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Food and Agriculture
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of the United Nations

An international journal
of forestry and forest
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Vol. 65

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242

**A NEW DYNAMIC FOR
MEDITERRANEAN FORESTS**



FOURTH MEDITERRANEAN FOREST WEEK – IV MFW

Improving livelihoods: the role of Mediterranean forest value chains in a green economy

17-20 March 2015, Barcelona

The Fourth Mediterranean Forest Week will focus on the contribution of Mediterranean forests to people's livelihoods and the economy. Aimed at experts and key stakeholders involved in the integrated management of Mediterranean woodlands, it seeks to contribute to a greener economy by tackling environmental and social challenges.

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- Energy and forests
- Tourism and forests
- Forest products
- Entrepreneurship, innovation and industry
- Tools and initiatives to support forest development
- Education and knowledge transfer

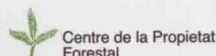
Who is it for:

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- Technical and scientific organizations, forestry experts and managers
- Forest services and forest owners
- Environmental organizations and other NGOs
- Experts from other relevant sectors: water, tourism, agriculture, energy
- Investors and key donors
- Young professionals and students
- Media

Languages: English, French, Spanish

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Cover: Pine tree (*Pinus pinaster*), near the beach of Corrubedo in Galicia, Spain.

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Cover: Pine tree (*Pinus pinaster*), near the beach of Corrubedo in Galicia, Spain.

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A tool for monitoring and assessing changes and risks to Mediterranean forests and other wooded lands is needed, therefore, to help ensure the sustainable management of Mediterranean forest ecosystems. With this in mind, members of the Committee on Mediterranean Forestry Questions—*Silva Mediterranea* requested FAO, at a meeting held in April 2010 in Antalya, Turkey, to prepare a report on

TABLE 1. Mediterranean countries* grouped into eastern (EMC), northern (NMC) and southern (SMC) subregions

Classification	Country
EMC	Israel
	Jordan
	Lebanon
	Palestine
	Syrian Arab Republic
	Turkey
NMC	Albania
	Andorra
	Bosnia and Herzegovina
	Bulgaria
	Croatia
	Cyprus
	France
	Gibraltar
	Greece
	Holy See
	Italy
	Malta
	Monaco
	Montenegro
	Portugal
	San Marino
	Serbia
	Slovenia
	Spain
	The former Yugoslav Republic of Macedonia
SMC	Algeria
	Egypt
	Libya
	Morocco
	Tunisia

*Countries officially involved in the Barcelona Process in the context of the Euro-Mediterranean Agreement (Barcelona Declaration, 1995).

Source: EU, 1995.

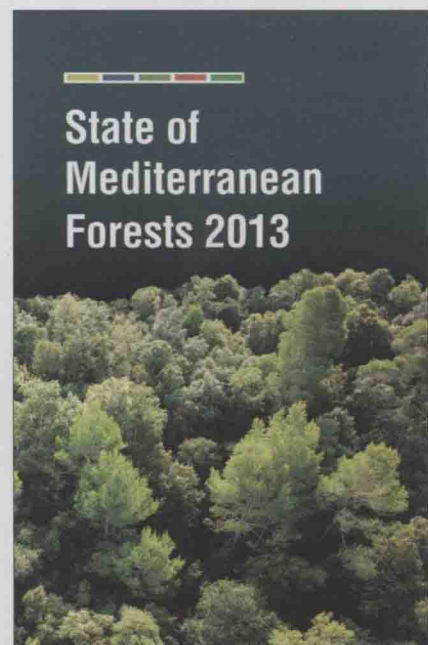
the state of Mediterranean forests, in collaboration with other institutions. It was agreed to use already available data collected by regional and international institutions in the context of other environmental assessment processes, such as the state of the environment and development in the Mediterranean process (Plan Bleu, 2009) and FAO's five-yearly global forest resources assessment (FAO, 2010a).

The proposed approach and structure of the first *State of Mediterranean Forests* report was presented and formally approved by member countries at the 21st session of the Committee on Mediterranean Forestry Questions—*Silva Mediterranea*, also held in Antalya, in February 2012, and the report was subsequently compiled under the coordination of Plan Bleu and FAO (see box on next page). This article presents some of the main findings of the report.

THE MEDITERRANEAN REGION

This article considers the Mediterranean region to comprise the countries surrounding the Mediterranean Sea (i.e. those shown in Table 1). A Mediterranean climate is one characterized by mild winters and hot and dry summers, with precipitation concentrated in autumn, winter and early spring. Total rainfall varies strongly from year to year and violent precipitation events and dry winds can occur. Winter temperatures occasionally fall below 0°C at sea level, and snow and below-zero temperatures are common at high altitudes (e.g. the Alps, the Pyrenees and the Atlas mountains).

Typical Mediterranean forests are composed of broadleaved species (mainly oaks), both evergreen and deciduous, such as *Quercus ilex*, *Q. suber*, *Q. coccifera*, *Q. pubescens*, *Q. cerris*, *Q. pyrenaica*, *Q. toza*, *Q. calliprinos*, *Q. ithaburensis* and others, and conifers such as *Pinus halepensis*, *P. brutia*, *P. pinea*, *P. pinaster* and *Juniperus* species. Where water availability is not a limiting factor in plant growth (e.g. along rivers),

