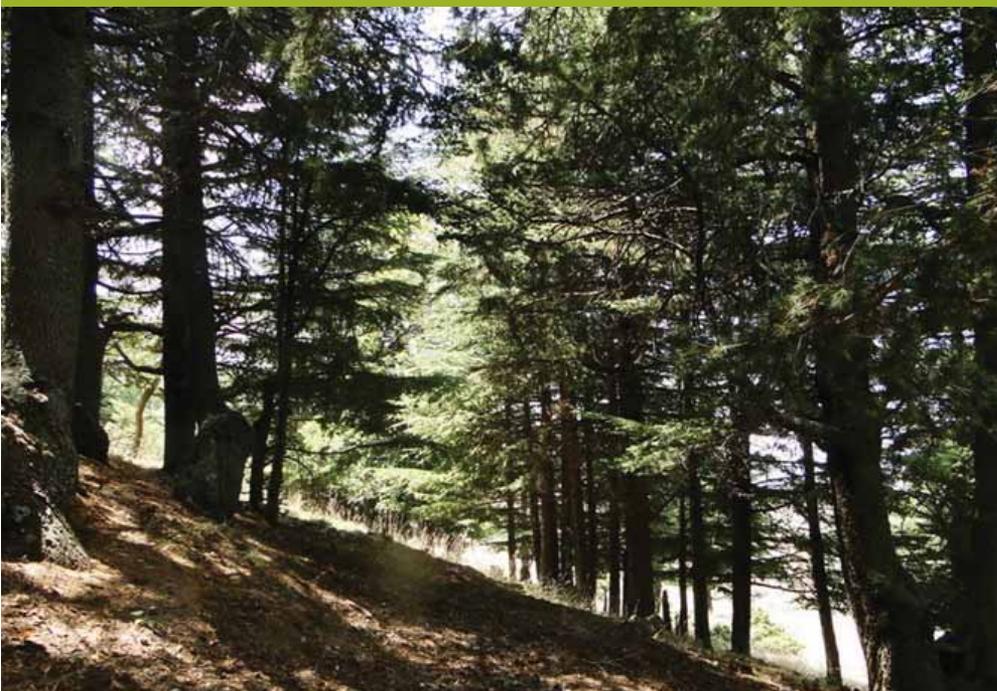


Forests and Rangelands in the Near East Region Facts and figures



By
Hedi Hadri, Senior Forester
and
Mustapha Guellouz, Senior Rangelands Specialist



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Agriculture
Organization
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Foreword

Forests and rangelands in the Near East are closely inter-related natural resources, often found within the same ecosystem. The management of forests and rangelands in arid and semiarid lands, as silvicultural or silvo-pastoral systems, provide goods and services which satisfy the diverse needs of society and lay the foundations of a strong rural economy. Moreover, the combination of range and forest science in natural resource management and development provides the opportunity to address environmental degradation and desertification in a coordinated and holistic manner.

The services rendered by Near East forests and rangelands go far beyond the mere provision of wood and food. They provide critical ecosystem support by, for example, regulating the local climate, sustaining biological diversity, and contributing to both rural and urban livelihoods and sustainable development. Despite the frequent over-use and degradation of the natural vegetation cover, they are still inhabited by large numbers of mammals, birds, and plant communities. And just as they have done for many generations in the past, the forest and range resources in the Near East will continue to sustain rural populations and national economies. But for how long?

The aridity of the Near East Region, its low forest cover, and the poor quality of its rangelands, coupled with high deforestation rates and overgrazing in some countries, make natural forests and range systems vulnerable to further degradation and consequently to exacerbated soil erosion, loss of topsoil, desertification and lower carbon stocks – all of which lead to increased emissions of greenhouse gases (GHG), and more rural poverty and migration to cities.

FAO is working through its Near East Forestry and Range Commission (NEFRC) as well as other regional and sub-regional bodies and processes to encourage regional cooperation in forests and rangelands conservation and development. FAO works to strengthen country capacities, provide information, raise public awareness of the need for sustainable management and conservation of all types of forests and ranges, as well as engaging people in a dialogue on national forest and rangelands programmes.

As part of the celebrations of the International Year of Forests 2011, the NEFRC has organized a series of activities in the region to connect people to what is going on in their forests and rangelands. This review has been prepared to further this purpose. It has been drafted by Hedi Hadri (Forestry and Range Management Specialist) and Mustapha Guellouz (former Director-General, Office of Rangeland and Pasture, Tunisia) to whom grateful acknowledgement is made.

The primary objective is to provide an overview of the actual status and potential of forests and rangelands, their potential contribution to national economies and their impact on

dependent populations in the Near East. It examines the major issues, challenges and opportunities related to the forest and rangelands sector and provides information to decision-makers, forest and range managers, scientists and the wider public, enabling them to think about the weaknesses, strengths and opportunities of the sector and to

devise adequate strategies to protect and conserve the natural resource base for the present and future generations.

This publication constitutes a major output of the FAO forestry programme in the Near East. Countries are invited to exploit the wealth of information provided, to build on it for coordinated long term development strategies, and to provide updated data and information in due course.

Mohamed Saket
Senior Forestry Officer
Regional Office for the Near East
Food and Agriculture Organization of the United Nations

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Acronyms and Abbreviations

CWANA	Central and West Asia and North Africa
ESCWA	Economic and Social Commission for Western Asia
FAO	Food and Agriculture Organization of the United Nations
FRA	(Global) Forest Resources Assessment
FU	Forage unit
GC	Grazing capacity
GDP	Gross Domestic Product
GHG	Greenhouse gas
GVC	Global Vegetative Cover
Ha	hectares
HDI	Human Development Index
HPI	Human Poverty Index
i.a.	Inter alia, or among others
IAASTD	International Assessment of Agriculture, Science and Technology for Development
ICARDA	International Center for Agricultural Research in the Dry Areas
ILO	International Labor Organization
IUCN	World Conservation Union (formerly International Union for Nature Conservation)
KSA	Kingdom of Saudi Arabia
m ³ ob	Cubic metres, over bark
MT	Metric tonne
NE	Near East
NEFRC	Near East Forestry and Range Commission
NGO	Non Governmental Organization
NWFP	Non-wood Forest Product
OEP	Office de L'Élevage et des Pâturages
OWL	Other Wooded Land
PPP	Purchasing power parity
SR	Stocking rate
UAE	United Arab Emirates
UMA:	Union Maghreb Arab. Includes: Algeria, Lybia, Mauritania, Morocco and Tunisia
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
US\$	United States Dollar
WANA	Western Asia North Africa
WB	World Bank
WESCANA	West, Central Asia and North Africa
WFP	World Food Programme
WISP	World Initiative for Sustainable Pastoralism
WWF	World Wild Fund for Nature

A note on country names

The abbreviated forms of the formal version of several country names have been used in the text and tables, in order to save space. They are: Libyan Arab Jamahiriya, referred to as Libya; Islamic Republic of Iran, referred to as Iran; Kingdom of Saudi Arabia, referred to as Saudi Arabia; Occupied Palestinian Territory, referred to as Palestine; and Syrian Arab Republic, referred to as Syria.

Definitions

The definitions of forestry terms used in this review are those also used in the Global Forest Resources Assessment 2010 (FAO, 2010c).

Forest: Land spanning more than 0.5 hectares with trees higher than 5 metres and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.

Other Wooded Land: Land not classified as “Forest”, spanning more than 0.5 hectares; with trees higher than 5 metres and a canopy cover of 5-10 percent, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use.

Planted forest: Forest primarily composed of trees established through planting and/or deliberate seeding.

Afforestation: Establishment of forest through planting and/or deliberate seeding on land that, until then, was not classified as forest.

Reforestation: Re-establishment of forest through planting and/or deliberate seeding on land classified as forest.

Forest function:

- **Primary function:** The primary function or management objective assigned to a management unit either by legal prescription, documented decision or the landowner/manager, or evidence provided by documented studies of forest management practices and customary use.
- **Protected areas:** areas specifically designated for the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.
- **Production:** Forest area designated primarily for production of wood, fibre, bio-energy and/or non-wood forest products.
- **Protection of soil and water:** Forest area designated primarily for the protection of soil and water.

- **Conservation of biodiversity:** Forest area designated primarily for the conservation of biological diversity. Includes, but is not limited to, areas designated for biodiversity conservation within protected areas.
- **Multiple use:** Forest area designated primarily for more than one purpose and where none of these alone is considered as the predominant designated function.

The following country groupings are quoted in the document:

Gulf Cooperation Council (GCC). The countries of Kuwait, Bahrain, Qatar, UAE, Oman and Saudi Arabia

Mashriq is defined as the region of Arabian countries to the east of Egypt and north of the Arabian Peninsula.

Maghreb is defined as the region of Northwest Africa, west of Egypt, including Morocco, Algeria, Tunisia, Libya, and Mauritania and the disputed territory of Western Sahara.

Ecosystem: A dynamic complex of plant, animal and microorganism communities and their non-living environment interacting as a functional unit.

Agroecosystem: A biological and biophysical natural resource system managed by humans for the primary purpose of producing food as well as other socially valuable nonfood goods and environmental services.

Biodiversity: The variability among living organisms from all sources, including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; including diversity within species and gene diversity among species, between species and of ecosystems.

Endemic species: An endemic species is a native species restricted to a particular geographic region owing to factors such as isolation or in response to soil or climatic conditions.

Habitat: Area occupied by and supporting living organisms. It is also used to mean the environmental attributes required by a particular species or its ecological niche.

Biomass: Refers to the amount of living material, or material that was once living, in a community.

Carbon sequestration: The process of removing and storing carbon from the atmosphere into a carbon pool, such as the ocean, forests or soil, through physical or biological processes, such as photosynthesis.

Carbon sink: Forest and other ecosystems that absorb carbon, thereby removing it from the atmosphere and offsetting CO₂ emissions.

Soil organic matter: The fraction of the soil made up of anything that was once living, including plant and animal remains, cells and tissue, plant roots and soil microbes and their excretions.

Desertification: Land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities.

Drought: The naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land production systems.

Catchment: An area that collects and drains rainwater.

Soil Erosion: The detachment and movement of soil from the land surface by wind and water in conditions influenced by human activities.

Land degradation: A reduction in land productivity that affects the integrity of an ecosystem through erosion, salinization, loss of soil fertility and the like.

Graze(s)(d); grazing: Consumption of native forage from rangelands or pastures by livestock or wildlife.

Grazing Management Practices: Grazing management practices include such things as grazing systems (rest-rotation, deferred rotation, etc.), timing and duration of grazing, herding, salting, etc. They do not include physical range improvements.

Grazing pressure: It is the relationship between the number of animal units and the weight of forage dry matter per unit area at any one point in time; an animal-to-forage relationship.

Land Cover: The physical coverage of land, usually expressed in terms of vegetation cover or lack of it. Influenced by but not synonymous with land use.

Pasturelands: consist of uncultivated land, including forest land, which produces forage suitable for livestock grazing (FAO).

Rangeland: Land on which the native vegetation (climax or natural potential) is predominantly grasses, grass-like plants, forbs, or shrubs and the land is managed as a natural ecosystem. This includes lands revegetated naturally or artificially when routine management of that vegetation is accomplished mainly through manipulation of grazing.

Resilience: power of recovery, characterizes the vegetation according to its ability to regain its previous characteristics, once the environmental constraints lifted.

PART I: INTRODUCTION

1. Purpose and scope of the review

Mankind has always depended on forests and rangelands for clean air to breathe, food and water, fodder for animals, fuel, shade and shelter, livelihoods and economic development, as well as a wide range of environmental and social services. Worldwide, forests support the livelihoods of 1.6 billion people.

Yet people have been causing deforestation and forest degradation through the unsustainable production of wood, fibre, energy and non-wood forest products and, especially, the conversion of forests and rangelands for residential and agricultural development.

Early humans were known to respect trees, and even today, in some parts of the world, forests are regarded as places of cultural and spiritual importance. In the culture of many countries in the Near East healthy stands of trees are protected and revered in cemeteries and around marabouts (burial places of holy men) where forests are found e.g. in Syria and Iraq.

The low-forest cover of the region can potentially be greatly enhanced by trees and shrubs thus increasing the productivity of agricultural and livestock systems and, at the same time, providing a multitude of environmental services which contribute to the protection of soils and water resources, help conserve biodiversity, mitigate global warming and contribute to livelihoods and sustainable development of both rural and urban people.

This review provides a range of data, examples and analysis to improve understanding of the multiple functions and contributions that forests and forestry and rangelands can make to the lives and livelihoods of people in the Near East. It highlights the critical importance of managing forests and rangelands on a sustainable basis to provide social, cultural, environmental and economic services for this and future generations.

Box 1: Did you know?

That in the Near East:

- Forests only cover 6.3 % of land area compared with the global area of 31% in 2010.
- Forest cover declined by 590 000 ha/year from 1990 to 2000.
- The creation of planted forests is weak, averaging 77 450 ha/year from 1990-2010.
- Only 8 countries in the Region have forests with management plans.
- Forests with management plans represent only 12 % of the total forest area.
- The import of sawn timber is about 97 % of total consumption.
- The contribution of forests and trees to total energy demand is 6% in the Middle East and 18 % in North Africa.
- Biodiversity levels are high, higher than in most temperate areas of the same size.
- Protected areas cover 113.9 million ha or 7.9 % of the total land area.
- Carbon stocks in the Near East forests were estimated to be about 2.05 million tons in 2010 of which 68 % is within Sudan forests.

The target audience of this review are politicians and decision-makers in the various government agencies related to forestry and rangelands in the Near East, as well as development practitioners. The information can also be useful to journalists, academics, the private sector and teachers. It is meant also to sensitize all rangeland managers and users to the gravity of the range deterioration and the urgency for corrective action.

It aims to:

- Introduce decision-makers to information on the economic, social and environmental contributions of forestry and rangelands to livelihoods and development;
- Present information on forests in the Near East and examples on the interface between forestry and poverty reduction and range and natural resources degradation;
- Provide information on the role of forestry and rangelands in the protection of soil and water resources and in combating desertification;
- Raise awareness of the need to sustainably manage forests, rangelands and other natural resources.

2. Sources

Sources of information on Forests included the Global Forest Resources Assessment 2010 (FRA, 2010), the State of the World's Forests 2009 (FAO, 2009), FAO publications including country outlook studies and country reports, articles in *Unasylva* (the periodical of the Forestry Department of FAO), articles from the internet, and the personal experience of the authors. The assessment, analysis and comparison of figures from the different databases have been problematic, due to inconsistencies in the diverse sources of data. In addition, some figures are incomplete or unreliable; for example data on Non-wood Forest Products are incomplete, there is an absence of data on charcoal production, and there are inconsistencies in the data on wood production. Regarding Rangelands, there are no systematic figures or information for all of the Near East countries and the existing information is not readily available, except for statistics on animal numbers, meat and milk production which exist in FAOSTAT and some other FAO publications. Data is scarce, incomplete, sometimes contradictory and very often outdated, which explains the frequent use of country examples to illustrate specific cases. Some of the available data has been reworked to make it easier for analysis.

3. The Near East region

The Near East Region as defined by this review includes 20 countries. In alphabetical order they are: Algeria, Bahrain, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco and Western Sahara, Oman, Palestine, Qatar, Saudi Arabia (Kingdom of), Sudan, Syria (Arab Republic), Tunisia, United Arab Emirates, and Yemen. A note on the official country names is found in the section on Abbreviations and Acronyms.

Sudan is included in this review, which was drafted before the declaration of the new state of South Sudan – which is not at present a member country of FAO. Sudan is not a member of

the FAO Near East Regional Office, but is a member of the FAO Near East Forestry and Range Commission – as well as of the African Forestry and Wildlife Commission.

Figure 1: FAO Near East member countries



Source: FAO, Cairo

4. Near East area

The total area of the Near East countries, including Sudan, is 1.47 million ha (of which Sudan is the largest), or 11 percent of the global land area. Without Sudan the total area is 1.23 million ha and the largest country is Algeria. Table 1 of the Annex gives country areas.

5. Population

Table 7 of the Annex gives data relevant to the population of the countries of the Near East in 2008. The total population of the region was estimated to be nearly 409 million, or 6 percent of the world's population.

Population size varies widely between the countries of the Near East, with Egypt (82 million) and Iran (73 million) being the most highly populated. The smallest populations are Bahrain (0.78 million) and Qatar (1.3 million). During the twentieth century the population of some Near East countries has more than quadrupled e.g. Egypt, Saudi Arabia and Iran, although now the population growth of nearly all of the countries is around 13- percent/year.

The density of the population per square kilometre (km²) of land area in the Near East is generally low e.g. Mauritania 3 people/km², Libya 4/km², Iran 45/km², and Tunisia 65/km². In Bahrain, however, the density is above 1 000/km² and in Lebanon it is 410/km².

The rural population as a proportion of the total also varied widely from one country to another. It is the lowest in the Gulf countries e.g. 2 percent in Kuwait and 4 percent in Qatar, but is high in Yemen (69 percent) and in Mauritania (59 percent).

Statistics of population living on rangelands are extremely sparse, may be contradictory and often are not reliable.

Data on populations, especially population density and growth rates, may reflect pressure on forest land, especially when combined with income (or lack of it) and other socio-economic indicators, which are discussed in the next section.

6. Socio-economic indicators and agricultural land

Some socio-economic indicators are given in Table 8 of the Annex. They include the UNDP Human Development Index (HDI) and Multi-dimensional Poverty Index (MPI). The former refers to a measurement of development, which combines life expectancy, educational attainment and income, while the latter replaces the former human poverty index; it is a weighted measure of ten indicators (education – years of schooling and school attendance; health – child mortality and nutrition; and standard of living – cooking fuel, sanitation, water, electricity, floor, asset ownership). For a full description of these two indices see <http://hdr.undp.org/en/statistics/hdi/> Table 8 also includes Gross Domestic Product at Purchasing Power Parity per head, and GDP growth rates.

Table 1. Country ranking of HDI, 2011

Very high	High	Medium	Low
UAE; Qatar; Bahrain	Iran; Kuwait; Lebanon; Libya; Oman; Saudi Arabia; Tunisia	Algeria; Egypt; Iraq; Jordan; Morocco; Palestine; Syria	Mauritania; Sudan; Yemen

Source: <http://hdr.undp.org/en/statistics/>

HDI and MPI may be linked to deforestation, of which the strongest driver is rural poverty. GDP, which is also linked to the loss of forests, varied widely among Near East countries, largely depending on their possession, or not, of crude oil. The poorest are Mauritania and Yemen (GDP/head of US\$ 919 and US\$ 1 118 respectively) and the richest are Qatar, Kuwait, the UAE and Bahrain. Between these two extremes come countries such as Iran, Tunisia, Algeria and Jordan, which have GDP/head in the range of US\$ 4 000 to 5 000. The proportion of people living on less than 2 US dollars daily is very high in Sudan (90 percent) (a predominantly rangeland country), Yemen (45 percent), Egypt (53 percent) and in Mauritania (69 percent) in all of which the influence of desertification is very important.

In the Near East Region the proportion of agricultural land of the total is highly variable, ranging from highs of 67 percent in Morocco and Lebanon, 64 percent in Tunisia, 22 percent in Iraq, and 17 percent in Algeria, down to 8 percent in Kuwait and 6 percent in Qatar. See Table 9 of the Annex.

PART II: FORESTRY IN THE NEAR EAST

Photo 1: Pine forest in the coastal area of Syrian Arab Republic



1. Near East forest ecosystems

The forest ecosystems of the Near East are characterized by four bio-geographical regions:

1. The southernmost limit of the cold and humid Euro-Siberian region, in the Black Sea coastal mountains of northern Iran are mainly characterized by broadleaf deciduous trees. At lower elevations, oaks, hornbeam, chestnut and several maple trees predominate, while the oriental beech (*Fagus orientalis*) characterizes the upper zones. The mountains of Iran are home to limited extents of tertiary relics like *Cupressus sempervirens* and *Thuja orientalis*.
2. A large part of the cold and dry Irano-Turanian region, covering most of Iran, inner Anatolia, inner Syria, Iraq and part of Jordan, is characterized by deciduous oaks and juniper trees. Lower elevations host *Prunus*, *Pistacia* and *Pyrus* species.
3. The southern part of the summer drought-prone Mediterranean region extends all along the coastal lowlands and mountains of North Africa and the Near East. Here carob, wild olive, "araar", Aleppo pine, holly oak, juniper and pistachio trees are typical of the coastal and inner dry lowlands. Mid elevations are characterized by a mix of evergreen oaks, deciduous oaks, conifers and cypress. High mountain forests host relics of endemic conifers with a narrow distribution of cedar, fir, pine, and juniper.
4. The hyper-arid Saharo-Arabian region, covering all the desert land from Morocco to Iran, part of Sudan and the southern part of the Arabian Peninsula, are characterized by the presence of scattered trees and stands of *Acacia*, *Balanites*, *Commiphora*, *Cassia*, *Prosopis* and *Populus* spp. Few tertiary relics, like *Cupressus drupeziana* and *Olea laperrini* occur in the form of scattered trees in the Saharan Mountains.

High rainfall savannah woodlands only occur in Sudan and are characterized by *Khaya senegalensis*, *Combretum hartmannianum*, *Parkia africana*, *Daniellia oliveri*, *Isoberbinia doka*

and *Anogeissus leiocarpus*. Mangrove forests are found in some areas along the Red Sea coast of Egypt and Sudan, the Arabian Peninsula, Kuwait and Iran.

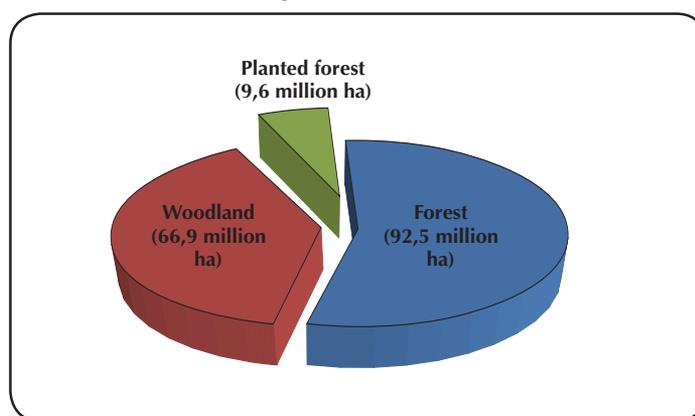
In summary, the faunal and floral characteristics of the Near East have adapted to the region's climatic features which vary from Mediterranean through semiarid to arid regimes. But these ecosystems are particularly fragile and, despite traditionally developed practices of sustainable use, increasing human and livestock pressure over the recent decades have resulted in serious environmental degradation and even loss.

2. Current state of the forests

2.1 Forest extent

The Near East is characterised by semi-arid to desert conditions with low forest cover; because of pressure on suitable land even potential forest area is low. Table 1 of the Annex shows that forests (see Definitions) cover nearly 93 million hectares - of which 76 percent are located in Sudan (70 million hectares). The forest area of the region is about 11 percent of the global total. Other wooded land (OWL - see Definitions) cover an additional 67 million hectares, nearly all in Sudan; this is only 0.9 percent of the global total of OWL, which in many other regions is a highly important resource for rural livelihoods. Planted forests cover over 9 million hectares, or less than 4 percent of the global total. This is very low, and the role of planted forests, and the ways in which they can be established in areas of low rainfall, are discussed further in Sections 2.4 and 2.5.

