Towards sustainable development in the Mediterranean: challenges to face

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State of Mediterranean Forests

There is a close relationship between development and environmental issues in the Mediterranean region (Figure 1.1). With a population (in 2010) of 507 million people on three continents and an extremely rich natural and cultural heritage, the Mediterranean is an “ecoregion”, in which human and economic development is largely dependent on sometimes-scarce natural resources and a vulnerable environment. After thousands of years of co-evolution between ecosystems and societies, human activities are creating substantial environmental pressure, with significant disparities between the northern, southern and eastern rims. This chapter gives a regional overview of the challenges facing forest management in the Mediterranean region.

The Mediterranean region in numbers, 2010

- 6.5% of land mass
- 7.7% of the global population
- 13.5% of global GDP (16.2% in 1990)
- 32% of international tourism
- 60% of people living in water-poor countries globally
- 7.7% of CO$_2$ emissions

Figure 1.1. Countries of the Mediterranean region, Mediterranean bioclimatic and watershed limits. The watershed limit is defined by topography and the resulting runoff patterns of rainwater; the bioclimatic limit is the limit of the Mediterranean region in term of vegetation and climate.  
Source: Plan Bleu from Ewing et al., 2010.
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Socio-economic division on each side of the Mediterranean

The human development index (HDI), calculated according to life expectancy, education and gross domestic product (GDP) per capita, is a measure of social well-being. It shows significant disparities between countries in the Mediterranean region, particularly with respect to poverty (Figure 1.2). In 2011, the average HDI in the Mediterranean was 0.76, which was higher than the global HDI (0.68). HDI has increased steadily in all countries in the Mediterranean region since 1990, but major disparities remain. In 2011, HDI was above 0.80 for 10 of the 27 Mediterranean countries and below 0.70 in 8. Israel had the highest HDI in the Mediterranean region (0.89) and ranked 17th among 187 countries globally, while Morocco had the lowest HDI (0.58) and ranked 130th globally. HDI data suggest that poverty levels are still high in Egypt, Morocco, Palestine and the Syrian Arab Republic.

Unsustainable development trajectories

The ecological footprint (EF) measures the biologically productive surface area required to produce the resources consumed by a person or population and to absorb the waste generated (through eating, housing and travel, etc.), taking into account the resource management processes in effect. EF is expressed in global hectares (gha) per capita, where 1 gha measures the average productivity of all biologically productive areas, measured in ha, on earth in a given year. Biocapacity,

1 The EF does not take into account certain environmental impacts, such as the pollution of soil and water resources caused by agricultural practices, or toxic waste production.
Figure 1.3. Ecological footprint, Mediterranean countries, 1997 and 2007
Note: World average ecological footprint and world-average biocapacity are represented respectively in green and violet.
FYROM = The former Yugoslav Republic of Macedonia; Syria = Syrian Arab Republic.
Source: Plan Bleu from Ewing et al., 2010.

Figure 1.4. The eastern, northern and southern Mediterranean subregions.
Source: FAO.
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which is also expressed in gha, is the available biologically productive surface area and reflects the availability of natural resources. It represents the EF threshold, beyond which the use of resources is unsustainable.

Comparing the EF ("demand") and biocapacity ("supply") provides an indication of the pressure exerted by a population on natural resources and, in turn, of the environmental sustainability of that population’s lifestyle.

Biocapacity in the Mediterranean region was estimated at 1.3 gha per capita in 2007, which was 16 percent lower than in 1961 (1.5 gha per capita). It was also lower than the (2007) global value of 1.8 gha per capita. The average EF in the Mediterranean region in 2007 was 3.1 gha per capita, which was higher than the global EF of 2.7 gha per capita and much higher than the estimated biocapacity of the region. The EF in the Mediterranean region increased by 52 percent between 1961 (2.1 gha per capita) and 2007, due mainly to an increase of 185 percent in the carbon component of the EF. Components of the EF related to other natural resources did not increase to the same extent: by +29 percent for agricultural land; +23 percent for forests; +20 percent for developed land; 6 percent for pastureland; and 54 percent for fishing (Figure 1.3).

In only four countries (Algeria, Egypt, Morocco and the Syrian Arab Republic) was the EF below the biocapacity threshold in 2007 (compared with seven countries in 1997). In only four countries (Lebanon, Malta, Morocco and the Syrian Arab Republic) did the EF decrease between 1997 and 2007 (although note that numbers can fluctuate significantly from year to year).

There were significant disparities in EFs between northern Mediterranean countries (NMCs) and southern and eastern Mediterranean countries (SEMCs) (Figure 1.4 and Table 1.1). The NMCs accounted for the top 12 EFs in the Mediterranean region, while the SEMCs accounted for the lowest four. In 2007, the average EF was 4.69 gha per capita for the NMCs and 2.02 for the SEMCs.

The increase in EF in most countries in the Mediterranean region indicates growing pressure on resources as a result of unsustainable methods and levels of consumption. It also highlights the difficulty of implementing sustainable development policies.

