PART

4

Sustainability dimensions

Agriculture – including crops, livestock, forest, fisheries and aquaculture – is the main human activity responsible for natural resource management at the local and regional levels. The Near East and Africa region's critical shortage of water and cultivable land and the pressure on these resources, and their degradation make their efficient management a paramount task. Appropriate management of demand can help ensure that water and land are used optimally for crop, livestock, fisheries and forestry production. A holistic approach to water and resource management is the first step in addressing the challenges the region is facing and to identify working solutions. Livestock and fisheries are particularly important food resources in many countries of the region, which makes preservation and sustainable management of rangelands and marine ecosystems resources an important priority.

In several countries in the region, forestry, although limited, plays an important role in the preservation of the natural environment and the mitigation of the impacts of climate change. Increasing efficiency

of water and land use through new technologies could expand production and increase the use of these resources in the alleviation of food insecurity and poverty. Opportunities for water harvesting, reutilization of wastewater and enhancement of rangeland have great potential in many countries of the region. For these opportunities to be realized, it will be necessary to promote the engagement and participation of all stakeholders in planning and managing water, land and genetic resources. Regional cooperation on transboundary water management will also be essential.

With proper policies, agricultural sectors can deliver a wide range of benefits, including the provision of environmental services and amenities through water storage and purification, carbon sequestration and the maintenance of rural landscapes. In this context, research-driven sustainable pathways to agricultural intensification can save vast areas of natural forest and grasslands that would be developed in the absence of higher crop, meat and milk yields.

Both new and traditional demands for produce are increasing the pressure on scarce agricultural resources in the region. While the agriculture sector will be forced to compete for land and water with expanding urban settlements and industrial zones, it may also be required to meet the growing demands of the emerging bio-based economy, increasingly through bioenergy and new emerging markets for renewable and sustainable industrial products.

Climate change is likely to affect agriculture and food security in the region primarily through changes in temperature, precipitation, extreme climatic events and sea level. These may result in increased water scarcity, land degradation, crop failures, loss of rangeland and other vegetation covers, livestock deaths and reduced fisheries production. To move toward sustainable food and agriculture systems, governments, public institutions and farmers, particularly the poor producers, need to be supported in their efforts to adapt to and, where appropriate, mitigate climate change.

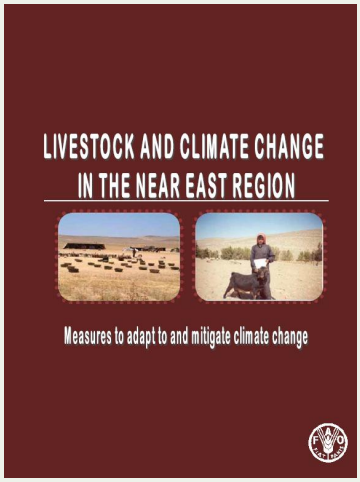
Emissions of greenhouse gases (GHGs) from agriculture, forestry and other land uses contribute significantly to the threat of global warming. The land sectors are responsible for nearly 30 percent of all human-induced GHG emissions into the atmosphere, a contribution comparable to that of the energy sector and far exceeding total emissions from transportation. Crop and livestock production alone is responsible for half of the methane and two-thirds of the nitrous oxide emitted into the atmosphere by human activity.

Key Resources

Livestock and Climate Change in the Near East Region: Measures to Adapt to and Mitigate Climate Change

The primary objective of this document is to provide an overview of the actual and potential impacts of climate change and climate variability on the livestock sector in the region for adaptation and mitigation measures. It analyzes and documents the impacts, hotspots of climate change, projections and vulnerability of the sector, and the needed measures to adapt to and mitigate climate change. The authors used an in-depth analysis of literature, utilization of GIS tools and experiences in the region.

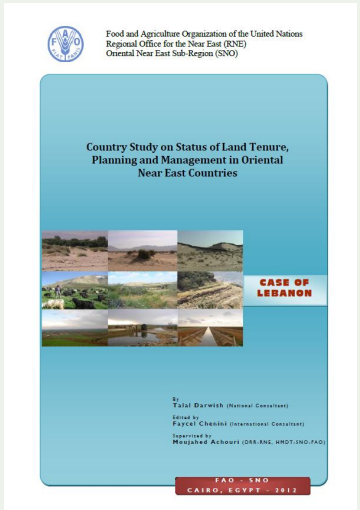
Webpage:
www.fao.org/docrep/016/i2714e/i2714e.pdf



Country Study on Status of Land Tenure, Planning and Management in Oriental Near East Countries

The report reviews state policy in the management of soil and water resources, challenges, responses and assess the constraints and interventions for sustainable land management by highlighting the best practices. Specifically, the report reviews works on how to promote water saving using drip irrigation, disseminate good practices like conservation agriculture, integrated pest management and organic farming. It presents the important role the green plan is playing to help farmers in land reformation, road building, land cleaning, water reservoirs construction, and discusses the promulgation of laws that protect agricultural land and encourage the construction on rocky terrains. It also looks at chemical, physical and biological land degradation, including water pollution and water scarcity, soil erosion, soil salinity, soil sealing and rangeland deterioration.

Webpage: http://neareast.fao.org/Download.ashx?file=app_uploads/XF2013111307/Files/Final_edited_country_report_Lebanon.pdf



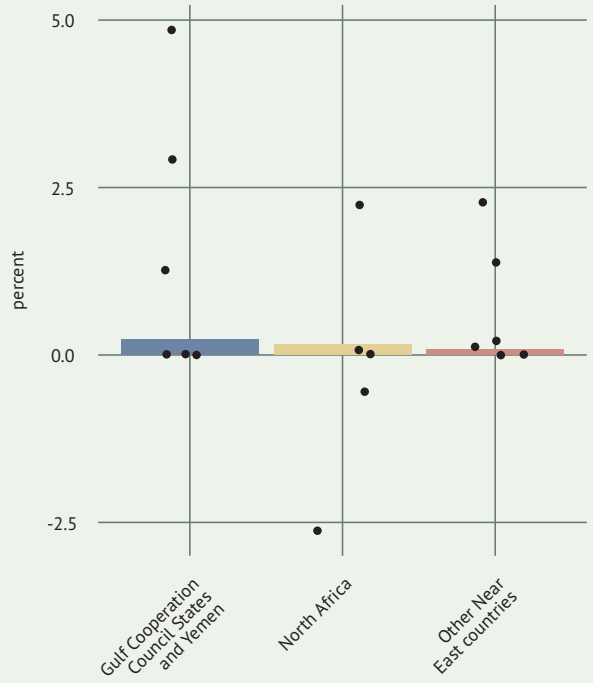
Land and Forestry

Forests play an essential role in mitigating climate change and providing products and ecosystem services that are essential to the prosperity of humankind. The latest estimate of the world's total forest area is more than 4 billion ha, corresponding to about 30 percent of total land area. The five most forest-rich countries – the Russian Federation, Brazil, Canada, the United States of America and China – account for more than half of the planet's total forest area. At the global level, deforestation has decreased from an estimated 16 million ha per year in the 1990s to about 13 million ha per year in the last decade. Most of the loss of forest continued to take place in countries and areas in tropical regions, while most of the gain took place in temperate and boreal zones.

As indicated earlier, forests cover only about two percent of the total land area in the Near East and Africa. The region's relatively meager forest resources account for only 0. 6 percent of the world's total forest resources. However, many countries in the region have registered slight increases in forest cover since 1990. In the GCC countries and Yemen, forested area increased by nearly 100 000 hectares to reach over 1.8 million hectares in 2011. Almost all of this was concentrated in the United Arab Emirates. Most other countries in the sub-region showed little or no increase in forest cover.

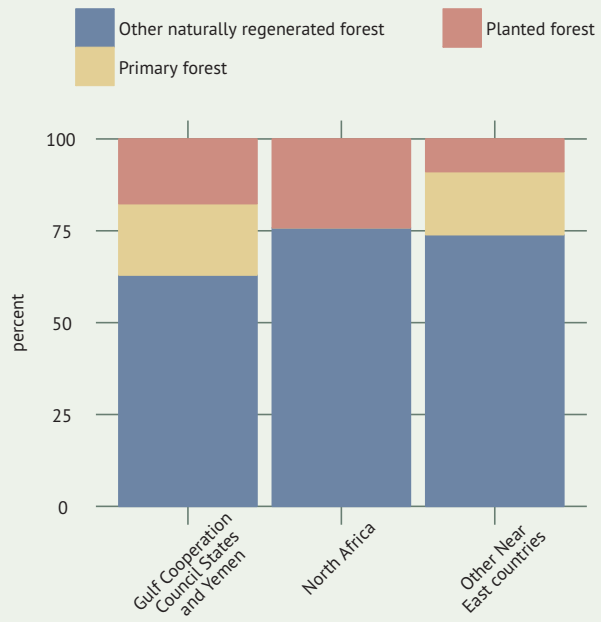
In North Africa, the amount of forest cover increased very slightly, to just over 8 million hectares. Tunisia made significant progress in increasing forest cover, expanding its forested area from 643 000 hectares to over a million hectares between 1990 and 2011. Morocco also showed an increase in forest coverage, although to a much more modest degree. The gains in these two countries were slightly greater than losses in forest cover in Algeria and Mauritania. Forest cover remained stable in Libya.

CHART 92: **Annual growth rate in forest area (1990-2011)**



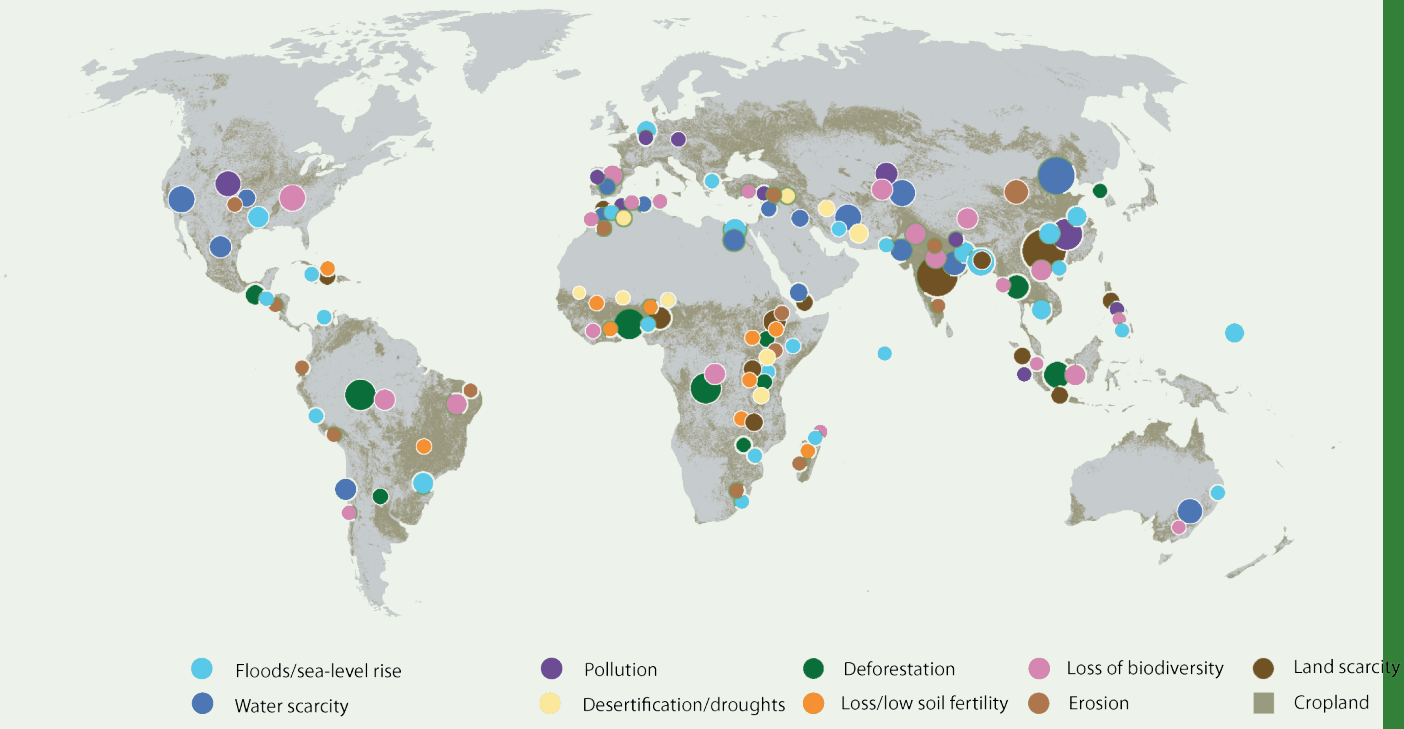
Source: FAO, Statistics Division (FAOSTAT).

CHART 93: **Forest characteristics (2010)**



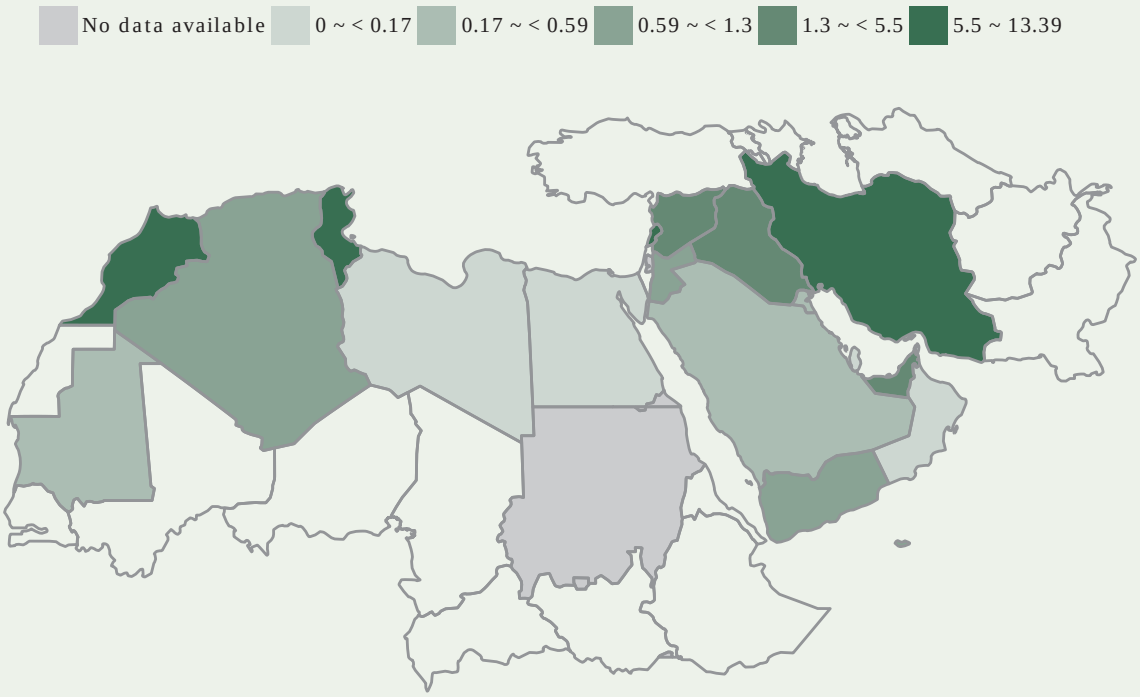
Source: Global Forest Resources Assessment.