Figure 2: Areas of forest, wooded land and planted forest

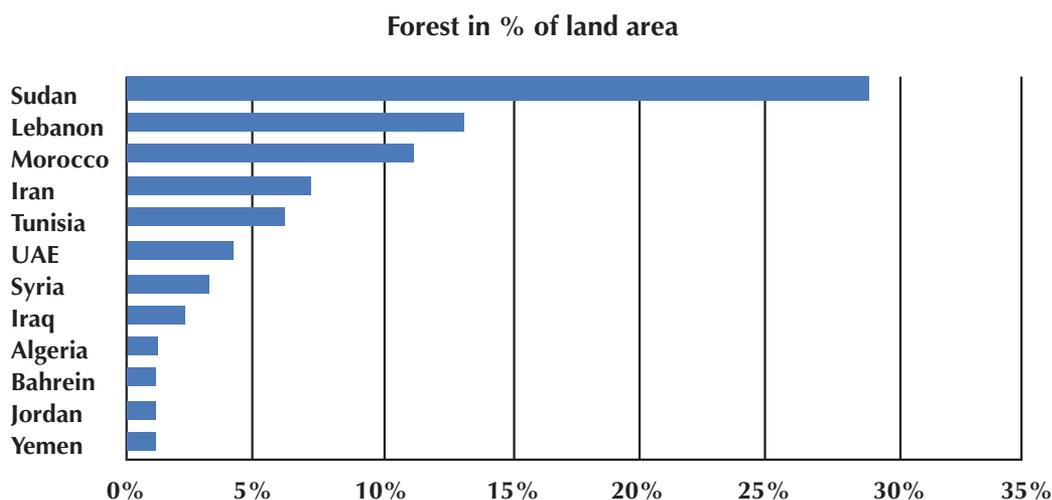


Source: FAO, 2010c

A Low Forest Cover Country (LFCC) is defined by the 1999 Tehran Process as one having less than 10 percent forest cover, and according to Table 1 only three countries have forest cover exceeding this: Sudan (29 percent), Lebanon (13 percent) and Morocco (11 percent). All of the rest are LFCC and while Iran and Tunisia have forest cover of 6 and 7 percent respectively all others have forest cover of less than 3 percent of the land area. (Figure 3)

Virtually all of the forests of the Gulf countries (Bahrain, Kuwait, Oman, Qatar, and the UAE) as well as Egypt and Libya are planted forests which also represent a significant component of the forest cover in Syria, Jordan and Tunisia.

Figure 3: Forest areas in percent of land area



Source: FAO, 2010c

2.2 Forest loss and degradation

7

Many countries in the region were long ago famed for their rich forests, such as the well-known Cedars of Lebanon. Today these forests are few in number, scattered, and their extent is constantly being diminished, so that neither their protective nor productive roles can be fulfilled.

The increase in the population combined with poverty, rapid urbanization and agricultural encroachment has forced people to convert forest and rangelands into cultivated land, towns have expanded and there has been overuse of wood as fuel for domestic use.

At the same time larger herds have led to overgrazing and increased collection of fodder, which have strongly reduced the natural regeneration of forests. Thousands of hectares of oak forests used mainly for grazing in Northern Iraq, for example, have been transformed into poor and degraded coppice.

Land use change, abandonment of traditional grazing systems and climate change all represent

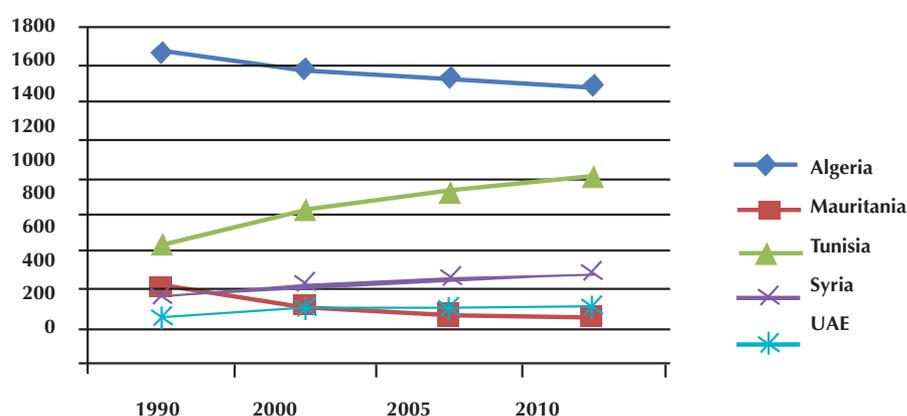
Box 2: Forests in Yemen?

Many Yemenis are astonished to hear that forests and woodlands still exist in their country. But in fact about 1.9 million ha of forest still exist, mainly along the western and Southwestern Escarpment («serrata»). Two of the species that grow there are *Acacia gerardii* and *Commiphora kataf*, which are not rare and are endemic. Relics of juniper forest also cover 2 132 ha in Jabel Bouraa and Jabel El Louz.

important threats to Near East forests. Forest depletion has now reached a stage where «forests» often consist of only a few poorly scattered trees or bushes. If these practices continue unchecked, the provision of goods and ecosystem services will be drastically diminished and the protection functions of forests will cease.

The dieback of forest trees is a problem especially affecting conifers in mixed mountain forests in Algeria and Morocco and juniper forests in Lebanon, Saudi Arabia, Oman and Yemen. Moreover, stands of relic forests and unique tree species, like the relic cypress trees in Morocco and Algeria, and oak forest in Jordan are increasingly becoming over-mature with little or no natural regeneration.

Figure 4: Forest cover change in some countries, 1990- 2010 (1000 ha).



Source: FAO, 2010c

The available information warrants caution in interpreting forest depletion in the region; no strong conclusion could be drawn. The overall picture and national reports indicate a serious forest depletion and natural resources degradation. According to FRA 2010 the area of forest in the Near East declined at the estimated rate of 590 000 ha/year from 1990 to 2000, 41 000 ha/year from 2000 to 2005 and the same rate from 2005 to 2010 (FAO, 2010c). This decrease occurs particularly in North African countries namely Algeria, Mauritania and Sudan, with the main change due the changes in Sudan. In the same period other countries recorded a slight increase in the forest area such as Egypt, Morocco, Tunisia, Syria and United Arab Emirates due to the progress in tree plantation (Fig.3).

2.3 Forest fire

The use of fire as a management tool in agriculture and rangeland, combined with public apathy, neglect in fire management, arson, the irresponsible behaviour of tourists and picnickers, and social conflicts are the main causes of uncontrolled fires, which burn significant areas of forest every year. Many countries in the Near East show an increase in fire frequency and severity. The little forest that remains in Syria is being further degraded due to recurrent fires that increased

from 199 annual fires in 1990 to 364 in 2005. In Lebanon, more than 300 fires were declared in less than 24 hours on 3 October 2007, destroying thousands of hectares of forests and other wooded lands (Asmar et al., 2009). However, there are success stories in the region in combating forest fires. For example forest area destroyed by fire in Tunisia decreased from 1 375 hectares in 2000 to 98 hectares in 2009 (FAO, 2010d), and Jordan's forest area affected by fire decreased from 133 hectares in 1993 to 62 hectares in 2002.

2.4 Afforestation and reforestation

Many countries of the region (e.g. Syria, Sudan, Jordan, Iran and the Maghreb countries), have active programmes of afforestation and reforestation (see Definitions) of degraded forestlands, mainly for protective purposes, although some of the planted forests have a productive function as well. Planted forests for productive purposes are found in Iran, especially in areas with high potential. Lebanon has also a high proportion of planted forests, primarily established for the production of stone pine nuts (*Pinus pinea*). The benefits to local communities from afforestation and reforestation include employment opportunities in nurseries, as well as planting, maintenance, management and protection.

Multipurpose tree species (e.g. for fruit, fodder, woodfuel, charcoal and honey production) have been planted in reforestation programs to provide local benefits. For example, Lebanon is planting *Pinus pinea* for stone pine nuts and Syria *Juglans regia* for walnut production, both of which benefit rural communities. Many countries have also planted fodder trees and shrubs on degraded forest lands e.g. *Acacia*, *Atriplex*, *Cactus*, *Morus* (mulberry) species to improve the forage supply (e.g. Morocco and Tunisia).

Countries have made efforts to implement integrated watershed management programs that include large afforestation and reforestation activities by planting trees along the contour lines for erosion and landslide control e.g. in Morocco, Algeria, Tunisia, Jordan, Syria and Iran.

For several decades, afforestation for sand dune stabilization has been carried out to arrest sand encroachment on agricultural land, roads, and villages and to limit the risks of desertification, to which most of the Near East countries are exposed.

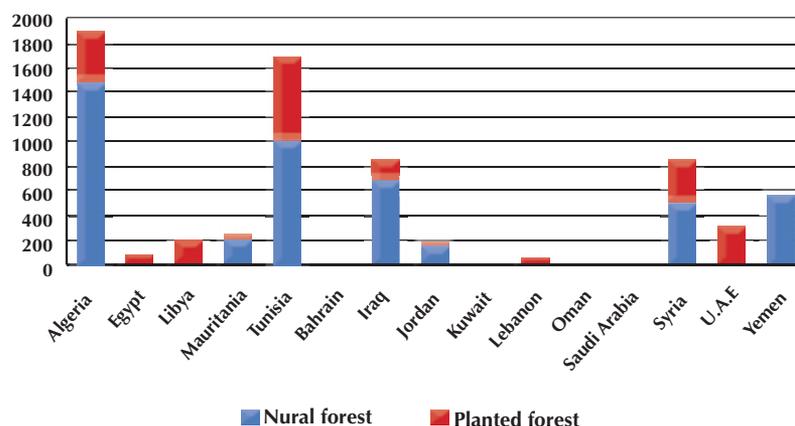
In Saudi Arabia, United Arab Emirates, Syria, Iran, Iraq, Kuwait and Oman, the improvement of the environment is a major objective in reforestation and afforestation programs. The use of forests and trees for amenity and recreational purposes is gaining in importance due mainly to trends in urbanization and the demands of urban populations – and increasing prosperity. Many countries in the region have been establishing greenbelts, plantings along roadsides and other urban and peri-urban tree planting.

2.5 State of planted forests

Currently, the total area of planted forests in the region is estimated to be 9.63 million hectares, or 9.6 percent of the forest cover. From 1990 to 2010, the increase in planted forests was very weak

averaging 77 450 hectares/year in the entire region or a total of 1.55 million hectares during 20 years of which 42 percent was in Sudan (6.07 million ha) followed by Iran (844 000 ha), Tunisia (690 000 ha), Morocco (621 000 ha), Algeria (404 000 ha), UAE (317 000 ha), Syria (294 000 ha) and Libya (217 000 ha). See figure 6. All other countries of the region have a total area of planted forest less than 70 000 hectares. Almost all planting is undertaken by governments, thus progress is highly dependent on governmental priorities and budget allocation.

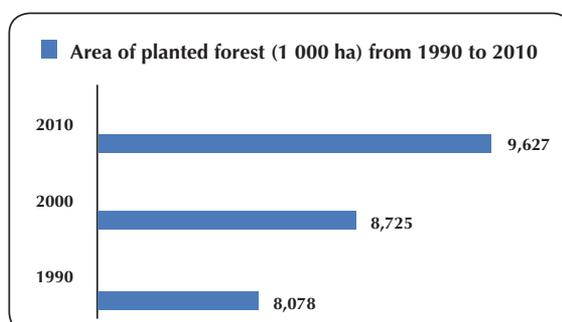
Figure 5: Areas of natural and planted forest areas by country



Source: FRA, 2010

In the Gulf countries, despite the recognition of the importance of environmental protection, the need for greening urban spaces and establishment of recreational areas, afforestation efforts are very weak. The lowest planted forest areas are in Iraq (15 000 ha), Kuwait (6 000 ha), Lebanon (11 000 ha) and Oman (2 000 ha). Qatar, Saudi Arabia and Yemen did not report planted forests. Planted forests face many constraints. Adverse growing conditions, especially aridity, poor planting techniques, inappropriate species selection, insufficient protection and the absence of management plans limit the scope for commercial purposes and sustainability. In fact many planted forests in the region are in very poor condition, subject to illegal cutting, mutilation of trees and over-grazing. Taking into account the availability of suitable land, the institutional capacity and the financial resources of some countries, the rate of establishment of productive and protective planted forests could be much increased.

Figure 6: Increased area of planted forests in the Near East



Source: FAO, 2010c

2.6 Afforestation using waste water

The Near East is the most water scarce region in the world; and one response to this situation is the use of municipal wastewater to irrigate planted forests, greenbelts and amenity trees. Using wastewater in forestry helps meet the increasing demand for water in the region and, through tree planting, decreases the risk of desertification

A number of countries – Egypt, Iran, Jordan, Oman, Saudi Arabia, Sudan, the United Arab Emirates and Yemen – have developed the use of treated municipal wastewater for irrigating planted forests greenbelts and in the stabilization of sand dunes, using multi-purpose and fast-growing species such as Eucalyptus, Acacia, Casuarina, Pinus and Tamarix. Overall, however, the large-scale use of wastewater for the irrigation of planted forests is still relatively limited. The high investment required to irrigate the trees is an important constraint in expanding such programmes.

In Egypt, there are 22 wastewater treatment plants and about 150 plants under construction (Hamdallah and Gawhari, 2000). Some communities in Egypt already use municipal wastewater or drainage water after primary treatment to irrigate woodlots. In Yemen, a forest tree plantation irrigated with wastewater was established as a part of a greenbelt around the city of Aden and another green belt was established around Al-Hodeidah city as well as along 14 kilometres of roads.

The wastewater produced in Jordan in 1995 was 300 million m³ and the volume of treated wastewater available was 69 million m³. The main planting irrigated include Eucalyptus, Casuarina, Cupressus and Tamarix species for the establishment of windbreaks and shelterbelts which are irrigated primarily by furrow systems.

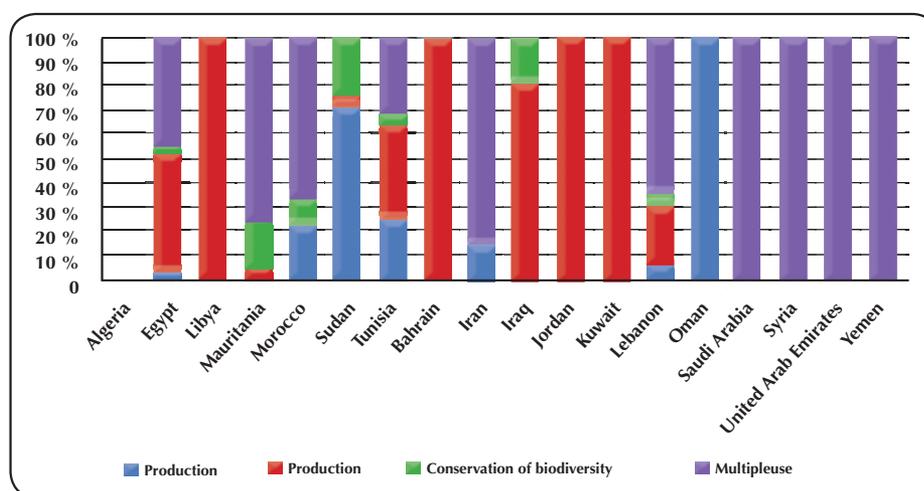
3. Functions of Near East forests

The productive function of forests is traditionally one of the main objectives of the forestry sector and forest resources support many national economies and forest-dependent local communities. Forest areas that have been designated for such functions serve primarily for the production of various goods, including wood, fibre, woodfuel and non-wood forest products.

Given the harsh climatic conditions, low stocking and poor productivity combined with the need for forests predominantly to fulfil protective functions, the productive functions of forests vary markedly in the countries of the region. Table 2 of the Annex gives percent figures for the various forest functions, but expanding on that from the FRA 2010, about 38.4 million hectares of forest are managed predominantly for the production of wood and non-wood forest products in the region. Countries which reported productive functions of forests included Algeria (522 200 ha, 35 percent), Egypt (1 400 ha, 2 percent), Morocco (1.08 million ha, 21 percent), Sudan (34.97 million ha, 50 percent), Tunisia (241 440 ha, 24 percent) and Iran (1.55 million ha, 14 percent). (Figure 7). There are no forests with predominantly productive functions in the other countries of the region.

The important protective functions of forests are recognized worldwide. They act at local and global levels to protect soils from wind and water erosion, protect coasts, prevent landslides, and act as air filters. They also play a very significant role in the carbon cycle that affects global climate change. For most Near East countries, these environmental services are probably more important than the production functions of their forests and woodlands.

Figure 7: Percentage of different function of Near East Forests

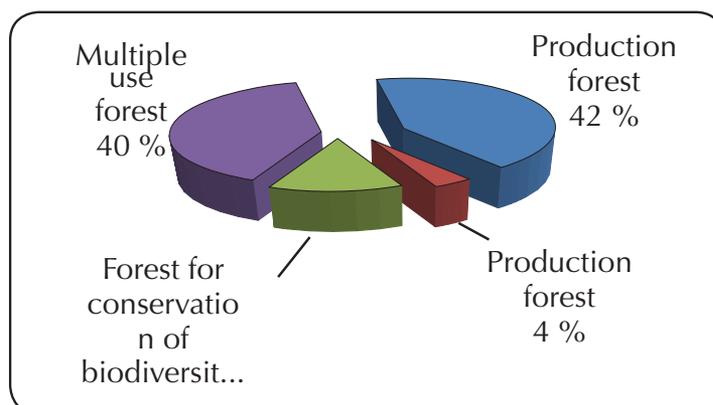


Source: FRA, 2010

The total forest area designated for predominantly protective functions is 4.3 million hectares or 4.0 percent of the forest area of the region. The protective functions of forests dominate in countries like Algeria (780 769 ha, 78 percent), Egypt (34 300 ha, 50 percent), Libya (217 000 ha, 100 percent), Tunisia (241 440 ha, 24 percent), Bahrain (1 000 ha, 100 percent), Jordan (96 000 ha, 98 percent) and Kuwait (6 000 ha, 100 percent).

The multiple use function of forest concerns the management of forest or woodland for more than one purpose, such as production of wood, NWFP, forages and browse for domestic livestock, proper environmental conditions for wildlife, landscape effects, protection against floods and erosion, recreation, and protection of water supplies. Forests with multiple purposes occupy 46 to 100 percent of the total forest area in countries like Egypt (32 000 ha, 46 percent), Mauritania (177 000 ha, 73 percent), Morocco (3 438 ha, 67 percent), Iran (9 414 000 ha, 85 percent), Lebanon (90 000 ha, 66 percent), Saudi Arabia (977 000 ha, 100 percent), Syria (491 000 ha, 100 percent) and Yemen (549 000 ha, 100 percent).

Figure 8: Forest functions in the Near East



Source: FAO, 2010c

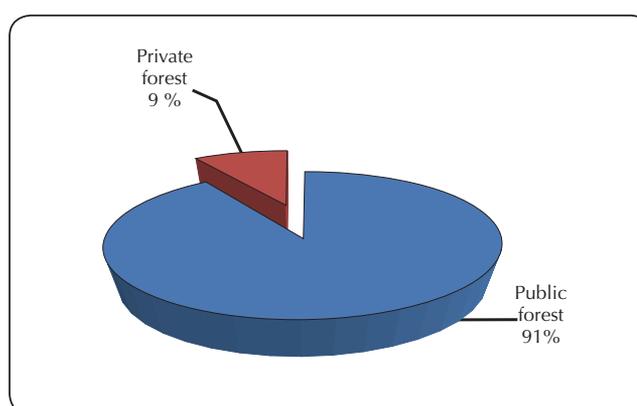
Sudan with about 34 million ha of production forest explains the high percentage of production forest in the Near East.

4. Forest ownership and management

4.1 Forest ownership

Most forests in the Near East countries are in public ownership (Figure 9), or 91 percent of the total; private forests dominate only in Lebanon and Yemen.

Figure 9: Forest ownership in percent of the total forest area in the Near East



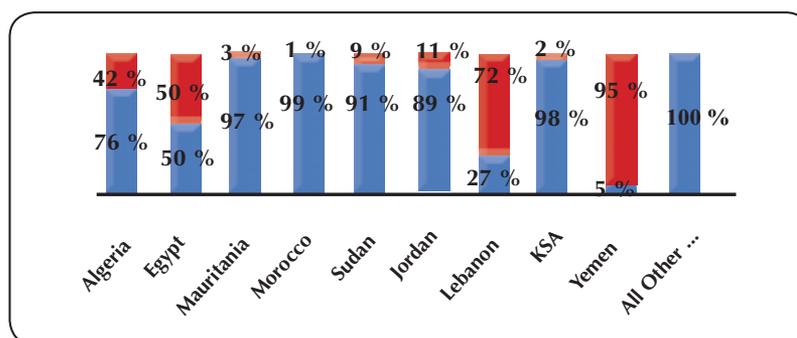
Source: FAO, 2010c

Lebanon's private forests, mostly owned by religious groups, account for about 72 percent of the country's forest area and are well managed, although government regulations prohibit the removal of wood. In Algeria private forests represent 24 percent and in Egypt 50 percent of the total forest areas.

Yemen also has a substantial extent of “private” forests, estimated at about 95 percent of the forest area where certain communities manage forest lands as common property, according to traditional rules and rights. However, the precise nature of ownership is unclear because of the absence of proper surveys and mapping and, even more important, an effective legal system that protects ownership rights.

Public ownership varies from 90 to 100 percent in Mauritania, Morocco, Sudan, Tunisia, Bahrain, Iran, Jordan, Kuwait, Saudi Arabia, Oman, UAE and Syria (Figure 10).

Figure 10: Forest ownership



Source: FRA, 2010

4.2 Forest management

Forest management is the conservation and regeneration of the ecological resources of a forest while maintaining its productivity through the manipulation of trees and forest stands to meet landowner objectives.

In simpler terms, the concept can be described as the attainment of a balance between societies' increasing demands for forest products and benefits, and the preservation of forest health and diversity.

Most forests in the region are managed for their multiple functions with conservation being an important objective. Management of protected areas or national parks has gained importance in countries such as the North African countries, Iran, Jordan, Lebanon and Saudi Arabia. In Saudi Arabia, the hima is a communal management system, which consists of a set of rules for the sustainable use of pasture and forestland in a territory utilized by one or more pastoralist communities (i.e. tribes or villages).

Box 3: Why manage forests?

Forest managers determine how to use forests today and also ensure similar benefits in the future. Forest managers must assess and integrate a wide array of sometimes conflicting factors - commercial and non-commercial values, environmental considerations, community needs, and even global impact - to produce sound forest plans. Nowadays forest managers develop their forest plans in consultation with stakeholders, organizations and other interested parties in and around the forest area being managed.

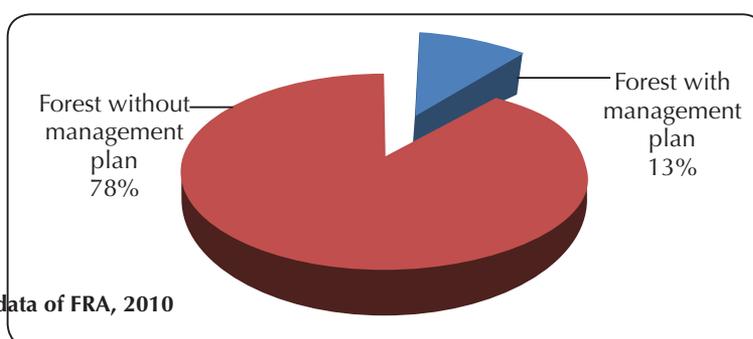
FAO, 2004

Protective and amenity planting – especially as windbreaks and shelterbelts and green spaces in urban areas – is also receiving considerable attention and management plans for them have been implemented. Pine nut production is a major objective in the management of the forest in Lebanon, while the main purpose for the management of the oak forests in the North African countries is cork production.

