

# FORESTS: FACING THE CHALLENGES OF GLOBAL CHANGE

Inazio Martínez de Arano, *EFIMED*

Valentina Garavaglia, *FAO*

Christine Farcy, *Université catholique de Louvain*

Mediterranean countries have around 85 million hectares of forests, representing 2% of the world's forest area. There are more than 12 million hectares of new forests since 1990, most of them due to natural regeneration and colonisation of agricultural lands. This represents an increase of 0.68% every year and suggests the strong dynamic character of the region.

Home to ancient civilisations, birthplace of three great religions, cradle of the Renaissance, the Mediterranean Basin has for millennia been under human pressures that left a visible mark on the landscape. Mediterranean forests are highly humanised ecosystems and complex socio-ecological systems that require more attention from the international community. The Mediterranean region is totally immersed in global megatrends (i.e. globalisation, tertiarisation, urbanisation, climate change) that affect all aspects of life. The way people think about and relate with forests is also changing, as is the socio-ecological environment in which silviculture takes place.

New threats, like climate change or demographic increase, new challenges, like adapting forest management to forest multifunctionality, and new opportunities like the green economy, emerge. In this changing and challenging context, the need to promote sustainable forest management practices and policies became urgent, in order to obtain social and economic benefit and avoid waste of forestry resources.

This chapter gives an overview of the evolution of the Mediterranean forest in the past and presents current trends, explores the impacts of some of the main global megatrends in Mediterranean silviculture and highlights some emerging solutions.

## The evolution of Mediterranean forests and current trends

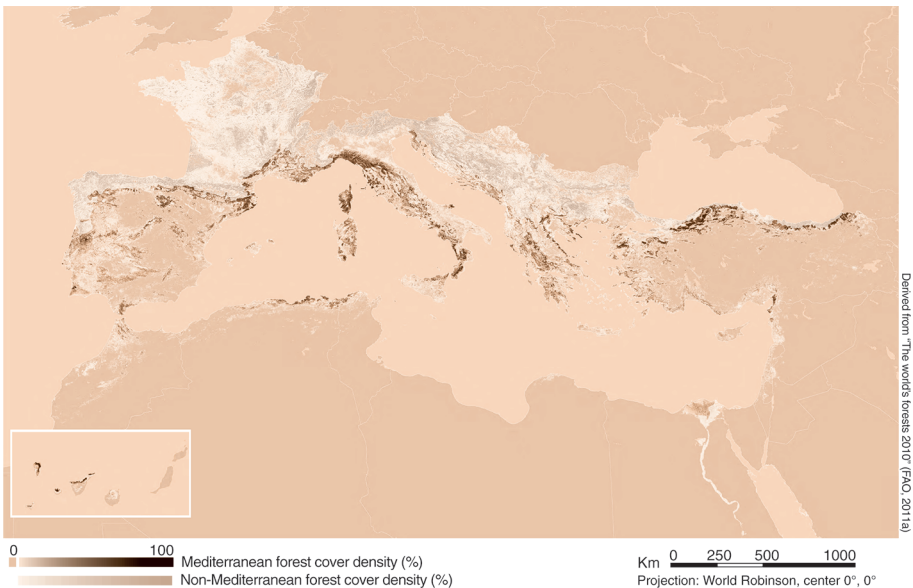
The current extent (see Figure 1) and conservation status of Mediterranean forests and their structure dynamics are determined as much by societal processes as by biological ones. These influences are quite old and date back to prehistory. Through successive waves of high pressure and remission, the forest changed, disappeared or withdrew away from human action.

### Human activity, a key factor in Mediterranean forest ecology

The impact of humans on Mediterranean forests is much deeper and subtle than commonly expressed by the terms “deforestation” and “forest degradation”. There is increased evidence that humans have contributed to configure the Mediterranean forests we see today since long before the last Glacial Maximum.

Despite the fact that the use of fire as a tool to modify the structure of the landscape expanded across Europe only around 120,000 BC, traces signal a possible use of fire by humans with the arrival of *Homo sapiens* populations (1.2 million years BP) and it was probably used to conquer new hunting grounds 400,000 years ago. It is legitimate to think that human action was already a relevant factor in shaping the structure and dynamics of forest ecosystems while they were retreating and expanding under the influence of changing climates.

**Figure 1 - Distribution of Mediterranean forests**



Sources: FAO and Plan Bleu (2013).

During the Last Glacial Maximum (120,000-10,000 BP) the climate was much colder and dryer across the Mediterranean basin and ice caps covered mountains in the Iberian Peninsula, Greece, the Balkans, Turkey and the Atlas Mountains (Morocco). A period of rapid warming and increased humidity followed. By 11,000 BP forests had greatly expanded across the Mediterranean region. Only after 8,000 BP a “typical” Mediterranean forest dominated by evergreen oaks and pines became dominant in areas like current Greece and Cyprus. By then, the capacity of humans to modify the landscape had greatly increased.

The Ohalo site in Galilee shows evidence of cultivation and seed processing by 19,000 BP. Pigs, goats and sheep were domesticated in the Fertile Crescent between 13,000 and 9,000 BP during the Neolithic Revolution. The population growth resulting from this deep change in lifestyle is substantial (Le Houérou, 1981). All these developments rapidly expanded across the Mediterranean. The extensive use of fire, tree cutting and the selection of useful trees have certainly influenced vegetation, already favouring certain species or live traits such as those related with fire resilience.

In the subsequent millennia, the Mediterranean region gave birth to complex societies capable of using and shaping natural resources. During the Bronze and Iron ages, the expansion of agriculture, livestock farming and the use of fire to shape vegetation were accompanied by a sophisticated use of wood and the development of trade on a large scale. In many respects, it was during the classical times that what we consider the “typical Mediterranean landscape” was modelled. All along the emergence of human civilisations, Mediterranean forests made room for agriculture and human settlement, creating the mosaic landscapes that we still recognise today. Forests also sustained livelihoods and social developments by supplying, along with long-range trade, fundamental resources for the construction of fabulous fleets and buildings, fuel for domestic and proto-industrial needs, materials for food, health and handicraft, as well as fodder and feed for livestock. Locally, this has led to forest destruction and shortages of resources.

## **Mediterranean forests become scarce**

In the subsequent centuries, as population and demand for multiple resources augmented, the pressures on forest ecosystems increased. Demand for agricultural and grazing lands pushed forests back to mountainous and remote areas. Forests still remained the main source of biological raw material for humans and their activities well into modernity. As an example, looking at their present situation, it is difficult to imagine how, although complemented by wood imports from remote areas, Mediterranean forests could maintain, through several centuries, multiple human needs and also supply the fine woods needed to create the fabulous fleets of the Ottoman Empire and its Spanish, French or Italian rivals.