MAP 53: **Global distribution of risks associated with main agricultural production systems**



Source: FAO, Fisheries and Aquaculture Department (fishery and aquaculture statistics).

MAP 54: **Forest area as share of total land area (percent, 2011)**



Source: FAO, Statistics Division (FAOSTAT).

Global production of the main forest products was between one and four percent higher in 2011 than in 2010. This shows that countries are slowly coming out of recession. For example, production of wood-based panels and paper in 2011 was above the pre-crisis levels of 2007 and appeared to be growing relatively strongly in most regions. On the other hand, global production of industrial roundwood – despite a 3 percent increase from 2010 – has not yet reached its pre-crisis levels. In the markets for pulp and paper, overall growth was very modest over the period 2007–2011, with a growth trend of about 1 percent per year. However, this overall result conceals major differences at the regional level, with pulp and paper production and consumption increasing significantly in the Asia and the Pacific region, but generally declining in Europe and Northern America.

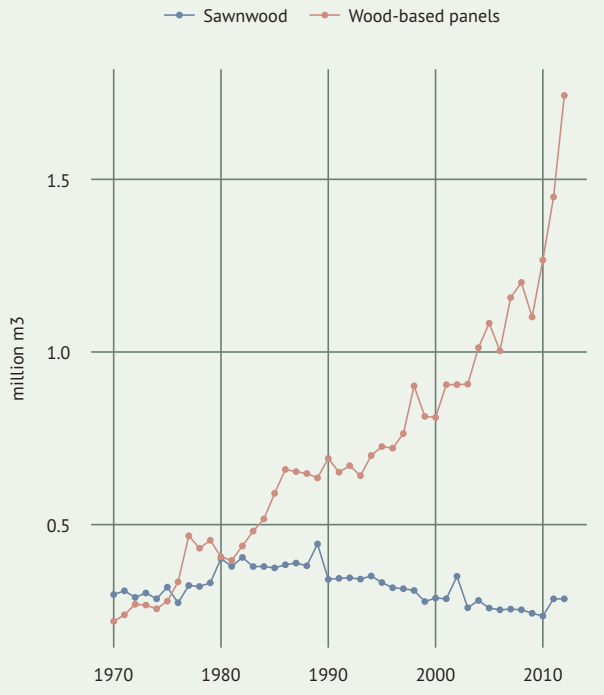
Because the Near East and North Africa has very limited forest resources, its share of international trade in forest products is low. In 2011-2012, the Near East and Africa produced 4 million cubic metres of industrial roundwood. The Islamic Republic of Iran produced almost all of wood-based panels in the region (1.4 million cubic metres out of a regional total of 1.7 cubic metres). The country was also the region's largest producer of wood pulp (246 000 tonnes), followed by Morocco (221 000 tonnes) and Egypt (41 000 tonnes). Saudia Arabia was the region's leading producer of paper and paperboard, producing 1.1 million tonnes out of a regional total of 3.2 million. Other major producers of paper and paperboard in the region are Egypt (660 000 tonnes) and the Islamic Republic of Iran (515 000 tonnes).

Although the region's production of forest products is relatively low, almost all countries in the region have seen modest growth in this area. Only the Islamic Republic of Iran and Lebanon have registered declines in production of most major forest products.

Further reading

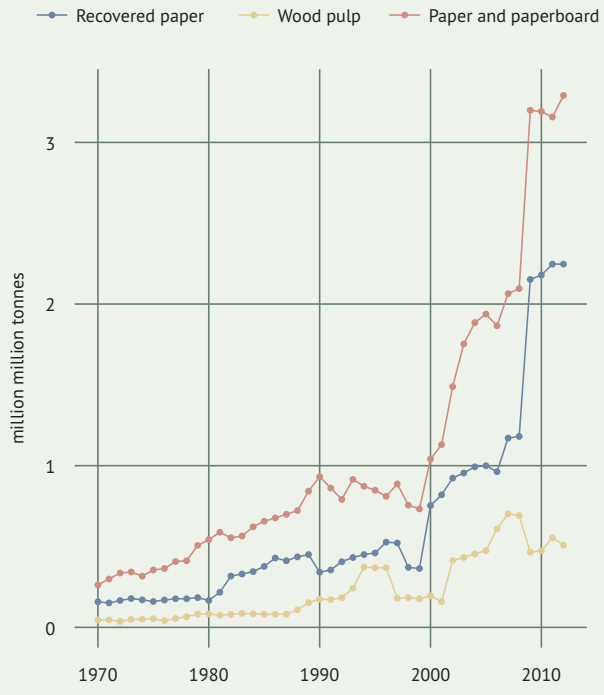
- FAO The State of the World's Land and Water Resources for Food and Agriculture (SOLAW) - Managing Systems at Risk 2011 (www.fao.org/nr/solaw/solaw-home/en/)
- UN International Year of Forests 2011 (www.fao.org/forestry/iyf2011/en/)
- FAO Land degradation assessment (www.fao.org/nr/land/degradation/en/)
- Global Forest Resources Assessment 2010 (www.fao.org/forestry/fra/fra2010/en/)

CHART 94: **Near East and North Africa production of selected forest products (1970-2012)**



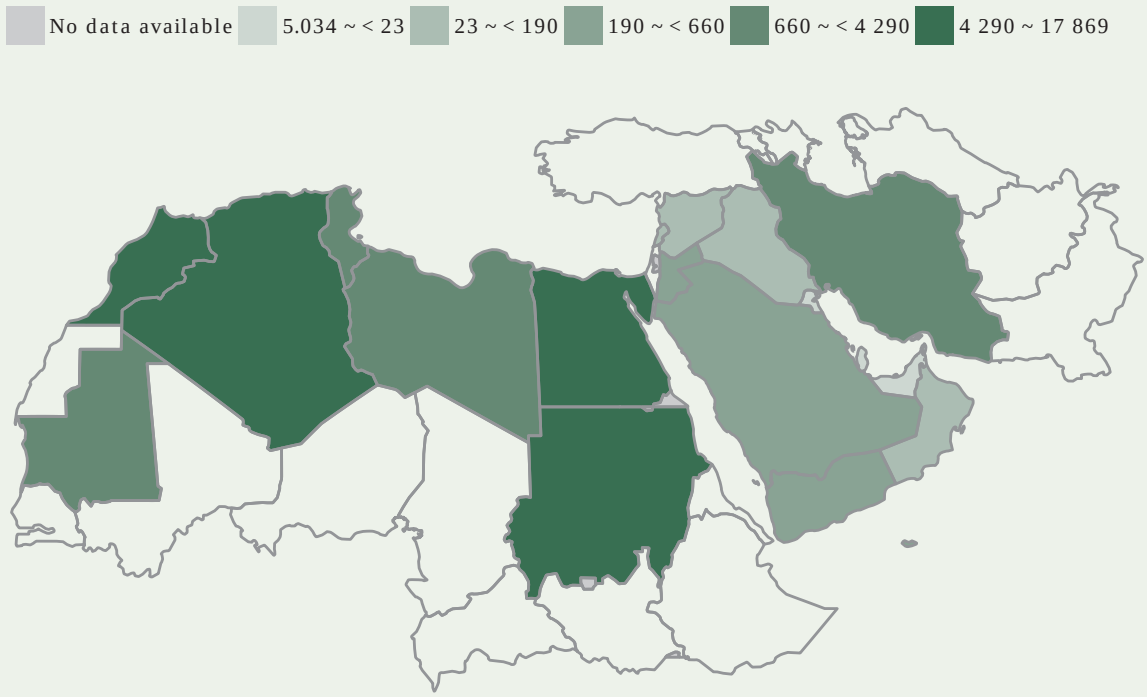
Source: FAO, Statistics Division (FAOSTAT).

CHART 95: **Near East and North Africa production of selected forest products (1970-2012)**



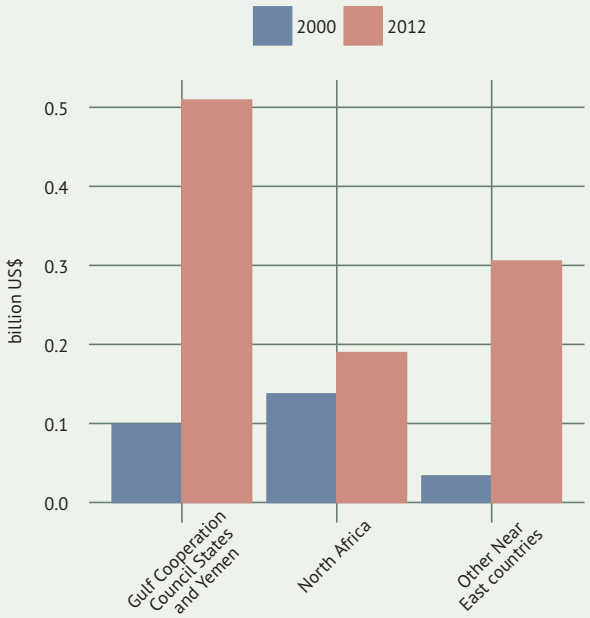
Source: FAO, Statistics Division (FAOSTAT).

MAP 55: **Roundwood production (thousand m^3, 2012)**



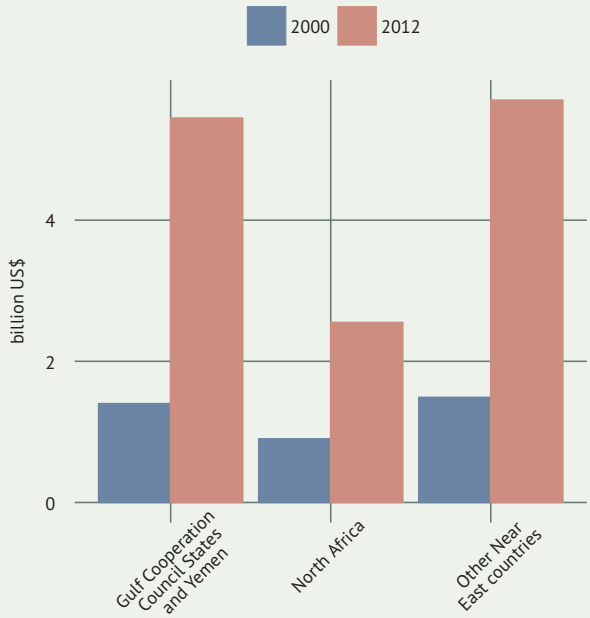
Source: FAO, Statistics Division (FAOSTAT).

CHART 96: **Exports of forest products (2000 and 2012)**



Source: FAO, Statistics Division (FAOSTAT).

CHART 97: **Imports of forest products (2000 and 2012)**



Source: FAO, Statistics Division (FAOSTAT).

Water

Global demand for water has risen sharply over the last century. Total annual water withdrawal (for agriculture, industries and municipalities) rose from less than 600 cubic kilometres per year at the beginning of the twentieth century, to 1 350 in the middle of the century and to more than 3 800 by the beginning of the twenty-first.

Agricultural water management is perhaps the most formidable challenge to sustainability facing the Near East and Africa Region. Per capita availability of renewable water resources in the region is currently around 1 050 cubic metres per person per year and is projected to drop by half by 2050. In contrast, the global average for per capita water availability is 8 900 cubic metres per year.

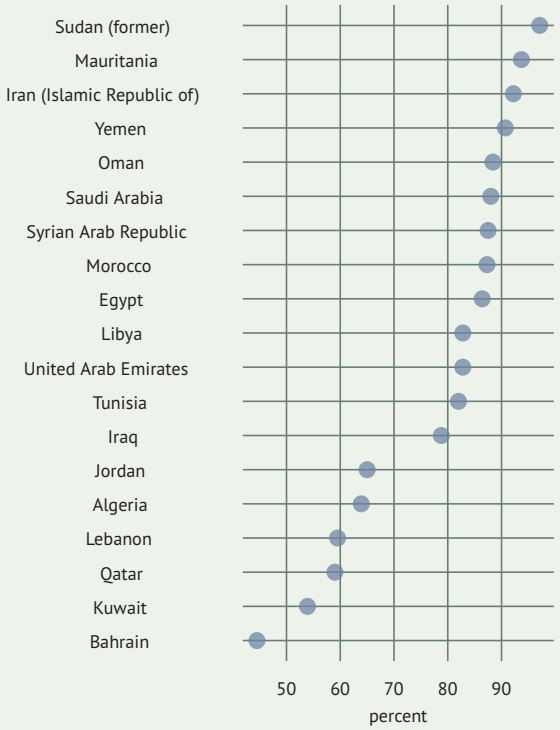
Agriculture's share in water use is already extremely high, accounting for about 78 percent of the region's total freshwater withdrawals. At the global level, roughly 65 percent of water withdrawals are used for agriculture. In 2000 in the former Sudan, agriculture accounted for more than 97 percent of water withdrawals. The most recent data from the Islamic Republic of Iran, Mauritania and Yemen show that more than 90 percent of water withdrawals in those countries are for agricultural use. In eight other countries in the region, the percent is higher than 80 percent. Only in Bahrain was the percentage of fresh water withdrawals higher for municipal uses than for agriculture.

In many countries in the region, the percentage of water withdrawn for agriculture exceeds 100 percent of the renewable water resources. Values over 100 percent indicate that more freshwater is withdrawn than the quantity annually renewed on a long-term basis, thus depleting the freshwater resources and using fossil groundwater. In this regard, Kuwait has by far the highest value at 2 460 percent, meaning that extensive use is made of fossil groundwater. The United Arab Emirates and Saudi Arabia follow, with 2 208 percent and 868 percent respectively. Oman is the only country on the Arabian Peninsula that uses less than 100 percent of its renewable water resources for agriculture. Other countries that, as of 2010, were using more than 100 percent of their renewable water resources for agriculture are Libya (512 percent) and the Islamic Republic of Iran (103 percent). Although Mauritania uses almost all its water withdrawals for agricultural purposes, the country uses only 13.2 percent of its renewable freshwater resources for agriculture. Lebanon uses the second lowest percentage (17.3 percent).