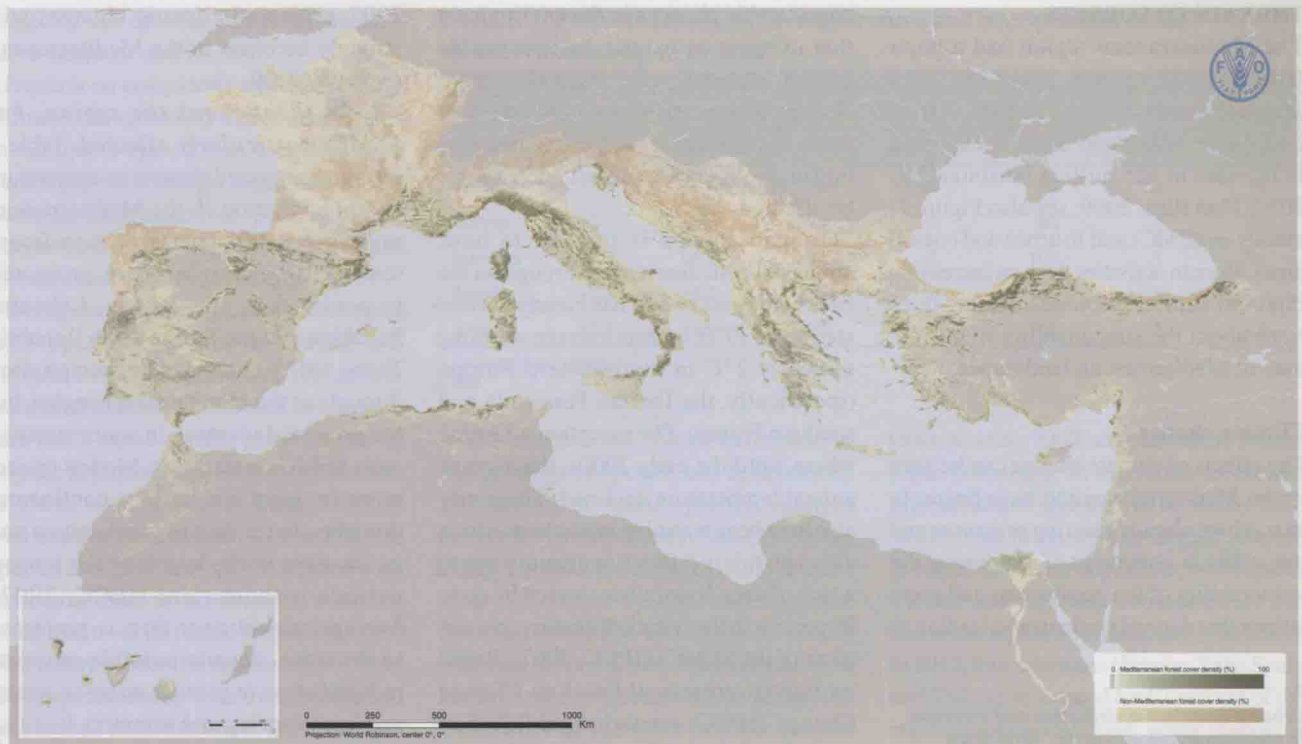


The first edition of the *State of Mediterranean Forests* report is a collaborative effort that will provide a basis for monitoring forests in the region

forests of *Q. robur*, *Q. petraea*, *Fraxinus* species, *Populus alba* and *Populus nigra* can prosper.

In some areas, human influence has modified Mediterranean forests, producing areas of sparse woody vegetation known as the *maquis* and the *garrigue*. A multifunctional agro-sylvopastoral system known as the *dehesa* found on the Iberian Peninsula is characterized by pastures with scattered oaks, both evergreen and deciduous, sometimes mixed with *Pinus pinea*.

Many Mediterranean countries also have areas that do not have a typically Mediterranean climate: for example, northern Mediterranean countries (NMCs) such as France, Italy and Spain have substantial temperate areas, while many southern and eastern Mediterranean countries (SEMcs) have large deserts. Many of the data used here were available only at the national level, making it difficult to distinguish between biogeographic zones. This article covers all forest areas in the Mediterranean region, focusing wherever possible on forests growing in a Mediterranean climate.



Note: Gradient of green = percent of Mediterranean forest cover; beige = other wooded lands (wooded areas with less than 10 percent canopy cover); brown = non-Mediterranean forests; grey = other land uses.

Source: FAO and Plan Bleu, 2013.

1

Distribution of Mediterranean-type forests in Mediterranean countries

Contributors to the first State of Mediterranean Forests 2013 report

Under the coordination of Plan Bleu and FAO, the following organizations contributed to *State of Mediterranean Forests 2013*:

- Association internationale forêts méditerranéennes – AIFM (International Association for Mediterranean Forests);
- Centre for Mediterranean Cooperation (IUCN-Med);
- Centre Tecnològic Forestal de Catalunya – CTFC (Forest Sciences Centre of Catalonia);
- Centro de Investigación Ecológica y Aplicaciones Forestales – CREAM (Centre for Ecological Research and Forestry Applications, Spain);
- Consiglio per la Ricerca e la Sperimentazione in Agricoltura – CRA (Agricultural Research Council, Italy);
- Corpo Forestale dello Stato (State Forestry Corps, Italy);
- Forestry Timber Section and Trade and Timber Division of the United Nations;
- Haut Commissariat aux eaux et forêts et à la lutte contre la désertification (High Commission for Water, Forests and Desertification Control, Morocco);
- Institut méditerranéen du liège (Mediterranean Institute of Cork, France);
- Institut national de la recherche agronomique – INRA (National Institute for Agricultural Research, France);
- Istituto di Genetica Vegetale, Consiglio Nazionale delle Ricerche – IGV-CNR (Institute of Plant Genetics of the National Research Council, Italy);
- Instituto Superior de Agronomia – ISA (Higher Institute of Agronomy, Portugal);
- International Union for Conservation of Nature – IUCN;
- Joint Research Centre/European Forest Fire Information System – JRC/EFFIS;
- Mediterranean Model Forest Network – MMFN;
- Mediterranean offices of the World Wildlife Fund;
- Mediterranean Regional Office of the European Forest Institute – EFIMED;
- Office national des forêts (National Forests Office, France);
- UNECE/FAO partnership; Forest Research Centre (CIFOR-INIA);
- Università degli Studi di Bari (University of Bari, Italy);
- Università degli Studi di Firenze (University of Florence, Italy).

THREATS TO FORESTS

The Mediterranean region had a population of 507 million people in 2010 across three continents (Europe, Africa and Asia). This population is expected to increase to 625 million inhabitants by 2050 (Plan Bleu, 2009; see also Figure 2), mainly in SEMCs and in urban and coastal areas. Human activities pose an increasing threat to natural resources, raising questions about the sustainability of current uses of Mediterranean landscapes.