2 Figure 1.4 shows these as three subregions, but mostly the eastern and southern subregions are dealt with collectively in the term SEMCs.
A country’s situation is considered to be compatible with sustainable development if its HDI is above 0.8 and its EF is less than 1.8 global hectares per capita (Figure 1.5). In 2007, no Mediterranean countries (and none globally) were in this “sustainable development” zone. HDI increased in all countries in the Mediterranean region between 1997 and 2007, but only two (Lebanon and Malta) significantly reduced their EFs per capita. The relatively low EFs (i.e. lower than the global average of 1.8 gha per capita) in Algeria, Egypt, Morocco and the Syrian Arab Republic are due mainly to constraints related to the arid climate in those countries. Their low HDIs reflect a high dependency on natural resources and significant levels of poverty. The challenge for countries with a median or high HDI, such as the Balkan states and the southern Mediterranean countries, is to continue their human development while implementing measures to control or decrease their EFs. The challenge for countries with very high HDIs – the European Union (EU) member states and Israel – is to maintain this level while reducing their EFs.

Demographics: stabilization in the north, transition in the south and east

The population of the Mediterranean region doubled between 1955 and 2010 (Figure 1.6), due mainly to the SEMCs, where the population increased by 238 percent in the period. In 1955, the SEMCs accounted for just over one-third of the region’s population and in 2010 they accounted for more than half. Figure 1.6 shows changes in population in the countries of the Mediterranean region between 2000 and 2010. The population in the region is projected to increase for some years (driven mainly by the SEMCs), before stabilizing and beginning to decrease by 2050 (Figure 1.7). The population is projected to start declining by 2030 in the NMCs and by 2060 in the SEMCs. The seven most populated countries (in Egypt, Turkey, France, Italy, Spain, Algeria and Morocco, in descending order by population) account for three-quarters of the Mediterranean population but have differing growth rates (Figure 1.7). Between 2000 and 2010, the population increased by 20 percent
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or more in the majority of SEMCs (Egypt, Israel, Jordan, Libya and Syrian Arab Republic) and by 11–20 percent in the other SEMCs.

Up to 1990, the population increased in all the NMCs and continued in most countries to 2010 with the exceptions of Albania, Bulgaria, Bosnia and Herzegovina, Croatia, Montenegro and Serbia, due mainly to significant emigration with the fall of the “Iron Curtain”.

Figure 1.6. Population growth in Mediterranean countries, 1950–2010.
Source: United Nations, Department of Economic and Social Affairs, Population Division, 2011

Figure 1.7. Population in Mediterranean countries, 2000 and 2010.
Note: BH = Bosnia and Herzegovina; FYROM = The former Yugoslav Republic of Macedonia; Syria = Syrian Arab Republic.
Source: United Nations, Department of Economic and Social Affairs, Population Division, 2011.
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Fertility rate (the number of children per woman of child-bearing age) is a measure of demographic dynamics. Figure 1.8 shows that the decline in fertility rate in the Mediterranean has been particularly rapid in the SEMCs. Overall, the fertility rate was above the replacement fertility rate (2.05) in all NMCs except Croatia and Malta in 1970 but in only 8 in 2010. Population growth rates vary greatly between NMCs and SEMCs but seem to be converging. Considerable structural differences remain, however: the population of the SEMCs is much younger than that of the NMCs. In the NMCs, the proportion of people aged under 15 decreased from 22.7 percent of the total population in 1990 to 16.2 percent in 2010, while the proportion of people in the over-65 age bracket increased from 10.8 percent to 15.3 percent. In the SEMCs, the proportion of people aged under 15 decreased from 40.9 percent to 30.5 percent over the period and the proportion of people aged over 65 increased from 4.1 percent to 5.5 percent. While the population in the SEMCs is projected to stabilize eventually, the current growth is accompanied by a lack of employment opportunities and is contributing to considerable social pressure.

Continuous, poorly managed and mainly coastal urban sprawl

In general, population growth in the region is concentrated in urban and coastal areas. The urban population is increasing in both the NMCs and the SEMCs (Figure 1.9); in the SEMCs, the urban population doubled between 1950 and 2010. The rural population declined in the NMCs over the period but increased in the SEMCs, where it is projected to stabilize and start declining between 2020 and 2050.

In the SEMCs, the extent and pace of urbanization is rarely planned, and urban growth is exceeding the capacity of many countries to meet infrastructural and employment needs. Depending on the country and urban area, 30–70 percent of city-dwellers in the SEMCs are able to construct their housing only by resorting (legally or illegally) to the informal sector. As a result, urban areas develop in an uncontrolled way and often lack adequate access to water, sanitation and other basic urban services.

Figure 1.8. Number of children per woman of child-bearing age, NMCs and SEMCs

Source: United Nations, Department of Economic and Social Affairs, Population Division, 2011.
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High population density in cities generates considerable problems. For example, youth unemployment is above 30 percent in several SEMCs and there is a lack of access to facilities and essential services. This urbanization is occurring mainly in coastal areas and as sprawls on the outskirts of urban centres, which intensifies pressure on resources and aggravates the fragmentation and even destruction of already vulnerable coastal and peri-urban ecosystems. Figure 1.10 shows the growth of population centres in the Mediterranean region, especially in some SEMCs and in coastal areas.