Only 8 countries of the region have forest with management plans – see Table 3 of the Annex, namely Algeria, Egypt, Mauritania, Morocco, Sudan, Syria and Tunisia; these areas represent only 13 percent of the total forest area in those eight countries and only 0.4 percent of the total forest area in the region.

The public sector, which owns most forests, often pays little attention to the needs of local communities and marginalized groups, who depend directly on forests and their products. The lack of participatory planning and management, including limited access to forest resources, unclear demarcation and ownership of forests, and lack of land-use planning, have generated conflicts between the forest dwellers and the Forest Authorities. Moreover, forest management in the Near East countries is hindered by weak mapping, absence of forests inventories, deficient databases and insufficient skilled forest managers.

Figure 11: Forest management status of the Near East countries



Source: Based on data of FRA, 2010

5. Forest Production

Forests, trees and woodland provide raw materials for housing and many wood products in the Near East and it still remains an important fuel particularly for the poor in rural areas. However, vast areas in the region are completely treeless in the desert and sub-desert regions of Egypt, the Arabian Peninsula, Libya, Syria, and Iraq as well as many mountainous regions of Iran, Morocco, Tunisia and Algeria. Many forest stands, both conifer and broadleaved, are degraded and thinly stocked with an extremely low standing volume of wood and low annual growth. Considerable areas in Iran, Iraq, Syria, Tunisia and Yemen,

Box 4: Community involvement

The formal involvement of community organizations in resource management is still in its infancy and there are only limited initiatives to involve local communities in the management of forest and tree resources. However, there is also increasing recognition of the role of local communities in decision-making.

FAO, 2004

described as forests, are little more than brushwood and coppice, which can barely produce wood for fuel or charcoal. Although many countries record thousands of hectares as forest, only a small fraction can be regarded as true productive forest. The example of Syria, where detailed information is available, shows that only 20 percent of designated forestland is considered as true forest; the remaining 80 percent are composed of bare land, shrub land, grazing land but cannot be considered as forest (Sulayem and Joubert, 1994).

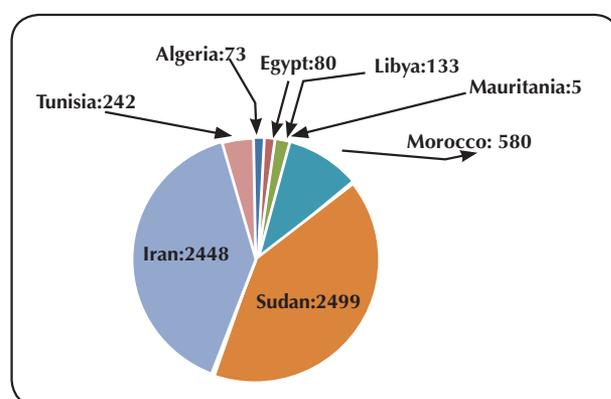
5.1 Wood production

Industrial roundwood production is negligible in most countries because of low stocking and slow growth rates and yields, but also because many forests fulfil protective functions. Forests in the region provide some 6.1 million m³ of industrial roundwood of which 2.5 million m³ are produced in Sudan and 2.5 million m³ in Iran, accounting for 48.7 percent of the region's total roundwood production; then comes Morocco with 580 000 m³ and Tunisia with 242,000 m³. Algeria with a forest cover of 1.5 million hectares produces only 73 000 m³ of industrial roundwood. The low volume of roundwood removal in these countries is partly the result of lack of policy, management strategy and plans to improve forest production.

Eleven countries of the region with low forest covers (Bahrain, Iraq, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, U.A.E and Yemen) reported no roundwood production from their forests.

All the countries of the region are largely dependent on imports for meeting their needs for wood products. They import about 9 million m³ of sawnwood which is about 97 percent of the total consumption. Only 3 percent is produced in the region, mostly in Sudan.

Figure 12: Roundwood removals (1000 m³)



Source: FRA, 2010

5.2 Wood production outside forests

Trees outside forests, growing on agricultural land as shelterbelts, windbreaks, live fences, village woodlots and tree rows along roadsides are used for supplying industrial wood. Some species like poplars, casuarinas, eucalyptus, plane trees, acacias, walnuts or cypresses are highly appreciated by the woodworking industries, and play a particularly important role in providing local small

industries and handicrafts with raw material. Moreover, some countries of the region have irrigated plantings of poplars and eucalyptus around the villages which provide timber and woodfuel for local use and help to protect the agricultural crops against wind as well as providing amenity and improving the environment.

For instance in Syria, Lebanon, Iraq, Jordan and Iran, wood production outside the forest, on agricultural land, small woodlots and in agroforestry systems, is very high and often exceeds 10 m³/hectare, an increment often greater than that of forests proper. The gardens of Damascus, where poplar plantings cover some 3 000 hectares, produce more than 50 000 m³ of industrial wood/year. In Iran, around 58 percent of the annual production of wood (estimated at 1 million m³) is from plantings and trees in orchards.

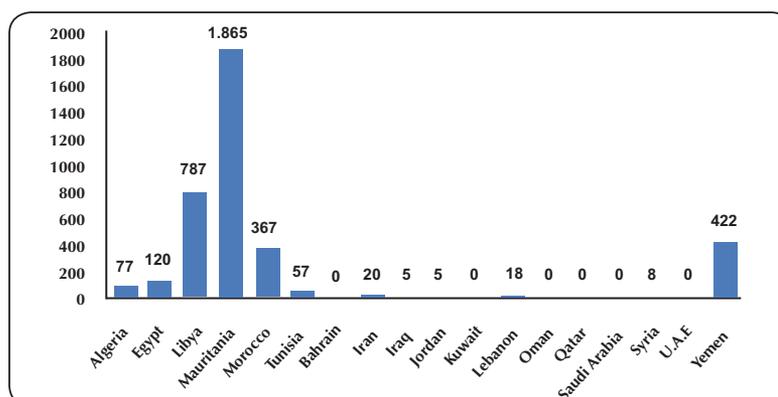
5.3 Woodfuel

Woodfuel comprises all types of biofuel derived directly and indirectly from trees and shrubs grown in forests and non-forest lands. Woodfuel also include biomass derived from silviculture activities (thinning, pruning etc.) and harvesting and logging (tops, roots, branches, etc.), as well as industrial by-products derived from primary and secondary forest industries, which are used as fuel.

Woodfuel and charcoal are the most important wood products in the Near East, and their volume of production is about two-thirds that of all industrial wood products (FAO, 2005). These commodities meet important energy needs of the rural population. For the poor in the region, urban as well as rural, wood is usually the principal source of energy for cooking food and heating houses, which all too often have resulted in the destruction of the forest and in a worsening of the situation of rural people whose lives to a great extent depend on forest products.

The energy contribution of forests and trees to total energy demand at the regional level is only 6 percent in the Middle East and 18 percent in North Africa. However, the wood energy share at national level varies considerably from country to country. Mauritania, Morocco and Sudan, are the largest woodfuel consumers. Oil rich countries, such as Bahrain, Qatar, Oman, Kuwait, Iraq and Iran rely to a large extent on oil and gas for their energy needs.

Figure 13: Woodfuel removal in the Near East forests (1000 m3)



Source: FRA, 2010

Remark: Woodfuel removal in Sudan is estimated at 20.35 million m3

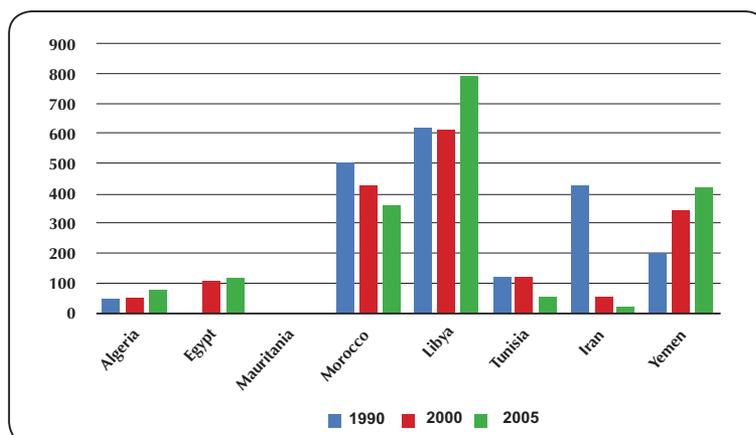
Available data on woodfuel consumption are based largely on estimates, as the greater part of wood fuel production and usage occurs outside commercial channels and thus goes unrecorded. On the basis of the latest information provided by FRA 2010, the total annual output and use of all wood for fuel in the Near East was estimated at 24.1 million m3 in 2005. All of the woodfuel volume is extracted from the forests in the Near East, except Sudan where woodfuel removal from forests account for 57 percent and Lebanon 70 percent.

Sudan has the largest woodfuel production in the region, about 20.4 million m3 (in 2005). Mauritania with 1.9 million m3 is another country with a considerable production of woodfuel (Figure 13). All of the woodfuel production in the region is consumed locally.

In Morocco, Algeria, Tunisia, Lebanon, Syria and Iran dependence on woodfuel has declined largely because of the growth in incomes, increased urbanization and improved access to fossil fuels, particularly gas. In recent years, Iran has made a concerted effort to reduce the dependence on woodfuel for meeting household energy needs. Consequently, woodfuel production decreased there from about 425 000 m3 in 1990 to 20 000 m3 in 2005 because gas pipelines were extended, even to remote areas (FAO, 2010c).

Information on woodfuel production and consumption in the Gulf countries is scarce and/or unavailable. These countries, however, consume only a minor amount of the total woodfuel in the region, due to lack of forest resources in combination with considerable oil resources.

Figure 14: Trends of woodfuel removal in some countries of the Near East (1 000 m3)



Source: FAO, 2010c

Woodfuel is mainly collected from forests and other wooded land in most countries for example Libya, Mauritania, Sudan and Lebanon, reaching 80-100 percent of total removals of wood products. Although, woodfuel collection is regulated by forest legislation, illegal collection is common and accounts for as much as 69 percent of total woodfuel removal in Morocco. Women and children are heavily involved in woodfuel collection. The main use is for cooking, traditional bakeries and heating, and it is seldom for sale. The value of woodfuel is about US\$ 8/ha or less in most southern and eastern Mediterranean countries including the Maghreb countries, Syrian and Libya (Croitoru, 2003).

5.4 Charcoal

Charcoal has been an important domestic product for many years and, regardless of how it is produced, it has wide market acceptance. Its greatest use is for home and outdoor recreational cooking (barbecues and picnics). In North African countries charcoal is traditionally used for cooking, tea and coffee preparation and heating houses. In recent years, important quantities of charcoal are used for smoking water pipes and by grill restaurants. It is expected that charcoal production will continue to expand as this use increases. There is strong interest in the manufacture of charcoal and job creation in, and export from, forested regions.

Box 5: Why use charcoal?

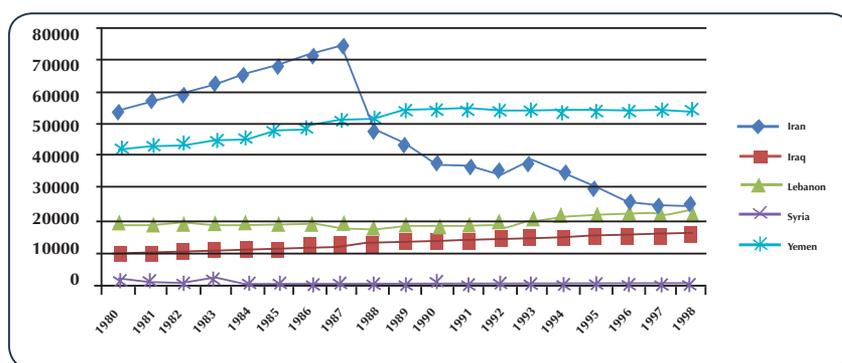
Charcoal is a high-quality fuel and in terms of efficiency of domestic use it may actually be cheaper than fuelwood. Many factors contribute to preference for it: it is smokeless; its burning characteristics; the flavour it imparts to food; ease of storage; simplicity of charcoal stoves, which make possible the use of the fuel with very little cash outlay. Charcoal can be transported economically over longer distances.

Charcoal is made from residues derived from silvicultural operations (clearing, thinning, pruning etc.), forest harvesting (tops, roots, branches), and from thinning of fruit trees (e.g. olive trees in

Tunisia). Charcoal will undoubtedly continue to be made for the most part from wood.

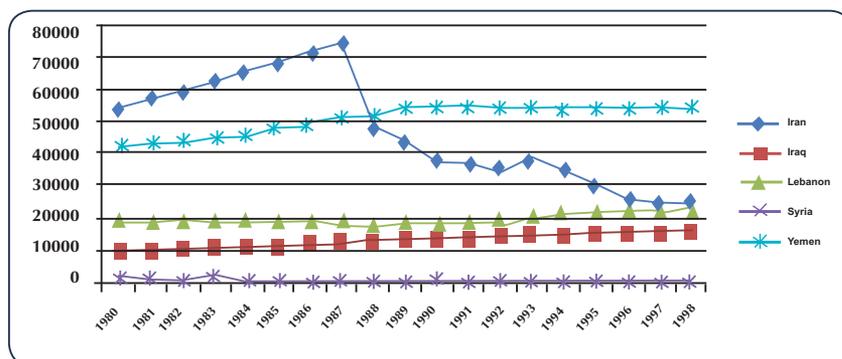
The information on charcoal available shows that the charcoal consumption in Near East countries is important. (Figure 15). Sudan is the biggest consumer of charcoal with 2.4 million tonnes, with a slight decrease the last twenty years. Morocco has the second biggest consumption at 350 000 tonnes; followed by Tunisia at 148 850 tonnes (all the figures refer to 1995) (FAO, 2000). Similarly to woodfuel, charcoal production and consumption showed a substantial increase in almost countries of the region except Iran that relies on gas and oil to meet its energy demand.

Figure 15: Trend of charcoal production in some countries (MT)



Source: FAO-The role of wood energy in the Near East. Working paper-FOP/W/002/

Figure 16: Trend of charcoal consumption in some countries (MT)



Source: FAO-The role of wood energy in the Near East. Working paper-FOP/W/002/

5.5 Non Wood Forest Products (NWFP)

NWFP are goods of biological origin other than wood, derived from forests, other wooded land and trees outside forests (FAO, 1995). NWFP may be gathered from the wild, or produced in planted forests, agro-forestry schemes and from trees outside forests. Table 22 in the Annex lists many of the main non-wood forest products found in the Region.

Photo 2: Pods of *Ceratonia siliqua* (Carroube)

In the Near East countries there is a long tradition of management of forests and woodlands for NWFP, which support the livelihoods of millions of people. They range from subsistence items to products traded in the international markets. The most important NWFP are herbs for health care, food – such as fruits, leaves, nuts, mushrooms, honey and meat from wildlife - support to agricultural and livestock production, materials for construction, and household items.

Some of these products are commodities traded on the international markets (cork, stone pine, gum and exudates, honey, aromatic and medicinal plants). However, in the Near East countries, most NWFP are used for subsistence and in support of small-scale, household-based enterprises which provide income and employment for the livelihoods of rural people, especially women (e.g. argan oil in Morocco, Aleppo pine seeds in Tunisia, stone pine nuts in Lebanon, carob pods for making a refreshing drink in Egypt). NWFP production is the main income-generating activity in several forest regions, and some communities depend on these products for their living.

Photo 3: Argan oil of Morocco (*Argania spinosa*)

Data on production and value are scarce, unavailable or out-dated for some products. Available data on NWFP are based largely on estimates, as the greater part of production, use and marketing occur outside commercial channels and are thus not formally recorded. Data on NWFP presented here are indicative figures, which have been collected in published and unpublished reports, and do not represent official statistics.

Photo 4: Cork harvesting (DGF-Tunisia)

6. Environmental services provided by forests

Forests, other wooded land and trees in farmland provide very important environmental services, including biodiversity conservation, climate change mitigation, protection against desertification and land degradation, watershed services and nature tourism. Forests provide shelter and habitats for wildlife, and regulate stream flow in watersheds that supply much of the irrigation and drinking water.

Globally, a number of countries that had earlier depended on their forests for wood production have over time reduced the level of harvesting as there is an increasing emphasis on improving the provision of environmental benefits. Growth in income coupled with greater awareness will continue to increase the demand for the provision of environmental services provided by forests.

6.1 Biodiversity and endemism

The Near East countries, located at the junction of Europe, Asia and Africa, have an outstanding biogeography and unique biological diversity. Despite their aridity, levels of biodiversity are amazingly high, higher than in most temperate areas of the same size (Krupp, 2009). Forest and woodland constitute a habitat rich in species, essential for some threatened and endangered species.

High plant endemism is recorded in the Mediterranean eco-region which includes Morocco, Algeria, Tunisia, Egypt, Lebanon, Syria and part of Jordan; they have about 12 000 endemic species. The mountains around the Mediterranean Basin are home to 36 endemic conifer species and subspecies

Box 6: Endemism

Endemism is the ecological state of being unique to a defined geographic location, such as an island, nation or other defined zone, or habitat type; organisms that are indigenous to a place are not endemic to it if they are also found elsewhere. For example, all species of lemur are endemic to the island of Madagascar; none are native elsewhere. The extreme opposite of endemism is cosmopolitan distribution.

with a narrow distributional range. Lower rates of plant endemism occur in the southern mountains of the Arabian Peninsula (2 750 species), the Irano-Turanian region (2 500 species) and the Caucasus (1 600 species) (Myers et al., 2000).

As far as the fauna concerned, the Near East forests are a crossroads of pale-arctic species such as the brown bear, the lynx, the chamois and the wolf and more sub-tropical species, including the mountain gazelle, several leopard subspecies, the striped hyena, and the jackal.

Only a few mammals are endemic to the Near East: among these, the Barbary Ape in the Rif and Atlas mountains of Morocco and Algeria; the Barbary Deer (*Cervus elaphus barbarus*) in the coastal mountain forests between Algeria and Tunisia; several subspecies of mouflon (*Ovis orientalis*) in Iran; the almost extinct Arabian tahr (*Hemitragus jayakari*) in Oman and United Arab Emirates; and several subspecies of the Atlas Barbary sheep (*Ammotragus lervia*) in North Africa and Sudan. The two primary predators of northern Africa, the Atlas bear and Barbary leopard, are now extinct, and close to extinction, respectively. The last Barbary lion (*Panthera leo leo*), also known as the Atlas lion or Nubian lion, a subspecies of lion, was shot in the Atlas Mountains in 1922 and is believed to be extinct in captivity as well.

6.2 Threats to Biodiversity

In the Near East, as in many other parts of the world, the growing human population and increased demands for renewable resources are placing enormous pressure on ecosystems and their floral and faunal components. Many countries in the region have human population growth rates among the highest in the world.

The Near East forests are considered globally outstanding and critically endangered from the biodiversity point of view. There is a multitude of threats to ecosystems and biodiversity such as deforestation, hunting, overgrazing and degradation of rangelands. Habitat destruction is the most serious cause of biodiversity loss.

There are numerous plants and animals that are threatened with extinction in the region. Uncontrolled medicinal and aromatic plant harvesting constitutes an important threat to the survival of many endemic aromatic species and for the conservation of soil and vegetation cover in many mountain areas.

Box 7: Arabian Eden, the Socotra Island in Yemen

The Socotran Archipelago has such a unique assemblage of animal and plant species that it has been described as an Arabian Eden. The islands are best known for their plant diversity, including the dragon's blood tree and a variety of succulents. Approximately 30% of plants are endemic to the islands and ten genera are only found here. Reptilian fauna also demonstrate a high rate of endemism and a rich avifauna is found on the island. While currently relatively pristine, the eco-region has had a long history of human occupation and over 50 endemic plants are listed on the IUCN Red List of Threatened Species. The Socotran Archipelago remains vulnerable to increased human activity and tourist and industrial development.

Evans, 2001

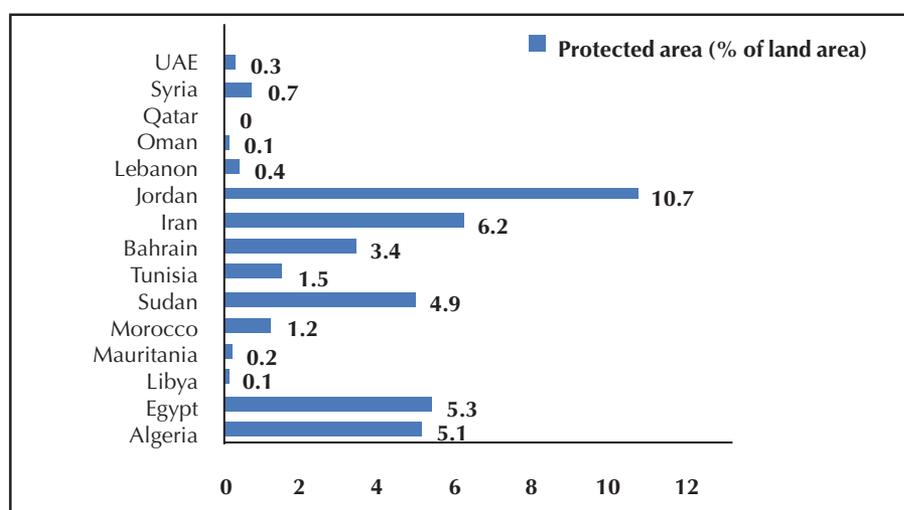
6.3 Protected areas

A network of protected areas in the Near East has made significant progress in the last two decades. Countries developed plans for a protected area system, adopted legislation and trained protected area managers and rangers. Most countries of the region have endorsed the international conventions relevant to biodiversity conservation and the protection of threatened species and wetlands.

The extent of protected areas (IUCN categories I to IV) is 126 million hectares or 8.6 percent of the total land area (Table 6 in the Annex). Saudi Arabia reports 42.3 percent of their total land area as protected (probably hima which do not fall under IUCN categories I to IV), while Jordan at present has 10.7 percent of its land area designated for protection. Libya, Mauritania, Lebanon, Oman, Syria and United Arab Emirates have protected areas less than 1 percent of total land area. Protected areas lying within forests vary between 12 to 35 percent in countries like Algeria (12 percent), Egypt (28 percent), Sudan (19 percent), Jordan (35 percent) and Syria (20 percent) Figure 17.

Most of the protected areas in the region are managed by national conservation agencies. However, the quality of management in many countries falls below acceptable international standards. Many protected areas are still thoroughly protectionist in orientation, and this has raised hostility among the rural populations that are crucial to the protected areas' success. In very few protected areas have the local populations been successfully involved as participants in management (Othman, 2000).

Figure 17: Protected areas in percentage of land areas



Source: UNEP-World conservation Monitoring Center. 2006.

N.B.: Saudi Arabia has outstanding protected area amounting 43.2 % of its land area

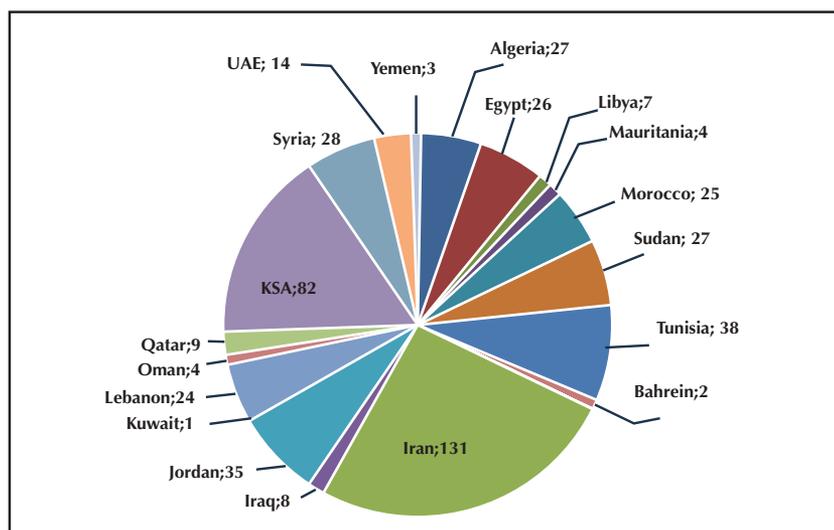
6.4 Nature tourism

Global tourism grew rapidly in the 20th century, especially after World War II. In the 1960s, nature tourism emerged, defined by IUCN as “travel and visit environmentally responsible natural areas relatively undisturbed, in order to enjoy nature and appreciate it”. Nature tourism is a type of sustainable tourism that preserves natural habitats. This is an evolving process in many countries, where some protected areas and undisturbed sites have been developed for nature tourism.