Climate change

The effects of climate change can be seen in the Mediterranean and have begun to exacerbate already existing pressures and degradation phenomena, increasing the vulnerability of the ecosystems and populations that depend on them and leading to

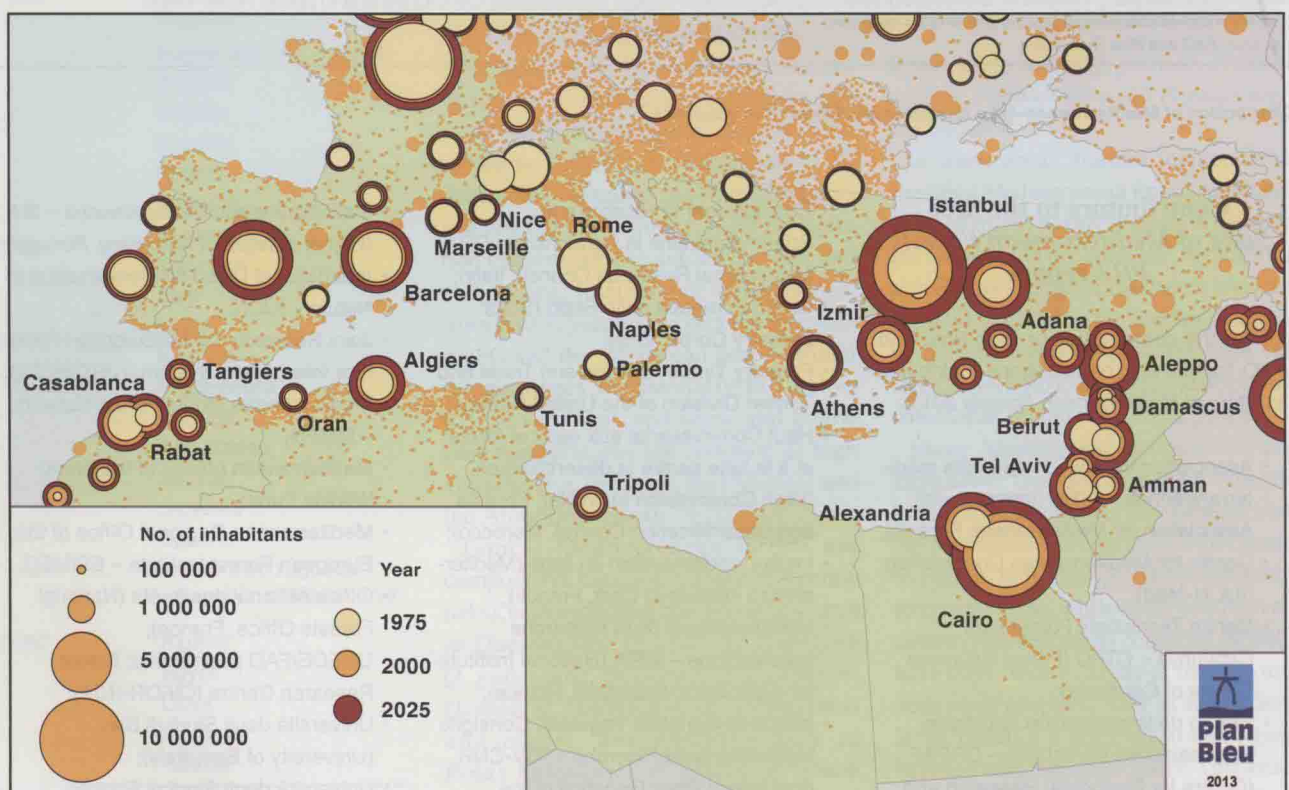
considerable changes in the environment that in some cases may be irreversible (such as desertification and soil erosion). Numerous essential economic activities (such as agricultural activities and grazing) in the region are and will increasingly be affected.

Climate change is thought to have affected the Mediterranean throughout the twentieth century and has clearly accelerated since 1970, with an average warming of nearly 2 °C in southwestern 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 (IPCC, 2007). Based on Intergovernmental Panel on Climate Change (IPCC) scenarios published in

2007, projected climatic changes will strongly increase in the Mediterranean region by 2100.

Risks throughout the region, but SEMCs particularly affected. Table 2 shows the projected changes in temperature and precipitation in the Mediterranean region in 2100. The most significant temperature increases are projected to occur in 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) (IPCC, 2007). Average annual river flow is projected to decrease, despite possible seasonal redistribution (e.g. more water in winter and less in spring and summer). It is also

2
Urban population distribution and increase in Mediterranean countries, 1975–2025



Source: FAO and Plan Bleu, 2013. Based on information from United Nations, Department of Economic and Social Affairs, Population Division, 2011.

projected that extreme events will become more frequent and intense.

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 fire, diseases and species invasions.

Rising temperatures may displace vegetation types and species 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, combined with overuse, lead to accelerated desertification. Such changes

TABLE 2. Projected changes in temperature and precipitation in the Mediterranean region in 2100

Season	Temperature variation (°C)		Precipitation variation (°C)		Occurrence of extreme events (% increase)		
	Min.	Max.	Min.	Max.	Hot	Humid	Dry
Winter	+1.7	+4.6	-16	+6	93	3	12
Spring	+2	+4.5	-24	-2	98	1	31
Summer	+2.7	+6.5	-53	-3	100	1	42
Autumn	+2.3	+5.2	-29	-2	100	1	21
Annual	+2.2	+5.1	-27	-4	100	0	46

Source: IPCC, 2007.

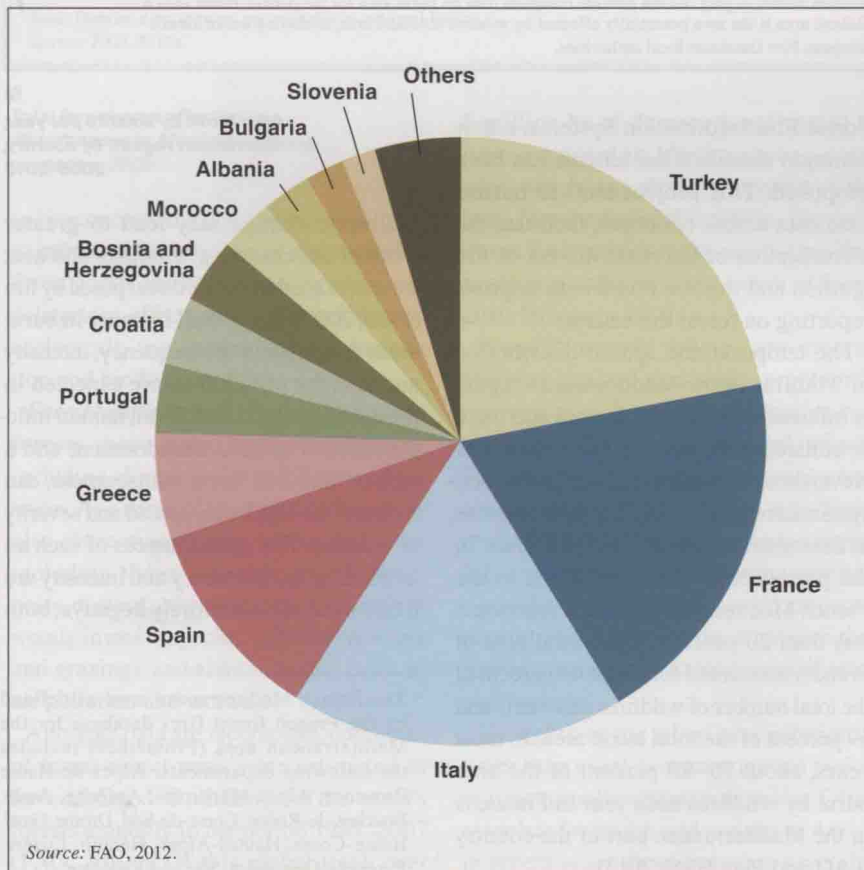
could increase the risk of extinction of a wide range of species and ecosystems.