Figure 1.9. Population trends in Mediterranean countries, 1950–2050
Source: United Nations, Department of Economic and Social Affairs, Population Division, 2011.

Figure 1.10. Urban population distribution and increase in Mediterranean countries, 2011
Source: United Nations, Department of Economic and Social Affairs, Population Division, 2011.
A worrisome demographic situation, a source of environmental pressure

On the whole, the demographics of the Mediterranean region can be characterized by an increase in total population, and by significant disparities which nevertheless seem to be waning. The general trend, which is more distinct in the NMCs, is a decreasing birth rate and an aging population that should lead to a decline in the region’s population from 2050. By then, the population could exceed 626 million, a 20 percent increase over 2010. While, overall, the population of rural areas could be in decline by 2015, increasing demographic pressure in urban, peri-urban and coastal regions remains a crucial challenge. The development trajectories of Mediterranean countries appear to be unsustainable.

Growing yet unevenly distributed economic wealth

The GDP of the Mediterranean region constituted 13.5 percent of world GDP in 2010, down from 16.2 percent in 1990. GDP per capita in the region was 76 percent higher than the global average. There are major subregional disparities, with the NMCs accounting for 80 percent of total GDP in the region in 2010. This was a slight decrease from 2000 (Figure 1.11) due to a comparatively higher GDP growth rate in the SEMCs, where GDP increased by 48 percent in the decade compared with 12 percent in the NMCs.

Figure 1.12 confirms the disparity between NMCs and SEMCs. For example, nine of the ten countries with the highest GDP per capita in the region are NMCs, and five of the ten countries with the lowest GDP per capita are SEMCs. These differences are considerable: the GDPs per capita in Cyprus and France are ten times higher than those in the Syrian Arab Republic and Algeria, respectively. The Balkan states are an intermediate group. GDP per capita is above US$10,000 in Greece and Slovenia and about US$6,000 in Croatia, but it is similar to the southern Mediterranean countries in the other Balkan states.
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Unemployment, especially among the young

Figure 1.13 shows that, in 2010, unemployment exceeded 20 percent of the working population in The former Yugoslav Republic of Macedonia, Palestine and Spain. In most other countries in the Mediterranean region, unemployment was roughly 10 percent, which was well above the world average of 6–7 percent. Unemployment among people aged under 25 remains worryingly high in most countries in the region.

Towards economies based on an expanded service sector

In the Mediterranean region and especially in the NMCs, the economy is increasingly dominated by services. In the NMCs an increase in services has corresponded with a decline in the contribution of the agricultural and industrial sectors: services generated 60 percent of GDP in 1998 and 67 percent in 2008, while the contribution of agriculture decreased from 10 percent to 6 percent over the period and industry’s contribution decreased from 30 percent to 27 percent. In the SEMCs, the contribution to GDP is growing for the industry (from 32 percent in 1998 to 35 percent in 2008) and services (from 54 percent to 55 percent) sectors, and declining for agriculture (from 14 percent to 10 percent).

In both the NMCs and the SEMCs, agriculture is therefore less dynamic than other sectors of the economy, despite an increase in the added value it generates. The rural exodus to cities is clear in the demographic data. The agricultural population has been in decline since the 1960s in the NMCs and since the mid 1980s in the SEMCs (Figure 1.14). In the NMCs, the agricultural population decreased by half between 1995 and 2010 (to 11 million people). In the SEMCs, the agricultural population declined from 69 million people in 1985 to...
60 million in 2010. This decline is projected to continue to at least 2020 in both subregions. The rapidly growing total population, and its urbanization, is having an effect on the availability of arable land (Figure 1.15). In 2009, arable land comprised 2.5 percent of the total land area in the NMCs and only 0.6 percent in the (often more arid) SEMCs. The area of arable land per capita continues to decrease, diminishing by half in 40 years. In several NMCs, rural abandonment, with a spontaneous forest recovery, explains most of the changes observed on the availability of arable land.

Tourism is an emblematic economic sector in the Mediterranean region. Tourist arrivals in the region increased by 100 million between 1997 and 2008; in 2010, tourist arrivals in the region represented 32 percent of global tourism. Tourism spending comprises 1.5–2 percent of GDP in the Mediterranean region, although there are major national and local disparities. In 2010, for example, foreign tourist spending accounted for 13 percent of GDP in Lebanon and 0.7 percent in Turkey. There are significant local differences in Turkey; for example, tourism accounted for more than 60 percent of the GDP of Alanya Province in 2011.