Further reading

- General summary Middle East region Explanatory notes(http://www.fao.org/nr/water/aquastat/regions/meast/index.stm#a15)
- FAO The State of the World's Land and Water Resources for Food and Agriculture (SOLAW) - Managing Systems at Risk 2011 (www.fao.org/nr/solaw/solaw-home/en/)
- FAO Water (www.fao.org/nr/water/)
- FAO AQUASTAT (www.fao.org/nr/aquastat/)

CHART 98: **Freshwater withdrawal by agricultural sector, shares of total (2000-2010*)**

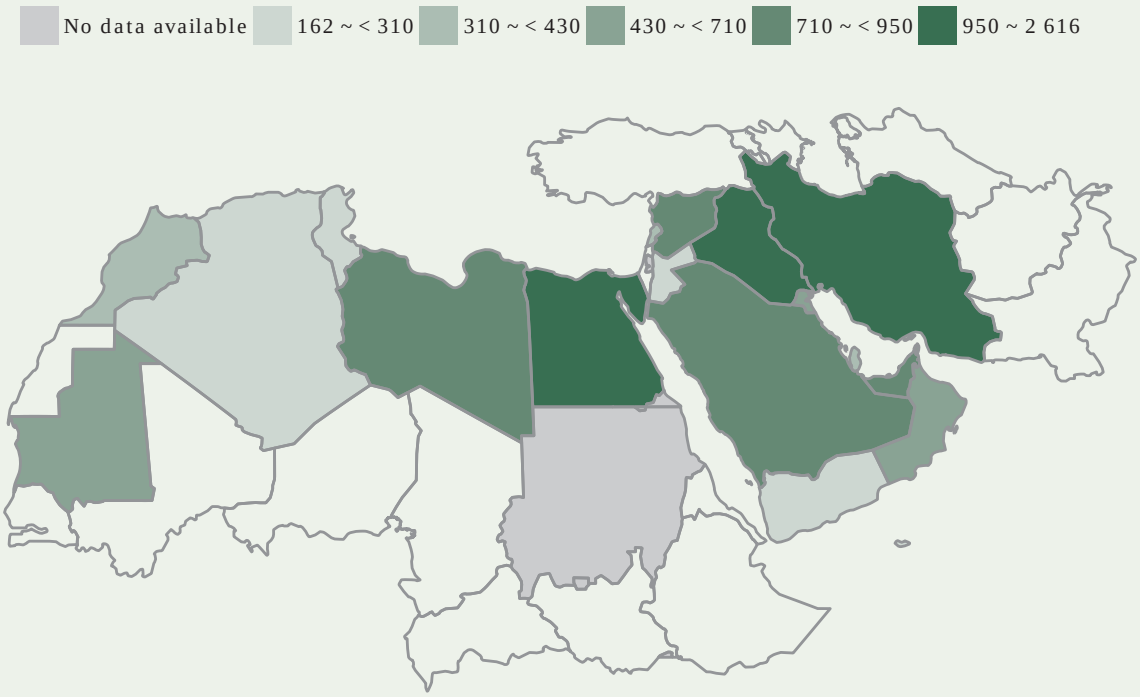


Source: Land and Water Division (AQUASTAT).

CHART 99: **Freshwater withdrawal by industrial sector, shares of total (2000-2010*)**

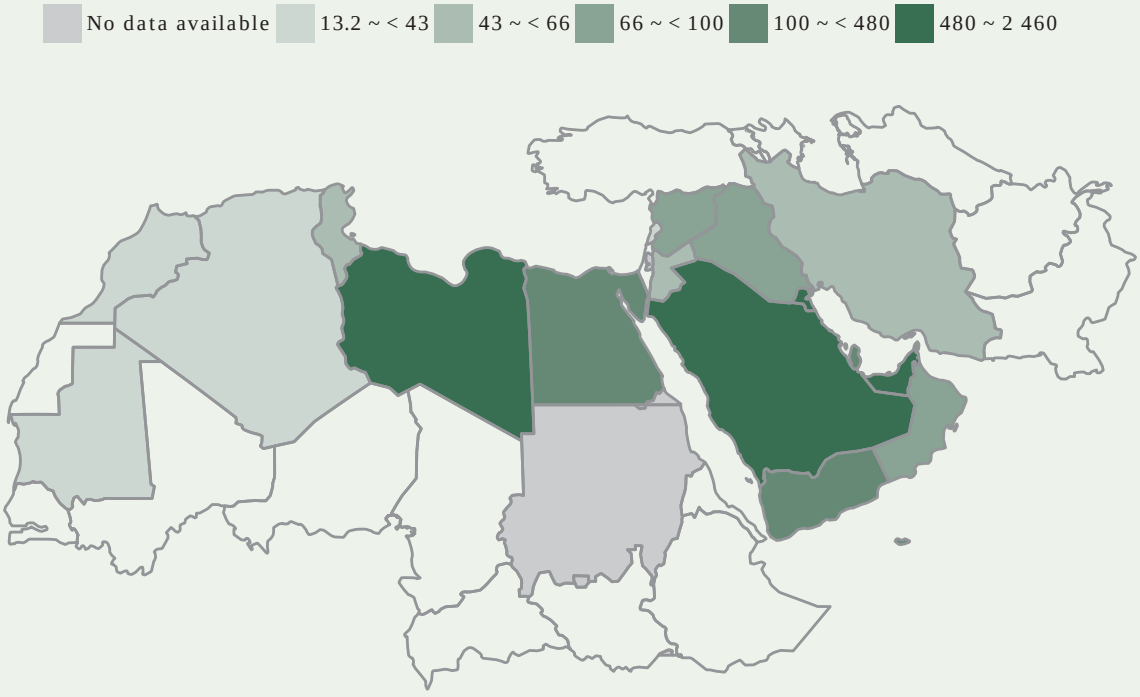
Source: Land and Water Division (AQUASTAT).

MAP 56: **Total water withdrawal per capita (m^3/yr/cap, 2000-2010*)**



Source: Land and Water Division (AQUASTAT).

MAP 57: **Renewable freshwater resources withdrawn by agriculture (percent, 2000-2010*)**



Source: Land and Water Division (AQUASTAT).

Biodiversity

Biodiversity concerns the degree of variation of life forms within a given ecosystem and serves as a measure of the health of the environment. Biodiversity for food and agriculture includes the components of biological diversity that are essential for feeding human populations and improving the quality of life. It applies to the genetic, species and ecosystem levels and includes the variety and variability of ecosystems, animals, plants and microorganisms that are necessary to sustain human life and the key functions of ecosystems. It is the result of thousands of years of farming and breeding activities, land and forest utilization, and fisheries and aquaculture activities, combined with millions of years of natural selection.

The North African coastal region of the Mediterranean is part of the centre of origin for many crops. The Near East is also one of the centres of domestication for several livestock species, with a high genetic diversity remaining today. In 2012, there were 219 mammal species, 209 bird species and 460 aquatic in threat of extinction in the region.

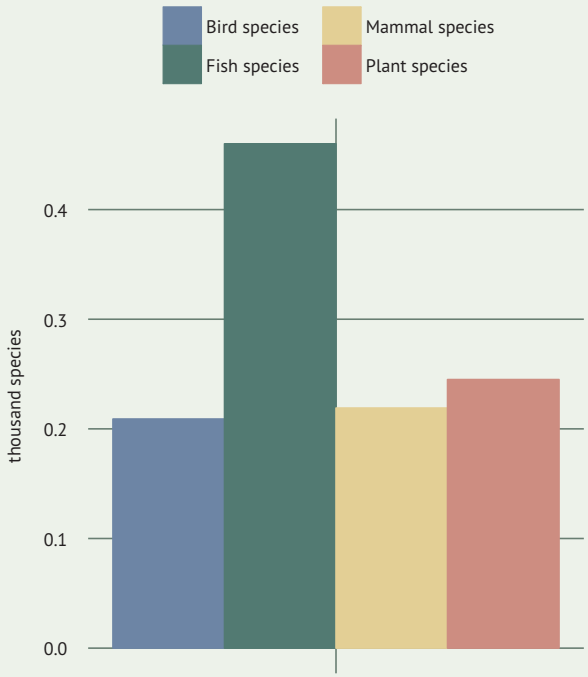
Countries in the region have made progress in protecting vulnerable ecosystems over the last decades. Between 1990 and 2010, the percentage of land covered by nationally protected areas doubled, increasing from 3.9 percent to 7.9 percent. This is, however, less than the global average, which rose from 8.6 percent to 11.6 percent during the same period. In 2012, Saudi Arabia had by far the greatest percentage of protected land (31.3 percent), an increase of more than 20 percent from 1990. Oman, which had no protected areas in 1990, is the only other country in the region where the percentage of protected areas in 2012 was higher than 10 percent.

In 1990, 13 countries in the region had no nationally marine protected areas at all. Mauritania has by far the highest percentage of protected waters (32.1 percent), a figure that has remained largely unchanged since 1990. Jordan has done the most to protect its territorial waters. In 1990, none were under protection, but by 2010, the country had protected 30 percent of its territorial waters.

Further reading

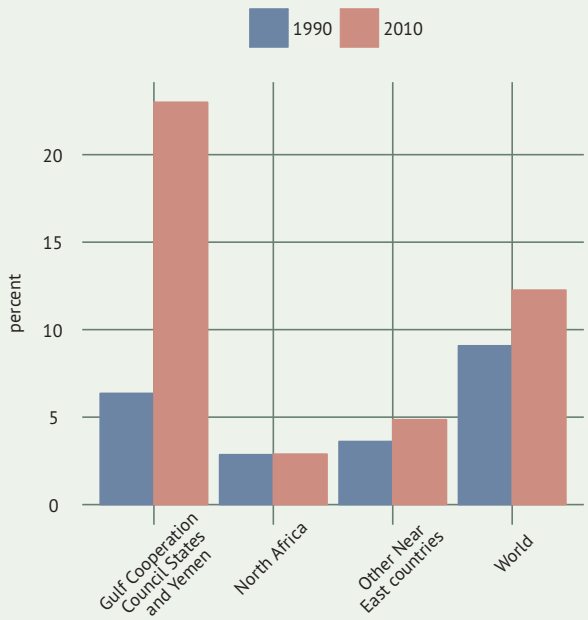
- FAO Biodiversity (www.fao.org/biodiversity)
- UN International Year of Biodiversity 2010 (www.fao.org/biodiversity/2010-international-year-of-biodiversity)
- FAO/INFOODS: Nutrition and Biodiversity (www.fao.org/infoods/infoods/food-biodiversity/en/)

CHART 100: **Species threatened in Near East and North Africa (2012)**



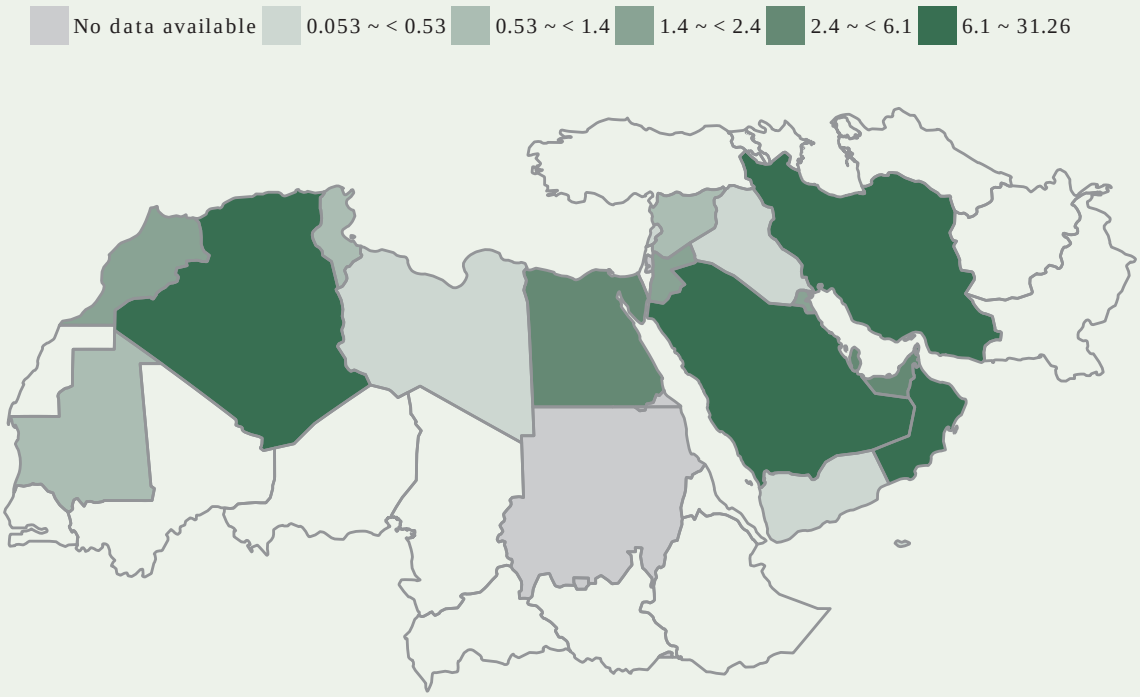
Source: World Bank (WDI).

CHART 101: **Terrestrial protected areas, share of total land area (1990 and 2010)**



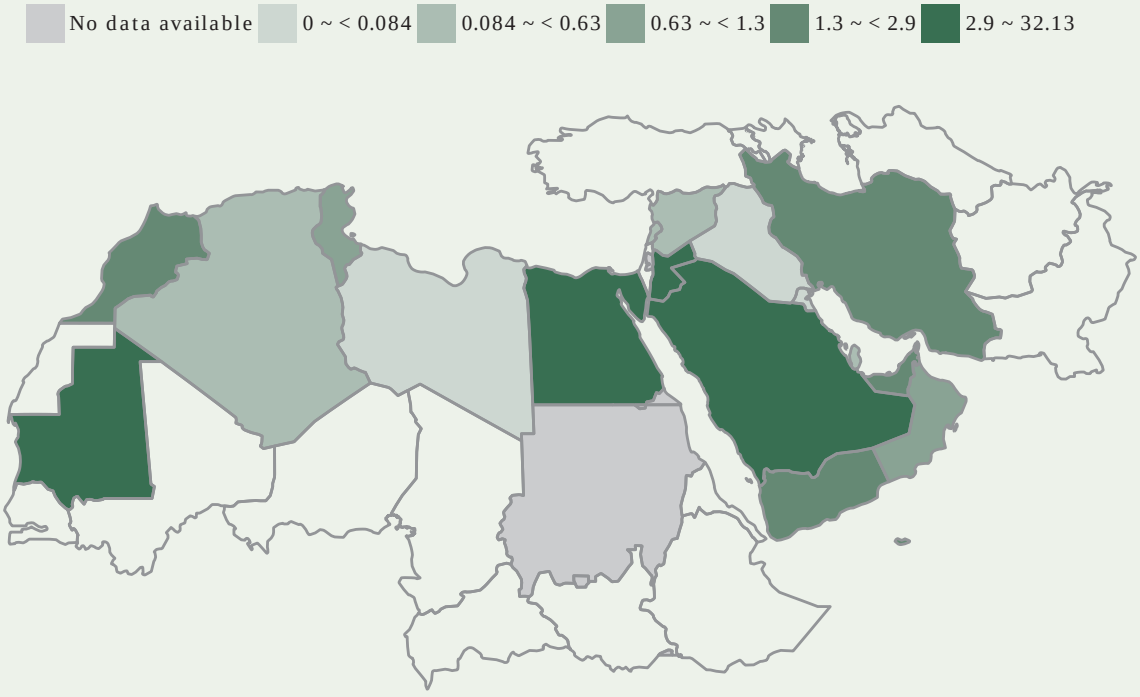
Source: World Bank (WDI).