The progressive reduction and increased utilisation of Mediterranean forests accelerated greatly during the 17<sup>th</sup> and 18<sup>th</sup> centuries in most regions, and was especially intense in the northern Mediterranean countries. Due to high demands for timber and other non-wood forest products (cork, pitch, etc.), conflicts for the use of forest resources became prominent and the need for regulation was more pressing. Across

the northern Mediterranean and other European regions, a large collection of trials and regulations attempted at mediating the conflicts between shipbuilding and energy uses, between the navy and the forge industries and between the crown and local communities. Frequently, rulers have tried to reserve the best forests for shipbuilding against the will of local populations, while the obligation to replace harvested trees with new plantings became widespread (Williams, 2006). However, no regulation would stop the wave of severe deforestation and degradation that expanded across the globe during the late 17<sup>th</sup> and early 20<sup>th</sup> centuries accompanying the industrial revolution. The until then unknown demands for feedstock and timber to supply the energy and material needs of new industries, railroad ties and electricity posts grew exponentially. This happened simultaneously with the maximum agricultural expansion, which was necessary to feed a growing population on the eve of the green revolution.

The evolution in the eastern Mediterranean was not that dissimilar, although it is now recognised that forest resources, although heavily used by a large rural population, were largely preserved until the mid-19<sup>th</sup> century (Davis, 2007). Customary governance structures had been largely kept under Ottoman rule, as the empire had no forest regulation except for those large areas reserved to serve the imperial navy and armouries. The situation changed abruptly in the 19<sup>th</sup> century. The modernisation efforts of the Ottoman administration facilitated the adoption of modern forest ideas developed in France and Germany. The State sought greater control over forest resources and significant amounts of timber were harvested to help replenish the suffering State Treasury. The development and supply of the Ottoman railways during the first half of the 20<sup>th</sup> century brought in an intense wave of deforestation, with Lebanon, for example, losing over 60% of its remaining forests (Oedekoven, 1963).

In the southern Mediterranean, the new colonial powers that took over the Ottoman possessions, brought in new rules, ideas and values. Colonial forest regulations gave the State the right to manage all forests, frequently favouring the needs of the metropolis and upsetting customary arrangements, which led to the destabilisation of secular land tenure. The result was a period of intense deforestation. It is estimated that half of the remaining forests in Morocco, Algeria and Tunisia were deforested under colonial rule. Turkey also suffered significant destruction of forest resources during this period (Williams, 2006).

Although known since antiquity, it is in these times of great resource degradation that the strategic relevance of water-related forest services was recognised in the emerging regulations and institutional arrangements. In fact, intense erosion and catastrophic flood events have frequently given a final impulse to governmental action. Modern forest services and forest regulations were created across the globe and particularly in the Mediterranean region, frequently to “protect” forests from people. Forestry schools spread notions about “sustainable forest management”, but these were not always well adapted to the local context and in particular to the agrarian economy in place (Mermet and Farcy, 2011). Afforestation programmes become mainstream, frequently related to sand dune control (Portugal, Spain) or hydrological corrections.

## Mediterranean forests under global change

The situation changed considerably in the last sixty or seventy years, at least in relation to forest area and deforestation. In fact, forests are expanding at unprecedented rates in northern Mediterranean countries while deforestation has stopped or even been reversed in southern and eastern Mediterranean countries (see Table 1) (FAO and Plan Bleu, 2013). The reasons for this drastic change needs to be found in the deep socio-economic changes that are taking place at accelerated rates since the mid-20<sup>th</sup> century.

The pace of global change has dramatically changed to reach a level where human activities have become an environmental force that rival natural processes (Steffen *et al.*, 2011). Between 1950 and 2010, the population more than doubled and there was a tenfold increase in economic activity. International trade, capital and information flows rapidly expanded leading to highly integrated national economies. The pressure on natural resources has greatly increased. Half of the world surface is domesticated. Water use and water resources regulation has increased six fold in the same period reaching planetary limits (about 70% of the world's freshwater resource is now used for agriculture). There has been a fivefold increase in the use of fertilisers: today, manufactured nitrogen for soil amendment exceeds the terrestrial natural production of reactive nitrogen. The atmospheric concentration of CO<sub>2</sub> rose from 58ppm in 1950 to 369ppm in 2000. Sociological and cultural changes are also deep and fast. One of the most dramatic changes of the past decades is urbanisation and rural abandonment or stagnation (Farcy *et al.*, 2016). For the first time in history, since 2010, over half of the human population now lives in urban areas. In the 19<sup>th</sup> century, a new change of gear took place. Before, the “great acceleration” was almost entirely driven by developed countries. Nowadays, several large developing countries are rapidly increasing their share in the global economy and in the consumption of natural resources (Steffen *et al.*, 2011) as is the case for some northern African and eastern Mediterranean countries. In addition, biotechnologies increasingly allow for modifying life organisms to better suit human needs creating conditions for a new “Green Revolution”.

Global change is now affecting all the life support systems of the Earth and is challenging more than ever the capacity of society to provide decent livelihoods for all. There is increased awareness on the biological boundaries of our landscapes. The Rio Conventions are an attempt to build global governance by structuring the relationship between humankind and the Earth's systems. The need to decouple economic growth and resource consumption is well recognised. This has sparked a new interest in the knowledge-based production and transformation of bio-based resources for multiple uses and is opening new opportunities for the forest-based products.