A number of studies predict changes in certain environments. Safi (1999), 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. Forecasts made within the framework of the CARBOFOR project

(Badeau *et al.*, 2005) suggest that, in France, areas favourable to mountain forest and higher latitude species will be lost by 2100, while areas favourable to species adapted to hotter and drier conditions will expand.

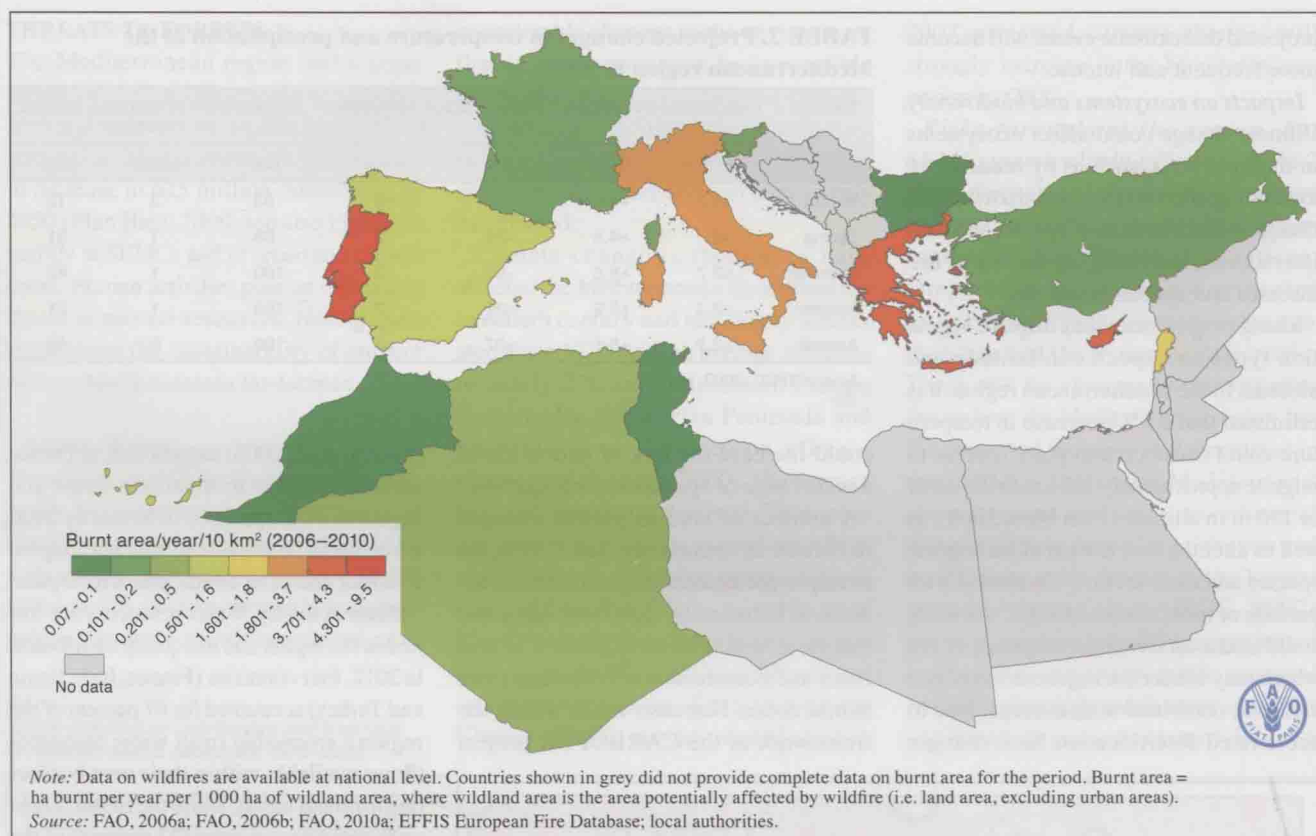
Water scarcity. Water resources are limited in the region and unequally distributed: in 2012, four countries (France, Italy, Spain and Turkey) accounted for 67 percent of the region's renewable fresh water resources (flows available within their own borders on an annual basis), while the SEMCs held only about one-quarter (27 percent) of the region's water resources between them (Figure 3) (FAO and Plan Bleu, 2013 from FAOSTAT and AQUASTAT databases). Forest management approaches are needed that increase the resilience of forests to water stress and help meet demand from the various economic sectors.

Wildfires. Over millennia, human activities in Mediterranean landscapes have modified natural forest fire dynamics and the capacity of vegetation to respond to disturbance (i.e. its resilience). The climate also plays a major role in fire dynamics and risk: for example, the moisture content of litter is reduced by the generally prolonged hot and dry season (generally between about June and October), when the average daytime temperature is often above 30 °C, there is little rain, and winds are characterized by high speeds and strong desiccating power.



3

Share of the total volume of Mediterranean water resources, by country, 2012



4

**Area burnt by wildfire per year,
Mediterranean region, by country,
2006–2010**

In the period 2006–2010, over 2 million ha of wildlands (not all forest) were burnt in the Mediterranean region, an average of more than 400 000 ha per year (Figure 4). In the same period, about 269 000 wildfires were reported in the region (an average of about 54 000 wildfires per year).

The limited information available about the causes of fires suggests that the Mediterranean region is characterized by a prevalence of human-induced wildfire. In the case of Algeria, Bulgaria, Italy, Portugal and Turkey, which reported statistics on fire causes (European Commission, 2011), “unknown” accounts for 51 percent of the total (ranging from 88 percent in Algeria to 14 percent in Bulgaria and 12 percent in Turkey). This confirms the need highlighted by the European Commission (2011) for improved knowledge and reporting on wildfire causes and for more post-fire investigation.

