Irrigated crops (other)	<p>There are two types of irrigation under this system. These are flood(spate) irrigation which is basically used in lower escarpement and coastal plains and deltas. Crops predominantly grown under this system are sorghum (grain and fodder), millet, cotton, cucurbits, legumes, sesame and groundnuts. The second system is wells and springs irrigation farming system. It forms the base of intensive agriculture mainly for cash crops such as qat, vegetables, fruits and forage crops. Under such system intercropping and crop rotations can be easily utilized.</p>
C9	Rainfed crops	<p>This system can be classified into three categories:</p> <ol style="list-style-type: none"> <li>1. The low rainfed system with rainfall average &lt; 450 mm,</li> <li>2. The moderate rainfed with rainfall average between 450–620 mm; and</li> <li>3. The high rainfed system with rainfall average &gt; 600 mm.</li> </ol> <p>Major crops grown under rainfed farming are : sorghum, wheat, barley, millet and legumes. Barley is considered to be the base of dry land farming system in the highlands while millet is a marginal crop of low lands and sand dunes. Generally rainfed farming system is considered as the base of agriculture where more than 77% of the total cultivated area is under this system.</p>
M1	Mixed systems (livestock, crop, trees (Agro-forestry))	<p>Yemeni agro-forestry systems are very old and varied. They are encountered in most ecological areas supporting farming land use systems, its area 500 thousand hectare, cover 0.9% of the total land area of Yemen (FRA 2010), which are very important to local populations in terms of food security, income generation and environmental protection. The ecological and socio-economic importance of traditional agro-forestry systems is now widely recognized, the trees are there to perform various functions ranging from provide various products including fruit, construction wood, fuel-wood, fodder, honey etc. They are also protection of the</p>

		Agriculture lands of sand encroachment and sand blasting, drying wind effect, water erosion, sunshine, animals etc (UNCCD, UNDP, 2000)
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**Question 6. Provide a map of production systems in your country, marking the places and regions mentioned in the Country Report.**



**Question 7. For each production system found in your country (refer to Table 1), indicate in Table 3 the area under production (km<sup>2</sup>, hectares, acres, other). If not applicable, indicate the estimated production quantity (major products aggregated) using the appropriate unit or measure (tonne, head, inventory, cubic metre, etc.) for the production system. If available, indicate the contribution of the production system to the agricultural sector economy in the country (%). Please use the most recent data available and indicate the year of reference for the data or estimates. Specify NK if not known or NA if not applicable.**

Table 3. Area under production, production quantity and contribution to the agricultural sector economy of production systems in the country.

Code PS	Name PS	Area (indicate unit)	Production – quantity (indicate unit)	Contribution to the agricultural sector economy (%)	Reference year
L1	Livestock grassland-based systems(tropical)	22,600,000 ha. (The actuation from natural pastures represents only 53%)	20 million	20%	<i>Agricultural Statistics Year Book (MAI,2012a</i>
L5	Livestock landless based systems(tropical)	255148 ha	>5% of total domestic animals		Country Pasture/Forage Resource Profiles 2006
F2	Naturally regenerated forests(tropical)	1,955,000 ha			2010
A1	Self-recruiting capture fisheries(tropical)	700 000 (thousand ha)	238,000 ton	1.9% of Yemen's GDP	2009
A9	Fed aquaculture (tropical)	400 ha	600 ton	NK	2014
C5	Irrigated crops (tropical)	693000 ha	NK	NK	2010
C9	Rainfed crops(tropical)	695000 ha	NK	NK	
M1	Mixed systems (livestock, crop, forest and /or aquatic and fisheries): tropics				

**Question 8. Comment on the effects on biodiversity for food and agriculture of production destined for exportation versus production for local and/or national consumption. Where information is available, indicate for each production system the proportion of production that is destined for export, the major commodities involved, the impact on the methods of production (e.g. adoption of specific production practices to meet export needs) and the implications for biodiversity.**

Specific species of fish and other marine life are mainly targeted for export as a result of demand in external markets and rising prices. Example of these species include Cuttlefish, cucumber Sea, Lobster, Shrimp, *Portunus pelagicus*, *Scylla serrate* and Ornamental fish in addition to a number of other types of fish. There are no standards for the operations of fish

exports accredited to cover the local market needs. This is one of the potential problem in terms of providing fish species for the needs of the local market, which cause fish price increase at the local level. Such target-specific types of fishing contributes to the degradation of bio-diversity and prejudice marine ecological balance.

Agriculture is a key sector in the Yemeni economy, and provides a main source of employment for 54% of the population. It contributes 17.5% of Yemen's GDP in 2010, according to the Central Statistics Office (CSO). Agriculture also plays an important role in food security, in improving the trade balance, and in efforts towards integrated rural development. In addition, the agriculture sector helps to stabilize the population by reducing internal migration and its related social and economic problems. The agriculture sector is also a key factor in natural resource management, and may consume up to 90% of available water in Yemen.

Forests and rangelands resources have multiple environmental and socio-economic functions important at the local, national and global scales, and play a vital part in sustainable development in Yemen. There are no reliable and up-to-date information on the state of forests and rangelands resources - not only in terms of area but also in terms of change overtime, nor on such variables as growing stock, wood and non-wood products, carbon, protected areas, use of forests and rangelands for recreation and other services, biological diversity and its' contribution to national economies. Such information if available is crucial to support decision-making for policies and programmers in forestry and sustainable development at all levels. Though Yemen has been known as the greenest country in the Arabian Peninsula, its green cover is only occupies 2455 thousand hectare, being about 4.6% of the country land area, of which 549 thousand hectare is recognized as forests; 1406 thousand hectare is classified as other woodlands; and 500 thousand hectare of the country tree cover is known as agroforestry, based on the set criteria for classification of forests, as well as 22600 thousand hectare classified as rangelands.

Yemen Forest is typified as mangrove forest, Hyphaene trees, Tihama Acacia forest, Acacia-Commiphora forest, valleys forest (Ficus spp, Acacia spp., other forest trees), and Juniperus spp. forest. The vast majority of these forests or 68% (375 thousand hectare) occur in the Central Highlands and valleys (Wadis) and the remaining 32% are located in the Coastal Plains & Al-Mahara Source. Other woodland areas in the Yemen currently amounts to 1406 thousand hectare, and are fully found in escarpment and western mountains. Yemen woodlands species in this area are classified as a combined cover of shrubs, bushes and tree, such as Tihama Acacia woodland, Acacia-Commiphora woodland, and Acacia-Commiphora woodland /shrub land among others.

Agroforestry ecosystems currently account for about 500 thousand hectare, being 0.9% of Yemen total area. Agroforestry lands are mainly the home for Yemen crop products as well as for date palm tree and shrub species which are of socio economic importance. Agroforestry occur across three physiographic regions, namely: 1) the Western Mountains; 2) the Coastal Plains and 3) the Central Highlands, including the valleys. Approximately 82% (381 thousand hectare) of Yemen agroforestry area is found in the escarpment and western mountains & the remainder of which is found in the Coastal Plains at a share of 8%, 9% and 1% respectively.

Rangelands or pasturelands cover 42.8% of the total land area of Yemen, i.e. 22600 thousand hectare. As defined by the national action plan to combat desertification, this vegetation cover "is made up of natural grasslands, agro-forestry tree and shrub formations". It comprises a wide spectrum of woody species, grasses and forbs and includes a number of succulent plants belonging to the Euphorbia and cactus-like species. Rangelands form an

important resource in view of their environmental role, provision of forage for herds and flocks and due to its economic significance as a cheap source of livestock feed. Rangelands are quite variable in their condition judged from plant cover, species composition, and degree of use.

The biodiversity for food and agriculture is a renewable resource if properly used and exploited optimally. But if this is not done, the excessive exploitation will result in harmful future repercussions, both for the resource itself or for the users of the resource. The production directed for export may have a useful economic and financial return that leads to an increase in the national economy and an improved livelihood level of per capita and the community living. But the accompanying modern practices of the intensive farming production directed for export will result in a biodiversity loss through uniform techniques and in a shortage of the important local traditional knowledge, which is gradually disappearing with this type of production. The same is applicable with the excessive use of pesticides. If such a production system lasts for prolonged durations without considering the resulting consequences on the biodiversity resources of the country, many local species and relative wild species of crops and that the future impact will be catastrophic.

Therefore, the fulfillment of the requirements of exportable produce should be balanced with conserving indigenous species and creating awareness about the importance of traditional farming knowledge. There must be a sustainable and rational use while producing for export. The production system for export is not confined only to crop farming as the exportable products may include a fishery or forest resource accompanied with the unsustainable extraction (excessive fishing) and oppressive wood cutting and capturing activities that exceed substitution rate and hence subject the concerned resource to danger and perhaps to total extinction.

## Chapter 2: Drivers of change

### ***2.1 Effects of drivers of change on associated biodiversity***

***Question 9. What have been the most important drivers affecting the extent and distribution of associated biodiversity in the last 10 years in your country? In describing the drivers you may wish to indicate the production systems where associated biodiversity is most affected and identify drivers that are common to the various components of associated biodiversity listed. Indicate where possible the indicators used to measure changes, along with the sources of information.***

**The most important drivers affecting the extent and distribution of associated biodiversity are:**

- Population growth and urbanization
- Inadequate protected areas Coverage for protect forests, woodlands rangeland ecosystems
- Unsustainable harvesting of forests, woodlands and rangelands products beyond the limits of the productive capacity of its ecosystems.
- Over-exploitation and overhunting of endemic species and endangered species
- Lack of policies, strategies, legislations, and management plans on natural resources

- Recession of traditional systems on land used, forests and rangelands.
- Lack of alternative sources of income for local communities, therefore, there over grazing , hunting, cutting and collecting plants for multiuse
- Spread of invasive species (Prosopis juliflora, Opuntia dillinii).
- Climate change associated with high risks of rain-flood and drought.

***Question 10. Where associated biodiversity is believed to be affected by climate change, please provide additional information on the nature, severity and frequency of the climate threat and the production systems impacted.***

In association to climate change, the country is already suffering from recurrent drought, rain flood, land erosion among other disastrous risks . Extreme weather and climate events such as flash floods and droughts are frequently occurring displacing thousands of people, causing loss of life and significant damage to assets and livelihoods. In 2008, the floods killed 180 people, displaced 10,000 and caused damage and losses to infrastructure, shelter, and livelihoods estimated at US\$1,638 million equivalent to 6 percent of Yemen's GDP with agriculture accounting for nearly 64% of the total losses. Increased climate variability may induce heavy economic losses and spikes in food security and hunger (for example it is estimated that the 2008 flood caused an immediate 15% increase in food insecurity of affected farmers). As Yemen exhibits a high level of food import dependency, much of this reduction in household welfare is due to projected global food price increases resulting from global climate impacts (EPA 2015a).

- Climate change is reported as a pressure habitats, and there is evidence that it is already negatively impacting coastal habitats. Predictions indicate that degraded costal land habitats, and in particular, will become less resilient to the impacts of climate change in the immediate future. These predictions relate mainly to drier summers and higher levels of more intense rainfall which are likely to result in floods and landslides, which may indirectly impact other of habitats and species such as valleys and many of coastal plains which not adequately conserve .

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

- Currently, Yemen's ecosystems and habitats are already experiencing degradation due to over-exploitation, and climate change impacts.. But unfortunately, there is no inventory or reliable and systematic recorded data and information available for impacts of the climate change on associated biodiversity. Therefore, - Lack of long-term, systematic records of rainfall and temperature severely hampers efforts to quantify long-term climate changes on components biodiversity in Yemen. (EPA 2015a).

## 2.2 Effects of drivers of change on biodiversity for food and agriculture

**Question 11.** For each production system present in your country as indicated in Table 1, fill in the code and name of each production system in Table 4 (repeat Table for each production system). For each production system indicate which drivers have been influencing biodiversity for food and agriculture, disaggregated by sector, during the past 10 years (description of drivers can be found in Annex 3). Drivers may have a strongly positive (2), positive (1), negative (-1), and strongly negative effect (-2), or no effect at all (0) on biodiversity for food and agriculture. If the effect of the driver is unknown or not applicable, please indicate not known (NK) or not applicable (NA).

Table 4. Effect of drivers on sector biodiversity within production systems in the country, by animal (AnGR), plant (PGR), aquatic (AqGR) and forest (FGR) genetic resources.

Production systems	Drivers	Effect of drivers on sector biodiversity for food and agriculture(2, 1, 0,-1, -2, NK, NA)			
		PGR	FGR	AnGR	AqGR
L1,L5,F1, A1,A9,C5 ,C9,M1	Changes in land and water use and management	-2	-2	-2	NA
	Pollution and external inputs	-1	-1	NK	-2
	Over-exploitation and overharvesting	-2	-1	-1	-2
	Climate change	-1	NK	-2	-1
	Natural disasters	-2	-1	-1	-1
	Pests, diseases, alien invasive species	-1	-2	-1	-1
	Markets, trade and the private sector	-1	-1	-1	-2
	Policies	-1	-2	-1	-1
	Population growth and urbanization	-2	-2	-1	-2
	Changing economic, socio-political, and cultural factors	-1	-2	-1	-1
	Advancements and innovations in science and technology	-1	-2	NK	NK

## 2.3 Effects of drivers of change on ecosystem services

**Question 12.** What have been the main drivers affecting regulating and supporting ecosystem services in the country during the last 10 years? Describe, for each production system identified in Table 1, the major driver(s) affecting ecosystem services and indicate the effect on ecosystem services as being strongly positive (2), positive (1), negative (-), strongly negative (-2), no effect (0), not known (NK), or not applicable (NA) in Table 5 (repeat table for each production).



Table 5. Major drivers and their effect on ecosystem services in production systems.

Production systems	Drivers	Effect of drivers on ecosystem services (2, 1, 0,-1, -2, NK, NA)								
		Pollination	Pest and disease regulation	Water purification and	Natural hazard regulation	Nutrient cycling	Soil formation and	Water cycling	Habitat provision	Production of oxygen/ Gas
C5&C9	Changes in land and water use and management	NK	-1	-1	-2	NK	-1,1	NK	-1	-1
	Pollution and external inputs	-1	-1	-1	Nk	NK	-1	-1	-1	-2
	Over-exploitation and overharvesting	-2	NK	-1	-1	-1	-1	-1	-2	-1
	Climate change	-1	-1	-1	-1	-1	-1	-1	-1	-1
	Natural disasters	-1	-1	-1	-1	-1	-1	-1	-1	-1
	Pests, diseases, alien invasive species	-1	-1	-1	NK	-1	-1	-1	-1	-1
	Markets, trade and the private sector	NK	-1	NK	NK	NK	NK	NK	NK	NK
	Policies	NK	1	NK	NK	NK	NK	NK	1	NK
	Population growth and urbanization	-1	-1	-1	NK	-1	-1	NK	-1	-1
	Changing economic, socio-political, and cultural factors	-1	-1	NK	NK	NK	NK	NK	-1	NK
	Advancements and innovations in science and technology	NK	1	1	NK	NK	1	1	NK	NK



Production system	Drivers	Effect of drivers on ecosystem services (2, 1, 0, -1, -2, NK, NA) (Place pointer on the ecosystem service name for a detailed description)								
		Pollination	Pest and disease regulation	Water purification and waste treatment	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Habitat provisioning	Production of oxygen/ Gas regulation
A1	Changes in land and water use and management	NA	0	NK	1	-1	NA	NK	1	NK
	Pollution and external inputs	NA	-1	NK	NK	-1	NA	NK	-1	NK
	Over-exploitation and overharvesting	NA	0	NK	-1	NK	NA	NK	-1	NK
	Climate change	NA	NK	NK	0	NK	NA	NK	-1	NK
	Natural disasters	NA	NK	NK	0	NK	NA	NK	NK	NK
	Pests, diseases, alien invasive species	NA	NK	NK	0	NK	NA	NK	NK	NK
	Markets, trade and the private sector	NA	NK	NK	NK	NK	NA	NK	-1	NK
	Policies	NA	NK	NK	0	NK	NA	NK	1	NK
	Population growth and urbanization	NA	NK	NK	NK	NK	NA	NK	NK	NK
	Changing economic, socio-political, and cultural factors	NA	NK	NK	NK	NK	NA	NK	NK	NK
	Advancements and innovations in science and technology	NA	NK	NK	NK	NK	NA	NK	NK	NK
	Other [please specify]:									
A9	Changes in land and water use and management	NA	-1	0	NK	NK	NA	NK	-1	NK
	Pollution and external inputs	NA	NK	NK	-1	-1	NA	NK	-1	NK
	Over-exploitation and overharvesting	NA	NK	NK	NK	NK	NK	NK	NK	
	Climate change	NA	NK	NK	NK	NK	NK	NK	NK	NK
	Natural disasters	NA	NK	NK	NK	NK	NK	NK	NK	NK
	Pests, diseases, alien invasive species	NA	0	-1	NK	NK	NA	NK	-1	NK
	Markets, trade and the private sector	NA	0	-1	NK	NK	NA	NK	-1	NK
	Policies	NA	0	0	NK	NK	NA	NK	0	NK
	Population growth and urbanization	NA	NK	NK	NK	NK	NA	NK	-1	NK
	Changing economic, socio-political, and cultural factors	NA	NK	NK	NK	NK	NA	NK	NK	NK
	Advancements and innovations in science and technology	NA	NK	NK	NK	NK	NA	NK	NK	NK
	Other [please specify]:									

**Question 13. Briefly describe the main driver(s) affecting ecosystem services in each production system, as identified in Table 5. Include where possible a description of the components of associated biodiversity that are affected, the indicators used to measure change, and the source of information.**

Coastal and marine resources are threatened by over fishing, spear-fishing, aquarium fishing and dynamite fishing. These factors also represent major disturbances to the coral reefs of Yemen. Oil exploration and transport have resulted in several oil spills. Sewage discharge, agro-chemicals flushed by floods, and sedimentation from urban development pose further threats to the Red Sea's coral reefs. Industrial and urban development, as well as extensive coastal development, land filling, and coastal engineering are dramatically altering certain coastal areas. Recreation and tourism also contribute to eutrophication and reef degradation. Coastal and marine biodiversity, including Socotra Island, and Kamaran Island is threatened by the cutting of mangroves for wood and the use of mangroves for feeding animals, fuel-wood supply

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

### **Climate change.**

#### **Vulnerability Assessment of Key Sectors to Climate Change**

Yemen identified three main sectors that are vulnerable to climate change, water resources, agriculture, and coastal zones

#### **Water:**

Water availability and quality difficult situations due to changing patterns of rainfall, impact directly on the livelihoods of the communities. Groundwater sources are at risk from sea level rise induced sea water intrusion.

#### **Agriculture & Food Security:**

Drought, temperature variability, and changes in precipitation regime can lead to disastrous consequences for agriculture and food security. Climate changes may imply degradation of agricultural lands, soils and terraces, desertification, which negatively affects agricultural incomes for local communities specifically and leading to national food insecurity as food production levels change.

#### **Biological Diversity**

Frequency in drought, temperature fluctuation, and changes in precipitation patterns due to climate change will lead to the deterioration of and changes in the habitats of endangered and endemic species. The intense wave activity of storms already damage near shore coral reefs in the Red Sea and Gulf of Aden, as sea levels rise and storms become more frequent Yemen may see an increase in intense wave activity.

#### **Coastal areas Communities**

Flooding of low-lying areas and coastal erosion threaten local communities and their livelihoods. Communities may experience damage to household assets and property, constraints on services such as water supply and quality, and damage to agriculture.

#### **Coastal environment/ infrastructure**

Deterioration of wetlands, mangrove forests along the shoreline as well as in islands in the Red Sea. As a result of sea level rise, Yemen can expect damage of infrastructural assets in coastal cities as well as to cultural heritage assets.

#### **Health**

Changes in climate will create more suitable conditions for the occurrence and spread of vector borne and water borne diseases such as malaria.

### **Tourism**

Impacts include loss of beaches, degradation of coastal ecosystems, saline water intrusion, damage to infrastructure, and coral reef loss and bleaching

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

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

Coastal, inshore and offshore ecosystems are most pressured by coastal development and Over-exploitation of living marine resources, respectively ,has led to severe depletion of some fish resources (e.g. rock lobster, shrimp)., pollution and mismanagement of fishing in the Red Sea, Arabian sea, Gulf of Aden and Yemeni Islands are very risky on the marine resource"s sustainability. EPA,2015 b).

## **2.4 Effects of drivers of change on wild foods**

**Question 14. What were the main drivers affecting the availability, knowledge and diversity of wild foods during the last ten years in the country? In Table 6, indicate the major drivers affecting availability, knowledge and diversity of wild foods, and if the effects are strongly positive (2), positive (1), negative (-1), strongly negative (-2), no effect (0), not known (NK), or not applicable (NA).**

Table 6. Drivers affecting availability, knowledge and diversity of wild foods.

Drivers	Effect of drivers (2, 1, 0,-1, -2, NK, NA)		
	Availability of wild foods	Knowledge of wild foods	Diversity of wild food
Changes in land and water use and management	-2	NK	-2
Pollution and external inputs	-1	NK	-1
Over-exploitation and overharvesting	-2	NK	-2
Climate change	-1	NK	-1
Natural disasters	-1	NK	-1
Pests, diseases, alien invasive species	-1	NK	-1
Changing markets	-2	-1	-2
Policies	-1	NK	-1
Population growth and urbanization	-2	-1	-2
Changing economic, socio-political, and cultural factors	-2	NK	-2
Advancements and innovations in science and technology	-2	NK	NK

**Question 15. Briefly describe the main drivers affecting the availability, diversity and knowledge of wild foods in your country, as identified in Table 6. Include where possible indicators used to measure change, along with the source of information.**

There is an increasing focus pressure on wild plant species to meet the demand of increasing population. The diversity of wild plants in their habitats is getting dramatically decreased. Diversity of some species that are utilized by local people as traditional food or as medicinal plants are also in danger this due to intensive utilization of these plants and lack of ecological education and protection activities. (EPA b,2015 )

Although the other different drivers might have affected to certain extent various elements of biodiversity, the socio-economic factors are perhaps the main driver that have negatively affected biodiversity especially the high population growth rate, internal and external migration, and the sever poverty rate especially in highly populated rural area. These aspects coined with parallel greater reliance on food imports, open market and the lifting of subsidies resulted in greater pressure on various biodiversity elements and loss. In fact, the situation even has worsened with the advent of heightened socio-political conflict (2011 uprising or the so called Arab Spring), and the disruption of armed conflict later on by the end of 2014 and throughout 2015-2016. The whole country was suffering of total lack and/or discontinued services such as electricity and cooking gas provision, the hampered flow of other varied goods and services and the absence of security. Many people even were displaced and forced to leave their houses in some cities and villages. These and other people resorted then to resort to their surrounding natural settings and resources to make their living and search for alternatives (food plants, wood for cooking, some herbs for medicine and the like).