**Table 1 - Evolution of forest cover in the Mediterranean (1990-2010)**

Country	Land area (1,000 ha)	Forest		Other wooded land				% of total forest area in Mediterranean countries
		1,000 ha	% of land area	1,000 ha	% of land area	1,000 ha	% of land area	
Spain	49,919	18,173	36	9,574	19	37,438	68	21
France	55,010	15,954	29	1,618	3	55,261	72	19
Turkey	76,963	11,334	15	10,368	13	18,495	63	13
Italy	29,411	9,149	31	1,767	6	38,868	87	11
Morocco	44,630	5,131	11	631	1	6,937	64	6
Bulgaria	10,864	3,927	36	0	0	6,351	49	4.6
Greece	12,890	3,903	30	2,636	20	5,457	60	406
Portugal	9,068	3,456	38	155	2	5,623	64	4
Serbia	8,746	2,713	31	410	5	2,099	41	3.2
Bosnia and H.	5,120	2,472	48	549	11	3,118	56	2.9
Croatia	5,592	1,920	34	554	10	233,997	98	2.2
Algeria	238,174	1,492	1	2,685	1	740	37	1.7
Slovenia	2,014	1,253	62	21	1	14,230	92	1.5

**Table 1 - Evolution of forest cover in the Mediterranean (1990-2010) (continued)**

Country	Land area (1,000 ha)	Forest		Other wooded land			% of total forest area in Mediterranean countries	
		1,000 ha	% of land area	1,000 ha	% of land area	1,000 ha		% of land area
Tunisia	15,536	1,006	6	300	2	1,402	55	1.2
FYROM*	2,543	998	39	143	6	1,709	62	1.2
Albania	2,740	776	28	255	9	17,852	97	0.9
Syria	18,378	491	3	35	0.002	638	46	0.6
Montenegro	1,382	467	34	277	20	175,407	100	0.5
Libya	175,954	217	0.001	330	0.002	537	58	0.3
Cyprus	924	173	19	214	23	1,977	91	0.2
Israel	2,164	154	7	33	2	780	76	0.2
Lebanon	1,023	137	13	106	10	8,675	98	0.2
Jordan	8,824	98	1	51	1	99,455	100	0.1
Egypt	99,545	70	0.0007	20	0.0002	29	64	0.1
Others	686	25	4	0	0	632	92	0.1

\* FYROM: Former Yugoslav Republic of Macedonia.  
Source: FAO and Plan Bleu (2013).

## Population growth, urbanisation and social change: consequences for forests and forestry

The Mediterranean region has undergone significant socio-economic development. In the last 60 years its population has more than doubled, reaching 570 million inhabitants in 2010 and heading towards over 600 million by 2050 (Population Reference Bureau, 2013). Most of this growth is taking place in the Middle East and North Africa (MENA) region, which has one of the world's most rapidly expanding and young populations. Southern and eastern Mediterranean countries now contribute with over half the population, while they represented less than one third in the 1950s. Additionally, the region supports a very significant seasonal population, as it is the destination of almost one third of the world tourism or over 330 million international visitors in 2014 (World Travel and Tourism Council, 2014). All across the region, there is a strong surge in demand for food, water, housing and transport that has not been matched by a similar increment in the production of raw materials, feedstock and food. According to a recent study "the overall Mediterranean region is using approximately 2.5 times more renewable resources than its ecosystems can provide" (Global Footprint Network, 2015). The Mediterranean has become a net importer of raw materials and consumer goods. The region has the biggest share of the world's population living under water scarcity (FAO and Plan Bleu, 2013). Moreover, it faces enormous difficulties to provide jobs to its population as is reflected by high unemployment rates (Roudi, 2011). Stimulating green entrepreneurship to create local value chains on goods and services provided by forests and to progress towards sustainable consumption and a more circular economy would open new opportunities for forest and rangeland management.

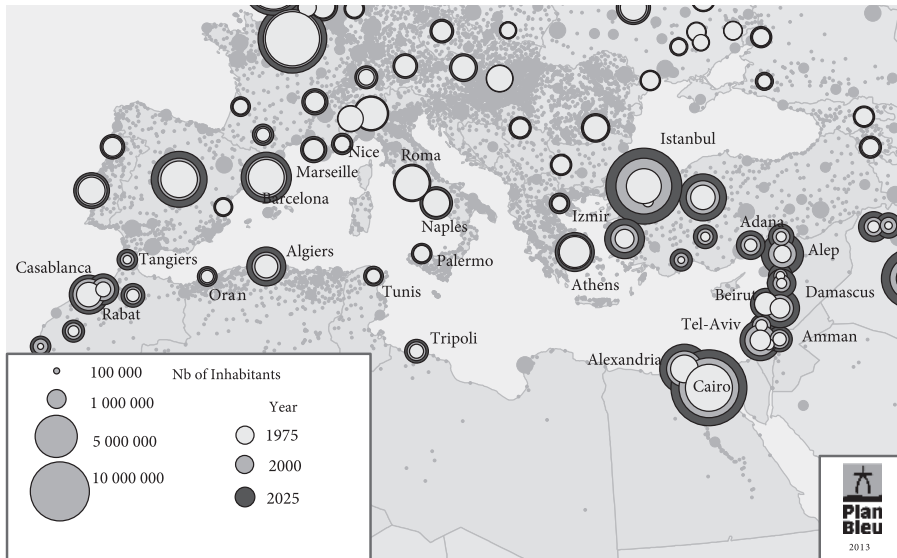
Urban areas have been the primary locus of this growth (see Figure 2). In the MENA countries, the rate of urbanisation grew from 48% in 1980 to close to 60% in 2000, and it is expected to exceed 70% by 2015 (against an average of 54% for all developing countries). Indeed, the region's average annual urban growth rate of 4% in the past two decades is exceeded only by sub-Saharan Africa, which is far less urbanised (World Bank, 2015).

This rapid increase of urban populations and lifestyles constitutes one of the major changes of our era (Seto *et al.*, 2011). The resulting expansion of urban areas leads to the irreversible loss of land. It is a primary driver of habitat loss, and species extinction, destruction of prime agricultural soils, also having impacts on hydrological systems and local climates. It is occurring in a context of poor economic performance and high unemployment rates leading to the proliferation of slums and informal peri-urban settlements, increasing urban sprawl and informal economic activities (World Bank, 2015). In less developed countries, this is putting additional pressures on forest resources as urban dwellers still frequently rely on firewood as a source of domestic energy. In addition, available data clearly shows that Mediterranean citizens have very limited access to forests and green areas. This can be as low as 7m<sup>2</sup> *per capita* in Italy or 2.5m<sup>2</sup> *per capita* in Morocco (Salbitano *et al.*, 2013). This has deleterious effects in quality of life and human health. Urban expansion is a complex issue related not only to increasing urban and rural exodus, but also to



international capital flows, land use policies, transport costs or the structure and size of the informal economy (Seto *et al.*, 2011). Consequently, preserving and managing urban and peri-urban forests must be a crosscutting objective across policy areas for the wellbeing of inhabitants.