The Near East countries that have great potential for nature tourism are especially in North Africa and in the Gulf countries. There are 495 protected areas and many sites, as well as a large number of wild and endemic species, which have the potential to support nature tourism in the region (Figure 18). The Region has a wide variety of ecosystems and natural habitats both on land and in the sea including forests, vast woodlands, rocky areas, and remote islands (e.g. Socotra in Yemen). It hosts thousands of terrestrial and marine species of flora and fauna, some of which are endemic while others are globally important endangered or vulnerable species (e.g. Arabian Oryx, Arabian Tahr, Sand Gazelle, Houbara Bustard, and the Sooty Falcon (Mohammed et al. 1995). The forests contain significant numbers of breeding bird species and more than 500 million birds pass over the region twice a year in the autumn and spring migrations providing a good opportunity for bird watching (e.g. Ichkeul lake in North Tunisia).

The current expansion of ecotourism and nature tourism has led to a sharp increase in income, contributing significantly to poverty reduction in some cases, a development with great potential in many countries. Hunting for certain wildlife species as an organized tourist activity has become a good source of income for forest dependent communities (e.g. wild boar hunting in Tunisia attracts many Italian and Scandinavian tourists).

Figure 18: Number of protected areas in the Near East



N.B. IUCN categories

Source: Croitoru, 2003

6.5 Some success stories: Nature reserves in the Near East

Al-Shouf Cedar Nature Reserve in Lebanon and Jordan's Dana Reserve Project are two successful examples of nature conservation in the Near East.

Al-Shouf Cedar Nature Reserve represents a mountain ecosystem of the central Mount Lebanon chain covering an area of about 500 km² at the southern-most limit of the cedar trees of Lebanon. According to the Ministry of the Environment, the flora of the area is represented by about 425 species that include a wide variety of trees, shrubs, grasses and herbs. This Reserve is one of the last remaining areas in Lebanon where larger mammals that once roamed the region can be found, such as the wild boar, wolf, hyena and wild cat.

About 123 species of birds have been recorded there, representing one third of Lebanon's birds. A feature of note is that the Reserve is on a major migratory bird corridor between Africa and Europe/Asia. Many birds use it as a resting spot during their annual migrations, such as the white stork, the imperial eagle and the corncrake.

Dana Reserve in Jordan was established in 1989 and is home to numerous Mediterranean forest trees and shrubs as well as numerous wildlife species such as the Nubian ibex, the mountain gazelle, wolves, fox, jackals and others (Othman, 2000).

The presence of the Reserve contributes to the livelihoods of people living in the nearby village. Opportunities were created for local people to gain from the nature reserve without destroying it. Fruit trees growing on neglected areas around the village improved and medicinal herbs were introduced to terraced gardens as a cash crop.

At the end of 1998, after 3 years of operations, the Dana Reserve income-generation activities increased to US\$ 380 000 in sales and tourism receipts, created 55 new jobs and provided substantial benefits to over 160 people. The tourism receipts alone in 1997 covered 60 percent of the reserve's running costs and 70 percent of the visitors were Jordanian (Irani and Johnson, 1998).

Box 8: Islamic teaching recognizes the significance of natural ecosystems for the welfare of the world

On the Arabian Peninsula, protected areas were basically grazing reserves known as himas. Virtually every village was associated with one or more himas. Their management was highly adapted to the particular requirements of a given village and the potential of a given area. For example, himas were managed to: limit animal grazing but allow the cutting of fodder; permit seasonal grazing and fodder cutting after plants had flowered, thus ensuring natural reseeding; limit grazing to certain types of animals; or protect tree resources. This hima system reached an advanced stage of development in the early Islamic era and, even today in Saudi Arabia, the areas that have best withstood the ravages of human demands are the traditional himas.

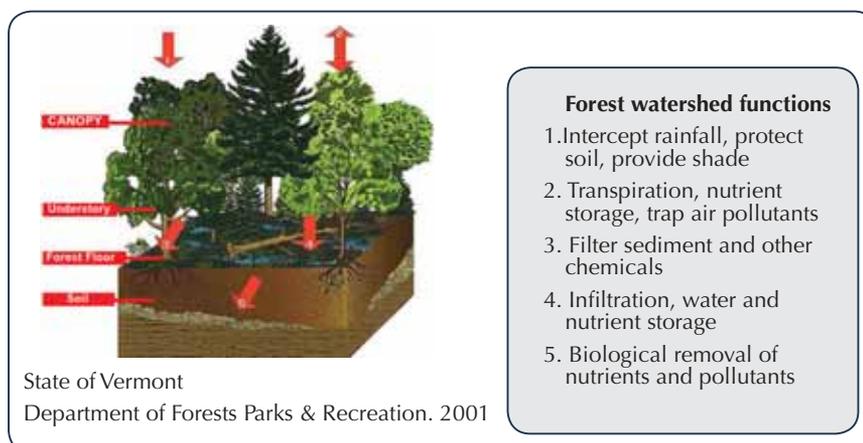
In its wisdom, Islamic teaching recognizes the significance of natural ecosystems and their various components for the welfare of the world. It stresses the importance of conserving renewable resources and human beings' role as their custodian while using them to generate the greatest good over time.

6.6 Forests and water

The Near East is the most water scarce region in the world with only around 2.2 percent of global renewable water resources (Bazza, 2002). Countries in the region face an imminent shortage of water; the threat of deforestation and forest degradation as a result of agricultural expansion and urbanization would worsen the water crisis.

In the fragile environment of the Near East, the role of forests and trees is important to protect water resources and water supply. Forest stands with multiple layers of vegetation act to control erosion, facilitate water infiltration, reduce sedimentation, regulate water flow and mitigate floods. Forests, trees and the sustainable management of watersheds are key to improving water security.

Figure 19: Forest watershed function



Runoff from watersheds dominated by land uses such as agriculture is often 3 to 10 times higher than watershed covered by forest (Hadri and Tschinkel, 1976). Landowners can help improve water quality by planting trees as windbreaks, shelterbelts, live fences, and in agro-forestry systems. Even small woodlots can help protect watersheds.

6.7 Forestry and desertification control

The threat posed by desertification is particularly acute in the Near East where arid and semi-arid conditions dominate. For most of the Near East very little is known about the extent of land degradation and desertification. Information available indicates that about 96 percent of the North African (Algeria, Egypt, Libya, Morocco and Tunisia) and 95 percent of the Asian part of the Near East (Bahrain, Iraq, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates, and Yemen) lie in the arid and semi-arid areas. Over half of Saudi Arabia is hyper-arid (Nasr, 1999). All these areas are affected by, or prone to, desertification.

Despite the occurrence of unexpected floods, for example in Saudi Arabia and Oman recently, the region has faced persistent rainfall shortages and drought in the last decades. Drought, in combination with population growth and unfavourable socio-economic conditions, has caused the degradation of the protective vegetation cover, soil degradation and sand encroachment.

Forests have a major role to play in reversing desertification trends. Live trees and dead vegetation materials are widely used methods for sand dune fixation as windbreaks, shelterbelts and mulching, while the planting of fast-growing species aims to speed up the process of desertification control.

6.8 Success stories in sand dune fixation

In North Africa, the first achievements in sand dune fixation, dating back to the beginning of the 20th century, were aimed at combating sand encroachment in order to protect roads, railways and villages.

Moroccan experience started in 1915 with the biological fixation of coastal dunes along the Atlantic coast to protect cities such as Tanger, Kenitra and Agadir. Rainfall conditions were often favourable, thus allowing the introduction of fast-growing species, such as *Eucalyptus* spp., *Acacia cyanophylla* and *Acacia cyclops*. Over 34 000 ha were planted in 60 years aimed to control sand dune movement in Morocco.

Since 1979, oases and continental cities have also been protected with smaller greenbelts ranging from 3 to 165 ha in Morocco (Ouerzazet, Rachdia). At the same time, sand dune stabilization involved 20 000 ha of plantings comprising both local and introduced species.

In the early 19th century in Tunisia, the colonial Forest Administration implemented sand stabilization works with the aim of protecting the oases, railways, and roads in the south as well as the stabilization of the coastal sand dune in Rimal (Bizerte), Gammarth (Tunis) and Darchichou

(Nabeul). Several sand dune fixation techniques were used successfully such as mulching, micro windbreaks with palm fronds, *Retama retam* branches, fiber-cement panels and other materials. Today, these sites are forests of acacia, eucalypts and pines used intensively for recreation.

In Algeria, the green dam along its border with the Sahara was put in place in the 1970s. The original concept entailed reforestation with Aleppo pine (*Pinus halapensis*) planted on an East/West arid strip of essentially pastoral land covering 3 million hectares. Since the goals were too ambitious to be implemented, a new concept was developed taking into account land tenure and the involvement of the local communities, especially herders and farmers.

Between 1975 and 1992, Mauritania established its first green belt of 750 ha around Nouakchott. Between 2000 and the end of 2007, a new project was initiated of 800 ha to rehabilitate and extend the Green Belt. The objective was to reduce sand encroachment and protect Nouakchott's socio-economic infrastructure by ensuring the permanence, extension and sustainable management of the urban and suburban forest stands of the capital.

Desertification control initiatives are also vigorous in Saudi Arabia, Yemen, Mauritania, Libya and Iran.

6.9 Windbreaks and shelterbelts

Most agricultural lands in the Near East suffer harsh climatic conditions and the soil is vulnerable to wind erosion. Wind causes high transpiration, heat stress, windblown sands and loss of fertile topsoil resulting in reduced crop production.

Windbreaks, shelterbelts, woodlots, and trees for shade in agricultural and pasture lands alter the microclimate in the protected zone through wind speed and evaporation reduction and soil improvement. As a result, the effect of windbreaks on growth and development improves yields from crops and livestock. For example, windbreaks of two rows of *Casuarina* sp. in wheat and barley fields in West Nubariah, a newly reclaimed desert area in Egypt, increased the yield of cereals by 10 to 15 percent as compared to that in the open field (Khalil, 1983).

Many countries in the region have made considerable efforts in land reclamation and agricultural development. Despite intensive research, the role of tree planting as windbreaks and shelterbelts to protect the agricultural land is often overlooked.

7. Forests and climate change

Climate change has been defined as a significant and lasting change in the average weather conditions or in the number or intensity of extreme weather events, due to natural causes or human activities. Human activities have substantially increased concentrations of greenhouse gases in the atmosphere, which are almost certainly driving climate change and climatic variability. Countries that have ratified the United Nations Framework Convention on Climate

Change have committed themselves to actions that would lead to the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. In addition to these mitigation actions, countries have also pledged to take action to reduce vulnerability and to adapt to climate change.

Climatic change affects natural ecosystems and human livelihoods. In the Near East region, it is likely to be seen in increased temperatures, changes in annual and seasonal precipitation patterns and altered frequencies of extreme events such as droughts, floods, and storms. Forest and range resources in many places are expected to be exposed to increased risk of wildfires, to experience reduced productivity and dieback, and to be affected by sea level rise. The aridity of the region, coupled with degradation due to human pressures increases the vulnerability of these resources to the negative impacts of climate change. Considerable forest degradation and the slow rate of forest growth in the region mean that forest areas are net sources rather than net sinks of carbon in the Near East. Rural communities will become increasingly at risk of crop failure caused by climate change, extreme weather events and the outbreak of crop diseases and pests, which will in turn have negative impacts on their food security.

Forests have great potential to contribute to climate change mitigation and adaptation. Mitigation options in the forest sector in the Near East region can include reducing emissions from deforestation and forest degradation; afforestation, reforestation and forest restoration; and improved forest management to conserve or enhance forest carbon stocks. Increased efficiency in the use of wood-based energy and substituting fossil fuels or energy-rich materials with wood are other mitigation options.

Climate change adaptation measures may include i.a. selection of new tree varieties and species better adapted to the changing climate; intensified efforts in forest fire management; soil and water conservation measures in areas that are increasingly vulnerable to floods, erosion and landslides; and measures to protect and enhance biodiversity which will enhance ecosystem resilience.

Countries will need to carry out new research, increase awareness among the public, and implement climate change projects of benefit to vulnerable local communities. Countries will have to revise their forest and range policies in order to integrate climate change into existing policy frameworks. They should also take advantage of new opportunities offered by climate change in terms of strengthened international cooperation on forestry development. New funding sources linked to climate change may become available (e.g. REDD+ programmes, the Adaptation Fund, and GEF funding).

8. Social services provided by the forestry sector

Globally, forests provide a wide range of economic and social benefits to humankind. In the Near East, the goods and services provided by forests and trees are much more important than wood production. They include contributions to the overall economy and investments in the sector.

Social services of forests may include recreation, tourism and conservation of sites with cultural or spiritual importance. As forestry activities occur in rural areas that are often poorer than the national average, their contribution to poverty reduction is important.

Small-scale enterprises based on forest products have increased in recent years. They are the source of income and employment for several hundred thousand peoples in the region, particularly in countries with good forest cover like Morocco, Iran and Sudan. Forestry also generates significant employment and incomes associated with nature tourism, forest management, silvicultural interventions, forest protection, afforestation and reforestation and processing and trade of forest products and energy.

The processing and export of NWFP generate significant foreign exchange for some countries, for example cork in Algeria, Morocco and Tunisia, Gum Arabic in Sudan and Gum Tragacanth in Iran. Forest products produced or collected for family use or sale such as woodfuel, fodder for livestock, mushroom may be very important to the household economy.

Social benefits generated by the forestry sector have market value, but are difficult to quantify as many forest activities occur in the informal sector. The area of forests available for social functions, the number of people employed in the sector and the number of forest dependent people is very important and may increase rapidly in the near future.

8.1 Forest dependent people

31

Forest dependent people are people living in the forest or near it, including small farmers who rely for part of their livelihood on adjacent forest or woodland, herders, hunters, woodfuel and NWFP gatherers, charcoal producers/traders, processors of forest products, and employees in forest industries who obtain most of their livelihood from the forest.

Commonly, forest-dependent people who live in or near forests are the vulnerable portion of society. They are poor and rely on forests for a range of basic needs: food, shelter, wood for construction and domestic energy. They also draw upon products from forests, woodland and grazing land to meet part of their subsistence and income. Data on the number and importance of these peoples are scarce or not available and difficult to measure as their activities occur in the informal sector and are carried out generally to meet family needs.

8.2 Forest employment

Forestry has always played an important role in boosting the economy and addressing unemployment in several countries. Afforestation and reforestation, including reclamation of degraded lands, offer great scope for job creation, particularly where rural unemployment or underemployment is high and vast tracts of degraded land are available. Land preparation, production of planting material, planting tree seedlings and maintenance, can be important sources of employment. For example Tunisia, with the support of the World Food Programme in

the last century, took up reforestation and afforestation work and soil conservation programmes in poor remote mountainous areas as a strategy for addressing the high level of unemployment.

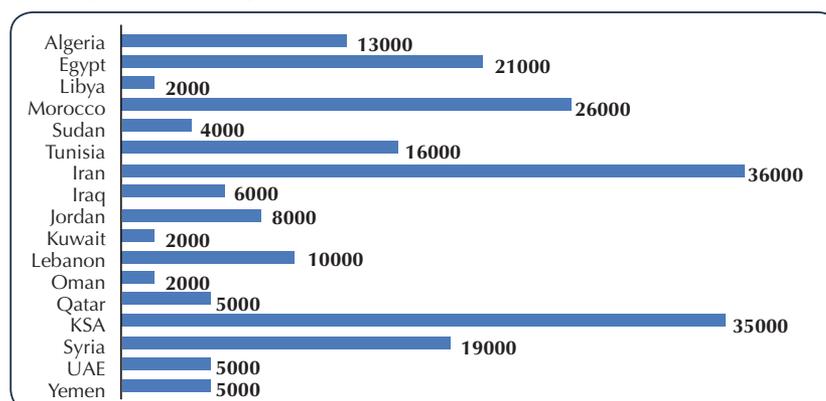
In the Near East the employment related to the primary production of forest goods and related services as well as the management of protected areas amounts to 295 000 FTE (Figure 20). With regard to public institutions, the forestry sector provides 30 499 jobs (FAO, 2010c). These employment figures only include “formal” or “visible” activities in the forestry sector. Lebedys, 2004 estimates that, on average, for every one job in the formal forestry sector there are another one or two jobs in the informal forestry sector (the majority of which are activities related to the production of woodfuel and non-wood forest products). Based on this very rough estimate, the employment generated by the forestry sector could be closer to 1 million jobs in the Near East.

High levels of employment in the forestry sector are reported in Algeria, Egypt, Morocco, Tunisia, Iran, Saudi Arabia and Syria. Considering the number of jobs in relation to forest area, Egypt (0.30 worker/ha), Jordan (0.08 worker/ha), Kuwait (0.33 worker/ha) and Lebanon (0.07 worker/ha) have the highest employment rates in the region. Six countries with 0.01- 0.02 worker/ha are Algeria, Iraq, Libya, Tunisia, UAE and Yemen. Three countries have very low employment rates in the forestry sector namely Sudan (4 000 workers or 0.0001 workers/ha), Iran (0.003 workers/ha) and Morocco (0.005 workers/ha).

The high employment rate in the Gulf countries is due to the need for greening and creation of reserves and recreational areas, while in some other countries the target is to respond, among other challenges, to the problem of underemployment in rural areas.

Public investments could generate new jobs in afforestation, reforestation, management of natural and planted forests, establishment and management of urban and suburban green spaces, improvement of watersheds, protection of forests from fire, and the construction of forest infrastructure. Most of these jobs are in rural areas, where they would help raise living standards and reduce poverty and such investments help restore natural resources that have been severely depleted in the past.

Figure 20: Total forestry sector’s employment



Source: State of the World’s Forests 2009 (FAO 2008b)

9. Economic contribution of the forestry sector

In view of the low productivity of the Region's forests, largely due to their small extent and the harsh climatic conditions, the direct contribution of trees, forests and woodlands to the national economy is negligible in most countries.

Industrial roundwood production is limited to a few countries. The highest values of industrial roundwood, woodfuel and NWFP removals, for the year 2005, were in Egypt (US\$ 11 million), Morocco (US\$ 49) and Tunisia (US\$ 11). Iran reported the value of industrial roundwood removal at US\$ 114 million (FAO, 2010c). The following countries provided information only on the value of woodfuel: Lebanon (US\$ 5 million), Mauritania (US\$ 2 million), Saudi Arabia (US\$ 8 million) and Yemen (US\$ 26 million). No information on the value of NWFP was available except for Egypt (US\$ 1 million), Morocco (US\$ 13 million) and Tunisia (US\$ 6 million).

Meanwhile, other goods and environmental benefits, recreational values and the income derived from nature tourism, although not quantified, were important. Sylvo-pastoralism for livestock production (often based on nomadic systems) is the main land use production system in many countries of the region, for example Algeria, Iran, Morocco, Syria and Tunisia. Forest grazing and forest fodder, therefore, represent a major contribution to local and national economies of Near East countries.

Collection, grading and processing of aromatic and culinary plants is an important income generating activity for rural communities.

The contribution of the forestry sector to the Gross Domestic Product (GDP) is estimated in North Africa at US\$ 1.64 million or 0.4 percent (Figure 21).

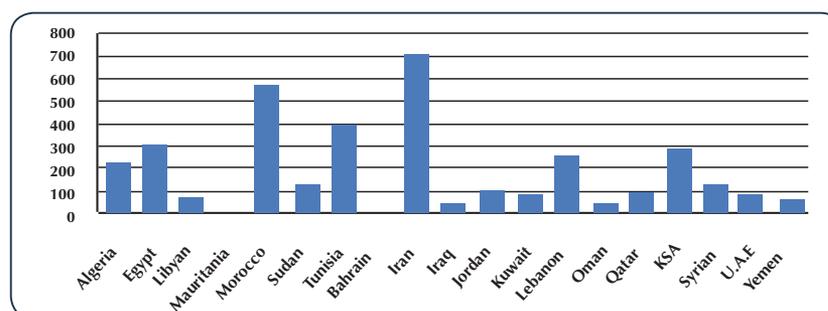
Even Sudan and Iran, with forest cover of 69.95 million hectares and 11.08 million hectares, reported the contribution of the forestry sector to GDP as less than 0.3 percent although at global level, forestry is estimated to contribute to some 1 percent of world GDP (FAO, 2009).

The contribution of the forestry sector to national GDP is attributed to the low productivity of forests and the marginalization of the sector compared to other development sectors in general. It suffers from low investment, insufficient budget allocation and lack of technical management as indicated previously. However, the forests and other wooded lands in the region have great potential and opportunities for investment. There are many reasons to invest in the sector:

- Demand for wood is increasing because of growing populations and house construction;
- Demand for charcoal is increasing because of changing lifestyles;
- Woodfuel will remain an important source of energy for countries with low fossil fuel resources and poor rural areas;
- Increased need for environmental protection through forests and other wooded lands;
- Rapid growth of domestic and international tourism including nature tourism;

- Creation of improved urban environments by increasing green spaces;
- Need for extension activities to promote tree planting for carbon sequestration;
- Herbal medicine is becoming popular and more people use plants for health treatments and cosmetic purposes.

Figure 21: Forestry sector's contribution to GDP (US\$ million), 2006



Source: FRA, 2010

9.1 Forestry expenditure and revenue generated

Forests are predominantly publicly owned and forestry activities are largely financed by public investment in the Near East. Public expenditure in the forestry sector is still dominated by operational expenditure, mainly for establishment of plantations, forest protection, fire suppression, infrastructure construction and personnel costs. Transfer payments are very low and the role of non-state actors (communities, NGOs and private sector) is still limited. Recently the private sector, encouraged by external funding such as The World Bank, the European Union and bilateral cooperation, has supported implementation of some forestry projects in the region.

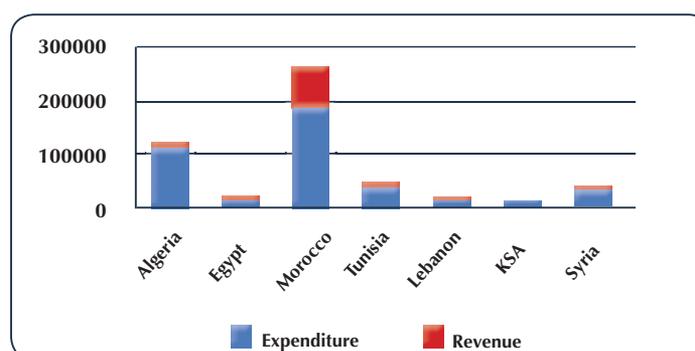
The levels of public investment vary widely, driven by the country's overall economic situation and the extent of its forests. The Gulf countries of Qatar, Saudi Arabia and the United Arab Emirates have been providing strong financial support for large-scale tree planting programmes and encouraging municipalities to green urban areas, reflecting growing environmental concerns within the countries. In Syria, where the main concern is the protection of the few existing natural forests, the Forestry Directorate has been receiving increased allocations to supplement its budget, which represents 20 percent of the total agricultural budget.