Mediterranean tourism is dominated by three countries: France, Spain and Italy. In 2010, these countries received approximately 60 percent of all inbound tourists in the Mediterranean (26 percent, 18 percent and 15 percent, respectively) and 70 percent of their spending (Figure 1.16). Although the tourism sector is responsible for the direct redistribution of wealth through the jobs that it generates, it is sensitive to economic downturns and, in at least some SEMCs, to political disturbances. The wealth and jobs generated by tourism benefit local people to only a moderate degree as the use of foreign seasonal workers is widespread.
**Interdependent economies**

The NMCs have traditionally been somewhat dependent on the SEMCs for their energy needs, and the SEMCs have typically had a level of dependence on the NMCs for financial flows (aside from direct investments). In addition to investments, the southern Mediterranean countries and eastern European Mediterranean countries (i.e. the Balkans, excluding Greece) receive foreign capital through public aid mechanisms and the transfer of funds from workers living abroad. These financial flows are significant economic levers and demonstrate varying degrees of dynamism and economic dependence (Figure 1.17). Foreign direct investment is the main financial flow to eastern Mediterranean countries. Funds transferred from people living abroad were the main financial flow to southern Mediterranean countries in 2007–2010, although foreign direct investment is also increasing. Inflows from people living abroad are particularly high in the Maghreb and contribute to the balance of external accounts. However, they are mainly used to purchase consumer goods and real estate.

The relative share of public aid is decreasing: it accounted for 18 percent of incoming funds in the SEMCs in 1999–2002 and 10 percent in 2007–2010. The relative increase in foreign direct investment in SEMCs suggests that their economies are becoming increasingly dynamic and capable of generating their own income.

The EU is the main economic partner of the SEMCs, particularly in the Maghreb. These strong interdependencies should continue to grow, especially in gas and electricity, further strengthening economic ties between the subregions.

**North–south integration: between free trade priorities and sustainable development objectives**

In the Mediterranean, conflicts and other instability have affected several Middle Eastern and Balkan countries and subregions in the last 30 years. In the northern Mediterranean, the inclusion of several Mediterranean countries in the EU contributed to significant progress in terms of peace, democracy and economic and political integration. In the south and east, however, there is no equivalent integration process. Despite several initiatives, the region remains subject to persistent conflicts and a lack of structured cooperation.

**Figure 1.17.** Sources of financial flows to Mediterranean countries, 1999–2002, 2003–2006 and 2007–2010

**Source:** Plan Bleu from World Bank, 2011.
The Euro-Mediterranean Partnership, or “Barcelona Process”, was initiated in 1995 with the ambitious goal of creating an “area of stability and shared prosperity”. However, this Euro-Mediterranean cooperation, integrated into the European Neighbourhood Policy since 2003, still needs to be improved in terms of resources, reciprocal commitments and spill-over effects. Up to 2008, the Euro-Mediterranean Partnership focused mainly on security and trade liberalization, with the aim of creating a free-trade zone and bilateral approaches. It did little to include environmental and sustainable development issues in its priorities and funding.

The Action Plan for the Mediterranean (1975) and the Convention for Protection against Pollution in the Mediterranean (1976, known as the Barcelona Convention) were established under the aegis of the United Nations Environment Programme and provide the institutional framework for regional cooperation is centred specifically on environmental protection and sustainable development. These regional plans originally targeted marine pollution and were broadened in 1995 to include other sustainable development issues (e.g. energy, transport, tourism and rural development). This dynamic was reinforced in 1996 with the creation of the Mediterranean Commission on Sustainable Development (MCSD). The MCSD acts as a consultative body and is designed as a forum for dialogue, exchange and proposals for its Parties and their partners. It has 36 members, with representatives from networks of local authorities, socio-economic players and NGOs specialized in the environment and sustainable development. In 2001, the Parties of the Barcelona Convention asked the MCSD to develop the Mediterranean Strategy for Sustainable Development (MSSD), which was adopted in 2005.

The MSSD promotes the gradual integration of environmental concerns into economic development through the following objectives:

- contribute to economic development by enhancing Mediterranean assets;
- reduce social disparities by implementing the Millennium Development Goals and strengthen cultural identities;
- change unsustainable production and consumption patterns and ensure the sustainable management of natural resources;
- improve governance at the local, national and regional levels.

The MSSD identifies seven priority areas of action: integrated management of water resources and demand; improved rational use of energy with increased renewable energy use and mitigation of, and adaptation to, climate change; sustainable mobility through appropriate transport management; sustainable tourism as a leading economic sector; sustainable agriculture and rural development, including the sustainable management of forests; sustainable urban development; and sustainable management of the sea, coastal areas and marine resources.

By reinforcing these initiatives launched within the framework of the Barcelona Process, the Union for the Mediterranean was created in 2008 with the goal of improving the political visibility of regional integration and to facilitate this in the areas of water, the environment, transport, energy, education and research, and support for small and medium-sized enterprises. The Union for the Mediterranean has 44 members – the countries of the EU and the Mediterranean region as well as Jordan, Mauritius and the Arab League. Libya is an observer nation.

