



UNIVERSITÀ
DEGLI STUDI
DI PADOVA

Sede Amministrativa: Università degli Studi di Padova

Dipartimento Territorio e Sistemi Agro-Forestali

Scuola di Dottorato di Ricerca in Territorio, Ambiente, Risorse e Salute

Ciclo XXVI

From failure to value

Towards estimation, accounting and sharing of the Total Economic Value for Mediterranean forests

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*Many people think
they are able to understand, describe and measure whatever they want to:
life, emotions, relativity, nature, sunshine, music, poems, silence, colour,
distance, time, flavour, lack, presence, past, present, people, words, thoughts.
Are they kidding? Are they serious?
What we can do is just trying to set up bridges among
different points to keep them together as long as we can.
Isn't just a miracle to say 'see you tomorrow'?*

M. Butyesiwas
(Please, do not feed animals with *sangria*)

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Abbreviations and acronyms

€	Euro
Bln	billion
C	carbon
C _{eq}	carbon equivalent
CSR	Corporate Social Responsibility
CUM	cubic meter
EC	European Commission
EM	Eastern Mediterranean
EU	European Union
FAO	Food and Agriculture Organisation (of the United Nations)
FLO	Fairtrade Labelling Organisation
FRA	Forest Resources Assessment
FSC	Forest Stewardship Council
FU	forage unit
GDP	Gross Domestic Product
GIS	geographic information system
ha	hectare
M	million
MEA	Millennium Ecosystem Assessment
MFRA	Mediterranean Forest Research Agenda
NEM	North-East Mediterranean
NWM	North-West Mediterranean
NTFP	Non timber forest product
PDO	Protected designation of origin
PEFC	Programme for the Endorsement of Forest Certification schemes
PES	Payment for ecosystem service
PGI	Protected geographical indication
SEEA	System of Environmental-Economic Accounts
SM	South Mediterranean
SoMF	(FAO) State of Mediterranean Forests
TEV	Total Economic Value
tonne	Metric tonne
TSG	Traditional speciality guaranteed

UN	United Nations
US\$	United States Dollar
Yugoslavia SFR	The Socialist Federal Republic of Yugoslavia

Acknowledgement

I would like to express my most sincere gratitude to my supervisor, Prof. Davide Matteo Pettenella, and co-supervisor, Dr. Laura Secco, for their advice, patience and friendship.

There are many other people I would like to thank for the support they gave me during the last three years: all of them deserve a huge 'thank you', but I do prefer to tell them in person.

Summary

Forests are critically important ecosystems in relation to the multitude of services they provide. Some of these services (e.g. timber and some non-timber forest products, NTFPs) are traded in markets and generate direct income to forest owners/managers, while others (e.g. watershed protection, soil creation, biodiversity conservation) have limited or no access at all to markets. Nevertheless they remain very important for the human well-being and the functioning of forest systems themselves. In economic terms these services have a public good nature (externalities) and economists normally referred to them as 'market failures' (Samuelson, 1954; Coase, 1960; Buchanan, 1988). The failure in assigning proper values to forest services may result in the degradation of the ecosystems or the abandon of management activities. The ultimate consequence may be a consistent loose of public values.

Within the international forest context, the above-described dynamics clearly characterise forest resources and landscapes in the Mediterranean basin. Such resources stretch over twenty-one countries, covering a total area of about 74 Million hectares (Mha), i.e. 9.5% of the whole land area in the region (FAO, 2010). Differences between North and South-East Mediterranean countries can be found in terms of forest types and cover, growing stocks, and institutional and socio-economic aspects, including land ownership and forest governance. Forests in the two macro-areas also show different trends: while in the North they are expanding due to the abandon of marginal areas and agriculture practices, in the South-East human pressure in terms of direct consumption of forest goods is still very high. In both cases some risk for depletion and degradation exists, with worsening perspectives in connection to emerging threats represented by climate change (Milano, *et al.*, 2012; Lindner and Calama, 2013) and demographic dynamics (UN, 2013). Notwithstanding this, Mediterranean forests present a remarkable set of features and an exceptionally large variation of environmental conditions. The Mediterranean basin is one of the 35 biodiversity hotspots identified by Conservation International worldwide. Such variety is well reflected in the wide arrays of services delivered by Mediterranean forests. It is also well known and (at least partly) exploited since centuries, but it has rarely been fully recognised and taken into account at macro (policy and decision making) and micro (forest planning, management and investment activities) level. Among the reasons for this a pivotal role is played by the fact that only few of the many benefits are traded in formal markets, while other forest benefits are either traded just through informal markets - as in the case of many NTFPs - or are not traded at all.

A first valuation of the Total Economic Value (TEV) of Mediterranean forests has been performed by Merlo and Croitoru in 2005 and estimated an average value of 133 €/ha, with huge differences among services and countries. Although the work done by Merlo and Croitoru (2005) can still be considered as the most complete study trying to evaluate TEV for Mediterranean forests, some new elements came out since it was published, including: new forest/ecosystem valuation studies and projects at national and international level (e.g. MEA, 2005; Braat *et al.*, 2008; Chiabai *et al.*, 2009; Kumar, 2010), new forest data made available by FAO at international (FAO, 2010) and Mediterranean scale (FAO, 2013), a growing attention on ecosystem services and emerging markets for them (e.g. the raising of Payments for Environmental Services, PES, schemes (Wunder, 2005)), the

improved relevance of Mediterranean forests on the international policy and research agenda, and changes in international environmental accounting frameworks (UNSTATS, 2011). Therefore an up-to-date estimate of the TEV of Mediterranean forests represents a preliminary step towards the informing of future policy aiming to the conservation of the many public values implicit in these ecosystems, and the creation of new opportunities for rural development in the region. TEV estimation *per se* however is not enough for turning potential values into marketable ones. In this perspective governance issues shall be analysed as well. Mediterranean forests do not just provide many public values, but are also subject to different types of land ownership and management mechanisms, and affect a wide number of different stakeholders. As a consequence a broad range of policy, research, and management tools is needed to promote the sustainable stewardship of Mediterranean forests resources.

The present study analyses new challenges for non-conventional markets for Mediterranean forest resources. The research includes: (i) an analysis of markets for both wood (industrial timber and energy wood) and non-timber forest products (NTFPs), as well as for a selection of ecosystem services, with focus on Carbon sink capacity and grazing. The assessment estimates the economic value of selected products and services through different methodologies and approaches; (ii) an analysis of relevant forest governance tools within the Mediterranean region, including (a) conventional funding opportunities for Mediterranean forest resources at both national and international scale, (b) the implementation of Payment for Environmental Services (PES) mechanisms as new tools for financing and enhancing Mediterranean forests, and (c) the adoption of other voluntary instruments within Corporate Social Responsibility (CSR) approaches.

Value estimations for selected products (timber and non-timber ones) and services (grazing and carbon-sink) at regional level brought to a total estimation ranging between €12,508.6 Million (M) and €13,155M. Wood products prevail on other products, representing more than 80% of the total value. Within wood products, timber is the most relevant component, equivalent to about 62% of the total value estimated for selected products/services and about 76% of the total value for wood products only, while the remaining proportion is covered by firewood. The total estimated value for grazing is 11% of the total value for provisioning services, i.e. almost twice the estimated value for NTFPs. It shall be noticed, however, that figures for NTFPs are likely to be underestimated because data are available only for some products and ten countries. Indeed, when using alternative estimation methodologies - as tested for pine nuts, pine resin and cork - the estimated value could show a €36.8-572.4M increase, depending on different scenarios. In geographical terms, the economic value of Mediterranean forests is highly concentrated: 65% of this value depends on North-West Mediterranean countries, and nearly 90% of the total value is concentrated in five countries only (France, Spain, Turkey, Italy and Algeria).

As for governance issues, conventional funding resources for the Mediterranean region are shifting from international to national public funds. Moreover, there is growing room for private financing tools and initiatives. Among them a relevant role could be played by Payments for Environmental Services (PES) schemes, but their implementations is still limited in the region, with strong concentration in Northern Mediterranean countries. A shift from the conventional funding channels to new voluntary tools is much needed as an answer both to the growing maturity

and responsibility of civil society and to the needs for more efficient and effective tools for dealing with natural resources management problems.

1. Introduction

The present Chapter is introductory to the thesis and presents the research background, defines problems behind the study as well as research questions and objectives. Moreover it includes a general overview of the thesis contents and structure.

1.1 Background

Forests are critically important ecosystems in relation to the multitude of services they provide. Some of these services (e.g. timber and some non-timber forest products, NTFPs) are traded in markets and generate direct income to forest owners/managers, while others (e.g. watershed protection, soil creation, biodiversity conservation) have limited or no access at all to markets. Nevertheless they remain very important for the human wellbeing and the functioning of forest systems themselves. In economic terms these services have a public good nature (externalities) and they are normally referred to by economists as ‘market failures’ (Samuelson, 1954; Coase, 1960; Buchanan, 1988). The failure in assigning proper values to forest services may result in the degradation of the ecosystems or the abandon of management activities. The ultimate consequence may be a consistent loose of public values.

Within the international forest context, the above-described dynamics clearly characterise forest resources and landscapes in the Mediterranean basin. Interrelations between natural resources and major landscapes in the region, and the human activities that have been shaping them for thousands years are closer than in any other area in the world (Thirgood, 1981; Pons and Quézel, 1985; Matvejevic, 1991; Abulafia, 2011). Although large extensions of dense forest may not represent a typical Mediterranean picture, forests are a fundamental part of such a system. Depending on the situation and historical period, they have provided (and still provide) firewood, wood for constructions, game, fruits, land for agriculture and grazing, fodder, water purification, soil protection, recreation and many other outputs. Innumerable testimonies of this exist over time: from the cedar wood traded by *Phoenicians* and used to build-up Egyptian pharaohs’ palaces and the Salomon temple (Breasted, 1920; Palahi *et al.*, 2008), to the Roman *viae legnariae* for the transport of timber¹ across the Empire (Muzzi, 1953) and the *societates picariae* for the extraction and trade of pitch (André, 1964); from the high contribution of cork production to the Portuguese Gross Domestic Product (GDP) still in present times (Mendes, 2005), to the grazing activities taking place within forests since the early Holocene and the Bronze Age (Le Houreou, 1981; Papanastatis, 2009); from the XV century forest policy and management initiatives in some areas, such as Catalonia and the Republic of Venice, aiming to combine timber production and water/soil protection (Appuhn, 2009), to the fashionable modern tourism activities/facilities in coastal areas (Pröbstl *et al.*, 2010).

A strong tie between Mediterranean forests and people who lived around and within them exists: almost ten thousand years of increasingly intensive human

¹ To underline the importance of wood being used for many millennia as the main building material for palaces, ships, tools, etc. it can be remember the Latin word “*materia*” originally meant timber.

presence have radically changed the forest landscapes in the region, turning them into a complex mosaic of horticulture, fields, vineyards, olive groves, orchards, rangelands, semi-natural forests, scrub and dry grasslands (Plan Bleu, 2004). The relationship between humans and the Mediterranean forests has developed over time, but anthropic activities have very often turned into overexploitation, with negative impacts in terms of resource depletion (Thirgood, 1981; Tsoumis, 1996). Many reasons for this exist and many drivers for land change and forest degradation can be mentioned. Among them the main ones are represented by the global climate change, the growing demographic pressure, the conversion of natural areas to farming and urban development, the introduction of invasive alien species, the pollution or over-exploitation of resources including water and soils and the harvesting of wild plants and animals at unsustainable rates (Thirgood, 1981; Schröter *et al.*, 2005; Regato, 2008; Palahi *et al.*, 2008; Plan Bleu, 2009; FAO, 2013). Moreover, recent events, ranging from the global financial crisis, to the dramatic facts that took place during the 'Arab spring' strongly affected some countries in the region. While being influenced by demographic booming and food insecurity due to global changes (Werrel and Femia, 2013), these events had huge potential impacts also on natural resources and their conservation.

In recent times forest land cover dynamics shown different patterns in Northern and South-Eastern Mediterranean countries: while in the North forests are expanding mostly because of the abandon of marginal areas and agriculture practices, in the South-East human pressure in terms of forest degradation due to direct consumption of forest goods is still very high. In both cases some risks for depletion and deforestation exists. Although Mediterranean forests have demonstrated for several centuries their strong resilience to changes of anthropogenic origins (Regato, 2008; FAO, 2013) today they are characterised by a common feature in terms of fragility, instability and frequent degradation (M'Hirit, 1999; Palahi *et al.*, 2008).

1.2 Problem statement

The Mediterranean basin is one of the most bio-diverse areas worldwide and this variety is well reflected in the wide arrays of services delivered by Mediterranean forests. Such diversity of outputs is well known and exploited since centuries, but it has rarely been fully recognised and taken into account at macro (policy and decision making) and micro (forest planning, management and investment activities) level. Among the reasons for this a pivotal role is played by the fact that only few of the many benefits are traded in formal markets, while other forest benefits are either traded just in informal markets - as in the case of many NTFPs - or are not traded at all. Putting a proper value on these services could be the first step towards their internalisation and conservation.

A first valuation of the Total Economic Value (TEV) of Mediterranean forests has been performed by Merlo and Croitoru in 2005: they estimated an average value of 133 €/ha, with huge differences among services and countries. Since then no update took place, but new issues have emerged, including new forest valuation studies and projects at national and international level, new forest data made available by FAO, a growing attention on ecosystem services and emerging markets for them, the improved relevance of Mediterranean forests on the international policy and research agenda, and changes in international environmental accounting frameworks. Although the work done by Merlo and

Croitoru (2005) can still be considered as the most complete study trying to evaluate TEV for Mediterranean forests, some new elements came out since it was published. Among them the following ones can be listed as the most relevant:

- › *new forest economic evaluation studies and projects (increased quantity of available data and experiences, and methodological improvement)* - The book by Merlo and Croitoru was quite pioneering because just few experiences in the field of economic evaluation for forests on large scale were existing at that time, basically limited to the study run by Adger *et al.*, 1995 for Mexico, the paper on the value of the world's ecosystem services and natural capital published by Costanza *et al.* (1997), and the one developed by the Secretariat of the Convention on Biological Diversity at global level (2001). In the last years the number of studies increased and methodologies were refined, with stronger attention on ecosystem services and a new focus on land use change, drivers behind it and effects on ecosystem functions and the value of the services they deliver (Thoroe *et al.*, 2004; MEA, 2005; Kumar, 2010);
- › *FAO Forest Resource Assessment (FRA) 2010 and tentative development of European forest types* - in 2010 FAO published an up-to-date edition of its FRA, so that fresh data are available for all countries in the region, covering the 1990-2010 period. While FAO FRA data do not provide specific information on Mediterranean forest ecosystems, new opportunities could emerge from the recent definition and pilot application of the European Forest Types. Among them 'Broadleaved evergreen forests' and 'Coniferous forests of the Mediterranean, Anatolian and Macaronesian regions' - complemented by 'Thermophilous deciduous forests' and 'Floodplain forests' - cover Mediterranean forest types (Barbati *et al.*, 2011). Recent developments in reporting with regard to these types could help focusing on Mediterranean forests instead than generally refer to forests in Mediterranean countries;
- › *growing attention on ecosystem services and emerging markets for them* - in the last years attention on ecosystem services grew up very much. Such attention has been boosted by the publication of the Millennium Ecosystem Assessment (MEA) in 2005 and more recently by The Economics of Ecosystems and Biodiversity (TEEB) initiative, aiming to draw attention to the global economic benefits of biodiversity, as well as to highlight the growing costs of biodiversity loss and ecosystem degradation (Kumar, 2010). In the future attention to ecosystem services could be further increased by new policies, including new elements within the revised European Union Common Agriculture Policy and the new European Union Rural Development Policy for 2014-2020. At the same time major developments took place with regard to Payment for Ecosystem Service (PES) initiatives. Carbon issues opened the way and still play a major role, but new opportunities exist with regard to services connected to biodiversity and water (Forest Trends and the Ecosystem Marketplace, 2008);
- › *emerging of new issues and opportunities in the forest sector, mainly with regard to the energy sector and the use of biomasses* - In recent years the importance of biofuels has increased, and forest biomass makes no exception. Although Mediterranean forests are not characterised by high

biomass production, they might be interested by such dynamics. On the one hand wood represents the main energy source for communities in rural areas, especially in Southern and Eastern sub-regions; on the other many Northern countries are experiencing an increased consumption of wood as a source of energy (Mantau, 2010). EU policies (e.g. Directive 28/2009) are driving this demand by considering forest biomass as the first source of renewable energy in Europe and by trying to set-up sustainability criteria for biofuels. The topic is relevant also for the Mediterranean region as confirmed by the Proforbiomed (Promotion of residual forestry biomass in the Mediterranean basin) project². Co-financed by the MED Programme of the European Union, the project aims to promote renewable energies in rural areas by developing an integrated strategy for the use of forest biomass as a renewable energy source. The project has already delivered relevant outputs, including a Situation report on forest biomass use in the Mediterranean region (Proforbiomed, 2012);

- › *improved relevance of Mediterranean forests on the international policy and research agenda* – Palahi *et al.* (2008) commented that, apart from activities carried on by Plan Bleu program and the FAO initiative of drawing up a Mediterranean forests action programme (approved at the March 1992 session of Silva Mediterranean in Faro, Portugal), no comprehensive, joint international research agenda has been developed to simultaneously address the economic, ecological, and social challenges of sustainable Mediterranean forest management. Things are now changing. In 2009 a Mediterranean Forest Research Agenda (MFRA) describing the main research priorities for forestry in the region during 2010–2020 has been published under the co-ordination of the Mediterranean Regional Office of the European Forest Institute (EFIMED). Based on the approval of the MFRA by the European Commission, the ERA-NET FORESTERRA³ ('Enhancing FOrest RESearch in the MediTERRAnean through improved coordination and integration') international project was launched in 2012. In 2010 a concept paper on the FAO State of Mediterranean Forests has been published, and a full report was then finalised in 2013 (FAO, 2013) together with the Strategic Framework on Mediterranean Forests (SFMF) that defines nine strategic lines for the management and development of Mediterranean forests and forest landscapes (SFMF, 2013). The Collaborative Partnership on Mediterranean Forests has been launched in 2010 with a formal agreement signed in Istanbul by eight international institutions. The aim of this Partnership is to accelerate the implementation of sustainable forest management practices and the protection of forest-based ecosystem services under climate change conditions in the Southern Mediterranean region, namely in Morocco, Algeria, Tunisia, Lebanon, Syria and Turkey⁴. The experience of Sylva Mediterranean shall be mentioned: launched in 1911, it became an FAO statutory body in 1948, under the name of Committee on Mediterranean Forestry Questions Sylva Mediterranea. Organised into six working groups, this Committee embraces twenty-six

² For more details see: www.proforbiomed.eu

³ For more details see: www.foresterra.eu

⁴ For more details see: www.fao.org/forestry/silvamed/66624/en/

countries and the European Community allowing the sharing of experiences as well as the development of cooperative programmes and projects⁵.