## ***2.5 Effects of drivers of change on traditional knowledge, gender and rural livelihoods***

***Question 16. Which drivers have had the most significant effect on the involvement of women in the maintenance and use of biodiversity for food and agriculture?***

The factors driving for change that include: natural disasters, excessive exploitation and excessive harvesting, and the changing economic, socio-political and cultural factors, are the main driving factors for a change, which demonstrate great effect on woman involvement in the conservation of biodiversity for food, agriculture and use as follows:

Family members are the main source of farm labor and that women undertake a major role with men who are responsible principal activities such as plowing while the largest portion of farm work such as weeding, and harvesting are the responsibility of women.

Rural women are an integral part of the traditional farming system and possess skills that are used in application of ecological farming practices. Women have extensive knowledge in pest management, harvesting, seed selection and preservation for the next season, in enriching the soil ... etc. Many female farmers save the grass seed, practice medication through provision of herbal plants and fodders for animals, and also care for cattle among many other works and duties. Women have knowledge on various species of plants of special taste, the plants of high value, and those plants used in health care. Women's knowledge is not limited to varieties of food crop but their knowledge extends to wild plants used in folk traditional medicine that keeps people alive in the painful and difficult times, which represents a source of income for them as well. All these tremendous skills of rural women have been gained through experience, innovation and experimentation when faced with problems. This is especially true for the case of seed-related skills and a variety of farming skills that have been acquired and accumulated over the generations, and contributed to the provision of food security for thousands of families. (Report of Documentation of traditional knowledge associated with biodiversity for food and agricultural, 2013).

The natural disasters and over - exploitation of biodiversity are considered the most driving factors that have a clear impact on the involvement of women in the conservation of biological diversity. This is because natural disasters like floods, that occurred in many parts of Yemen such as that happened in Hadramout in 2008, resulted in the sweeping away of large number of farms, including soil, agricultural crops, fruit trees, hundreds of honey beehives, large number of livestock like sheep, goats and large numbers of houses, all of which are a source of food and livelihood of the population in the affected areas.

The pain of the calamity and the enormity of the disaster losses forced women to stand by the man to preserve the rest of biodiversity and in view of the urgent need for food, drink and shelter during the disaster. While for the post – disaster, the population of the flooded areas, men and women have worked side by side to preserve the remnant of the agricultural land and worked together to maintain and preserve what remains of trees and cultivated crops. The impact of this factor strongly influenced in the involvement of women in the preservation of biodiversity.

Another example with regard to the excessive exploitation is represented by the example of timber cutting and overgrazing in many Yemeni highland areas that caused a scarcity of such resources and reaching in some inflicted areas to the level of serious deterioration and a disappearance of rangeland important to the livestock and the absence of needed firewood and timber. The damage of this factor brought about an alerting bell with its warning heard and echoed to all farming community member women prior to men. Therefore, women declined from undertaking unjust firewood collection except in certain allowed locations. Women also refrained also from sporadic animal herding and carried out animal grazing in the annually pre-determined locations and this was initiated by women before men. This is, as stated earlier, because of the direct harm that touched the essential needs of people livelihood.

As for the changing economic, socio-political and cultural factors, the need or the demand for a certain thing makes it a spot of a very high attention, which is the situation that happened in the previous two examples. With respect to the changing social-political and cultural habits, it is notable that situation has changed in the few last decades with more number of rural women becoming literate while some of them even reaching higher level of education. Many of the rural families have more than one educated woman. This created a kind of awareness among farm households especially the women which constitute the main actor of farming in Yemen. This has coincided and accompanied with state policy orientation of integrating gender in its plans and programs including the issues linked to biodiversity whether on the level of government institutions and public agencies or at the level of women involvement in field studies of need assessment and priorities identification including biodiversity issues and community awareness creation in this important aspect of many agricultural projects that were executed during the past 10 years in all areas covered by such projects.

***Question 17. Which drivers have had the most significant effect on the maintenance and use of traditional knowledge relating to biodiversity for food and agriculture?***

A study of documenting traditional knowledge in four provinces of the Yemeni Highlands was conducted by the research component of the "Agricultural Biodiversity for Adaptation to Climate Change Project" in 2013. It concluded that in many of the targeted areas, farmers face enormous problems in production in terms of the limited agricultural and natural resources; the problems of soil erosion due to flooding, problems of crop deterioration due to drought, pests and diseases, and the lowering soil fertility. It seems that many of the farmers

were able to mitigate such effects and overcome them by using many traditional skills and knowledge as principles as unique management principles among which are the following:

- Maintenance of agricultural biodiversity (crops and vegetative cover)
- Optimizing the benefit of the crop pattern and increasing the use efficiency of the natural resources.
- Activation of the foundations of the farming system management (Plant and animal complementarity) .
- Conservation, management and sustainable use of water.
- The application of farming practices that increase crop productivity through suitable sowing date, plant protection, caring for land preparation and fertility etc..

The study of agricultural biodiversity and the associated traditional skills in the targeted areas (eight districts in four provinces; Almahweet, Sana'a, Ibb and Taiz) can contribute much to the development of sustainable agro - ecosystems in those particular areas especially that all farmers feel concerned as a result of the accelerating climate changes, in addition to the problems of abject rural poverty and the shortage of food. Therefore, all are in need of a sustainable farming models that coin all elements of traditional and modern knowledge. This requires an institutional changes in the economics of agriculture to adopt such a model in the national development programs.

It must be noted that the agricultural biodiversity is of great importance to address the risks resulting from climate and environmental changes and to promote the flexibility of traditional farming systems for rural communities through a combination of local knowledge with modern technologies which will contribute to the achievement of food security and realizing sustainable growth of development.

It is also important to re - think about the prevailing traditional farming that relies on the application of traditional skills on a large scale. There is a need to develop new measures to protect the traditional knowledge of the indigenous and local communities in the face of agricultural modernization and to encourage local farmers to produce for global competition without sacrificing the methods of sustainable traditional and environment-friendly farming . Therefore, it should be seriously considered to create a food supply chain through the establishment of a network of small - scale farmers as a model for traditional agriculture through the exercise of the activities of small income-generating projects. These projects would enable beneficiaries to conserve the prevailing biodiversity and the traditional farming skills and heritage. This, in turn, would be conducive to the preservation of sustainable agricultural development.

- Policies and legislations are also one of the driving factor for change and that have an impact on the preservation of the traditional knowledge linked to biodiversity for food and agriculture.
- Policies in Yemen and in legislation particular (decrees and laws) related to biodiversity have had a positive impact as it turned out so clearly in the second national report issued in February 2009 on the "State of Plant Genetic Resources for Food and Agriculture in Yemen", the general attitude and interest of the state in biodiversity and the associated traditional knowledge. In this context, the issuance of several decrees and laws that aimed at preserving agricultural biodiversity and the associated local knowledge. This coincided with the attraction of numerous relevant projects and the community awareness



creation and dissemination about the importance of the local traditional knowledge and its documentation using different means.

- The issue of biodiversity conservation has become a matter of pillar of environmental protection activities especially with the declaration of a number of protected areas. In addition, there exists a growing awareness of the environmental issue among those concerned about the importance of biodiversity and the role of local lifestyles in the integrity of ecosystems. But, the application on the ground level is still slow. However, the activities of sustainable agriculture, landscaping and the sound methods of fishing activities have spread in most provinces of the Republic.

**Question 18. Which drivers have had the most significant effect on the role of biodiversity for food and agriculture in improving food security and sustainability?**

The evolution and innovation of science and technology in the field of agricultural research for the genetic improvement of crops and livestock led to the launch of several high - yielding improved genetically-homogenous varieties. Although these high-yielding improved varieties represent a major threat to local varieties but they represent a solution to the problem of food shortage through providing food for millions of growing number of human mouths rapidly and scary especially in Yemen. The population growth rate in Yemen is one of the highest rates in the world (3%). Improved varieties of grain crops has given higher production almost three times higher as compared to the best local varieties under ideal conditions (The State of Plant Genetic Resources for Food and Agriculture in Yemen: The 2<sup>nd</sup> National report of The Republic of Yemen, 2009).

**2.6 Countermeasures addressing current and emerging drivers of change, best practices and lessons learned.**

**Question 19. Referring to the information provided in this Chapter, identify countermeasures planned or in place to reduce adverse consequences of drivers on a) associated biodiversity, b) ecosystem services and c) wild foods. Provide any expected outcomes, lessons learned and best practices.**

Some laws and bi-laws were issued by government such as protected areas, approve of many world agreements some of which have not been translate to action.

The implementation of bilateral and multilateral projects concerning biodiversity and food security.

Establishing a number of national and sector entities devoted to protected ecosystem, biodiversity.

The foundation of some specializes fields or disciplines the education institution at the university degree and higher education levels.

Establishment of some nongovernment organization that taking involve in activates relating to conservation of ecosystem and biodiversity .

Information and education awareness creation activities through various media include the internet.

The country responses to local, regional and international focusing on the biodiversity and ecosystem including the release of specials reports.

In Yemen<sup>21</sup>, the World Bank is supporting highland farmers that rely on rainfed agriculture to identify coping strategies for adaptation to climate change. Strategies include the conservation and use of biodiversity of importance to agriculture, such as the conservation of

local land races and wild relatives. The project also focuses on conserving the associated local traditional knowledge of these highland farmers.

<http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/MENAEXT/0,,contentMDK:21596766~pagePK:146736~piPK:146830~theSitePK:256299,00.html>

### ***Chapter 3: The state and trends of biodiversity***

#### ***3.1 Overall synthesized assessment of forest, aquatic, animal or plant genetic resources***

***20. Describe the overall 1) state, 2) trends and 3) state of conservation of diversity of forest, aquatic, animal or plant genetic resources in your country with respect to:***

***a) common characteristics shared by all sectors;***

***b) major differences between sectors;***

***c) synergies or trade-offs in the state of diversity between sectors.***

#### **Plant Genetic Resources Biodiversity.**

Differences in environmental conditions among the agro-ecological zones of Yemen make it possible to grow a wide range of tropical, subtropical and temperate crops. Two broad farming systems are practiced in the country: rainfed and irrigated agriculture. Rainfed agriculture is practiced in about 68% of arable land. The main crops are cereals, legumes, vegetables, fruit trees, and industrial and stimulant crops including sesame, cotton, tobacco, qat, and coffee.

The country's crop diversity is comprised of cultivated crop species and varieties grown for different uses of the community. These have evolved through natural selection and selective breeding by traditional agricultural practices over long periods in the different environmental conditions of the country. Crop relatives and wild species also have been used for different purposes. The resultant varieties and races of crops may form homogeneous varieties or heterogeneous populations. The number of land races of each crop species is dependent on the distribution of the crop across the environment. Crop diversity is the basis for successful agriculture and the sustainable use of the country's scarce water and soil resources. 40 plant species belonging to 27 genera and 16 families are cultivated in the country; these are cereals, legumes, fruits, vegetables and industrial and stimulant crops.

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

1. Periodic drought;
2. Change in cropping pattern and drastic shift towards each crops;
3. Expansion of infrastructure and building in agricultural lands;
4. Terraces erosion and
5. Sand dune movement and desertification

In wheat, it has been found drastic decrease in the area of growing the land race. Alas, an old land race of unthreshable form (*Triticum dicoccum*), due to its relatively low yield and difficulties in threshing. Finger millet (*Eleusine crococa*), (*Eragrostis tef*) and oil rape (*Brassica napus*, var., *napus*), which were among the important traditional crops to be grown in the country, are no more grown or only grown in very specific areas. Terrace deterioration and seasonal flood destruction can be among the major factors that cause partial loss of land races. Qat (*Catha edulis*) expansion also is among the factors that lead to threaten plant genetic resources.

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

Diversity of some plants, extensively used by people with small industrial and sale is also in danger. These plants include: *Pulicaria jaubertii*, *Rumex nervosus*, *Cometes abyssinica*, *Dianthus uniflorus*, *Foeniculum vulgare* and *Portulaca oleracea*. Wild plant species that have been used also in hunger & famine time include *Cissus hamaderoensis*, *C. quadrangularis*, *Lycium shawii*, *L. sokotranum*, *Commiphora kua*, *C. ornifolia*, *C. parvifolia*, *C. planifrons*, and *C. socotrana*, these species can be in critical conditions in future time.

The loss of plants is related directly or indirectly to population growth. Population growth brings further pressure on the natural vegetation lands for urban development and cultivated production. The movement of rural population to main cities has caused major pressure on plant biodiversity. Due to over cutting, expand of buildings and infrastructure, species like *Dobera glabra* and *Thymus laevigatus* are losing their natural areas. Few fruit trees and shrubs such as *Syzygium guineense*, *Lannea transulta*, *Punica protopunica*, *Rosa abyssinica*, *Tamarindus indica*, *Balanites aegyptiaca* and others are found as scattered and highly endangered.

Intensive use of some wild plants as food or as feed has threatened some species; these are *Chapmannia gracilis*, *Chapmannia sericea*, *Commiphora ornifolia*, *Commiphora parvifolia*, *Commiphora planifrons*, *Commiphora socotrana*, *Lannea transulta*. Some species are also in endangered; these are *Chapmannia reghidensis*, *Chapmannia tinireana*, *Justicia takhinensis*, *Neuracanthus aculeatus* and *Portulaca samhaensis*. Overgrazing is also playing an important factor in decreasing of wild palatable grasses. For example species such as *Hyparrhenia papiilipes*, *Hyparrhenia quarrei*, *Hyparrhenia variabilis*, *Taverniera lappacea*, *Seddera fastigiata*, *Seddera semhahensis*, *Neuracanthus aculeatus*, *Metaporana obtuse*, *Marsdenia robusta*, *Justicia takhinensis*, *Helichrysum nimmoanum*, *Heliotropium kuriense*, *Festuca obturbans*, *Eragrostis curvula*, *Eragrostis aspera*, *Croton sulcifructus*, *Clerodendrum galeatum*, *Chrysopogon aucheri*, *Chloris roxburghiana*, *Chapmannia gracilis*, *Chapmannia reghidensis*, *Chapmannia sericea*, *Chapmannia tinireana*, *Cephalocroton socotranus*, *Brachiaria ovalis*, *Brachiaria brizantha*, *Brachiaria chusqueoides*, *Brachiaria comata*, *Arthraxon micans*, *Aristida migiurtina* and *Aristida funiculata* are rare or endangered in their habitats, some of these species are endemic to Yemen.

Intensive use of some wild plants as food or as feed has threatened some species; these are *Chapmannia gracilis*, *Chapmannia sericea*, *Commiphora ornifolia*, *Commiphora parvifolia*, *Commiphora planifrons*, *Commiphora socotrana*, *Lannea transulta*. Some species are also in endangered; these are *Chapmannia reghidensis*, *Chapmannia tinireana*, *Justicia takhinensis*, *Neuracanthus aculeatus* and *Portulaca samhaensis*. Overgrazing is also playing an important factor in decreasing of wild palatable grasses. For example species such as *Hyparrhenia papiilipes*, *Hyparrhenia quarrei*, *Hyparrhenia variabilis*, *Taverniera lappacea*, *Seddera fastigiata*, *Seddera semhahensis*, *Neuracanthus aculeatus*, *Metaporana obtuse*, *Marsdenia robusta*, *Justicia takhinensis*, *Helichrysum nimmoanum*, *Heliotropium kuriense*, *Festuca obturbans*, *Eragrostis curvula*, *Eragrostis aspera*, *Croton sulcifructus*, *Clerodendrum galeatum*, *Chrysopogon aucheri*, *Chloris roxburghiana*, *Chapmannia gracilis*, *Chapmannia reghidensis*, *Chapmannia sericea*, *Chapmannia tinireana*, *Cephalocroton socotranus*, *Brachiaria ovalis*, *Brachiaria brizantha*, *Brachiaria chusqueoides*, *Brachiaria comata*, *Arthraxon micans*, *Aristida migiurtina* and *Aristida funiculata* are rare or endangered in their habitats, some of these species are endemic to Yemen.

Major Forest & Woodland types in Yemen: Mangrove Forests, *Acacia ehrenbergiana* Woodland, *Acacia tortilis* - *Commiphora* Woodlands, *Acacia tortilis* *Euphorbia cuneata* Woodlands, *Trichilia emetica* Woodlands, *Combretum molle*- *Ficus* spp Forests, *Phoenix caespitosa* Woodlands, *Anisotes trisulcus* Woodlands, *Anogeissus dhofarica* Woodlands, *Salvadora persica*-*Tamarix* spp Woodlands, *Acacia asak* Woodlands, *Acacia mellifera* Woodlands, *Acacia etbaica* Woodlands, *Juniperus procera* Forests, *Acacia yemenensis* Woodlands, *Acacia nilotica* subsp *kraussiana* Woodlands, *Acacia origena* Woodlands, *Acacia campoptila* Woodlands, *Anogeissus dhofarica* Forests, *Croton socotranus* Forests, *Dracaena cinnabari* Woodlands

### **Animal Genetic Resources Biodiversity**

Livestock are estimated to contribute about 20% to agricultural GDP; agriculture was about 17% of total GDP. In addition, nearly 80% of farms are either pure livestock producing, or mixed (mixed farmers 59%, livestock farmers 20%, arable farmers 21%). Women are prominent players in animal production which provides them with essential food, financial security and independence.

Livestock in Yemen are mainly Cattle, Sheep, Goats and Camels. There are ten sheep breeds: Aansi, Sana'a White, Amran Grey, Amran Black, Yemen White, Taiz Red, Dhamari, Tihami, Marib White and Socotri (there is no evidence of the source and origin of this last breed, but it is believed that sheep and cattle in Socotra come from East Africa). Goats breeds are Yemeni Mountain, Taiz Black, Taiz Red, Surdud and Mawri. The local cattle are horned, small bodied Zebu; being *Bos indicus*, they have a thoracic hump which is larger in males and tends to fall laterally or backwards, especially in older animals. All cattle, sheep and goats are small. The average adult weight of cattle is 250 kg. Sheep and goats are 25 and 22 kg respectively.

Camels are mainly kept in Coastal areas and in the eastern desert. They depend on salty and thorny trees, shrubs and dwarf shrubs for their feed (*Acacia*, *Ziziphus*, *Suaeda*, *Salvadora*, *Lycium*). Their productivity is not well documented, but they contribute significantly to ploughing and transport in remote areas in addition to their productivity. Wardeh (1989) stated that a female gives 6 to 7 young during her life and could produce 5 000 kg of milk per year with good feed. The daily gain of the new born could reach 0.8–1.5 kg if they get suitable feed.

Donkeys are kept in rural areas. They are usually left to graze freely. They are used for transport of fuel, water, crop, fodder, and goods as well as for draught. There is no statistical data on the donkey population and distribution. However, based on computer modeling done for the Mountain Plain the animals appear to play an economic role that should not be underestimated.

Farm animals are kept for meat, milk, sour milk (laban), butter (ghee) and draught power, together with wool, skin and manure.

Livestock are providers of food and other products and contribute to poverty alleviation, food security, and gender equality. Livestock distribution is variable according to regions, feed resources and agriculture activities. There are 1 422 409.4 Tropical Animal Units in the highland, 604 382.5 TAU in the Coastal and 1 009 040.5 TAU in the desert region. Thus, livestock production systems vary from traditional pastoralism to agro-pastoral systems and recently small-scale intensive animal production units. Pasture-fed livestock has been traditionally practiced and is a prominent feature of rural economy and agricultural activities in many parts of Yemen.

### **Quatic Genetic Resources Biodiversity**

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

Over 186 islands lie in the seawater of Yemen with distinct climatic and natural characteristics. More than 151 of these islands lie in the Red Sea region. Among those located in this region: Kamaran Island is the largest, and Mayoos Island, located in the Bab Mandab Strait, has strategic importance. Most corals and coral habitats exist around the Yemeni islands, but with different diversity of communities and number.(EPA,2009)..

### **3.2 State and trends of associated biodiversity and ecosystem services**

**Question 21. Have any changes been detected in your country for the different production systems over the last 10 years in components of associated biodiversity? If so, indicate if trends are strongly increasing (2), increasing (1), stable (0), decreasing (-1) or strongly decreasing (-2) in Table 7. If no information is available, indicate not known (NK). If not applicable, (NA).**

Table 7. Trends in the state of components of associated biodiversity within production systems.

Production system	Trends in last 10 years (2,1,0,-1,-2, NK, NA)			
	Micro-organisms	Invertebrates	Vertebrates	Plants
L1	NK	NK	NK	-1
L5	NK	NK	NK	-1
F1	NK	NK	NK	-1
A1	NK	NK	NK	NA
A9	NK	NK	NK	NA
C5	NK	NK	NK	-2
C9	NK	NK	NK	-2
M1	NK	NK	NK	-2

**Question 22. Briefly describe the changes or trends in diversity recorded in Table 7. Where possible provide information on: baseline levels (last 10 years, indicate if otherwise), measurements and indicators used, the extent of change, and the likely cause(s). Include references to the sources of information.**

no comprehensive monitoring and periodically conducted measurements and indicators are carried out at the national level for all production systems, even though some prepared reports are developed but they are separated and not linked.