This 20-year regional process has been critical in achieving more structured governance in the Mediterranean, which has nevertheless been affected by the fragmentation process that has also been seen at the global scale. The MCSD was innovative in its integration of civil society from inception, but its operation and relationships with governments and international players have revealed weaknesses. The MCSD could benefit from closer collaboration in the social and economic areas of sustainable development in order to achieve greater regional cooperation.
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Increasing pressures on the environment

At the heart of development in the Mediterranean region are environmental pressures arising from its growing population, especially in the south and east, the increasing exploitation of natural resources, particularly water, and intensified natural risks associated with climate change. Natural land ecosystems in the Mediterranean are rich in biodiversity, with a high level of endemism, and there has been a significant increase in forests in the north due to the abandonment of marginal agricultural lands and tree-planting campaigns. In the south, forest ecosystems are still threatened, particularly in the Maghreb, due to clearing and farming on marginal lands and overgrazing. Closely integrated into local and regional economies since Antiquity, traditional uses of wooded lands and pastoral areas are being increasingly abandoned in the north but are still essential in the south. The ecosystem services provided by these areas – such as the protection of soil and water, protection against erosion and desertification, carbon sequestration and biodiversity conservation – are increasingly recognized. However, these services are threatened by degradation. Pressures include overuse in the south and, in the north, an increasing risk of forest fire as forest fuel loads increase and the climate becomes drier.

The ecological footprints and more generally the development trajectories of Mediterranean countries show alarming signs of unsustainability. Key points concerning pressures on resources and the main risk factors are described below.

Threatened biodiversity

The Mediterranean region is a highly complex environment due to the interactions between multiple factors such as climate, geomorphology, soil, hydrology and land use. It is estimated that around 25,000 plant species inhabit the region (Myers et al., 2000), of which about 60 percent are endemic (Thompson et al., 2005), making it one of the highest concentrations of endemic plants in the world (Myers et al., 2000). The region is regarded as a biodiversity hotspot because of its high endemism and because it is experiencing a widespread loss of habitat, making its conservation a priority. Table 1.2 details this species’ diversity and the levels of endemism and threat.

Mediterranean ecosystems have been strongly linked to human activity for millennia. The current high level of endemism and of genetic diversity is a positive result of this long term interaction between human activities and ecosystems. Unfortunately, the current model of development is increasing pressure on the environment with different impacts on the north and the south of the region. The current loss of biodiversity affects the economic potential by reducing human welfare (e.g. health, food and other ecosystem services) and by limiting options for the future.

Environmental pressure is rising, particularly as a result of tourism, urban concentration in coastal areas, the development of intensive agriculture, the overexploitation of natural resources, overgrazing and the abandonment of traditional agricultural practices. Some effects of these pressures, such as changes in vegetation cover and habitat loss, can be estimated, but others are very difficult to quantify.

It is estimated that only 5 percent of the original vegetation remains relatively intact in the region. According to the IUCN Red List, about 124 plant species found in forests in the Mediterranean region are threatened with extinction. For example, two oak species endemic to the Mediterranean (Quercus pauciradiata and Q. orocantabrica) are classed as critically endangered (Oldfield and...
Eastwood, 2007), Region-wide recent studies (e.g. Cuttelod et al., 2009) suggest that about 18 percent of the species in the various taxonomic groups listed in Table 1.2 are threatened with extinction. The majority of Mediterranean countries have signed the following eight multilateral agreements in the past 40 years, demonstrating their willingness to commit to ecosystem and biodiversity conservation: the Ramsar Convention; the Barcelona Convention; the Convention on International Trade in Endangered Species of Wild Fauna and Flora; the Convention on Biological Diversity; the Bern Convention; the Bonn Convention; the EU Habitats and Birds Directives; and the African Convention on the Conservation of Nature and Natural Resources. The number of protected areas (with varying degrees of protection) has also increased in the Mediterranean region in the last 40 years, to more than 4 200.

**Table 1.2. Biodiversity in the Mediterranean region**

<table>
<thead>
<tr>
<th>Taxonomic Group</th>
<th>Estimated no. of species</th>
<th>Endemic species</th>
<th>Threatened species</th>
<th>Species classified as data deficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plants</td>
<td>25 000</td>
<td>11 700</td>
<td>118*</td>
<td>1</td>
</tr>
<tr>
<td>Aquatic plants</td>
<td>469**</td>
<td>150</td>
<td>73</td>
<td>12</td>
</tr>
<tr>
<td>Invertebrates</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dragonflies and damselflies</td>
<td>162</td>
<td>23</td>
<td>31</td>
<td>5</td>
</tr>
<tr>
<td>Freshwater crabs</td>
<td>12</td>
<td>5</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Mollusc</td>
<td>155**</td>
<td>82</td>
<td>70</td>
<td>26</td>
</tr>
<tr>
<td>Fishes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marine fishes</td>
<td>515</td>
<td>75</td>
<td>43</td>
<td>149</td>
</tr>
<tr>
<td>Freshwater fishes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endemic</td>
<td>253**</td>
<td>253</td>
<td>142</td>
<td>41</td>
</tr>
<tr>
<td>Amphibians</td>
<td>112</td>
<td>76</td>
<td>34</td>
<td>0</td>
</tr>
<tr>
<td>Reptiles</td>
<td>351</td>
<td>169</td>
<td>47</td>
<td>19</td>
</tr>
<tr>
<td>Birds</td>
<td>601</td>
<td>16</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>Terrestrial mammals</td>
<td>296</td>
<td>88</td>
<td>48</td>
<td>37</td>
</tr>
<tr>
<td>Marine mammals</td>
<td>9</td>
<td>1</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

*Note:* "Threatened" = the estimated total number of species in the threatened categories of the IUCN Red List (i.e. critically endangered, endangered or vulnerable), 2012. * 50 threatened species of plants were assessed on 12 islands of the Mediterranean region, 2012. ** Number of assessed species according to the Mediterranean Red List, 2012.