Finally it is worth mentioning the French Global Environment Facility (FFEM) project that aims to maximize the production of goods and services of Mediterranean forest ecosystems in six countries in North Africa (Algeria, Morocco, Tunisia) and the Near East (Lebanon, Syria and Turkey). The project is co-financed by the German Cooperation (GIZ), the European Union, and the French Ministry of Agriculture, Food and Forests (MAFF) with a budget of €8.5M for three years (2011-2015)⁶;

- › *major attention in linking geo-physical data (via GIS) and economic estimations regarding ecosystem services* - the adoption of geographic information system (GIS) tools, techniques and software in the frame of ecosystem evaluation and estimation has become more and more common. The spatially variable nature of ecosystem services in terms of generation and flow has brought to the use of GIS systems to map and modelling of ecosystem services for planning purposes (e.g. Egoh *et al.*, 2008; Naidoo *et al.*, 2008), to facilitate the creation of datasets for the purposes of benefits transfer (e.g. Troy and Wilson, 2006) and finally to compute values derived from biophysical and economic models (Eade and Moran, 1996; Bateman *et al.*, 1999; Soares-Filho *et al.*, 2004 and 2006). Specific tools for mapping and valuing ecosystem services have been set-up, including InVEST⁷ (Integrated Valuation of Ecosystem Services and Tradeoffs) - a family of tools developed in the frame of the Natural Capital project to map and value ecosystem services - and SolVES⁸ (Social Values for Ecosystem Services) - a GIS Application for assessing, mapping, and quantifying the social values of ecosystem services developed by the US Government. Additional tools, like ARIES (Artificial Intelligence for Ecosystem Services) and Costing Nature, have been recently made available;
- › *growing attention on national accounting systems taking into consideration environmental externalities* - the increased interest in ecosystem services as positive externalities and their value is reflected also in the growing attention paid to environmental accounting systems. In 2008 the United Nations (UN) System of National Accounts (SNA) has been revised, while the UN System of Environmental-Economic Accounts (SEEA) is currently under revision. The new version was expected to be completed by the end of 2013 and include a session on Experimental Ecosystem Accounts (UNSTATS, 2011). During 2011 the European Commission published Regulation (EU) No 691/2011 that establishes a common framework for the collection, compilation, transmission and evaluation of European environmental economic accounts.

All these new issues call for a revised evaluation of TEV for Mediterranean forests. An appropriate estimate of the TEV of Mediterranean forests is a preliminary step towards the full conservation of the many public values implicit in these ecosystems, creating new opportunities for rural development in the region.

⁵ For more information see: www.fao.org/forestry/silvamed/en/

⁶ For more information see: www.fao.org/forestry/82782/en/

⁷ For more information see: www.naturalcapitalproject.org/InVEST.html

⁸ For more information see: solves.cr.usgs.gov/

However, this is not enough for turning potential values into marketable ones. In this perspective governance issues are to be analysed as well. Mediterranean forests do not just provide many public values, but are also subject to different types of ownership and management mechanisms, and affect different stakeholders. As a consequence a broad range of policy, research, and management tools is needed to promote the sustainable stewardship of Mediterranean forests resources.

1.3 Objectives and research questions

The research mainly intends to investigate the state of Mediterranean forest resources, analysing their TEV and exploring opportunities and limits for their governance.

The research is driven by the following **research questions**:

- › what is the state of the art of Mediterranean forests?
- › what are the products/services provided by the Mediterranean forests?
- › what is the TEV of products/services provided by Mediterranean forests?
- › how can this TEV be recognised and compensated?
- › what are the main governance issues that influence the management of Mediterranean forests and can help recognising and compensating their value?

The above-presented research questions determine **one general** and **six specific research objectives** that are presented below.

General objective: to analyse and discuss future challenges for Mediterranean forest resources by evaluating the economic value of selected products/services and assessing key-governance dimensions within the region.

Specific objectives:

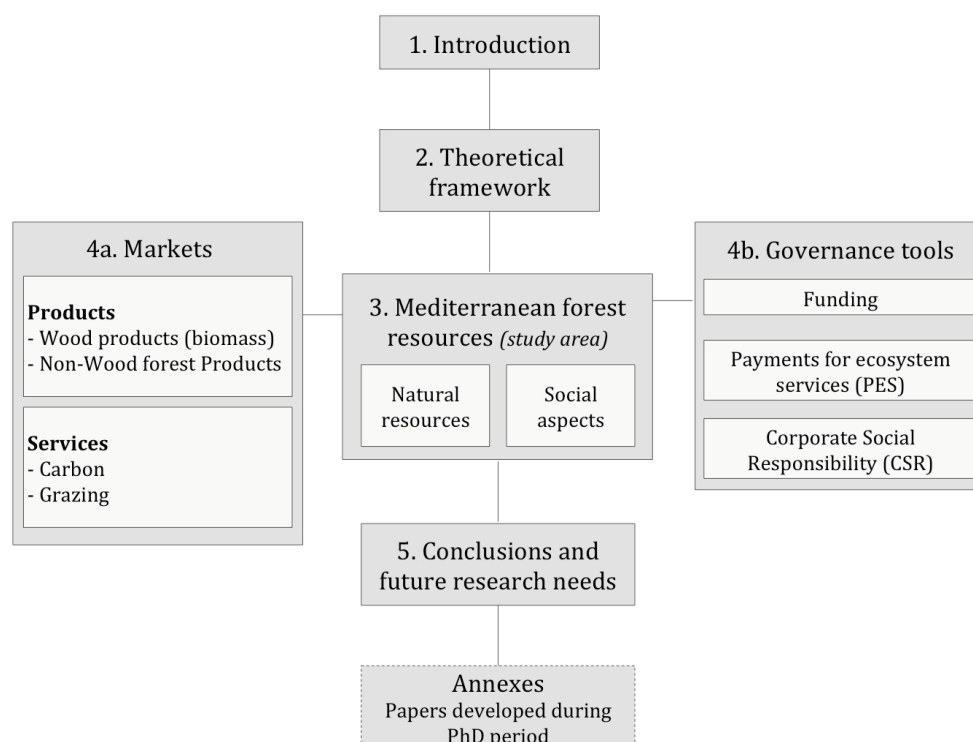
- › to provide an up-to-date picture of Mediterranean forests and the products/services they deliver, taking into consideration both ecological and socio-economic features in different parts of the region;
- › to provide up-to-date estimations of the TEV for a selected set of Mediterranean forest products and services;
- › to analyse land use change drivers and their role in influencing the value and the management options of the forests within the analysed region;
- › to analyse selected governance dimensions influencing the management of Mediterranean forests;
- › to organize the findings and produce a set of 'lessons learned' informing the possibilities for future improvements and policies in the analysed sector;
- › to define a proposal for the development of a public, dynamic, interactive information-sharing platform reporting an up-to-date evaluation of TEV for

forests in the Mediterranean region. This platform is intended for online implementation and will allow direct up-dating and improvements by users.

1.4 Structure of the thesis

Figure 1.1 provides an overview of the thesis contents and structure.

Figure 1.1 - Thesis structure



Source: own elaboration.

Chapter 1 gives background information and sets out research problems based on the former. Research questions and objectives are then presented. *Chapter 2* introduces the theoretical framework, summarising the main theories that form the conceptual background for the research and have been made reference to. *Chapter 3* presents the study area - i.e. Mediterranean forests - with special reference to both natural resources and social aspects. As for the latter, reference is made to socio-economic dynamics in the region and to corruption issues as well as illegal practices affecting forest resources. *Chapter 4* includes the research results that are distinguished into a first section (4.1) dedicated to markets for Mediterranean forest products, i.e. to the presentation of estimated values for wood and non-wood forest products, as well as for a selection of services provided by Mediterranean forests; and a second section (4.2) that includes an overview of governance tools that might be adopted to improve forest management and the delivery of products/services to the market. *Chapter 5* provides conclusions drawn from results presented in Chapter 4 as well as indications and suggestions about future research needs.

Annexes largely contribute to the thesis contents by presenting a selection of papers developed during the Ph.D. period. Whenever appropriate these papers are recalled within the thesis in order to integrate the text and provide additional

elements and information. Figure 1.2 shows how Annexes will be recalled within the text whenever relevant.

The thesis is then completed by references both in terms of literature and relevant online resources.

Figure 1.2 – Example of Annex citations as they appear within the thesis

<i>Pettenella and Masiero (2013) (Annex 8), Paragraph 4.1</i>	The general trend observed during the last years at global level indicates that private funding sources are being increasingly used and, at the same time, new financing mechanisms - combining public and private actors and funds - are being developed and implemented. Forms of financing are dynamic over time and new types of investment partnerships are being set up: between governments, international donor agencies, civil society, local community and the private sector forest investors.

Source: own elaboration.

2. Theoretical framework

The concept and understanding of 'forest products' have changed dramatically from their original interpretations to the contemporary sense. For many decades, following the so called 'wake theory' (or *Kielwasser theorie*) developed by Rupf (1960) forest management focused almost exclusively on wood production, considering all other functions as secondary values depending on the former. Such a theory built on a traditional and solid perception of forests as solely wood providers, and of wood as the main (if not the only) forest output. According to Fernow (1902, p. 86) for example *'[...] the first and foremost purpose of a forest growth is to supply us with wood material; it is the substance of the trees itself, not their fruits, their beauty, their shade, their shelter, that constitutes the primary object'*. The centrality of wood within forest production is indirectly confirmed by the terminology adopted for long time by FAO and other relevant institutions, according to which products other than wood - such as for example NTFPs - were identified as 'minor forest products', 'secondary forest products', 'other forest products' etc. (FAO, 1995). The definition of 'minor products' was often regardless of their value to local people or the national/international economies, and the fact that these products in many cases form an integral part of the household daily life. While in the past the leadership of wood among forest products was undoubted, the *'major significance of 'minor' forest products'* (FAO, 1990) has been recognised over time, together with the idea that their value must be accurately assessed at local and regional scales. Moreover the concept of 'environmental (or ecosystem) service(s)' has emerged in recent years (see paragraph 2.2 below for definitions and further details) further enlarging the perceived spectrum of potential benefits flowing from ecosystems, including forests (Secretariat of the Convention on Biological Diversity, 2001). Among these services, provisioning ones are included, and wood falls within them (MEA, 2005).

In the last decades, reflecting socio-economic, ecological and cultural changes, a relevant paradigm shift has been observed in forestry and forest management. The growing attention on responsible forest management has been linked to an increasing interest in forest multifunctionality. The essence of the changes lies in the expansion of public interest in the multiple functions of forests and in the increased number of stakeholders involved in forest management decision making processes (Wang and Wilson, 2007). Today forestry is expected to support the provision of a wide range of products and services in an economically as well as socially and ecologically sustainable way (Janse and Ottisch, 2005; Cubbage *et al.*, 2007; Cesaro *et al.*, 2008). Meanwhile, market demand on forests are changing rapidly, as people become more aware of the important environmental benefits they provide (Bishop, 1998). This paradigm shift can be summarised as a stepwise progression from a timber-dominant stage to a stage of multiple forest uses, followed by a stage of co-management and shared production, and today's multiple interest forestry (Wang and Wilson, 2007). The transition from an approach based on the 'wake theory' to a multifunctional (and integrated) use of forests has passed through an intermediate stage, represented by 'segregative forest management', i.e. forestland zoning that consists in spatially distinguished management regimes between different forest stands (Brukas *et al.*, 2013). This implies the creation of a

mosaic of forestlands, where each component of the mosaic is specialised in the provision of a certain product or service and managed accordingly⁹.

Many concepts lay behind this shift from a wood-centred to a multifunctional forest management, and two of them are believed to be quite relevant for the purposes of the present research: multifunctionality, and economics of ecosystem services. Both concepts can be linked to post-productivism rural economy that has been investigated mainly in the field of agriculture (Ilbery and Bowler, 1998), but also with regard to forestry (Mather, 2001; Mather *et al.*, 2006). The key concept behind post-productivism is that of a shift from a policy driven, production dominated, input intensive rural economy, aiming to maximisation of the production of commodities, to a new one where environmental dimensions and diversification into services-related business activity prevail (Wilson 2001; Burton 2004; Slee, 2011). As observed by Mantau *et al.* (2001) many of these diversifications away from conventional productivism have public good characteristics.

2.1 Multifunctionality

Although less disputed and more largely accepted, the concept of multifunctionality is somehow linked to post-productivism. The term has been used with different meanings, depending on the country, the context and the perspective (biological, ecological, functional, economic, managerial, etc.) and can be generally described as the capacity of an economic activity to have multiple outputs and, by virtue of this, contribute to several societal objectives at once. In 2001 and 2008 the Organisation for Economic Co-operation and Development (OECD) tried to define an analytical framework for multifunctionality in agriculture, englobing the core elements recognised by Member countries. Such elements are: (i) the existence of multiple commodity and non-commodity outputs that are jointly produced by the primary sector; and (ii) the fact that some of the non-commodity outputs exhibit the characteristics of externalities or public goods, with the result that markets for these goods do not exist or function poorly.

The concept of multifunctionality is deeply embedded in forestry and this seems never to have been questioned (Cesaro *et al.*, 2008). Its origin can be traced back to von Carlowitz's *Sylvicultura Oeconomica* (1714) that introduced the concept of '*nachhaltigkeit*', i.e. the sustainable forest management intended as a management aimed to produce a permanent flow of products or products and services from the forest¹⁰. In modern times multifunctionality was then analysed in Dieterich's *Funktionenlehre* (i.e. doctrine of functions) (1953) that intended to describe the relationship between forests and people, showing the role of forests to people's well-being. Dieterich's assumptions have been very influential to modern forest scientists not because he was the first one to name multifunctionality, but due to his concise elaboration and logic composition of ideas. Multifunctionality in forestry gained political momentum in the 1990s (Cesaro *et al.*, 2008) when it was

⁹ An example of segregative forest management is provided by the case of a mosaic of forest stands under strict protection, that remain untouched, combined with nearby forest stands managed for maximizing productive purposes.

¹⁰ 'Wird derhalben die größte Kunst/Wissenschaft/Fleiß und Einrichtung hiesiger Lande darinnen beruhen / wie eine sothane Conservation und Anbau des Holtzes anzustellen / daß es eine continuierliche beständige und nachhaltende Nutzung gebe / weilm es eine unentberliche Sache ist / ohne welche das Land in seinem Esse nicht bleiben mag' (von Carlowitz, 1714, p. 105-106).

placed by UN Conference on Environment and Development (1992) as the pivotal element of the definition of Principles for the 'Management, Conservation and Sustainable Development of all types of Forests'. Few years later the European Union (EU) Forestry Strategy (1998) has emphasised the importance of the multifunctional role of forests and sustainable forest management for the development of society, and the same concepts have been strongly embraced by the 2007-2011 EU Forest Action Plan approved in 2006. The Plan places the valuation and compensation for non-market forest goods and services as one of its 18 key actions, while the stakeholder consultation process within the EU Forestry Strategy and the report of the strategy's implementation identify the issue of creating markets for currently non-market forest goods and services as an emerging issue. These aspects have then been further re-elaborated by the new EU Forestry Strategy, published in 2013, that stresses the point of forests as a source of '*environmental public goods*' and hence the importance '*to promoting the social functions of sustainable forest management*' (European Commission, 2013 p. 7). The concept of forest multifunctionality is central in many other policy and institutional documents at international and national level. With regard to the Mediterranean context it has represented the basis of initiatives such as FAO Sylva Mediterranea and UNEP Plan Bleu since their establishment, and has recently been included in the Mediterranean Forest Research Agenda (MFRA) and the Strategic Framework on Mediterranean Forests (SFMF).

Multifunctionality implies multiple forest outputs are taken into consideration, including goods and services without a market. On the one hand this is associated to the functioning of ecosystems providing those products and services, on the other it is linked to the appropriate estimation of their economic value, in order to inform policy choices, decisions and priority setting, as well as planning and performing of management operations. As a third relevant aspect, multifunctionality also refers to multiple stakeholders: the public good nature of many products/services as well as the potential synergies and trade-offs among them require the development of a governance structure based on a wide participation of different stakeholders to prevent and mitigate potential conflicts (Cesaro *et al.*, 2008). When considering multifunctionality of Mediterranean forests it shall be underlined that scientists have acquired a rather sophisticated knowledge on the components and functioning of ecosystems, but have often failed to integrate and synthesize information in a way that can provide adequate decision-making tools (Palahi *et al.*, 2007).

2.2 Ecosystem services

At present, many policy analysts look at natural resource management using the ecosystem approach and the idea of ecosystem services. It builds on the concept of multifunctionality but, at the same time, constitutes a subtle step away from an exclusively economic perspective towards more ecocentric thinking (Slee, 2011a). Ecosystem services can be defined as the 'multiple benefits provided by ecosystems to humans' (Millennium Ecosystem Assessment, 2005) or, according to the approach adopted by TEEB as 'direct and indirect contributions of ecosystems to human well-being' (Kumar, 2010). Box 2.1 provides an historical overview of the development of the study of ecosystem services.

When speaking about ecosystem services many issues arise, including their (i) **classification/categorisation**, the (ii) **estimation of their economic value**, and

the management of ecosystems in order to provide an optimal flow of services. As for the last issue, it is relevant not just in technical terms, but also in terms of (iii) **governance of natural resources**. These three issues will be further discussed in the next paragraphs.