**Figure 2** - Urban population distribution and increase in Mediterranean countries (2011)



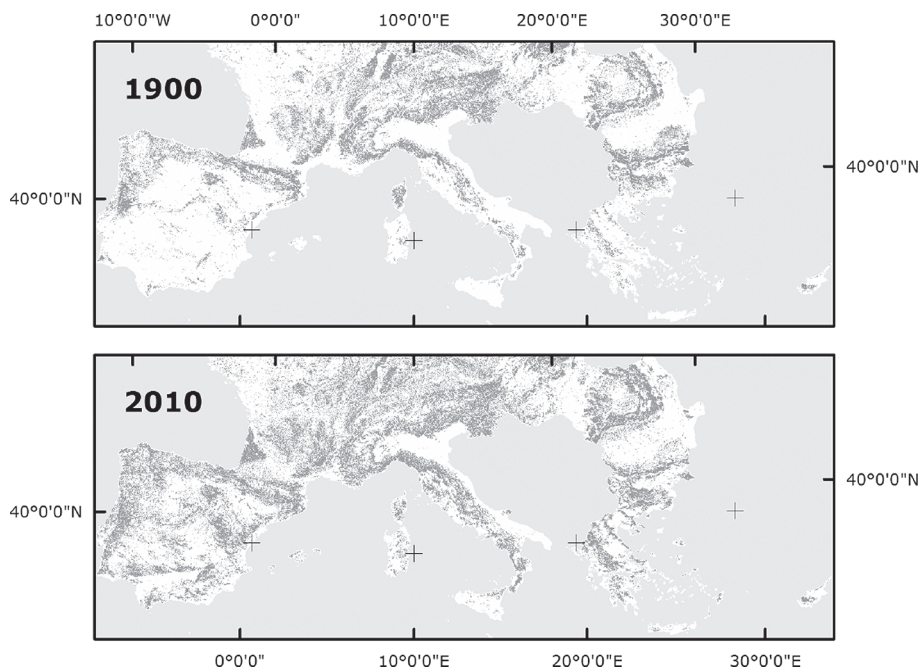
Source: United Nations, Department of Economic and Social Affairs, Population Division, 2011.

In the northern Mediterranean, the “Green Revolution” has favoured the intensification of crops in the low lands, rendering traditional extensive agro-forestry economically and socially unviable. Urbanisation induces progressive social desertification and aging of the population in the rural areas, as extensive grazing and family subsistence farming are abandoned and agriculture is only maintained where intensification is profitable (Farcy *et al.*, 2016). The rapid adoption of fossil fuels as the main energy source also in rural areas, has led to a general lack of demand for firewood and charcoal and in turn to land abandonment and an increase of forests (see Figure 3). These new forests remain largely unmanaged. The incapacity of society to generate value from large proportions of the landscape entails a waste of resources.

Forests in Europe’s southern countries have expanded rapidly in the past few decades, with forest cover at the highest level in centuries. Across the region, forest cover fell to a minimum of approximately or even less than 10% during the 19<sup>th</sup> and early 20<sup>th</sup> centuries. Today it is set to surpass the 50% mark. Generally, these expanding forests are also gaining biomass, as management intensities are generally very low. With few exceptions, fragmented, uncompetitive value chains are unable to supply other more sophisticated demands or to sustain decent jobs and

to retain rural population. Except for areas dominated by plantations, wood extraction represents typically up to 50% of the increment. Paradoxically, some Mediterranean regions host important forest-based industries, but these are almost totally based on wood imports and are unconnected to local forest resources.

**Figure 3** - Estimated expansion of European Mediterranean forests since 1900



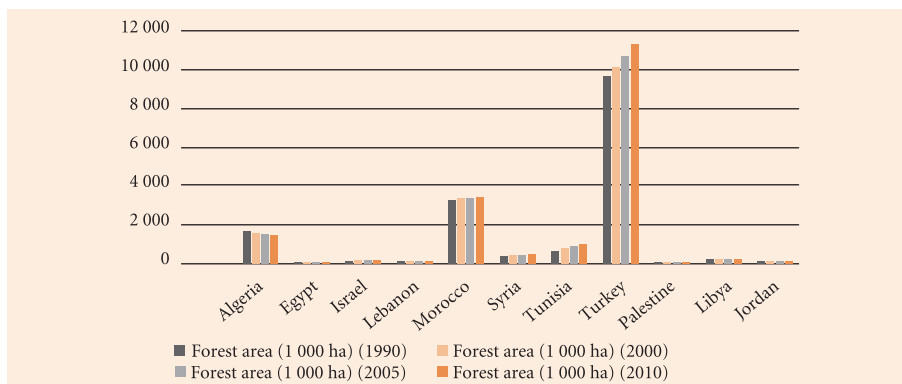
Source: Elaborated based on data from Fuchs *et al.* (2013).

The absence of viable value chains maintains these young new forests largely unmanaged, vanishing the economic income that could be generated for the region. The consequences of this phenomenon are multiple and complex. Some are clearly positive. The increased forest area and increased stocking levels can help restore soil fertility after centuries, sometimes millennia, of degradation. In addition, it is increasing the habitat availability for forest specialist species. On the other hand, those species depending on open landscapes are suffering from habitat loss. There are also negative consequences. The lack of management leads to rapid build-up of fuels and produces forest structures that are very favourable for fire spread. Increased continuity in the landscape and favourable climatic conditions increases the occurrence of *megafires* (San Miguel-Ayanz *et al.*, 2013) and associated ecological and societal risks.

Southern and eastern Mediterranean countries share many of those trends (see Figure 4). Strong urbanisation and reliance on fossil fuels have also reduced the pressures on forests. However, rural areas are still relatively densely populated.

Forests and rangelands help sustain stable or increasing populations then inevitably exert strong pressures on natural resources through subsistence agriculture. The presence of browsing animals is ubiquitous and firewood removals are intense. Low-density, low-stocked forests with sparse understory dominate. They are frequently threatened by the encroaching of agriculture and expansion of settlements. In this context, governmental actions in the last decades have been a decisive factor to slow (Algeria), halt (Lebanon, Jordan) or even to revert (Morocco, Tunisia) deforestation (FAO and Plan Bleu, 2013; FAO, 2015). As shown in Table 2, planted forests account for a significant share of forests in most northern African and eastern Mediterranean countries. This has also required significant investments in afforestation and in protecting forests from social pressures. Forests are generally state-owned and local populations typically have limited capacity to manage them and to realise material benefits within sustainable practices. At the same time, forest authorities, following a “command and control” scheme, try to reduce human pressures. This generates frequent conflicts of interest between the rural population and the forest administration. Careless action and conflicts with the forest authorities are among the major causes of forest fires in Algeria (Meddour-Sahar *et al.*, 2012).