In some countries of the region with weak economies such as Jordan, Mauritania and Yemen, forestry activities rely greatly on external assistance especially from bilateral and multilateral agencies and international NGOs. The governments are unable to support the sector, especially in the context of limited resources and the need to give priority to such sectors as education and health care. Budget allocations cover mainly the salaries and wages of seasonal workers and only a small amount remains for the development of the forests - certainly not sufficient for any ambitious tree planting or management programmes.

In North Africa, countries spend more on forestry than they collect in revenue except for Egypt where irrigated plantings generate important revenue. In 2005, forestry revenue generated in Morocco was about US\$ 76.8 million, followed by Egypt US\$ 11.4 million and Tunisia US\$ 11.3 million. Expenditure in Morocco was about US\$ 184.9 million, followed by Algeria US\$ 111.6 million, Tunisia US\$ 11.3 million and Egypt US\$ 6.1 million. Total annual public expenditure on forestry in North Africa recently amounted to US\$ 335.6 million while revenue collected from the sector was only US\$ 104.1 million.

There was no forestry revenue and expenditure data reported by Bahrain, Iraq, Kuwait, Oman, Qatar and UAE; this is due probably to the low forest cover and the absence of a forestry administration and forestry activities - except for tree planting for greening undertaken by municipalities. Syria has the highest net expenditure in the sub-region which, in 2005 was US\$ 34.5 million, followed by Saudi Arabia US\$ 8.3 million and Lebanon US\$ 5.6 million. Revenue generated by the forestry sector in these countries was negligible and support from the public sector is generally below the level needed (FAO, 2010c).

Figure 22: Forest revenue and public expenditure of some countries in the Near East (US\$ 1,000)



Source: FRA, 2010

10. Forestry sector development: threats, issues, opportunities and challenges

For several decades little interest has been devoted to forest resources, which have suffered severely in consequence. Recently, however, governments have shown a growing interest and changes in their attitude towards forestry – although this development has yet to advance very far.

A note on the challenges facing both the forests and rangelands sectors in the Region is found in Part IV.

10.1 Threats to forest resources

The fragile ecosystems in the Near East exacerbate forest degradation, loss of biodiversity and desertification. The greatest threats to forests in the Near East are:

- The increase of population combined with poverty, rapid urbanization and agricultural encroachment, which have led to serious declines in forest and rangeland areas.
- Land use change, abandonment of traditional grazing systems, and climate change have caused forest degradation.
- Numerous endangered plants and animals are threatened with extinction in the region.
- Uncontrolled medicinal and aromatic plant harvesting constitutes an important threat to the survival of many endemic species.
- Countries in the region face an imminent shortage of water and the threat of deforestation and forest degradation would worsen this water crisis.
- Because arid and semi-arid conditions dominate in the major countries of the Near East, the threat of desertification is particularly acute.
- Forest degradation contributes to climate change and thus rural communities will be increasingly at risk of water shortages, crop failure, extreme weather events and outbreaks of crop diseases and pests.

10.2 Issues that limit forestry interventions

The forestry sector in the region is confronted with following issues that need to be addressed:

- Illegal and uncontrolled collection of woodfuel, grazing and fire remain the most important causes of forest degradation.
- Planted forests are affected by poor planting techniques, inappropriate species selection, insufficient protection measures and absence of management plans in several countries.
- Reduced institutional capacity to protect and manage forests as a result of low budgets, absence of policies and strategies have resulted in increased degradation.
- The reliability of information remains a basic problem, because country capacity and scarce financial resources limit applied research, forest inventories, and regular assessment and monitoring.

10.3 Opportunities

Although forests cover only a small proportion of the Near East, the sector has the potential to provide meaningful opportunities socially, economically and environmentally:

- Wood production outside forests, on agricultural lands, small woodlots and agro-forestry systems, is high and often greater than that of the forests proper. This needs support and encouragement to enable reduction of wood imports.
- Non-wood forest products are more valuable than wood products and important sources of livelihood in most countries. However, benefits and contribution to the national economy could be improved through better resource management, increased processing and better marketing.
- The recreational value of forests and other wooded lands and the management of protected areas have gained importance in a number of countries in North Africa and the Arab countries in West Asia, which could boost household and rural incomes.
- Forests have significant potential to adapt to and mitigate climate change. Mitigation options

in the forest sector in the Near East region offer opportunities to develop an important afforestation and reforestation programme.

- In response to the acute water scarcity in the Near East region, the use of municipal wastewater offers a good opportunity to extend planted forests, greenbelts, amenity planting and management for recreation.
- Experience throughout the world has confirmed that including local communities in planning resource management and allowing them to benefit from their utilization is a powerful arrangement for improving protection and production.

10.4 The challenges confronting the threats and limitations

In spite of the progress described above, difficult challenges remain in overcoming the threats to the forests of the Near East:

- Promotion of family planning, especially in rural areas, in order to decrease pressure on natural resources.
- Development and revision of forest policies, strategies and legislation in concert with other sectors, allocating budgets commensurate with the tasks assigned.
- Give priority to, and create the capacity for, protection of the remaining forests and biodiversity in collaboration with local communities.
- Improve forest management, harvesting and the processing of wood products, thereby improving incomes of rural populations.
- Involve local communities in managing the watersheds that supply them with water for household and irrigation use. Provide funding to expand multipurpose-tree planting on farms and on public land.
- Create incentives and mechanisms to prevent overgrazing.
- Carry out research and monitoring to overcome technical and operational obstacles.

PART III: RANGELANDS

State of the art and functions of range in the Near East region

Photo 5: Small ruminants on rangeland in the Near East



1. Diagnosis and description: the aridity paradigm in the Near East

1.1 Ecosystems in the Near East

Marginal ecosystems with low rainfall and high aridity index (the classification of the aridity index is described in Box 9) that dominate in the Near East Region are among the most vulnerable to drought, and are often susceptible to widespread environmental deterioration, and loss of habitats and wildlife.

Different moisture regimes exist in the Near East Region and temperature levels vary considerably. The Near East countries have a high degree of aridity in large parts of their territories and are therefore highly vulnerable to drought (Tables 2 and 3).

Box 9: Dry land categories according to the aridity index classification scheme

P/PET	Rainfall (mm)	Classification
< 0.05	< 200	Hyper-arid
0.05 - < 0.20	< 200 (winter)	Arid
	< 400 (summer)	
0.20 - < 0.50	200 - 500 (winter)	Semi-arid
	400 - 600 (summer)	
0.50 - < 0.65	500 - 700 (winter)	Dry sub-humid
	600 - 800 (summer)	

Source: Schreiber et al. 2010
 Winter – defined as the period December to February.
 Summer – defined as the period June to August.

Table 2: Aridity of Some Countries of the Near East region

Country	Degree of aridity					Very dry areas	
	HA	A	SA	SH	H	km ² x 1 000)	%
Algeria	Do	As	As		In	1 245	54
Egypt	Do	In				508	51
Libya	Do	As	In		In	1 162	72
Mauritania	As	As	In			733	70
Morocco		As	As	In	In	110	27
Tunisia		Do	As	In	In	72	47
Jordan	In	Do	In			50	56
Lebanon			Do			1	11
Syria			As			115	61

Source: De Pauw, 2004

Explanatory notes: (a) degree of aridity: HA: hyper-arid; A: arid; SA: semiarid; SH: semi humid; H: humid; (b) The symbols used refer to relative importance within the country: In: inclusion (< 5% of country) As: associated (at least 510%- of country) Do: dominant (> 50% of country); (c) The category 'very dry areas' is derived from the FAO Soil Map of the World as areas where Xerosols and Yermosols occur.

Table 3: Approximate areas of arid rangelands in the Arabian Peninsula, 1 000 km²

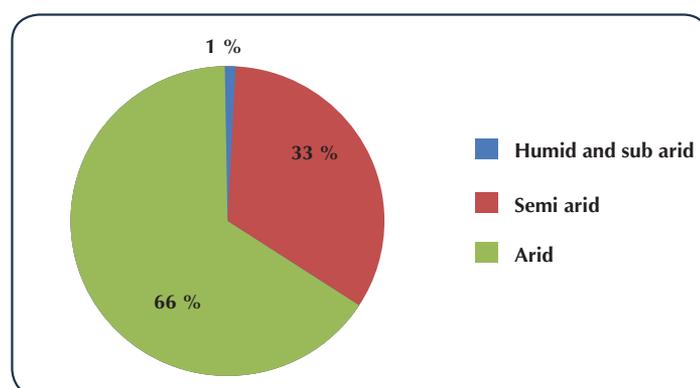
Country	Total Area	Non Arid Non Desert	Arid	Desert	Desert wasteland
Kuwait		P > 400mm	400 > P > 100 mm	100 > P > 50 mm	50 > P mm
Saudi Arabia	18	-	18	-	-
Qatar	2 150	10	200	1 240	700
UAE	22	-	-	22	-
Oman	84	-	-	84	-
Yemen	212	2	12	91	107
Total	527	40	160	257	70
	3 513	52	390	1 674	877

Source: Chaudhary et al. 2006

It is evident that in the Near East arid areas and desert are predominant which is problematic for agriculture and biodiversity. In Table 2, all Near East countries cited have more than 50 percent of their area are very dry except Lebanon, Morocco and Tunisia. Table 3 indicates that other Near

East countries have 2.9 million km² out of 3.5 million km² (83 percent) in arid and desert zones. In Near East countries much of the marginal dry land is home to pastoral communities. In Arab countries (18 out of the 19 countries of this study), 66 percent of the arable lands are found under arid conditions (Figure 23).

Figure 23: Arable areas distribution by bio-climate



2. Extent and main contribution of rangelands in the Near East

Agricultural land in the region is mainly devoted to permanent pasture and range. The proportion of rangelands of the total land area is in general high but differs from one country to another, e.g. Iran 57 percent, Syria 55 percent Tunisia 25 percent. Predominantly desert countries, such as Libya and Egypt, have little rangeland left. But a word of caution must be given related to these data: they may be erroneous because they might correspond to different definitions of rangelands that are not referred to in national accounts.

In Tunisia the rangelands support 30 percent of the livestock population but provide now only 1020- percent of the animal needs depending on rain, drought and range status. Because of the extent of rangelands in the Near East region, small changes in vegetation cover can significantly affect the organic carbon dynamics and storage in the ecosystem.

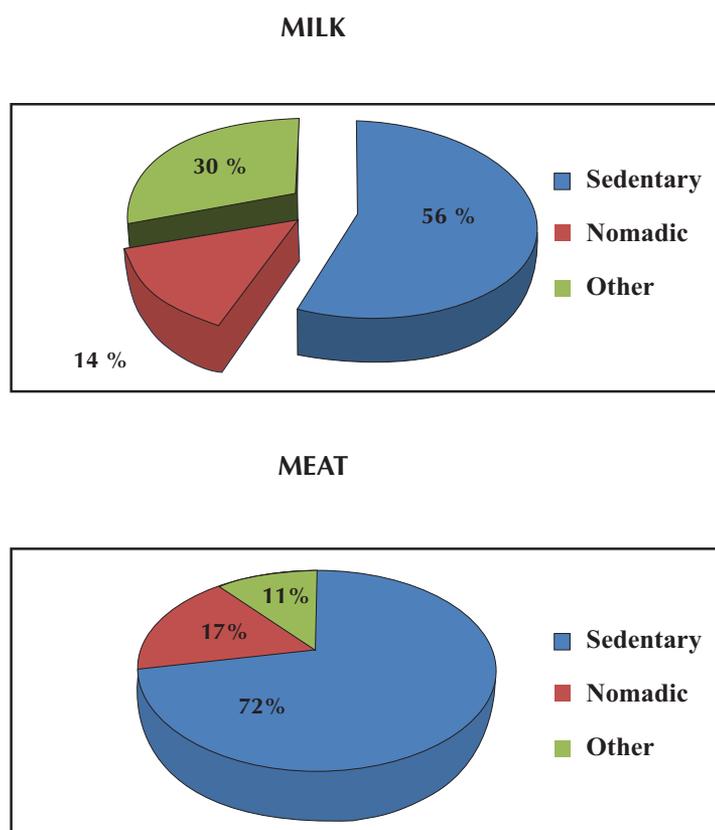
The contribution of rangelands to the national economies is not well understood in the countries of the Near East. In North Africa the share of agriculture in the national GDP varies from 5 percent in Libya to 16.8 percent in Morocco (Table 4) whereas the share of livestock in agricultural GDP ranges from 26 percent in Morocco to 48 percent in Algeria. In Syria the agricultural share is 30 percent and livestock's share is 33 percent.

Table 4: Share of agriculture and livestock in GDP in some Near East Countries

Share	Country	Algeria	Libya	Morocco	Tunisia	Egypt	Syria
Share of agriculture in national GDP		10.2	5	16.8	12.1	16.1	30
Share of livestock in agriculture GDP		48	30	26	30	-	33

Source: Dutilly-Diane, 2006.

The share of livestock on rangelands is not well estimated but one could suppose it is high in countries like Syria, Sudan and Saudi Arabia that have a high proportion of sheep, camels and goats. FAO provides data on the contribution of the different livestock production systems in Iran, according to which nomadic pastoralists contribution is 14 percent of milk and 17 percent of meat production (Figure 24). This includes transhumant systems.

Figure 24: Milk and meat production by the different systems in Iran (FAO)

Source: Gura, 2006.

3. Status of the rangelands

3.1 Rangeland Degradation

Rangelands in the Near East Region are much affected by degradation which is one of the main environmental problems facing these countries. This is especially true in the countries where the share of agricultural gross domestic product (GDP) in the economy is higher or equal to 10 percent, such as in Egypt, Lebanon, Syria or Yemen. Drought, wind and water erosion and human induced degradation are the principal causes. Land tenure and inadequate policies are also some of the key issues in the degradation of rangelands. Human-induced degradation arises from overgrazing, improper agro-practices including tillage using heavy machinery, and fuel-wood over-cutting which also increase susceptibility to water erosion.

Desertification is affecting large areas, particularly in Iraq, Jordan, the Syrian Arab Republic, and most countries on the Arabian Peninsula. Many of these countries already have deserts, ranging from 10 percent in the Syria to close to 100 percent in Bahrain, Kuwait, Qatar and the United Arab Emirates (Figure 25). Soil erosion of more than 20 tonnes/ha per year is common in many areas (IAASTD/CWANA, 2009). Putting the situation in context, about 1020- percent of the susceptible dry lands in the world are believed to have already undergone land degradation (ibid.).

Figure 25: Dune landscapes with extremely sparse vegetation cover in the hyperarid zone. South West of Al Ain (UAE), June 2003



Source: Brown, 2003

Severe and very severe human-induced degradation affects up to around 30 percent of the total area of North Africa and about 38 percent of the Arabian Peninsula with more potential for land degradation in the latter. Indeed Arabian Peninsula has 55 percent of its land already under light and moderate human-induced degradation compared to around 23 percent for North Africa. (Table 5).

Table 5: Severity of human-induced land degradation in parts of the Near East region (percent)

Share	Country	Algeria	Libya	Morocco	Tunisia	Egypt	Syria
Share of agriculture in national GDP		10.2	5	16.8	12.1	16.1	30
Share of livestock in agriculture GDP		48	30	26	30	-	33

Source: adapted from IAASTD 2009.

Cause: A = agriculture; D = deforestation; O = overgrazing; V = over exploitation of vegetation

Type: C = chemical deterioration; N = water erosion; P = physical deterioration; W = wind erosion

Of all the factors stated, overgrazing is frequently perceived as being the main cause of rangeland degradation (Figure 26).

Figure 26: Overgrazing: the main cause of rangeland degradation

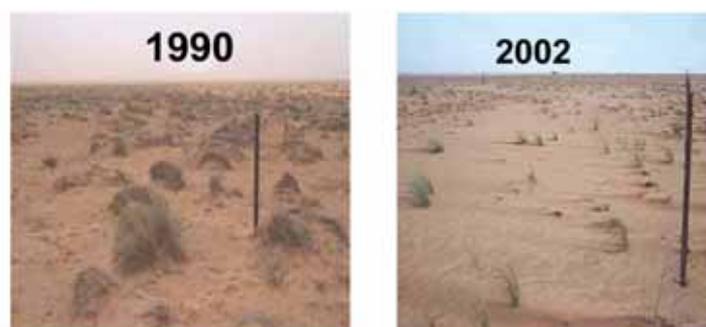
Source: Brown, 2003

3.2 The overgrazing phenomenon

Overgrazing sometimes attains catastrophic proportions e.g. the degradation of alfa steppe in Algeria became very clear following a 12 year period of overgrazing (Figure 27 and Box 10). It was mainly caused by a large increase in the stocking of animals while the carrying capacity was declining. This was a result of an unprecedented increase of the number of animals especially small ruminants to meet an increasing demand for meat and other products of a growing population, the increase in wealth and a change in peoples' dietary habits.

² The figures in this table do not add up to 100% as they are percent of different agents-induced land degradation not indicated here.

Figure 27: Degradation of alfa steppes in Algeria from 1990 to 2002



Source : Vertigo, 2008.

There is a fragile balance between carrying capacity and actual stocking rate. Normal range condition means that vegetation cover level has to be above the threshold of 2025- percent and more than 70 percent of the plant species should be palatable to the animals. In woody rangelands, the density and height of woody vegetation should not be so high as to prevent a homogeneous distribution of animals all over the rangelands area.

Good management of the stocking rate (SR) in comparison with the grazing capacity (GC) is a major factor in the sustainability of rangelands. The SR is the number of grazing animals equivalent (SE)/area grazed in ha, then the GC may be expressed as:

GC = [Area grazed (ha) x maximum forage production (kg/ha)] /

[Monthly grazing equivalent of a SE (Kg) x Grazing period (months)]

For example: - one sheep equivalent (SE) = 1 sheep = 0,8 goats = 0,2 cattle

or
- one camel equivalent= 1.0 camel= 0.7 cattle = 0.1 sheep= 0.1goat.

If SR equals GC then the rangeland is properly grazed, but if SR does not equal GC then grazing is unbalanced and should be adjusted. The optimum stocking rate relates to the objective of the herder: low SR favours better productivity per head and higher SR favours better output per hectare, but could threaten the stability and sustainability of range resources.

In many Near East countries, the carrying capacity is decreasing because of overgrazing and other factors such as tillage and cultivation. A continuous decrease in capacity for the last 70 years is observed in all Near East countries. According to some estimates, the present carrying capacity of rangelands has been in decrease by about 70 percent. Overgrazing in recent decades illustrates the disequilibrium SR-

Box 10: Overgrazing

Overgrazing and extensive woodcutting, in addition to intensive agricultural practices, have led to destruction of natural habitats which in turn caused a major threat to wildlife in Jordan. Despite the economic importance of mining in Jordan, unplanned mining and quarrying can also destroy habitat.

The good fortune of Arabia after the economic boom from oil wealth sadly proved to be unfortunate for the rangelands. As early as 1972, it had been estimated that two thirds of the natural vegetation of Saudi Arabia had been destroyed by overgrazing and tree felling for fuel.

Source : Shaukat, 2006

GC, hence the importance of the size of the herd and the need for strict respect of the good timing and the right duration.

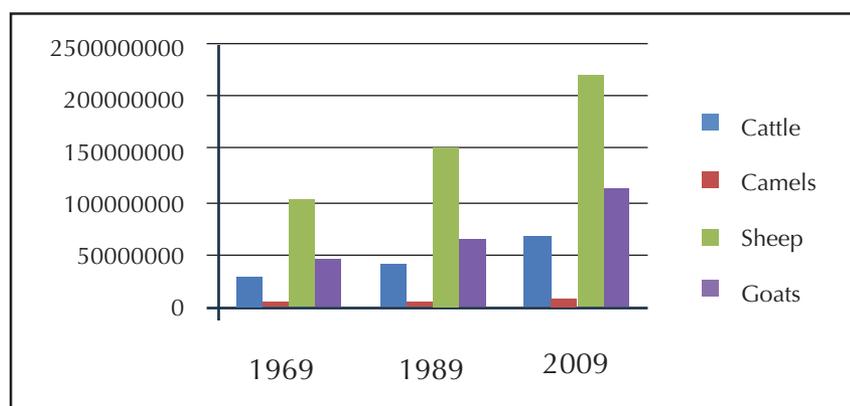
Therefore mastering the number of animals per unit area or stocking rate is important to avoid overgrazing but it is also important to have good management practices in terms of timing and length of the period of grazing. Indeed early and prolonged grazing could affect seriously the composition of plant species in range.

Animal numbers: Importance and evolution

The livestock population of cattle, camels, goats and sheep in the Near East countries has more than doubled in 40 years, increasing from 185 million head in 1969 to 411 million head in 2009 (Figure 28) with sheep numbers increasing by 115 percent in the same period.

In terms of animal units, the trend shows very visible increase of the number of animals in Near East countries. Although the relative growth of animal units indicates the greatest increase in cattle numbers, nevertheless it is assumed that in most countries of the Near East it is the absolute increase of the numbers of sheep, small ruminants and camels that has taken place on rangelands.

Figure 28: Evolution of animal numbers in the Near East including Sudan



Source: developed from FAO, 2010a

Morocco and Algeria have the greatest numbers of small ruminants in the Maghreb sub region (or 23 million head in each country in 2009). The small ruminant population is more limited in the three other countries, with respectively 9, 8.8 and 10.1 million sheep and goats in Libya, Tunisia and Egypt in 2009. Goats in Egypt represented 45 percent of the small ruminants. In the eastern part of Near East in 2009, Iran and Sudan were the biggest producers of sheep with 53.8 million head compared to 30 million in 1969 and 51.6 million compared to 11.5 million in 1969 respectively.

Sudan has the largest herd of cattle in the region; it increased 3.5 times between 1969 and 2009. There the growth of cattle numbers has taken place on the rangelands. In 2009, it increased by up to 62 percent of total cattle while the share of Iran decreased from 17 percent to 12 percent.

3.3 Critical interpretation of meat & milk production parameters

Animal numbers in the Region have increased by more than 110 percent between 1969 and 2009. But this increase is smaller than the growth in meat and milk production, of more than 170 percent and 350 percent respectively. The explanation lies in the fact that fattening on industrial basis (feed lots and paddocks) is now common practice in the Near East countries and that supplementary feeding mainly with barley for animals on rangelands is taking place in these countries. Moreover cattle meat produced mainly in feed lots represents around 4244- percent of total production, whereas sheep meat represents 3542- percent. In Iran 17 percent of the meat produced comes from rangelands.

The sharp increase in milk production at a faster rate than the number of animals could probably be explained by the introduction of highly productive exotic cattle breeds, and the crossing of the local with these exotic breeds. In Syria much of the milk produced comes from ewes on rangeland while in Iran this represents 14 percent of the total.

Table 6: Animal growth parameters

Year	% increase in animal head	% increase in meat	%increase in milk	Production meat/ head/year (kg)	Production milk/ head/ year (kg)
1969-1989	43	83	101	13.9	35.35
1989-2009	56	52	126	17.83	49.76
1969-2009	122	177	357	17.32	72.48

Source: from FAO, 2010a

In the Region, numbers count for more than quality or productivity. Overall, there appear to be 1 sheep for every 3 people in the Region, a higher ratio than in many other countries, despite its arid nature. For example, in France there was 1 sheep for 8 people, while in the USA the ratio is 1:54, all in 2009.

The impact of overgrazing in the 1990s on rangelands was very strong, with forage production decreasing by half while in the Algerian steppes the stocking of herds was 10 times higher than the grazing capacity.

During the 1970s certain less palatable species such as *Peganum harmala*, did not represent a threat in Morocco, but in the 1990s degradation became much more apparent as such less palatable species began invading new territory while the preferred species continued to disappear (Figure 29).