Box 2.1 – The study of ecosystem services: an historical overview

The study of interactions between people and the environment with a focus on the effects of nature's services on human well-being stretches back centuries. Although some exceptions can be found¹¹, in ancient times the prevalent interest was on the effects of the environment on mankind rather than on the influence of man over environmental resources. Some tension could be observed between the need to control nature and bend it to human needs, and the perceived limits of lifestyles that seemed no longer in harmony with nature (Hughes, 1975; Fedeli, 1990; Sallares, 1991, Andréassian, 2004). The modern idea of nature's services, however, was born with Marsh in 1864. In his 'Man and Nature' - that is widely considered as the first modern discussion on ecological problems - the author described how the deterioration of the services provided by nature can affect human well-being. Marsh's contribution passed almost unnoticed and society's attention was brought again to the matter just on late 1940s by Osborn (1948), Vogt (1948), and Leopold (1949) who started introducing the idea of 'natural capital' as an extension of the economic notion of capital (manufactured means of production) to environmental goods and services. Such concept was then overtly mentioned for the first time by Schumacher in 1973 and further developed by other authors in the 1990s. In the same years Krutilla and Fischer (1975), and Westman (1977) analysed the connections between ecological functions and economic systems. The term 'ecosystem services' was first mentioned in 1970 in a study edited by Wilson and Matthews at the Massachusetts Institute of Technology (MIT). The full concept was then developed by Holdren and Elrich (1974) and Ehrlich and Ehrlich (1981), and further refined by several authors (Hueting, 1980; Thibodeau and Ostro, 1981; Ehrlich and Mooney, 1983; Kellert, 1984; de Groot, 1987; Odum, 1989; Folke *et al.*, 1991). Although the concept of ecosystem services relies on earlier literature, previous authors normally used the term 'ecosystem functions'. This was originally intended to identify any set of ecosystem processes operating within an ecological system, but - as observed by Gómez-Baggethun *et al.* (2010) - in the late 1960s and 1970s a large number of contributions started referring to this term with specific reference to those functions serving human societies. In late 1970s, 1980s and early 1990s attention on ecosystem services was mainly pedagogic and intended to demonstrate the link between biodiversity loss, services depletion and human well-being reduction. The final aim was to increase society's interest in biodiversity conservation (Gómez-Baggethun *et al.*, 2010). It was just in the second half of the 1990s, however, that ecosystem services received a great deal of attention by the scientific community and visibility on the international scene. Such visibility was strongly supported by the growing interaction between ecologists and economists and the definition of new side topics such as that of (critical) natural capital that clearly embodies the idea of ecosystems providing the biophysical foundations for societal development and human economies (Costanza and Daily, 1992; Jansson *et al.*, 1994; Arrow *et al.*, 1995). Significant boost to research on the topic arose from the Beijer Institute's Biodiversity Program (Perrings *et al.*, 1992 and 1995) that marked the way for later publications and studies such as those by Costanza *et al.* (1997) and Daily (1997) that are normally considered as milestones in the study of ecosystem services and represent the first attempts to estimate their economic value on large scale. Such publications were not free from criticisms, nevertheless they brought the issue of ecosystem services into the scientific and policy

¹¹ For example in his *De causis plantarum* Theophrastus analyses climate changes linked to deforestation, land use change and deviations of the course of rivers (Caus. plant. V, 14, 2-5). In a controversial piece of his *Critias* (111 a-d) Plato describes the permanent damage to the environment caused by deforestation and the effects of this on human life. Pliny the Elder was probably the first to allude to the hydrological role of forests. In his *Natural History* he observes the following: '*Often, after woods have been cut down, springs on which trees used to feed emerge: for example, on mount Himus, when Cassander besieged the Gauls, who cut down a forest to build themselves an entrenchment. Often, disastrous torrents are formed after the felling of mountain woods, which used to hold back clouds and feed on them*' (XXXI, 30). Concerns for deforestation/forest degradation and the consequent loss of benefits can be found in many other ancient authors including Thucydides (History of the Peloponnesian War), Plato (Critias) and Strabo (Geographica).

arena. Between late 1990s and early 2000s attention on ecosystem conservation was reinforced by the definition and methodological organisation of the so-called Ecosystem Approach (EsA)¹² at the Fifth meeting of Conference of the Parties the Convention for Biological Diversity (CBD, 2000). Meanwhile in 1995 UNEP published the Global Biodiversity Assessment, a 1,140 page report funded by a \$2 million grant from the Global Environment Facility and representing the “[...] *most comprehensive analysis of the science underpinning biological diversity*” (Heywood and Watson, 1995). Ecosystem services definitively gained a place on the global policy agenda with the publication of the Millennium Ecosystem Assessment (MEA) in 2003. The MEA helped providing a classification¹³ of services as well as emphasizing the dependency of human well-being on such services and - ultimately - on ecosystems functioning. After the publication of the MEA the literature on ecosystem services multiplied and the increasing research on the monetary value of ecosystem services has grown together with the research on tools for marketing such services. This lead to the introduction of concepts like Markets for Ecosystem Services (MES) (Bayon, 2004) and Payments for Ecosystem Services (PES) (Landell-Mills and Porras, 2002; Wunder, 2005; Wunder *et al.*, 2008). In the last few years attention has been paid to focus on ecosystem issues in economic terms, mainly under the form of cost-benefit analysis (Gómez-Baggethun *et al.*, 2010). Among several examples, the Stern Review on the Economics of Climate Change (Stern, 2006), the Potsdam Initiative – Biological Diversity 2010 and the subsequent Economics of Ecosystems and Biodiversity (TEEB) project can be mentioned as the most representative¹⁴.

2.2.1 Classification of ecosystem services

As regards classification of ecosystem services, it has been largely debated in recent years (de Groot *et al.*, 2002; Boyd and Banzhaf, 2006; Wallace, 2007; Fisher and Turner 2008; Costanza, 2008) and many different classification schemes have been proposed. A pragmatic and largely used scheme is the one introduced by the Millennium Ecosystem Assessment (MEA) (2005) and adopted by several studies and initiatives (Fisher *et al.*, 2008; Giergiczny *et al.*, 2008; Mavsar *et al.*, 2008; Giupponi *et al.*, 2009; Chiabai *et al.*, 2009; EPA, 2009) sometimes with slight adjustments, such as in the case of TEEB (Kumar, 2010). Services are distinguished into four categories: (i) provisioning services; (ii) regulating services; (iii) cultural services; (iv) supporting services. More recently a new Common International Classification for Ecosystem Services (CICES) has been launched by the European Environmental Agency in 2010 (Haines-Young and Potschin, 2010) and then revised up to the current version 4.3. This new classification is a summary of pre-existing initiatives and is likely to represent a common framework for future activities in the field of ecosystem services. A summary of different classification systems for ecosystem services as identifiable from literature is reported in Figure 2.1. There is probably no unique way to classify ecosystem goods and services, because classification depends on the purpose. Moreover it can change in relation to the fact that ecosystems are complex, dynamic, adaptive systems with non-linear feedbacks, thresholds, hysteresis effects, etc. Classification is linked to a

¹² ‘The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. An ecosystem approach is based on the application of appropriate scientific methodologies focussed on levels of biological organization, which encompasses the essential structures, processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of many ecosystems’ (CBD, 1992).

¹³ A preliminary classification was suggested by de Groot in 2002. As discussed in the next paragraphs the issue of defining and classifying ecosystem services is still largely debated and controversial.

¹⁴ At the meeting of the environment ministers of the G8 countries and the five major newly industrialising countries that took place in Potsdam in March 2007, the German government proposed a study on ‘The economic significance of the global loss of biological diversity’ as part of the so-called ‘Potsdam Initiative’ for biodiversity. The study, named TEEB, began in 2007 and has been conducted in phases, being still in progress. For more information: www.teebweb.org.

utilitarian and anthropocentric vision and the properties of ecosystems that people regard as useful can change over time and space even if the ecosystems themselves remain in a relatively constant state (Costanza, 2008; Pascual and Muradian, 2010).

Figure 2.1 – Classification of Ecosystem services according to different schemes found in literature

a. CICES v.4.3 (2013)

<i>Provisioning</i>	Nutrition (biomass and water)	Materials (biomass, fibre, and water)	Energy (biomass-based, mechanical)						
<i>Regulation and maintenance</i>	Mediation of waste, toxics and other nuisances	Mediation of flows (mass liquid, gaseous)	Lifecycle maintenance	Habitat and gene pool protection	Pest and disease control	Soil formation and composition	Water conditions	Atmospheric composition and climate regulation	
<i>Cultural</i>	Physical and intellectual interactions with environment	Spiritual, symbolic and other interactions with environment							

b. MEA (2005)

<i>Provisioning services</i>	Food	Fiber	Energy sources	Genetic resources	Biochemicals, natural medicines	Ornamental resources	Fresh water				
<i>Regulating services</i>	Air quality regulation	Climate regulation	Water regulation	Erosion regulation	Water purification, Water treatment	Disease regulation	Pest regulation	Pollination	Biological control		
<i>Cultural services</i>	Cultural diversity	Spiritual and religious values	Knowledge systems	Educational values	Inspiration	Aesthetic values	Social relations	Sense of place	Cultural heritage values	Recreation and ecotourism	
<i>Supporting services</i>	Soil formation	Photosynthesis	Nutrient cycling	Water cycling							

c. De Groot (2002 and 2006)

<i>Regulation functions</i>	Gas regulation	Climate regulation	Disturbance prevention	Water regulation	Fresh water supply	Soil retention	Soil formation	Nutrient regulation	Waste treatment	Pollination	Biological control
<i>Habitat functions</i>	Refugium function	Nursery function									
<i>Product functions</i>	Food	Raw materials	Genetic resources	Medicinal resources	Ornamental resources						
<i>Information functions</i>	Aesthetic information	Recreation	Cultural and artistic information	Spiritual and historic information	Science and education						
<i>Carrier functions</i>	Habitation	Cultivation	Energy-conversion	Mining	Waste disposal	Transportation	Tourism-facilities				

d. Burkhard (2009)

<i>Ecological integrity</i>	Abiotic heterogeneity	Biodiversity	Biotic water flows	Metabolic efficiency	Energy capture	Reduction of nutrient loss	Storage capacity				
<i>Regulating services</i>	Local climate regulation	Global climate regulation	Flood protection	Groundwater recharge	Air quality regulation	Erosion regulation	Nutrient regulation	Water purification	Pollination		
<i>Provisioning services</i>	Crop	Livestock	Fodder	Capture fisheries	Aquaculture	Wild floods	Timber	Wood Fuel	Energy (biomass)	Biochemicals and medicine	Freshwater
<i>Cultural services</i>	Recreation and aesthetic values	Intrinsic value of biodiversity									

e. De Groot et al., 2010 in TEEB

<i>Provisioning services</i>	Food	Raw materials	Freshwater	Medicinal resources					
<i>Regulating services</i>	Local climate	Carbon sequestration	Extreme events	Waste water treatment	Soil erosion and fertility	Pollination	Biological control		
<i>Habitat or supporting services</i>	Habitat for species	Habitat for genetic diversity							
<i>Cultural services</i>	Recreation	Tourism	Aesthetic appreciation	Spiritual experience					

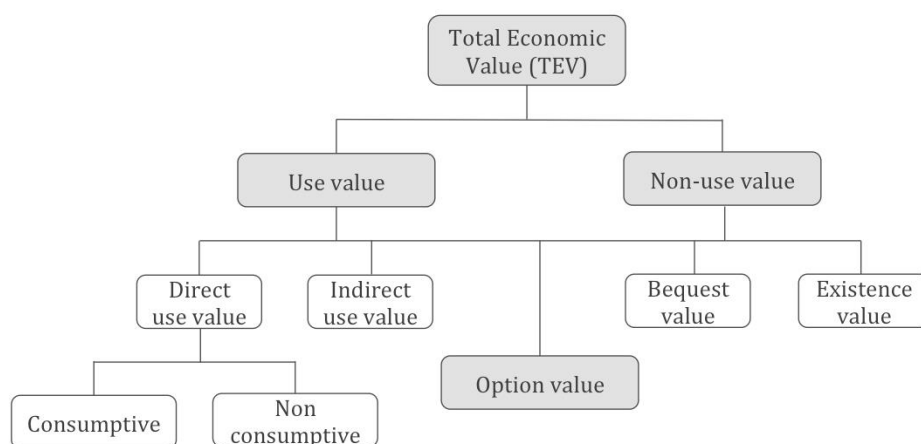
Source: MEA, 2005; De Groot, 2002 and 2006; Burkhard, 2009; De Groot et al., 2010; CICES (2013)

2.2.2 Estimation of ecosystem services

Classification of ecosystem services is linked to their value estimation and, in particular, to the concept of Total Economic Value (TEV).

The concept of TEV of forest ecosystems is used throughout the research and represents a fundamental concept this work relies on. The term 'total' refers to different categories of value measured under marginal changes in the system being valued (Turner *et al.*, 1994; Pascual and Muradian, 2010). Since the very preliminary applications to ecosystem services (Krutilla, 1967) TEV has generally been distinguished into two main categories of value (i.e. use and non-use), each further disaggregated into lower sub-categories. A third category - still debated by environmental economists as for its belonging to one of the previous two, or independence from them - is represented by option values. On the basis of these considerations, we assume that the value of a forest includes: direct and indirect use values, option values, non-use bequest values, and existence values¹⁵ (Figure 2.2).

Figure 2.2 - TEV and its component categories



Source: own elaboration from Turner *et al.*, 1994; Pascual and Muradian, 2010.

Based on definitions given by several authors (Pearce and Turner, 1990; Turner *et al.*, 1994; De Groot *et al.*, 2002; Merlo and Croitoru, 2005), TEV categories with reference to forestry can be briefly described as reported in Table 2.1.

The concept of TEV is deeply related to the concepts of private, impure, and public goods that are especially relevant when dealing with environmental (or ecosystem) services. Distinction is done making reference to the concepts of excludability and rivalry in consumption. Excludability indicates users who are unwilling to pay for a certain good are excluded from using it. Rivalry in consumption indicates a good can be divided in such a way that the use by a user can reduce the availability for another user interested in it or even exclude the second user from the use of the good. While private goods are excludable and rival, public ones qualify themselves as non-excludable and non-rival (Musgrave and Musgrave, 1973; Turner *et al.*, 1994; Cowen, 1999). Between pure private and

¹⁵ It shall be highlighted that while TEV concept is uniquely defined, its component categories are still under debate and definition of boundaries between them is sometimes unclear and lead to inclusions and overlapping.

public goods a wide array of hybrid situations can exist, normally referred to as impure goods. They can be summarised in quasi-private (i.e. non-excludable and rival) and quasi-public (i.e. excludable and non-rival) goods. Focusing on public goods and making reference to the above-given definitions, non-excludability implies the impossibility of preventing non-paying individuals from enjoying the benefits of a good or service. On the other hand non-rivalrous consumption is connected to indivisibility of benefits and implies individuals' ability to consume a good or service is not diminished by allowing additional individuals to consume them (Cornes and Sandle, 1986; Turner *et al.*, 1994). Markets work well as long as they deal with private goods: when moving towards non-exclusivity and non-rivalry in consumption they tend to fail.

Table 2.1 - TEV categories and subcategories: definitions and examples with reference to the forest sector

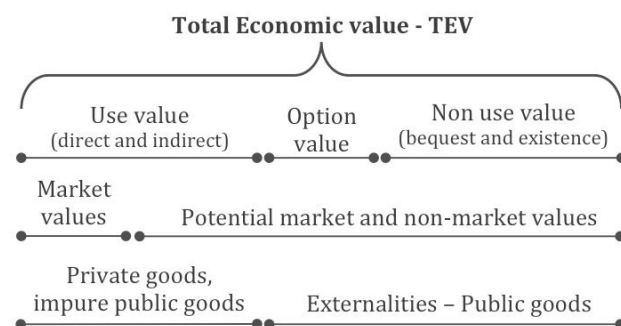
Total Economic Value (TEV)		Description	Examples
Category	Sub-category		
1. Use value	1.1 Direct use	Benefits derived from the actual and direct use of the forest.	<i>Consumptive (or extractive)</i> : extraction of timber, firewood and NTFPs. <i>Non-consumptive (or non-extractive)</i> : recreation and landscape quality.
	1.2 Indirect use	Benefits derived from the forest ecosystem's functions.	Watershed protection, water quality and purification, carbon sequestration.
2. Option value	-	Benefits derived from having the option of directly or indirectly using forests in the future. It can be a component either of use or of non-use values depending on whether actual generations decide to use the environment or not.	Personal future recreation and environmental interests; Potential source of timber and firewood; Potential source of biodiversity and active principles/medicinal plants.
3. Non-use value	3.1 Bequest value	Benefits derived from placing a value on conservation of a certain forest feature for future generations. They reflect satisfaction people derive from knowing such feature is maintained and other people will have access to them.	Timber, firewood, non-timber forest products, landscape and recreation availability for future generations; biodiversity and environmental conditions for future generations.
	3.2 Existence value	Benefits derived from the knowledge of the existence of a particular forest feature or characteristic.	Biodiversity and environmental conditions; welfare of non-human beings.

Source: own elaboration from Pearce and Turner, 1990; Turner *et al.*, 1994; de Groot *et al.*, 2002; Merlo and Croitoru, 2005.

Another valuable distinction making reference to the concepts of exclusivity and rivalry in consumption is the one between common goods and club goods. Common goods are rivalrous and non-excludable (e.g. fish stocks), while club goods are non-rivalrous and excludable (e.g. cinemas, private parks, etc.) (Pearce and Turner, 1990; Cowen, 1999). Club goods have been first defined by Buchanan (1965) and are characterised by ownership or membership restrictions in order to maximise the utility in their consumption by imposing a certain level of exclusion. In forestry this could be the case, for example, of mushroom picking or hunting when picking and hunting rights are allocated and enforced.

The connections between TEV categories and different kinds of goods are shown in Figure 2.3. The present research aims to highlight the importance of estimating the values represented in Figure 2.3, with particular attention to public goods and externalities, and will also provide estimations for a selected set of values.

Figure 2.3 - Connections between TEV categories and different kinds of goods

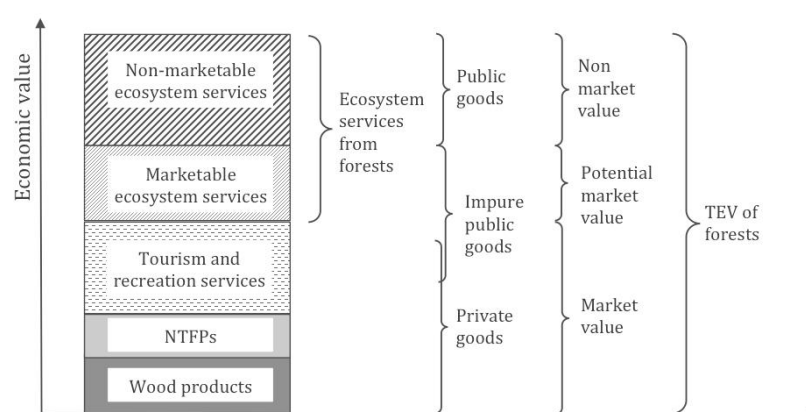


Source: Croitoru *et al.*, 2000.