**Question 23. Have any changes been detected in your country for the different production systems over the last 10 years in regulating and supporting ecosystem services? If so, indicate if trends are strongly increasing (2), increasing (1), stable (0), decreasing (-1) or strongly decreasing (-2) in Table 8. If no information is available, indicate not known (NK). If not applicable, (NA).**

Table 8. Trends in the state of regulating and supporting ecosystem services within production systems.  
Production systems

Production systems	Trends in last 10 years (2,1,0,-1,-2, NK, NA)									
	Pollination	Pest and disease regulation	Water purification and waste	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Provisioning of habitat	Production of oxygen/ Gas regulation	Others: [please specify]
L1	NK	NK	NK	NK	NK	NK	NK	NK	NK	NK
L5	NK	NK	NK	NK	NK	NK	NK	NK	NK	NK
F1	NK	NK	NK	NK	NK	NK	NK	NK	NK	NK
A1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
A9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C5	NK	NK	NK	NK	NK	NK	NK	NK	NK	NK
C9	NK	NK	NK	NK	NK	NK	NK	NK	NK	NK
M1	NK	NK	NK	NK	NK	NK	NK	NK	NK	NK

**Question 24. Briefly describe the changes or trends in diversity recorded in Table 8. Where possible provide information on: baseline levels (last 10 years, indicate if otherwise), measurements and indicators used, the extent of change, and the likely cause(s). Include references to the sources of information.**

Data for Table 8 is not available for all sectors because changes in different production systems were not detected.

**Question 25. Is there evidence that changes in biodiversity for food and agriculture have impacted ecosystem services in your country? Indicate if strongly increasing (2), increasing (1), stable (0), decreasing (-1) or strongly decreasing (-2) in Table 9 and provide a description of specific situations and documentation where available (repeat table for each production system).**

Table 9. Impact of changes in biodiversity for food and agriculture on ecosystem services. Production systems Changes

Production systems	Change	Trends in last 10 years (2,1,0,-1,-2, NK, NA)										
		Pollination	Pest and disease regulation	Water purification and waste	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Provisioning of habitat	Production of oxygen/ Gas regulation	Others: [please specify]	
L1	Changes in animal genetic resources	NK	NK	NK	NK	NK	NK	NK	NK	NK	NK	
L5	Changes in crop genetic resources	NK	-1	-1	1	NK	NK	NK	NK	0		
F1	Changes in forest genetic resources	NK	NK	NK	NK	NK	NK	NK	NK	NK		
A1	Changes in aquatic genetic resources	NA	NA	NA	NA	NA	NA	NA	NA	NA		
A9	Changes in micro-organism genetic resources	NA	NA	NA	NA	NA	NA	NA	NA	NA		
C5	Changes in invertebrates genetic resources	NK	NK	NK	NK	NK	NK	NK	NK	NK		
C9	Changes in vertebrates genetic resources (	NK	NK	NK	NK	NK	NK	NK	NK	NK		
M1	Changes in plants genetic	NK	NK	NK	NK	NK	NK	NK	NK	NK		

**Question 26. Briefly describe the impacts on ecosystem services recorded in Table 9. Where possible provide information on: baseline levels (last 10 years, indicate if otherwise), measurements and indicators used, the extent of change, and the likely cause(s). Include references to the sources of information.**

The changes which occur on crops genetic resources are represented in the growing number of high-yielding, genetically improved and pests-resistant varieties. In most cases, the improved varieties require more water requirements than those local cultivars and breeds, which are of good adaptability to the local environmental and of low water requirements as they are mostly strains grown under rainfall conditions .

Therefore, most of the effects that arise from the changes in crop genetic resources have unknown or unlimited impact on the ecosystem services as compared to the genetic resources of the forests and woodlands vegetation and pasture plants as well as the other vegetative covers.

The changes that have occurred in genetic resources of many of crops for acquiring pest and diseases resistant varieties affected those pests through reducing their numbers, some of their species and a complete disappearance of some pests in the event of unavailability of appropriate host necessary for their own food, shelter and completion of their life cycle.

The same applies to the case of the effect of the change in the genetic resources of crops and the new improved varieties, which the production management practices require the introduction of agricultural inputs such as fertilizers, pesticides which negatively affects the soil microbiology, while such organisms plays an important role in the analysis of organic wastes and pollutants in water and the remove synthetic toxins through the biological processes in the soil and sub-soil.

The impact of developing crop genetic resources and acquiring stress-resistant biotic or abiotic varieties like drought or/and saline tolerant varieties was positive through lessening the natural risks especially the climate changes and the severe drought durations resulting from climate change. With regards to the effect of crop genetic resources in the Oxygen / gas regulation, its impact is almost un-tangible as compared to the vegetation cover of forests and woodland as the effect occurs through the creation of oxygen in the atmosphere by the process known as photosynthesis.

**Question 27. List any associated biodiversity species or sub-species (if information is available) that are in some way actively managed in your country to help provide regulating or supporting ecosystem services in Table 10. Indicate in which production systems they occur and indicate if diversity information is available. Provide any available sources of information.**

Table 10. Associated biodiversity species that are in some way actively managed in your country to help provide regulating or supporting ecosystem services.

Ecosystem service provided	Actively managed species (name) and sub-species (where available)	Production systems	Availability of diversity information (Y/N)	Source of information
Pollination	<i>Honey bees (Apis mellifera)</i>	L1,F1,C5,C9, M1	Y	AREA/Sieun Research station, 2002)
Pest and disease regulation	<i>Aphytus milnus to control Homoptera, Diaspididae. Copidosoma koehleri to control Phthorimaea operculella,. Aphelinus mali to control Eriosoma lanigerum</i>	C5.C9,M1	Y	Algashm. 1994.



	<i>(Amblyseius idaeus)</i> to control <i>Tetranychus urticae</i>			
Water purification and waste treatment	<i>Phragmites australis</i> (introduced) <i>Sorghum halepense</i> <i>Pobulus sp.</i>	C5,C9,M1	Y	NGRC 2006-2015
Natural hazard regulation	<i>Avicenna marina</i> <i>Phoenix dactylifera</i> L <i>Atriplex halimus</i> <i>Juniperus sp.</i>	A1,F1,C5,C9,M1	Y	NGRC 2006-2015
Nutrient cycling	<i>Legumes species such as</i> <i>Pisum sativum</i> L <i>Vicia sativa</i> , <i>Lens culinaris</i> , <i>Medicago sp.</i>	C5,C9,M1		NGRC 2006-2015
Soil formation and protection	<i>Prosopis Juliflora</i> <i>Opuntia Spp</i> <i>Odyssea mucronata</i> <i>Acacia spp</i> <i>Tamarix arabica</i> <i>Panicum turgidum</i> <i>Allio spp</i> <i>Aeluropus lagopoides</i> <i>Panicum turgidum</i> <i>Cadada rotundifolia</i>	LI,F1,M1	Y	AREA-FAO, 2009
Water cycling	<i>Atriplex halimus</i> ,	L1,L5,F1,C5,C9,M1	Y	(AREA-FAO, 2009)
Habitat provisioning	<i>Acacia ssp</i> <i>Plicosepalus curviflorus</i> <i>Ziziphus spina</i> <i>Dipterygium glaucum</i> <i>Tamarindus indica</i> <i>Mimusops laurifolia</i>	L1,L5,F1,C5,C9,M1	Y	AREA-FAO, 2009
Oxygen regulation	All of Above species	L1,L5,F1,A1,C5,C9,M1	Y	

**Question 28. Does your country have monitoring activities related to associated biodiversity? If yes, describe these. Where possible provide information on the components of associated biodiversity that are monitored and on the geographical coverage of the monitoring system (local, regional, national, global). Include references to the sources of information, if possible.**

There are no monitoring activities related to associated biodiversity in Yemen

### **3.3 Species of associated biodiversity at risk of loss**

**Question 29. List in Table 11 any components of associated biodiversity for which there is evidence of a significant threat of extinction or of the loss of a number of important populations in your country. Specify the degree of the threat according to the classification in use in your**

**country or following the IUCN Red List Categories and Criteria18. Include a description of the threat and list references or sources of information if available.**

Table 11. Main threats to associated biodiversity identified as at risk.

<b>Associated biodiversity species</b>	<b>Degree of threat</b>	<b>Main threat (indicate)</b>	<b>References or sources of information if available</b>
<i>Pulicaria jaubertii</i> ,	High	Overharvesting,overgrazing, drought	NGRC(2006-2015)
<i>Rumex nervosus</i> ,	High	Overharvesting,overgrazing, drought	NGRC(2006-2015)
<i>Cometes abyssinica</i> ,	High	Overharvesting,overgrazing, drought	NGRC(2006-2015)
<i>Dianthus uniflorus</i> ,	High	Overharvesting,overgrazing, drought	NGRC(2006-2015)
<i>Foeniculum vulgare</i>	High	Overharvesting,overgrazing, drought	NGRC(2006-2015)
<i>Portulaca oleracea</i>	High	Overharvesting,overgrazing, drought	NGRC(2006-2015)
<i>Ficus palmate</i>	High	Overharvesting,overgrazing, drought	ARAE-FAO 2009
<i>Punica granatum (Rouman)</i>	High	Overharvesting,overgrazing, drought	ARAE-FAO 2009
<i>Punica protopunica</i>	High	Overharvesting,overgrazing, drought	ARAE-FAO 2009
<i>Lycopersicum esculentum wild</i>	High	Overharvesting,overgrazing, drought	NGRC Reports
<i>Juglans regia</i>	High	Overharvesting,overgrazing, drought	ARAE-FAO 2009
<i>Abelmoschus esculentus wid</i>	High	Overharvesting,overgrazing, drought	ARAE-FAO 2009
<i>Corchorus erodiodes Balf.f. wild</i>	High	Overharvesting,overgrazing, drought	ARAE-FAO 2009
<i>Olea europaea</i>	High	Overharvesting,overgrazing, drought	ARAE-FAO 2009
<b>Aquatic and Marain</b>			
Sea turtles <i>Chelonia mydas</i> <i>Eretmochelys imbricata</i>	High	Overfishing, catch, destroying the habitat of nesting	
Sea cucumber <i>Holothuria scabra</i> <i>Holothuria nobilis</i> <i>Holothuria fascogilva</i>	High	Overfishing	ARAE-FAO 2009
Mangrove trees <i>Avicenna marina</i>	Medium	Loggers, food for animals, the use of firewood as fuel. Climate change	<b>-(Abdul Baki, 2013)</b>
<i>Lepus capensis</i>	high	Hunting	EPA, GEF,UNDP, 2012
<i>Arabian Gazelle</i>	high	Hunting	EPA, GEF,UNDP, 2012
<i>Capra nubiana (Nubian ibex)Oal</i>	high	Hunting	EPA, GEF,UNDP, 2012
<b>Oryx leucoryx</b>	high	Hunting	EPA, GEF,UNDP, 2012

(Maha)			
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### **3.4 Conservation of associated biodiversity**

**Question 30. Does your country currently have any ex situ conservation or management activities or programmes for associated biodiversity for food and agriculture? These may include, for example, culture collections, collections of pollinators, etc. If so, list these in Table 12.**

Currently, No ex situ conservation or management activities or programmes for associated biodiversity are known or implemented in Yemen .

Table 12. Ex situ conservation or management activities or programmes for associated biodiversity for food and agriculture.

<b>Components of associated biodiversity</b>	<b>Organisms, species and sub-species (where available) conserved</b>	<b>Size of collection</b>	<b>Conservation conditions</b>	<b>Objective(s)</b>	<b>Characterization and evaluation status</b>
Micro-organisms	NK	NK	NK	NK	NK
Invertebrates	NK	NK	NK	NK	NK
Vertebrates	NK	NK	NK	NK	NK
Plants					

Yemen currently have 6 protected areas for in situ conservation, but lack to any management activities or programmes support the maintenance of associated biodiversity.

Several activities have been undertaken during last 10 years to inventory and the study of current state of plant genetic resources in the In situ conservation areas. Agricultural Research Extension Authority (AREA), Environmental Protection Authority (EPA) and other international and national organizations, has carried out these studies. Thorough surveys and studies were made with community participation results on formulation management plans several locations and declared them as natural protected areas such as:

The Socotra Archipelago , "Bura'a" mountain, Hawf" mountain forest, Utma , wet land as in Aden Governorate ,Coastal protected areas. There are efforts to declare these areas as natural protected areas in Bal-Haf, Brum, and Sharma - Gathmoon.

**Question 31. Does your country currently have any in situ conservation and management activities or programmes in your country that support the maintenance of associated biodiversity? If so provide any available information on organisms and species managed or conserved, site name and location, production system(s) involved, conservation**

**objective and specific actions that secure associated biodiversity or ecosystem services (if any).**

Table 13. In situ conservation or management activities or programmes for associated biodiversity for food and agriculture.

Components of associated biodiversity	Organisms, species and sub-species (where available) conserved	Size of collection	Conservation conditions	Objective(s)	Characterization and evaluation status
Micro-organisms	NK	NK	NK	NK	NK
Invertebrates	NK	NK	NK	NK	NK
Vertebrates	NK	NK	NK	NK	NK
Plants					

**Question 32. What activities are undertaken in your country to maintain traditional knowledge of associated biodiversity? Has traditional knowledge of associated biodiversity been used to inform conservation and use decisions in your country? Please share best practices and lessons learned.**

Currently, there are no activities are undertaken to maintain traditional knowledge of associated biodiversity, But, The NBSAP 2015-2025 includes provisions and activities for the maintain traditional knowledge of associated biodiversity, and continuation of the traditional knowledge for conservation of associated biodiversity and uses decisions.

**Question 33. Provide any available information on gender dimensions with respect to the maintenance of and knowledge about associated biodiversity. These may include differences in the roles and insights of women and men with respect to maintaining particular resources, monitoring their state, overseeing their management at different stages of production or ecosystem management.**

There are No available information on gender dimensions with respect to the maintenance of and knowledge about associated biodiversity. However, some rural development projects such as the rainfed agriculture project and the biodiversity project that have included some activities relating to preserving and managing agricultural biodiversity and the natural resources such terraces protection and cultivation, construction of water storage tanks and improving livestock wealth, growing some nutritious crops, aromatic and medicinal herbs for food and food flavoring or animal feed. (Nasher,2014)

### **3.5 State and trends of wild resources used for food**

**Question 34. Provide in Table 14 a list of wild food species known to be harvested, hunted, captured or gathered for food in your country, and that are not already included in a completed or ongoing Country Report on Forest, Aquatic, Animal or Plant Genetic Resources. Indicate in or around which production system the species is present and harvested, and the change in state of the species over the last 10 years (strongly**

**increasing (2), increasing (1), stable (0), decreasing (-1), or strongly decreasing (-2), or not known (NK)). Indicate where differences within species have been identified and characterized.**

Table 14. Wild species used for food in the country.

Species (local name)	Species (scientific name)	Production systems or other environments in which present and harvested	Change in state (2,1,0,-1,-2, NK)	Differences within species identified and characterized (Y/N)	Source of information
	<i>Abutilon pannosum</i>	L2,L6, F2, C6,C10, M12	NK	N	NGRC
Madh	<i>Anisotes trisulcus</i>		NK	N	NGRC
Kermish	<i>Annona squamosal</i>		NK	N	NGRC
Halg	<i>Balanites aegyptiaca</i>		NK	N	NGRC
Kanas	<i>Berchemia discolor</i>		NK	N	NGRC
Suttah	<i>Boerhavia diffusa</i>		NK	N	NGRC
alhydwan	<i>Boerhavia elegans</i>		NK	N	NGRC
Thowah	<i>Boscia angustifoia</i>		NK	N	NGRC
Sarh	<i>B. arabica</i>		NK	N	NGRC
Tondob	<i>Capparis deciduas</i>		NK	N	NGRC
Load	<i>Carissa spinarum</i>		NK	N	NGRC
Kharoob	<i>Ceratonia siliqa</i>		NK	N	NGRC
Halas	<i>Cissus rotundifolia</i>		NK	N	NGRC
Halqah	<i>Citrus aurantifolia</i>		NK	N	NGRC
Besham	<i>Commiphora gileadensis</i>		NK	N	NGRC
Uod Helba	<i>Cometes abyssinica</i>		NK	N	NGRC
Molokeeh	<i>Corchorus trilocularis</i>		NK	N	NGRC
Taneb	<i>Cordia africana</i>		NK	N	NGRC
Spansar	<i>C. avalis</i>		NK	N	NGRC
Gharaf	<i>Cordia sinensis</i>		NK	N	NGRC
Halqah	<i>Cyphostemma digitatum</i>		NK	N	NGRC
Uod Helba	<i>Dianthus uniflorus</i>		NK	N	NGRC
Dhabr	<i>Dobera glabra</i>		NK	N	NGRC
Shahth	<i>Dodonaea viscosa</i>		NK	N	NGRC
Waraf	<i>Ehretia cymosa</i>		NK	N	NGRC
Euklat	<i>Euclea schempi</i>		NK	N	NGRC
Balas	<i>Ficus palmata.</i>		NK	N	NGRC
Sukam	<i>Ficus sycomorus</i>		NK	N	NGRC
Mudah	<i>Ficus popufolia</i>		NK	N	NGRC
Sar	<i>F. sur</i>		NK	N	NGRC
Tawlak	<i>F.vasta</i>		NK	N	NGRC
Shamar	<i>Foeniculum vulgare</i>		NK	N	NGRC
Shawhat	<i>Grewia tenax</i>		NK	N	NGRC
Nasham	<i>Grewia mollis</i>		NK	N	NGRC
Ghuair	<i>G.villosa</i>		NK	N	NGRC
Dawm	<i>Hyphanea thebaica</i>		NK	N	NGRC
Awsag	<i>Lycium shawii</i>		NK	N	NGRC

Mara'	<i>Maerua crassifolia</i>		NK	N	NGRC
Mersin	<i>Myrtus communis</i>		NK	N	NGRC
Tari Saghir	<i>Nannorrhops richieana</i>		NK	N	NGRC
Habaq	<i>Ocimum forskolei</i>		NK	N	NGRC
Utom	<i>Olea europaea L.</i>		NK	N	NGRC
Teen shawki	<i>Opuntia ficus-indica</i>		NK	N	NGRC
Teen shawki ahmar	<i>Opuntia delinii</i>		NK	N	NGRC
Kusma	<i>Orbea wissmannii</i>		NK	N	NGRC
Shawaf	<i>Pavetta longiflora</i>		NK	N	NGRC
Regllh	<i>Portulaca oleracea</i>		NK	N	NGRC
Shawgab	<i>Premna resinosa</i>		NK	N	NGRC
Dhyhan	<i>Punica protopunica.,</i>		NK	N	NGRC
Gadb	<i>Rhammus staddo</i>		NK	N	NGRC
Hawgam	<i>Rosa abyssinica</i>		NK	N	NGRC
Uthrub	<i>Rumex nervosus</i>		NK	N	NGRC
Mughallaf	<i>Ruta africanaa</i>		NK	N	NGRC
Nahaf	<i>Secorinega vrosa</i>		NK	N	NGRC
Homar	<i>Tamarindus indica</i>		NK	N	NGRC
Diriem	<i>Teclea nobilis</i>		NK	N	NGRC
Zaa'tr	<i>Thymus laevigalus</i>		NK	N	NGRC
Habad	<i>Ziziphus leucodermis</i>		NK	N	NGRC
Ullab	<i>Ziziphus mucronata</i>		NK	N	NGRC
Sedr	<i>Ziziphus spina-christi</i>		NK	N	NGRC
Ohbr	<i>Procavia capensis</i>				
Gazahl	<i>Gazella gazella</i>				
Gazahl	<i>Gazella subgutturosa</i>				
Tabee	<i>Capra ibex</i>				

### 3.6 Wild food resources at risk

**Question 35. List in Table 15 any wild food species for which there is evidence of a significant threat of extinction or of the loss of a number of important populations in your country. Specify the degree of threat according to the classification in use in your country or following the IUCN Red List Categories And Criteria. Include a description of the threat and list references or sources of information if available.**

Table 15. Main threats to wild food species identified as at risk.

Wild food species (scientific name)	Degree of threat	Main threat (indicate)	References or sources of information if available
<i>Ceratonia siliqua</i>	Endangered	Overharvest	NGRC(2006-2015)
<i>Commiphora gileadensis</i>	Endangered	Overharvest	NGRC(2006-2015)
<i>Ficus popuifolia</i>	Endangered	Overharvest	NGRC(2006-2015)
<i>Tamarindus indica</i>	Endangered	Overharvest	NGRC(2006-2015)
<i>Ficus sycomorus</i>	high	Use this trees in bee cells.	NGRC(2006-2015)
Rock (HYRAX)	High	Hunting	EPA, GEF,UNDP, 2012
<i>Gazella gazella</i>	High	Hunting	EPA, GEF,UNDP, 2012
<i>Gazella subgutturosa</i>	High	Hunting	EPA, GEF,UNDP, 2012
<i>Capra ibex</i>	High	Hunting	EPA, GEF,UNDP, 2012
<i>Chelonia mydas</i>	Endangered	By catch in marine fisheries, harvest of eggs and adults from nesting beaches, and habitat degradation at nesting beaches.	Bawazir G. & Abu –Al-fotooh A. 2001

The Wild food resources are utilized in Yemen on food basics of rural population. Significantly for long time all species under considerable pressure and some became rare and threatened. It is difficult to accurately assess the Wild food resources losses from over harvesting, collecting, grazing, deforestation and woodland removal & degradation or ways of redressing the situation in Yemen due to the lack of knowledgeable forestry personnel in the country, and lack of data base. However, the threats to wild food plants and animals in forest woodland & rangelands areas of Yemen can be enumerated in the Population Growth and Attendant Challenges; Invasive Alien Species; Drought; Floods; Grazing; and plants collection.

### 3.7 Conservation of wild resources used for food

**Question 36. Are any ex situ conservation or management activities or programmes established in your country for wild food species? These may include, for example, culture collections, collections of insects, fungi, etc. If so, list these in Table 16.**

There are no any Ex situ conservation or management activities or programmes established for wild food species

Table 16. Ex situ conservation or management activities or programmes for wild food species.

Wild food species conserved (scientific name)	Size of collection (number of accessions and quantities)	Conservation conditions	Objective(s)	Characterization and evaluation status
NK	NK	NK	NK	NK

**Question 37. Are any in situ conservation and management activities or programmes established in your country that supports maintenance of wild food species? If so list these in Table 17 provide the following information for each activity or program: site name and location, production system(s) involved, conservation objective and specific actions that secure wild food species (if any).**

There are no any In situ conservation or management activities or programmes established for supports and maintenance of wild food species.