*Source:* IUCN Red List and Cuttelod et al., 2009.

**Water: a scarce and unequally distributed resource**

A water-poor country is defined as a country with less than 1 000 m³ of water per person per year. Sixty percent of people living in water-poor countries globally live in the Mediterranean region. There are considerable inequalities within the region in terms of water availability and the extent of renewable resource use. In 2009, France, Italy, Spain and Turkey accounted for 67 percent of renewable fresh water resources (flows available within their own borders on an annual basis) in the region.

About 18 percent of Mediterranean species are threatened with extinction. Five oak species endemic to the Mediterranean are threatened with extinction. Protected areas are unequally distributed in the region, more than 90 percent being in the northern part of the region.
The SEMCs accounted for a little more than one-quarter (27 percent) of the region’s water resources in 2009 (Figure 1.18). If Turkey is excluded, they accounted for only 6 percent, yet they are home to 40 percent of the region’s population.

The per capita availability of water, including imported quantities, shows similar disparities between NMCs and SEMCs (Figure 1.19). With the exception of Lebanon and Turkey, less than 1 000 m³ of water is available per person per year in southern Mediterranean countries, and the value is less than 500 m³ per person per year in six of those countries and as little as 94 m³ per person per year in Libya. The Balkan states are in a more favourable situation, with more than 5 000 m³ per person per year in five of the seven countries.

The water exploitation index for natural renewable freshwater resources is used to measure the relative pressure on those resources arising from their annual use (Figure 1.20). Exploitation above 40 percent of the sustainably available resource indicates a situation of severe water stress (i.e. the water exploitation index exceeds the water stress threshold). This is the case in Egypt, Libya, Malta, Israel and the Syrian Arab Republic, where the index exceeds 80 percent. With the exception of Malta, no NMCs have an index value above 40 percent. Of the SEMCs, Turkey is the only country with an index value below 30 percent.

![Figure 1.18. Water resources, Mediterranean countries, 2012](source: FAOSTAT, 2012, AQUASTAT database)

![Figure 1.19. Water resources per inhabitant, Mediterranean countries, 2012](source: FAOSTAT, 2012, AQUASTAT database)
It has been estimated that, by 2070, the area of land in the NMCs experiencing occasional water stress will have increased by 19–35 percent (Margat and Blinda, 2005). Where water demand has stabilized, efforts are focused on conservation and the use of non-conventional resources (e.g. wastewater treatment and desalination). In the SEMCs, where demand could increase by 18 percent by 2025 (Margat and Blinda, 2005), priorities for reducing vulnerability to water shortages include the management of demand and usage; the efficient use of water during transport and distribution, by users and in irrigation; and wastewater treatment.

**Growing energy demand met mainly by fossil fuels**

To meet rapidly increasing energy consumption due to the growth of both population and economies, the Mediterranean region is facing pressure in energy supply, transport and distribution. More than 80 percent of current energy demand of the Mediterranean region is met by fossil fuels. Renewable energies (hydroelectricity, biomass, wind, solar and geothermal energy) represent 6.7 percent of the regional energy supply, and nuclear energy supplies the remaining 13.3 percent. In 2007, Mediterranean countries imported 35 percent of their energy needs from other regions (Figure 1.21). With a total consumption of 688 million tonnes of oil equivalent, per capita energy consumption in the Mediterranean region is 13 percent higher than the global average. Between 1971 and 2007, energy consumption in the region more than doubled, including a four-fold increase in the share of electricity. The NMCs are the largest energy consumers, although the gap with the SEMCs is shrinking. The ratio of per capita energy consumption between the NMCs and the SEMCs declined from 8:1 in 1971 to 3.6:1 in 2007. Fuelwood remains an essential source of energy in the SEMCs, especially for rural people, which can cause degradation of the resource in case of lack of sustainable management options. It can also be an opportunity for the development of wood energy value chains in sustainable-managed forest ecosystems.

![Figure 1.20.](image-url) **Figure 1.20.** Water exploitation index for natural renewable freshwater resources in Mediterranean countries, 2012

**Note:** BH = Bosnia and Herzegovina; FYROM = The former Yugoslav Republic of Macedonia; Syria = Syrian Arab Republic.

**Source:** Plan Bleu from Ewing et al., 2010.
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Net intra-Mediterranean trade reached nearly 97 million tonnes of oil, 74 billion m$^3$ of gas and 70 terawatts (TWh) of electricity in 2006. Oil and gas exporting countries (Algeria, Egypt, Libya and the Syrian Arab Republic) supplied 22 percent of oil and met over 35 percent of the demand for gas in France, Greece, Italy, Slovenia, Spain and Turkey. Electricity trading accounted for only a minor part of overall consumption; about one-tenth of all intra-Mediterranean trade in electricity (approximately 7.5 TWh) was between SEMCs.