When considering forests and their products/services, they can be distinguished into three groups: private, impure public, and public goods (Figure 2.4).

The first group includes timber, firewood and NTFPs, but also those recreational services offered by forests and marketed through established prices in well functioning markets. The second and third groups cover goods presenting different degrees of excludability and rivalry in consumption, hence they have not yet a defined market value. In both cases they represent ecosystem services provided by forests, but present different nature. Some of them, in fact, are pure externalities (public goods) - i.e. they are completely non-excludable and non-rival - and cannot be marketed and commercialized at all (e.g. microclimate regulation, soil conservation, flood prevention, etc.). Some others are impure goods therefore they can be marketed and by doing so become sources of income (e.g. carbon storage, water quality, landscape beauty, etc.). Of course these classifications must be interpreted with flexibility when applied to the real world, always making reference to the specific context conditions.

Figure 2.4 - TEV and forest goods



Source: own elaboration from Maso, 2008.

The link between ecosystem service classification and their evaluation can be seen under another perspective: proper classification can help avoiding the problem of double counting that may occur where two or more ecosystem services are inter-related, and the delivery of one supports the delivery of another. Supporting services (such as primary production, nutrient cycling and soil formation) are of particular concern in this respect, since they do not directly influence human welfare but instead support the delivery of other provisioning, regulating and/or cultural services. Therefore they need to be treated with care, and not aggregated with other services. The problem is not limited to supporting services, however, and may also apply to regulating services. For example, the benefits of services such as soil quality maintenance, water purification and erosion control may be reflected in the value of other services, especially provisioning services such as food production (Markandya *et al.*, 2007). Apart from overlapping, trade-offs between different services shall be taken into consideration. While Rupf's Wake Theory (1960) has been refuted, highlighting potential trade-offs between wood production (and provisioning services in general) and other ecosystem services, recent studies put evidence on possible trade-offs among other services. Locatelli *et al.* (2013) for example analysed synergies among different ecosystem services in Costa Rica and found that services have different spatial distribution but are positively correlated. Nevertheless they also verified that biodiversity hotspots have the highest co-benefits for other services, while carbon hot-spots have the lowest. This findings indicate that forest-based climate mitigation initiatives do not automatically maximize bundled co-benefits for biodiversity and other services. Therefore careful classification provides the basis for accurate assessments and valuations (EPA, 2009; Haines-Young and Potschin, 2010) and appropriate TEV estimations become more and more important to inform policy and decision-making regarding management of forest resources.

Finally classification can also help identifying spatial distribution of services: where the function occurs, where the provision of service(s) can be assessed and finally where benefits are appreciated (Kumar, 2010).

2.2.3 Ecosystem services valuation: different paradigms and values

The second relevant point highlighted in this session dedicated to ecosystem services is economic valuation. Economic valuation of ecosystems and their services represents a balancing act. From one side valuation can be seen as a system of cultural projection that imposes a way of thinking and a form of relationship with the environment, as well as a view of development and what constitutes human well-being; from the other it can serve as a tool for self-reflection, helping people rethinking their relations to the natural environment and increase knowledge about consequences of consumption choices and behaviour (Brondizio and Gaztweiler, 2010). As such, valuation represents the hinge between ecosystem functioning and governance regarding their management. Ascribing values to ecosystem services is not an end in itself, but rather a step in the much larger and dynamic arena of political decision making towards human well-being (Daily *et al.*, 2009). The primary role of economic analysis is to present information to decision makers regarding how society might balance the trade-offs inherent to resource allocation decisions (Nunes *et al.*, 2009; Markandya *et al.*, 2007; Kumar, 2010). Moreover, valuation plays an important role

as a pre-requirement for creating markets for ecosystem services through the PES mechanisms (Landell-Mills, and Porras, 2002).

Based on the contributions of several authors (Turner *et al.*, 1994; Costanza *et al.*, 1997; Fisher *et al.*, 2008; Pascual and Muradian, 2010) different reasons for valuing ecosystem services can be recognized: (i) identification of missing markets; (ii) internalisation of externalities and correction of market failures; (iii) identification of viable alternatives and alternative uses for ecosystem services; (iv) management of uncertain scenarios on demand/supply of natural resources; (v) designing of ecosystem conservation initiatives and programs by both private and public actors; (vi) natural resource accounting.

Alternative views of valuation exist, as well as multiple theories of value. The meaning of 'value' - i.e. what is it and how to measure it - has been largely debated by economists over centuries. Although there is widespread agreement on the fact that ecosystems are 'valuable' and their value shall be taken into considerations by decision-makers - being them individuals or governments - (Daily, 1997) different interpretation remain possible. The human valuing process is complex and with multiple meaning of the concept of value. Literature on environmental philosophy and ethics distinguishes within three couples of values (Oelschlaeger, 1997; Callicott, 2004) (Box 2.2):

- › instrumental and intrinsic values;
- › anthropocentric and biocentric (or ecocentric) values;
- › utilitarian and deontological values.

Box 2.2 – Value in environmental philosophy and ethics

The National Research Council of the United States (NRC, 2005) has carried out a detailed analysis of these three couples of values. The instrumental value of an ecosystem service is a value derived from its role as a means toward a certain end. In other words, its value is derived from its usefulness in achieving a goal. In contrast, intrinsic value is the value that exists independently of any such contribution: it reflects the value of something for its own sake. Since intrinsic value is the value of something not in relation to its instrumental use of any kind, it is often named 'non-instrumental' value. Intrinsic value is related but not identical to the existence value already described in paragraph 2.2.2, which reflects the desire by some individuals to preserve and ensure the continued existence of certain environmental features. As such, existence value is an anthropocentric and utilitarian concept.

Anthropocentrism assumes that only human beings have intrinsic value and that the value of everything else is instrumental to human goals. This assumption implies that only humans assign value, and thus the value of other organisms stems from their usefulness to humans. Non-anthropocentric (or biocentric) values assume that certain things have value independently from human being's perception. Therefore a non-anthropocentric approach assigns intrinsic value to all organisms, including but not limited to humans.

Utilitarian values descend from the capacity to provide 'welfare' broadly defined to reflect the overall well-being of an individual or group of individuals. In this sense, utilitarian values are instrumental because they are viewed as a means toward the end result of increasing human welfare. In contrast, under the deontological (or duty-generating) approach, intrinsic value implies a set of rights that include a right of existence. Under this approach, something with intrinsic value is irreplaceable, implying that a loss cannot be offset or 'compensated' by having more of something else.

Whereas ecologists have generally advocated biocentric perspectives based on intrinsic ecological values, economists adopt anthropocentric perspectives that

focus on instrumental values and are based on utilitarian principles (Pascual and Muradian, 2010). In economic terms ecosystems, including forest ones, can broadly be seen as part of the global natural capital (Jansson *et al.*, 1994; Arrow *et al.*, 1995) and the flow of services they deliver as the interest society receives on that capital (Costanza and Daily, 1992).

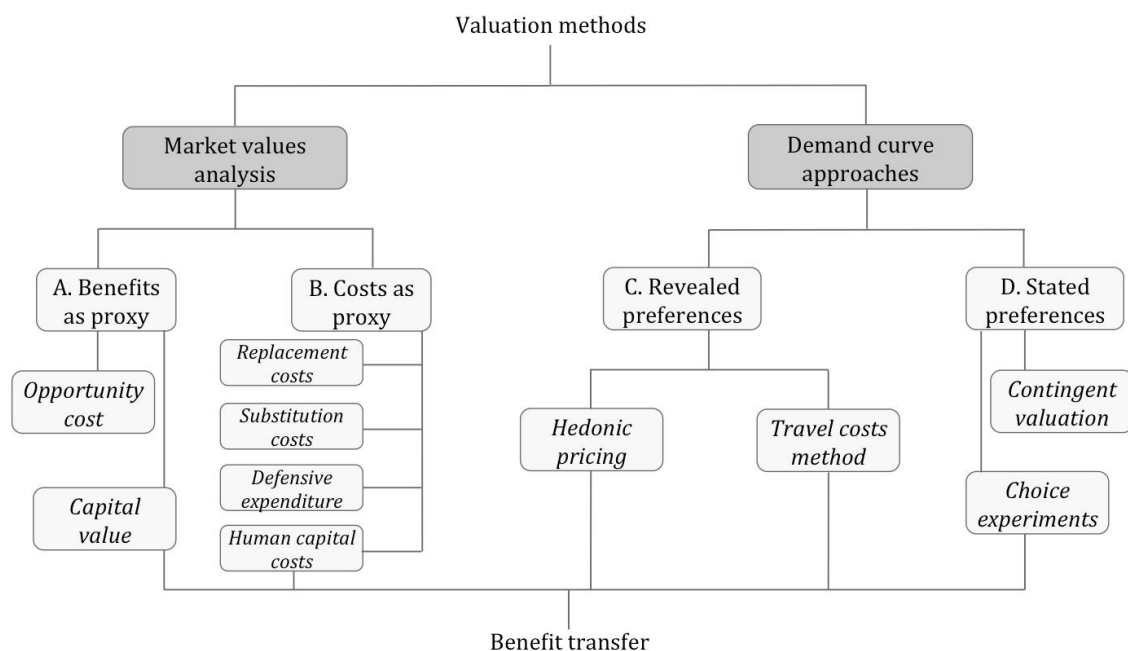
When reviewing different approaches to valuation, it is possible to trace them back to two main **valuation paradigms** (Gómez-Baggethun *et al.*, 2010): (i) **biophysical methods**; and (ii) **preference-based methods**. The first ones rely on a 'cost of production' perspective, i.e. they derive values from measurement of the physical costs (labour, energy, material inputs, etc.) needed to produce a certain good. When referring to ecosystem services valuation, this is linked to costs for maintaining a given ecological state. The second ones rely on models of human behaviour and are based on the idea that values arise from individual preferences, therefore are individual-based, subjective, context-based and state-dependent (Goulder and Kennedy, 1997; Nunes and van den Bergh, 2001). The two different paradigms refer to different (but complementary) dimensions of ecosystem values. Biophysical methods address the so-called insurance value (Farber *et al.*, 2002), also known as glue value (Gren *et al.*, 1994; Fisher *et al.*, 2008). It refers to ecosystem resilience, i.e. the capacity to remain at a given ecological state: this concept partly overlaps with the one of supporting services as identified by the Millennium Ecosystem Assessment (MEA, 2005). As commented by Pascual and Muradian (2010) many challenges and limitations exist when valuing ecosystem resilience. They are linked, for example, to the fact that transitions in ecosystems may be sudden and uncertain, making their evaluation through marginal values impossible. Moreover the capacity of ecologists to assess the level of resilience and to detect when a system is approaching a threshold is still incipient. This explains why at the present valuation efforts focus on preference-based methods that address TEV, which is also referred to as output value (Farber *et al.*, 2002). Of course outputs can be positive (see for example Table 2.1) or negative (e.g. costs related to forest fires, deforestation, etc.). What is important to underline here is that by choosing to use a TEV approach a strongly anthropocentric vision is adopted that allows only a part of the total value of ecosystems to be computed.

A wide family of valuation methods have been developed for computing different TEV components. Figure 2.5 shows a full taxonomy of different methods.

Methodologies for estimating the value of ecosystem services vary depending on the good or service being evaluated. If a market for such a good/service exists - such as in the case of wood products, many NTFPs, game, carbon credits, etc. - reference can be made to 'market price'. For the majority of ecosystem services, however, a market does not exist, therefore it is not possible to refer to an explicit market price and reference shall be made to methods using costs as a proxy or 'Revealed preferences' and/or 'Stated preferences' methods. In the first case, for example, 'Replacement cost' is used to estimate the value of a service through the cost of a surrogate good or service. An example is the estimate of the value of grazing service offered by a certain ecosystem based on the value of a fodder-surrogate, such as barley or hay. The 'Production function' method estimates the value of a certain good/service as an input for producing a market good. For example the 'Damage cost avoided' method can be used to estimate soil erosion control by vegetation through costs needed to address damages deriving from soil losses. Methods based on 'Revealed preferences' analyse complementary or substitute markets for a certain good (or service) estimating for example the

influence of a given ecosystem service on market goods (Hedonic pricing). Travel costs method is used for estimating the value of cultural services, such as for example recreation, landscape beauty, etc., provided by a certain area (e.g. a park or a protected area). This approach is based on computing all the costs borne by visitors to reach the site and access the desired service. As for methods based on stated preferences, 'Contingent evaluation' and 'Choice experiment' are used to directly or indirectly analyse - by means of interviews and questionnaires - people's 'willingness to pay' (WTP) to access/preserve a certain ecosystem service, or the 'willingness to accept' (WTA) to compensate the loss of the service.

Figure 2.5 - Taxonomy of TEV evaluation methods



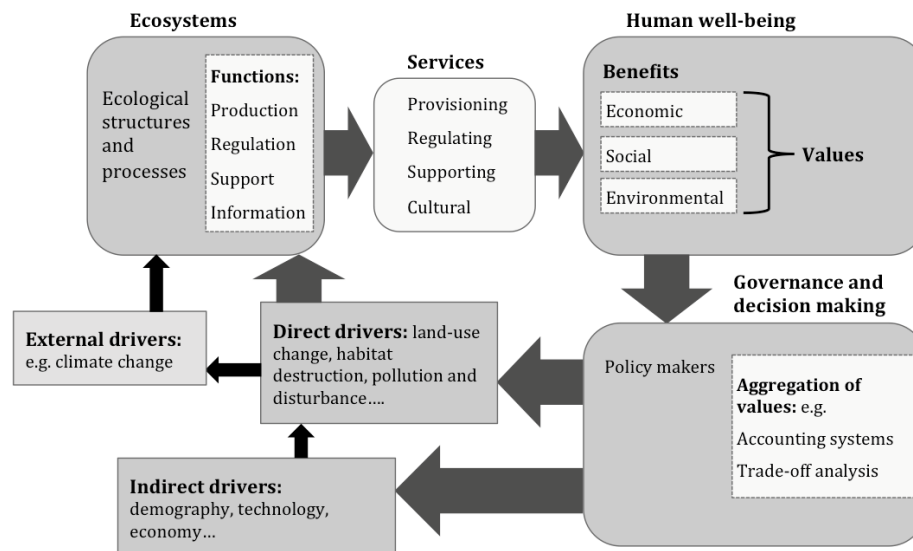
Source: own elaboration from Merlo and Croitoru, 2005; Perrot-Maître, 2006.

2.3 Governance and good governance of natural resources

Figure 2.6 summarises the role of valuation in the general framework of ecosystem services. The aim of the present study is to focus only on valuation and drivers, with some highlights on accounting aspects.

Valuation is functional to the decision making process and the (good) governance of natural resources. As observed by the De Groot *et al.* (2010) in making decisions, decision makers shall decide how to balance different - i.e. ecological, socio-cultural and economic - values. As a preference, the importance of each of these value components should be analysed and assessed on its own dimension, for example through Multi-criteria Decision Analysis. From an economic point of view, however, special attention should be paid to value aggregation of monetary values and trade-off issues. Accurate estimations allow decision makers to be supplied with useful inputs to make decision that will affect different drivers influencing the functioning of ecosystems, their capacity to deliver services and, finally, human well-being. In brief, TEV estimation represents a valuable resource to inform governance processes for ecosystems and their services.

Figure 2.6 - Ecosystem valuations in the general framework linking ecosystems and human well-being



Source: own elaboration from Haines-Young and Potschin, 2010; Kumar, 2010.

Governance has been a highly debated concept in recent times, representing *‘the key-buzzword in political sciences and public administration for the last two decades’* (Arts and Visseren-Hamakers, 2012). Despite a growing centrality and relevance, and although it has been largely (ab)used in different fields, this concept remains ambiguous and subject to multiple interpretations. As a result, no common and universally accepted-definition exists so far (Jessop, 2002; Kiær, 2004) and this ambiguity often leads to misunderstanding. The term governance has been used as synonymous with government for long time. During the economic crisis of the 1980s the ‘big’ government of the Northern welfare state lost credibility and public administrations became subject to intense reform programmes, and new modes of governance emerged (Kjaer 2004; Arts and Visseren-Hamakers, 2012). As a consequence in the 1980s political scientists started to differentiate ‘government’ and ‘governance’ concepts, using the second one to indicate the ability to involve civil society actors in decision policies. Governance is more than just formal actions by government (World Bank, 2009) and in broad institutional terms can be defined as *‘the setting of rules, the application of rules, and the enforcement of rules’* (Kiær, 2004). When adopting this definition the concept of governance relies on distribution of authority among different actors and includes two main interplay dimensions (Rayner *et al.*, 2010): (i) horizontal interplay - i.e. all the formal and informal modes of interactions between institutions and other actors - and (i) vertical interplay - i.e. power relations among the different levels within the same institution.

While in broad terms governance can be interpreted as the many ways in which public and private actors from the state, market and/or civil society govern public issues at multiple level, more strict interpretations exist as well. For example Pierre and Peters (2000) define governance as a paradigm shift in the way in which we govern societies and organizations. In other words this can be referred to as a *‘a shift from government to governance’* (Rosenau and Czempiel, 1992) suggesting that authority and competencies have moved away from the state to other bodies, such as international organizations, NGOs and private businesses

(Pierre and Peters 2000). According to Peters (2000), indeed, it is possible to identify two different governance models. The first one (old governance) consists of traditional government-based (i.e. hierarchical and top-down) approach to decision making, and builds on the capacity of government to exert control over society by developing and implementing policies. The second one (new governance) relies on rules for multilevel and multisectoral decision-making, with a consensus-oriented approach and dynamic interactions among multiple public/private actors (Kiær, 2004; Rayner *et al.*, 2010). Nevertheless some still use governance in both the old and new sense. This is for example the case of international development institutions (e.g. the World Bank) that look at governance as a tool for strengthening government steering capacity while at the same time promoting participation by different actors in governing. In this perspective governance can be seen as *'the institutional capacity of public organisations to provide the public and other goods demanded by a country's citizens or their representatives in an effective, transparent, impartial, and accountable manner, subject to resource constraints'* (World Bank, 2000).

While many interpretations of the concept of governance emphasize the multi-actor character, some other focus on a multi-level character of this concept. The idea of multi-level governance has been developed and discussed as the involvement of actors in networks of different layers (normally three) as for example local, national and international. For example at European level there is a growing interest for 'third level policy', via the action and involvement of sub-state units within the EU, together with European institutions (first level) and those belonging to nation-states (second level) (EU Committee of the Regions, 2009). In more general terms multi-level governance has been used in the field of sub-national, national and global policy analysis to argue that the old distinction between domestic and international politics has become outdated (Held and McGrew 2002; Arts and Visseren-Hamakers, 2012).