Table 17. In situ conservation or management activities or programmes for wild food species

Wild food species conserved (scientific name)	Site name and location	Size and environment	Conservation objective(s)	Actions taken
NK	NK	NK	NK	NK

**Question 38. What activities are undertaken in your country to maintain traditional knowledge of wild food species (indicate if the extent to which these have already been described in sector reports)? How can traditional knowledge of wild food species be accessed and used to inform conservation and use decisions?**

Surveying, documentation and collation of traditional knowledge related to some wild food species where conducted through some projects like Agro-Biodiversity and Climate Adaptation Project (ACAP) and Enhancing the Contribution of Neglected and Underutilized Species to Food Security and to Incomes of the Rural Poor.



**Question 39. Provide any available information on gender dimensions with respect to the maintenance of and knowledge about wild food species. These may include differences in the roles and insights of women and men with respect to harvesting particular resources, monitoring their state, overseeing their ecosystem management.**

There are no any available information on gender dimensions with respect to the maintenance of and knowledge about wild food species. And with respect to harvesting particular resources of wild food, the roles of women is very clear in this area

### **3.8 Natural or houman-made disasters and biodiversity for food and agriculture**

**Question 40. Has your country experienced any natural or human-made disaster(s) that has had a significant effect on biodiversity for food and agriculture and/or on ecosystem services in the past 10 years? List in Table 18 those for which any information exists on their effect on biodiversity for food and agriculture and/or ecosystem services. Indicate the effect on different components or services as significant increase (2), increase (1), no change (0), some loss (-1), significant loss (-2), or not known (NK).**

Table 18. Natural or human-made disasters that has had a significant effect on biodiversity for food and agriculture in the past 10 years in the country

<b>Disaster description</b>	<b>Production system(s) affected (code or name)</b>	<b>Effect on overall biodiversity for food and agriculture (2, 1, 0, -1, -2, NK)</b>	<b>Effect on ecosystem services (2, 1, 0, -1, -2, NK)</b>
<p><b>Tsunami</b> Cyclone Gonu 2007, its impact on the provinces of Hadramaut and Mahara Cyclone Chapala 2015 big impact on the province of Hadramaut and Mahara and the island of Socotra.</p> <p>Cyclone Meg 2015 hit the island of Socotra and the province of Hadramout. It is a set of tropical cyclones that occur Arabian Sea and cause significant damage to property and loss of life. And serious damage to infrastructure and services.</p>	A1	-2	NK
Drought, conflicts			

**Question 41. Briefly summarize any available information, including the year of the disaster, a description of the effects of the disaster on the different components of biodiversity for food and agriculture and/or on the effects on ecosystem services, and references to the supporting documentation.**

Flooding: Extended periods of heavy rainfall can result in flooding. We have seen extensive flooding occurring in different parts of the country approximately once every decade.

However, we have had a number of significant floods in recent years. The rainfall that occurred in September 1996 in south region and east region, and October 2008 particularly in east region (Hadramaot and Al-Mahara), resulted in severe and prolonged flooding in many valleys catchment areas, as well as multi areas in this year 2016 in the north region. And floods cause big impacts on the species and habitats for valleys and coastal plains ecosystems.

- Drought: are alternating in Yemen perhaps every 10 years or Extended spells of dry weather cause difficulties particularly in east areas. Drought can have a big impact on the agriculture sector and can increase the risk on forest and rangelands ecosystems (components biodiversity). Some climate change reports suggest that drought may become more common in the future on Yemen

-Marin storms are defined as events producing winds of gust speeds in excess of 100 km/h. Such events are experienced in the Socotra; south and southeast of Yemen typically one or two times each 5 year, but their impact there is usually very high on the different components of biodiversity for coastal plains species, habitats and ecosystems.

***Question 42. Provide any available evidence from your country that changes in biodiversity for food and agriculture caused by natural or human-made disasters have had an effect on livelihoods, food security and nutrition.***

The study conducted in Aden University (Shamsher, 2009 ) on the causes of floods and the size of their damage in Hadramout province and on basis of statements issued by the sub- committee for relief and shelter in the valley and desert of Hadramout, Syieun, headed by the deputy governor of the Valley and desert affairs of the province to the affairs of the valley and the desert stated that the damage were as follows:

1. The erosion of areas cultivated with grown crops,
2. Destruction and abrasion of soil, Irrigation facilities and canals, dams and water blockades,
3. Loss of animal camels, sheep and other cattle wealth,

The report also pointed out that the floods washed away about 236 thousand beehives resulting in a profound effect on honey production famous in the Valley area of Hadramout. According to the statement of the Director General of the office of agriculture and irrigation, Hadramout, a member of the sub-commission on relief and accommodation, out of the total arable area in Wadi Hadramout estimated at (100) thousand acre, approximately 50 thousands acres was immersed by the flood result thus into huge losses that could be summarized as follows:

- The value of the losses and damages in the agricultural sector in these districts reached an amount of (fifty billion nine hundred seventy million and four hundred and forty five thousand and five hundred Rial, of which the amount of (fifteen billion thirty-five million and two hundred and thirteen thousand) represent the value of damage and losses of agricultural crops and livestock wealth and the honey bees; and the amount estimated at (six Billion and two hundred and eight million, and six hundred and seventy-two thousand and five hundred Rials) as the value of damages and losses in tube-wells and irrigation units (pumps + engines), buildings for agricultural purposes, underground water irrigation networks and

equipment and farm machineries and equipment; and the amount of (Twenty nine billion seven hundred and twenty six million and five hundred sixty thousands) as a values of damage and losses in flood irrigation, flood control, spate irrigation and torrents and bank valleys protection, and spate irrigation channels infrastructure and the erosion of soil and farm lands.

- Proposed Solutions by the field work teams:  
Due to the large mass of the basic infrastructure of the agriculture sector, the commission proposed the following measures:
  - \* Compensation for those affected in their crop and livestock wealth, honey beehives, irrigation units (pumps + engines), wells, farm purposes buildings, underground water irrigation networks and farm equipment and machinery. This need to be undertaken urgently.
  - \* With regard to the tackling of damages in the area of spate irrigation and flood network control, protection of villages and land, as well as damage of eroded soil and agricultural land in addition to expansion of date palm tree planting using high-yielding and high-quality seedlings produced through tissue culture and suitable for growing and production under conditions of local atmosphere. Therefore, it is suggested that the an emergency intervention project for dealing with flood damages need to established for 2-3 years.

***Question 43. Provide any available evidence that the enhanced use of biodiversity for food and agriculture has contributed to improving livelihoods, food security and nutrition in the context of natural or human-made disasters. Describe and provide source of information.***

Enhancing the Contribution of Neglected and Underutilized Species to Food Security and to Incomes of the Rural Poor Project 2002. Biodiversity center.

Seeds alhydwan are common in the of south of Yemen, commonly known as alhydwan in yemen, is an edible herbaceous member of the Nynctaginaceae family. Being one of the compositions of the traditional cuisine of Yemen with long history of uses, alhydwan is now gaining popularity throughout the country as one of the staple ingredients in the manufacture of porridge, desserts and savory products. It is also eaten as a supplement mixed in bread and cakes, characterized by texture and good flavor.

Overall, findings of the present study revealed alhydwan seed flour has a great potential and can be used in food industry especially for bakery products and products that require the absorption of large amounts of water, it can be efficiently used for a promising way of diversifying its uses in extract gum due to high gum content.

**Al-Farga Ammar . et. Al. 2016. Physicochemical and Cooking Properties of a Novel Food: Alhydwan (Boerhavia elegana Choisy) Seed Journal of Academia and Industrial Research (JAIR) Volume 4, .**

After that the demand for this wild crop has increased, some farmers in Hadramout cultivation of this plant for the purpose of propagation of seeds and sold on the domestic market and neighboring countries.

### 3.9 Invasive alien species and biodiversity for food and agriculture

**Question 44. Are there invasive alien species identified in your country that have had a significant effect on biodiversity for food and agriculture in the past 10 years? List in Table 19 those for which any information exists on their effect on biodiversity for food and agriculture and/or ecosystem services. Indicate the effect on different components or services as strong increase (2), increase (1), no effect (0), some loss (-1), significant loss (-2), or not known (NK).**

Table 19. Invasive alien species that have had a significant effect on biodiversity for food and agriculture in the past 10 years.

Invasive alien species (scientific name)	Production system(s) affected (code or name)	Effect on components of biodiversity for food and agriculture (2,1,0,-1,-2, NK)	Effect on ecosystem services (2,1,0,-1,-2, NK)
<i>Parthenium hysterophorus</i> L. (Asteraceae).	L2,F2,M2	NK	NK
<i>Tagetes minuta</i>	L2,F2,M2	NK	NK
<i>Lantana camara</i>	L2,F2,M2	NK	NK
<i>Opuntia ficus-indica</i> (L),	L2,F2,M2	NK	NK
<i>Opuntia dillenii</i>	L2,F2,M2	-2	-2
<i>Prosopis juliflora</i>	L2,F2,M2	-2	-2
<i>Nicotiana glauca</i>	L2,F2,M2	NK	NK
<i>Verbesina encelioides</i>	L2,F2,M2	NK	NK
<i>Mirabilis jalapa</i>	L2,F2,M2	NK	NK
<i>Argemone ochroleuca</i> ,	L2,F2,M2	NK	NK
<i>Argemone mexicana</i>	L2,F2,M2	NK	NK
<i>Flaveria trinervia</i>	L2,F2,M2	NK	NK
<i>Bidens aurea</i>	L2,F2,M2	NK	NK
<i>Zygophyllum album</i> .1	L2,F2,M2	NK	NK
<i>Calotropis procera</i>	L2,F2,M2	NK	NK
<i>Prosopis farcta</i>	L2,F2,M2	NK	NK
<i>Citrullus colocynthis</i>	L2,F2,M2	NK	NK
<i>Dipterygium glaucum</i>	L2,F2,M2	NK	NK
<i>Fagonia indica</i> ,	L2,F2,M2	NK	NK
<i>Xanthium spinosum</i>	L2,F2,M2	NK	NK
<i>Polygonum aviculare</i> L	L2,F2,M2	NK	NK
<i>Datura stramonium</i> L	L2,F2,M2	NK	NK
<i>Pistia stratiotes</i> L	L2,F2,M2	NK	NK
<i>Erigeron canadensis</i> L	L2,F2,M2	NK	NK
<i>Senna occidentalis</i>	L2,F2,M2	NK	NK

**Question 45. Briefly summarize any available information related to the invasive alien species listed in Table 19, including a description of the effects of the invasive alien species on the different components of biodiversity for food and agriculture and/or on the effects on ecosystem services, and references to the supporting documentation.**

***Parthenium hysterophorus* L. (Asteraceae).**

Its common names are congress grass and rag weed and in Yemen, as a new plant it does not have a common name. It is native to the southern United States and Mexico, as well as to Central and South America. Observed effects of *Parthenium hysterophorus* L. to human health are skin irritation, runny nose and sneezing, and these symptoms were personally experienced by the author. Many cases of allergy due to consumption of honey from bees which feed on the flowers were reported in Hajah. Children, shepherds and farmers who have direct contact with this plant get dermatitis, nausea, giddiness and respiratory problems like asthma. The first record of this plant in the Arabian Peninsula was made in 1998 in Dhofar, Oman (Kilian *et al.*, 2002). It is regarded as a weed of national significance in India and Australia. This study is the first report its presence in the western mountains of Yemen. Immediate action is needed from Yemen and Oman to eradicate *Parthenium hysterophorus* plants.

***Tagetes minuta***

is a member of the Asteraceae family, native to South America. It is a noxious mountain weed in many countries, and is cultivated for its oil. In Yemen, it is displacing and reducing populations of native and several edible plants. Its flowers are not visited by honey bees, but other insects were observed foraging on its flowers. It also displaces plants preferred by honey bees. In the mountains where heavy and early invasion was seen, populations of native trees like *Acacia asak* are reduced and new generations have not been observed. This weed is generally avoided by animals, but is rarely eaten by donkeys when no other plants are available for grazing. When forced to graze it, cows become dizzy and produce milk with an unpleasant smell and taste, which also affects the milk products. Published data indicate it is allelopathic to many plants (Alhammad, 2008). This invasive species is expected to create new landscapes, and increase the incidence of dermatitis in humans. There is no known use of it in Yemen.

***Lantana camara***

is of Central American origin and a member of a Verbenacea. Its observed impacts include changes in land-cover, infestation cultivated land, field boundaries, pastures, rangelands, and waste places. In pastures it forms dense thickets which shade out and encroach upon desirable pasture plants. It forms pure stands over large areas rendering the land useless for pasture. It is especially insidious in the mountains of Ibb and Hajah. In Sana'a city it is cultivated as an ornamental. In valleys its dense thickets redirect runoff water causing soil erosion and flooding in agricultural lands. Some people eat its fruits, but no cases of poisoning have been reported. Small plants are spreading extensively around the cities of Sana'a, Hajah and Ibb.

***Opuntia***

is member of the New World family Cactaceae. About four species were found in the study area. One, *Opuntia ficus-indica* (L), is naturalized and used as a source of large edible orange-yellow fruit. This species is not invasive, and in Sana'a some farmers grow it as a crop. It is expected to be an alternative crop to grapes due to its drought resistance and the low input needed for its production and higher yield. Exportation of its fruits began two years ago. It is a medium to high altitude plant (1500-3000 m). The second species is *Opuntia dillenii*. It has a sour, prickly, pink unpalatable fruit. Some local people say it was deliberately introduced by the Imam of the previous ruling regime for ink making purposes. The plant occurs mostly at lower altitudes (200-1200 m) and at the core of

the Jabal Bura' Protected Area. Although there was an eradication program just after the area was declared protected, this plant has already ascended to high altitudes, and it is an invasive plant in Sana'a and Raima, where it has become a devastating pest. It causes blindness to human and animals by small spine of its fruits. It is also changing ecosystems, by blocking natural water flow, and its dense thickets are excluding grazing animals. The other two species are probably hybrids. One of them is spreading in Sumarah Mountain in Ibb governorate. It has very dense and thick thorns. The last three species represent threats to the integrity of ecosystems and land-cover.

*Verbesina encelioides* species caused livestock death as a result of toxic compound named galegine the compound compromises respiration, causes hemorrhaging of heart, and ultimately results in death (Keeler et al., 1992)

#### *Prosopis juliflora*

is native to Central and South America. It is a fast growing nitrogen fixing species tolerant to arid conditions and saline soils. It was deliberately introduced in the 1970s to stabilize sand in Tihama. It is a coastal and low altitude plant, but is increasing its range upward towards the Jabal Bura' protected area. A few plants were also seen in Sana'a city and in Thamar at elevations above 2000 m. It is a serious invasive plant in United Arab Emirates, Oman, Saudi Arabia and Yemen (Miller, and Cope, 1996).

It is used for construction, charcoal production, and recently the seeds were mixed with wheat to produce a very palatable human food. It is also forage for honey bees. Regional cooperation is needed to manage or eradicate this plant.

Alhammedi .A. S. A.( 2010) PRELIMINARY SURVEY OF EXOTIC INVASIVE PLANTS IN SOME WESTERN AND HIGH PLATEAU MOUNTAINS IN YEMEN Ass. Univ. Bull. Environ. Res. Vol. 13 No. 1,

At the request of the Yemen government, in 2002/2003 FAO implemented a project to manage and control *prosopis juliflora* better. Farmers were trained in the use of *prosopis juliflora* pods for animal feeding and the stems of the plant for firewood.

Recently the collection of *prosopis juliflora* pods became a profitable enterprise for local people, who collect them in the plains and transport them to feed animals in higher altitudes.

***Question 46. Has biodiversity for food and agriculture contributed to managing the spread and proliferation or controlling established invasive alien species in your country? If yes, provide information on the invasive alien species involved, the components of biodiversity for food and agriculture and any indication on how the components of biodiversity contributed to managing the spread and proliferation or controlling established invasive alien species in your country. Provide references to the supporting documentation.***

### ***3.10 Similarities, differences and interactions***

***Question 47. Comment on those aspects with respect to the state, trends and conservation of associated biodiversity or wild food biodiversity in relation to the state, trends and conservation of sector genetic resources. It would be helpful to provide your observations under the following headings:***

***a) main similarities between associated biodiversity, wild food diversity and the different sectors;***

***b) major differences between associated biodiversity, wild food diversity and the different sectors;***

***c) synergies or trade-offs between associated biodiversity, wild food diversity and the different sectors.***

### **3.11 Gaps and priorities**

#### **Question 48. With respect to the state, trends and conservation of associated biodiversity and ecosystem services:**

▪ ***a) What are the major gaps in information and knowledge?***

- Limited researches on the situation rare and endangered species.
- Lack of research on the situation and critical habitats.
- Poor information and knowledge on state and trends of associated biodiversity and ecosystem services
- Outdated surveys on Natural resources( forest, rangelands, wildlife).
- Inadequate assessment studies on degradation of associated biodiversity and ecosystem services.
- Inadequate studies and inventories on biodiversity components
- Lack of using modern technologies in biodiversity
- Weak scientific and technical cooperation and information exchange
- Limited knowledge on climate change, biodiversity issues, and friendly technologies
- Limited use of traditional knowledge on forest and rangelands resources

▪ ***b) What are the main capacity or resources limitations?***

- Insufficient skills to carry out surveys on and classify the components of biodiversity.
- Scarcity of financial resources
- Lack in research, education, extension and awareness activities at all levels
- Weak institutional capacity to implementation
- Lack of financial resources and poor infrastructure
- Weak planning capacity of biodiversity issues
- Inadequate Monitoring and Evaluation mechanisms
- Lack of data base system that depends on GIS and remote sensing
- Weak capacity in preparing, implementing plans and programs and reporting in biodiversity.
- Weak capacity to mitigate and adapt to climate change issues
- Limited public education and awareness
- Weak in the ability to collect and document the Genetic Resources and regulate their use
- Lack of human resources to address climate issues.
- Weak recognition of the climate change issue relative to other development priorities
- Weak organizational capacity to evaluate and manage the invasive alien species
- 

▪ ***c) What are the main policy and institutional constraints?***

- Lack of Institutional Capacities
- Lack of integration between policies and legislations related to biodiversity issues.
- Inadequate policy, legal and enabling frameworks
- Weak of the organizational ability enforce the laws and legislations related to biodiversity.
- Insufficient skills to carry out surveys on and classify the components of biodiversity.
- Scarcity of financial resources
- Absence policy and legislations related to forests and rangelands

▪ ***d) What actions are required and what would be the priorities?***

- surveys and inventories on biodiversity components.
- Initiate researches on rare and endangered species and their habitats.
- Research on critical habitats, including methods to restore and maintain the ecological functioning of biodiversity components.
- Initiate research to quantify and forecast the response of genotypes, species, habitats, ecosystems and landscapes under anticipated climate change.
- Develop methodologies for adaptation and conservation policies.

- Develop flora, fauna inventories.
- Provide funds and infrastructure for research institutions to develop research programs in the target areas.
- Conduct forest, range, soil and desertification surveys.
- Support traditional and environmentally sound land use practices.
- Study and review policies
- Policy Development and planning
- Resource mobilization
- Institutional and legislative strengthening
- Data and information collection, dissemination and monitoring
- Research and technology development

**Question 49. With respect to the impact and response to natural or human-made disasters and biodiversity for food and agriculture:**

*a) What are the major gaps in information and knowledge?*

- Very limited and scattered data
- Very limited research, studies and articles.

*b) What are the main capacity or resources limitations?*

- Lack of professional and systematic training in the field of biodiversity
- Shortage of biodiversity specialists and general lack of adequately trained human resources in research, planning, policy development, monitoring and documentation.
- weakness of funding.

*c) What are the main policy and institutional constraints?*

- Lack of national policy and legislation on the conservation of wild resources used for food

*d) What actions are required and what would be the priorities?*

- Implement a specialized training program
- Strengthen a national network of stakeholders .
- Capacity building plane for conservation and sustainable use
- Strengthen cooperation and coordination at local, regional and global levels in the relevant biodiversity conservation areas
- Ensure financial support

**Question 50. With respect to the impact and response to natural or human-made disasters and biodiversity for food and agriculture:**

*a) What are the major gaps in information and knowledge?*

- Lack of a information and knowledge
- lack of long-term, systematic records of rainfall and temperature severely hampers efforts to quantify long-term changes in climate

*b) What are the main capacity or resources limitations?*

- Lack of funding
- lack of adaptive capacity & inadequate protective measures

*c) What are the main policy and institutional constraints?*

- Absence of an institutional structure aimed at integrating climate change issues into national plans
- Lack of adequate policies and programs
- Institutional to withstand against and manage the anticipated occurrence of natural disasters



- lacks of a plan for restoring and safeguarding ecosystems that provides essential service
- lack of national and adaptation plans for climate change
- limited public awareness on climate change issues and biodiversity

***d) What actions are required and what would be the priorities?***

- Assess renewable natural resources, prepare climate projections, and develop adequate policies and programs. In addition, institutional weaknesses undermine the state's ability to withstand against and manage the anticipated occurrence of natural disasters.
- Strengthening institutional against climate and other natural disasters
- Action plan for addressing the potential impacts of climate change and adaptation measures focus on mitigating impact of natural disaster risks. the action plan gives special attention for improving knowledge base through research oriented for measuring & documenting the biological and meteorological variables relevant.

***Question 51. With respect to the impact of invasive alien species on biodiversity for food and agriculture:***

The spread of invasive alien species has become increasingly serious problem in the Yemen, *Prosopis juliflora* has caused biodiversity loss of associated shrubs; the wild cactus *Opuntia* spp. has invaded Agriculture lands, woodlands and rangelands.

***a) What are the major gaps in information and knowledge?***

- Still there is no inventory identifying and documenting the alien species.
- Lack of precise information/ data and knowledge on alien species and impacted them on biodiversity ecosystems, habitats or species
  - Lack of enough information on numbers, species, composition and the effect of invasive alien species
  - Lack of ecological and biological studies for invasive species.