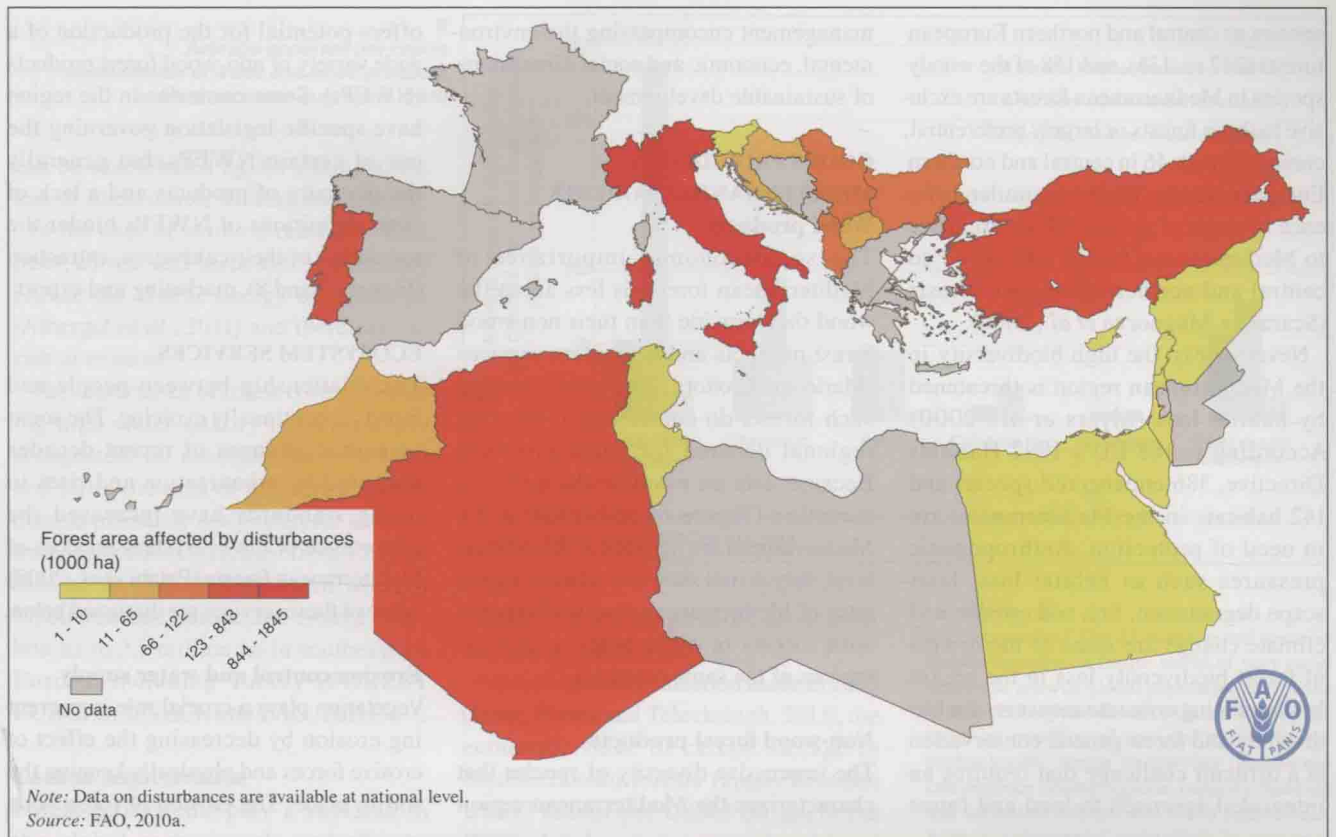
In the context of a European project led by Cemagref (France) and the European

Forest Fire Information Systems, a new common classification scheme has been proposed. This project aims to harmonize data across countries, facilitate the identification of the main drivers of fire ignition and make it possible to improve reporting on forest fire causes.

The temporal and spatial distribution of wildfires in the Mediterranean region is influenced by several factors and there is considerable year-to-year variation. Nevertheless, Mediterranean forest ecosystems are particularly prone to wildfire, as demonstrated by the case of France. In the period 2000–2010, wildfires in the French Mediterranean¹ (which represents less than 20 percent of the total area of France) accounted for about 49 percent of the total number of wildfires nationally and 69 percent of the total burnt area. In most years, about 70–80 percent of the area burnt by wildfires each year in France is in the Mediterranean part of the country (FAO and Plan Bleu, 2013).

Climate change may lead to greater weather extremes (e.g. droughts and heat waves), exacerbating the threat posed by fire (FAO, 2007). An overall increase in burnt areas and a rise in the frequency, intensity and severity of wildfires are expected in the next decades. In addition, human influences, such as land abandonment and a lack of land and forest management, can increase the incidence, spread and severity of wildfire. The consequences of such an increase in fire frequency and intensity are likely to be almost entirely negative, both

¹ The French Mediterranean zone as defined by the French forest fires database for the Mediterranean area (Prométhée) includes the following departments: Alpes-de-Haute-Provence, Alpes-Maritimes, Ardèche, Aude, Bouches-du-Rhône, Corse-du-Sud, Drome, Gard, Haute-Corse, Hautes-Alpes, Hérault, Lozère, Pyrénées-Orientales, Var and Vaucluse.



5

Total forest area affected by disturbances in Mediterranean countries, 2005

socioeconomically (e.g. increased damage to infrastructure, the loss of merchantable forest goods and ecosystem services, and deleterious effects on human health) and ecologically (e.g. increased forest degradation and biodiversity loss).

Forest health threats. The Mediterranean forests share many common features, including climate, soils and forest composition. As a result of these similarities, they also share many forest health problems, including those associated with insect pests, disease, other biotic factors (such as woody invasive species, wildlife browsing and grazing), and abiotic factors (such as air pollution and storms).

Although data are incomplete, outbreaks of forest insect pests were estimated to have damaged 35 million ha of the world's forests annually in the period 1988–2007 (FAO, 2010a). Of this global total, over

5 million ha of damage is estimated to have occurred in Mediterranean countries, which was almost 6 percent of the total forest area of the region. Figure 5 shows the countries in the region classified according to the reported extent of forest disturbances in 2005.

Woody invasive species are increasingly recognized as a major problem in the region, with a range of negative economic, social and environmental impacts. For example, *Ailanthus altissima*, a tree species native to China, is a significant invasive plant in the Mediterranean region. It is an aggressive, fast-growing tree and a prolific seeder that may overrun native vegetation; it also produces toxins that prevent the nearby establishment of other plant species.

Droughts occur when precipitation is lower than usual over an extended period of time (usually a season or more). Often associated with the arid regions of Africa, in recent years drought events have also

occurred in the Mediterranean countries of Europe (WMO, 2011). Drought can affect forests in various ways and can lead to increased mortality, declines in productivity, dieback, and increased susceptibility to insect pests and pathogens.