Finally the concept of good governance has been developed and studied. Although some authors argue that there is not a common opinion/understanding about the concept of good governance, literature review allows identifying some agreed and generally accepted aspects that are normally used to define and measure it. As highlighted by Kiær (2004) common elements are (among others): accountability, transparency, participation, efficiency and equity. Such elements - sometimes further elaborated and enriched with additional aspects - represent the core dimensions adopted by the main existing initiatives for the assessment of Good Governance. Da Re (2012) has performed an in-deep analysis of the key-dimensions adopted by the main international initiatives for the assessment of good governance. With special reference to forestry Saunders and Reeve (2011) have identified eleven initiatives linked to the evaluation of at least one of these key-dimensions for governance. Such initiatives refer to specific forestry issues such as illegal logging and corruption, and climate change and related mitigation measures. Two relevant exceptions are the Governance of Forest Initiative (GFI)¹⁶ and the Forest Governance Diagnostic Tool by the Agriculture and Rural Development Department of the World Bank (World Bank, 2009). Both tools are

¹⁶ The GFI is a project developed by the World Resource Institute in co-operation with two Brazilian partners, i.e. Instituto do Homem e Meio Ambiente da Amazonia (IMAZON) and the Instituto Centro de Vida (ICV). For more information see: www.wri.org/our-work/project/governance-forests-initiative.

intended for Developing Countries and include a wide set of principles and indicators for the assessment of good governance.

The concept of good governance has been included also in the draft text of the Legally Binding Convention on Forests that should be approved at the next Ministerial Conference of the Forest Europe process. Among the principles for implementing the Convention it is stated that (art. 3) '*Good governance and enabling conditions for sustainable forest management, including clear and secure land tenure and ownership rights, stable and effective policies and institutions, adequate legislation, transparency, gender equality and a sound knowledge base, and a balance among economic, social and environmental aspects*' shall be met. When approved, this document will be the most authoritative statement on the issue of good governance in the forestry sector (INC, 2013).

2.3.1 Forest governance

It is generally accepted that improving (good) forest governance is crucial for supporting sustainable forest management (Blaser, 2010). Definitions of forest governance follow broader definitions of governance in general, just indicating that forests are the subject of the governance being referred to. Broekhoven *et al.* (2012), for example, defined forest governance as the many ways (norms, processes, instruments) through which public and private actors co-operate to create capacity to make and implement decisions about forest management at multiple spatial, temporal and administrative scale.

Traditionally, the state has been dominant in governing forests, not only within the European context, but also in the colonies and during the post-colonial era (Scott, 1998). Such a strong role built on 'public/common pool goods' nature attributed to forests and the consequent need to properly manage them. In order to avoid 'The tragedy of the commons' Hardin (1968) indicated access to these goods was to be limited and controlled through either state regulation or private ownership. Since the first option matched the tradition of state forestry so well (Scott, 1998), during the 1970s and 1980s it was largely considered as the most promising mechanism to prevent the depletion and erosion of forest resources. Notwithstanding this, state authorities have often turned into bad forest managers by (i) overexploiting the resources, often in conflicts with local communities and public conservation interests, (ii) issuing concessions to private or public entities without any control over their activities, and (iii) being sometimes absent and leaving forest resources open for illegal exploitation by different actors (Humphreys 2006; Arts and Visseren-Hamakers, 2012). Hardin's theory and assumptions, however, have been strongly criticised. In her 'Governing the Commons' Ostrom (1990) showed that local community institutions can be very successful in managing common pool goods. In particular Ostrom has criticised Hardin's simplistic idea of rationalism that stays behind the 'tragedy of the commons' thesis. Questioning whether choices by individuals are only based on cost-benefit calculation and utility maximisation, Ostrom (2011) has developed the concepts of bounded rationality and institutional choice. Bounded rationality refers to the fact that people often lack crucial information to make good decisions (Arts and Visseren-Hamakers, 2012), while institutional choice reflects the fact that choices made by individuals are deeply influenced by institutions (i.e. rules, norms, beliefs and values) that are valid for a specific community (Ostrom, 2011). Ostrom's work has been very influential in embedding most of the (forest) governance literature in neo-institutionalism

(Kjaer, 2004). As a consequence the literature on forest governance is dominated by a strong belief in institutions in general ('rules do and can guide behaviour') that is not free of criticism.

Today forest governance comes into three main forms (Agrawal *et al.*, 2008; Arts and Visseren-Hamakers, 2012): decentralization, participation and marketization.

Decentralisation means the de-concentration of administrative competencies and/or the transfer of political authority from the central authority to sub-national administrations (Ribot *et al.*, 2006). It is intended to bring politics and decision makers closer to the people, thus increasing policy effectiveness and checks. Although questioned by some authors (Ribot *et al.*, 2010), decentralisation has become a very common process worldwide, in forestry too.

As regards participation, the concept of Participatory Forest Management (PFM) is an umbrella term covering different initiatives such as community forestry, community-based forest management, collaborative forest management and joint forest management. The central idea behind PFM is that local forest management (by local communities alone or with the support of local forest departments) can be more effective than management performed by central institutions. So far PFM has been implemented in several countries (Nepal, Mexico, Bolivia, Kenya, Tanzania, Ethiopia, Albania, etc.) but results are waving. Indeed conflicts between forest officials and communities have been reported, as well as little 'real' transfer of management and use rights and decision-making power from the state to local communities (Blomley *et al.*, 2008; Mustalahti and Lund, 2010). As an additional remark, PFM has mostly focused on small-scale forest operations, often depending heavily on external financial support.

Finally marketization refers to internalisation of externalities, in order to allow overcoming market failures and allow improving forest profitability, while assuring sustainable management and resource conservation (Slee, 2011). Two main instruments can be mentioned: Corporate Social Responsibility (CSR) tools, with special reference to forest certification, and Payments for Environmental Services (PES) in relation to carbon, water and biodiversity. A PES can be defined as a voluntary transaction where a well-defined environmental service (or a land-use likely to secure that service) is being 'bought' by a (minimum one) buyer from a (minimum one) provider if and only if the environmental service provider secures provision conditionally (Wunder, 2005).

CSR tools and PES, together with forest financing sources, will be analysed as key-governance issues with regard to the Mediterranean forest context. Governance of natural resources in the region has mostly been studied with regard to marine resources and protected areas (IUCN, 2009, MRAG, 2013). As for the forestry sector, the promotion of good governance as a tool for ensuring the sustainable management and the provision of valuable forest goods and services in the context of Mediterranean forests has been invoked by several initiatives, as for example the Mediterranean Forest Research Agenda (MFRA), the Strategic Framework on Mediterranean Forests (SFMF) and the Tlemcen Declaration¹⁷. More recently

¹⁷ The Tlemcen Declaration has been approved by participants to the FAO Third Mediterranean Forest Week (Tlemcen, Algeria, 17th-21st March 2013). For more information see: www.iii-med.forestweek.org/story/tlemcen-declaration.

specific projects were launched and implemented as well, including for example MedGovernance¹⁸ and Qualigouv¹⁹ projects.

Within the Mediterranean region national and local governance frameworks for environmental planning and management vary greatly from country to country, but governments are generally highly centralized with often high levels of state control, especially in the South and East. Most recent national policy frameworks include provisions for private sector and public stakeholder participation in environment and development decision-making, and stakeholder participation is promoted under many regional and international initiatives in which Mediterranean Basin governments are involved (Derneği, 2010). Nevertheless the general governance framework remains very poor and needs to be further investigated and reinforced.

¹⁸ For more information see: www.medgov.net/.

¹⁹ For more information see: www.qualigouv.eu.

3. Study area: Mediterranean forest resources

This chapter presents an overview of the study area. Besides giving a definition of the area, it is organised into two main sessions: the first one provides key information on the state of forest resources, while the second one presents relevant socio-economic information.

When defining Mediterranean forests several criteria can be adopted. Based on agro-bioclimate aspects, they can be identified with the '*Mediterranean forests, woodlands, and scrub biome*' which is characterized by dry summers and rainy winters, and occurs in what Le Houérou (2004) called the isoclimatic Mediterranean zone. Such zone covers about fifty countries in five different regions, including the Mediterranean Basin, the Chilean *matorral*, the California *chaparral* and woodlands ecoregion of California and the Baja California Peninsula, the Cape Province-Western Cape of South Africa and the Southwest Australia corner area.

Masiero et al. (2013)
(Annex 1)

The connotation 'Mediterranean climate' is included in many qualitative climate-type classifications adopted worldwide and identifies the characteristics of many regions located between 32° and 41° North or South of the Equator. Besides specific climate characteristics, the Mediterranean region presents ecological features determined by geographical position, morphology and socio-cultural issues. Variety and diversity represent two of the main aspects, fully mirrored by high biodiversity rates, the large number of endemisms and the multiple functions played by forests.

Bio-geographers and ecologists agree on the fact that based on floristic and vegetation structure, as well as on climatic and bioclimatic criteria, the area where Mediterranean climate prevails can be identified with the one delimited by the range of the olive cultivation (figure 3.1a) (Lemée, 1967; Ramadé, 1997). In line with the etymology of the word 'Mediterranean', that derives from the Latin *medius terrae*, i.e. surrounded by land²⁰, and following the approach adopted by UNEP Plan Bleu initiative, the Mediterranean Action Plan (MAP) (1975) and the related Barcelona Convention (1976)²¹ promoted by UNEP, the Mediterranean region has been considered as the region made up of the twenty-one countries bordering the Mediterranean Sea and falling within the limits of the bioclimatic Mediterranean region as well as the Mediterranean catchment area (figure 3.1b).

²⁰ As commented by Mercatore (1609) the Mediterranean is known under several names depending on the lands it gets to and the historical period. A wide overview of all these different names along ancient times has been developed by Matvejevic (1991). In his '*De Mediterraneo mari Orig.*' Isidoro of Sevilla was the first one to use the word *Mediterraneus* as the name for the Mediterranean sea (Matvejevic, 1991).

²¹ For more information see: www.unepmap.org/index.php?module=content2&catid=001001004.

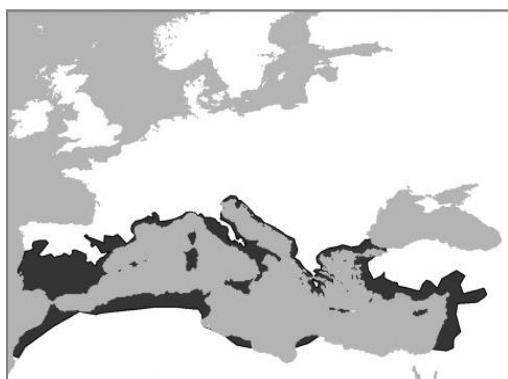
The twenty-one selected countries have been grouped into four sub-regions (Figure 3.1c)²²:

- › **Southern Mediterranean (SM)** i.e. Algeria, Egypt, Libya, Morocco and Tunisia;
- › **Eastern Mediterranean (EM)** i.e. Cyprus, Israel, Occupied Palestinian Territories, Syria and Turkey;
- › **North-Eastern Mediterranean (NEM)** i.e. Albania, Bosnia and Herzegovina, Croatia, Greece, Montenegro and Slovenia;
- › **North-Western Mediterranean (NWM)** i.e. France, Italy, Malta and Spain.

Altogether these countries/territories cover about 858.3 Million (M) ha, i.e. 6.6% of the global land worldwide, hosting an overall population of nearly 495 M people, equivalent to 7.2% of the world's total population (FAO, 2013; UN, 2013).

Figure 3.1 - Mediterranean region and sub-regions

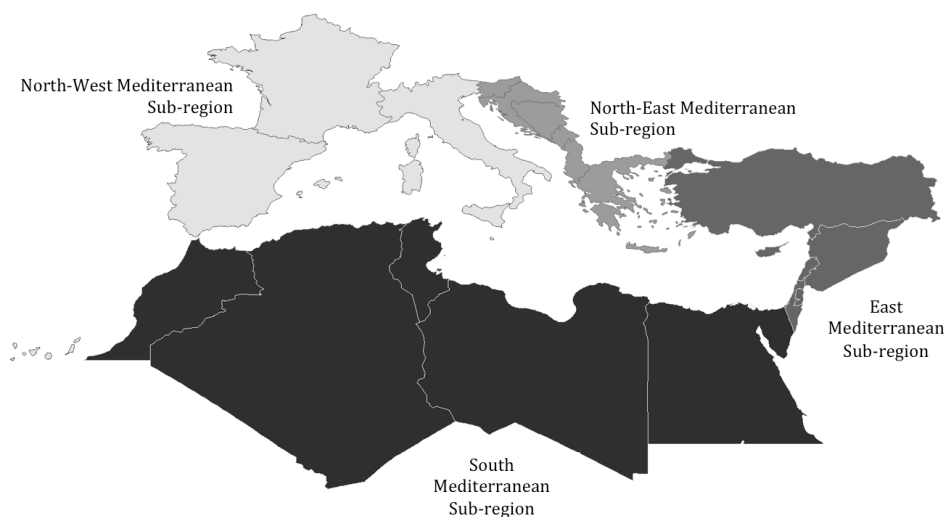
a. Olive tree range



b. Mediterranean catchment area



c. Mediterranean sub-regions as defined for the present research



Source: (a) Moriondo *et al.*, 2008; (b) Plan Bleu, 2009; (c) own elaboration.

²² Due to small dimensions, negligible relevance in forestry terms and lack of detailed information regarding the forest sector, countries like Monaco, San Marino and Vatican City have not been included as such: it can be assumed they are covered by data referring to France and Italy respectively. The same considerations can be done for Andorra (France and Spain) as well as for territories like Gibraltar (Spain), Ceuta and Melilla (Morocco), and Akrotiri and Dhekelia (Cyprus).

3.1 Natural resources

Within the twenty-one selected countries a variety of forest types stand over a global area of more than 74 Mha, covering about 9% of the whole land area in the region (FAO, 2010). Quézel (1985) distinguished Mediterranean forest ecosystems into six vegetation categories: (i) thermophillic wild olive and pistachio scrub; (ii) conifer forests of pines (Aleppo, Brutia, stone, etc.), Barbary Thuya and Phoenician juniper; (iii) schlerophyllus evergreen forests of oaks; (iv) hilly deciduous forests of oaks, hornbeam, ash and occasionally beech; (v) mountain forests of cedar, black pine and beech; (vi) oro-stage-stands of arborescens juniper and xerophytes.

Based on Quézel studies, and with regards to the European context, Barbati *et al.* (2011) have recently suggested four forest types as Mediterranean ones: 'Broadleaved evergreen forest', 'Coniferous forests of the Mediterranean, Anatolian and Macaronesian regions'²³, 'Thermophilous deciduous forests' and 'Floodplain forests'. They cover around 9% of the total forest area in Southern East, Southern West and Central West Europe as defined by Forest Europe (2011)²⁴ (Table 3.1).

Table 3.1 – European forest types in the Mediterranean region

Forest type	Description
A. Thermophilous deciduous forests	The deciduous forests under this category mainly occur in the supra-Mediterranean vegetation belt, the altitudinal belt of Mediterranean mountains corresponding to the mountainous level of middle European mountains. Thermophilous deciduous forests are limited to the north (or upslope) by temperature and to the south (or downslope) by drought. The mild climatic conditions of the supra-Mediterranean level determine the predominance of mixed deciduous and semi-deciduous forest of thermophilous species, mainly of <i>Quercus</i>, <i>Acer</i>, <i>Ostrya</i>, <i>Fraxinus</i>, <i>Carpinus</i> species are frequent as associated secondary trees. Anthropogenic exploitation has modified the natural mixed composition of thermophilous deciduous forests, leading in most cases to the elimination of natural species without a commercial interest or with poor resprouting capacity or, conversely, the introduction of forest species that would not occur naturally (e.g. chestnut). Simplified forest structures shaped by traditional silvicultural systems predominate (coppice, coppice with standards, mixed coppice/high forest); of purely cultural origin are also the chestnut-groves, today largely replaced by coppice-woods or left unmanaged. High forest-like structures developing from the abandonment of forest cultivation are relatively frequent in the category.
B. Broadleaved evergreen forests	Forests under this category are related to the thermo- and meso-Mediterranean vegetation belt and to the warm-temperate humid zones of Macaronesia. These kind of climates determine a forest physiognomy characterised by the dominance of broadleaved sclerophyllous or lauriphyllous evergreen trees. Water availability varies considerably between the Macaronesian and thermo- and meso-Mediterranean vegetation belts and it is the main climatic factor limiting tree-growth. In the Mediterranean, the structure of broadleaved evergreen forest has been profoundly shaped by traditional agro-forestry (<i>dehesas</i>, <i>montados</i>) and coppice cultivation systems. Forest degradation is a very common phenomenon, due to a complex historical interplay of harsh environmental conditions (drought, aridity, soils prone to erosion) and anthropogenic influences (fire, grazing, intensive forest exploitation).
C. Coniferous forests of the Mediterranean, Anatolian and Macaronesian region	This category includes a large group of coniferous forests, mainly xerophytic forest communities, distributed throughout Europe from coastal regions to high mountain ranges. Forest physiognomy is mainly dominated by species of <i>Pinus</i>, <i>Abies</i> and <i>Juniper</i>, that are variously distributed according to altitudinal vegetation belts. The relation with dry and, often, with poor or poorly developed soils limits tree growth. Although some pine forests under this category are adapted to fire (e.g. <i>P. halepensis</i>, <i>P. canariensis</i>), in the Mediterranean region repeated forest fires of anthropogenic origin seriously threaten these coniferous forests, by triggering forest degradation.

²³ The coniferous forests of the Mediterranean, Anatolian and Macaronesian regions comprise the 'strict' Mediterranean forests, while thermophilous and broadleaved deciduous forests may include tree species that also occur in other parts of Europe.