***b) What are the main capacity or resources limitations?***

lack of financial and technical resources has impeded the capacity of inventory, research, monitoring, planning, and management

***c) What are the main policy and institutional constraints?***

- Lack of national policy and law for Monitor and control the expansion and Strengthen quarantine measures to control intentional and unintentional introduction of alien invasive species.
- Lack of monitoring system for alien invasive species
- Lack of institutional capacities in evaluating and preserving alien species
- no management plans to control on alien species

***d) What actions are required and what would be the priorities?***

- Prepare a national policy to prevent invasive alien species of threatening ecosystems, and mitigate their negative impacts on forests and rangelands ecosystems & biological diversity in general
- Establish data base and institutional capacities building.
- Prepare a list of alien invasive species and identify the most dangerous ones
- Develop and implement national strategy an integrated to controlling and managing invasive alien species
- Management plans in place for major alien species that threaten ecosystems, habitats or species.

## *Chapter 4 : The state of use of biodiversity*

### **4.1 The use of management practices or actions that favour or involve the use of biodiversity for food and agriculture**

**Question 52. For each of the production systems present in your country (indicated in Table 1) indicate in Table 20 the extent of use of management practices that are considered to favor the maintenance and use of biodiversity for food and agriculture.**

Table 20. Management practices that are considered to favor the maintenance and use of biodiversity for food and agriculture.

<b>Production system Irrigated crops.</b>			
<b>Management practices<sup>21</sup></b>	<b>Percent of production area or quantity under the practice (%)</b>	<b>Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)</b>	<b>Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)</b>
Integrated Plant Nutrient Management (IPNM)	80%	1	1
Integrated Pest Management (IPM)	7%	1	1
Pollination management	2%	1	1
Landscape management	NK	NK	NK
Sustainable soil management practices	30%	NK	NK
Conservation agriculture	NA	NA	NA
Water management practices, water harvesting	10%	NK	NK
Agroforestry	0.75%	NK	NK
Organic agriculture	3%	NK	NK
Low external input agriculture	1.5%	NK	NK
Home gardens	0.007%	-1	-1
Areas designated by virtue of production features and approaches	NA	NA	NA
Ecosystem approach to capture fisheries	NA	NA	NA
Conservation hatcheries	NA	NA	NA
Reduced-impact logging	NA	NA	NA

<b>Production system Rianfed crops.</b>			
<b>Management practices<sup>21</sup></b>	<b>Percent of production area or quantity under the practice (%)</b>	<b>Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)</b>	<b>Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)</b>
Integrated Plant Nutrient Management (IPNM)	50%	1	1
Integrated Pest Management (IPM)	55%	1	1
Pollination management	NA	NA	NA
Landscape management	NK	NK	NK
Sustainable soil management practices	30%		
Conservation agriculture	0.5%		
Water management practices, water harvesting	30%		
Agroforestry	2%		
Organic agriculture	80%		
Low external input agriculture	90%		
Home gardens	0.002%	-1	-1
Areas designated by virtue of production features and approaches	0.006% Sogatrah		
Ecosystem approach to capture fisheries	NA	NA	NA
Conservation hatcheries	NA	NA	NA
Reduced-impact logging	NA	NA	NA
<b>Production system livestock grassland based</b>			
<b>Management practices<sup>21</sup></b>	<b>Percent of production area or quantity under the practice (%)</b>	<b>Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)</b>	<b>Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)</b>
Integrated Plant Nutrient Management (IPNM)	NA	NA	NA
Integrated Pest Management (IPM)	NA	NA	NA
Pollination management	NA	NA	NA
Landscape management	NK	NK	NK
Sustainable soil management practices	NA	NA	NA
Conservation agriculture	NA	NA	NA
Water management practices, water harvesting	NK	NK	NK
Agroforestry	NK	NK	NK
Organic agriculture	NA	NA	NA
Low external input agriculture	NA	NA	NA
Home gardens	NA	NA	NA
Areas designated by virtue of production features and approaches	NA	NA	NA
Ecosystem approach to capture fisheries	NA	NA	NA
Conservation hatcheries	NA	NA	NA
Reduced-impact logging	NA	NA	NA

<b>Production system</b> Naturally regenerated forest			
<b>Management practices<sup>21</sup></b>	<b>Percent of production area or quantity under the practice (%)</b>	<b>Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)</b>	<b>Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)</b>
Integrated Plant Nutrient Management (IPNM)	NA	NA	NA
Integrated Pest Management (IPM)	NA	NA	NA
Pollination management	NA	NA	NA
Landscape management	NK	NK	NK
Sustainable soil management practices	NA	NA	NA
Conservation agriculture	NA	NA	NA
Water management practices, water harvesting	NK	NK	NK
Agroforestry	NA	NA	NA
Organic agriculture	NA	NA	NA
Low external input agriculture	NA	NA	NA
Home gardens	NA	NA	NA
Areas designated by virtue of production features and approaches	NA	NA	NA
Ecosystem approach to capture fisheries	NA	NA	NA
Conservation hatcheries	NA	NA	NA
Reduced-impact logging	NA	NA	NA
<b>Production system: M1 Mixed</b>			
<b>Management practices<sup>21</sup></b>	<b>Percent of production area or quantity under the practice (%)</b>	<b>Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)</b>	<b>Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)</b>
Integrated Plant Nutrient Management (IPNM)	NK	NK	NK
Integrated Pest Management (IPM)	NK	NK	NK
Pollination management	NA	NA	NA
Landscape management	NK	NK	NK
Sustainable soil management practices	NK	NK	NK
Conservation agriculture	NA	NA	NA
Water management practices, water harvesting	NK	NK	NK
Agroforestry	NK	NK	NK
Organic agriculture	NA	NA	NA
Low external input agriculture	NA	NA	NA
Home gardens	NA	NA	NA
Areas designated by virtue of production features and approaches	NA	NA	NA
Ecosystem approach to capture fisheries	NA	NA	NA
Conservation hatcheries	NA	NA	NA
Reduced-impact logging	NA	NA	NA

<b>Production system:</b> Self recruiting capture fisheries			
<b>Management practices<sup>21</sup></b>	<b>Percent of production area or quantity under the practice (%)</b>	<b>Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)</b>	<b>Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)</b>
Integrated Plant Nutrient Management (IPNM)	NA	NA	NA
Integrated Pest Management (IPM)	NA	NA	NA
Pollination management	NA	NA	NA
Landscape management	NA	NA	NA
Sustainable soil management practices	NA	NA	NA
Conservation agriculture	NA	NA	NA
Water management practices, water harvesting	NA	NA	NA
Agroforestry	NA	NA	NA
Organic agriculture	NA	NA	NA
Low external input agriculture	NA	NA	NA
Home gardens	NA	NA	NA
Areas designated by virtue of production features and approaches	NA	NA	NA
Ecosystem approach to capture fisheries	NA	NA	NA
Conservation hatcheries	NA	NA	NA
Reduced-impact logging	NA	NA	NA
<b>Production system:</b> fed aquaculture			
<b>Management practices<sup>21</sup></b>	<b>Percent of production area or quantity under the practice (%)</b>	<b>Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)</b>	<b>Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)</b>
Integrated Plant Nutrient Management (IPNM)	NA	NA	NA
Integrated Pest Management (IPM)	NA	NA	NA
Pollination management	NA	NA	NA
Landscape management	NA	NA	NA
Sustainable soil management practices	NA	NA	NA
Conservation agriculture	NA	NA	NA
Water management practices, water harvesting	NA	NA	NA
Agroforestry	NA	NA	NA
Organic agriculture	NA	NA	NA
Low external input agriculture	NA	NA	NA
Home gardens	NA	NA	NA
Areas designated by virtue of production features and approaches	NA	NA	NA
Ecosystem approach to capture fisheries	NA	NA	NA
Conservation hatcheries	NA	NA	NA
Reduced-impact logging	NA	NA	NA

**Question 53. For each of the production systems present in your country (indicated in Table 1) indicate in Table 21 the extent of use of diversity based practices that involve the use of biodiversity for food and agriculture.**

**In each table indicate the percent of total production area or quantity under the practice (where known), changes in the production area or quantity under the practice that have occurred over the last 10 years (strongly increasing (2), increasing (1), stable (0) decreasing (-1), strongly decreasing (-2), not known (NK)) and any identified change in biodiversity for food and agriculture associated with the diversity based practice (strongly increasing (2) increasing (1), stable (0) decreasing (-1), strongly decreasing (-2), not known (NK)).**

Table 21. Diversity based practices that involve the enhanced use of biodiversity for food and agriculture

Production system Livestock grassland-based systems: Tropics			
Diversity based practices	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)
Diversification	30	-1	-1
Base broadening	25	-1	-1
Domestication	15	-2	-2
Maintenance or conservation of landscape complexity	14	-1	-1
Restoration practices	26	1	1
Management of micro-organisms	10	NK	NK
Polyculture/Aquaponics	NA	NA	NA
Swidden and shifting cultivation agriculture	38	1	1
Enriched forests	NK	NK	NK
Others			

<b>Production system Livestock landless systems:</b>			
Tropics			
<b>Diversity based practices</b>	<b>Percent of production area or quantity under the practice (%)</b>	<b>Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)</b>	<b>Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)</b>
Diversification	5	NK	NK
Base broadening	1	NK	NK
Domestication	NK	NK	NK
Maintenance or conservation of landscape complexity	NK	NK	NK
Restoration practices	NK	NK	NK
Management of micro-organisms	NK	NK	NK
Polyculture/Aquaponics	NA	NA	NA
Swidden and shifting cultivation agriculture	NK	NK	NK
Enriched forests	NK	NK	NK
Others			

<b>Production system Naturally regenerated forests:</b>			
Tropics			
<b>Diversity based practices</b>	<b>Percent of production area or quantity under the practice (%)</b>	<b>Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)</b>	<b>Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)</b>
Diversification	50	NK	NK
Base broadening	10	NK	NK
Domestication	1	NK	NK
Maintenance or conservation of landscape complexity	5	NK	NK
Restoration practices	15	NK	NK
Management of micro-organisms	NK	NK	NK
Polyculture/Aquaponics	NK	NK	NK
Swidden and shifting cultivation agriculture	NK	NK	NK
Enriched forests	20	NK	NK
Others			

<b>Production system</b> Self-recruiting capture fisheries: Tropics			
<b>Diversity based practices</b>	<b>Percent of production area or quantity under the practice (%)</b>	<b>Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)</b>	<b>Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)</b>
Diversification	NK	NK	NK
Base broadening	NK	NK	NK
Domestication	NK	NK	NK
Maintenance or conservation of landscape complexity	NK	NK	NK
Restoration practices	NK	NK	NK
Management of micro-organisms	NK	NK	NK
Polyculture/Aquaponics	NK	NK	NK
Swidden and shifting cultivation agriculture	NK	NK	NK
Enriched forests	NK	NK	NK
Others			

<b>Production system</b> Fed aquaculture: Tropics			
<b>Diversity based practices</b>	<b>Percent of production area or quantity under the practice (%)</b>	<b>Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)</b>	<b>Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)</b>
Diversification	NK	NK	NK
Base broadening	NK	NK	NK
Domestication	NK	NK	NK
Maintenance or conservation of landscape complexity	NK	NK	NK
Restoration practices	NK	NK	NK
Management of micro-organisms	NK	NK	NK
Polyculture/Aquaponics	NK	NK	NK
Swidden and shifting cultivation agriculture	NA	NA	NA
Enriched forests	NA	NA	NA
Others			



<b>Production system</b> Irrigated crops (other) : Tropics			
<b>Diversity based practices</b>	<b>Percent of production area or quantity under the practice (%)</b>	<b>Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)</b>	<b>Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)</b>
Diversification	10	2	2
Base broadening	10	1	2
Domestication	NK	NK	NK
Maintenance or conservation of landscape complexity	5	1	1
Restoration practices	NK	NK	NK
Management of micro-organisms	NK	NK	NK
Polyculture/Aquaponics	NK	NK	NK
Swidden and shifting cultivation agriculture	60	1	1
Enriched forests	NK	NK	NK
Others			

<b>Production system</b> Rainfed crops : Tropics			
<b>Diversity based practices</b>	<b>Percent of production area or quantity under the practice (%)</b>	<b>Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)</b>	<b>Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)</b>
Diversification	30	0	0
Base broadening	10	0	0
Domestication	NK	NK	NK
Maintenance or conservation of landscape complexity	10	1	1
Restoration practices	NK	NK	NK
Management of micro-organisms	NK	NK	NK
Polyculture/Aquaponics	NK	NK	NK
Swidden and shifting cultivation agriculture	40	1	1
Enriched forests	NK	NK	NK
Others			

<b>Production system</b> Mixed systems (livestock, crop forest and /or aquatic and fisheries): Tropics			
<b>Diversity based practices</b>	<b>Percent of production area or quantity under the practice (%)</b>	<b>Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)</b>	<b>Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)</b>
Diversification	40	1	1
Base broadening	20	1	1
Domestication	NK	NK	NK
Maintenance or conservation of landscape complexity	20	1	1
Restoration practices	NK	NK	NK
Management of micro-organisms	NK	NK	NK
Polyculture/Aquaponics	NK	NK	NK
Swidden and shifting cultivation agriculture	40	1	1
Enriched forests	NK	NK	NK
Others			

**Question 54. List and briefly describe any specific programmes or projects that have been undertaken in the country to support any of the practices listed in Table 20 and Table 21. Provide information where available on what types of activities were supported, areas and numbers of farmers, pastoralists, forest dwellers and fisher folk involved, state and outcome with respect to components of biodiversity for food and agriculture.**

#### **4.2 Sustainable use of biodiversity for food and agriculture**

**Question 55. What are the major practices in your country that negatively impact associated biodiversity and/or wild foods? Answers can be provided in Table 22 where examples of general types of practices are listed.**

Table 22. Major practices that negatively impact associated biodiversity and/or wild foods in the country.

<b>Types of practices</b>	<b>Major practice (Y/N)</b>	<b>Description</b>	<b>Reference</b>
Over-use of artificial fertilizers or external inputs	Yes	Wetland & mangroves pollution, due to excessive use of agro-chemicals and artificial fertilizers in land Irrigated crops and dumping of waste & Sewage, flushed by floods	NBSAP. 2015
Over-use of chemical control mechanisms (e.g. disease control agents, pesticides, herbicides, veterinary drugs, etc.)	Yes	Increasing use of agro-chemicals control mechanisms (disease control agents, pesticides, herbicides) resulting in habitat degradation and wildlife pollution, particularly, Wetlands pollution. mainly as a result of agricultural development .	NBSAP. 2015
Inappropriate water management	Yes	Deterioration of interior wetlands due to Increased water extraction and depletion for agriculture irrigation associated with lack of water conservation systems	NBSAP. 2015
Practices leading to soil and water degradation	Yes	Over extraction of water resources and the subsequent depletion of water ecosystems is attributed to numerous drivers, including population explosion, economic development, include the accelerated development and competition for water in the urban, industrial and agricultural sectors, On the other hand, chemical fertilizers and pesticides used in agriculture seep into groundwater aquifers causing excessive pollution that exceed the capacity of ecosystems to maintain water quality. The depletion of ecosystems with the consequent water scarcity leads to reduction in water availability, It also leads to the gradual loss of agricultural land with the subsequent reduction of crop production combined with loss of genetic resources & the extinction of livestock and biodiversity species	NBSAP. 2015
Over-grazing	Yes	Mangrove trees are exposed to overgrazing and unsustainable. over-grazing which uncontrolled and neglect of sustainable traditional practices leads to the degradation gradual and loss of rangelands plants and biodiversity	Ahmed, kadri Abdul Baki (2013) Bab al-Mandab Pilot Coastal Zone. Pilot Program for Climate Resilience Consultancy for Rapid risk assessment of Climate Change on

			Coastal Zones. Final Report, Report Submitted to Environment Authority.
Uncontrolled forest clearing	Yes	The forests are suffering from illegal cutting and deforestation, which uncontrolled to become highly fragmented in many of forests ecosystems, mainly as a result of development, expansion randomly of agriculture and infrastructure particularly the roads and tourism. all this contributed to degradation wildlife and biodiversity	NBSAP. 2015
Fishing in protected areas	Yes	Biodiversity is affected by the use of fishing tools irrational and overfishing with weak monitoring.	<b>Bawazir, G. M. (2009). Marine Biodiversity of Aden Wetlands Protected Areas. (Wings Over Wetlands Project ), GEF - UNEP. Aden</b>
Overharvesting	Yes	Biodiversity subjected to deterioration due to lack of control and weak enforcement hunting law.  Unsustainable harvesting of forest products beyond the limits of the productive capacity of forest ecosystems -The wildlife are suffering from illegal Overharvesting, hunting, cutting and collecting plants, almost everywhere and uncontrolled. -Excessive hunting of wild life. -Over-exploitation of endemic species and endangered species -Uncontrolled exporting of indigenous livestock and native genetic species.	<b>Bawazir, G. M. (2009). Marine Biodiversity of Aden Wetlands Protected Areas. (Wings Over Wetlands Project ), GEF - UNEP. Aden</b>  NBSAP. 2015
Others			

**Question 56. Briefly describe any actions and countermeasures taken to limit unsustainable use and/or support sustainable use of associated biodiversity and/or wild foods.**

**Question 57. Provide in Table 23 any information available that lack of biodiversity for food and agriculture is limiting food security and nutrition, and/or rural livelihoods in the different production systems in your country. Indicate the production systems affected together with any information on the extent of problem (significant lack (2), some lack (1)), describe the effects on livelihood, food security and nutrition, and the components of biodiversity for food and agriculture that are limited. The list of components of biodiversity for food and agriculture given in Annex 1 should be used where possible.**

### **4.3 The contribution of biodiversity for food and agriculture in improving productivity, food security and nutrition, livelihoods, ecosystem services, sustainability, resilience and sustainable intensification**

**Question 58. Where available, provide information that increasing the amount of biodiversity for food and agriculture, including associated biodiversity, in production systems in your country have improved the following:**

- a) productivity;**
- b) food security and nutrition;**
- c) rural livelihoods;**
- d) ecosystem services;**
- e) sustainability;**
- f) resilience;**
- g) sustainable intensification.**

**What specific actions have you undertake to strengthen the contribution of biodiversity for food and agriculture to improving these outcomes? For each of these aspects, briefly describe the nature and scale of the actions implemented, the production systems involved, and the outcomes, results obtained or lessons learned from these actions.**

The main outputs in Yemen forests; woodlands; agroforestry and rangelands relate to Timber; Fuel wood and charcoal; Extraction of genetic material for medicinal purposes; Sources of food mainly wild fruits, meat, gums; honey; Fodder for livestock, a result in large measure of Yemen's high level of self-sufficiency in many products (NBSAP, 2015). This level of forests; woodlands; agroforestry and rangelands biodiversity production for local consumption and export markets is currently achieved through under over harvesting, may have implication for biodiversity.

#### **Forests and woodlands production system :**

Yemen's forest and woodland resources deliver a wide range of direct & indirect benefits to Yemeni peoples & to environment. Forest direct benefits are derived in the form of fuel wood, fodder, medicinal plants and honey production among others. Indirect benefits are provided by as services for retaining ecosystems functions, such as carbon sequestration, pollination, and soil erosion prevention, biodiversity conservation, protection of watersheds, prevention of land degradation and desertification. These economic benefits have been partially valued & it has been found that direct & indirect benefits of services delivered by Yemen forest has been

estimated to be worth some USD 260,787 million per year. The value of fuelwood is inclusive of the contribution from rangelands. Unfortunately, most of the ecosystem values such as value of energy from fuel wood, the medicinal values of forests & pollinators are not taken into account when estimating GDP. Thus, a significant value portion of forest ecosystem services and functions is undervalued while unsustainable management, decision making and consumption of natural resources, lead to the subsequent loss of forest resources. One of the factors contributing to the overlooking of ecosystem values and forest loss is attributed to policy & law failures, which are consequently given high priority in updating the current strategy. Specific attention is to be given to policy reform in the sectors of energy, traditional health sector, water sector so as to ensure the integration of the ecosystem values in deriving national income accounts and at all levels of decision making (NBSAP, 2015).

Mangroves are forests but have been classified under marine ecosystems. Covering approximately 900 hectares (FRA 2010), mangroves provide vital functions mostly protective roles for the coastline and other marine ecosystems such as sea grass. Mangroves are also known to have extraordinary properties of absorbing nutrients thus reducing marine pollution. Moreover, they provide food, in the form of fish to communities and are a source of tourism opportunities. Based on the assumptions and availability of data, the use values of mangroves were estimated at USD 482 million. This amount is the aggregated summation of the values of fuelwood, fodder, fish production and carbon stock (69.4%, 0.1%, 30.2% and 0.4% respectively). Other functions such as absorption of nutrients, reduction of pollution and protective functions of mangroves were not estimated due to lack of data (NBSAP, 2015).

### **Agro-forestry**

Yemen agroforestry systems are very important to local populations in terms of food security, income generation and environmental protection, but have not been sufficiently documented and evaluated. Yemeni agroforestry systems comprise numerous indigenous tree and shrub species ecosystems associated either individually or collectively with the main country cropping systems. Yemen agroforestry cropping ecosystems are managed for production of wide range varieties of indigenous products of cereals, fruit, vegetables, fodder, etc. Tree and shrub ecosystems host numerous species and are mainly dominated by *Zizyphus* orchards, *Acacia* spp, *Ficus* spp, and date palm,. Trees within agroforestry systems, perform various functions ranging from protection against: sand encroachment and sand blasting, drying wind effect, water erosion, sunshine, animals, etc. They also provide various products including: fruit, construction wood, fuel-wood, fodder, honey, etc. Agroforestry systems are also valuable grazing areas providing forage for livestock, e.g. (sorghum stover and crop residues), but the value of fodder derived by livestock is estimated under section rangeland. The agroforestry provide useful products for household as well as for local and national economies. Such commodities range from food and medicinal products for humans and animals, to construction and fuel-wood, and cash income. They furthermore contribute to the sustainability of soil nutrient and water cycles and buffer climatic extremes. The agriculture sector, including plants, animals and forestry plays a fundamental role in achieving food security, increasing the GDP, diversifying the economic platform, creating job opportunities and reducing poverty, particularly in rural areas. It absorbs almost “ 33% of the work force and accounts for 11.4% of GDP (current prices) in the average during the period 2001-08. However, its exports did not exceed 1.2% of the gross non-oil exports in 2008 (NBSAP, 2015).