Increases in energy consumption and particularly the consumption of fossil fuels was a major cause of increases in greenhouse gas emissions between 1999 and 2008 in all Mediterranean countries except Israel and Portugal (Figure 1.22). In 2008, total emissions of greenhouse gases (carbon dioxide equivalent) in the Mediterranean region were 2 487 million tonnes, a 15 percent increase over 1999. The NMCs were responsible for 63 percent of these emissions, and France, Italy and Spain alone were responsible for 48 percent. Emissions increased by 32 percent in the SEMCs over the period due to strong economic and population growth and by 7 percent in the NMCs.

Figure 1.21. Energy consumption in the Mediterranean region, 1990 and 2009

Figure 1.22. Greenhouse gas emissions, in Mediterranean countries, 1999 and 2008
Note: Other = Albania, Andorra, Cyprus, Gibraltar, Malta, Palestine, The former Yugoslav Republic of Macedonia.
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Soil degradation and land-use change proceed at alarming pace

Urbanization, population growth and the overexploitation of resources lead to concerns about soil degradation and the loss of arable land (Figure 1.23). Land degradation decreases agricultural productivity and compromises essential ecosystem services and is a major factor in poverty and biodiversity loss.

At the European level, a framework directive on soil protection was proposed in 2007. This directive reported that 45 percent of European soil is degraded and depleted of organic matter and noted that the problem was particularly pressing in the Mediterranean region. Degradation can involve erosion, settling, the loss of organic matter, salinization, landslides, the loss of soil biodiversity, acidification, desertification and subsidence. All these problems could be exacerbated by climate change.

Between 1992 and 2009, the area of arable land decreased by 7 million hectares (13 percent) in the NMCs and by 4 million hectares (9 percent) in the SEMCs. Figure 1.24 shows that there were considerable differences between countries, with losses of arable land greater than 25 percent in Croatia, Malta, Portugal and The former Yugoslav Republic of Macedonia, and gains of between 15 percent and 20 percent in Bosnia and Herzegovina and Egypt.

In some countries there was an overall increase in arable land, although this might mask local declines. In Egypt, for example, despite an overall increase in arable land due to desert reclamation, there were irreversible losses of other lands as a result of urbanization, desertification and salinization. Overgrazing is also a major cause of soil degradation in many SEMCs.

Most national governments in the Mediterranean region have ratified the United Nations Convention to Combat Desertification (UNCCD, 1994) and are committed to adopting public policies and programmes to combat desertification. National Action Programmes to Combat Desertification play an important role at the national and local levels.

Figure 1.23. Evolution of arable lands in the Mediterranean region, 1992–2009
Towards sustainable development in the Mediterranean: challenges to face

Climate change: aggravating existing problems

Hotter and drier. The effects of climate change can be seen in the Mediterranean and have begun to exacerbate already existing pressures and degradation phenomena and the vulnerability of ecosystems and populations that depend on them, leading to considerable and sometimes irreversible changes to the environment. Numerous essential economic activities in the region are and will be increasingly affected.

Global climate change affected the Mediterranean throughout the twentieth century and has clearly accelerated since 1970, with an average warming of nearly 2 °C in south-western Europe (specifically, the Iberian Peninsula and southern France). The exception is Greece, where, until the early 2000s, the average annual temperature declined. There may also have been warming in northern Africa, although this is difficult to quantify due to a lack of data. Rainfall decreased by up to 20 percent in the twentieth century in some parts of the SEMCs.

Based on IPCC scenario published in 2007, the projected changes will strongly increase in the Mediterranean region by 2100 (Figure 1.25 and Table 1.3).

Risks throughout the region, but SEMCs particularly affected. Table 1.3 shows the projected changes in temperature and precipitation in the Mediterranean region in 2100. The most significant temperature increases in the region are projected to occur in the Machrek (Egypt, Jordan, Lebanon, Palestine and the Syrian Arab Republic). There will be changes in precipitation throughout the Mediterranean region, but the projected increase in water stress in most SEMCs is alarming. Models project more frequent and serious continental droughts (fewer days of precipitation and an increase in the length of the longest periods without rain). Average annual river flow is projected to decrease,
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despite possible seasonal redistribution (e.g. more water in winter and less in spring and summer). It is also projected that extreme events will become more frequent and intense. Such changes for human activities would have direct consequences. Hotter and drier summers and more extreme events could increase the risk of fire and flooding; add to already significant pressure on water resources, particularly for agriculture; make the region less attractive for tourism; and increase the health risks associated with high temperatures and the expansion of the habitats of tropical disease-carrying insects.

Impacts on water resources. The Mediterranean region is in a serious situation of water stress. The catchment areas of Libya, southern Spain, Tunisia and the southeast Mediterranean (Israel, Lebanon, Palestine and the Syrian Arab Republic) are most vulnerable due to limited water resources and high demand (Figure 1.26; Milano et al., 2012). Moreover, these areas often use nonconventional water resources (e.g. desalination and wastewater treatment) and non-renewable resources (extracting from fossil aquifers) in addition to surface water (Qadir et al., 2007). Basins in northern Italy, western Greece and the Ebro in Spain are in a situation of moderate water stress, while the Mediterranean parts of France and the Balkans are stable.