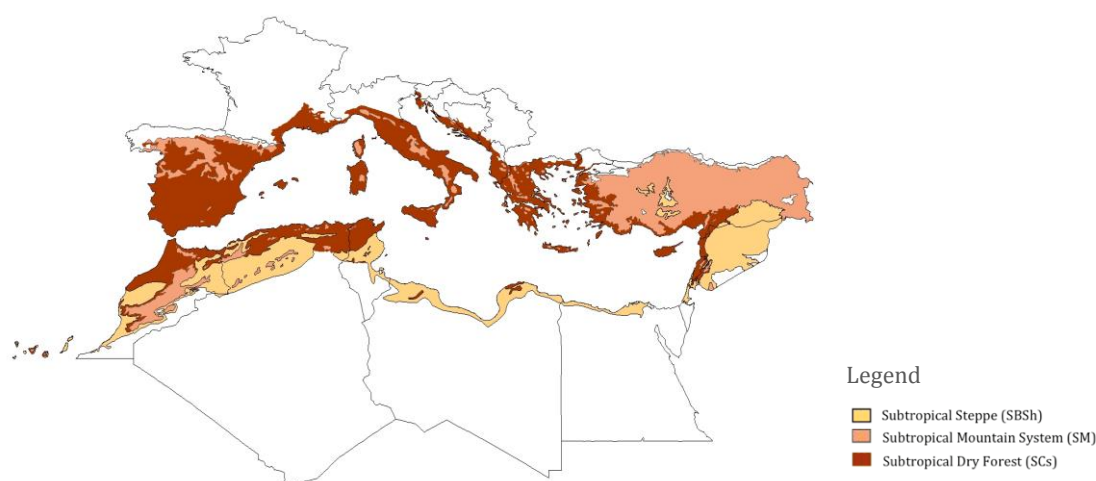
²⁴ Southern-East Europe includes Portugal, Spain and Italy; Southern-West Europe includes the Balkans and Turkey; Central-West Europe includes several countries but with regard to the forest types taken into consideration it may be assumed reference should be made to France only (Forest Europe, 2011).

From a structural viewpoint, even - aged forest characterise the category.	
D. Floodplain forests	The riparian or alluvial hydrological regime (high water table subject to occasional flooding) determine the appearance of forests under this category, distributed along the main European river channels. Floodplain forest are species - rich often multi - layered communities characterised by different assemblages of species of <i>Alnus</i>, <i>Betula</i>, <i>Populus</i>, <i>Salix</i>, <i>Fraxinus</i>, and <i>Ulmus</i>. In the Mediterranean and Macaronesian regions local species are also found (e.g. <i>Fraxinus angustifolia</i>, <i>Nerium Oleander</i>, <i>Platanus orientalis</i>, <i>Tamarix gallica</i>). Forest composition and structure largely depends on the frequency of flooding. Anthropogenic activities like the river damming and canalisation, drainage of riparian areas to provide agricultural land have brought significant changes in the area of floodplain forest during the last century. The conservation and restoration of these riparian forests is the main focus of forest management today.

Source: EEA, 2007 and Forest Europe, 2011.

According to FAO (2013) Mediterranean forests can be classified based on a biogeographic–bioclimatic definition as those forests falling into three main ecological zones: subtropical dry forest, subtropical steppe and subtropical mountain system (Figure 3.2).

Figure 3.2 - FAO Global Ecological Zones assumed to host Mediterranean forests in the 21 selected countries



Source: own elaboration from Iremonger and Gerrand, 2010.

By combining these ecological zones with the European forest types in the Mediterranean region for the purposes of the State of Mediterranean Forests (SoMF) FAO (2013) has estimated 25.5 Mha of Mediterranean forests in 2005. This estimate, however, includes also countries that are not considered in the present research, i.e. Bulgaria, Jordan, Portugal, Serbia and the Former Yugoslav Republic of Macedonia. Due to difficulties in identifying data specifically related to Mediterranean forests, the present study refers broadly to all forests within selected Mediterranean countries.

Differences among sub-regions and countries can be observed in terms of forest distribution, cover, trends, regeneration and ownership: they will be analysed in the next paragraphs, together with key ecological issues. Finally some considerations on potential threats depending on climate change will be presented.

3.1.1 Distribution of forests in the Mediterranean region

Masiero et al. (2013) (Annex 1, Paragraph 3)

Distribution of forest area across the Mediterranean is uneven. Around 73% of forests are concentrated in the Northern sub-regions (58% just in the NWM sub-region), while 16% lay in the EM region and nearly 11% in the SM one. More than 63% of the global Mediterranean forest area is hosted in only four countries of the Northern sub-regions: Spain, France, Italy and Greece. Outside these areas, Turkey and Morocco are the only countries with relevant forest areas: they represent more than 80% of the forest coverage outside the Northern sub-regions, with Turkey alone representing around 92% of the overall forest area in the EM sub-region.

Differences in distribution of forests reflect on different concentration of forest biomass and stocks. The Northern sub-regions host nearly 79% of the total wood volume and 75% of the total biomass in the Mediterranean basin. Such high stock figures are partly due to the fact that many of the countries in the Northern sub-regions (e.g. Croatia, France, Italy, Slovenia, and Spain), include relevant quantities of temperate forests. NWM sub-region accounts also for more than 54% of the total Carbon stock in living forest biomass: when considering also Turkey this figure grows up to 74% (FAO, 2010). Detailed data on this issue are presented in paragraph 4.1.2.2, when evaluating carbon-related services provided by Mediterranean forests.

With few exceptions, in both SM and EM sub-regions forests are mainly represented by sparse, pre-desert shrub vegetation, with low levels of wood volume and biomass. Not considering Morocco (11%), the SM sub-region presents the lowest forest cover rates: 0.6% for Algeria, around 0.1% for Libya and Egypt. The higher rates can be found in the Balkans - with Slovenia showing a 62%, Bosnia and Herzegovina 43% and Montenegro 39% - and in Spain (36%). Outside the Northern sub-regions no country with a forest cover rate higher than 20% can be found, while only four (Cyprus, Turkey, Lebanon and Morocco) show figures higher than 10%.

3.1.2 Forest area variation and trends in the Mediterranean region

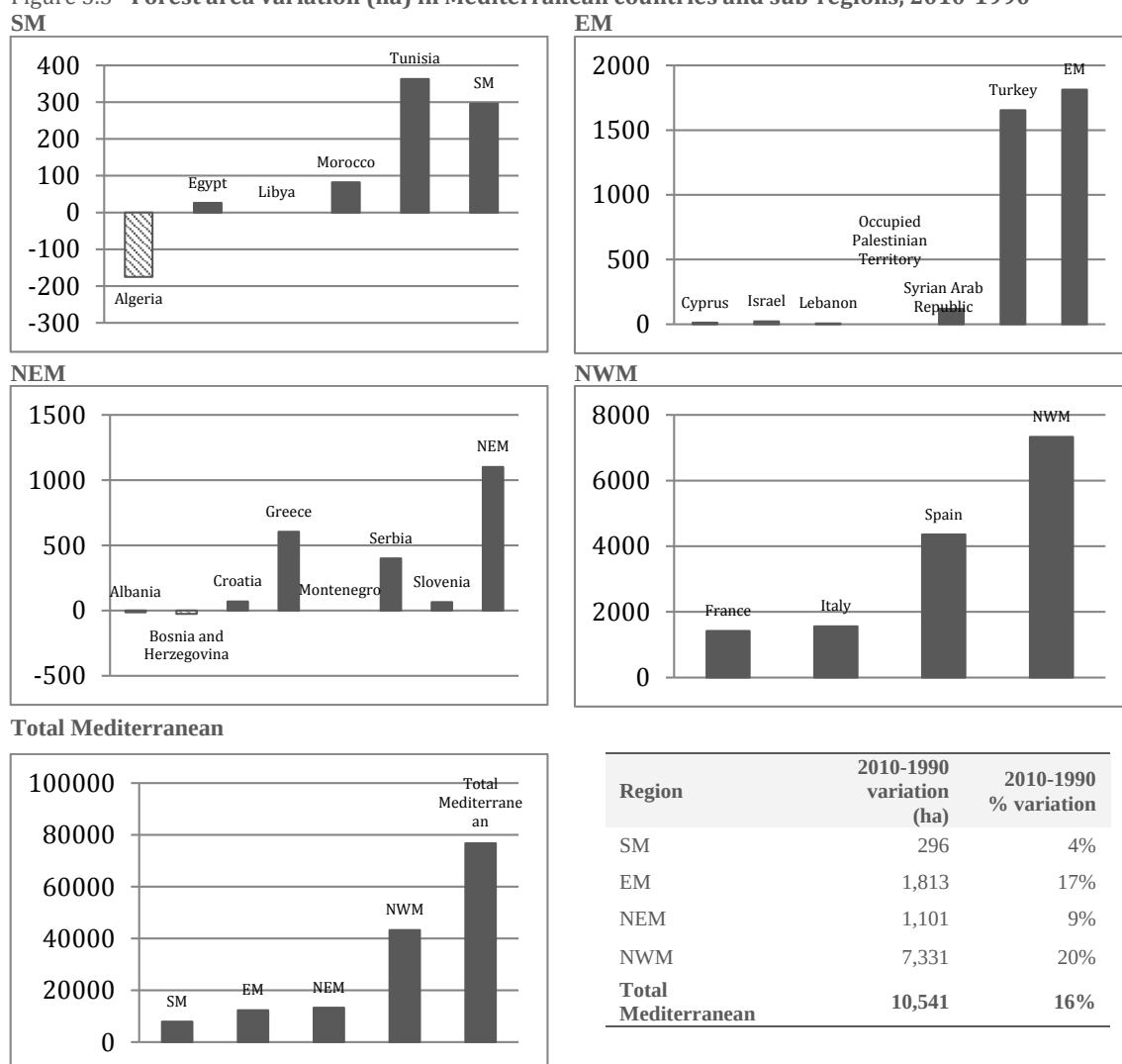
According to FAO (2013) there was no significant net change in the total area of Mediterranean forests between 1990 and 2005. When considering FAO FRA data for the 1990-2010 period this trend is generally confirmed (FAO, 2010).

Masiero et al. (2013) (Annex 1, Paragraph 3)

During the last twenty years almost all the countries in the Northern sub-regions experienced a huge increase in forest area, with annual rates up to 1% (or even higher) for Italy and Spain. Such trend is in relationship with the decline of agriculture and grazing activities, and the consequent abandonment of marginal areas that are being colonised by expanding new forest formations. Another reason of the increasing trend can be found in reforestation campaigns, especially

in flat areas and the creation of forest plantations for both protective and productive purposes. Exceptions can be observed with regard to some NEM countries: Albania and, to a certain extent, Bosnia and Herzegovina show some decline in their forest area that is particularly evident in the 1990-2000 period. Apart from few cases (Algeria and - for 2005-2010 - Israel) FAO figures confirm an increase in forest areas also with regard to SM and EM sub-regions (Figure 3.3).

Figure 3.3 - Forest area variation (ha) in Mediterranean countries and sub-regions, 2010-1990

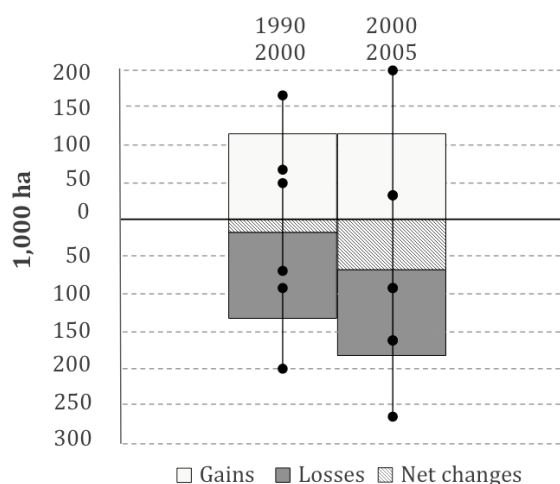


Source: own elaboration from FAO, 2010.

However, although the global picture shows a stable to expanding trend in forest area, the considerable gains and losses detected at lower scale indicate that forest cover in the Mediterranean area is dynamic (FAO, 2013) (Figure 3.4). Overuse, fires, overgrazing, and competition from other forms of land use hamper productivity and reduce the environmental services provided by the region's remaining forests. Over the past two decades, Algeria lost more than 10% of its forest cover (Van Acoleyen and Khelladi, 2011) and its deforestation rate was 0.6% per year during 2005-2010 (FAO 2010). In many countries, forest degradation is likely to be a more important problem than deforestation itself (CIFOR, 2009).

Overall, the cost of deforestation and forest degradation can be high: 0.2% of the GDP in Morocco (Ellatifi 2005). While land use change and related forest degradation are more evident in Southern Mediterranean countries (Croitoru and Liagre, 2013), similar dynamics can be observed also in Northern ones. For example Marchetti *et al.* (2012) reported about 7,000 ha of forest-lands annually converted into other land uses in Italy during the 1990-2008 period.

Figure 3.4 - Average annual change in Mediterranean forest area, 1990–2000 and 2000–2005



Source: FAO, 2013.

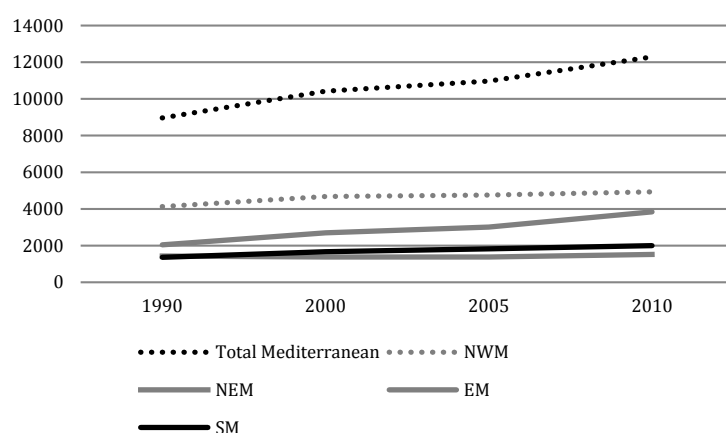
3.1.3 Forest regeneration: the role of planted forests

Based on FAO data (2010) today there are but few primary forests left in the Mediterranean region (2% of the total forest area), while naturally regenerated (82%) and planted forests (16%) prevail. Primary forests have expanded for 280,000 ha in the region during the 1990-2010 period, however data for 1990 were available only for ten countries and just two of them (i.e. Slovenia and Turkey) reported increased figures. A growing trend can be observed also for planted forests that are established for both productive and protective purposes (figure 3.5). The total extent of planted forests in the Mediterranean region increased by 3.3 Mha between 1990 and 2010, mainly thanks to planted area expansion in Turkey, Spain and, at a lower rate, Tunisia. Planted forests comprise the total forest estates in Egypt and Libya, and more than 50% of the forest estates in Israel, Syria and Tunisia (Figure 3.6). Turkey hosts the largest planted area in the Mediterranean region (3.4 Mha) and ranks 11th at world scale, followed by France (12th) and Spain (17th) (FAO, 2006 and 2010). In these countries plantations are mostly production-oriented and feed local wood and paper processing industries, while in SM countries planted forests provide multiple services, from wood/firewood production, to protection against desertification and soil erosion. Massive reforestation projects and initiatives took place in Tunisia and Algeria. In Tunisia reforestation projects have been started since 1956 and some 202,000 ha have so far been planted. The largest area (718,000 ha) has been planted in Algeria: 40,000 ha are represented by eucalyptus plantations and 48,000 ha by pine (FAO, 2010a).

With reference to SM countries, forest plantations, except those on farmlands, were mainly established by the public sector, while the involvement of the private sector is still very limited. This is due to many factors, including low yields -

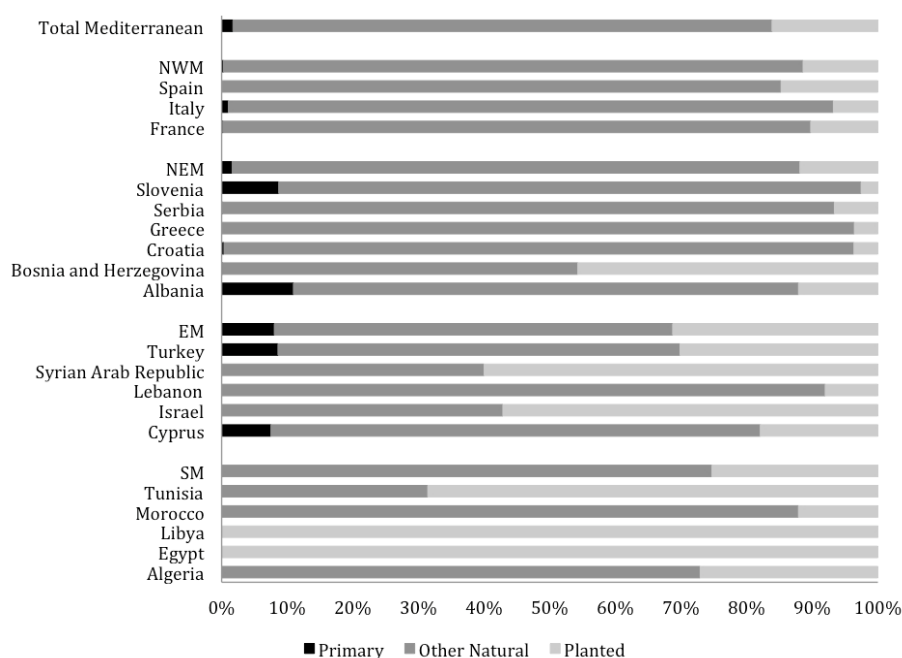
because of old-fashion planting techniques, unsuitable sites (soil and climate conditions) for the species selected or poor maintenance (Hadri and Guellouz, 2011) - high costs, and (at least in some areas/countries) the predominant public land ownership that limits the private sector's participation (FAO, 2010a). Conversely the accompanying measures of the EU Rural Development Program in the 1990s have supported a relatively large scale conversion of private farmland to plantations in the EU Mediterranean countries. Only during the last planning period (2006-2013) the rate of plantation investments has decreased.

Figure 3.5 - Trend in planted forest area (1,000 ha) in Mediterranean sub-regions, 1990-2010



Source: own elaboration from FAO, 2010.

Figure 3.6 - Forest area % composition: primary, other naturally regenerated and planted forests in Mediterranean countries and sub-regions, 2010



Notes:

Category	Description
A. Primary forest	Naturally regenerated forest of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed.
B. Other naturally regenerated forest	Naturally regenerated forest where there are clearly visible indications of human activities.

B. Other naturally regenerated forest of introduced species (sub-category)	Other naturally regenerated forest where the trees are predominantly of introduced species.
C. Planted forest	Forest predominantly composed of trees established through planting and/or deliberate seeding.
C. Planted forests of introduced species (sub-category)	Planted forest, where the planted/seeded trees are predominantly of introduced species.