The cultivated system contributes to food security significantly. In 2009, cereals production was 756,000 Tons, representing 15.2% of the national demand<sup>24</sup> . Currently, Yemen only meets 7.8% of wheat demand (2010 data), which is down from 8.9% in 2005, and 89% in 1970. Yemen relies on imports of wheat, which opens it up to severe price swings, such as in

2008 & in 2011. As per 2014 survey, food insecurity was about 10.6 million, of whom 5 million (or 19 percent of the population) were severely food insecure (Comprehensive Food Security Survey (CFSS)). During the 2015 war- March to June- , food insecurity has reached a critical situation under which about 12.9 million people, or 44 percent of the population, no longer have enough to eat, and 6 million of whom are facing extreme food insecurity resulting in high acute malnutrition or excess mortality, according to a report from the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) in June 2015. The agriculture sector can address both food sovereignty and food security through higher production of grains, and increased incomes from expanded production of cash crops

**Rangelands production system :**

Yemen's rangelands provide fuelwood, a source of energy for the rural poor population, fodder for livestock (cattle, camels, goats, sheep and donkeys) and medicinal plants. In addition, the rangelands offer services and functions which support economic production processes such as habitat for wildlife, pollinators, soil erosion prevention and soil maintenance, carbon sequestration and watershed properties. Total value of goods and services produced by Yemen rangelands has been estimated to be worth some USD 12,146 million per year. The bulk of this value (80.3%) is the value of fodder derived by livestock, while the remaining 19.7% is the value of other benefits such as honey production, medicinal plants, pollination of agricultural products and Soil erosion prevention. The total area coverage of the rangelands in Yemen is estimated at approximately 22600 thousand hectares, and provides 55 million tons of fodder for survival of about 9.4 million sheep, 9.2 million goats, 0.44 million camels and 1.7 million cattle. As per current study on economic valuation of key ecosystem of Yemen, total value of fodder delivered by Yemen's Rangelands in 2012 was estimated at approximately USD 9,752 Million (NBSAP, 2015).

Fishery resources are the most important goods delivered by marine ecosystem. They play an important role in supporting Yemen's economic growth, food supply & food security and addressing poverty issue through job creation for the rural poor. In figures, fisheries is regarded as the Yemeni economy's third sector in order of importance, contributes a 1.7% share to the country's GDP<sup>14</sup>, and provides more than 350,000 people with jobs<sup>15</sup>, being 8 to 10% of the total Yemeni labour force. In addition, the fishing sector contributes to the total national export through a share of 3.8%. Higher share of export from fisheries is highly feasible, provided that on-spot refrigeration has been introduced so as to improve freshness quality & meet export standards. Recent fishery data shows that production volume has increased from 179 thousand tons in 2007 to 199 thousand tons in 2010. Similarly, the export value has increased from US\$173 million in 2007 to US\$ 210 million in 2010.

Yet, fishery resources can offer greater potential for the country's economic development and are expected to play a vital role in ensuring food security, promoting pro-poor economic growth, and also achieve diversification of sources of income in the national economy, contributing through all these means to the country's overall achievement of national policies related to food security and poverty eradication. Specifically, the sector has the potential to increase its contribution to national food security and poverty eradication through enabling coastal people to equitable access and benefit from fishery resources, and subsequently contribute to overall achievement of MDG1.A as regard the reduction of proportion of Yemeni people under poverty, which is an important target of National Fisheries Sector Strategy (NFSS 2011). It has also the potential to promote the benefit sharing of natural resources, conservation, sustainable use of biodiversity and ecosystems services, thus contributing to the achievement of UNDP goal on Sustainable Management of Natural Resources with specific relation to the attainment of outcome<sup>4</sup> concerned with improvement of sustainable and equitable use of natural resources(outcome<sup>4</sup>).

**Question 59. Do you have information on the proportion of the population in your country that uses wild food on a regular basis for food and nutrition? If available, include information such as the proportion of the diet that is collected from the wild in normal time and in times of scarcity, drought, natural and human-made disaster, and the degree to which wild foods are used (for subsistence, supplementing, nutrition, other).**

- No information available on the proportion of the population that uses wild food on a regular basis for food and nutrition.

#### **4.4 The adoption of ecosystem approaches**

**Question 60. Describe in Table 24 the extent to which you consider that ecosystem approaches have been adopted for the different production systems in your country (widely adopted (2), partially adopted (1), not adopted (0), not applicable (NA)) and indicate whether ecosystem approaches are considered of major importance (2), some importance (1), no importance (0), not applicable (NA). You may also want to describe landscape approaches<sup>25</sup> that have been adopted in your country.**

Table 24. Adoption of and importance assigned to ecosystem approaches in production system.

<b>Production system</b>	<b>Ecosystem approach adopted (name)</b>	<b>Extent of adoption (2, 1, 0, NA)</b>	<b>Importance assigned to ecosystem approach (2, 1, 0, NA)</b>
L2 Livestock grassland-based	NBSAP2 2015-2025	1	1
L6 Livestock landless	NBSAP2 2015-2025	1	1
F2 Naturally forest	NBSAP2 2015-2025	1	1
A1 Self recruiting capture fisheries	NBSAP2 2015-2025	1	1
A9 Fed aquaculture	NBSAP2 2015-2025	1	1
C6 Irrigated crop	NBSAP2 2015-2025	1	1
C10 Rainfed crops	NBSAP2 2015-2025	1	1
M12 Mixed	NBSAP2 2015-2025	1	1

**Question 61. For each production system in which an ecosystem and landscape approach has been widely adopted (as indicated in Table 24) describe:**

- The specific actions that have been taken to ensure adoption;**
- Any observed results from adoption;**
- Plans for adoption or for further adoption in new or existing production areas;**
- Lessons learned.**



## **4.5 Gaps and priorities**

**Question 62. With respect to the use of management practices or actions that favor or involve the use of biodiversity for food and agriculture:**

**a) What are the major gaps in information and knowledge?**

There are big gap in data and information gathering for assessment of status and trends of biodiversity components, and for strengthening the sustainable management of biodiversity for food and agriculture.

Lack to information and knowledge for the management practices which favour the maintenance and use of biodiversity for food and agriculture

**b) What are the main capacity or resources limitations?**

Lack of sustainable funding for research and to the use of management practices or actions that favor or involve the use of biodiversity for food and agriculture.

- Rarity or even lack of knowledgeable & trained personnel in survey, research and Lack of capacity and staff skills for management practices of biodiversity for food and agriculture.

-Weakness a institutional structure, and Paucity of funds and requirements for capacity building

**c) What are the main policy and institutional constraints?**

- Lack of policies and legislations related to the conservation and sustainable use of Biodiversity.

- Weak institutional capacity to planning and implementation the practices or actions that favor or involve the use of biodiversity for food and agriculture.

- Absence of integrated plans for management of rangelands, forests, woodlands and other biodiversity

**d) What actions are required and what would be the priorities?**

-Develop national plan for strengthening the capacity and institutional structure for sectors.

- Training, awareness and education programs

- Research, monitoring and technology development.

- Database building on components biodiversity

- Mechanism for Resource mobilization

- Policy Development and planning

- Spatial planning is well coordinated

- Management units of all rangelands and forest-function areas are completely established;

- Formulation and implementation of action plan on use of biodiversity for food and agriculture

**Question 63. With respect to the sustainable use of biodiversity for food and agriculture:**

**a) What are the major gaps in information and knowledge?**

- Lack of data, information and knowledge on harvesting of forests, rangelands, wildlife products and native genetic species,

**b) What are the main capacity or resources limitations?**

- Lack of funding and capacities

- Lack of alternative sources of income for local communities

**c) *What are the main policy and institutional constraints?***

- Lack of policies and legislations on forestry and rangelands
- Lack of forest and rangelands management plans

**d) *What actions are required and what would be the priorities?***

- Mobilization of financial resources
- Develop forest policy & law to promote sustainable use of forests and rangelands products
- Strengthening the sustainable management of biodiversity for food and agriculture will require research and extensive monitoring, capacity building and awareness raising activities for which political commitment and additional resources are needed.
- Improvement of Public awareness, research and knowledge sharing
- organization and Issue the harvest permits for harvesting of forests and rangelands products on predefined sustainable annual allowable harvest
- Develop and implement rational forests and rangelands management plans
- Provide local communities with alternative sources of income from non-forest products such as dairy, honey, ecotourism and handy craft
- Expansion of Protected areas network for *Biodiversity and Ecosystems Conservation*

**Question 64. *With respect to the contribution of biodiversity for food and agriculture to improving productivity, food security and nutrition, livelihoods, ecosystem services, sustainability, resilience and sustainable intensification:***

**a) *What are the major gaps in information and knowledge?***

**b) *What are the main capacity or resources limitations?***

**c) *What are the main policy and institutional constraints?***

**d) *What actions are required and what would be the priorities?***

**Question 65. *With respect to the adoption of ecosystem approaches:***

**a) *What are the major gaps in information and knowledge?***

**b) *What are the main capacity or resources limitations?***

**c) *What are the main policy and institutional constraints?***

**d) *What actions are required and what would be the priorities?***

## **Chapter5: The state of interventions on conservation and use of biodiversity for food and agriculture**

### **5.1 National policies, programmes and enabling frameworks that support or influence conservation and sustainable use of biodiversity for food and agriculture and the provision of ecosystem services**

**Question 66. Identify and describe the main policies, programmes and enabling frameworks that support or specifically address the objectives below, briefly describing the policies, programmes or enabling frameworks listed and provide any available information on the extent of implementation or of lessons learned. For each objective, list up to 10 major policies, programmes and enabling frameworks.**

- a) Support the integrated conservation and sustainable use of biodiversity for food and agriculture across sectors;**
- b) Support the conservation and sustainable use of associated biodiversity;**
- c) Address food security and nutrition with explicit reference to biodiversity for food and agriculture, associated biodiversity and/or wild foods;**
- d) Address the maintenance of ecosystem services with explicit reference to biodiversity for food and, associated biodiversity and/or wild foods;**
- e) Improve resilience and sustainability of production systems with explicit reference to biodiversity for food and agriculture, associated biodiversity and/or wild foods;**
- f) Support farmers, pastoralists, forest dwellers and fisher folk to adopt and maintain practices that strengthen the conservation and use of biodiversity for food and agriculture.**

Yemen since 1990, prepared the number of the main policies, programs and enabling frameworks (i.e. laws, legislations and strategies & plans) that support or specifically address the objectives outlined above, categorized at an international and national level, are as follows:

#### **- International Conventions**

Yemen has signed and ratified a number of Conventions international (party) on nature conservation, including the 1992 Rio Convention on Biological Diversity (CBD); Contention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); Convention on Migratory Species of Wild Animals (Bonn Convention); Convention on Wetlands (Ramsar Convention); World Heritage Convention; Convention on Combat Desertification; Convention on Climate Change, and Convention for the protection of the marine environment of the red sea and Arabian sea and Aden gulf.

#### **- National Level**

the most of the main policies, programmes and enabling frameworks which listed below on national level, unfortunately are not widely applied, for example:

In accordance with its obligations under the CBD, the Government of Yemen started to develop its Biodiversity Strategy and Action Plan (NBSAP1), implemented during the period 2004-2013. It covered 18 Strategic Themes, But no progress, The weak capacities in the NBSAP implementation were attributed to the limited staff available and limited training provided as well as limited financial resources. The important information we have to know that no progress achieved during the past years due to the politics and economic country situation. And

National Action Plan to Combat Desertification (NAPCD), In its effort to address Yemen commitment stated in the United Nations Convention to Combat Desertification and Drought (UNCCD), the Government developed the National Action Plan to Combat Desertification (NAPCD) in Year 2000. The plan was prepared following a consultative process outlining the direct and indirect causes of desertification; its physical and socio-economic aspects, anti-desertification policies, and the strategic framework and action plan to mitigate drought effects. The NAPCD also provides a preliminary picture of the national capacity building needs and constraints for land degradation management. But no progress achieved during the past years due to the limited financial, limited staff available, limited training, and politics & economic country situation.

Yemen's second National Strategic and Action Plan (NSBAP2), Actions for Biodiversity 2015-2025, was launched in 2015. is in line with that of the CBD Strategic Plan for Biodiversity 2011-2020, in that "biodiversity loss and degradation of ecosystems are reduced and progress is made towards substantial recovery by 2020".

This second plan built upon the achievements of the first plan and focused on action that were not fully completed and also addressed emerging issues. An Ecosystem Approach is an integral part of Yemen's NSBAP.

Outlined the strategy in its framework for sustainable development, The framework aims to integrate sustainable development into key areas of policy, to put in place effective implementation mechanisms and to progress sustainable development. The framework identifies a number of national policies and programmes relating to areas such as: sustainable harvesting and production; conservation and management of natural resources; climate change and clean energy; sustainable agriculture; and education, communication and behavior change.

With regards to connectivity and resilience of protected areas network, the framework priorities action on the development of an integrated approach to infrastructure into sectorial polices and the creation of green corridors to enhance biodiversity.

#### **Legal Frameworks Supporting NBSAP and NAPDC Implementation and Environmental Management**

Over the last 20 years, Government has put in place the Environment Protection Law (EPL) in addition to a number of environment related legislations addressing sustainable natural resource management. These laws contribute to the achievement of national sustainable development and poverty alleviation goals, and also provide the basis for implementation of RIO conventions. The Environment Protection Law No. 26 of 1995 (EPL) embodied the main principles of Rio Declaration, 1992 on sustainable development. Among others, the EPL 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. But, The Environment Protection Law No. 26 of 1995 (EPL) and other Laws is not widely applied in these, thereby causing many threats to the country limited natural resources. Weak enforcement of Laws is attributed to the limited managerial and technical capacity of the

human resources available to EPA and other agencies concerned with biodiversity for food and agriculture, associated biodiversity and/or wild foods.

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

#### ***National Environmental Action Plan***

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

Environmental issues of national concern were identified and environmental analyses including biodiversity were carried out on the major resource assets and economic sectors; particularly on biodiversity and natural habitats, water, land, marine and coastal resources, urban environment, cultural heritage, , oil and energy sector, mining sector and the industrial sectors .The NEAP promotes sustainable use of natural resources and biodiversity through a set of policy options addressing priority issues. These policy options deal with legislative, institutional, economic and financial measures in addition to information and community involvement.

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

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

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

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

The 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

#### ***Vision 2025***

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.

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

Six 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

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

The NSES calls undertaking a numbers of short and medium term interventions to address the following critical environmental issues:

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

**Main relevant Sectorial Agricultural Policies:**

- Plant Production Policies
- Seeds and Fertilizer Production Policies
- Protection Policies
- Forestry and Anti-Desertification Policies
- Agriculture Research Strategy
- Livestock Policies
- Fisheries Sector Strategy

***Question 67. List up to 10 major policies, programmes and enabling frameworks in your country that enhance the application of an ecosystem approach or a landscape approach and that contain an explicit reference to biodiversity for food and agriculture, associated biodiversity and/or wild foods. Include a brief description of the policies, programmes and enabling frameworks together with any information on the extent of their application (production system and area) and observed effect. Where possible provide examples of best practices or lessons learned.***

Yemen policies, programmes and enabling frameworks that enhance the application of an ecosystem approach or a landscape approach are listed below. For details on these policies, programmes and enabling frameworks refer to Question 66.

- National Action Plan to Combat Desertification 2000.
- National Agricultural & Natural Resources Management Policies (PRSP) Agriculture.
- Fisheries Sector Strategy
- National Adaptation Programme of Action
- Vision 2025
- The National Strategy for Environmental Sustainability (NSES)
- National strategy and Action Plan to biodiversity (NBSAP2) 2015-2025.
- The Environment Protection Law No. 26 of 1995 (EPL)

**Programms**

- Mountain terraces project
- Rainfed Agriculture and Livestock Project
- Fisheries Resource Management and Conservation
- Agro-biodiversity and Adaptation
- Groundwater and Soil Conservation Project
- Sana'a Basin Water Management Project
- Protected Areas Management Project
- Yemen - Seeds and Agricultural Services
- Land & Water Conservation Project

- Sustainable Natural Resources Management Project
- Strengthening Socotra's Policy and Regulatory Framework for Mainstreaming Biodiversity Project Duration:

**Question 68. Describe up to 10 major policies, programmes and enabling frameworks in your country that embed the use of biodiversity for food and agriculture, including its different components, into disaster management and response.**

National Action Plan to Combat Desertification 2000 and The National strategic and Action Plan to biodiversity (NSBAP2) 2015 - 2025. Including:

Incorporating objectives to minimize biodiversity loss and degradation of ecosystem services, and to optimize biodiversity gains, in flood risk management plans; Ensuring that the reduction of risks from disasters is a national and a local priority with a strong institutional basis for implementation; Identification, assessment, and monitoring of risks from disasters, and enhancing its early warning system; Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels; Reduction in the factors that make Yemen more vulnerable to disasters; and Strengthening disaster preparedness for effective responses at all levels.

Farmers are being supported to adapt to climate change by taking actions such as developing greater resilience to changing weather patterns and reduce the impact of disasters like flooding and drought.

The Yemen Country Note is based on vigorous consultations undertaken with various governmental agencies, the UN agencies, and the World Bank country office staff to understand the current organizational structure for managing disasters in Yemen and identify possible areas of support for strengthening Disaster Risk Management (DRM). Major governmental agencies consulted include the ministries of Planning and International Cooperation, Oil and Minerals, Communications and Information Technology, Transport, Public Works and Highways, Civil Defense, Water and Environment, Agriculture and Irrigation, Health, and Local Administration. The findings of the consultations were presented to a cabinet level meeting, held on 23 April 2009, chaired by the Deputy Prime Minister, Ministry of Planning and International Cooperation. During the meeting, the Government of Yemen provided guidance and identified priority areas of interventions for DRM.

**Disaster Preparedness, Management & Recovery Project Duration: 2003 – 2010;** This project aims to provide support to the Government of Yemen in its exerted efforts to successfully respond to the scale of vulnerability and recurrent localized disasters, which include earthquakes, floods, droughts and various epidemics through disaster mitigation, disaster response and recovery. The project supports reduced risk and impact of natural and man-made disasters to enhance national security and stable of economic growth, enhancement of the policy and disaster management planning and implementation, setting up of an appropriate coordination mechanism for disaster migration and response that will be linked with key actors, enhancement of the disaster management information base and raising awareness levels among the decision makers, school children and the public.

**Question 69. Describe up to 10 major policies, programmes and enabling frameworks in your country that embed the use of biodiversity for food and agriculture, including its different components, into climate change adaptation and mitigation strategies and plans (NAPAs, NAPs, NAMAs, etc.31).**

In general, the environmental regulatory and policy frameworks have been developed in Yemen. For instance, the environmental policy including the National Environmental Action Plan (NEAP), and the National Strategy for Environmental Sustainability (NSES) specify the major environmental concerns and highlights constrains which includes capacity building of institutions to actively implement climate protection policies and meet the obligations of international agreements such as UNFCCC. Under the Kyoto Protocol, the Clean Development Mechanism (CDM) has been institutionalized. Also, Yemen has established the Inter-Ministerial Committee for Climate Change (IMCCC) in 2009 to strengthen institutional coordination capacity, and enhance climate change political leadership in the country. The IMCCC is supported by a Technical Committee which is composed of related agencies representatives to provide technical support for enhancing the decision-making process on climate change agenda in Yemen.

Yemen has also developed short- and long-term policy frameworks for climate change mitigation and adaptation under its UNFCCC commitments. Yemen's Initial National Communication (INC 2001), National Adaptation Programme of Action (NAPA 2008), and Yemen's Second National Communication (SNC 2011) have been developed. National communications to the UNFCCC provides update on proposes frameworks for national long-term mitigation, and adaptation strategies.

On the other hand, short-term adaptation strategies were under NAPA in which the vulnerability of Yemen to climate change has been highlighted, and three key most vulnerable sectors including water resources, agriculture and coastal zone are outlined.

For the time being, NAPA serves as Yemen's national climate change policy framework which outlines priority and urgent adaptation needs to climate change. However, as one of nine pilot countries under the Pilot Program for Climate Resilience (PPCR), Yemen is being supported undertake scaled-up climate action and transformational change by integrating climate resilience in their national development planning. The PPCR helps countries build on their NAPAs and helps fund public and private sector investments identified in climate resilient development plans. The PPCR is expected to provide Yemen with an opportunity to further understand climate change, and prepare a road map for climate resilience to be mainstreamed into development planning, while showcasing transformation changes at the institutional and sector levels through the implementation of key pilots. Additionally, climate change was mainstreamed into key developmental and sectoral polices including agriculture, and fisheries. The fourth National Plan for Development and Poverty Reduction (DPPR) recognizes climate change as a major threat. As reported in NAPA (2008), proper measures to address climate change associated potential impacts would necessarily entail enhanced governance including institutional coordination, community participation, and transparent and accountable policy and decision making processes for the vulnerable sectors, and the poor in rural areas.( Governance of Climate Change in Yemen, UNDP Yemen)

#### Projects

Adaptation to Climate Change Using Agrobiodiversity Resources in the Rain Fed Highlands of Yemen



Development of a National Adaptation Programme of Action  
Integrated Coastal Zone Management  
Design of national Strategic Programs for Climate Resilience (SPCR) (phase 1 funding)  
Climate Information System and PPCR Program Coordination (IBRD)  
Pilot Scheme to Improve the Resilience of Rural Communities to Climate Change in Yemen  
Rural Adaptation in Yemen  
Integrated Water Harvesting Technologies to Adapt to Climate Change Induced Water Shortage  
Yemen Geothermal Development Project  
Investment Plan Preparation Grant  
Third National Communication and First Biennial Update Report to the UNFCCC

***Question 70. What arrangements are in place or foreseen in your country that help to ensure that the conservation of biodiversity for food and agriculture is taken into account in national planning and policy development of sectors other than agriculture (e.g. NBSAPs or infrastructure development such as transport or energy)?***

There are no any arrangements in place to ensure that the conservation of biodiversity for food and agriculture is taken into account in national planning and policy development of sectors. But there are arrangements foreseen in context NBSAP2 is taken into account in national planning and policy development of sectors to ensure that the conservation of biodiversity for food and agriculture, included the following:

- By 2025, several business communities and public sectors, including ecotourism, mining, energy, industry and land use planning are benefiting from ecosystem services and have incorporated sustainability & biodiversity concerns into their national and local development plans and programmes, keeping the impacts of use of natural resources well within safe ecological limits (Aichi target 4).

- By 2025, biodiversity values & the maintenance of key ecosystem services have been integrated into national & local land use planning based on developing and implementing a number of land-zones and land use management plans (Aichi Target2).