Table 1.3. Projected changes in temperature and precipitation in the Mediterranean in 2100

<table>
<thead>
<tr>
<th>Season</th>
<th>Temperature variation (°C)</th>
<th>Precipitation variations (°C)</th>
<th>Occurrence of extreme events (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
</tr>
<tr>
<td>Winter</td>
<td>+1.7</td>
<td>+4.6</td>
<td>-16</td>
</tr>
<tr>
<td>Spring</td>
<td>+2</td>
<td>+4.5</td>
<td>-24</td>
</tr>
<tr>
<td>Summer</td>
<td>+2.7</td>
<td>+6.5</td>
<td>-53</td>
</tr>
<tr>
<td>Autumn</td>
<td>+2.3</td>
<td>+5.2</td>
<td>-29</td>
</tr>
<tr>
<td>Annual</td>
<td>+2.2</td>
<td>+5.1</td>
<td>-27</td>
</tr>
</tbody>
</table>

Source: IPCC, 2007b.

Figure 1.25. Comparison of current temperatures and rainfall, with projections for 2100

Note: DJF= December, January, February; JJA = June, July, August.

Source: IPCC, 2007b.
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Figure 1.26 shows water stress projected to 2050, when climate change is projected to lead to a significant (30–50 percent) depletion of water resources in the Mediterranean region and even greater depletion in arid to semi-arid subregions (Milano et al., 2012). Improvements in the efficiency of water transport and distribution networks, irrigation, use and consumption would limit overall water abstraction in the northern part of the region and in Morocco and Turkey. In the other SEMCs, however, water abstraction is still projected to double, particularly because of population growth. In the north, only the Ebro (in northern Spain), Albania and western Greece would experience moderate to severe water stress as a result of depleted water resources and an increase in agricultural water

Figure 1.26. Change in water use parameters in the Mediterranean in the context of global change

Note: a = available water resources for the period 1971–1990; b = projected available water resources in 2050; c = state of water abstraction for the period 2001–2009; d = projected state of water abstraction in 2050; e = current water stress; f = projected water stress in 2050 due to climatic and anthropogenic changes; <10% = no stress; 10–20% = low stress; 20–40% = moderate stress; 40–80% = high stress; >80% = severe stress.

Source: Milano et al., 2012.
use under projected hotter and drier climatic conditions. All SEMCs are projected to experience severe water stress; despite the expected low increase in water abstraction in Morocco and Turkey due to an improvement in water distribution systems and water conservation, those two countries are projected to experience severe water stress due to a decrease in water resources. Thus, while the overall situation in the NMCs may be stable, the risk is quite high in the SEMCs. In countries with the highest projected population growth and expansion of irrigated area, improvements to distribution networks and water-use practices alone will be insufficient to reduce pressure on water resources. In the medium term, under the combined effects of fewer available resources and increased use, there is likely to be an increase in water stress. The disparities between the NMCs and the SEMCs in a range of socio-economic and environmental factors are likely to intensify.

Impacts on ecosystems and biodiversity. Climate change could affect ecosystems in multiple ways, such as by reducing or expanding their extent and distribution, changing the behaviour of species and their interactions, and changing the risk of pressures such as fire, diseases and species’ invasions.

Rising temperatures cause vegetation to displace in latitude and altitude. In the Mediterranean region, it is estimated that a 1 °C increase in temperature could cause certain plant species to migrate approximately 180 km to the north or 150 m in altitude (Plan Bleu, 2009), as well as alter the distribution of pathogenic species and their vectors. Combined with periods of more severe drought, warming could lead to an increased frequency of fire, which may hinder the regeneration of species and lead to accelerated desertification. Such changes could increase the risk of extinction of a wide range of species and ecosystems.

A number of studies predict changes in certain environments. Safi (2004), for example, predicted changes in bioclimatic areas in Lebanon by 2080 and suggested that there would be an expansion of arid zones and a contraction of cooler and more humid zones (Figure 1.27). Forecasts made within the framework of the CARBOFOR project (Badeau et al., 2005) suggest that, in France, areas favourable to mountain forest and northern species will be lost by 2100, while areas favourable to species adapted to hotter and drier conditions will expand (Figure 1.28). Within a population, the effects of climate change on seasonal thermal and pluviometric variables

![Figure 1.27. Bioclimatic areas in Lebanon](image-url)

**Source:** Samir Safi, Lebanese University, Beirut, 2004.
also cause phenological modifications. Some behavioural adaptations in certain species to temporal phenomena that are favourable to growth, regeneration or reproduction could become obsolete; for example, a change in the timing of plant flowering could reduce the availability of pollinators. The metabolism of species could also be affected, with possible implications for carbon sequestration, for example. Carbon storage by vegetation, which mainly takes place during periods where there is sufficient precipitation and water in the soil, could decrease. The capabilities and pace of adaptation and movement are specific to species and are also limited by pedoclimatic factors, the fragmentation of habitats and the availability of colonizable space. The rate of species’ extinctions could therefore accelerate and endemic species are likely to be particularly affected.

Figure 1.28. Predicted changes in the ranges of forest species groups in France, 2004–2010