Figure 29: Invasion of less desirable species



Source: ICARDA, 2005

There are many palatable species that have dramatically declined. One example is the dwarf shrub *Rhanterium epapposum* or arfaj (Figure 30) and certain perennial grasses in the Gulf countries. Such species often play key environmental functions, for instance by stabilizing soil surfaces.

Figure 30: The valuable rangeland plant *Rhanterium epapposum* or Arfaj, which has suffered severely by overgrazing in Kuwait.



Source: Brown, 2003

3.4 Inadequate policies

Some policies introduced by some Near East countries for the purpose of lessening the impact of overgrazing had the opposite effect. One of these policies was the multiplication of water points to extend the grazing areas and minimize the stocking levels (Figure 31).

Figure 31: New water point - Tunisia

Source: ICARDA, 2005

It was introduced without taking into account the consequent increase in animal numbers, triggered by the high demand for meat and milk, nor the uncertain land tenure. The lack of balance between stock numbers and carrying capacity has led to more overgrazing.

On land tenure, tribes who traditionally used rangelands by long custom had good management practices, including reduced stocking during long droughts that encouraged sustainability. However, most Near East countries (Algeria, Iran, Jordan, Sudan, and Syria) established state ownership of these lands during the twentieth century with free access to all people without any restriction. Rangeland boundaries of grazing lands were not clearly determined or assigned. In the absence of clear land tenure systems, the users have no motivation to invest and manage rangeland resources properly. Moreover, the Near East States improved the road infrastructure leading to the rangelands considerably, to give access to markets. Rangelands thus became more accessible, allowing longer grazing and browsing which in turn led to more overgrazing and range deterioration. Another well-intentioned policy was the introduction in the 1990's of feed subsidies in periods of drought which protected the livestock owners' income but allowed the number of livestock to soar on already degraded rangelands, leading inevitably to more degradation. All of these policies have led to the degradation of rangelands and consequently the destruction of biodiversity.

3.5 Other damaging factors of rangelands

- Cultivation and tillage in rangelands, especially with mechanical equipment and heavy machinery on sites not adapted to such use, contributes to degradation and increases susceptibility to water erosion.
- In the past, draught animals were mainly camels and donkeys. But, for decades now, machinery, trucks and tractors have invaded almost all Near East rangelands, accelerating erosion and compacting soils.
- Gathering commercial firewood including uprooting plants (Figure 32) and soil disturbance by vehicles contribute significantly to the degradation of rangelands.

- The availability of trailers with subsidized supplement feed and water tankers (Figure 33) allowed quick movement and access of herds to remote areas where they often remain for long periods, thus accelerating range degradation.

Figure 32: Gathering commercial fire wood



Figure 33: Water tanks on rangelands



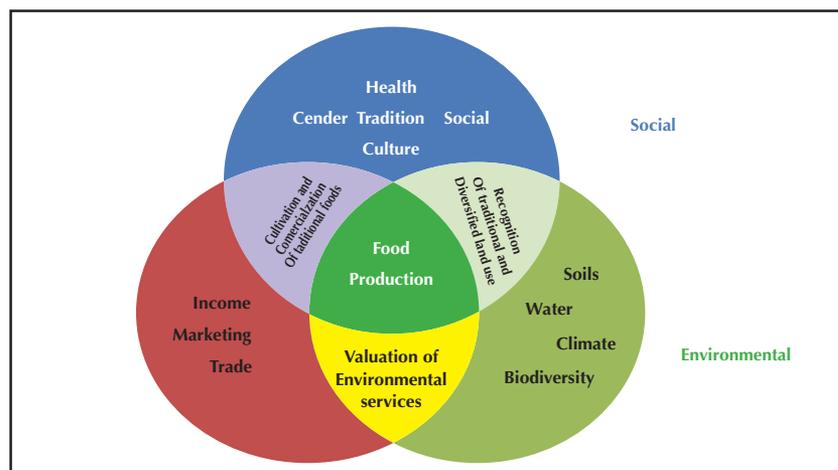
Source for Figs. 13 & 14: Saud and Al-Rowaily, 1999

4. Production functions of rangelands and challenges

Rangelands are characterized by their multi-functionality. They are very important ecosystems in fragile environments. Good management practices of this ecosystem will allow the fulfilment of their many functions (Figure 34):

- Provisioning function: production of food e.g. meat, milk
- Regulating function: protection against soil erosion and land degradation
- Cultural function: availability of recreation, amenity, leisure
- Supporting function: refuge for wildlife and flora and their biodiversity; photosynthesis of flora helps sequester carbon

Figure 34: Functions of Agriculture including rangelands



Source: IAASTD, 2009

Normally, rangelands act as a multifunctional resource, providing feed for livestock and for wildlife, food for people and a multitude of other products, such as wood for fuel, medicinal plants, culinary herbs, building materials, and items for rural industry, recreation and leisure. They also offer habitats for wildlife and contribute to soil and watershed protection. Rangelands play a special role in the Near East at ecological, economic and social levels.

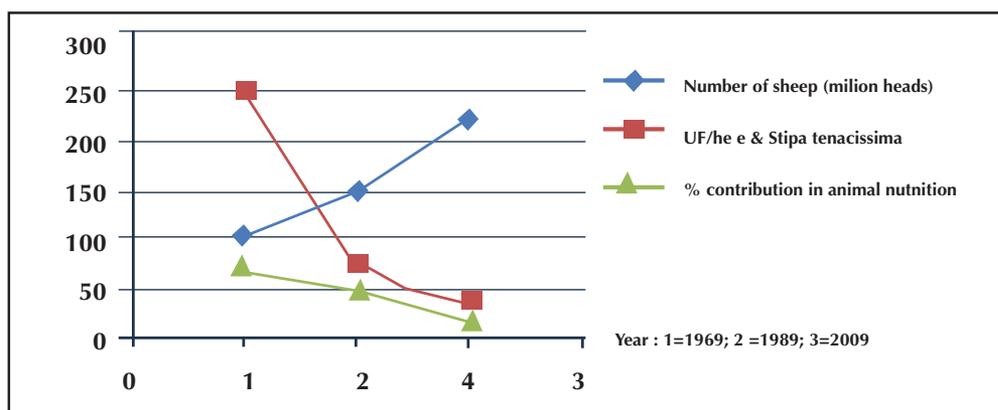
Given the aridity of the region, however, the production of locally-sourced feed and food is at this stage the predominant issue for herders, pastoralists and animal production specialists. Two issues will be of great importance for the future of rangeland production and productivity in the Near East region: climate change, and mismanagement of rangelands with their impacts on biodiversity and land degradation and hence on food security.

4.1 Animal feed production and constraints

As stated already, for decades the rangelands in the Near East have been deteriorating. Due to this situation, most rangelands' contribution to the animal nutrition in the region has decreased from around 60-70 percent from direct rangeland grazing in the mid 1960s to less than 20 percent today. Some good range indicators corroborate these observations: productivity per hectare in Forage Units (FU) and the Global Vegetation Cover (GVC).

As one would expect the number of animals is continuously increasing while the number of Forage Units per hectare and the percent contribution of rangelands are decreasing (Figure 35).

Figure 35: Increase in animal numbers and decrease in range productivity:



Source: from FAO, 2010a

4.2 Animal products

The Near East region, which extends from Morocco in the West to Iran in the East, is characterized by diverse environments, economies, social context and cultures which arose in response to economic, environmental and social conditions, the emergence of many types of production systems ranging from ancient nomadic, semi-nomadic, transhumant, and agro-pastoral to fairly new forms of sedentary and peri-urban small holders and large scale commercial units.

4.2.1 Livestock production systems

Nomadic pastoral system: This arid zone system is characterized by low incomes and low outputs, no permanent base and continuous mobility of herds (camels, small ruminants, and cattle in Sudan) and homesteads in search for water and green pasture. Frequent droughts and degraded rangelands made nomadic herds depend heavily on subsidized feed mainly barley in Saudi Arabia and other Near East countries.

Transhumant System: Transhumance is a form of semi-nomadic system with movement of flocks and herders from plains to mountains where they graze on pastures and meadows; it is found in cold mountainous areas of some Near East countries such as Iran, Iraq, Jordan and Morocco. They move from their base during late spring early summer then return in early fall. Transhumant people combine farming and livestock production during favourable seasons, but might migrate seasonally along regular routes when forage for grazing diminishes.

Semi-nomadic system: The semi-nomadic system is practiced under two different subsystems: pastoral and agro-pastoral. Semi-nomadic pastoral system households depend on raising livestock for subsistence and income.

In countries with a Mediterranean climate, herders in semi-nomadic pastoral systems move seasonally between homeland grazing areas and distant rangelands e.g. in Syria herds and herders

move to the distant steppes during winter and spring to graze available herbaceous vegetation, shrubs and bushes, then to cultivated areas in the East towards Hassaka areas during summer and early fall for crop residues and supplementary feed. Crop residues and failed crops are purchased. Semi-nomadic pastoral production systems are slowly disappearing, herd sizes are shrinking, and agro-pastoral systems are intensifying to meet the increasing demand for meat and milk, e.g. the disappearance of traditional management of flocks in Ain Beni Mather area of Morocco, which used to be based on tribal organization and extensive grazing.

These systems have been replaced by agro-pastoral systems characterized by intensive livestock production, which has resulted in resource degradation. In the central parts of Tunisia, the pastoral production system with some degree of mobility changed into an agro-pastoral (settled) system, while in the southern parts of the country the semi-nomadic system changed into an extensive agro-pastoral system.

In South Kordofan, Sudan, agro-pastoralists grow rainfed sorghum, millet, cowpeas, sesame, ground nuts and sometimes cotton. Camels or a mix of camels and small ruminant herds move along the stock routes in a synchronized manner (Figure 36 and box 11); nevertheless drought and armed conflict have often resulted in changes in their traditional routes.

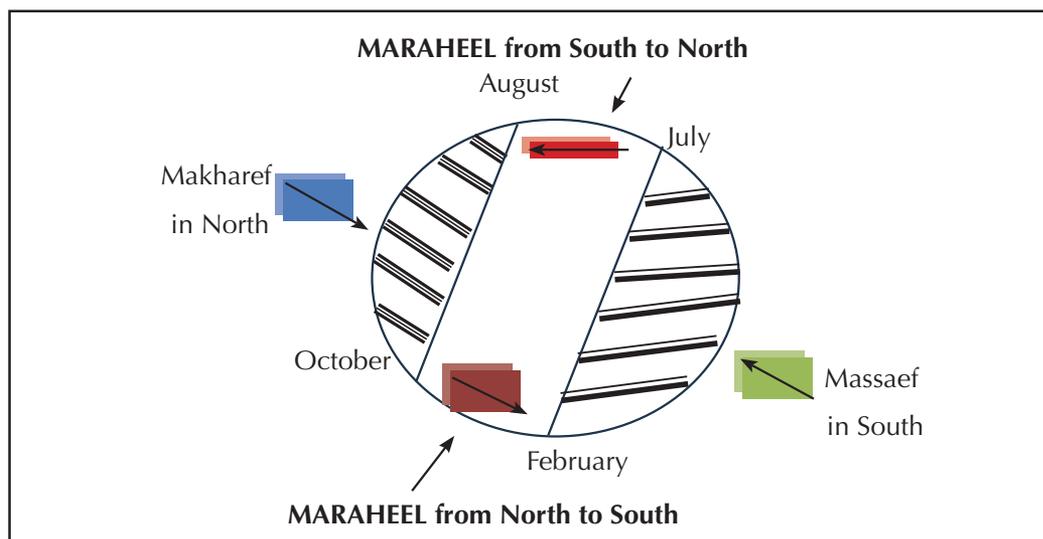
BOX 11: nomadic system

In South Kordofan, there are three climatic seasons: Summer: March to June, dry; Fall: July to October, rain; Winter: November to February, fresh, dry.

Given the interrelationship between climatic conditions, range grass development and general environment (type of soil, tsetse fly) the tradition in South Kordofan is that herds migrate on a set pattern from south (Massaef) to north (Makhref), called Maraheel with resting areas called Mahatta or Menzil from July to August. They stay in Makhref during the rest of the wet season till October away from the clay soil, on which it is difficult to graze, and the tsetse fly, responsible for the trypanosomiasis disease. In November the animals will take the same stock route in the opposite direction from North to South where they arrive in February and where they will stay till June-July. As it can be understood the movement puts a lot of pressure on grazing land and on hafirs (water points) and generates conflicts between pastoralists and farmers and villagers (hafir managers). The South Kordofan Range Strategy proposes a width of 500 metres for the stock route and a diameter of 3km in the rest areas.

Source: Guellouz, 2005

Figure 36: Maraheel South Kordofan, Sudan



Source: Guellouz, 2005

In Sudan, and partially in Mauritania, the traditional nomadic system has not completely disappeared. However, more and more sedentary farmers in the Near East practise intensified rainfed or irrigated agriculture.

Mixed systems: The mixed system is a risk-coping strategy, with livestock providing an important entry point for farm diversification, a source of cash to provide for production and domestic needs, including food security. The mixed system is characterized by livestock integration whereby the crop residues and by-products are used as animal feed.

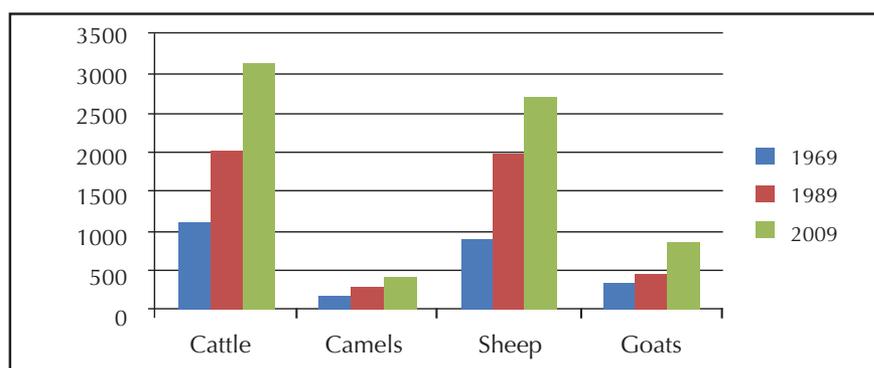
Many other systems exist, but they are not related to rangelands and do not pertain to this study. They include the village-based system, peri-urban landless system, finishing and fattening operations established near urban centres or markets and large-scale dairy farms, adopting semi-intensive or intensive system of production, all found in most countries of the Near East Region.

4.2.2 Main animal products and challenges

Presently the major component of the production function of rangelands in the Near East Region is livestock production, despite the variety of other potentially important functions. Meat and milk are the principal animal products; wool and hides are not much marketed in these countries and are a source of pollution.

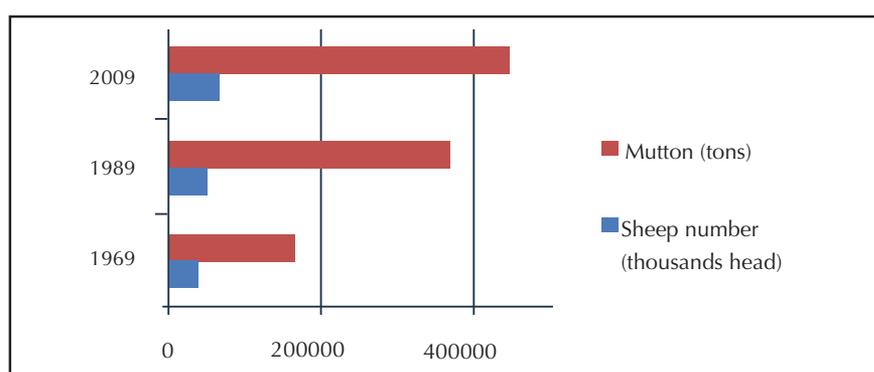
Cattle and sheep are the main source of meat in the Near East (Figure 37). Meat production varies in terms of species and countries. Algeria, Saudi Arabia and Syria produce more mutton than beef, whereas the situation in Egypt, Lebanon and Morocco is the opposite, and in Iran, Iraq and Tunisia, similar quantities of mutton and beef are produced.

Figure 37: Evolution of meat production in Near East



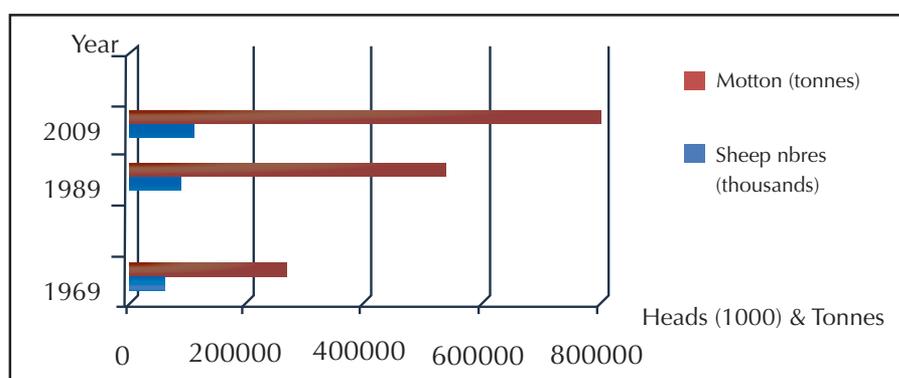
Source: FAO, 2010a

Figure 38: Increase in sheep numbers and in mutton production in North Africa including Egypt

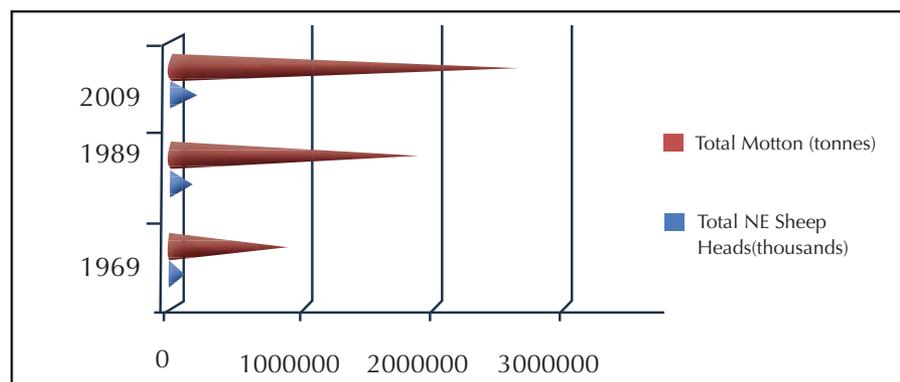


Source: FAO, 2010a

Figure 39: Increase in sheep numbers and mutton in Machreq including Iran



Source: FAO, 2010a

Figure 40: Increase in sheep numbers and mutton in the Near East region, including Sudan

Source: FAO, 2010a

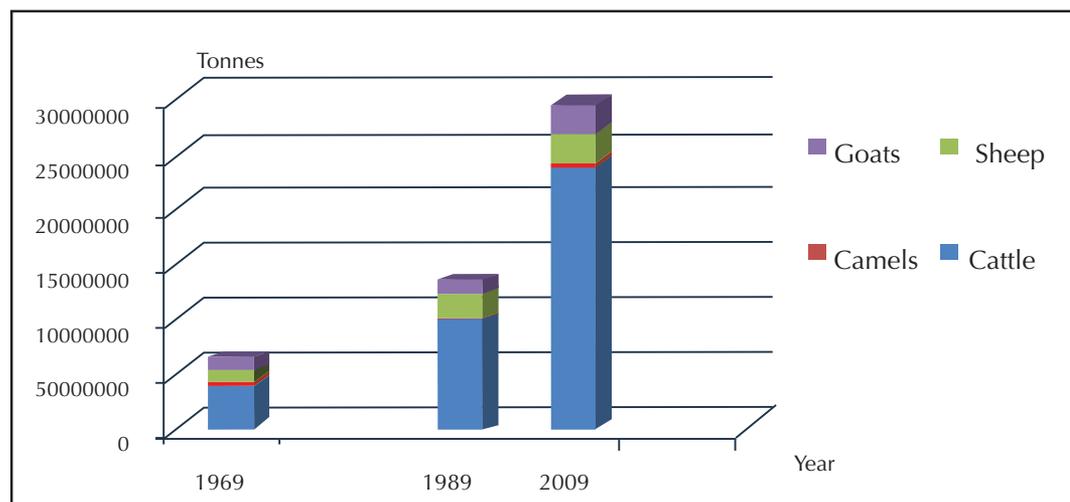
The total quantity of meat produced in the Near East countries including Sudan in 1969 was 2.57 million tonnes of which 1.30 tonnes were beef (44 percent), 911 742 tonnes were mutton (13 percent) and 187 492 tonnes were camel (7 percent). In 2009, the total meat production in the Near East was 7.11 million tonnes, of which 3.14 million tonnes were beef (44 percent), 2.70 million tonnes mutton (38 percent) and 413 803 tonnes camel (6 percent). There appears to have been a large proportional increase in mutton.

The biggest producer of beef (370 000 tonnes) and mutton (350 000 tonnes) was Iran in 2009. The biggest producer of cattle and sheep milk was Iran in 1969 but by 2009 Syria had become the first in sheep milk production, produced in the Badaea range. Most milk in the Near East came from cattle, then sheep, then goats and finally camels. The total milk production in the Near East region including Sudan has increased from 6.52 million tonnes to 29.76 million tonnes in the period 1969- 2009 (Figure 41).

Box 12: Woodfuel in rangelands

Figures from North Africa and Near East rangelands indicate that 1-1.5 kg dry fuel wood/person/day is collected from the rangelands, or 4 to 6 tonnes of wood for a 10-person family yearly. In the north eastern Aleppo steppe, it is reported that 2 to 3 abaya (30-40 kg each) are collected from the *Noaea mucronata-Haloxylon scoparium* range every third day by women and children to provide each range dweller and nomadic family with woodfuel, sufficient for cooking for two to three days. This amounts to 3-4 tonnes of woody material, equivalent to 8-10 hectares of chamaephytic range vegetation removed per family per year.

Source: Sécheresse, 2006

Figure 41: Total milk production in the Near East including Sudan

Source: FAO, 2010a

4.3 Food security

Rangelands contribute to meeting human needs in terms of meat and milk, but the price in terms of natural resource deterioration is very high, and predictions for the future seem to confirm the gloomy expectations, unless better policies and stronger measures are taken immediately.

The International Assessment of Agriculture Science and Technology (IAASTD/CWANA, 2009) indicated that the high disparities in the standards of living in the Near East coupled with poor rural livelihoods, reinforce the high risks concerning food security, especially in countries with difficult living conditions such as Mauritania, Sudan and Yemen.

In North Africa, the Nile Valley and the Red Sea, grain yields (which are also animal feed) are projected to decrease, further diminishing food security. According to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2001), the Near East countries and Sudan are among the most vulnerable regions in the world in predicted decreases in water and food security. All Near East countries and Sudan are net importers of food.

4.4 Woodfuel

In the rural areas of some non-oil producing Near East countries, where the proportion of the rural population can be very high, woodfuel along with unprocessed biomass are essential for rangeland dwellers and nomadic people – that is, for cooking, bread-making, or heating in winter. Almost one-fifth of the people rely on traditional woodfuel, dung and agricultural residues to meet their daily heating and cooking needs, particularly in Mauritania, Sudan and Yemen.

Furthermore, in oil producing Gulf countries (Saudi Arabia, UAE), where industrial substitutes for wood as a source of energy are readily and cheaply available, leisure-seeking city dwellers continue to cut wood from rangelands for so-called “cultural” reasons.