To address urbanization issues, the NBSAP2 seeks to minimize impacts of uncontrolled urbanization on biodiversity loss by promoting sustainable land use planning & management. This aim is translated in the action plan into multiple actions, focusing on minimizing land & natural habitats conversion via restriction of land conversions of critical ecosystems for other uses and strict application of EIA and SEA while permitting and approval of land conversion combined with firm enforcement of land regulation, pricing, registration and ownership

Prohibition of roads construction & infrastructures nearby sensitive ecosystems, particularly the key areas of breeding, feeding, birds migration sites. Complimentary to these restrictions, the action plan pays attention for enhancing land policies and planning via promoting ecosystem approach, integrating biodiversity values & sustainability while development of road and infrastructure development policies plans.

- By 2025, the values of biodiversity & ecosystem services are recognized by decision makers & integrated into key environmental sectors (Aichi Target2).

- By 2025, subsidies on water efficiency use are approved, subsidies on agro-chemicals & fertilizers are removed and fuel subsidies for water pumping are eliminated; Positive

incentives for the conservation and sustainable use of biodiversity are developed and enforced (Aichi: T3)

This Objectives of the NSBAP 2, and Actions for Biodiversity 2015-2025, to mainstream biodiversity in the decision making process across all sectors to gain the engagement of key Government Departments and State Agencies in the implementation of the Actions for Biodiversity 2015 - 2025 across sectors. these restrictions, the action plan pays attention to enhancing land policies and planning via promoting ecosystem approach, integrating biodiversity values & sustainability in roads and infrastructure development policies and plans.

***Question 71. Has your country identified any obstacles to developing and implementing legislation that would protect associated biodiversity?***

Since 1990, Yemen has experienced economic recession. The recession has had a significant impact on human and financial resources available in the public sector for developing and implementing legislation that would protect associated biodiversity. Limited economic capacity has resulted in delays to the implementation of objectives of NBSAP and NAPCD due to insufficient funds. It has not been possible due to staffing constraints to commence a full review of the Wildlife Acts, work which was intended under action of the NSBAP. Legislation to provide a legal basis to Natural resources and protected areas has not been progressed due to current staff resources.

Beside building the environmental capacity of national institutions, the Government has made tremendous efforts in developing and strengthening legislative frameworks as regard to environmental conservation and such efforts have led to endorsement and enactment of a number of relevant laws - including, Environmental Protection Law (EPL), 1995, The Water law, 2001, and Decentralization Local Governance Law, 2000. However, many of the existing legislations are found either outdated or/and irrelevant to the current environmental problems. Given that they were developed in the absence of coordinated and integrated way, they contain a number of conflicting and overlapping issues, which are thought to be responsible for the weak enforcement and inadequacy of current legislation.

As of yet, however, legislation framework is still incomplete and/or needs to be updated. This include the need for updating the EPL, the development of a Land tenure law, including agricultural land holdings and registration, and the development of an application decree for EIA law as well as the development of a Protected Areas law, and forests, rangelands law.

***5.2 Policies, programmes and enabling frameworks governing exchange, access and benefits***

***Question 72. Has your country taken measures with the aim of ensuring that access to its genetic resources shall be subject to its prior informed consent (PIC) and that benefits arising from their utilization shall be shared in a fair and equitable manner? If yes, identify for which resources and for which uses (e.g. to conduct research and development on the genetic and/ or biochemical composition of the genetic resource) prior informed consent has to be obtained and benefits have to be shared. Indicate in Table 26 for the different categories (and possibly uses) of associated biodiversity, if prior***

***informed consent has to be obtained and benefits have to be shared (Y: yes, N: no).***

There are no measures or Legislation governing the access to genetic resources and fair and equitable Sharing of Benefits for associated biodiversity in Yemen.

***Question 73. Has your country taken measures with the aim of ensuring that the prior informed consent or approval and involvement of indigenous and local communities is obtained for access to genetic resources and that benefits arising from the utilization of genetic resources that are held by indigenous and local communities, are shared in a fair and equitable way with the communities concerned, based on mutually agreed terms? If yes, provide a description of the measures and where possible, examples of best practices or lessons learned.***

There are no measures of ensuring that the prior informed consent for access to genetic resources and that benefits arising from the utilization of genetic resources

### **5.3 Information management**

***Question 74. List and describe any linkages between sector information systems on biodiversity for food and agriculture at national level. Where possible provide examples of best practices or lessons learned.***

#### **Information Sharing Mechanism on Plant Genetic Resources of Yemen**

It is a network of public and private institutions which conserve and/or use plant genetic resources in Yemen. The overall objective of the network is to share information related to plant genetic resources and, in particular, to the implementation of the [Global Plan of Action \(GPA\) on Plant Genetic Resources for Food and Agriculture \(PGRFA\)](#) in Yemen.

The mechanism is used in a transparent process to facilitate access and analysis of information, to assist decision making processes and also as a historical repository of information on plant genetic resources for food and agriculture in Yemen. Through this mechanism, participating institutions are given an opportunity to highlight their efforts, contribute to decision-making processes and to widen their visibility at national, regional and international levels.

#### **Clearing House Mechanism (CHM) of Yemen on Biodiversity**

1. The central clearing-house mechanism provides effective global information services to facilitate the implementation of the Strategic Plan for Biodiversity 2011-2020.
2. National clearing-house mechanisms provide effective information services to facilitate the implementation of the national biodiversity strategies and action plans.
3. Partners significantly expand the clearing-house mechanism network and

services.

**Question 75. Has your country established national information systems on associated biodiversity? List in Table 27, along with a description of the components of associated biodiversity addressed, and a brief description of information included, use and applications of the information system.**

No, Yemen still lack to national information systems on associated biodiversity.

**Question 76. Has your country established information systems intended to support maintenance of traditional knowledge on biodiversity for food and agriculture, including associated biodiversity? If yes, describe these and include information where available on socio-economic, policy and collective action aspects.**

No, Yemen still lack to national information systems intended to support maintenance of traditional knowledge on biodiversity for food and agriculture, including associated biodiversity

#### **5.4 Stakeholder participation and ongoing activities that support maintenance of biodiversity for food and agriculture**

**Question 77. List the most important stakeholder groups, including groups or associations of farmers, forest dwellers, fisher folk and pastoralists, NGOs or other civil society organizations active in the conservation of biodiversity for food and agriculture. Briefly summarize their scope, objectives and activities and any outcomes to date. Where possible provide examples of best practices or lessons learned.**

The important stakeholder for conservation of biodiversity for food and agriculture:

Legal and Institutional Framework for Biodiversity conservation, Given the significant importance of Yemen biodiversity and ecosystems to national economy and the livelihoods of Yemeni people, the Government has undertaken several efforts to enhance institutional frameworks so as to be adequately mandated and empowered to safeguard, protect and conserve the country's depleting natural assets effectively. To this end, the Ministry of Water and Environment (MoWE) was established in 2003 with broad responsibilities related to environmental protection and management, including its responsibility for environmental and water policies planning, external relations and legal affairs.

Additionally, in 2001 the Government of Yemen designated the Environment Protection Authority (EPA) as a regulatory body, coordinator of environmental activities among relevant stakeholders, and as a national body responsible for integrating environmental concern into national development policy.

Recognizing the multiple aspects of biodiversity and environmental issues, the GoY has also designated other key partners to be involved in managing the natural resource base and

implementing environmental strategies and these are: the Ministry of Planning and International Cooperation (MPIC) which is responsible for planning and coordination of all development activities and for resource mobilization; Ministry of Agriculture and Irrigation (MAI) which is responsible for food security and agricultural development; Ministry of Tourism which is responsible for development of the tourist infrastructure; Ministry of Petroleum and Mineral Wealth which is responsible for the oil and gas production mining; Ministry of Electricity; and Ministry of Fish Wealth which is responsible for managing fishery resources.

Other Government institutions with responsibilities in the environment sector include: the General of Forestry, Rangelands and Combating Desertification (GDFRCD); Civil Aviation and Meteorology Authority (CAMA) which is responsible for climate monitoring; Agricultural Research and Extension Authority (AREA) which is responsible for Scientific Research; National Water Resources Authority which is responsible for water management; and National Water and Sanitation Authority which is responsible for the water supply in urban areas, and the General Authority of Rural Water supply.

The economic production sector and NGOs (including academic institutes, consultancies and civil society organizations) are also very active in activities related to natural resource management and environmental protection. These include the Friends of the Environment and the Yemen Ornithological Society. At international level, NGOs like IUCN, Bird Life International, WWF and Wetlands International are considerably active and have active focal points in the Republic.

To contribute to the global environmental protection effort, the Government of Yemen has ratified UNCBD, UNCCD & UNFCCC and is party to a number of relevant international conventions and regional protocols, including the CITES, Hazardous Wastes, Law of the Sea and Ozone Layer Depletion, RAMSAR Convention, World Heritage Convention, and Bonn Convention, which make some provision for meeting global environmental objectives. By ratification of these conventions, the GoY assigned the EPA as a Government agency responsible for monitoring compliance with obligations made under international conventions such as the UNCBD and the UNFCCC. The EPA in this capacity hosts the secretariat and national implementation units of most of GEF/UNDP projects currently ongoing in Yemen, such as the Biodiversity planning, the Climate Change Enabling and the Socotra projects among others. In its capacity as national focal points for UNCBD and UNFCCC, the EPA has been engaged in conservation of biodiversity resources through the initiation and development of several legal and technical activities and improving environmental coordination based on its mandates and the Environmental Protection Law No. (26) for 1995 (EPL). This effort has led to the establishment of EPA board of directors to act as coordinating body for Climate Change, biodiversity, Land Degradation, etc. The current structure of the board of directors include representatives from the Environment Protection Authority (EPA) of the Ministry of Water and Environment (MoWE), the Ministry of Agriculture and Irrigation, the Ministry of Fish Wealth, the Ministry of Planning, the Ministry of Electricity, the Water Resources Authority, and the Ministry of Local Administration. Unfortunately, the board had no role in the production of the NBSAP2 and rarely met and thus it needs to be activated, its structure reformed and given stronger mandates, including the removal of overlapping responsibilities amongst environmental partners.

In its efforts to address desertification and land degradation issues, the Government after it had acceded to the United Nations Convention to Combat Desertification and Drought (UNCCD), has appointed the General for Forestry, Rangelands and Desertification Control (GDFRDC) as a Focal Point for the CCD. Following its designation as national focal point, the GDFRDC developed a National Action Plan to Combat Desertification (NAPCD) to meet the country's commitments stated by the UNCCD.

As yet, there are some of the synergic and common issues that affects the GDFRDC capacities to undertake their responsibilities effectively. This include, inter alia: lack of partnerships of private sector, NGOs and local community in management of forest and degraded land in addition to the lack of inter-institutional coordination collaboration among relevant parties associated with highly centralization in planning. All of these issues underpin the importance of a cross-sectorial approach in forest management, leading to unsustainable, ineffective and inefficient management of the country limited forestry resources. Therefore, it is urgently needed to the strengthen the GDFRDC through the creation of an autonomous and independent coordinating body with clear financial mandate, and institutional framework to act as catalyst and coordinating body in the preparation, implementation, monitoring & evaluating the desertification and drought. (NBSAP2, 2015-2025)

During last decade or so a number of funding agencies and international organization implemented projects and activities within and around KBAs' in Yemen EAM region. This include, but not necessarily limited to the World Bank, Small GEF Programme, UNDP, UNEP, the German International Cooperation (GIZ), French Agency for Development (AFD), Italy (DGCS), IUCN, Birdlife, and others.

NCSA Report and Action Plan for Environmental Capacity Development (2008) explained that prior to year 1990 there was only one environmental CSO/NGO in Yemen, however in year 2000 the number of CSOs/NGOs active in the field of environment jumped to 31 organizations. The report further explained that CSOs/NGOs active in the field of environment include:

- Organizations specializing in a specific aspect of environment protection, such as the pollution prevention societies, including among others the palm trees protection societies, horses and water protection societies.
- Local development societies, which dedicate part of its activities to environment protection activities, including the development of water resources, palm-tree planting, water and stream harvesting, combating desertification developing range land, and preventing over-cutting of trees, protecting fisheries and implementing sanitation projects, cattle breeding, developing bee-hives and conservation of heritage... etc.

**Critical Ecosystem Partnership Fund (CEPF). (2014). CEPF-Yemen CSOs training needs assessment report. Enviromatics, Majdi Salameh, AMJAD & MAJDI SALAMEH COMPANY, JORDAN.**

***Question 78. Describe any incentives or benefits to support activities for the conservation and sustainable use of biodiversity for food and agriculture or associated biodiversity (such as payments, provision of inputs, subsidies or other forms of incentives/ benefits). Briefly describe how these have been applied, to what extent and the stakeholders involved (including provisions on gender balance if any). Indicate any lessons learned and planned development incentives.***

Currently, There are no any incentives or benefits to support activities for the conservation and sustainable use of biodiversity for food and agriculture or associated biodiversity. But the Biodiversity objectives & targeted priorities for conservation, protection and enhancing the

ecosystems & species under NBSAP2, 2015-2025, are addressed a number of incentives or benefits under the Action plans, as well as some general actions which would have wider benefits to support activities for the conservation and sustainable use of biodiversity for food and agriculture or associated biodiversity.

**Question 79. List up to 10 major projects (either in progress or completed in the last five years) that support the conservation and sustainable use of biodiversity for food and agriculture, associated biodiversity and/or wild foods. For each project listed describe the components of biodiversity, the production system and area covered, and the results, outcomes and lessons learned. Projects described in sector reports need not be described here.**

The NBSAP update & formulation Project, Funded through the partnership with GEF and UNDP, completed in 2015.

To curb the consequences of direct and indirect drivers of biodiversity loss, the Government of Yemen has devised an updated National Biodiversity and Action Plan (NBSAP2), containing revised vision, mission and strategic goals, which are mainly delineated to address the current most pressing issues contributing biodiversity, including Biodiversity loss & Habitats destruction, over consumption of biological resource, natural & anthropogenic pressures contributing to biodiversity loss, Policy distortion, institutional weakness and poor public awareness.

The revised NBSAP2 vision calls for "achieving resilient, productive and sustainable socio-ecosystem by 2050". This vision is translated into shorter terms mission or action plan for the period 2015-2025, which is mainly focused on halting overall biodiversity loss and maintaining healthy, productive & functional ecosystems based on establishing coherent & resilient ecological networks supported by restructured policies & adequately mandated and empowered local communities & institutions for sustainable and equitable use of natural capitals of importance to human well-being and economic prosperity.

Yemen's vision is split into five strategic goals, outlining national outcomes concerned with the following national priority areas: 1) Biodiversity and Ecosystems Conservation, 2) promotion of sustainable use of biological resource, 3) reduction of natural & anthropogenic pressures contributing to biodiversity & ecosystem loss, 4) biodiversity & poverty mainstreaming into sectoral development plans, & 5) promoting good governance in biodiversity management.

The NBSAP2' strategic goals were designed so as to be highly aligned to the five CBD Strategic Plan goals, namely those devoted for addressing the underlying causes of biodiversity loss (strategic goal A), reduction of the direct pressures on biodiversity and promotion of sustainability (strategic goal B), improvement of biodiversity status, and safeguarding ecosystems and biological diversity (strategic goal B), enhancing the benefits to all from biodiversity and ecosystem services, and strengthening implementation capacity and capacity building.

State of the NBSAP2 alignment is being further envisaged by translating the five national goals into 20 national SMART targets, where each of which is closely aligned and consistent with specific Aichi target spelled out by the global Strategic Plan 2010- 20120. Specifically the NBSAP2 20 targets were converted to detailed actions plans, containing comprehensive policy measures and actions which are highly relevant for internalizing the various aspects of Aichi targets such as the following : a) incorporation of the value of biodiversity of and

ecosystem services into sectoral development policies and poverty reduction strategies (Targets 1 and 2); enforcing positive incentives and removing harmful subsidies (Target 3); developing landscapes that have sustainable production and consumption and ensure the use of natural resources falls well within safe ecological limits (Target 4); expansion of the national terrestrial protected areas and the marine to meet Aichi targets (Target 11); restoration and safeguarding key ecosystem services, especially of importance for water delivery and livelihoods (Target 14); strengthening ecosystem resilience and the contribution of biodiversity to carbon stocks, including the restoration of at least 15 per cent of degraded ecosystems Target 15), and mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources (Target 20). Annex 2 present more details on the degree of alignment of national targets with Aichi targets

**Question 80. List in Table 28 up to 10 major landscape based initiatives to protect or recognize areas of land and water in your country of particular significance for biodiversity for food and agriculture.**

Table 28. Landscape based initiatives to protect or recognize areas of land and water in the country with particular significance for biodiversity for food and agriculture.

Landscape based initiatives	Description of sites and their characteristics of relevance to biodiversity for food and agriculture	Extent (area)
Socotra archipelago (Biosphere Reserve)	<p>Socotra archipelago comprises four islands President (Socotra, Abd Korea, Darsah and Samha )</p> <p>Socotra Island is the largest of these islands has a length of 130 kilometers and displayed about 45 km. According to the decision to establish the Socotra archipelago Reserve has been divided into areas for protection:</p> <p>1- protectorates the use of resources..Managed so as to ensure the protection of the outstanding biodiversity of the archipelago.</p> <p>to provide needs, products and services in a sustainable manner. A protected sustainability of wild resources, an area of about 16,498 km2</p> <p>2- Areas of public use. And located within the area of the use of natural resources.</p> <p>3- national park areas. It is intended to protect the ecosystems built for the archipelago and to prevent exploitation conflicting with the objectives of protecting biodiversity. And to provide scientific, educational, recreational and environmental material benefits, which cover an area of about 1514 km.</p> <p>4- Nature protected. Areas of nature has not changed a rare and sensitive natural areas. Covering an area of 154 km2.</p> <p>Archipelago is characterized by dozens of endemic species of fauna and flora, wildlife and marine life.</p> <p>Reference: <a href="#">Center for the Study and Environmental Sciences (2001) study of environmental Socotra Island in Yemen. Aden University</a></p>	3798Km



## **5.5 Collaboration between institutions and organizations**

**Question 81. Describe existing linkages and collaboration between sectors in national programmes and policies governing conservation and sustainable use of biodiversity for food and agriculture. These may include overall strategies and plans developed by your country, committees or other national bodies which oversee or support collaboration, shared actions, facilities or resources and specific activities which involve inter-sector collaboration.**

In the past, the linkages and Collaboration between sectors institutions was very weak, But in the context updating the second National Biodiversity strategy and Action Plan (NBSAP2), Actions for Biodiversity 2015-2025, was developed in line with the all National stakeholders (sectors).

As learned from pervious NBSAP, the country was lacking of coordination mechanism ,monitoring mechanism, biodiversity indicators and reporting systems to help guiding all stakeholders to meaningfully participate in the process of the implementation of NBSAP. As a result, accountability and responsibility towards biodiversity conservation were scattered among various environmental institutions, leading to ineffective and inadequate implementation of NBSAP, weak monitoring and reporting on biodiversity status, including the reporting to the CBD convention. To this end, national stakeholders during the development process of NBSAP2 have agreed to reverse this situation by creating an appropriate mechanism to monitor, review, and evaluate state of implementation activities towards achieving the strategic goals and targets

included in NBSAP2. The Mechanism is to ensure undertaking continuous monitoring of biodiversity status and trends, and producing periodic reporting, highlighting problems faced while implementation of the NBSAP2 programs and activities and proposing remedy actions to better ensure the attainment of goals targets identified by MBSAP in each specific areas. This mechanism may include the following elements: (a) a multi-sectoral coordination body with representation of various environmental agencies; (b) information system containing biodiversity indicators for information exchange, monitoring, evaluation of the NBSAP2 implementation & biodiversity status; and (c) a reporting system on biodiversity status and progress of implementation of the NBSAP2 for international, national and local stakeholder communities. Primarily, it is proposed to materialize on infrastructural and institutional capacities available to EPA focal point to establish coordination mechanism and monitoring scheme at EPA. And to enhance its information base. The put this mechanism in place, it is propose restructuring current coordination mechanism for managing environmental issues called the EPA Management Board to act as coordination mechanism for biodiversity issues beside its current mandate as coordination body for environmental issues. Specific steps in this process include:

- Restructuring the EPA management Board to act as coordination body.
- Develop and enforce legislative framework and by- law for the functioning of EPA Board of directors
- Issue cabinet decree declaring the following representatives as members of the Board of directors of the coordination body of biodiversity issues
  - Ministry of Water and Environment, chairman
  - EPA Biodiversity Department, secretariat
  - EPA Climate Change Unit,

- Environmental Protection Authority,
  - Ministry of Agriculture and Irrigation,
  - Union of Agricultural Cooperatives,
  - General Department of Forestry and Combating Desertification
  - Ministry of Tourism,
  - Social Fund for Development,
  - Public Works Authority,
  - Ministry of Finance,
  - National Women Committee,
  - Ministry of Planning and International Coordination,
  - Ministry of Oil and Mineral Resources,
  - Ministry of Electricity and Energy
  - Ministry of Fishery Wealth,
  - Local Communities of Aden Wetlands, Bura'a PA, Hawf PA,
  - Ministry of Information, Media
  - University of Sana'a, University of Hodiedah, University fo Hadramout, University of Aden,
  - Agricultural Research and Extension Authority,
- Amend the by-law of the EPA Biodiversity Department and Build the management capacity of clearinghouse mechanism (CHM) website so as to be secretariat for Board of directors of the coordination body
  - Improve the CHM website's performance, and make it accessible to all biodiversity partners through networking

In its capacity as secretariat for Board of directors of the coordination body, the Biodiversity Department in EPA will be responsible for updating biodiversity information of the CHM website, compiling reports on biodiversity status and trends, including reports on status of NBSAP2 implementation to serve as a guide for future strategic planning, and contribute information towards Yemen's national reporting to the CBD. The department will develop initial biodiversity status reports annually to submit it to the coordination body as monitoring and evaluation tool on which the board will decide on remedy actions. During the NBSAP2 implementation up to end of planning period by 2025, the board will independent develop mid-term evaluation of NBSAP2 implementation by in mid-2018. Progress in implementation will also be reported to the CBD through the 6th National Report by 2018, the 7th National Report by 2024. A final independent evaluation of the NBSAP2 implementation will be developed in 2025, will highlight the status of Yemen's contribution towards the achievement of the Aichi Targets, including lessons learned to capitalize on while developing the NBSAP3. (NBSAP2, 2015)

***Question 82. How are ministries working together to meet Aichi Targets as they may apply to the conservation and sustainable use of biodiversity for food and agriculture in your country?***

The NBSAP 2015-2025 addressed all Aichi Targets, But, Presently, the ministries not working to meet Aichi Targets, Because still need to funding for implementation its actions plans, and In this context the implementation of a Biodiversity Strategy and Action Plan, to meet the obligations of the country to the CBD, is of vital importance.