**Figure 4** - Changes in forest area in Southern and Eastern Mediterranean countries



Source: FAO and Plan Bleu (2013).

Big challenges remain in order to secure the conservation, sustainable management and restoration of forest resources. The complicity of local populations is probably the most relevant factor for success. Negative pressures will remain until rural and peri-urban populations are able to improve their livelihoods, or at least to perceive significant benefits, from the sustainable management of Mediterranean forests. Until then, the conservation of forest resources will remain a wicked problem for decision makers and the broader society.

The effects of increased urbanisation on forests do not stop there. The expansion of urban lifestyles and the reduced access to natural and rural areas are generating changes in the social perception on forests and forestry. Changes in the school

**Table 2 - Extension of planted forests**

Country/area	Planted Forest			Natural Forest	Planted Forest
	1,000 ha	% of forest area	% of which introduced species		
Albania	94	12	8	683	94
Algeria	404	27	–	1,088	404
Bosnia and H.	999	46	–	1,186	999
Bulgaria	815	21	5	3,112	815
Croatia	70	4	39	1,850	70
Cyprus	31	18	5	142	31
Egypt	70	100	83	0	70
France	1,633	10	36	14,321	1,633
Greece	140	4	–	3,763	140
Israel	88	57	30	66	88
Italy	621	7	15	8,528	621
Jordan	47	48	–	51	47
Lebanon	11	8	74	126	11
Libya	217	100	–	0	217
Morocco	621	12	33	4,510	621
Portugal	849	25	99	2,607	849
Serbia	180	7	–	2,533	180
Slovenia	32	3	–	1,221	32
Spain	2,680	15	37	15,493	2,680
Syria	294	60	17	198	294
FYROM*	105	11	–	893	105
Tunisia	690	69	30	316	690
Turkey	3,418	30	2	7,916	3,418

\* FYROM: Former Yugoslav Republic of Macedonia.  
Source: FAO and Plan Bleu (2013).

systems and lifestyle have been reinforcing this trend (Pergams and Zaradic, 2008). The role of peri-urban forests becomes increasingly important but this is often neglected (Scott *et al.*, 2007). Studies also suggest that forest management and related forest issues are not well understood outside the small forestry community and that there is a significant gap between reality and people's understanding. Such gaps in social perception can have high impacts on forest management decisions, where urban citizens and authorities make decisions that affect forest resources and rural population, or where people from developed countries draft a global agenda on forestry issues that affects developing countries (Farcy *et al.*, 2016). As an example, European citizens from Mediterranean countries still think that deforestation is major problem for their forests while, as we have seen, forest cover is reaching maximums unknown for centuries. Also, European highly urbanised societies generally disregard the actual or potential contribution of forest as a source of sustainable raw material and its economic dimension, favouring conservation and recreational uses (ECORSYS, 2009). Finally, social perception can shape forest-related policies and approaches, including financial frameworks for forest management.

## Globalisation and the structural changes in markets for forest products

Globalisation can refer to the fast spread of ideas and governance structures but frequently, its main objective focuses on the consequences of strong economic integration through the development of trade and capital flows across borders. The liberalisation of trade coupled with the emergence of new global players in the forestry sector is having major impacts in the markets of forest products and the related value chains.

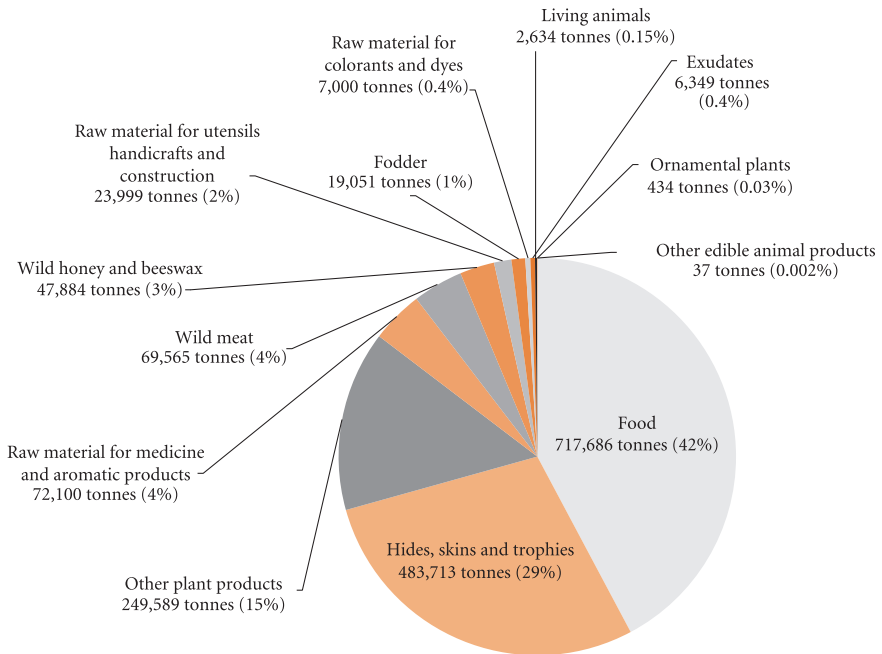
Mediterranean forests are known for the relatively higher and multifunctional value provided by non-wood forest products and ecosystem services (see Figure 5). Yet, wood is still one of the major contributors to the total economic value of Mediterranean forests and is still one of the main drivers and sources of income for forest management (Merlo and Croitoru, 2005). Wood markets have significantly changed in the last few decades and Mediterranean forests need to adapt.

Emerging economies in Asia and the Southern Hemisphere capture an increasing part of the production and the demand for forest-based products. The Mediterranean region is a significant net importer of wood products from other areas, and has no competitive advantages in commoditised low added value products. With few exceptions, Mediterranean silviculture is characterised by high harvest and logging costs, dispersion of the offer, high heterogeneity of qualities, and very different regulations and market arrangements. The biggest share of the paper and woodworking industries are based on imported timber. Local wood value chains are formed by small companies with low innovation capacity producing low added value products. The Mediterranean forest is not profitable and this is jeopardising forest management in itself.

Many countries of the Mediterranean region with significant wood resources are putting their efforts in developing biomass markets and the corresponding supply chains, even if currently stumpage prices are generally rather low. The question is,

whether biomass and forest products alone will be enough for the forest-based sector to stay viable. The answer might turn to be negative. Being at the bottom of the value chain, energy requires extensive resources and produces limited employment and wealth. Moving up towards higher added value products and services seems to be necessary if forests are to contribute to solving current societal challenges.