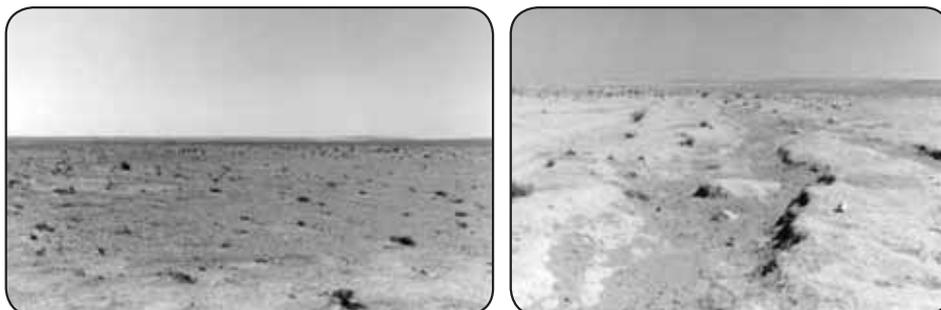
Figure 42: Meagre vegetation used as fuel by bedouin families



Source: GCP/SYR/009/ITA, Field projects report, Syria.

Whatever the reason, the result of excessive uncontrolled wood cutting on rangelands leads inevitably to more land degradation and the prevention of natural regeneration of rangeland flora and fauna (Figure 43).

Figure 43: Widespread rangeland degradation has led to decline in productivity, perennial species, and increased soil erosion



Source: Saud and Al-Rowaily, 1999

4.5 Production of other goods

Well managed rangelands can be a source of diversified production which reduces risks and may generate income from, for example, medicinal plants, dyes, or cosmetics.

4.6 Contributions to household income

Diversity is inversely proportional to a household’s vulnerability to drought: the more diversified the sources of income (part time off-range employment, or eco-tourism for example) the more secure rangeland-dependent people are in times of drought.

In Syria the main output of the sheep, goats and cattle sector is meat production. Sheep represent the principal economic output in the dry areas, and constitute 60- 90 percent of the small producers' income. Livestock production is practiced by almost all rural households in the Maghreb countries and constitutes respectively 26 percent, 30 percent and 50 percent of the agricultural GDP of Morocco, Tunisia and Algeria respectively (ICARDA, 2005). Efforts to diversify rangeland-people's income and create self-employment opportunities in many Near East countries by teaching the rural populations how to better valorise wool, or hides have not been fruitful because of their attitudes and the weak market for these products (Figure 44).

Figure 44: Rangeland handcrafts



5. Service functions and constraints

5.1 Environmental Services

5.1.1 Biodiversity

The Near East is one of the centres of domestication of many wild plants and animals. Approximately 83 species of the world's cultivated crops originated from the eastern side of the Mediterranean basin, the "Fertile Crescent". It was from the West Asia and North Africa regions that small ruminant production expanded to other parts of the world and they still represent a rich source of genetic diversity.

However, as stated earlier, there is severe vegetation degradation in the Near East due mainly to overgrazing and the adverse impact of drought. An important

Box 13: Biodiversity **Rangeland wildlife**

The rangeland wildlife in the NE region has been dangerously depleted due to excessive hunting and poaching using modern firearms and vehicles during the last century.

Two large herbivores, the Syrian wild ass (*Equus hemionus hemippus*) and the Arabian Oryx (*Oryx leucoryx*) are now extinct in the region with the last Oryx shot in 1914. Attempts to reintroduce the Oryx are now being made, but with much difficulty, in the range reserves in Syria, Israel, Jordan, Saudi Arabia, and the Gulf states. The gazelle are still present in remote places but are unfortunately poached by the local population. Most gazelle evidently belong to the goitered gazelle group (*Gazella subgutturosa*, "Rhim"), which is still fairly common in southern Turkey, Syria, Jordan and Middle Asia. Rare occurrences of *Gazella dorcas* (Afri) and *G. gazelle* are occasionally still reported in the southern desert of Iraq and Jordan along the Saudi border.

Source : Sécheresse, 2006

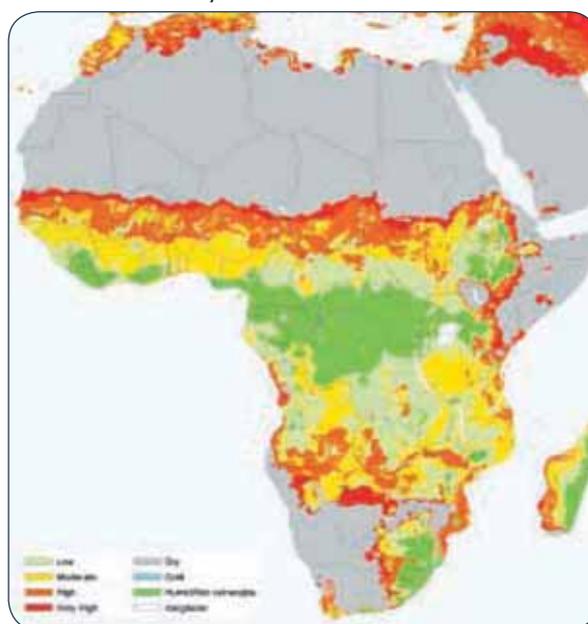
result of this degradation is the loss of the precious biodiversity, both flora and fauna, that the region has suffered in recent decades (Box 13).

The proportion of threatened plant species varies from 46 percent in the Nile Valley and the Red Sea area to 18 percent in North Africa. Only 1.4 percent of the original plant species are extinct in the Nile Valley and Red Sea Regions. Extinct animal species represent 0.2 percent in North Africa and 0.13 percent in the Arabian Peninsula whereas threatened animal species represent 8.6 percent in North Africa 5.7 percent in the Nile Valley and Red Sea Region and 8.7 percent in the Arabian Peninsula. Therefore the whole Near East needs to be closely monitored for the status of both plant and animal species.

5.1.2 Climate change

Climate change will play a major role in the future development of rangelands. Changes in temperature and rainfall patterns will likely affect biodiversity, causing extinctions of plant and animal species, which would affect negatively entire ecosystems and ultimately genetic resources and rural livelihoods. Consequently countries are called upon to adopt and introduce adaptation measures in rangeland management practices.

Figure 45: Desertification vulnerability in Africa



Source: GTZ, 2008

The map of Desertification Vulnerability in Africa (Figure 45) shows that 46 percent of the area is “at risk”, of which 55 percent is at “high” or “very high” risk.

Some sources indicate that in North Africa, and in Africa in general, grain yields are projected to decrease for many scenarios, diminishing food security. Desertification would be exacerbated

by reductions in annual rainfall, run-off and soil moisture and by increased evapo-transpiration. Doubling concentration of CO₂ in the atmosphere would lead to a projected temperature increase of 4°C in West Asia and North Africa. The global mean surface air temperature is projected to increase from 1990 to 2100 by 1.46.4°C, accompanied by extreme heat (IPCC, 2007). Precipitation patterns are projected to change, with most arid and semiarid areas becoming drier but with an increase in heavy precipitation events, leading to increased floods and droughts. The Millennium Ecosystem Assessment scenarios project a sea level rise of 988- cm. In this respect, the fourth report of the Intergovernmental Panel on Climate Change (IPCC, 2007) estimates that a global temperature rise during the century of between 2°C and 4.5°C is almost unavoidable.

5.1.3 Soil and water conservation

The vegetative cover of rangelands plays a very important role in protecting the soil against erosion. Hence, maintaining and/or restoring flora and ecosystem functions are, along with appropriate grazing management and protection, fundamental to the sustainable use of land susceptible to degradation.

Water erosion affects large areas in all Mashriq countries, including 1 260 ha in Lebanon, more than 1 million hectares in Syria and up to 21 percent of Iraq (GEO, 2000). Water erosion affects 20 percent of the soils in North Africa, 10 percent in the Arabian Peninsula and up to 50 percent in Yemen. Annual soil loss due to water erosion amount to 200 tonnes/hectare in the mountainous area of Jordan, and reaches similar values on deforested hill slopes in Syria. Poor irrigation techniques have resulted in salinization, alkalization and nutrient depletion in large areas.

Wind erosion affects 28 percent (1.1 million km²) of the total area, mainly in the Gulf Cooperation Council (GCC) countries of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE, as well as Iraq and Syria. When a large proportion of the soil surface becomes exposed over long periods of time due to lack of vegetation cover, sealing by raindrop splash may occur in soils with low organic matter content (Figure 46), and the soil structure is lost due to the absence of roots and organic matter. Consequently it is of utmost importance to arrest wind and water erosion.

Figure 46: Crusted soil near Sobiya, Kuwait 1996



Source: ICARDA, 2005

Given the poverty of the people and the aridity of the rangelands areas, developing low-cost soil conservation and rehabilitation techniques such as control of water flow over land will have to receive priority planning and actions (Figure 47).

Figure 47: Low cost rehabilitation techniques of water conservation



Source: ICARDA, 2005

5.1.4 Carbon sequestration

Rangelands are very important in capturing atmospheric CO₂ through photosynthesis. However, the capacity for carbon sequestration is questionable now, given the level of degradation.

Agriculture has been the second largest source of greenhouse gas (GHG) emissions, after the energy sector, for most Near East countries. Livestock contributes also to GHG emissions, which contribute to climate change: 3540- percent of all anthropogenic emissions of methane and through basic metabolism and respiration. Furthermore, the organic matter of most soils has been and is being depleted by soil degradation, erosion and exploitative farming.

5.2 Socio-economic dimensions of rangelands

5.2.1 Disruption of the traditional system

Disruption of traditional land use systems is one of the major socio-economic factors that have impacted on range sustainability. Traditional pastoral systems incorporate principles and strategies for coping with the various climatic, physical and biological environments. One important system of rangeland management is among the oldest in the world, and is commonly called Hima (Figure 48).

“Hima” means “protected area” or “reserve”, usually around springs and watercourses, where it refers to setting aside tracts of rangelands to be used as reserves during periods of stress. Himas play an important role in combating desertification with the genuine involvement of the tribes by monitoring nomadic grazing, promoting better animal husbandry practices, the proper management of water catchment areas, rehabilitation of rangelands, protection of biological

diversity, and serving as areas for ecological and socio-economic research.

Figure 48: View of a Hima region in Matali near Amra, Arabian Peninsula



Source: Internet, the concept of Hima: Protecting the environment in Islamic culture

This system prevailed until the 1950s when two major events caused many nomads to abandon their traditional grazing systems: Firstly, several countries (e.g. Saudi Arabia) promulgated new legislation which designated rangelands as public property and secondly, agricultural machinery was widely introduced which caused severe degradation of rangelands. As a result of these and other factors, rangelands have deteriorated throughout the region.

5.2.2 Legislation and policies

Inappropriate legislation such as that above concerning land tenure reform, considered rangelands as a public good, while inadequate policies related to feed subsidies, rangeland tillage and cultivation, water points and often late or insufficient official reaction to drought are the root causes of rangeland degradation, loss of natural ecosystems and looming food insecurity among the rural people.

5.2.3 Technical and institutional support

Generally there is insufficient research and extension in range husbandry and veterinary sciences, absent or unreliable data, and under-staffed and -funded government rangeland institutions, inadequate marketing facilities and little involvement of pastoral communities in decision-making.

5.2.4 Social services

Rangelands in the Near East offer a variety of social services besides adaptation to and mitigation of climate change, soil and water conservation, and habitats for biodiversity. They include leisure, eco-tourism, employment, traditional medicine, food, and many more. Tunisia and Morocco, for

example, are encouraging eco-tourism, targeting activities more in the desert than on rangelands. Eco-tourism offers significant seasonal job opportunities for the people of the region and particularly to the youth in the Near East rangelands.

Some of the countries in the Near East have created game reserves on rangelands for protection of threatened species. These areas in and outside rangelands are often widely used by hunters during the hunting season. But unfortunately social service activities often lead to the depletion or the destruction of the rangelands natural resources by irresponsible hunting and excessive wood fuel gathering. Rangeland by-products are numerous: truffles, wildlife game, wool, hides, essential oils, etc, but they are often over-exploited e.g. truffles, a good source of income, are collected without any care for sustainability.

Developing eco-tourism and cultural activities based on rangelands requires respect for the environment and maintaining the principles of sustainable development; these are the main challenges for policy makers, managers and rangeland dependent people.

6. Looking forward: Opportunities

Despite the present gloomy situation of the rangelands, the degradation in most places is not yet beyond correction, and remedies can still be implemented. This section looks at what could be considered in developing national strategies for rangelands.

6.1 Resilience

Various studies and experiences of rangeland protection show that rangelands are resilient if correctly managed. (Box 14). Studies in protected sites indicated that areas of high potential can double their production through improved management. Vast areas of degraded rangelands could be restored with significantly improved forage resources for livestock and the regeneration of threatened plants and animals.

6.2 Rehabilitation and improved management

Many ways of rehabilitating degraded rangelands have been tried in countries such as Jordan, Morocco, Syria and Tunisia, and many others in the Near East, including reseeded, seedling planting and others.

Direct reseeded is rarely successful. Some cases of success were recorded for example in

Box 14: Resilience and Rehabilitation

In Syria in the Bishri Area, 1 800 ha were rehabilitated by planting seedlings of indigenous plants adapted to the area, along with water harvesting. The improvement measures proved to be successful with plant density passing from 1.0 plants/m² in 1995 to 101.5 plants/m² in 2005. At the same time, the range shrub density increased from 0.06 to 5.8 shrubs/trees/m² and plant productivity increased eight times. In 1995 the dry material production was 90 kg/ha while by 2005 it had increased to about 748 kg/ha. This had a positive impact on grazing productivity which increased from 45 kg/ha in 1995 to 367 kg/ha in 2005, and this in turn increased the grazing capacity from 0.35 head/ha in 1995 to 2.83 head/ha in 2005.

Source: FAO Field Project GCP/SYR/009/ITA

Tunisia with *Medicago* sp. on fallow land especially where depletion of seed in the soil had resulted from continuous rainfed cropping in areas where rainfall was not less than 250300- mm/year. Reseeding, conducted by a FAO project in Syria, showed promising results (see Box 14). Native forage species selected for the reseeded programme have shown good establishment.

Passive means of regeneration of the native vegetation have been attempted by banning or deferring grazing applied in many countries of the Near East. The results are limited, although some results are noticeable. Work in Al-Jouf, Saudi Arabia, has shown the recovery potential of rangelands in protected areas. (Figure 49).

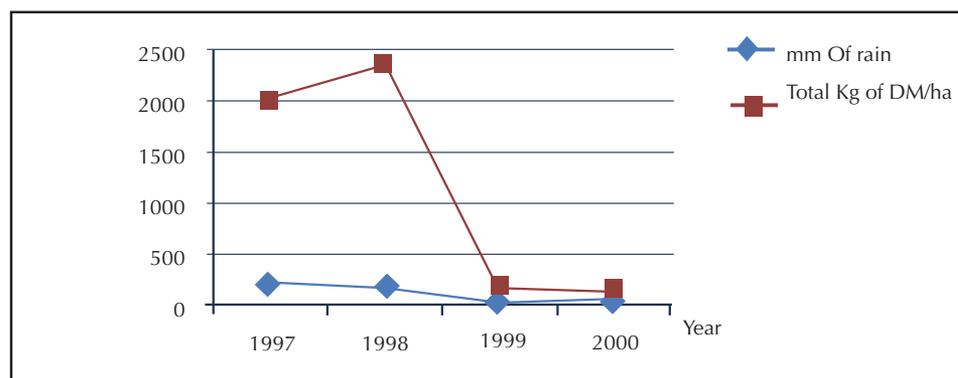
Figure 49: Vegetation recovery in areas with strict control of grazing, Al Jouf, Saudi Arabia



Source: ICARDA, 2005

Whenever the soil seed stock is totally depleted as is the case on overgrazed range or after continuous rainfed cereal cropping, rehabilitation using transplanted or sown native and exotic species has been attempted in countries such as Syria, Jordan and Lebanon.

Better water management for higher range forage biomass production: biomass production is closely related to precipitation e.g. total annual precipitation in Palmyra (Syria) for 4 years (1997-2000) was respectively 198, 181, 27 and 71 mm, while the total forage production by year were 2019, 2369, 178 and 144 kg of dry matter/ha) showing a clear relationship between biomass production and rainfall (Figure 50). This result is consistent with those under similar environment and ecosystem situations. Moreover, the coefficient of variation for dry matter production from annual plants may be as much as 172 percent, indicating the dependency of annuals on rainfall. The relatively lower coefficient for perennials (79 percent) indicates that they are more resilient to drought. A strong water policy and good water management are required for increasing biomass productivity.

Figure 50: Relationship between dry matter production and rainfall on rangelands

Source: International Conference on Agrarian Reform and Rural Development, Porto Alegre, Brazil, 2006.

Empowerment of rural communities by involving them in planning and implementation of any rangelands management and restoration activities has proved to be a promising approach for ensuring success; e.g. the case of the 2005 ICARDA Project “Sustainable Management of the Agro-Pastoral Resource Base in the Maghreb” where the participation of the local community ensured that the project has been sustainable and met real and urgent local needs. Furthermore, participatory technology development combines local knowledge with scientific expertise and new technologies (such as remote sensing, GIS, and simulation modelling) gives the activities a greater chance of acceptance and success. Algeria, Libya, Morocco, and Tunisia have thus gained effective tools and methodologies using this participatory approach.

Wood production as a source of extra income: Wood is used for fuel, construction, tools, art, fencing, etc. Production of firewood may substitute for livestock manure, which can thus be used as to soil fertilise the soil and it could be a major source of income to rangeland dependent people if well organized. In Saudi Arabia, a small pickup load of firewood of *Haloxylon persicum* or *Calligonum comosum* is sold for about 600 S.R³.

Extra revenue from carbon services: Studies in some RNear East countries such as Morocco show that switching from normal tillage to no-tillage practices could increase carbon sequestration by 13.6 percent after 11 years. The potential of soil carbon sequestration in different WANA ecosystems through desertification control and restoration of degraded ecosystems is 2.0 to 5.1 Pg C over 50 years (Table 7). Soils have the potential to reach an annual carbon sequestration rate of 0.2 to 0.4 Pg⁴ C, accounting for 24 to 30 percent of the potential of global dry land ecosystems (IAASTD/CWANA, 2009).

¹ Saudi Riyal was equivalent to US\$ 0.2666 at November 2011.

² Pg = Petagram, or 1012 grams

Table 7: Potential of soil carbon sequestration through desertification and restoration of degraded rangelands soils in the Central West Asia North Africa region.

Ecosystem	Land Area(10 ⁶ Ha)	Rate of soil C sequestration with improved management (Mg C ha ⁻¹ yr ⁻¹)			Total potential over 50 years (Tg ³ C)
		Soil organic C	Soil inorganic C	Total	
Rangeland*	583.3	0.05-0.1	0.05-0.1	0.06-0.15	1 735 - 4 337

*Rangeland area has been reduced by 250 106 ha allocated for bio-fuel production

Source: IAASTD/CWANA, 2009

This offers opportunities for funding CO₂ sequestration through land use change under the Land Use, Land-Use Change and Forestry (LULUCF) of the Clean Development Mechanisms (CDM), to rangelands managers if they undertake conservation and adaptation measures. The methodology as yet to be approved but when it is then rangeland projects will be eligible for the creation and trade of carbon credits in voluntary markets throughout the world.

Such options as well as reducing conversion of rangelands to cultivated land may be all the more possible if agricultural production is intensified on surfaces less prone to degradation; hence the great importance of participatory land-use planning.

Greenhouse Gas (GHG) emissions from rearing livestock may be substantially reduced in two ways. Firstly, by improving manure management, e.g. reducing anaerobic decomposition, both to lessen emissions but also capture methane production, using it to produce bio-energy, and secondly by improving ruminant feeding to reduce GHG emission from livestock husbandry through processing the feed for better digestibility, supplementing with nutrients and vitamins, or adding pro-biotics, yeasts and edible oils to animal feed. They also increase productivity and thus result in a reduction of emissions per unit of product such as meat or milk.

6.3 Policies

Policies in Near East countries related to rangelands are increasingly environmentally sensitive, and respectful of the role of rangelands in development. National Action Plans to fight desertification and protected areas are tools that have begun to be used to implement the renewal of rangelands programmes.

6.4 National Action Programmes and Plans

Many Near East countries e.g. Jordan, Morocco and Saudi Arabia have formulated National Action Plans since the 1980s to combat desertification in conformity with the recommendations of the International Conference on Desertification (Nairobi 1977) and have included them as components of national actions to ensure sustainable development. Two main objectives are underlined by these Plans: analysis of achievements and constraints during the implementation

³ Tg = Teragram, or 10⁹ grams

of previous anti-desertification programmes, and proposals for strategies aimed at combating desertification. Many countries have formulated strategies to improve rangelands which have enhanced the fight against desertification.

6.5 The benefits of protected areas

Protected areas were started in the 1990s in the Region. They were usually first identified as being important, unique and suitable for conservation of threatened plant and/or animal species and area of special scenic beauty. In the beginning and despite remarkable progress in establishing networks of protected areas to date (for example: 15 protected areas in KSA, 12 in Jordan, and 13 in Morocco), the exclusion of traditional resource users triggered conflicts within and around them. Also the failure of inter-agency cooperation to gain public support and even delay providing tangible benefits to local populations hindered their execution.

Regarding fauna, many species reintroduction actions have taken place in the Near East countries for decades e.g. the FAO project “Field projects GCP/SYR/009/ITA in Syria” has reintroduced with success a herd of Oryx from Saudi Arabia into the Talila wildlife reserve and has provided Syrian staff with veterinary training (Figure 51).

Figure 51: Reintroduction of Oryx in Syria in protected areas



Source: GCP/SYR/009/ITA, Field Project Report, Syria

Governments have taken several steps to restore ecological balance in the rangelands. For example, laws and decrees have been enacted to prevent cultivation of rangelands and a number of protected rangeland areas have been declared - there are now more than 60 in Syria and Jordan alone. However, most of these plans have not produced significant results; rangelands continue to degrade mainly because these ecosystems are so fragile and because the grazing stock far exceeds the carrying capacity of the land and the need for livestock products has and is soaring due to population growth and increase in demand.

7. Other potentially important economic areas for rangelands development

Hides, wool, processed sheep, goat and camel milk, aromatic plants, medicinal plants, eco-tourism and “niche products” need more attention from researchers, developers and investors.

Part IV :Overall Conclusions on Forests and Rangelands in the Near East Region

Land degradation of forests and rangelands in the Near East Region is expected to continue into the foreseeable future, unless the concerned countries take early and vigorous action. What is at stake, not only in the Near East, is the state of the natural resources of the whole Earth.

Some practical suggestions for immediate action include:

- There is an urgent need for current, reliable data on all aspects of arid zone forestry and range management in the Near East Region. Data and information collection systems must be developed and set in place as soon as possible.
- From that data and information, develop policy-related recommendations targeted to politicians, planners and opinion-formers, as well as the general public.
- Based on those recommendations, encourage more commitment to arid zone forestry and range management in the Region among political leaders.
- Such political commitment should also be translated into active participation by the countries of the Region in the international negotiations on climate change, forestry and other environmental issues.
- Next, identify priority areas for research in arid zone forestry and range management in the Region. Such priority areas should include the un-quantified benefits obtained from forests and rangelands, especially contributions to the livelihoods of the rural poor and disadvantaged, and investment opportunities in both sectors.
- Promote collaboration between regional bodies dealing with rangelands and forestry, such as the International Center for Agricultural Research in Dry Areas (ICARDA), the Tehran Process for Low Forest Cover Countries (LFCC) etc
- Promote co-operation and collaboration among research stations in the Near East Region, but look also for partners in other developing economies outside the region especially in arid African countries south of the Sahara in the spirit of «south-south» co-operation. Look for financial support in the developed economies.
- Carry out public information campaigns related to forest and range management in general and fire prevention in particular.