Source: own elaboration from FAO, 2010.

3.1.4 Forest ownership and dependency

Forest ownership conditions as well as forest dependency represent another relevant factor within the region (Figure 3.7). While on average 54% of Mediterranean forests are public owned, figures may widely change depending on Mediterranean countries and sub-regions (FAO, 2010).

Masiero et al. (2013) (Annex 1, Paragraph 3)

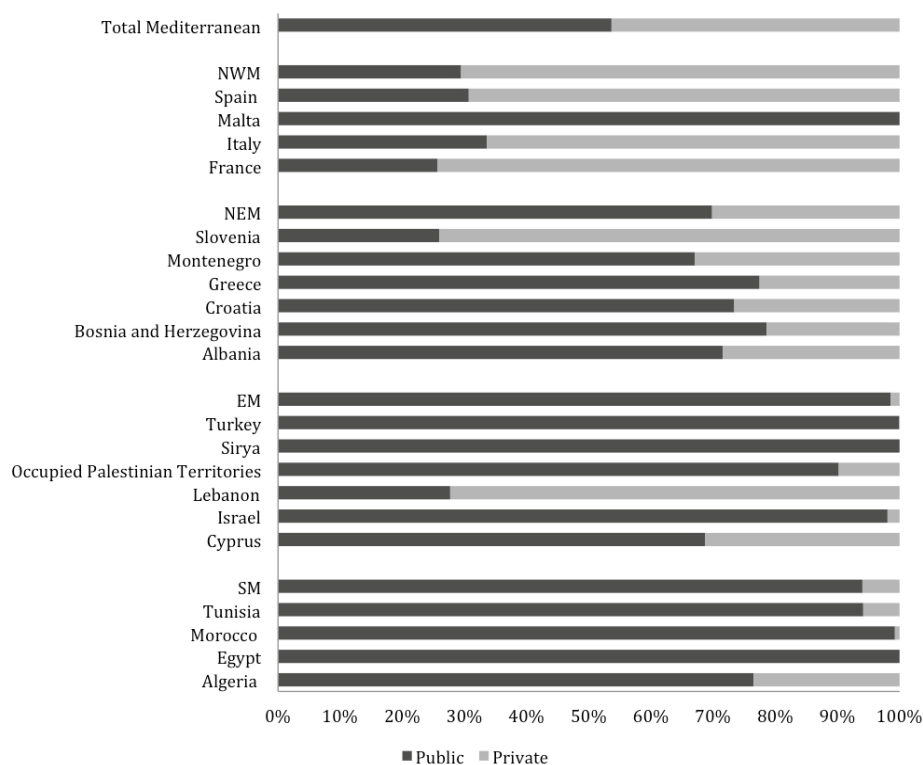
With the only exception of Malta, in NWM countries most of the forest area is privately owned (71%). While public forests are efficiently managed, many private forests suffer from a certain lack of care or poor management, quite often connected with small-holding conditions. This situation often results in the abandonment of primary activities in marginal areas in favour of more profitable activities. Not considering Slovenia, in NEM sub-region relative figures are the opposite ones: public forests prevail (70%) nevertheless private ones play a relevant role as well.

In the SM and EM sub-regions public ownership dominates, representing 94% and 99% respectively of total forest ownership. In many countries most forests are public (i.e. Stately) owned.

Apart from ownership, dependency issues are important in the region. At least six SM and EM countries host indigenous people²⁵ depending from forests and their resources (Table 3.2). According to various studies and sources quoted by Chao (2012) their total number can be estimated between 9.3 and 25.2 Million, i.e. about 1.9-5.1% of the total population in the whole study area (UN, 2013; see paragraph 3.2.1 below) and 5.5-14.8% of the six countries/territories hosting them. When referring to single countries relative figures are even higher: this is, for example, the case of Algeria where forest dependent indigenous people represent around 28% of the national population, while in the case of Morocco it could be estimated up to 70%.

²⁵ In the most general sense, indigenous peoples can be understood as descendants of those who inhabited a country or a geographical region at the time when peoples of different cultures or ethnic origins arrived. Although there is no universal definition of 'indigenous peoples', the factors which international organisations and legal experts have considered relevant to understanding the concept of 'indigenous' include (Chao, 2012): (i) priority in time with respect the occupation and use of a specific territory; (ii) the voluntary perpetuation of cultural distinctiveness, which may include aspects of language, social organisation, religion and spiritual values, modes of production, laws and institutions; (iii) self-identification, as well as recognition by other groups, or by State authorities, as a distinct collectivity; (iv) an experience of subjugation, exclusion or discrimination, whether or not these conditions persist.

Figure 3.7 - Forest ownership in Mediterranean countries and sub-regions, 2010 (% figures)



Source: own elaboration from FAO, 2010.

Table 3.2 - Indigenous people depending on forests in Mediterranean countries

Country	Indigenous people	Indigenous people as a % on total national population	Sources*
Algeria	10,000,000	28.2%	IWGIA, 2011
Egypt	666,000 ÷ 1,166,000	0.8 ÷ 1.4%	ILO and ACHPR, 2009
Morocco	6,946,300 ÷ 22,366,000	21.7 ÷ 70.0%	IWGIA, 2011
Tunisia	527,500	5.0%	ILO and ACHPR, 2005
Israel	190,000	2.6%	IWGIA, 2011
Occupied Palestinian Territories	13,000	0.3%	IWGIA, 2011
Total	9,342,800 ÷ 25,262,500	5.5 ÷ 14.8%	

* all sources are quoted from Chao, 2012.

Source: own elaboration from Chao, 2012.

3.1.5 Key ecological features

Masiero et al. (2013) (Annex 1, Paragraph 2)

According to Köppen climate classification, the Mediterranean region can be classified under 'dry-summer subtropical' climate types. As such it is characterised by dry and hot summers, and cool and rainy winters, with rainfall ranging from as little as 100 millimetres/year to as much as 3,000 millimetres/year. The region however is also characterised by areas that do not present a strictly Mediterranean climate: Northern countries and Turkey, indeed, present substantial temperate areas, while Southern countries host huge desert zones.

As a consequence of prevalent climate conditions, Mediterranean forests mainly consists in ecosystems where broadleaved, evergreen

schlerophyllus trees prevail. They include a variety of formations, with different levels of woody vegetation and open areas, and their classification is not always easy. This is the result of continuous anthropic pressure and action that facilitate the growth of scrublands formations such as *maquis* and *garrigue* (Box 3.1). Whether these formations are original Mediterranean vegetation or just degraded remnants of previous forests is difficult to say (Thirgood, 1981).

Box 3.1 – Scrubland formations in the Mediterranean region

Dozens of scrubland formations occur in the Mediterranean region, most of which are secondary and result somehow from human activities, including farming, grazing, fire, etc. The high variety of substrates, microclimates and land uses determines a wide range of structural forms (Tomaselli, 1981). Such variety is well reflected in the huge number of different denominations in use at local level (*garriga*, *maquis*, *macchia*, *matorral*, *tomillar*, *phrygana*, etc.). These formations are characterised by the dominance of schlerophyllus scrubs, with an overstorey of small trees sometimes being present and (very often) an understorey of annual and herbaceous perennials. Typical examples of schlerophyllus species that can be found in such formations include evergreen oaks, carob and lentisk, but also different species of *Arbutus*, *Daphne*, *Phillyrea*, *Ramnus*, *Myrtus* and *Viburnum*. Although strictly dichotomical distinction is not always possible, *maquis* is normally considered as the first major stage in forest degradation, followed by *garrigue*, that is characterised by lower stature and complexity. The two types can also be distinguished based on substrate and species: *garrigue* is told to grow primarily on limestone substrate and include the full range of species associated to holm-oak (*Quercus ilex*) while *maquis* occur on acid, siliceous soils, being characterised by the presence of calciphobe marker species like the strawberry tree (*Arbutus* spp.), and other heat-family shrubs (*Erica* spp. and *Calluna* spp.) as well as rock roses (*Cistus ladanifer*), lavenders and other shrubs (Blondel and Aronson, 2004).

Biodiversity is one of the main characteristics of Mediterranean forests: the region hosts the second highest number of endemic plant species in the world after the tropical Andes (Byrot quoted in Merlo and Croitoru, 2005). Mediterranean forests contain about 290 indigenous arborescent species, among which 201 are endemic; moreover 15 genera are specific to Mediterranean forests (Quézel *et al.*, 1999). This rich diversity is a result of palaeogeographical (Verlaque *et al.*, 1997) and historical factors as well as ecological conditions (Quézel, 1985). The Mediterranean basin represents one of the 35 biodiversity hotspots identified by Conservation International²⁶ (Figure 3.8). Of the 22,500 species of vascular plants in this hotspot - representing 10% of the world's flowering plants on just over 1.6% of the Earth's surface (FAO, 2013) - approximately 13,000 are found nowhere else in the world. The endemics are mainly concentrated on islands, peninsulas, rocky cliffs, and mountain peaks. Endemism at the higher level is very reduced, with only two endemic families (*Aphyllanthaceae* and *Drosophyllaceae*), both represented by single species, *Aphyllanthes monspeliensis* and *Drosophyllum lusitanicum*. A number of trees are important flagships, including the cedars (such as the famous cedar of Lebanon, *Cedrus libani*, which has been exploited since the rise of civilization in the Fertile Crescent); the argan tree (*Argania spinosa*), a species in the Souss region of southwest Morocco, largely exploited for the production of cosmetic and food oil; oriental sweet gum (*Liquidambar orientalis*); and Cretan date palm (*Phoenix theophrasti*) the only palm native to the

²⁶ For more information see: www.biodiversityhotspots.org/xp/hotspots/Pages/default.aspx.

Mediterranean that is found in a tiny part of Crete and on Turkey's Datca Peninsula.

Figure 3.8 - Biodiversity hotspot in the Mediterranean region



Source: own elaboration from Conservation International, 2013.

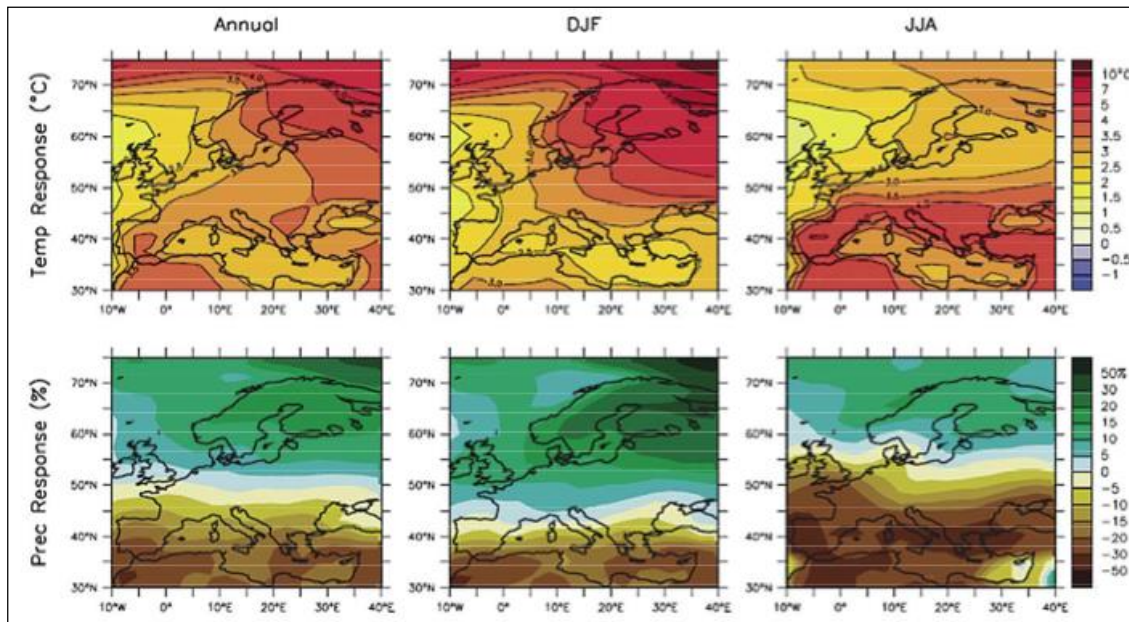
3.1.6 Mediterranean forests and climate change threats

Throughout centuries the close interaction between human activities and natural ecosystems has largely contributed to forest conversion and degradation, determining a general state of depletion for Mediterranean forest resources.

In literature five main exogenous macro-factors can generally be found as the most important drivers for forest land change: economic development, globalization, climate change, scientific and technological developments, and demographics (Thoroe *et al.*, 2004; MEA, 2005; FAO-UNECE, 2005; EFORWOOD, 2010; Jonsson, 2011). Most of the reports and studies on the Mediterranean basin focus over two of them, namely climate change and demographic growth, as the most relevant for the region. Demographic and (more in general) socio-economic aspects will be analysed in detail in the sub-session 3.2, while climate change issues are discussed below.

Due to its position as a transition region between different climate regimes, intrinsic morphological characteristics and correlations with variations of meteorological parameters in other areas, the Mediterranean region is potentially very sensitive to global climate change. Many studies identify this area as a climate change hotspot for the coming years. Schroeter *et al.* (2005) have reported for Europe an average projected temperature increase ranging from 2.1 to 4.4 °C, with the strongest warming consistently at high latitudes. Palahi *et al.* (2008) observed that the problem in the Mediterranean area could be much worst than predicted and the temperature could increase 2.5 or even 3.5 °C by 2050. In the frame of climate change, the increase of temperature is normally associated to important changes in the precipitation patterns (Figure 3.9).

Figure 3.9 - Simulated temperature and precipitation changes over Europe for the A1B climate change scenario



Top row: annual mean; winter (DJF); summer (JJA); temperature change between 1980 to 1999 and 2080 to 2099 averaged over 21 models. Bottom row: same as top, but for fractional change in precipitation.

Source: IPCC 4th assessment report, 2007.

All climate models and socioeconomic scenarios agree on the fact that precipitations will increase (10 to 40% more rainfall) over much of Northern Europe and decrease in the South of Europe (up to 20% drier), particularly during summertime. This reduction predicted for Southern Europe can have severe effects as, for example, the increase of frequency and intensity of the drought periods, which in turn will affect water resources, forestry and agriculture. In addition, in the Mediterranean region, water scarcity is expected to be aggravated by higher extractions for irrigation and tourism (World Tourism Organization, 2003).

Among all bioclimatic regions, the Mediterranean appears to be the most vulnerable to global change. Most of this vulnerability is associated to the general atmospheric circulation and the role of water as a limiting resource for Mediterranean ecosystems (Palahi *et al.*, 2008). The Mediterranean basin is characterized by limited and unevenly distributed water resources. It currently accounts for 1.2% of the world's renewable water resources, i.e. freshwater stored in rivers and groundwater reservoirs whose flows are maintained by the water cycle. About 75% of these resources are located in catchments in Italy, France, Greece and Turkey (FAO-ACQUASTAT, 2013). A study performed by Milano *et al.* (2012) explored the impacts of climatic and anthropogenic changes on Mediterranean basin water stress in the light of a sustainable development strategy adopted by the twenty-one Mediterranean countries. The research has found that - despite higher stress due to climate change - in Northern Mediterranean countries current water stress conditions should be maintained thanks to decrease in population as well as irrigated areas and increased efficiency of water networks and facilities. Water stress is expected to worsen only in Western Greece and Northern Spain because of improved water withdrawal. Catchments in France and the Balkans should be the only ones within the entire Mediterranean basin to remain under no- or low-stress conditions. As for SM and

EM countries, the combined effect of decreasing freshwater availability and increasing water withdrawals should lead to severe water stress conditions in particular in Turkey, Syria and Morocco.

Climate change is expected also to influence forest resources in multiple ways (Lindner and Calama, 2013). A general decrease in tree growth and forest production has been observed in Mediterranean forests during the last decades (Carnicer *et al.*, 2011). While these processes are quite obvious in connection to severe summer drought years, general decreasing trends have been observed for the whole basin, with special reference to the edges of species ranges (Sarris *et al.*, 2011). Reduced growth and production do not just refer to timber: reduction in production by several valuable NTFPs such as holm oak acorns, mushrooms (Ogaya and Peñuelas, 2007) and pine seeds (Ogaya and Peñuelas, 2005) has been observed as well.

In association to increased temperature, higher frequency of heat waves and summer droughts, induced die-back is expected to occur for many species especially in dense and unmanaged forests (Allen *et al.*, 2010). Climate change can also affect species distribution and community composition, causing a shift of limits distribution towards higher latitudes and altitudes. This process is more evident in Mediterranean mountainous areas where temperate (and less drought and heat adapted) species are moving upward and are replaced by more typical Mediterranean species. This is the case for example of Aleppo and maritime pines replacing Scots pine, or holm oak replacing beech at low altitudes (Lenoir *et al.*, 2008). Although less evident than altitudinal ones, latitudinal shifts are also occurring in the Mediterranean region. Substitution processes include for example the replacing of maritime pine by stone pine and evergreen broadleaves such as *Quercus ilex* and *Quercus faginea* in Spain (Rennenberg *et al.*, 2006). Typical Mediterranean species are expected to spread into the current areas of temperate and continental climate within oceanic forests. In the most extreme cases, substitution can also turn into extinction for the most vulnerable and isolated species. Such changes in composition might strongly affect Mediterranean countries both in ecologic and economic terms. This threat is particularly strong for SM and EM countries hosting vulnerable and degraded forest ecosystem and suffering an increasing demographic pressure. For example an analysis of climate change vulnerability in Tunisia showed that climate change could cause a loss of 1,200 - 18,500 ha of cork oak (1-20% of the total national cork oak area) leading to an economic loss of €1.6-21.8 M for the period 2010-2050. This represents about 0.3-4.8% of the TEV of cork oak forests (Daly *et al.* 2012).

Finally, climate change can also determine an increase in disturbances due for example to pests and forest fires. Among other similarities Mediterranean forests also share many health problems, including those associated with insect pests, diseases, other biotic factors (such as woody invasive species, wildlife browsing and grazing), and abiotic factors (such as air pollution and storms) (FAO, 2013). According to data reported by FAO (2010) about 35 Mha forests worldwide are affected by disturbances and 7.4% of them are located within Mediterranean countries included in the present study. This corresponds to a total area covering more than 2.6 Mha (table 3.3).