MAP 58: **Terrestrial protected areas, share of total land area (percent, 2010)**



Source: World Bank (WDI).

MAP 59: **Marine protected areas, share of territorial waters (percent, 2010)**



Source: World Bank (WDI).

Agri-environmental indicators

Agri-environmental indicators are quantitative tools that help assess and quantify the status of and trends in the environmental performance of agriculture. They facilitate the identification of effective management solutions and policy measures for avoiding potential damage, including soil and water degradation, air pollution and loss of biodiversity. Most of the data presented in this section are from a selection of core indicators originally developed by OECD and Eurostat for their member countries, and recently expanded by FAO to achieve global coverage.

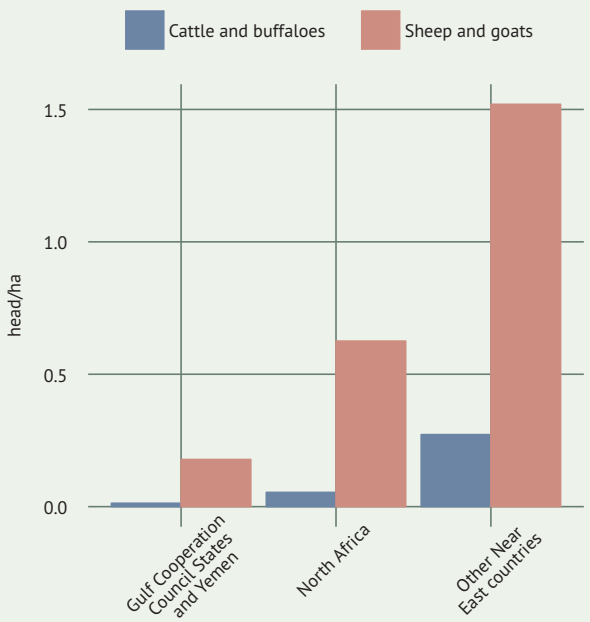
Changes in land cover have caused the most pressing environmental issue in recent decades. In the Near East and North Africa region as a whole, the percentage of agricultural land to total land area is 33.8 percent. Saudi Arabia has the largest percentage of agricultural land (80.6 percent) almost all of which is meadows and pastures. The Syrian Arab Republic also has a large percentage of land dedicated to agriculture (75.5 percent), nearly 60 percent of which is meadows and pastures. In Lebanon, Morocco and Tunisia the percentage of agricultural land is over 60 percent.

The Near East and North Africa has the highest density of sheep and goats per hectare of land of any of FAO's regions. The highest densities are found in the GCC countries, with Qatar registering the highest density of sheep (6 per hectare) and United Arab Emirates the highest density of goats. As poultry production has expanded, so too have poultry densities, and the region now has the highest density of poultry of any of FAO's regions (6.9 birds per hectare). Poultry densities are especially pronounced in the smaller GCC countries. For example, in Qatar poultry densities have almost doubled since 2000, moving from 63.8 to 121.2 birds per hectare. Kuwait has the highest poultry density in the region at 177.8 birds per hectare. In North Africa, Tunisia has the highest density of poultry (8.3 birds per hectare) and in the Oriental Near East, Lebanon has the highest (59.6 birds per hectare). Only Oman recorded a reduction in poultry densities between 2000 and 2011. In contrast, the region has the lowest cattle and buffalo density (0.1 head per hectare) of any of FAO's regions. Egypt (2.3 head per hectare) and Bahrain (1.2 head per hectare) have the highest cattle and buffalo densities.

Further reading

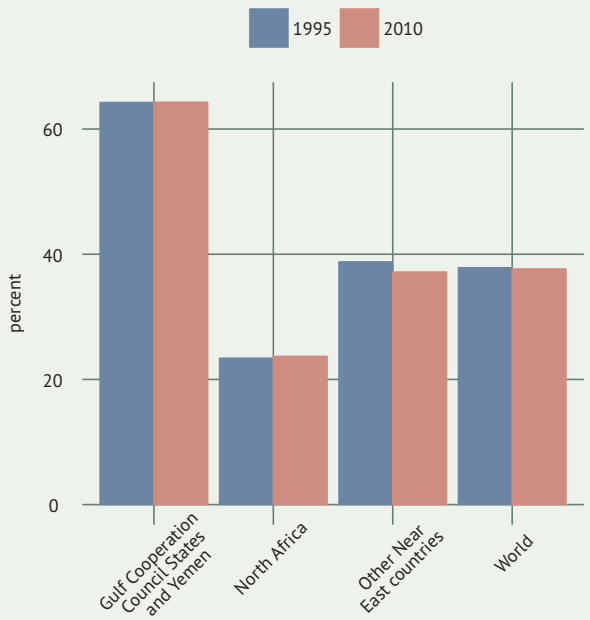
- OECD (www.oecd.org/agriculture/env/indicators)
- EUROSTAT (http://epp.eurostat.ec.europa.eu/portal/page/portal/agri_environmental_indicators/introduction)

CHART 102: **Livestock density per ha of agricultural land, cattle and buffaloes, sheep and goats (2011)**



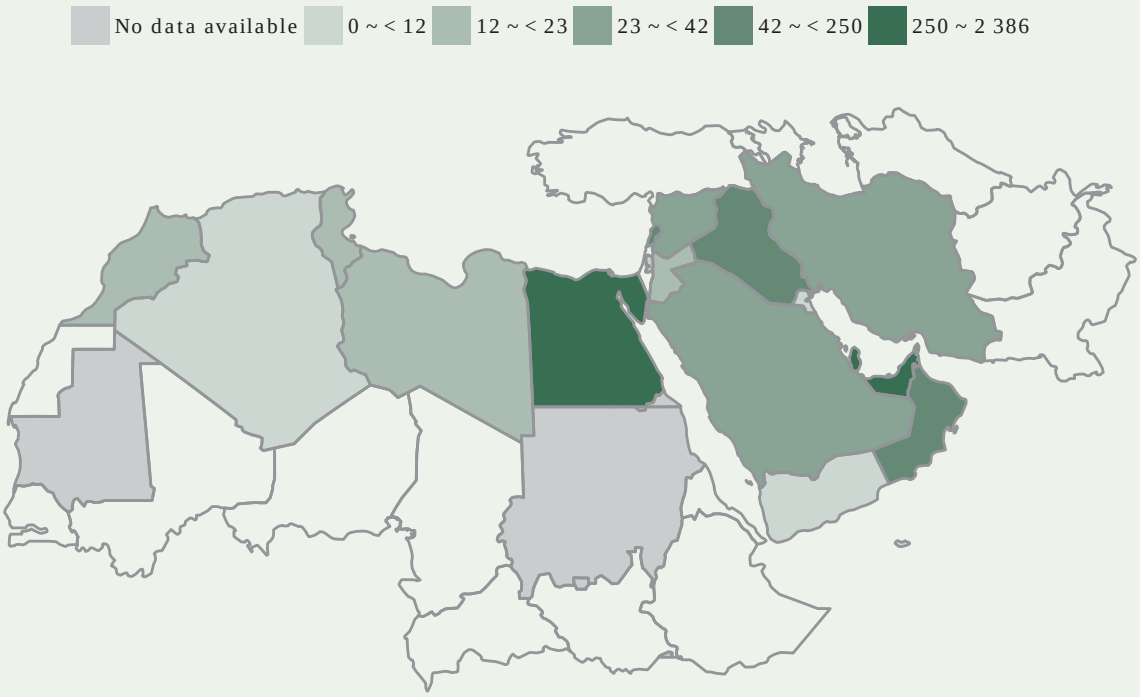
Source: FAO, Statistics Division (FAOSTAT).

CHART 103: **Agricultural land, share of total land area (1995 and 2010)**



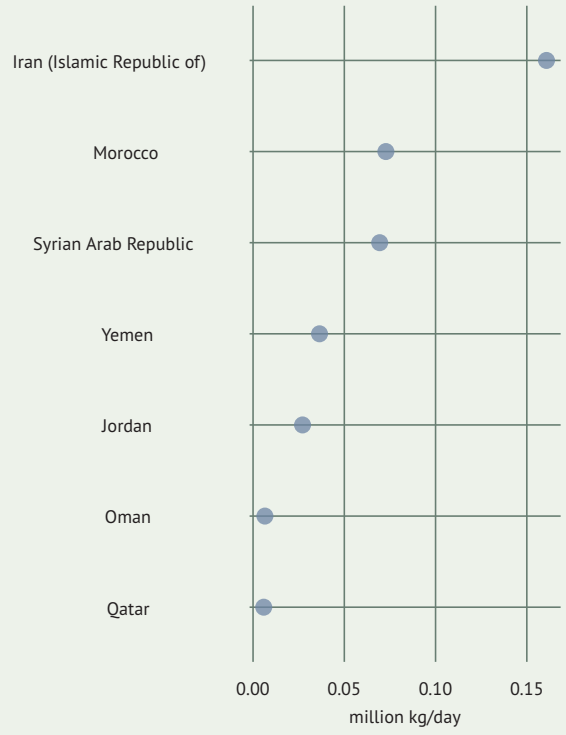
Source: FAO, Statistics Division (FAOSTAT).

MAP 60: **Nitrogen fertilizer consumption per ha of arable area and permanent crops (kg/ha, 2009)**



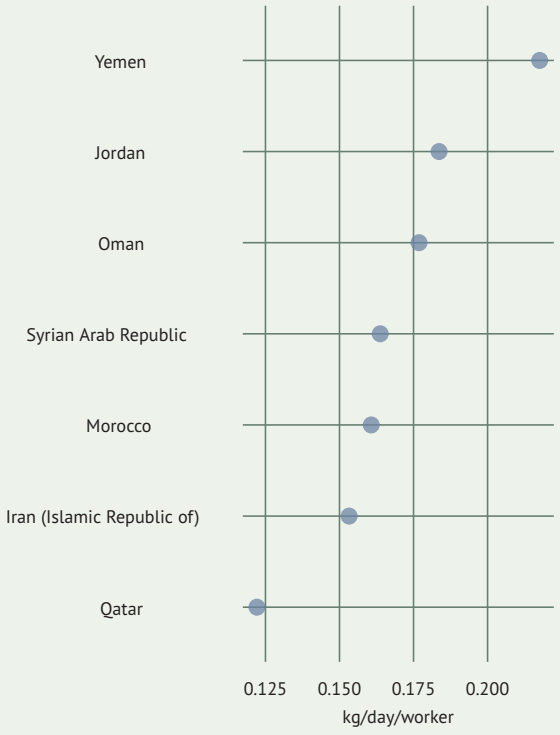
Source: FAO, Statistics Division (FAOSTAT).

CHART 104: **Organic water pollutant (BOD) emissions (2005)**



Source: World Bank (WDI).

CHART 105: **Organic water pollutant (BOD) emissions per worker (2005)**



Source: World Bank (WDI).

Organic farming

Organic agriculture is a production management system that promotes and enhances ecosystem health, including biological cycles and the biological activity of soil. It is based on minimizing the use of external inputs and represents a deliberate attempt to make the best use of local natural resources. Methods are selected to minimize pollution of air, soil and water. Organic agriculture comprises a range of land, plant and animal management procedures, circumscribed by a set of rules and limits that are usually enforced by inspection and certification schemes. Synthetic pesticides, mineral fertilizers, synthetic preservatives, pharmaceuticals, genetically modified organisms, sewage sludge and irradiation are prohibited in all organic standards.

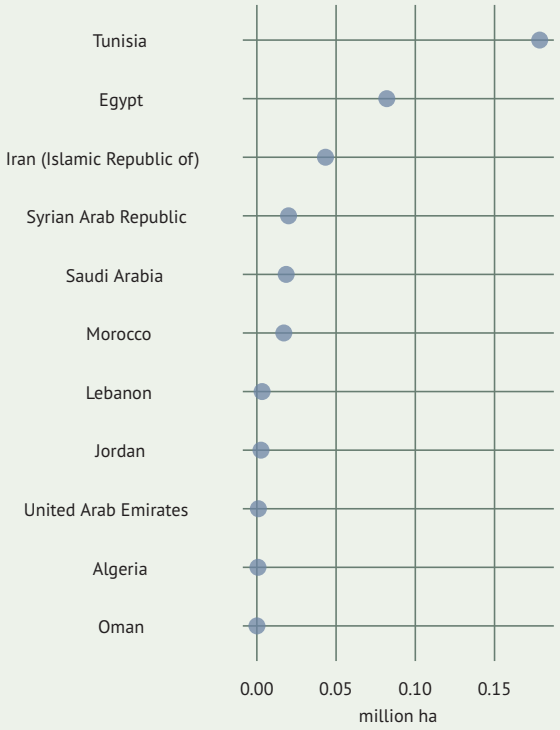
The land area under organic management has been steadily increasing worldwide for several decades, reaching 37.2 million ha in 2011, up from 11 million ha in 1999. The total value of organic food and beverages sold in 2011 was almost US$63 billion, some US$4 billion higher than in 2010. The organic market has grown considerably since 2002, and – unlike the rest of the food sector – has continued to grow, despite the global economic slowdown.

Although, data are not available for every country in the region, it is apparent that organic agriculture is not widespread in the Near East and North Africa. In 2011, most countries had less than half of one percent of their agricultural area dedicated to organic agriculture. Only in two countries, Egypt (2.2 percent) and Tunisia (1.8 percent), was the percentage of land used for organic agriculture higher than one percent.