Biodiversity loss. The unusually high geographical and topographical variability (e.g. irregular coasts and many mountain ranges) and a pronounced climatic bi-seasonality have had a strong positive influence on species richness and distribution in the Mediterranean region, which is a biodiversity hotspot with high endemism (Myers *et al.*, 2000; Médail and Quézel, 1997). Twenty-five percent of the approximately 200 terrestrial animals found in the region are endemic to it, and 350 species of bird are also found in the region. There are more than 25 000 plant species in the Mediterranean region, compared with about 6 000 in central and northern Europe. Mediterranean forests have nearly twice the number of woody

species as central and northern European forests (247 vs. 135), and 158 of the woody species in Mediterranean forests are exclusive to those forests or largely preferential, compared with 46 in central and northern European forests. There is a similar difference in terms of genera: 34 are exclusive to Mediterranean forests and only 7 to central and northern European forests (Scarascia-Mugnozza *et al.*, 2000).

Nevertheless, the high biodiversity in the Mediterranean region is threatened by habitat loss (Myers *et al.*, 2000). According to the EU's 1992 Habitats Directive, 386 endangered species and 142 habitats in the Mediterranean are in need of protection. Anthropogenic pressures such as habitat loss, landscape degradation, fire, soil erosion and climate change are some of the drivers of forest biodiversity loss in the region. Implementing concrete measures for biodiversity and forest genetic conservation is a difficult challenge that requires an integrated approach to land and forest

management encompassing the environmental, economic and social dimensions of sustainable development.

GOODS PROVIDED BY MEDITERRANEAN FORESTS

Wood products

The socioeconomic importance of Mediterranean forests is less about the wood they provide than their non-wood forest products and ecosystem services (Merlo and Croitoru, 2005). Nevertheless, such forests do contribute to meeting regional demand for wood products. Because data on wood production, consumption (Figure 6) and trade in the Mediterranean are reported at the national level, they do not show the relative importance of Mediterranean forests compared with forests in other biogeographical regions of the same countries.

Non-wood forest products

The impressive diversity of species that characterizes the Mediterranean region

offers potential for the production of a wide variety of non-wood forest products (NWFPs). Some countries in the region have specific legislation governing the use of certain NWFPs, but generally the diversity of products and a lack of clear definitions of NWFPs hinder the regulation of their cultivation, extraction (Figures 7 and 8), marketing and export.

ECOSYSTEM SERVICES

The relationship between people and forests is continually evolving. The socioeconomic changes of recent decades triggered by urbanization and rises in living standards have increased the importance of the ecosystem services of Mediterranean forests (Palahi *et al.*, 2008). Some of these services are discussed below.

Erosion control and water supply

Vegetation plays a crucial role in preventing erosion by decreasing the effect of erosive forces and physically keeping the soil in place. The erosion of forest soils



Mediterranean stone pines are the source of pine nuts. The Mediterranean region produces approximately 6000–9000 tonnes of pine nuts per year, not including domestic or local consumption

6
Average apparent per capita
consumption of wood and wood products,
by Mediterranean subregion, 2010

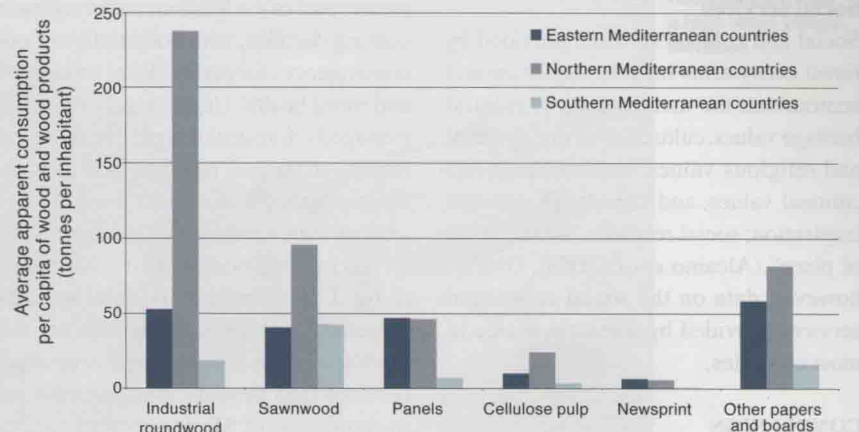
can be exacerbated by, for example, the loss of forest cover, wildfire and storms.

In the case of extreme rainfall events, trees, shrubs and herbs can significantly reduce the kinetic energy of raindrops (Albergel *et al.*, 2011) and therefore the risk of erosion.

The importance of forest cover in ensuring high water quality is increasingly recognized: for example, between 1990 and 2010, the area of protective forests (forests primarily designated for soil and water protection) increased from 15.2 million ha to 15.9 million ha in western Mediterranean Europe and from 2.1 million ha to 3.1 million ha in southeastern Europe, including Turkey (FOREST EUROPE, UNECE and FAO, 2011).

Carbon sequestration

Forest ecosystems play a key role in the global carbon cycle and climate regulation because carbon is exchanged naturally and continuously between vegetation, soils and the atmosphere through



Note: Pulp, other papers and boards are expressed in tonnes per capita; other values are in m³ per capita.
Source: FAO, 2010b; UNECE/FAO, 2012.

photosynthesis, respiration, decomposition and combustion.

According to an evaluation made in 2005 (Ding, Nunes and Telucksingh, 2011), the economic value of carbon storage in Mediterranean forests ranges between US\$37 billion and US\$63 billion in the IPCC global emission scenarios A1 and B2,² respectively, with 2050 as the horizon. The economic value of carbon is smaller in Mediterranean forests than in forests in central-northern Europe, but higher than that of forests in northern Europe and Scandinavian Europe.

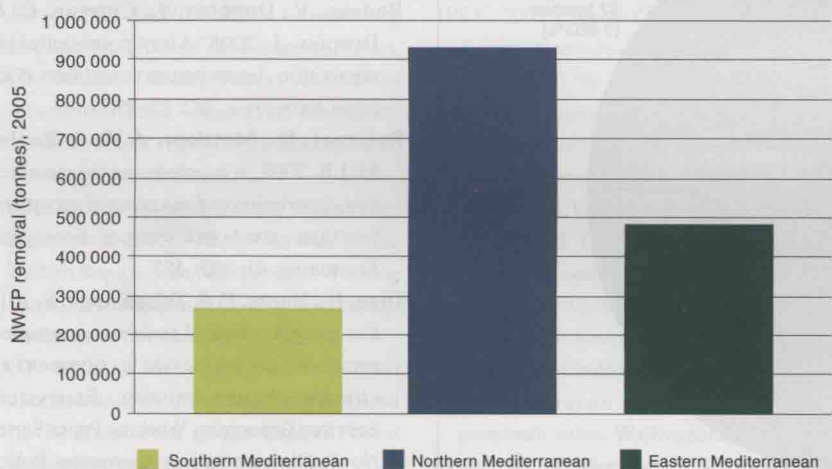
² IPCC scenarios: "The A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income ...