**Figure 5 - Non-wood forest products removals in the Mediterranean countries (2010)**



Source: FAO and Plan Bleu (2013).

Globalisation does not only have an impact on wood and timber-based products but also on non-wood forest products. China is the world's largest producer of honey and dominates export markets of pine nuts and resins. Spanish resin production peaked in 1962 with 55,000 tonnes. It dropped to only 2,500 tonnes in 2010, as local industries moved to imported resins. In the same period, China's production expanded from 180,000 tonnes to over 800,000 tonnes. Overall, western countries (USA, France, Spain, Portugal) represented some 60% of the world production of resins until the early 1960s. In the last 20 years, China alone has supplied around 80% of the global demand, with Brazil in second place with an additional 8% (MAGRAMA, 2013). This market situation produces big pressures on prices and also high price volatility, factors that are seen as the main obstacle for reactivating resin production in the region. The increased relevance of Chinese internal markets and a favourable momentum for the "green chemistry" can offer new opportunities for producing resin in over 8 million hectares of Mediterranean forests (MAGRAMA, 2013).

Activating forest management in the Mediterranean region is a major challenge that requires the development of competitive value chains on wood, non-wood products, agroforestry and ecosystems services. There is an urgent need to find a new paradigm and to start seeing Mediterranean forests and rangelands as a source of richness. Finding adequate business models and advancing through the value chains to capture an increased share of the value is definitely necessary.

### Maximise the production of goods and services of Mediterranean forest ecosystems in the context of global changes

Mediterranean forests in Europe, North Africa and the Middle East will be increasingly subject to human pressures (overgrazing, fuel wood collection, wildfire, agricultural conversions, etc.) and the effects of climate change (increasing temperatures, declining rainfall, pest attacks, etc.). These consequences are all the more evident where populations are strongly dependent on forest ecosystems. In this region, forest administrations and managers also have to face significant technical and financial difficulties in sustainably managing Mediterranean forest ecosystems. In this context, the regional project that focused on maximising “the production of goods and services of Mediterranean forest ecosystems in the context of global changes” was funded by the French Global Environment Facility and managed by the FAO Committee on Mediterranean Forestry Questions - *Silva Mediterranea* - and Plan Bleu.

The aims of the project are 1) to integrate the impacts of climate change into forestry management policies and produce data and tools regarding both the vulnerability of forests and their ability to adapt; 2) to assess the socio-economic values of goods and services provided by Mediterranean forest ecosystems; 3) to improve modes of governance for Mediterranean forest ecosystems at territorial scale; 4) to optimise and value the role of Mediterranean forests in climate change mitigation (carbon sinks), via the production of methodological tools.

The support provided to the targeted countries (Algeria, Morocco, Lebanon, Tunisia and Turkey) will promote the sustainable management and rehabilitation of Mediterranean forests in order to ensure and value the sustainable provision of forest goods and services.

## Climate change

The Mediterranean is one of the world regions with a greater impact of climate change, which is already having a concrete impact on forest-related policies. Increased temperatures, reduced precipitation and longer and more frequent droughts are predicted under scenarios of the Intergovernmental Panel on Climate Change (IPCC). Such changes have major implications for the functioning and sustainability of Mediterranean forest ecosystems. Increased water stress, more favourable conditions for catastrophic wildfires, tree species migrations, forest dieback, proliferation of existing and new pests and diseases are among the expected impacts of climate change on forests (Lindner *et al.*, 2010).

In a context of increased uncertainty, adaptive management approaches are needed. These are not only urgent for the Mediterranean forests themselves but also for regions that might experience a shift in climate towards a typically Mediterranean one in the future.



There is quite a significant amount of knowledge available that can guide sound forestry practices. The most critical challenge is integrating that knowledge into the rapidly-evolving environmental, social and economic context. Adaptation to climate change needs to be not only scientifically sound; it must also be economically sustainable and socially acceptable. Forest management objectives, decision-making tools, policies and strategies need to be adapted to future conditions and new demands for forest goods and ecosystem services.

Climate change is at the core of significant policy developments and the role of forests in the adaptation and mitigation of climate change is increasingly recognised. Until now, the main focus has been placed on mitigation efforts targeting high-productivity tropical forests, but this might change in the short term (see for example the 2009 initiative of the Global Environment Fund [GEF]). The decision taken at the COP21 puts adaptation of forest to climate change at the same level as mitigation. Developing carbon stocks and reducing emission from deforestation and forest degradation is recognised along with the non-carbon benefits of the integral and sustainable management of forests. The need to move towards a more sustainable development model is creating a suitable and positive momentum to forests. The role of forests in a green economy and the potential to supply the bioeconomy is increasingly recognised at global, regional, national and local levels.

## Innovative forest management policies and approaches

Mediterranean forests are immersed in a striking paradox. They are very valuable and represent a critical green infrastructure that can help addressing the most critical challenges that emerge from global change. However, it seems that our society has lost the capacity to understand those values, to insert them into the economic flows and to develop a balanced approach to their sustainable management. Therefore, Mediterranean forests have become a *sink of* public resources needed to protect forests from climate change and people.

Developing sustainable and complete value chains on wood, non-wood products, agroforestry and ecosystems services has become the cornerstone for the protection and management of Mediterranean forests, as stated also in the Tlemcen Declaration<sup>1</sup> and the Strategic Framework for Mediterranean Forests (SFMF)<sup>2</sup>.

The Tlemcen Declaration calls on regional, national and local political, administrative authorities and stakeholders in the Mediterranean region to develop and adapt their strategies and policies (including governance) for the sustainable development of forests. A broad consultation is exhorted, which includes forest managers, experts, the scientific community and stakeholders to implement innovative strategies. The Tlemcen Declaration promoted the adoption of the SFMF that aims to provide a common policy direction for integrated management. With the support of this regional policy agenda, the several initiatives already happening in the region are

---

1 - Tlemcen Declaration ([www.fao.org/forestry/36632-03883494ea162d6695e84f2182b57129f.pdf](http://www.fao.org/forestry/36632-03883494ea162d6695e84f2182b57129f.pdf)).

2 - SFMF ([www.fao.org/forestry/36306-08872a0d33e559c4f5c42304068d43763.pdf](http://www.fao.org/forestry/36306-08872a0d33e559c4f5c42304068d43763.pdf)).



moving towards a renewed regional collaboration. The objective is to make the inhabitants aware of the values of Mediterranean forests by promoting regional initiatives and collaborations.