Further reading

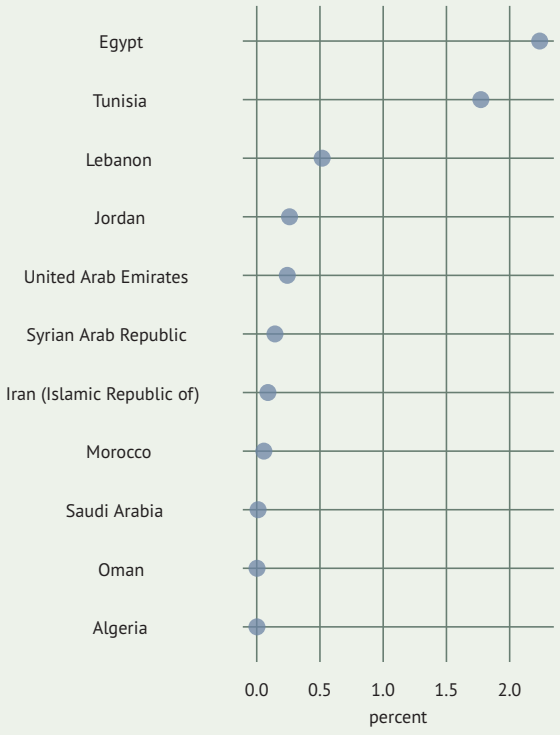
- FAO Organic Agriculture (www.fao.org/organicag/en/)
- FAO Organic Agriculture and Environmental Stability of the Food Supply - FAO (ftp://ftp.fao.org/docrep/fao/meeting/012/ah950e.pdf)

CHART 106: **Organic agriculture area (2011)**



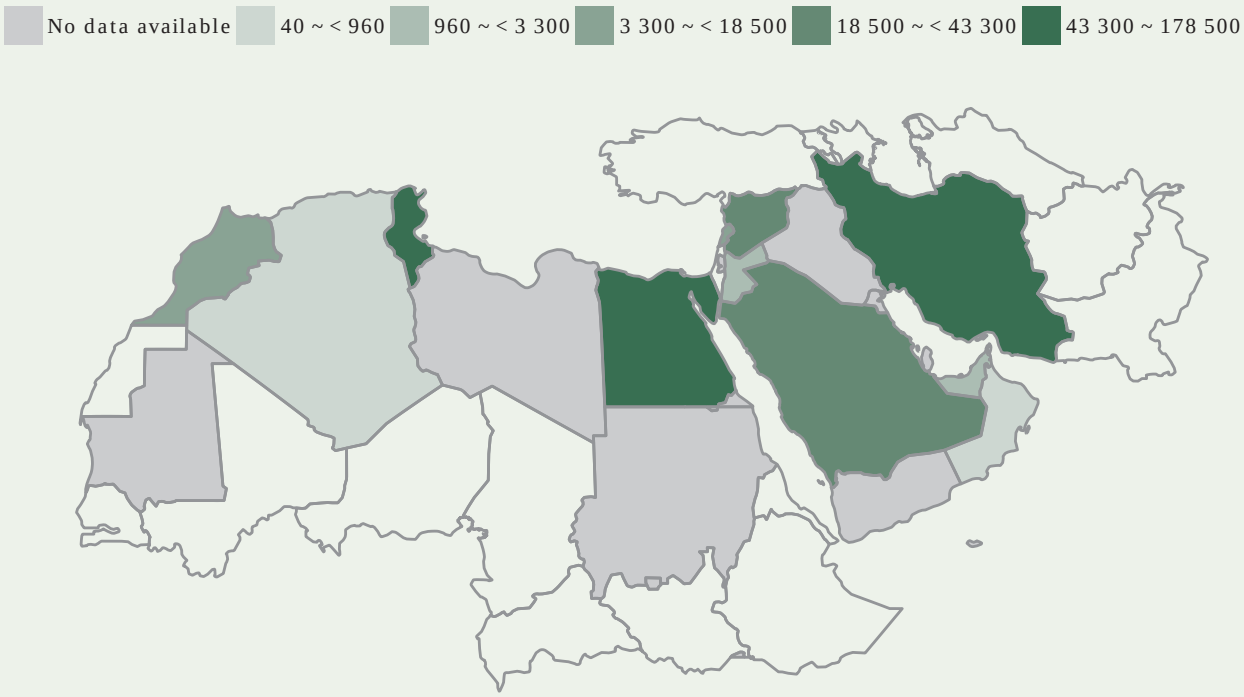
Source: FAO, Statistics Division (FAOSTAT).

CHART 107: **Organic agriculture, share of total agricultural area (2011)**



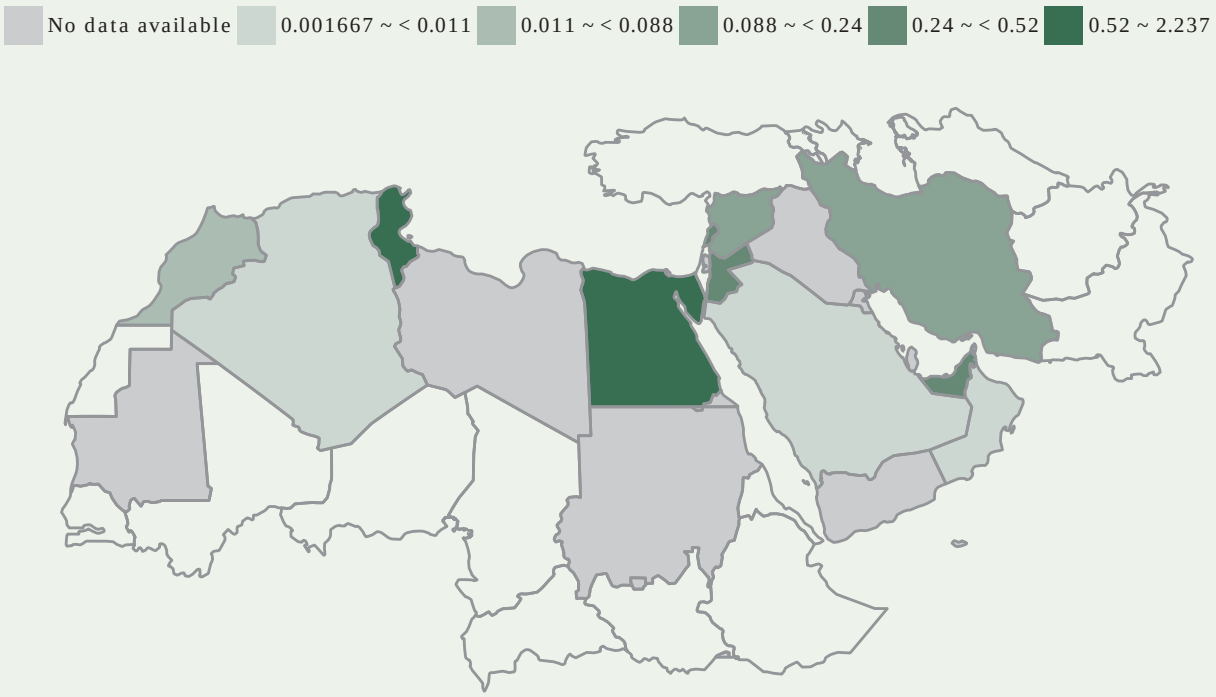
Source: FAO, Statistics Division (FAOSTAT).

MAP 61: **Organic agriculture area (ha, 2011)**



Source: FAO, Statistics Division (FAOSTAT).

MAP 62: **Organic agriculture, share of total agricultural area (percent, 2011)**



Source: FAO, Statistics Division (FAOSTAT).

Bio-based economy

Agriculture is playing an increasingly important role in the bio-based economy, providing feedstocks for the production of liquid fuels, chemicals and advanced materials, such as natural fibre composites for industry. Biological science has the potential both to make incremental efficiency improvements and to bring radical change in a wide range of sectors, including through the use of enzymes, fermentation and organisms for processes and products in the energy, chemical, pharmaceutical, food, textile, and pulp and paper industries.

Much of this potential is already being realized, especially through the rapid growth of the biofuel sector. Currently, ethanol is produced from easily fermentable agricultural feedstocks such as sugar cane, sugar beet, cereal grains and cassava. Biodiesel is produced from vegetable oil (typically rapeseed, soybean and palm oils) using a process of chemical modification.

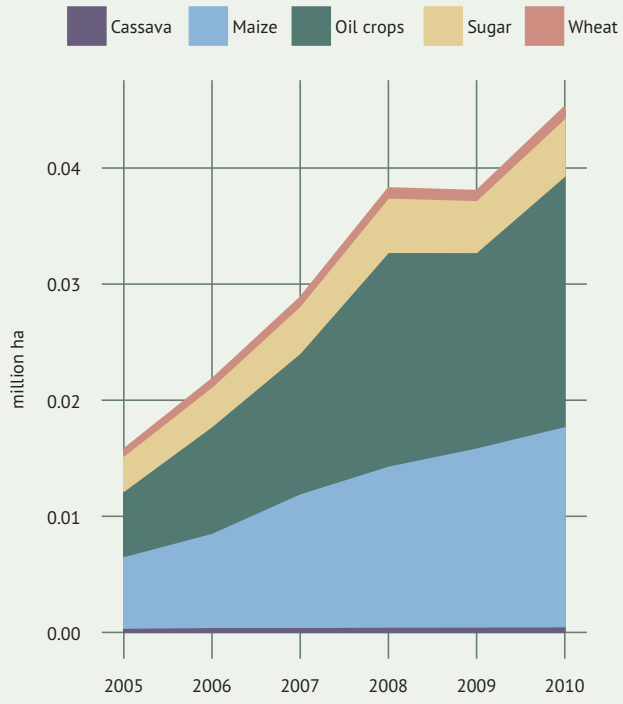
In 2010, global production of biofuels reached a record 195 billion litres, a 17 percent increase from 2009. Various factors including an increase in new laws and mandates in Argentina, Brazil, Canada and the United States of America, an upswing in the global economic, and the high prices of fossil fuels has spurred this growth.

The Near East and North Africa region produces a very small share of the world's biofuel. Production in the region was 4.2 kilotonnes in 2009, which marks a modest increase over the 2000 production level of 3.5 kilotonnes. Two countries account for three-quarters of the region's biofuel production: Egypt (1.6 kilotonnes) and Tunisia (1.3 kilotonnes). In both countries production has increased only slightly since 2000.

Further reading

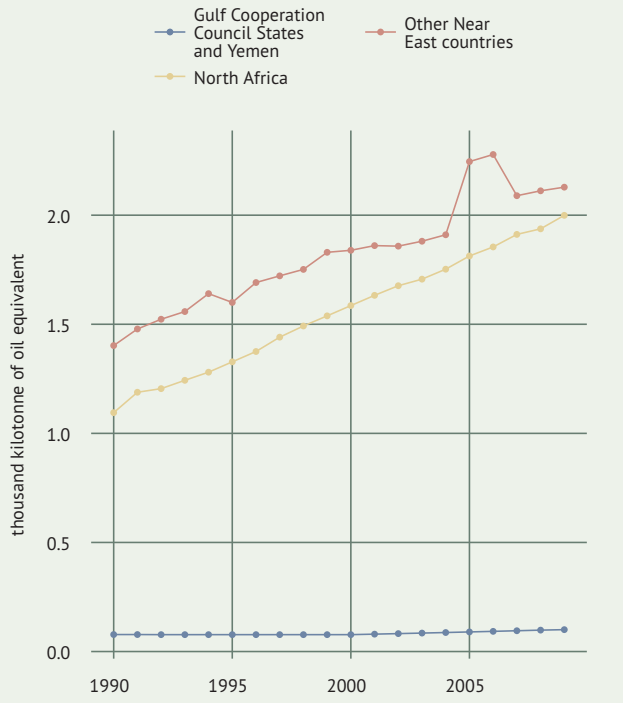
- FAO Bioenergy (www.fao.org/bioenergy)
- UN International Year of Natural Fibres (www.naturalfibres2009.org/en/index.html)

CHART 108: **World area under bioenergy crops (2005-2010)**



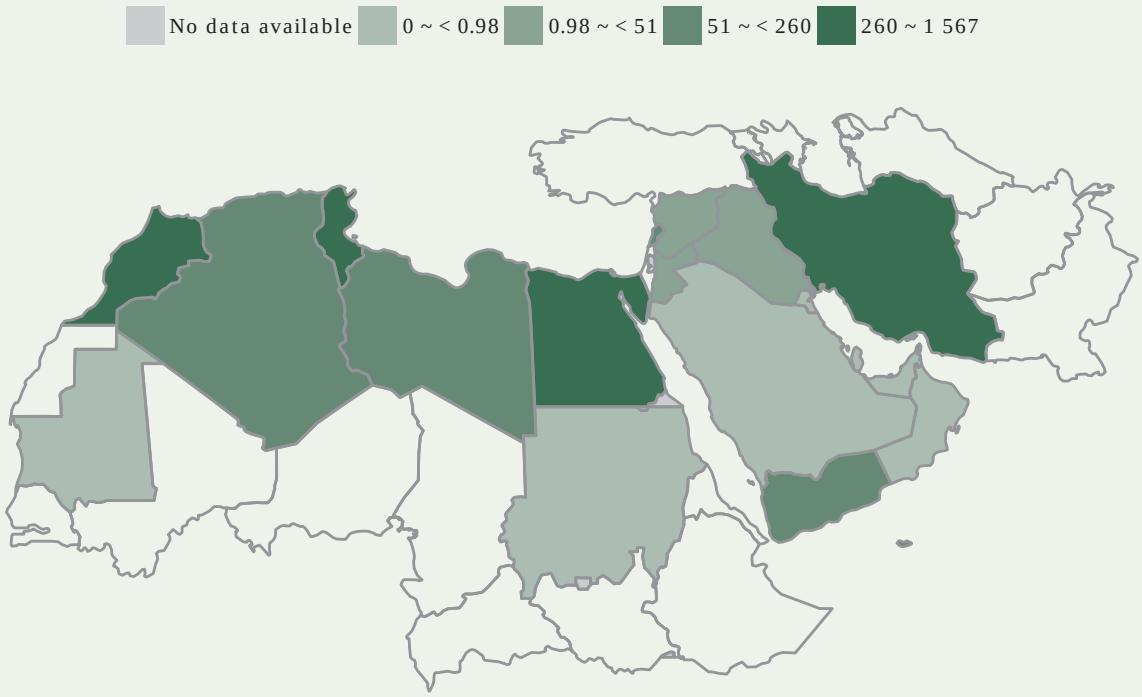
Source: FAO.

CHART 109: **Biofuel production (1990-2009)**



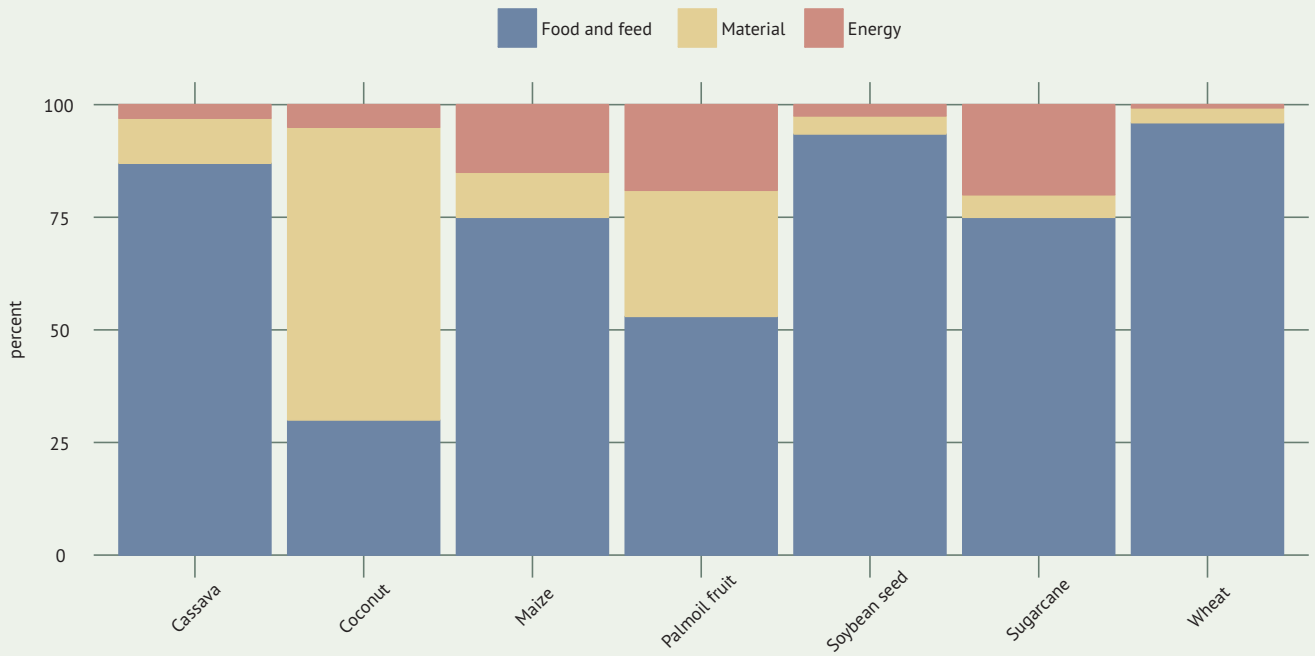
Source: IEA.