"The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing global population. Economic development is primarily regionally oriented and per capita economic growth and technological change are more fragmented and slower than in other storylines.

"The B1 storyline and scenario family describes a convergent world with the same global population that peaks in mid-century and declines thereafter, as in the A1 storyline, but with rapid changes in economic structures toward a service and information economy, with reductions in material intensity, and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social, and environmental sustainability, including improved equity, but without additional climate initiatives.

"The B2 storyline and scenario family describes a world in which the emphasis is on local solutions to economic, social and environmental sustainability. It is a world with continuously increasing global population, at a rate lower than A2, intermediate levels of economic development, and less rapid and more diverse technological change than in the A1 and B1 storylines ..." (IPCC, 2007)

7
NWFP removals in the
Mediterranean region, 2005



Note: Pulp, other papers and boards are expressed in tonnes per capita; other values are in m³ per capita.
Source: FAO, 2010b; UNECE/FAO, 2012.

Social services

Social and cultural services provided by forest ecosystems include recreation and ecotourism; the maintenance of cultural heritage values, cultural diversity, spiritual and religious values, aesthetic and educational values, and knowledge systems; inspiration; social relations; and a "sense of place" (Alcamo *et al.*, 2003). Overall, however, data on the social ecosystem services provided by forests is scarce in most countries.

CONCLUSION

The Mediterranean region is likely to be strongly affected by climate change, the effects of which will exacerbate existing pressures on Mediterranean forests and people. Water scarcity is likely to affect a

greater part of the Mediterranean region in coming decades, with potentially serious consequences for people, local economies and forest health. Unmanaged – or poorly managed – forest stands may be more vulnerable to natural hazards such as pests, disease, drought and forest fires.

Given the importance of Mediterranean forests for local people, their contribution to rural development and food security (in some countries more than others), and the wide range of goods and ecosystem services they provide, strategies for the management of Mediterranean forests are needed that increase resilience and equitably distribute their benefits and costs. To promote such strategies, ongoing monitoring is required. The *State of Mediterranean Forests*, if published every five years, could provide an overview of the situation of Mediterranean forests and assist in the development, monitoring

and assessment of regional strategies and coordination between national approaches. The improved sharing of information on forests in the Mediterranean region would help increase regional cooperation among the Mediterranean countries, mobilize financial resources to reduce the impacts of climate change on Mediterranean forest ecosystems and other wooded lands, and foster the development and implementation of a shared vision on Mediterranean forests. ♦