**The Great Green Wall for the Sahara and the Sahel initiative: promoting sustainable management and restoration of forests, rangelands and other natural resources in Africa's drylands**

Contrary to popular perception, desertification is not the loss of land to the desert or through sand-dune movement. Desertification refers to land degradation in arid, semi-arid and sub-humid areas resulting from factors such as human pressure on fragile ecosystems, deforestation and climate change. Desertification and land degradation have a strong negative impact on the food security and livelihoods of the local communities in Africa, where two-thirds of the land cover consists of drylands and deserts.

The Great Green Wall for the Sahara and the Sahel is Africa's flagship initiative, established in 2007 to combat the effects of climate change and desertification and brings together more than 20 African countries including North Africa, the Sahel and the Horn, together with international organisations, research institutions, civil society and grassroots organisations. More than a wall, it is conceived as a mosaic of sustainable management and restoration interventions in production landscapes including forests and agrosilvopastoral systems, rangelands and associated natural resources.

The FAO has provided technical support to the African Union Commission and thirteen partner countries with the financial support of the European Union (EU) benefiting Algeria, Burkina Faso, Egypt, The Gambia, Mauritania, Nigeria, Senegal, Sudan, Chad, Djibouti, Ethiopia, Mali and Niger. The aim is to initiate the Great Green Wall harmonised strategy which was adopted by the African Ministerial Conference on the Environment in 2012 and the African Union Assembly in 2013, to help in the start of projects in thirteen countries and to implement a capacity development strategy, an action plan as well as a communication strategy. As a follow-up to this successful EU-FAO collaboration, a 41-million euros wider programme "Action Against Desertification" (AAD) was launched in July 2014 in collaboration with the ACP Secretariat, the African Union Commission and funding support from the EU and other partners. This provides a great opportunity for implementation of some components of the Great Green Wall action plans developed in six Great Green Wall countries (Burkina Faso, Ethiopia, The Gambia, Niger, Nigeria and Senegal) and expansion of activities to the Caribbean (Haiti) and the Pacific (Fiji) building on the successful results of activities carried out in Africa and on south-south cooperation among African, Caribbean and the Pacific countries (ACP). The AAD specific objective is to improve the condition and productivity of the agrosilvopastoral landscapes of these eight countries affected by desertification, land degradation and drought.

Source: FAO ([www.fao.org/in-action/action-against-desertification](http://www.fao.org/in-action/action-against-desertification)) and [www.fao.org/forestry/aridzone](http://www.fao.org/forestry/aridzone).

Forests are dynamic social-ecological systems and they are subjected to innovation promoted by different forest-related stakeholders. The Mediterranean Model Forest Network (MMFN)<sup>3</sup> is exploring participatory approaches and territorial innovation to advance towards sustainable forest management. Created in 2008, it now gathers

3 - Mediterranean Model Forest Network ([www.imfn.net/index.php?q=node/158](http://www.imfn.net/index.php?q=node/158)).

thirteen regions from nine different countries. Andalusia's regional government has engaged shepherds in firebreak maintenance and fuel reduction through innovative contractual arrangements<sup>4</sup>. Today there are some 200 shepherds and over 100,000 animals involved in fire prevention. This successful approach is now expanding to other regions. In the Alentejo region, Portugal, a broad partnership of municipalities, cooperatives, business companies, research facilities and individual entrepreneurs have created a platform<sup>5</sup> to stimulate the creation of innovative business models for non-wood forest products and other wild resources such as aromatic plants, honey, mushrooms and wild fruits (*Arbutus unedo* or *Ceratonia siliqua*). Connecting actors fostered the sharing of knowledge conducive to the formation of greater added value and sustainable value chains. In Castilla y León, the regional government offers local communities the opportunity to auction their allowable hunting rights on the Internet in a way that resembles eBay<sup>6</sup>. This initiative not only increased transparency, it has also generated more income, and more importantly, it offers an unparalleled opportunity for territorial marketing and promotion of associated services. In Morocco, the booming demand for argan oil (the most expensive edible oil in the world) is providing economic and social benefits for rural communities especially when, organised in cooperatives, local actors have been able to capture a relatively greater part of the value (Lybbert *et al.*, 2010). Turkey has promoted the development of forest cooperatives since the 1970s with nowadays over 2,000 cooperatives involving some 300,000 villagers. Cooperatives are given priority to use forest products and to work in the forest. They produce planting stocks and provide technical assistance. Some cooperatives also engage in the collection and commercialisation of non-wood forest products and provide tourism and recreational services. Innovative approaches to the commercialisation of non-wood forest products, often associated with territorial marketing strategies, and the promotion of the bioenergy value chains are emerging throughout the region.

In the context of an increasing need for job creation, in particular for youth, bioeconomy presents promising opportunities that can be exploited through market-pull and innovation in bioenergy, but also through the increasing demand for engineered wood products for sustainable construction, and biomaterials based, for example, on cork and resin. Edible products also have economic potential, leveraged through territorial marketing and other accompanying actions. Financing multipurpose forestry might also require the development of instruments such as payments for ecosystem services (PES) to link forestry with other sectors (e.g. water and tourism sectors) that could, in turn, benefit from increased management levels and reduced risk (e.g. prevention of wildfires, landslides and flooding). Many of these developments are already happening across the Mediterranean.

---

4 - Ganadería extensiva ([www.ganaderiaextensiva.org/pastoralismo-y-prevencion-de-incendios/](http://www.ganaderiaextensiva.org/pastoralismo-y-prevencion-de-incendios/))

5 - [www.alentejosilvestre.com/](http://www.alentejosilvestre.com/)

6 - [www.subastasdecaza.com/](http://www.subastasdecaza.com/)

## Conclusion

It seems that modern societies have lost the capacity to generate value from large portions of the Mediterranean landscape. In some areas, forest cover, biomass and megafires proliferate, and in others strong land-use change, overgrazing and over-exploitation put increasing pressure on the ecosystem. The region cannot possibly afford this waste of resources. Reversing this situation will be the most critical challenge for Mediterranean forestry in the years to come. In this region, turning brakes into opportunities is possible, by creating better opportunities for youth in the field of tertiary economy, or by building more partnerships between private and public, cities and countryside, forest and water, culture and slow tourism. This requires innovative approaches to governance, land tenure, and the involvement of rural and urban populations. Finding adequate business models and moving to higher added value products and services is necessary. The Mediterranean region must be able to manage forests better for the benefit of urban, rural and local populations and create job opportunities and richness while preserving the multifunctionality of forests through sound practices and governance structures.