MAP 63: **Biofuel production (kilotonne of oil equivalent, 2009)**



Source: IEA.

CHART 110: **Share of food crop usage in world bio-based economy (2009)**



Source: FAO, Statistics Division.

Climate change

The severity and pace of climate change is becoming more acute. Current global surface temperatures are now about 0.6° C higher than the average for the last century. This increase is consistent with model predictions of the effects of rising atmospheric concentrations of carbon dioxide (CO_2) and other GHGs, which are a result of human activity. Also in line with the same model simulations, the observed warming is greater at higher latitudes – particularly in the northern hemisphere, where most land masses are located – than in the tropics. At the same time, extreme temperature events are becoming more frequent, causing increasing damage to ecosystems, agriculture and human health.

These warming trends will continue if emissions of anthropogenic GHGs continue to follow a business-as-usual scenario, with global atmospheric surface temperatures predicted to rise by at least 4° C by 2100. Moreover, the hydrological cycle will most likely become stronger because of increased rates of evaporation from land and sea surfaces. As a result, rainfall may increase in the tropics and at higher latitudes, but decrease over large continental interiors. Areas of the world, such as the Near East and North Africa, that are already facing critical water scarcity, are expected to become drier and hotter.

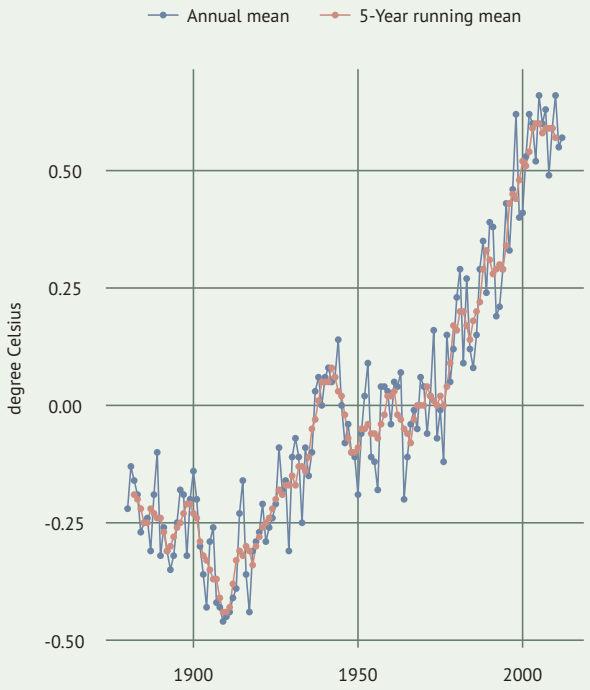
The Near East and North Africa region is one of the most vulnerable regions to climate change. Climate change puts food security at risk and jeopardizes the livelihoods of large segments of the population. Water shortages, already a problem in most countries of the region, will be further exacerbated by climate change. Agriculture in the Near East is likely to suffer major losses due to high temperature, droughts, floods and soil degradation. In Egypt alone, climate change could decrease the national production of rice by 11 percent and soybeans by 28 percent by 2050, compared with their production under current conditions.

In the entire Near East and North Africa region, rangelands and livestock are likely to be affected by climate change as they are located mostly in marginal areas. These changes will have an impact on nomadic systems and on livestock pests and diseases. Increases in the outbreak of epidemic are also possible. Soil moisture depletion will likely affect the productivity of major forestry species and lead to declines and extinctions of sensitive species, increased fire risks, and changes in the spread patterns of pests and diseases. The resulting changes in habitats will induce changes in wildlife populations. The combined effects of human actions, nature, and climate change could lead to further degradation and desertification in many parts of the region.

Further reading

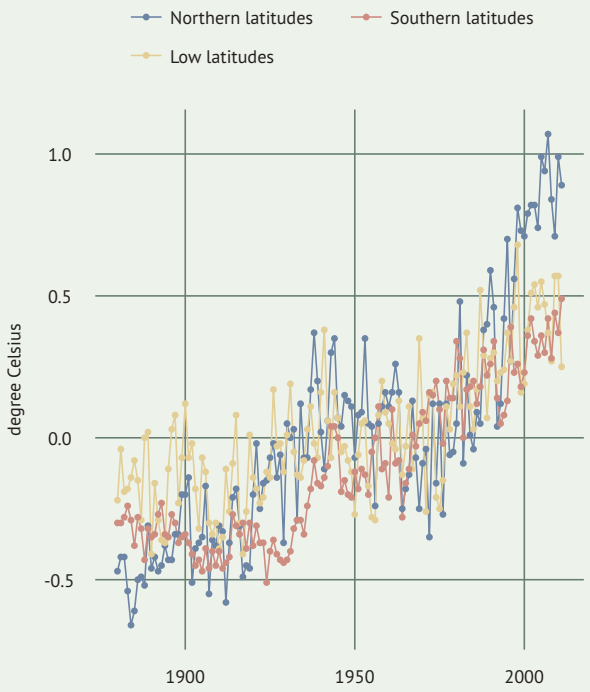
- FAO Climate Change, Water and Food Security 2011
- FAO Energy-smart food for people and climate (www.fao.org/docrep/014/i2454e/i2454e00.pdf)
- Intergovernmental Panel on Climate Change (IPCC) (www.ipcc.ch/)
- NASA (http://data.giss.nasa.gov/gistemp/)

CHART 111: **Global land-ocean temperature index, base period 1951-1980 (1880-2012)**



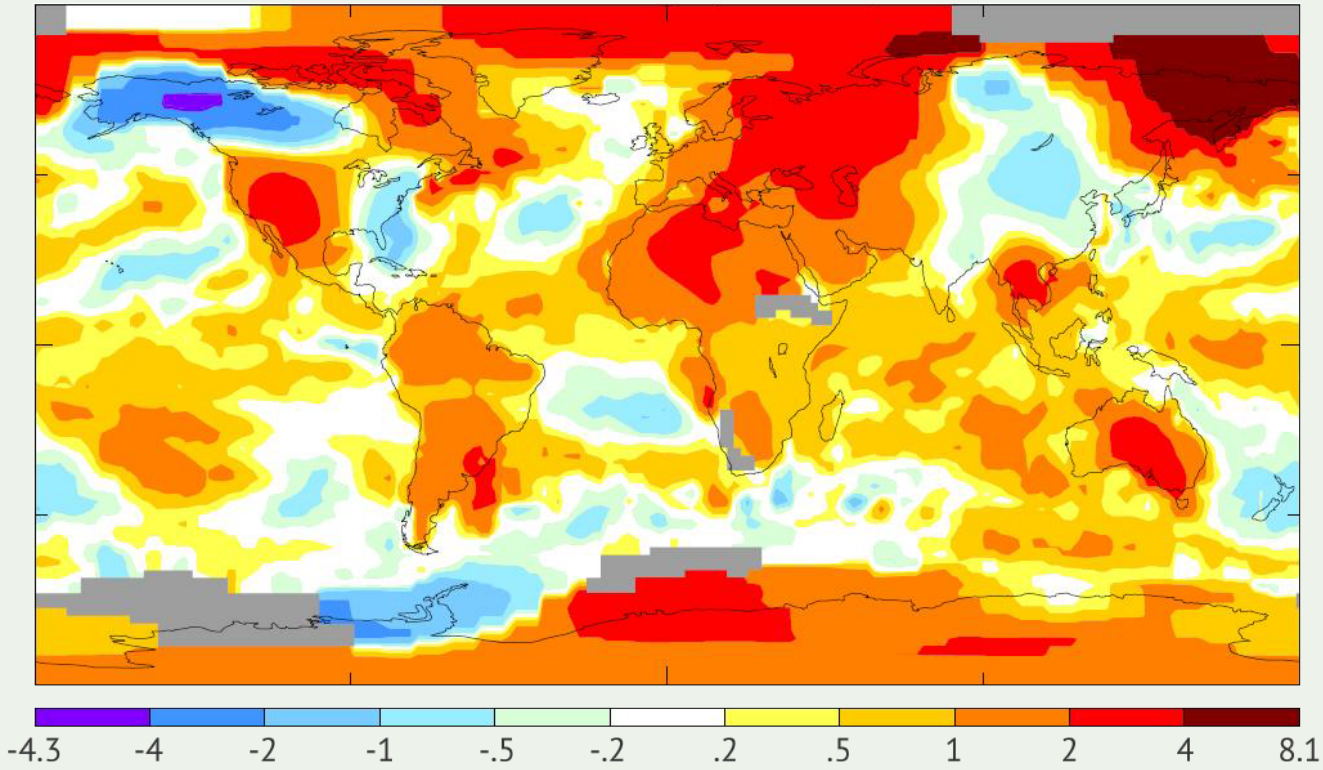
Source: NASA.

CHART 112: **Global land-ocean temperature index for three latitude bands, base period 1951-1981 (1880-2011)**



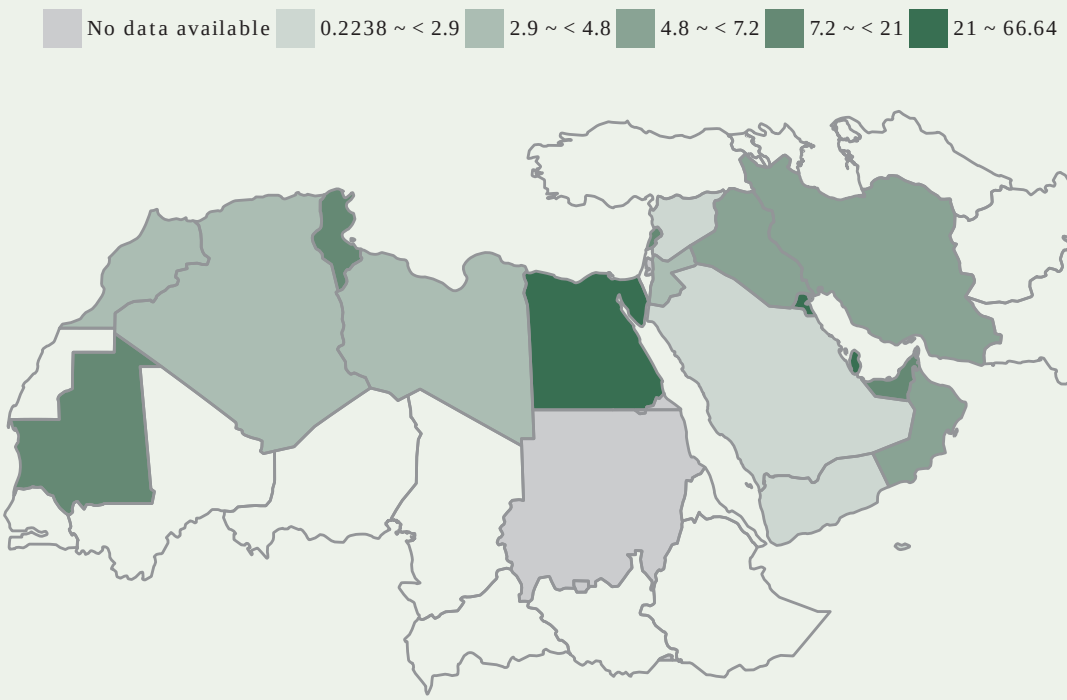
Source: NASA.

MAP 64: **Surface temperature, anomaly versus 1951-1980 (degrees Celsius, 2012)**



Source: NASA, GISS Surface Temperature Analysis.

MAP 65: **Share of population living in areas with elevation of 5 meters or less (percent, 2000)**



Source: World Bank (WDI).

Greenhouse gas emissions

GHG emissions from agriculture, including crop and livestock production, forestry and associated land-use changes, are responsible for a significant fraction of human-induced emissions – up to 30 percent globally, according to the Intergovernmental Panel on Climate Change (IPCC). GHG emissions presented in this section are available from the FAOSTAT Emissions database, which was launched in 2013.

GHG emissions from agriculture are dominated by non-CO_2 gases such as methane (CH_4) and nitrous oxide (N_2O), which are produced during crop and livestock production and management. These include emissions from the following categories: enteric fermentation, manure management systems, synthetic fertilizers, manure applied to soils, manure left on pastures, crop residues, rice cultivation, cultivated organic soils and burning of crop residues.

The region contributes a relatively small amount of the global agricultural emissions. As is the case all over the world, the largest source of agricultural GHG emissions in the Near East and North Africa comes from enteric fermentation (57 726 gigagrams of CO_2 equivalent), the lowest amount of any of FAO's regions. The second highest source of agricultural GHG emissions is manure left on pasture (37 525 gigagrams of CO_2 equivalent). In the region, the Islamic Republic of Iran produces the most emissions from these two sources. Synthetic fertilizers are the region's third highest source of agricultural emissions, with Egypt accounting for more than half of the total (9 198 gigagrams of CO_2 equivalent).

Changes in carbon stocks and ecosystem functions linked to human activities, such as land-use change and land management, determine the GHG emissions and removals. Activities that increase terrestrial carbon stocks over time lead to removal of CO_2 from the atmosphere, while activities that decrease total carbon stocks lead to net CO_2 and non-CO_2 emissions. Global GHG emissions from net forest conversion decreased from 3.6 to 2.6 gigatonnes of CO_2 per year per year between 1990 and 2010.