***Question 83. What future actions have been planned to support your country's efforts in addressing Aichi Targets as they may apply to the conservation and sustainable use of biodiversity for food and agriculture in your country?***

In Yemen, the actions taken to implement the CBD, including the Aichi Biodiversity Targets of the Strategic Plan for Biodiversity 2011-2020, are will carried out via the NBSAP2, Actions for Biodiversity 2015-2025.

The NBSAP2 identifies and translating the five national goals into 20 national SMART targets to protect Yemen's biodiversity, where each of which is closely aligned and consistent with specific Aichi target spelled out by the global Strategic Plan 2010- 20120. Specifically the NBSAP2 20 targets were converted to detailed actions plans, containing comprehensive policy measures and actions which are highly relevant for internalizing the various aspects of Aichi targets such as the following: a) incorporation of the value of biodiversity of and ecosystem services into sectoral development policies and poverty reduction strategies (Targets 1 and 2); enforcing positive incentives and removing harmful subsidies (Target 3); developing landscapes that have sustainable production and consumption and ensure the use of natural resources falls well within safe ecological limits (Target 4); expansion of the national terrestrial protected areas and the marine to meet Aichi targets (Target 11); restoration and safeguarding key ecosystem services, especially of importance for water delivery and livelihoods (Target 14); strengthening ecosystem resilience and the contribution of biodiversity to carbon stocks, including the restoration of at least 15 per cent of degraded ecosystems Target 15), and mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources (Target 20).

Under Action plans the NBSAP developed a set of indicators, These biodiversity indicators are tools in the evaluation of Yemen obligation to meet Aichi Targets, and to evaluate state of achievement.

**National Biodiversity Planning to Support the implementation of the CBD 2011-2020 Strategic Plan in Yemen project**

This project is part of the second generation of Biodiversity Enabling Activities (BD EA) under the GEF. Yemen has been Party to the Convention on Biological Diversity (CBD) since 1996. The project addresses the country's need to continue to fulfill its obligations under the CBD, with particular focus on the Convention's Article 6 and the CBD COP Decision X/2. Above all, the project is a significant contribution to Yemen's efforts towards implementing the CBD Strategic Plan 2011-2020 at the national level. The project builds on the current status and achievements of Yemen with respect to biodiversity planning and reporting. It aims to integrate Yemen's obligations under the CBD into its national development and sectoral planning frameworks through a renewed and participative 'biodiversity planning' and strategizing process. This process is expected to produce measurable targets for biodiversity conservation and sustainable use. It will equally ensure that the value of ecosystems' goods and services, as well as the challenges and opportunities for ecosystem-based adaptation and resilience are taken into consideration in the process. The project will achieve its objective through the implementation of three components, whose activities are thoroughly described in the GEF approved proposal for BD EA. They are:

(1) A participative stocktaking exercise on biodiversity planning takes place and national biodiversity targets are developed in response to the global Aichi Targets;

(2) The NBSAP is revised/updated and it fully integrates new aspects of the CBD strategic plan, such as mainstreaming and anchoring the implementation of the plan into national development frameworks, valuing ecosystem services and promoting ecosystem-based adaptation and resilience; and

(3) National frameworks for resource mobilization, Convention reporting and exchange mechanisms are strengthened.

**Question 84. Is your country involved in the implementation of regional and/or international initiatives targeting the conservation and sustainable use of associated biodiversity? List initiatives in Table 29.**

Yemen is involved in the implementation of numerous regional and international initiatives targeting the conservation and sustainable use of biodiversity for food and agriculture. Many of these initiatives also undertake activities with respect to components of associated biodiversity. Among others, Yemen is a Member country of the FAO Commission on Forestry and Genetic Resources for forests, of the International Treaty on Plant Genetic Resources for Food and Agriculture, The country signed and ratified the Rio Conventions. Yemen participated in UNDP, FAO and Arab Organization for Agricultural Development(AOAD) projects on plant diversity. Yemen signed United Nations Convention on Desertification Control (UNCCD) in 1996.The Convention was ratified by the Yemeni Legislature on 1996.The Arab Center for the Study of Arid Zones and Dry Lands Arab (ACSAD) was one of the pioneer institutions which trained forestry personnel and Forest Inventory. In 1995 Yemen ratified CBD. Yemen participates in the Network of West Asia & North Africa for Plant Genetic Resources (WANA), collaborates with ICARDA and GTZ.

## **5.6 Capacity development**

**Question85. What training and extension programmes, or elements of programmes, at all levels, exist that target the conservation and sustainable use of associated biodiversity?**

- Presently, There are no any training and extension programmes, target the conservation and sustainable use of associated biodiversity, But in context of NBSAP2 action plan, there are training and extension programmes, at all levels will implement thru 2016- 2025 Also there are:

- Some occasional training courses and extension programs, associated with certain development projects and special programs which implemented in some provinces such as honey bee rearing and honey production

**Question 86. What higher education programmes exist that target the conservation and sustainable use of associated biodiversity genetic resources? List in Table 30 the institutions, as well as the programmes and enrolment, disaggregated by sex, if possible.**

Presently, There are no any Higher education programmes (MSc, PhD) specifically targeting the conservation and sustainable use of associated biodiversity genetic resources in Yemen. But generally, There are in Yemen Universities, Colleges of Agriculture, BSc in Agriculture Science specializations (Horticulture & Forestry Science - Crops & rangelands Production Science), as well as Colleges Science specializations BSc in Plants Biology and Zoology Science.

Some new faculties were also opened during the past decade such as those relating to environment and marine sciences. One of these faculties was established in 2002 under the umbrella of Hadhramout university and called the "Faculty of Environmental and Marine Biological Sciences". Other similar faculty was also inaugurated under the Hodeida University at later stage. These College offers only BSc. Degree and no graduate programs are so far in place. Both faculties also meagerly contributes to research like other faculties of Yemeni universities due to lack of budget and other materials and infrastructure requirements.

### ***5.7 Knowledge generation and science for the management and sustainable use of biodiversity for food and agriculture***

***Question 87. List up to 10 major institutions within your country directly involved in research on the conservation and sustainable use of associated biodiversity. Provide a concise description of the institutions, of their key research programmes and, where possible, provide the number of active researchers***

major institutions within your country directly involved in research on the conservation and sustainable use of associated biodiversity. Provide a concise description of the institutions, of their key research programmes and, where possible, provide the number of active researchers

1. The Agricultural Research and Extension Authority (AREA):
2. The National Genetic Resources Center (NGRC)
3. The National Livestock Research Center (NLRC)
4. The National Honeybee Research Center (NHRC)
5. 8 Regional Agricultural Research Stations (RARs)
6. The Marine Sciences and Biological Research Authority (MSBRA)
7. the General Seed Multiplication Corporation (GSMC)
8. The Potato Seed Company (PSC)
9. The Environment Protection Authority (EPA)
10. The Ministry of Agriculture and Irrigation (MAI):
  - a) Directorate General of Plant Production
  - b) General Directorate of Livestock Production
  - c) General Directorate of Plant Protection
  - d) General Directorate of Marketing
  - e) General Directorate of Animal Health
  - f) General Directorate of Forestry, Rangelands and Desertification Control (GDFRDC)
  - g) General Directorate of Rural Women Development
11. University of Sana'a, (Faculty of Agriculture and Faculty of Science)
12. University of Aden, Nasser's Faculty for Agricultural Sciences & College of Science
13. University of Dhamar, Faculty of Agriculture and Veterinary Science
14. The University of Hadhramout (Faculty of Environment and Marine Life and Faculty of Science).
15. The University of Hodiendah, (Faculty of Environmental and Marine Sciences).
16. The Ministry of Industry and Commerce

AREA human resource has steadily grown to about 1400 persons of which about 400 researchers (75 PhD., 88 MSc., and 236 BSc. degree holders). The researchers are assisted by 204 technicians and 787 administrative and support staff. Among AREA technical research staff, only 31 are females. AREA researchers with PhD. Degrees were only 27 in the early 1990s. Research personnel are not evenly distributed among stations/centers and across disciplines, as some of these are actually dominant more than the others. Despite the fact that the total number of research staff has almost doubled during the past two decades, this disparity was never settled till the present. Additionally, the increase in research staff is still

low in proportion to total country's population, agricultural land, number of farmers and/or land holdings keeping in view the regional and world standards.

The biodiversity for food and agriculture in Yemen is comprised in several sub programs within AREA system mainly through its (NGRC), LIRC and the regional research stations; the Marine Science and Biological Research Authority (MSBRA), some agricultural institutions such as the General Seed Multiplication Corporation (GSMC) and the Potato Seed Company (PSC) operating under MAI, and the faculties of agriculture, veterinary, environment and marine life operating under some governmental universities (Sana'a, Aden, Dhamar, Hadhramout, Ibb and Hodeidah Universities), the Environmental Protection Authority (EPA) of the Ministry of Water and Environment.

The coordination of the activities of different institutions in the field of BFA was realized through the establishment of the National Committee (NC) for PGRFA in 1999. The National Committee for PGRFA was issued by a Ministerial Order and headed by the Vice Minister. Membership of the NC included representatives from MAI, the Universities of Sana'a and Aden, AREA, EPA, GSMC, and Farmers Union (FU). The National Committee was assisted by a Technical Secretariat (Sub-Committee) headed by the Assistant Deputy Minister (MAI). The meetings of the NC concentrate on coordinating efforts of different institutions with respect to Yemen commitments towards International Treaties, Conventions and Agreements such as the Convention on International Trade in Endangered Species of Wild Life Fauna and Flora (CITES). The Committee took a very important decision related to the nomination of the NGRC in AREA as the focal point and the National Entity for coordination with International Agencies in PGRFA.

The Genetic Resource Center of the University of Sana'a became a local Genetic Resource Center and part of the national network. Review of available literature of the NC revealed that the NC suffered from lack of funds to sustain its activities and organize meetings at regular intervals. The unavailability of a full time technical secretariat complicated further the situation. This led to the inability of this committee to come up with a coordinated national program on PGRFA as was expected in the initial stages of its formulation. The scattered nature of institutions with mandates related to BFA and the dependence of these institutions on a wide range of funding sources has led to scattered formulation of projects and implementation of project oriented activities. Efforts to streamline these activities were not always on the priority list of the NC.

Activities in the field of BFA are carried out by different institutions with varying degree of progress. While in the EPA most activities are externally funded with limited contribution of national sources of funds. AREA is almost dependent on the government budget with limited external support. The GSMC is also conducting project sponsored genetic enhancement of local and international landraces and varieties of field crops in its field stations.

The program of Universities is mainly project-oriented and cover the vicinity of the Academic Institutions in general or the targeted governorate in particular. The universities of Sana'a and Aden are mainly engaged in the collection of genetic resources. Conservation of collected genetic resources is also practiced to some extent. However, lack of storage facilities in Aden University and the breakdown of storage facilities in Sana'a University renders storage of collected genetic resources difficult. Plant breeding practices are very limited in different universities and are confined to few crops such as hybrid maize.

The documents of the HE-Strategy declaration stated that: "scientific research in Yemeni universities does not receive adequate attention and that universities lack the research culture and tradition. At the same time, they lack the requirements and means to conduct scientific research such as labs, technicians, libraries furnished with modern resources, and that references and specialized periodicals are all lacking and inadequate. This is in addition to the weak incentives that could encourage faculty staff members to conduct research and studies. Even the research work being published by teaching staff is being induced mostly by motivation to acquire promotion to higher rank and not within a scientific research strategy of the university.

It should be noted that all faculties of agriculture – just like their mother universities as a whole – have no regular research programs due to the lack of fund especially allocated for scientific research. However, faculties are able to avail of some funds for research work through cooperation and contractual relation with some government and private agencies or otherwise with some donor agencies.

Most research work at faculty level is carried out either as theses research or for staff promotion purposes. On the other hand, this academic research work is mostly conducted on bases of personal arrangement with little or no institutional implications.

### **5.8 Gaps and priorities**

**Question 88. With respect to information management, national policies, programmes and enabling frameworks that support or influence the conservation and sustainable use of biodiversity for food and agriculture and the provision of ecosystem services, and govern exchange, access and benefits:**

**a) What are the major gaps in information and knowledge?**

- - Lack of complete information and knowledge on BFA
- - Inadequate and contradictory statistics
- - Scattered and inaccessible information and knowledge
- 

**b) What are the main capacity or resources limitations?**

- - Lack of qualified staff in some relevant disciplines
- - Limited laboratory facilities
- - Inadequate training opportunities
- - Inadequate operational funding
- - Lack of funding and capacity to mobilizing adequate resources for biodiversity conservation.

**c) What are the main policy and institutional constraints?**

- Absent of clear national and sectorial policies, strategies and plans
- Lack of adequate and effective national, regional and sectoral bodies
- Weak information exchange and coordination mechanism
- Inadequate political and legislative support
- Inefficient management of institutions and law enforcement.
- lack of adequate legislation
- institutional setup is not appropriate for biodiversity conservation
- lack of facilities for biodiversity conservation and management, monitoring and evaluation.
- lack the reliable information system

**d) What actions are required and what would be the priorities?**

- Formulation of clear policies, strategies and action plans
- Resource mobilization and adequate funds for plans implementation
- Institutional capacity building including monitoring and evaluation and human resources development
- Setting up of operational information management system and coordination mechanism at different levels.
- - Institutional and legislative strengthening
- - Research and technology development
- - Data and information collection, dissemination and monitoring.
- - Rising biological resources awareness and education of Yemeni society and policy makers

**Question 89. With respect to stakeholder participation and ongoing activities that support maintenance of biodiversity for food and agriculture and collaboration between institutions and organizations:**

**a. What are the major gaps in information and knowledge?**

None identified

**b. What are the main capacity or resources limitations?**

- Lack of capacity for support participation
- Lack of funding

**c. What are the main policy and institutional constraints?**

- Weak inter-institutional coordination and collaboration among stakeholder
- Lack of Partnerships with private sector & NGOs.
- Lack of coordination mechanisms among different authorities responsible for law enforcement.

**d. What actions are required and what would be the priorities?**

- Prepare mechanisms for developing harmonized biological resources policies.
  - Promote participation of local authorities, community-based groups and private sector in support maintenance
- Establish an effective coordination mechanism for revival, integration and enforcement of laws

**Question 90. With respect to capacity development:**

**a. What are the major gaps in information and knowledge?**

- Lack of information for identified the needs of manpower and specialists
- Lack of knowledge for needs of institutional capacity

**b. What are the main capacity or resources limitations?**

- Lack of institutional capacity
- Absence of funding; Lack of financial resources and poor infrastructure
- Weakness manpower, Limited expertise and skills
- Weak planning capacity

**c. What are the main policy and institutional constraints?**

- Lack of training programs for develop staff skills; resource mobilization and to improve capacity of policy makers in developing biodiversity strategies and plans.
- Absence or incomplete organizational structure and job descriptions of some institutional
- Inadequate policy, legal and enabling frameworks

**d. What actions are required and what would be the priorities?**

- Gap assessment of manpower.
- Establish national data base for human resources.
- Training needs assessment.
- Prepare human development strategy and recruitment plans.
- Prepare and implement capacity building programs.



- Develop employment policy, legal and enabling frameworks
- Develop plan for Strengthening capacity building of institutional and Management Capabilities

**Question 91: *With respect to knowledge generation and science for the management and sustainable use of biodiversity for food and agriculture:***

There is a lack of qualitative and quantitative data and information on the status of biodiversity components in the country. Consequently, public awareness of ecosystems degradation and its implications is fragmentary(deficient) and not founded on complete information on species, ecosystems and land use systems. neither the gravity of the problems nor the causes and the processes involved are always well understood. There is still a lack of understanding of the value of biodiversity, even when it is admitted that the situation was better in the past, in terms of biomass production and in terms of number of species present. There is a lack of understanding as to how over-exploitation of one species can affect the well-being and the productivity of the ecosystem as a whole.

**a. *What are the major gaps in information and knowledge?***

- Data and Information on the biodiversity for food and agriculture is needed for a rational management and sustainable use
- There is also the knowledge generation and science on the biodiversity for food and agriculture is needed for a rational management and sustainable use
- Qualitative information and knowledge on the biodiversity component in the Yemen does not available
- The present gap in knowledge related to ITK needs to be filled up not only by research institutions, but also by extension and technical services

**b. *What are the main capacity or resources limitations?***

- Lack of human specialist and skills for inventories, research, education activities at all levels
- Lack of funding
- Lack of data base system that depends on GIS and remote sensing
- Weakness capacity of institutional related inventories, research, education

**c. *What are the main policy and institutional constraints?***

- Limited of research, education policies and Programs in the field of biodiversity as well as in Documenting and Enhancement Knowledge in the Sustainable use and Management
- Lack of using modern technologies
- Weakness in technical and scientific collaboration as well as exchange of information at local, national levels in the field of Biodiversity

**d. *What actions are required and what would be the priorities?***

- Experts committee for coordinating integrated research and education.
- Assessment needs research, and education institutions
- Establish data base system GIS and remote sensing data
- Initiate researches and education on, rare and endangered species and their habitats.
- Develop flora, fauna and habitat inventories and promoting programs
- Develop plan of infrastructure for related inventories, research, education institutions in the target areas.
- Develop mechanism for funding and Resource mobilization

## ***Chapter 6: Future agendas for conservation and sustainable use of biodiversity for food and agriculture***

### ***6.1 Enhancing the contribution of biodiversity for food and agriculture***

**92. Describe planned actions and future priorities to improve the conservation and sustainable use of biodiversity for food and agriculture with specific reference to enhancing its contribution to:**

- a) improving food security and nutrition;**
- b) improving rural livelihoods;**
- c) improving productivity;**
- d) supporting ecosystem function and the provision of ecosystem services;**
- e) improving the sustainability and resilience of production systems;**
- f) supporting sustainable intensification.**

The actions plans, objectives and targets of the National strategy biodiversity and Action plan (NBSAP 2015-2025) will address many of a-f provisions above. As well as more targeted priorities for protecting and enhancing the Agriculture and Biodiversity and Water under policies of various sectors.

### ***6.2 Strengthening the conservation and management of associated biodiversity and wild foods***

**93. Describe planned actions and future priorities to support conservation and management of the components of associated biodiversity and wild foods including the development of monitoring programmes and of information systems or databases.**

Under the NBSAP 2015-2025 are planned actions and future priorities to improve the conservation and management/ sustainable use of the components biodiversity for food and agriculture. The actions objectives and targets set out National biodiversity strategy addressed many of provisions and issues.

Direct support will be provided through NBSAP2 which has an increased focus on the biodiversity sustainability. The Actions in a more targeted manner, addressing specific issues on a more localised and regional basis and addressing many of the concerns in the NBSAP.

The cross-compliance provisions statutory management requirements and standards for Good Agricultural and Environmental Condition of land, will have positive benefits for to the environment, systems, biodiversity, climate change, wildlife, fauna and flora health, animal welfare and via the promotion of the good agricultural and environmental practices.

The planned actions and future priorities

1: Biodiversity and Ecosystems Conservation (Outcome 1)

1.1: Expansion of Protected Areas Coverage (Output 1.1)

1.2: Conservation & protection of endemic, rare & endangered species (Output 1.2)

1.3: Conservation of Genetic Resources and Biosafety (Output 1.3)

- 2: Sustainable Use of Natural Resource (Outcome 2)
- 2.1 Sustainable Management of Forests and Rangelands (Output 2.1)

**94. Describe planned actions and future priorities with respect to implementing ecosystem approaches for the various components of biodiversity for food and agriculture.**

There are under the NBSAP are planned actions and future priorities with respect to implementing ecosystem approaches for the various components of biodiversity.

Reduction of Natural & Anthropogenic Pressures Contributing to Biodiversity & Ecosystem Loss (Outcome 3)

3.1 Socio-Ecosystems Resilience Against Natural Disasters (Output 3.1)

3.2 Combat Invasive Alien Species (Output 3.2)

**6.3 Improving stakeholder involvement and awareness**

**95. Describe planned actions and future priorities to improve stakeholder awareness, involvement and collaboration in the conservation and sustainable use of biodiversity for food and agriculture. Include a description of the major challenges that will need to be overcome.**

promoting Good Governance in Biodiversity Management (Outcome 5)

Promoting Institutional Restructuring (Output 5.1)

Improvement of Public awareness, research and knowledge sharing (Output 5.2)

**96. Describe planned actions and future priorities to support the role of farmers, pastoralists, fisher folk, forest dwellers, and other rural men and women dependent on local ecosystems in the conservation and use of biodiversity for food and agriculture. Replies should include information on recognizing and enhancing the role of indigenous peoples. Include a description of the major challenges that will need to be overcome.**

The all planned actions and future priorities of NBSAP2 is will operate on the 20 target over a 10 years period from 2015-2025. It will seek to develop and demonstrate the best conservation and management practices of local farmers, pastoralists, fisher folk, forest dwellers, and other rural men and women dependent on local ecosystems, The actions will focus on various activities on the country within the Natural designated sites. It will harness local knowledge and experience with the scientific expertise of other actions or projects partners to overcome some of the challenges and to improve the conservation status of the designated sites for biodiversity and ecosystems. for example NBSAP2 Action Plan include: the Outcome 4: Biodiversity and Poverty Mainstreaming into sectorial development plans. Output 4.2 Poverty mainstreaming .

**97. Describe planned actions and future priorities to improve recognition of the contribution of women to the conservation and use of the different components of biodiversity for food and agriculture, including associated biodiversity. Include a description of the major challenges that will need to be overcome.**

The answer of question 96 above include the answer on this question (Refer to answer 96).

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