## Bibliography

Davis (D.K.) (2007), *Resurrecting the Granary of Rome. Environmental History and French Colonial Expansion in North Africa*, Athens (Ohio), Ohio University Press.

ECORSYS (2009), *Shaping Forest Communication in the European Union: Public Perceptions of Forests and Forestry*, Rotterdam, European Commission, DG Agriculture and Rural Development, Tender No. AGRI-2008-EVAL-10.

FAO (2015) *Global Forest Resources Assessment 2015: Desk reference*, Rome, FAO.

FAO and Plan Bleu (2013), *State of Mediterranean Forests 2013*, Rome, FAO.

Farcy (C.), Camino (R. de), Martínez de Arano (I.) and Rojas Briales (E.) (2016), “External Drivers of Changes Challenging Forestry: Political and Social Issues at Stake”, in G. Larocque, *Ecological Forest Management Handbook (Applied Ecology and Environmental Management)*, Boca Raton (Fla.), Taylor and Francis Group-CRC Press, pp. 87-105.

Fuchs (R.), Herold (M.), Verburg (P.H.) and Clevers (J.G.P.W.) (2013), “A High-resolution and Harmonized Model Approach for Reconstructing and Analysing Historic Land Changes in Europe”, *Biogeosciences*, 10 (3), pp. 1543-1559.

GEF (2009), *A New Climate For Forests. GEF Action on Sustainable Forest Management*, Washington (D.C.), Global Environmental Facility (GEF).

Global Footprint Network (2015), *How Can Mediterranean Societies Thrive in an Era of Decreasing Resources?*, Oakland (Calif.), Global Footprint Network ([www.footprintnetwork.org/documents/MED\\_2015\\_English.pdf](http://www.footprintnetwork.org/documents/MED_2015_English.pdf)).

- Le Houérou (H.N.) (1981), "Impact of Man and his Animals on Mediterranean Vegetation", in F. Di Castri, W. Goodall et R.L. Specht (eds), *Ecosystems of the World 11: Mediterranean Type Shrublands*, Amsterdam, Elsevier Scientific Publishing, pp. 479-521.
- Lindner (M.), Maroschek (M.), Netherer (S.), Kremer (A.), Barbati (A.), Garcia-Gonzalo (J.), Seidl (R.), Delzon (S.), Corona (P.), Kolström (M.), Lexer (M.J.) and Marchetti (M.) (2010), "Climate Change Impacts, Adaptive Capacity, and Vulnerability of European Forest Ecosystems", *Forest Ecology and Management*, 259, pp. 698-709.
- Lybbert (T.J.), Magnan (N.) and Aboudrare (A.) (2010) "Household and Local Forest Impacts of Morocco's Argan Oil Bonanza", *Environment and Development Economics*, 15 (4), pp. 439-464.
- MAGRAMA (2013), *Actas del II Simposio Internacional de Resinas Naturales, del 16 al 18 de abril de 2013*, Coca (Segovia).
- Meddour-Sahar (O.), Lovreglio (R.), Meddour (R.), Leone (V.) and Derridj (A.) (2012), "Fire and People in Three Rural Communities in Kabylia (Algeria): Results of a Survey", *Open Journal of Forestry 2013*, 3 (1), pp. 30-40.
- Merlo (M.) and Croitoru (L.) (2005), *Valuing Mediterranean Forests: Towards Total Economic Value*, Wallingford, CAB International.
- Mermet (L.) and Farcy (C.) (2011), "Contexts and Concepts of Forest Planning in a Diverse and Contradictory World", *Forest Policy and Economics*, 13 (5), pp. 361-365.
- Oedekoven (K.H.) (1963), "Histoire forestière du Proche-Orient", *Unasylva*, 17 (68), pp. 13-21.
- Pergams (O.R.W.) and Zaradic (P.A.) (2008), "Evidence for a Fundamental and Pervasive Shift away from Nature-based Recreation", *PNAS 2008*, 105 (7), pp. 2295-2300.
- Population Reference Bureau (2013), *World Population Data Sheet*, Washington (D.C.), Population Reference Bureau.
- Salbitano (F.), Conigliaro (M.), Fages (B.), Gauthier (M.) and Sanesi (G.) (2013), "Urban and Peri-urban Forestry in the Mediterranean Region", in FAO and Plan Bleu, *State of Mediterranean forests 2013*, Rome, FAO, pp. 104-112.
- San Miguel-Ayanz (J.), Moreno (J.M.) and Camia (A.) (2013), "Analysis of Large Fires in European Mediterranean Landscapes: Lessons Learned and Perspectives", *Forest Ecology and Management*, 294, pp. 11-22.
- Scott (A.J.), Carter (C.), Reed (M.R.), Larkham (P.), Adams (D.), Morton (N.), Waters (R.), Collier (D.), Crean (C.), Curzon (R.), Forster (R.), Gibbs (P.), Grayson (N.), Hardman (M.), Hearle (A.), Jarvis (D.), Kennet (M.), Leach (K.), Middleton (M.), Schiessel (N.), Stonyer (B.) and Coles (R.) (2013), "Disintegrated Development at the Rural-urban Fringe: Re-connecting Spatial Planning Theory and Practice", *Progress in Planning*, 83, July, pp. 1-52.
- Seto (K.C.), Fragkias (M.), Güneralp (B.) and Reilly (M.K.) (2011), "A Meta-analysis of Global Urban Land Expansion", *PLoS ONE*, 6 (8), e23777.
- Steffen (W.), Grinevald (J.), Crutzen (P.) and McNeill (J.) (2011), "The Anthropocene: Conceptual and Historical Perspectives", *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 369 (1938), pp. 842-867.

UN (2011), Department of Economic and Social Affairs, Population Division, New York (N.Y.), United Nations (UN).

UNEP (2005), *Mediterranean Strategy for Sustainable Development. A Framework for Environmental Sustainability and Shared Prosperity*, Athens, United Nations Environment Programme (UNEP) and Mediterranean Action Plan (MAP).

Williams (M.) (2006), *Deforesting the Earth. From Prehistory to Global Crisis, An Abridgment*, Chicago (Ill.), The University of Chicago Press.

World Bank (2015), “Open data, MENA region”, Washington (D.C.), World Bank (<http://data.worldbank.org/region/MNA>).

WTTC (2014), *Travel and Tourism Economic Impact 2014. Mediterranean*, London, World Travel and Tourism Council (WTTC).