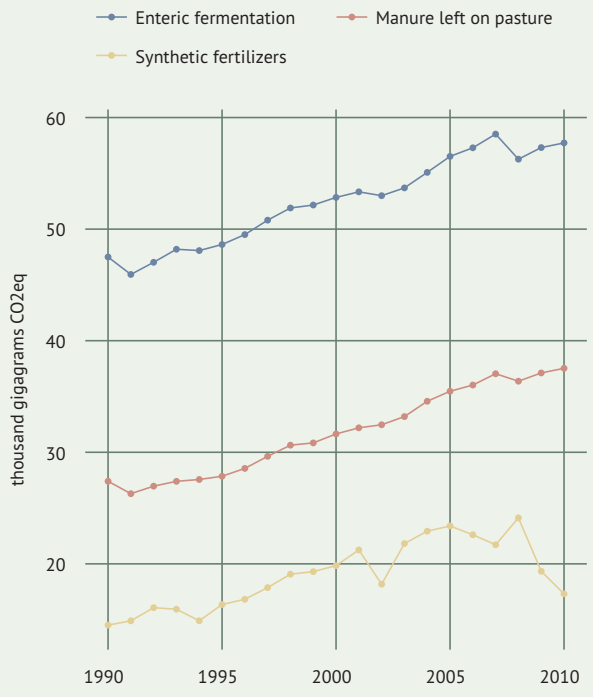
Further reading

- IPCC (www.ipcc.ch/)
- FAOSTAT (http://faostat.fao.org/)
- Monitoring and Assessment of GHG Emissions and Mitigation Potentials in Agriculture, MICCA (www.fao.org/climatechange/micca/ghg/en/)

CHART 113: **Net emissions/removals from net forest conversions (1990, 2000 and 2010)**

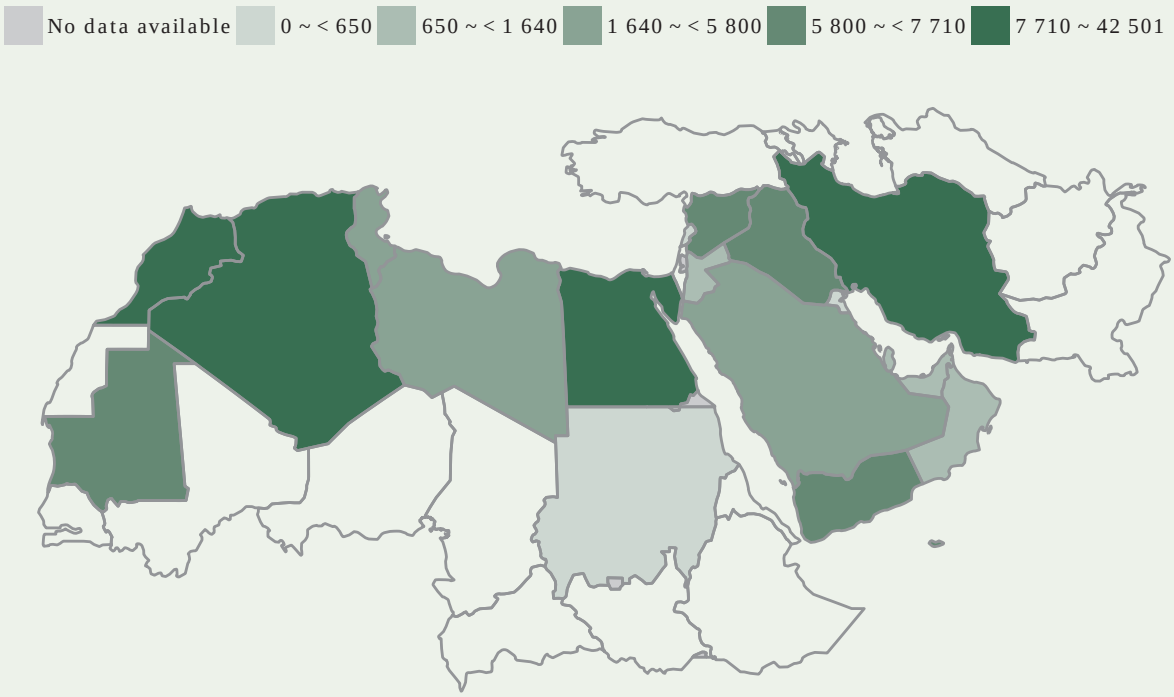
Source: FAO, Statistics Division (FAOSTAT).

CHART 114: **Agricultural greenhouse gas emissions (1990-2010)**



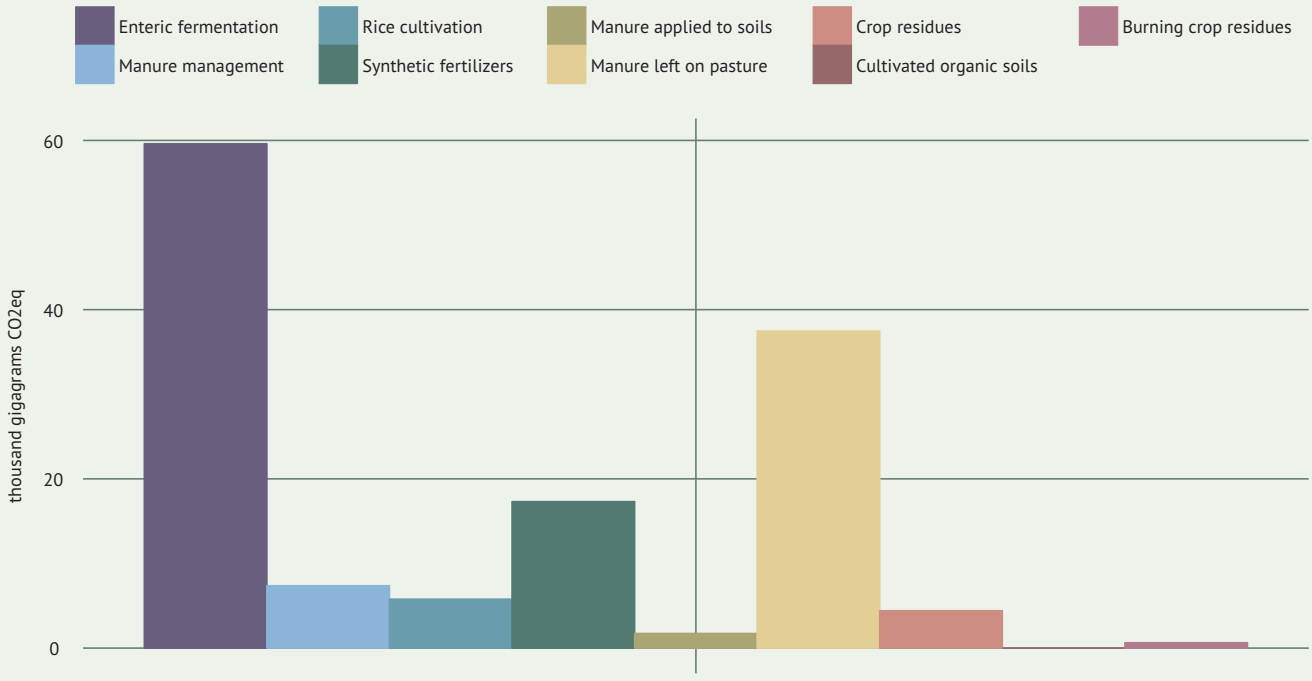
Source: FAO, Statistics Division (FAOSTAT).

MAP 66: **Total agricultural greenhouse gas emissions (gigagrams CO_2eq, 2010)**



Source: FAO, Statistics Division (FAOSTAT).

CHART 115: **Near East and North Africa agricultural greenhouse gas emissions by sector (2010)**



Source: FAO, Statistics Division (FAOSTAT).

TABLE 43: **Land and Forestry**

	Forest area				Forest characteristics					
	total		% total land		primary forest		other naturally regenerated forest		planted forest	
	thousand ha 1990	thousand ha 2011	percent 1990	percent 2011	percent 1990	percent 2010	percent 1990	percent 2010	percent 1990	percent 2010
Regional office for the Near East and North Africa	98 673	22 656	6.8	1.9	16.1	15.7	75.7	73.9	8.2	10.4
Gulf Cooperation Council States and Yemen	1 777	1 853	0.6	0.6	20.3	19.4	65.6	63.0	14.1	17.6
Bahrain	0	1	0.3	0.7	0.0	0.0	0.0	0.0	100.0	100.0
Kuwait	4	6	0.2	0.4	0.0	0.0	0.0	0.0	100.0	100.0
Oman	2	2	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0
Qatar	0	0	0.0	0.0						
Saudi Arabia	977	977	0.5	0.5	36.8	36.8	63.2	63.2	0.0	0.0
United Arab Emirates	245	318	2.9	3.8	0.0	0.0	0.0	0.0	100.0	100.0
Yemen	549	549	1.0	1.0	0.0	0.0	100.0	100.0	0.0	0.0
North Africa	7 991	8 101	1.4	1.4	0.0	0.0	83.4	75.9	16.6	24.1
Algeria	1 667	1 483	0.7	0.6	0.0	0.0	80.0	72.9	20.0	27.1
Libya	217	217	0.1	0.1	0.0	0.0	0.0	0.0	100.0	100.0
Mauritania	415	237	0.4	0.2	0.0	0.0	98.8	91.3	1.2	8.7
Morocco	5 049	5 141	11.3	11.5	0.0	0.0	90.5	87.9	9.5	12.1
Tunisia	643	1 022	4.1	6.6	0.0	0.0	54.4	31.4	45.6	68.6
Other Near East Countries	88 905	12 702	15.5	3.8	17.5	17.2	75.2	73.9	7.3	8.9
Egypt	44	71	0.0	0.1	0.0	0.0	0.0	0.0	100.0	100.0
Iran (Islamic Republic of)	11 075	11 075	6.8	6.8	1.8	1.8	90.6	90.6	7.6	7.6
Iraq	804	825	1.8	1.9	0.0	0.0	98.1	98.2	1.9	1.8
Jordan	98	98	1.1	1.1		0.0		51.9		48.1
Lebanon	131	137	12.8	13.4		0.0		92.3		7.7
Sudan										
Sudan (former)	76 381		32.1		20.0	20.0	72.9	71.3	7.1	8.7
Syrian Arab Republic	372	497	2.0	2.7	0.0	0.0	53.1	40.2	46.9	59.8
Regional Office for Africa	724 070	592 369	32.1	27.9	2.2	11.9	97.4	85.6	0.4	13.1
Regional Office for Asia and the Pacific	744 278	1 567 564	24.3	31.3	41.8	36.4	55.1	53.1	3.2	10.5
Regional Office for Europe and Central Asia		1 031 346		38.3	22.4	23.1	70.2	68.1	7.4	8.8
Regional Office for Latin America and the Caribbean	1 039 686	942 806	51.6	46.8	75.1	72.9	24.0	25.0	0.9	2.0
World	4 168 399	3 957 571	32.0	31.0	28.0	38.2	69.1	52.9	3.0	9.9

TABLE 44: **Forestry production and trade**

	Production of selected forest products							
	industrial roundwood		woodfuel		roundwood			
	total	p.a. growth	total	p.a. growth	total	p.a. growth	export	import
	thousand m^3 2011-12	percent 1962-2012	thousand m^3 2011-12	percent 1962-2012	thousand m^3 2011-12	percent 1962-2012	thousand m^3 2011-12	thousand m^3 2011-12
Regional office for the Near East and North Africa	4 059		53 680	1.3	57 738	1.2	40.9	964.5
Gulf Cooperation Council States and Yemen	0		823	4.2	823	4.2	18.7	229.4
Bahrain	0		7	2.0	7	2.0	0.5	4.6
Kuwait	0		19	5.0	19	5.0	0.9	1.1
Oman	0		41	4.9	41	4.9	0.1	19.0
Qatar	0		5	6.2	5	6.2	2.4	1.4
Saudi Arabia	0		261	5.7	261	5.7	2.3	34.5
United Arab Emirates	0		18	8.7	18	8.7	12.5	157.7
Yemen	0		472	3.1	472	3.1	0.0	11.2
North Africa	848		20 143	1.5	20 991	1.4	5.8	298.7
Algeria	139	0.2	8 317	2.1	8 455	2.1	0.3	6.4
Libya	116	3.4	975	2.4	1 091	2.5	0.0	5.1
Mauritania	3	0.0	1 919	2.1	1 922	2.1	0.3	31.5
Morocco	372	0.2	6 741	0.5	7 113	0.5	5.1	244.5
Tunisia	218	2.9	2 191	1.1	2 409	1.2	0.1	11.2
Other Near East Countries	3 211		32 713	1.1	35 924	1.0	16.4	436.4
Egypt	268	3.1	17 601	1.1	17 869	1.1	2.8	269.3
Iran (Islamic Republic of)	660	−4.1	45	−6.4	705	−4.3	0.1	85.9
Iraq	59	1.9	118	3.2	177	2.6	0.0	3.8
Jordan	4	1.4	318	3.2	322	3.2	0.2	1.8
Lebanon	7	−0.2	19	−1.4	26	−1.1	1.3	74.9
Sudan	2 173		14 583		16 756		9.8	0.6
Sudan (former)								
Syrian Arab Republic	40	0.6	30	−1.0	70	−0.3	2.2	0.1
Regional Office for Africa	69 067	2.5	586 388	2.2	655 455	2.1	3 898.2	166.3
Regional Office for Asia and the Pacific	492 829		791 993	0.4	1 284 822	0.6	45 379.5	60 337.6
Regional Office for Europe and Central Asia	548 725		158 139		706 864		61 838.4	55 978.3
Regional Office for Latin America and the Caribbean	221 276	4.2	289 182	1.2	510 458	2.1	1 430.0	242.5
World	1 652 146		1 882 369	1.1	3 534 516	1.1	116 680.1	124 720.0

TABLE 45: **Forestry production: finished products**

	Production of selected forest products							
	sawnwood		wood-based panels		wood pulp		paper and paperboard	
	total	p.a. growth	total	p.a. growth	total	p.a. growth	total	p.a. growth
	thousand m^3	percent	thousand m^3	percent	thousand tonnes	percent	thousand tonnes	percent
	2011-12	1962-2012	2011-12	1962-2012	2011-12	1962-2012	2011-12	1962-2012
Regional office for the Near East and North Africa	285		1 743		508		3 290	
Gulf Cooperation Council States and Yemen	0		0		0		1 530	
Bahrain	0		0		0		15	
Kuwait	0		0		0		57	
Oman	0		0		0		4	
Qatar	0		0		0		3	
Saudi Arabia	0		0		0		1 150	
United Arab Emirates	0		0		0		300	
Yemen	0		0		0		1	
North Africa	161		189		221		337	
Algeria	13	−3.0	48		0		46	1.2
Libya	31	4.2	0		0		6	1.8
Mauritania	14		2		0		1	
Morocco	83	2.7	35	3.4	221	4.7	127	2.2
Tunisia	20	4.3	104		0		157	7.8
Other Near East Countries	124		1 554		288		1 423	
Egypt	12		59	3.2	41		660	4.1
Iran (Islamic Republic of)	31	−2.7	1 415		246		515	9.7
Iraq	12	2.4	5		0		13	
Jordan	0		0		0		54	
Lebanon	9	1.3	46	0.7	0		103	8.0
Sudan	51		2		0		3	
Sudan (former)								
Syrian Arab Republic	9	1.1	27	1.8	0		75	
Regional Office for Africa	8 353		2 623		2 371		2 748	
Regional Office for Asia and the Pacific	140 473		165 941		39 878		184 549	
Regional Office for Europe and Central Asia	143 131		81 610		47 314		107 209	
Regional Office for Latin America and the Caribbean	42 296	2.6	17 538		22 174		20 078	
World	408 768		299 008		173 722		399 734	