“there is only one...please...take care of it for the next generations”



Source : IAASTD

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ANNEX

Table 1: Extent of Forest, other wooded land and planted forest, 2010

Country*	Land area 1 000 ha	Forest area 1 000 ha	Forest as % of land area	Other wooded land 1 000 ha	Planted forest 1 000 ha
Algeria	238 174	1 492	1	2 685	404
Bahrain	71	1	1	n.s.	1
Egypt	99 545	70	n.s.	20	70
Iran	162 855	11 075	7	5 340	844
Iraq	43 737	825	2	259	15
Jordan	8 824	98	1	51	47
Kuwait	1 782	6	n.s.	0	6
Lebanon	1 023	137	13	106	11
Libya	175 954	217	n.s.	330	217
Mauritania	103 070	242	n.s.	3 060	21
Morocco/W. Sahara**	44 630600 26/	5 131/707	11	631	621
Oman	30 950	2	n.s.	1 303	2
Palestine	602	9	2	0	0
Qatar	1 100	0	0	1	0
Saudi Arabia	200 000	977	n.s.	1 117	0
Sudan	237 600	69 949	29	50 224	6 068
Syria	18 378	491	3	35	294
Tunisia	16 361	1 006	6	300	690
U.A.E	8 360	317	4	4	317
Yemen	52 797	549	1	1 406	0
Total	1 472 413	93 301	6.3	66 872	9 628
World	13 010 509	4 033 060	31	7 832 762	c. 264 000

Source: FAO, 2010c

* Full country names are given in "A note on country names" in the Abbreviations and Acronyms section

** Morocco with Western Sahara. Where separate data are available they are both shown.

Table 2: Forest function as a proportion of forest areas (%)

Country*	Function				
	Production	Protection	Conservation	Multiple use	Other/ Unknown
Algeria	35	53	12	0	0
Bahrain	0	100	0	0	0
Egypt	2	49	3	46	0
Iran	14	0	1	85	0
Iraq	0	80	20	0	0
Jordan	0	98	1	0	1
Kuwait	0	100	0	0	0
Lebanon	6	25	3	66	0
Mauritania	0	7	20	73	0
Morocco/W. Sahara	21	0	12	67	0
Oman	100	0	0	0	0
Palestine	-	-	-	-	-
Qatar	-	-	-	-	-
Saudi Arabia	0	0	0	100	0
Sudan	50	3	17	0	30
Syria	0	0	0	100	0
Tunisia	24	41	4	32	0
United Arab Emirates	0	0	0	100	0
Yemen	0	0	0	100	0

Source: FAO, 2010c

Table 3: Forest with management plan, 2010

Country*	Forest with management plan				
	1000 ha	% of forest area	Country	1000 ha	% of forest area
Algeria	1325	89	Morocco/W. Sahara	985/0	19/0
Bahrain	0	0	Oman	0	0
Egypt	4	6	Palestine	0	0
Iran	0	0	Qatar	0	0
Iraq	0	0	Saudi Arabia	0	0
Jordan	0	0	Sudan	14 855	21
Kuwait	0	0	Syria	250	51
Lebanon	0	0	Tunisia	518	51
Libya	0	0	UAE	0	0
Mauritania	5	2	Yemen	0	0
			Total	16 617	0.4

Source : FAO, 2010c

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Table 4: Industrial roundwood and woodfuel production, 2008 (1 000 m3)

Country*	Roundwood removal	Fuelwood removal	Country	Roundwood removal	Woodfuel removal
Algeria	73	77	Morocco/W. Sahara	580	367
Bahrain	-	-	Oman	-	-
Egypt	80	120	Palestine	-	-
Iran	2 448	20	Qatar	-	-
Iraq	59	60	Saudi Arabia	0	8
Jordan	-	5	Sudan	2 499	20 347
Kuwait	-	-	Syria	-	-
Lebanon	0	18	Tunisia	242	57
Libya	133	787	UAE	0	-
Mauritania	5	1865	Yemen	-	422
			Total	6 060	24 093

Source: FAO 2010a

Table 5: Industrial roundwood & woodfuel production & consumption 2008, & charcoal consumption 2007

Countries	Industrial roundwood		Woodfuel		Charcoal
	Production	Consumption	Production	Consumption	Consumption
	1 000 m3				MT
Algeria	103	136	7 968	7 968	-
Bahrain	0	2	6	6	1600
Egypt	268	384	17 283	17 283	8909
Iran	819	926	67	68	25000
Iraq	59	61	60	60	16000
Jordan	4	7	286	285	60
Kuwait	0	1	0	0	5700
Lebanon	7	45	80	80	23300
Libya	116	124	926	926	358
Mauritania	3	3	1 747	1 747	-
Morocco/W. Sahara	577	981	339	339	384938
Oman	0	57	0	0	288
Palestine	0	0	0	0	-
Qatar	0	0	5	5	1229
Saudi Arabia	0	25	0	4	5783
Sudan	2 173	2 172	18 326	18 326	2361999
Syria	40	52	26	18	645
Tunisia	218	235	2 170	2 170	148208
UAE	0	630	0	0	4000
Yemen	0	10	410	410	54017
Total	4 387	5 851	49699	49695	3 042 034

Source: FAO 2010a

Table 6: Protected areas, 2006 and forest within protected areas, 2010

Country	Protected areas 1 000 ha	Protected area, percent of total land area)	Forest within protected area (1 000 ha)	Forest within protected area, percent forest area
Algeria	12 147	5.1	173	12
Bahrain	2	3.4	-	-
Egypt	5 276	5.3	20	28
Iran	10 097	6.2	-	-
Iraq	1	0.0	-	-
Jordan	944	10.7	35	35
Kuwait	0	0	-	-
Lebanon	4	0.4	4	3
Libya	175	0.1	-	-
Mauritania	206	0.2	-	-
Morocco/W. Sahara	536	1.2	376/-	7
Oman	31	0.1	-	-
Palestine	0	0	-	-
Qatar	0	0	-	-
Saudi Arabia	84 600	42.3	-	-
Sudan	11 642	4.9	13 346	19
Syria	129	0.7	100	20
Tunisia	233	1.5	71	7
UAE	25	0.3	-	-
Yemen	0	0	31	6
Total	126 048	8.6		

6 Covering IUCN categories I-VI. UNEP-World Conservation Monitoring Center. 2006

7 UNEP-World Conservation Monitoring Center. 2006

8 Global forest resources assessment, 2010

Table 7: Total & rural Population, density & growth In Near East Countries, 2008

Country	Total Population 1 000	Rural population (% total population)	Population density (people km ² land area)	Population growth annual %
Algeria	3 4373	35	14	1.5
Bahrain	776	12	1093	2.1
Egypt	81 527	57	82	1.8
Iran	73 312	32	45	1.2
Iraq	30 096	34	69	2.1
Jordan	6 136	22	70	3.3
Kuwait	2 919	2	164	2.4
Lebanon	4 194	13	410	0.8
Libya	6 294	23	4	2.0
Mauritania	3 215	59	3	2.4
Morocco/W. Sahara	31 606/497	44/19	71/2	1.2/3.5
Oman	2 785	28	9	2.1
Palestine	4 147	28	689	3.2
Qatar	1 281	4	116	12.6
Saudi Arabia	25 201	18	13	2.1
Sudan	41 348	57	17	2.3
Syria	21 227	46	116	3.5
Tunisia	10 169	34	65	1.0
UAE	4 485	22	54	2.8
Yemen	22 917	69	43	2.9
Total	408 509			
World	6 750 525	50	52	1.2

Source: FAO 2010b

Table 8: Some socio-economic indicators, Near East countries

Country	Human development index 2011	Multi-dimensional poverty index (MPI) 2011	GDP PPP* US\$/per head 2008	GDP yearly growth % 2008
Algeria	0.698	-	8 036	3.0
Bahrain	0.806	-	34 899	6.3
Egypt	0.644	0.024	5 425	7.2
Iran	0.707	-	11 666	5.6
Iraq	0.573	0.059	3 200	9.5
Jordan	0.698	0.008	5 474	7.9
Kuwait	0.760	-	57 500	6.3
Lebanon	0.739	-	11 777	8.5
Libya	0.760	-	16 208	3.8
Mauritania	0.453	0.352	2 100	2.2
Morocco/W. Sahara	0.582	0.048/-	4 263/2 500	5.6/-
Oman	0.705	-	20 200	7.8
Palestine	0.641	0.005	2 900	2.0
Qatar	0.831	-	111 000	16.4
Saudi Arabia	0.770	-	23 991	4.4
Sudan	0.408	-	2 155	8.3
Syria	0.632	0.021	4 583	5.2
Tunisia	0.698	0.010	7 965	4.5
UAE	0.846	0.002	44 600	7.4
Yemen	0.462	0.283	2 416	3.9
World	0.682	-	10 394	1.7

Source - HDI and MPI: <http://hdr.undp.org/en/statistics/>

GDP: FAO 210b

*PPP – Purchasing power parity

Table 9: Area of Near East Countries

Country	Area (1 000ha)	Arable land % of land area	Agricultural land (% of land area)
Algeria	238 174	3	17
Libya	175 954	1	9
Mauritania	103 070	0	38
Morocco	44 655	18	67
Tunisia	16 361	18	64
Egypt	100 145	3	4
Bahrain	76	2	11
Iran	174 515	10	30
Iraq	43 832	12	22
Jordan	8 878	2	11
Kuwait	1 782	1	8
Lebanon	1 045	14	67
Oman	30 950	0	6
Qatar	1 159	1	6
Saudi Arabia	214 969	2	87
Syria	18 518	26	76
UAE	8 360	1	7
Yemen	52 797	2	45
Sudan	250 581	9	58
Arab World	-	4	40
World	-	11	38

Source: FAOSTAT 2010a

Table 10: Total number (1 000 heads) of cattle, camels, sheep and goats in Near East Countries and Sudan: 1969, 1989 and 2009

Country	Cattle			Camels			Sheep			Goats		
	1969	1989	2009	1969	1989	2009	1969	1989	2009	1969	1989	2009
Algeria	871	1 405	1 650	178	122	295	7 668	17 316	20 000	2 557	2 404	3 800
Libya	105	240	185	206	130	50	1 928	5 000	6 500	1 289	10 004	2 500
Mauritania	1 920	1 300	1 700	700	910	1 495	4 000	4 800	8 860	3 000	33 004	5 600
Morocco	3 580	3 324	2 861	222	34	50	16 000	13 761	17 476	8 750	52 814	5 251
Tunisia	660	626	679	2 500	240	235	5 115	5 548	7 362	390	11 844	1 455
ST1	7 136	6 895	7 075	1 556	1 436	2 125	34 712	46 425	60 197	15 986	131 694	18 606
Egypt,ST2	2087	2 721	5 000	127	136	110	2 001	3 481	5 500	1 141	20 004	4 550
ST3=ST1 + ST2	9 223	9 616	12 075	1 683	1 572	2 235	36 713	49 910	65 697	17 127	15 170	23 156
Bahrain	4	13	10	0.6	0.8	0.9	20	19	40	13	16	19
Iraq	1 730	1 578	1 600	250	57	58	12 900	8 981	7 800	2 200	1 476	1 550
Jordan	49	29	65	13	18	8	854	1 523	2 071	528	475	920
Kuwait	5	20	32	10	8	6	90	309	900	69	45	145
Lebanon	86	59	77	0.4	0.4	0.5	213	210	330	348	406	450
Oman	68	136	326	10	83	127	37	220	381	135	715	1 684
Qatar	5	10	8	8	23	34	33	126	148	39	90	140
Saudi Arabia	150	194	421	110	406	260	2 255	6 173	8 000	735	3 114	4 300
Syria	514	800	1 085	12	3	32	6 096	14 011	21 700	761	1 011	1 508
UAE	12	46	62	103	105	380	85	238	620	230	614	1 710
Yemen	936	1 170	1 567	223	170	384	2 157	3 720	9 087	2 666	32 604	8 883
ST4	3 559	40 56	5 251	74	875	1 291	24 722	35 526	51 077	7 723	11 222	21 309
Iran, ST5	5 100	7 918	8 120	160	130	152	30 000	45 000	53 800	13 500	24 409	25 500
ST6=ST4 + ST5	8 659	11 973	13 371	900	1 005	1 443	54 722	80 526	104 877	21 223	35 631	46 809
Total RNE, T1=ST3 + ST6	17 882	21 589	25 446	2 583	2 577	3 678	91 435	130 432	170 574	38 351	50 801	69 965
Sudan, ST7	12 000	20 583	41 563	2 500	2 732	4 521	11 500	20 167	51 555	8 600	14 843	43 270
General Total Study GT=T1 +ST7	29 882	42 172	67 009	5 083	5 309	8 199	102 935	150 599	222 129	46 951	65 644	113 235

Source: FAO, 2010a

Table 13: Evolution of animal numbers in Near East in Animal Units (au): 1969-2009-1989- (1 000)

Year	Cattle 0.7 au	Camels 1 au	Sheep 0.1 au	Goats 0.1 au	Total: au
1969	20 917	5 083	10 294	4 695	40 989
1989	29 521	5 309	15 060	6 564	56 464
2009	46 906	8 199	22 213	11 323	88 641

Source: aggregated from FAO, 2010a

1 camel = 1.0 camel = 0.7 cattle = 0.1 sheep

Table 14: Aggregate Total Meat Production (1 000 Tons) of cattle, camels, sheep and goats in Near East, including Sudan

Year	Cattle	Contribution of cattle to total meat percent	Camels	Sheep	Goats	Total in the year
1969	1 130	43.97	187	91 2	341	2 570
1989	2 003	42.59	272	1 968	459	4 703
2009	3 137	44.11	414	2 702	859	7 111

Source: aggregated from FAO, 2010a

Table 15: Aggregate Total Milk Production (1 000 Tons) from Cattle, Camels, Sheep and Goats in Near East including Sudan

Year	Cattle	%contribution of cattle in total milk	Camels (tons)	Sheep (tons)	Goats (tons)	Total in the year (tons)
1969	3 98 2	61	136	1 225	1 175	6 517
1989	9 124	70	205	2 100	1 695	13 125
2009	24 006	81	323	2 674	2 754	29 758

Source: aggregated from FAO, 2010a

Table 16: % contribution of sheep to total meat and milk production in Near East including Sudan

Year/ period	Meat (1 000 tons)		percent	Milk (1 000 tons)		percent
	Total meat production	Sheep meat	%sheep contribution	Total milk production	Sheep milk	%sheep contribution
1969-1989	2 570	9 1 2	35	6 517	1 225	19
1989-2009	4 703	1 968	42	13 125	2 100	16
1969-2009	7 111	2 702	38	29 758	2 674	09

Source: aggregated from FAO, 2010a

Table 17: Increase in sheep numbers and mutton production in NA including Egypt

Year	Sheep number (Million head)	Mutton (1 000 tons)
1969	37	164
1989	50	369
2009	66	448
%increase	0.08	0.2

Source: aggregated from FAO, 2010a

Table 18: Increase in sheep numbers and milk in Near East including Sudan

Year	Total Near East thousands	Sudan thousands	% Sudan total Near East	Iran Thousands	% Iran total Near East	Total Near East Milk 1 000 tons	Sudan Milk tonnes	% Sudan of total milk	Iran Milk tonnes	% Iran of total milk
1969	102 935	11 500	11	30 000	29	6 517	1 195	18	1 833	28
1989	150 599	20 167	13	45 000	30	13 125	3 748	29	3 280	25
2009	222 129	51 555	23	53 800	24	29 758	7 428	30	7 626	26
%increase 1969- 2009	116	348	-	79	-	356	521		316	-

Source: aggregated from FAO, 2010a

Table 19: percent of Rangelands of territory of some Near East countries

Near East Country	% of national territory
Algeria	40
Egypt	1
Iran	54
Jordan	90
Libya	2
Morocco	40
Syria	55
Tunisia	25
Yemen	40

Table 20: % Contribution of rangelands

Country	Nowadays	1960s
Egypt	25-30	70-80
Jordan	20-30	70
Morocco	25-30	70-80
sSaudi Arabia	25-30	-
Tunisia	10 – 25	65

Table 21: Red List category summary sub region plants and animals in parts of Near East

		North Africa	Nile Valley and Red Sea	Arabian Peninsula
Plants	Extinct and extinct in the wild	0	6	0
	Threatened species	6	197	7
	Lower risk	27	222	9
	Total	33	425	16
Animals	Extinct and extinct in the wild	7	4	3
	Threatened species	267	233	197
	Lower risk	2,831	3,833	2,067
	Total	3,105	4,070	2,267

Source: IAASTD/CWANA, 2009.

Table 22: Main NWFP in Near East

Main NWFP	Main use	Producer	Data available
Cork from cork tree (Quercus suber)	Cork used for bottle stoppers, vibration pads, gaskets, oil retainers, polishing wheels, floats for rafts and nets, baseball cores. Cork flooring is excellent for insulating floors. Cork scrap cuttings are used to insulate refrigerators, to pack fruit for transportation, and to make linoleum. It has a high degree of fire resistance making it a good insulation material for high temperature environments. NASA uses cork in rockets to prevent rocket fuel from getting too hot during ignition.	Morocco, Algeria, Tunisia	About one third of the world cork supply comes from North Africa. Tunisia: cork generates 7% of the total economic value, benefit of about €200/ha, represents 30% of the total income from forest products (Merlo & Croitoru 2005).
Argan oil (Argania spinosa) woodlands	Argan woodlands are managed for oil production, pasture and fuelwood. Argan oil is also rich in Vitamin E and essential fatty acids, is an effective component of a healthy diet and cosmetic product.	Argan grows in unique and specific ecological areas in Morocco. Limited area covered by Argan trees could be found also in Algeria	Argan woodland covers an area of 820,000 ha in Morocco and ensures the subsistence of 2 million rural Moroccans, mainly women.
Caper (Capparis spinosa)	Caper plant is a multipurpose crop that can be used for culinary, pharmaceutical and medicinal purposes. Caper plants are best known for the edible bud and fruit (caper berry) which are usually consumed as pickle.	Caper plants grow in the Mediterranean "maquis" particularly in Morocco, Algeria, Tunisia, Libya and Egypt.	Information on production and value of capers are not available. But caper harvesting, processing and marketing provide employment and generate important incomes for rural people particularly women.
Aromatic and medicinal plants	The medicinal, aromatic and variety of wild plants such as Matricaria sp, Thymus sp, Artemisia sp, Myrtus sp, Rhus sp, Laurus sp, Rosmarinus sp, Majorana sp, Organum sp, Cistus sp, Capparis sp, as well as many tree and shrub species like Acacia spp, Eucalyptus spp, Juniperus sp, and other species are collected directly from the forest or woodland. These plants are mostly used for traditional health treatment and traditional medicines, making tea and flavouring dishes. Medicinal principles are present in different parts of the plant like root, stem, bark, heartwood, leaf, flower, fruit or plant exudates.	Near East Countries have a diverse base of flora estimated at 15, 000 species. Variety of tree, shrub and herb species used for health treatment and food preparation in most Near East countries	Aromatic and medicinal plants are important source of income, contributing significant income to many rural households in the region. Information on production and value are scattered and mostly unreliable.

Source: most of data are from Sabra et al. 2000

Source: Heller, 1997

Main NWF	Main use	Producer	Data available
Gum tragacanth, an Iranian locoweed shrub from (<i>Astragalus</i> sp.)	Gum tragacanth, used in folk medicine as laxative, persistent cough, diarrhoea, and as an aphrodisiac, in modern pharmaceutical uses include an adhesive agent for pills and tablets, and for emulsifying oil droplets in lotions, creams and toothpastes; it is used in many commercial products, from cosmetics to jellies and salad dressings, used in syrups, mayonnaise, sauces, liqueurs, candy and ice cream.	The primary source of gum tragacanth is the desert highlands of northern and western Iran, particularly the Zagros mountain region.	Iran: is one of the main producing countries worldwide, about 70 % of the supply originating from Iran alone. Average annual production is 400 tonnes and export of 257 tonnes Iran's
Gum arabic	Gum Arabic has several domestic uses in manufacturing ink, making adhesives, in cosmetic products, in confectionary and in foodstuff. It is also utilized locally in special meals and as chewing gum. Gum Arabic has been utilized in traditional medicine as a calming and softening agent. It is included in (traditional) medicine concoctions to address internal illness such as cough, diarrhoea, dysentery and haemorrhage and applied externally to daub inflammations. It is also used in veterinary medicine, to treat skin diseases and inflammations for example.	The most important NWWF in the Sudan which remains the global leader in Gum Arabic production to date.	In 2004 Sudanese production of A. senegal (Gum Arabic) is estimated to have been about 10 000 tonnes. Sudan can potentially produce 80 000 tonnes. The FOB prices reached, or even exceeded US\$ 3 000/tonne in June 2004
Honey	Trees and other plants growing in forests, woodlands, rangelands and steppes often have an important role in honey production as they provide fodder for bees. Beekeeping and honey production are an important aspect of rural livelihoods, providing important annual income. Yemen for example, with its extensive woodlands of "seder" (<i>Ziziphus spina Christi</i>), produces a good quality of honey which is exported to the Gulf countries.	Some of the Near East countries are important producers of natural honey from Acacia, Eucalyptus and Ziziphus species	Jordan: Production of 120 tonnes in 1999 Syria : • Production of 678 tonnes in 1991. Yemen: Annual production of 5 000 tonnes, annual export revenue worth US\$ 40 million. In Iran the value of the beekeeping industry is important. Morocco: Production of 4 000 tonnes honey/wax in 1992 • Lebanon: annual production of 200500- tonnes/year, exportation in 1999 worth US\$ 34 700
Carob (<i>Ceratonia siliqua</i>)	Carob pods have traditionally been used as animal and human food. Currently the main use is the seed for gum extraction. Carob is used as an ingredient in cakes and cookies, crushed pods used to make a refreshing drink, e.g. Egypt. In Libya, syrup extracted from carob named "rub" is used as a complement to an "Asida" which is a traditional meal. Carob is often used in preparations for the treatment of diarrhoea, and as a thickening agent in feeds for infants with gastro-oesophageal reflux; carob fibre could reduce LDL cholesterol in men and women within six weeks.	Carob trees are growing particularly common along the Near East and cover important areas in Syria, Jordan, Algeria, Tunisia and Morocco	The carob seed price ranges from 0.88 to 1.47 Euro/kg Syria: Annual production of carob is estimated at 8 tonnes in 1993, worth US\$ 24 000

Main NWF	Main use	Producer	Data available
Frankincense	Frankincense from <i>Boswellia papyrifera</i> , which is an important species from both an economical and ecological perspective in Yemen and Sudan. Frankincense is used in the manufacturing of varnishes, adhesives, fumigation powders, and dye. It is also used as a flavour in bakeries and other food industries .	Yemen, Sudan	Frankincense is an important source of income, contributing significantly to many rural households in the region.
Essential oil	Essential oil is produced from rosemary, thymus, lavender, marjoram, Cypress, white Artemisia and other aromatic plants in the Near East. Essential oils extracted from Laurel is used to produce the famous Aleppo soap in Syria. Frankincense oil supports the immune system, can be uplifting, and may relieve pain from inflammation. It can act as a tonic to the nervous system, used also in cancer therapy.	Iran, Syria, Tunisia and most Near East countries	Tunisia: production of rosmarin oil, menthol oil, oil of white artemisia, citron essential oil, Lavender oil and other aromatic oils was 226 tons in 1996. Syria: Annual production of 1 056 tonnes of liquorice, worth US\$380 000 in 1993

Source: most of data are from Sabra et al. 2000

Source: Heller, 1997



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