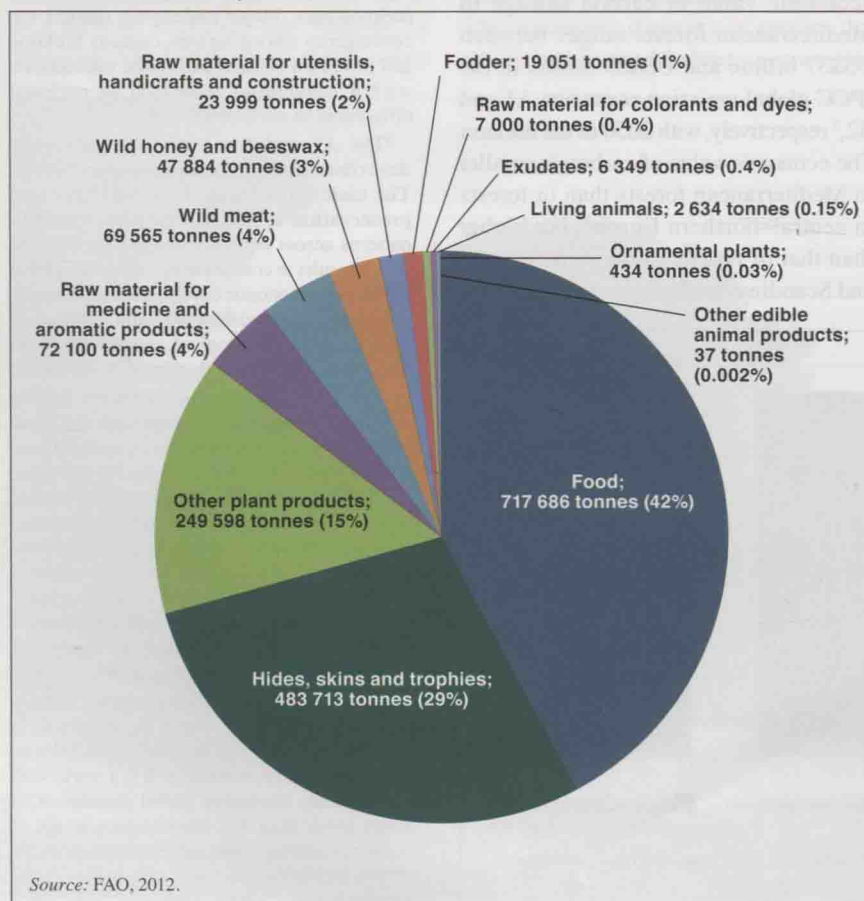


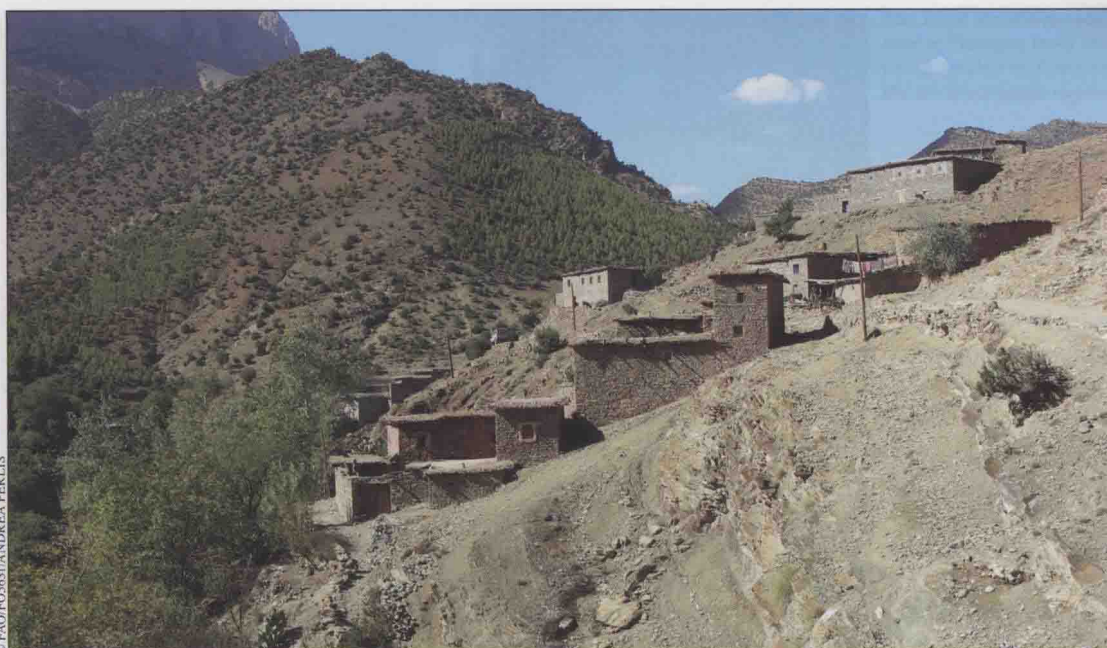
References

- Albergel, J., Collinet, J., Zante, P. & Hamrouni, H. 2011. Role of the Mediterranean forest in soil and water conservation. In Y. Birot, C. Gracia & M. Palahi, eds. *Water for forests and people in the Mediterranean region: a challenging balance*. What Science Can Tell Us No. 1. Helsinki, European Forest Institute.
- Alcamo, J., Bennett, E.M. *et al.* 2003. *Ecosystems and human well-being: a framework for assessment*. Washington, DC, Island Press.
- Badeau, V., Dupouey, J., Cluzeau, C. & Drapier, J. 2005. Aires potentielles de répartition des essences forestières d'ici. *Fôret Entreprise*, 162: 25–29.
- DeGroot, R., Matthew, A.W. & Roelof, M.J.B. 2002. A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecological Economics*, 41: 393–405.
- Ding, H., Nunes, P. & Telucksingh, S. 2011. *European forests and carbon sequestration services: an economic assessment of climate change impacts*. Ecosystem Services Economics Working Paper Series No. 9. Division of Environmental Policy Implementation. Nairobi, UNEP.
- EFFIS (European Forest Fire Information System). European Fire Database. URL:

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NWFP removals in the
Mediterranean countries, 2010





Reforestation near
a High Atlas village,
Morocco

- <http://forest.jrc.ec.europa.eu/effis/about-effis/technical-background/european-fire-database/>.
- EU.** Barcelona Declaration. 1995. *Final declaration of the Barcelona Euro-Mediterranean Ministerial Conference of 27 and 28 November 1995 and its work programme*. Available at: http://europa.eu/legislation_summaries/external_relations/relations_with_third_countries/mediterranean_partner_countries/r15001_en.htm (http://www.eeas.europa.eu/euromed/docs/bd_en.pdf).
- European Commission.** 2011. *Forest fires in Europe 2010*. EUR 24910 EN. Luxembourg, Publication Office of the European Union.
- FAO.** 2006a. Global Forest Resources Assessment 2005 – Report on fires in the Mediterranean region. Fire Management Working Paper 8. Rome.
- FAO.** 2006b. Global Forest Resources Assessment 2005 – Report on fires in the Balkan Region. Fire Management Working Paper 11. Rome (available at: www.fao.org/forestry/site/fire-alerts/en).
- FAO.** 2007. *Fire management global assessment 2006*. Thematic study prepared in the framework of the Global Forest Resources Assessment 2005. Rome.
- FAO.** 2010a. *Global forest resources assessment 2010*. Main report. FAO Forestry Paper No. 163. Rome.
- FAO.** 2010b. FAOSTAT (database). URL: <http://faostat/>.
- FAO.** 2012. AQUASTAT (database). URL: <http://www.fao.org/nr/water/aquastat/main/index.stm>.
- FAO & Plan Bleu.** 2013. *State of Mediterranean Forests 2013*. Rome.
- FOREST EUROPE, UNECE & FAO.** 2011. *State of Europe's forests 2011: status and trends in sustainable forest management in Europe*. Oslo, FOREST EUROPE Liaison Unit; Geneva, Switzerland, UNECE; Rome, FAO.
- IPCC.** 2007. *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. [Core Writing Team, Pachauri, R.K. and Reisinger, A. (eds.)]. Geneva, IPCC; Cambridge, Cambridge University Press.
- Médail, F. & Quézel, P.** 1997. Hot-spots analysis for conservation of plant biodiversity in the Mediterranean basin. *Annals of the Missouri Botanical Garden*, 84: 112–127.
- Merlo, M. & Croitoru, L.** eds. 2005. *Valuing Mediterranean forests: towards total economic value*. Wallingford, UK, CABI.
- Myers, N., Mittlemeier, R.A., Mittlemeier, C.G., Da Fonseca, G.A.B. & Kent, J.** 2000. Biodiversity hotspots for conservation priorities. *Nature*, 403: 853–858.
- Palahí, M., Mavsar, R., Gracia, C. & Birot, Y.** 2008. Mediterranean forests under focus. *International Forestry Review*, 10: 676–688.
- Plan Bleu.** 2009. *Etat de l'environnement et du développement en Méditerranée – 2009*. Athens, Plan Bleu.
- Safi, S.** 1999. Assessment of Bioclimatic Change – Lebanon Case Study. In *First National Communication on Climate Change*. GEF, B1. Beirut, Ministry of Environment, Lebanon; UNDP.
- Scarascia-Mugnozza, G., Helfried, H., Piussi, P. & Kallipi R.** 2000. Forests of the Mediterranean region: gaps in knowledge and research needs. *Forest Ecology and Management*, 132: 97–109.
- UNECE/FAO.** 2012. *Forest Product Market Review 2011–2012*. Geneva Timber and Forest Study Paper 30. New York and Geneva, United Nations.
- United Nations Department of Economic and Social Affairs.** 2011. Urban and rural population database. URL: http://esa.un.org/unpd/wup/unup/index_panel1.html.
- WMO (World Meteorological Organization).** 2011. Website (available at www.wmo.int). Accessed 12 June 2012. ♦