TABLE 46: **Water withdrawal and pressure on renewable water resources**

	Water withdrawal by sector				Water withdrawal		% of renewable freshwater resources withdrawn	
	Years	% of total			total	per capita	total	by agriculture
	years	agricultural percent	industrial percent	municipal percent	million m^3/yr	m^3/yr/cap	percent	percent
	1975-2010	2010*	2010*	2010*	2010*	2010*	2010*	2010*
Regional office for the Near East and North Africa								
Gulf Cooperation Council States and Yemen								
Bahrain	2 003	44.5	5.7	49.8	357	386	205.8	137.2
Kuwait	2 002	53.9	2.3	43.9	913	441	2 075.0	2 460.0
Oman	2 003	88.4	1.4	10.1	1 321	516	83.9	83.4
Qatar	2 005	59.0	1.8	39.2	444	377	381.0	451.7
Saudi Arabia	2 006	88.0	3.0	9.0	23 670	928	936.2	867.9
United Arab Emirates	2 005	82.8	1.7	15.4	3 998	740	1 867.0	2 208.0
Yemen	2 005	90.7	1.8	7.4	3 565	162	168.6	154.0
North Africa								
Algeria	2 000	63.9	13.5	22.5	6 161	196	52.7	33.8
Libya	2 000	82.8	3.1	14.1	4 326	796	609.7	512.0
Mauritania	2 000	93.7	1.6	4.7	1 601	572	14.0	13.2
Morocco	2 000	87.3	2.9	9.8	12 607	428	43.5	38.0
Tunisia	2 000	82.0	4.2	13.8	2 640	296	61.3	47.1
Other Near East Countries								
Egypt	2 000	86.4	5.9	7.8	68 300	973	94.7	103.0
Iran (Islamic Republic of)	2 004	92.2	1.2	6.6	93 300	1 306	67.7	62.6
Iraq	2 000	78.8	14.7	6.5	66 000	2 616	87.3	68.8
Jordan	2 005	65.0	4.1	31.0	941	166	90.5	65.2
Lebanon	2 005	59.5	11.5	29.0	1 310	317	18.6	17.3
Sudan								
Sudan (former)	2 000	97.1	0.6	2.3	37 140	1 037	57.6	55.9
Syrian Arab Republic	2 003	87.5	3.7	8.8	16 760	867	86.4	87.3
Regional Office for Africa								
Regional Office for Asia and the Pacific								
Regional Office for Europe and Central Asia								
Regional Office for Latin America and the Caribbean								
World								

TABLE 47: **Species threatened and nationally protected areas**

	Threatened species				Nationally protected areas			
	mammals	birds	fish	higher plants	terrestrial		territorial waters	
	species 2012	species 2012	species 2012	species 2012	% of total land area percent 1990	% of total land area percent 2010	% of territorial waters percent 1990	% of territorial waters percent 2010
Regional office for the Near East and North Africa	219	209	460	245	3.9	7.9		
Gulf Cooperation Council States and Yemen	46	64	118	168	6.4	23.0		
Bahrain	3	3	8	0	1.3	1.3	0	0.7
Kuwait	6	8	11	0	1.6	1.6	0	0.0
Oman	9	10	27	6	0.0	10.7	0	1.3
Qatar	3	4	11	0	1.7	2.5	0	0.3
Saudi Arabia	9	15	24	3	7.6	31.3	1	3.4
United Arab Emirates	7	9	13	0	0.3	5.6	0	2.6
Yemen	9	15	24	159		0.5	0	1.8
North Africa	72	46	172	51	2.9	2.9		
Algeria	14	11	36	13	6.3	6.3	0	0.3
Libya	12	4	24	3	0.1	0.1	0	0.1
Mauritania	16	13	32	0	0.5	0.5	32	32.1
Morocco	17	11	45	29	1.2	1.5	1	1.3
Tunisia	13	7	35	6	1.3	1.3	1	1.2
Other Near East Countries	101	99	170	26	3.6	4.9		
Egypt	18	10	40	2	1.9	5.9	4	9.3
Iran (Islamic Republic of)	16	22	30	2	5.2	7.1	1	1.7
Iraq	13	16	11	1	0.1	0.1	0	0.0
Jordan	13	10	13	1	0.7	1.9	0	30.0
Lebanon	10	9	22	1	0.5	0.5	0	0.1
Sudan	15	17						
Sudan (former)			20	17	4.2	4.2	0	0.0
Syrian Arab Republic	16	15	34	2	0.3	0.6	0	0.6
Regional Office for Africa	728	751	1 765	2 555	10.8	11.7		
Regional Office for Asia and the Pacific	1 147	1 204	1 549	2 978	9.0	10.5		
Regional Office for Europe and Central Asia	328	478	1 047	648		9.0		
Regional Office for Latin America and the Caribbean	599	960	1 051	4 090	9.7	20.2		
World	3 075	3 753	6 229	11 212	9.1	12.3		

TABLE 48: **Agri-environmental indicators**

	Stock of						Organic water pollutant (BOD) emissions	
	cattle and buffaloes		sheep and goats		poultry birds			
	per ha of agricultural area head/ha	per ha of agricultural area head/ha	per ha of agricultural area head/ha	per ha of agricultural area head/ha	per ha of agricultural area head/ha	per ha of agricultural area head/ha	kg/day	kg/day/worker
	2000	2011	2000	2011	2000	2011	2005-06*	2005-06*
Regional office for the Near East and North Africa	0.1	0.1	0.5	0.8	1.9	6.9		
Gulf Cooperation Council States and Yemen	0.0	0.0	0.1	0.2	1.0	1.4		
Bahrain	1.2	1.2	4.6	7.1	53.3	64.6		
Kuwait	0.1	0.2	5.2	4.3	177.8	210.5		
Oman	0.3	0.2	1.2	1.2	3.2	2.5	6 631	0.2
Qatar	0.2	0.2	6.0	6.5	63.8	121.2	6 388	0.1
Saudi Arabia	0.0	0.0	0.1	0.1	0.7	0.9	106 621	0.2
United Arab Emirates	0.2	0.3	3.2	8.3	22.1	52.9		
Yemen	0.1	0.1	0.6	0.8	1.3	2.6	46 526	0.2
North Africa	0.0	0.1	0.5	0.6	2.5	3.2		
Algeria	0.0	0.0	0.5	0.7	2.8	3.1		
Libya	0.0	0.0	0.3	0.6	1.6	2.2		
Mauritania	0.0	0.0	0.3	0.4	0.1	0.1		
Morocco	0.1	0.1	0.7	0.8	4.5	6.1	79 829	0.2
Tunisia	0.1	0.1	0.9	0.8	6.7	8.3		
Other Near East Countries	0.3	0.3	0.9	1.5	2.3	15.5		
Egypt	2.1	2.3	2.4	2.6	36.1	39.7		
Iran (Islamic Republic of)	0.1	0.2	1.3	1.5	4.0	18.5	160 776	0.2
Iraq	0.2	0.2	1.0	1.2	2.8	4.6		
Jordan	0.1	0.1	2.2	3.0	22.0	26.1	27 208	0.2
Lebanon	0.1	0.1	1.3	1.0	52.1	59.6		
Sudan								
Sudan (former)	0.3		0.6		0.3			
Syrian Arab Republic	0.1	0.1	1.1	1.5	1.7	2.0	77 854	0.2
Regional Office for Africa	0.2	0.3	0.4	0.5	0.8	1.3		
Regional Office for Asia and the Pacific	0.3	0.4	0.5	0.5	3.9	6.5		
Regional Office for Europe and Central Asia	0.2	0.2	0.3	0.3	2.8	3.3		
Regional Office for Latin America and the Caribbean	0.5	0.6	0.2	0.2	3.1	4.2		
World	0.3	0.3	0.4	0.4	3.3	4.8		

TABLE 49: **Water pollution**

	Water pollution							
	% of total BOD emissions							
	chemical industry percent 2005-06*	clay and glass industry percent 2005-06*	food industry percent 2005-06*	metal industry percent 2005-06*	other industry percent 2005-06*	paper and pulp industry percent 2005-06*	textile industry percent 2005-06*	wood industry percent 2005-06*
Regional office for the Near East and North Africa								
Gulf Cooperation Council States and Yemen								
Bahrain								
Kuwait								
Oman	16.3	23.7	21.6	4.3	21.6	5.1	5.2	2.1
Qatar	10.5	18.1	6.5	3.7	21.3	6.7	20.7	12.5
Saudi Arabia	11.6	10.7	20.0	3.2	30.0	6.9	14.4	3.3
United Arab Emirates								
Yemen	7.4	14.6	35.9		19.4	2.1	15.5	5.1
North Africa								
Algeria								
Libya								
Mauritania								
Morocco	8.7	9.5	17.4	1.0	16.7	2.8	42.1	1.9
Tunisia								
Other Near East Countries								
Egypt								
Iran (Islamic Republic of)	12.8	13.8	16.1	7.1	35.5	2.8	11.2	0.7
Iraq								
Jordan	14.7	11.6	21.6	2.5	24.2	6.1	16.8	2.6
Lebanon								
Sudan								
Sudan (former)								
Syrian Arab Republic	7.1	11.4	20.2	1.5	20.9	1.9	32.0	5.1
Regional Office for Africa								
Regional Office for Asia and the Pacific								
Regional Office for Europe and Central Asia								
Regional Office for Latin America and the Caribbean								
World								

TABLE 50: **Renewable feedstocks**

	Production		Organic agriculture	Production			
	biofuel		% of total area	natural fibre		recovered paper	
				total			
	thousand kilotonne of oil equivalent 2000	thousand kilotonne of oil equivalent 2009	percent 2011	thousand tonnes 1992	thousand tonnes 2011	thousand tonnes 2000	thousand tonnes 2012
Regional office for the Near East and North Africa	3.5	4.2				753	2 247
Gulf Cooperation Council States and Yemen	0.1	0.1				190	1 665
Bahrain	0.0	0.0				0	40
Kuwait	0.0	0.0				15	170
Oman	0.0	0.0	0.0			0	80
Qatar	0.0	0.0				0	0
Saudi Arabia	0.0	0.0	0.0			75	1 000
United Arab Emirates	0.0	0.0	0.2			100	375
Yemen	0.1	0.1		4.3	8.5	0	0
North Africa	1.6	2.0				110	107
Algeria	0.1	0.1	0.0	0.0	0.0	37	32
Libya	0.1	0.2				0	0
Mauritania	0.0	0.0				0	0
Morocco	0.4	0.5	0.1	4.8	1.5	35	35
Tunisia	0.9	1.3	1.8	0.5	0.6	38	40
Other Near East Countries	1.8	2.1				453	475
Egypt	1.3	1.6	2.2	383.1	147.4	350	380
Iran (Islamic Republic of)	0.4	0.4	0.1	101.0	73.4	80	80
Iraq	0.0	0.0		2.7	12.0	11	6
Jordan	0.0	0.0	0.3			12	3
Lebanon	0.1	0.1	0.5			0	0
Sudan	0.0	0.0				0	6
Sudan (former)				59.6	27.3		
Syrian Arab Republic	0.0	0.0	0.1	255.0	151.3	0	0
Regional Office for Africa	188.2	244.2		1 035.1	1 264.1	839	1 205
Regional Office for Asia and the Pacific	521.2	560.7	0.8			42 391	90 639
Regional Office for Europe and Central Asia	69.9	104.7	1.4		3 162.5	44 837	56 745
Regional Office for Latin America and the Caribbean	90.7	123.6	0.9	1 830.2	2 911.1	5 533	10 311
World	942.0	1 120.4				142 814	212 516

TABLE 51: **Agricultural emissions**

	Enteric fermentation	Manure management	Rice cultivation	Synthetic fertilizers	Manure applied to soils	Manure left on pasture	Crop residues	Cultivated organic soils	Burning crop residues
	gigagrams CO_2eq 2010	gigagrams CO_2eq 2010	gigagrams CO_2eq 2010	gigagrams CO_2eq 2010	gigagrams CO_2eq 2010	gigagrams CO_2eq 2010	gigagrams CO_2eq 2010	gigagrams CO_2eq 2010	gigagrams CO_2eq 2010
Regional office for the Near East and North Africa	57 726	6 346	5 781	17 311	4 986	37 525	4 417	0	635
Gulf Cooperation Council States and Yemen	6 679	475	0	2 001	334	5 793	191	0	15
Bahrain	15	1	0	16	1	14	0	0	0
Kuwait	104	27	0	42	34	216	0	0	0
Oman	609	35	0	0	10	430	2	0	0
Qatar	102	11	0	529	8	76	0	0	0
Saudi Arabia	1 466	161	0	1 071	167	1 693	107	0	7
United Arab Emirates	774	53	0	189	23	454	0	0	0
Yemen	3 609	187	0	154	91	2 910	80	0	8
North Africa	17 054	960	195	1 927	536	13 465	1 071	0	168
Algeria	4 621	246	1	294	146	3 900	366	0	54
Libya	1 265	66	0	305	37	1 134	24	0	4
Mauritania	4 067	194	151	0	34	2 136	24	0	2
Morocco	5 257	324	44	881	220	4 650	576	0	96
Tunisia	1 844	129	0	447	100	1 645	81	0	12
Other Near East Countries	33 992	4 911	5 585	13 383	4 116	18 268	3 155	0	452
Egypt	9 828	721	2 702	9 198	170	3 962	997	0	118
Iran (Islamic Republic of)	18 287	3 854	2 601	2 520	3 734	9 445	1 511	0	236
Iraq	2 615	157	282	697	96	1 915	308	0	48
Jordan	378	31	0	102	29	414	6	0	1
Lebanon	134	25	0	98	43	275	16	0	1
Sudan	0	0	0	0	0	0	0	0	0
Sudan (former)									
Syrian Arab Republic	2 750	122	0	769	45	2 256	316	0	48
Regional Office for Africa	228 466	14 842	23 645	8 309	6 520	157 705	7 777	5 177	2 288
Regional Office for Asia and the Pacific	809 434	169 122	457 990	435 707	127 041	264 047	74 036	56 496	9 150
Regional Office for Europe and Central Asia	274 240	99 643	7 909	100 457	48 548	49 963	27 897	29 124	3 218
Regional Office for Latin America and the Caribbean	526 629	22 670	17 027	47 721	23 512	208 745	19 177	1 605	2 757
World	1 960 484	348 079	519 531	682 636	220 255	741 025	152 903	99 048	19 702