Table 3.3 - Forest area affected by abiotic/ biotic disturbances in Mediterranean countries in 2005 (ha)

Country	Biotic disturbances			Abiotic disturbances	Total affected area	Affected area as a % of total national/sub-regional forest area
	Insects	Diseases	Other			
Algeria	217	n.a.	n.a.	n.a.	217	14
Egypt	1	n.s.	n.s.	0	1	2
Morocco	33	n.a.	16	n.a.	33	1
Tunisia	10	0	0	n.s.	10	1
SM	261	0	16	0	277	*4
Cyprus	6	0	4	0	10	6
Israel	3	n.s.	0	n.s.	3	2
Lebanon	1	1	0	2	4	3
Syria	1	n.a.	n.a.	n.a.	1	0
Turkey	172	12	n.a.	11	195	2
EM	183	13	4	13	213	*2
Albania	1	1	101	n.s.	103	13
Croatia	27	10	8	19	64	3
Serbia	118	n.a.	n.a.	n.a.	118	5
Slovenia	1	n.s.	n.s.	1	2	0
NEM	147	11	109	20	287	*3
Italy	347	591	323	584	1,845	21
NWM	347	591	323	584	1,845	*4
TOTAL Mediterranean	938	615	452	617	2,622	*4

*Figures include forest area also for countries within the sub-region but not reported in the table.

NOTE: n.a. = not available

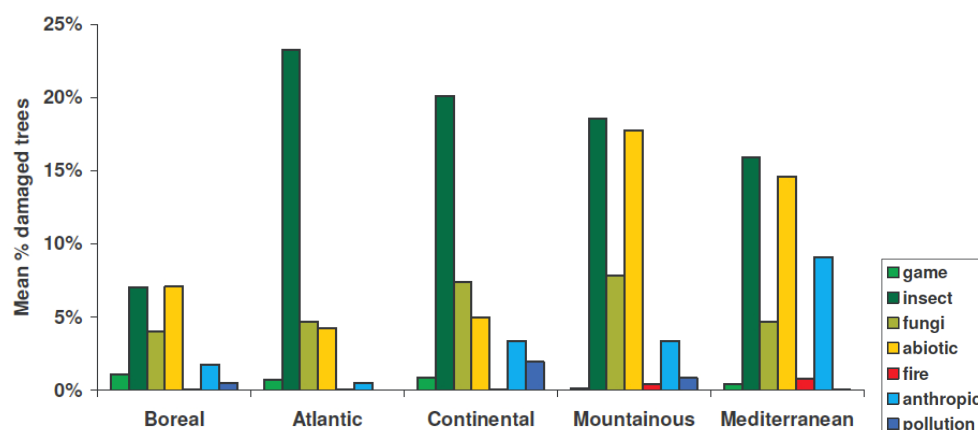
Source: own elaboration from FAO, 2010.

The most recent data collected by FAO date back to 2005 and cover just a part of Mediterranean countries, because most countries were unable to provide reliable quantitative information on forest health since they do not systematically monitor the requested variables (FAO, 2013). On average 4% of total Mediterranean forests are affected by disturbances, a figure that is likely to be underestimated due to the lack of data for many countries, including those hosting huge forest areas like France and Spain. NWM sub-region is the most affected in absolute terms, although data are only available for Italy that shows the highest proportion of forests disturbed by biotic and abiotic factors (21%). Among disturbances, insects play a major role, followed by diseases and abiotic disturbances. This is in line with the results of an analysis performed by Jactel and Vodde (2011) on the prevalence of biotic and abiotic hazards in European forests (figure 3.10).

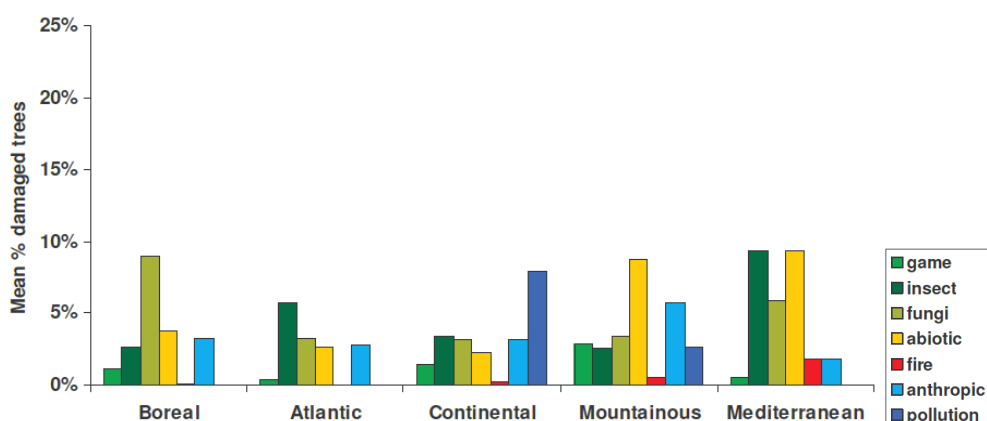
The study by Jactel and Vodde (2011) also highlighted the effect of climate on the prevalence of hazards, with most of damages concentrated in bio-geographical zones with harsher climates, such as in Mountainous and Mediterranean areas. This implies potential effects of climate change, with magnified drought risk that will weaken forest stands thus making them subject to increased biotic risks. In particular, distributional (i.e. upward and northward) shifts of insect populations are highly probable, while highly thermophilic pathogen species are likely to become more virulent (Lindner, 2008). Additionally, exogenous pests and diseases could be favoured by changing climate conditions (Lindner and Calama, 2013).

Figure 3.10 - Mean absolute percentage of damaged trees per cause of damage in the 5 European forest biomes and the 2 tree taxa between 1994 and 2005

a. Broadleaved forests



b. Coniferous forests



Source: Jactel and Vodde, 2011.

As regards forest fires, it is worth to remember that fire plays a critical role in the structure and functioning of forest ecosystems in the Mediterranean basin. Such a role is determined by predominating climatic conditions, including prolonged summers, with limited or absent rainfalls, average daytime temperatures well in excess of 30°C, and inland summer winds characterized by high speeds and strong desiccating power (FAO, 2006a). While in the Holocene, climate seasonality favoured fire expansion in Southern Europe, during the Neolithic Age, humans began affecting the fire regime that was previously related only to climatic conditions, leading to higher fire frequency (Vanniere *et al.*, 2008). Today human-induced forest fires are estimated to cover around 95% total fires in the Mediterranean region, i.e. the highest proportion among different regions worldwide (FAO, 2007). Most of the studies and reports on forest fires within the Mediterranean region concentrate on European countries, where, on average, 85% of the annual burned area is recorded (San-Miguel-Ayanz and Camia, 2010). North-Africa is characterized by fewer forest fires than the northern Mediterranean Basin (Meddour-Sahar *et al.*, 2012) but the area is under the severe threat of climate changes and human pressure. Data on forest fires in the Maghreb area include those for Morocco (Mounir and Charki, 2012), Algeria (Meddour-Sahar *et al.*, 2012) and Tunisia (Daly, *et al.*, 2012). Moreover the EU Joint Research Centre (JRC) has included Middle East and North Africa in their 2011 technical report on forest

fires. According to this report in 2011 the total burnt forest area²⁷ in the Mediterranean basin totalised 146,503.2 ha, i.e. about 45% of total burnt areas in the region (table 3.4). The most affected sub-regions are the northern ones, with NEM covering about 52% and NWM another 32% (figure 3.11).

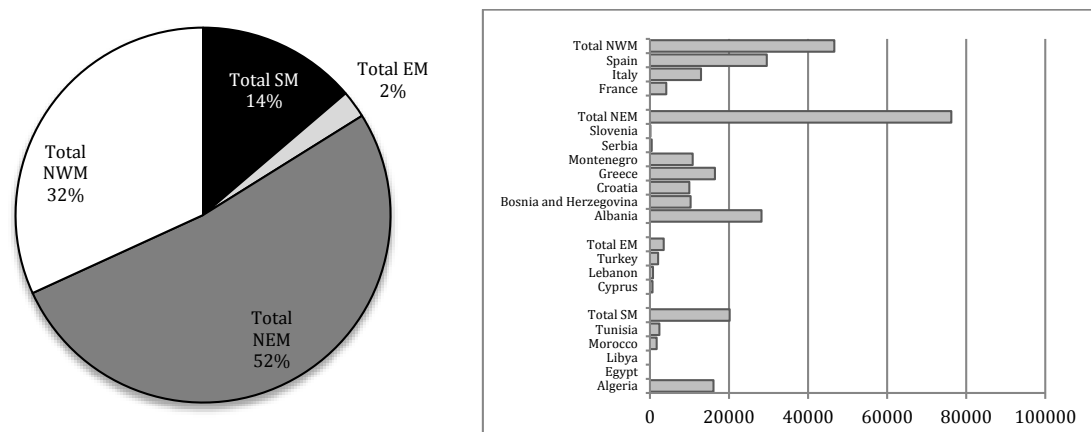
Table 3.4 - Burnt areas in Mediterranean countries in 2011 (ha)

Country	Forests/Other Wooded Lands	Other Natural Lands	Agriculture	Other	Total
Algeria	16,068.21	1,951.94	34,470.14	464.06	52,954.35
Morocco	1,697.86	329.77	2,639.19	n.a.	4,666.82
Tunisia	2,380.08	64.01	1,074.91	1.34	3,520.34
SM	20,146.15	2,345.72	38,184.24	465.40	61,141.51
Cyprus	645.76	293.48	n.a.	n.a.	939.24
Lebanon*	762.23	n.a.	n.a.	n.a.	762.23
Turkey	2,059.24	1,540.05	5,385.66	n.a.	8,984.95
EM	3,467.23	1,833.53	5,385.66	0.00	10,686.42
Albania	28,203.23	19,742.86	4,986.21	376.45	53,308.75
Bosnia and Herzegovina	10,276.11	5,369.06	1,404.45	50.67	17,100.29
Croatia	9,969.97	4,090.39	3,288.05	31.17	17,379.58
Greece	16,454.50	10,734.91	9,572.11	110.99	36,872.51
Montenegro	10,798.47	5,390.83	1,567.63	7.00	17,763.93
Serbia	432.44	528.50	95.97	n.a.	1,056.91
Slovenia	123.25	n.a.	n.a.	164.87	288.12
NEM	76,257.97	45,856.55	20,914.42	741.15	143,770.09
France	4,116.03	594.53	117.36	2.75	4,830.67
Italy	12,938.11	10,686.76	13,864.84	67.47	37,557.18
Spain	29,577.73	28,754.15	5,895.76	370.46	64,598.10
NWM	46,631.87	40,035.44	19,877.96	440.68	106,985.95
TOTAL Mediterranean	146,503.22	90,071.24	84,362.28	1,647.23	322,583.97

*data refer to 2008; note: n.a. = not available

Source: own elaboration from JRC, 2012.

Figure 3.11 - Burnt areas in Mediterranean in 2011: per sub-region (%) and country (ha)



Source: own elaboration from JRC, 2012.

²⁷ Data include Forests and Other Wooded Land according to FAO definition and refer only to fires affecting an area of at least 40 ha.

According to Lindner and Calama (2013) more megafires (i.e. forest fires affecting more than 500 ha) are expected to occur in the region, together with a prolongation of the fire risk period beyond summer. As a consequence, the total forest area vulnerable to fires is likely to expand, also because of the northward shift of Mediterranean species and biomes, as well as affected recovery capacity by forest species as a consequence of drier and warmer conditions.

3.2 Social and economic aspects

In this session some key socio-economic features of the Mediterranean region are analysed with reference to their link to forest resources and their value. In particular the analysis will focus on: (i) demographic figures and trends; (ii) macroeconomic features; (iii) pressure on forest resources and illegal practices.

3.2.1 Main demographic trends

The Mediterranean had 285M inhabitants in 1970 and 378M in 1990 (UN, 2004). Today the population of the region has reached 493.5M inhabitants (UN, 2013) and is likely to be around 520M in 2020: it is not far from doubling in the space of just half a century. Differences exist among sub-regions and countries. In Northern sub-regions population is now scarcely increasing, while in Southern and Eastern ones population is almost exploding. Countries within these areas, however, are not all growing at the same pace. The population is growing much faster in the Near East than in the Maghreb, where the demographic transition is now well established. Peak values in terms of annual population growth are registered for Occupied Palestinian Territories (+3,8%), Syria (+2,6%) and Israel (+2,4%) (UN, 2013). While until the 1980s the North Mediterranean more or less equalled the South-East Mediterranean in terms of inhabitants, in 2020 two thirds of Mediterranean people will be located on the southern shores and these figures are likely to increase in the following years. According to Groenewold *et al.* (2012) during the 2010-2050 period populations in SM and EM countries are expected to grow considerably, from about 280M to a figure between 395 and 426M, while in the same period populations in EU27 countries are only expected to grow from about 500 to 525M units. Future population prospects are mainly determined by demographic behaviour in the largest countries, i.e. Egypt and Turkey, and, to a lesser extent, Algeria and Morocco. To date, about 45% of the population in SM and EM sub-regions lives in these four countries.

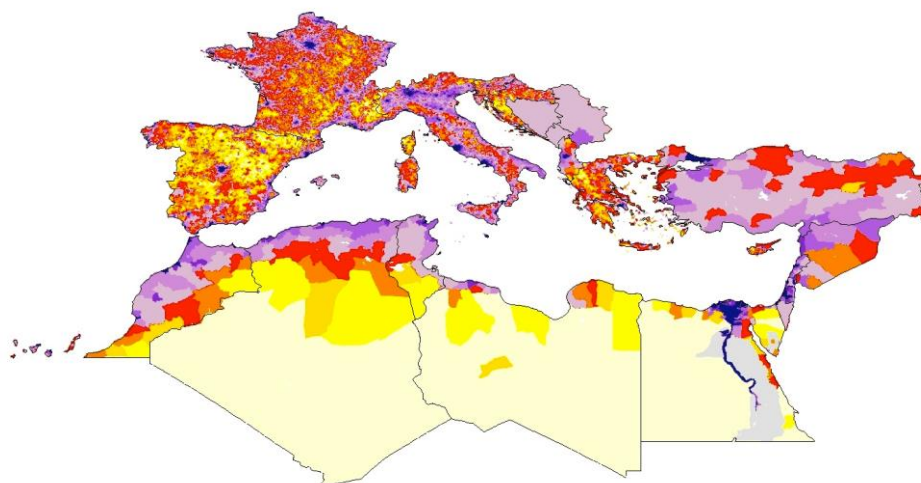
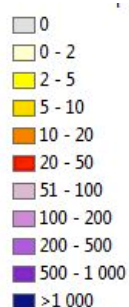
Population growth rates vary greatly between Northern and SM/EM countries but tend to be converging. Nevertheless relevant structural differences remain: the population of the SM and EM countries is much younger than Northern one. In the NWM sub-region the proportion of people aged under 15 decreased from 19% of the total population in 1990 to 16% in 2010, while the proportion of people in the over-65 age bracket increased from 25% to 30%. During the same period in the SM sub-region the proportion of people aged under 15 changed from 41% to 29% of the total population, while over-65 age people passed from 9% to 12% of the total population. Similar trends can be observed for the EM and NEM sub-regions. In particular in the EM sub-region the proportion of people aged under 15 is the same as in the SM sub-region (UN, 2013). It can be observed that while the population in

the SM and EM countries is projected to stabilize, the current growth is accompanied by a lack of employment opportunities and is contributing to considerable social pressure (FAO, 2013). When considered together, SM and EM sub-regions represent one of the regions worldwide with the most daunting employment challenge, at least in relative terms. Official labour participation rates are the lowest in the world: less than 46% of working age population, compared to the world average of 61.2%. Unemployment rate was almost 15% in 2008, with female unemployment averaging over 20% in the region, and youth unemployment often exceeding 30% for young women. Unemployment rates are increasing among workers with higher qualifications, and graduate unemployment is a widespread phenomenon. This implies a dramatic loss of educational investment (European Commission, 2010). Demographic prospects described in paragraph 3.2.1 make foreseen scenarios for future employment conditions even more negative and are likely to improve South-North and East-West migration flows within the entire region.

Currently, 64% of Mediterranean people live in urban and coastal areas (Figure 3.12) and this percentage could grow up to 68% by 2020. It is in the Maghreb and the Near East that the highest rates of urban growth in the region are recorded (Figure 3.13b): in these regions urban population has doubled between 1950 and 2010 (FAO, 2013). Despite this, the Mediterranean countryside is not in demographic decline. In 1990, the number of rural dwellers was 148 M for the Mediterranean as a whole. They were 164 M in 2005 and their number is likely to remain the same in 2020. The region maintains a profoundly rural character with approximately one third of the population living in rural areas. Projections to 2020 confirm these figures and in the SM rural population represents 46% of total population (UN, 2004; FAOSTAT, 2013). As shown in Figure 3.13 below, SM and EM sub-regions remain the only ones where the annual rural population rate has a positive variation resulting in an increase in rural population. In Northern regions this variation is negative since 1960s and rural population decreased by half between 1995 and 2010 (FAO, 2013).

Figure 3.12 - Population density within the Mediterranean Basin

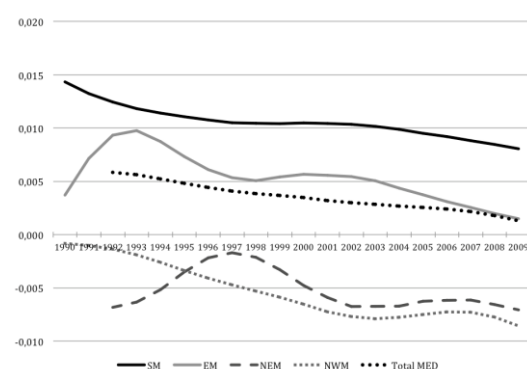
Inhabitants per
squared
kilometre



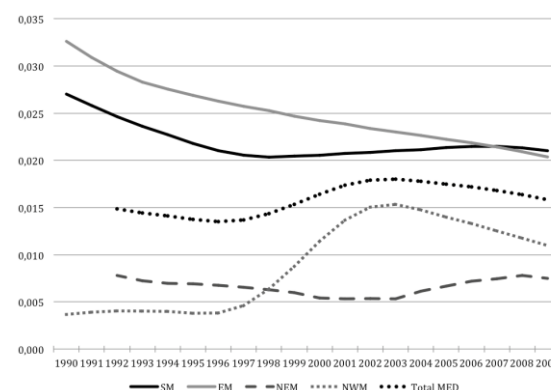
Source: own elaboration from SEDAC, 2013.

Figure 3.13 - Annual Rural (a) and Urban (b) population rate variation in Mediterranean sub-regions (1990-2010)

a. Rural



b. Urban

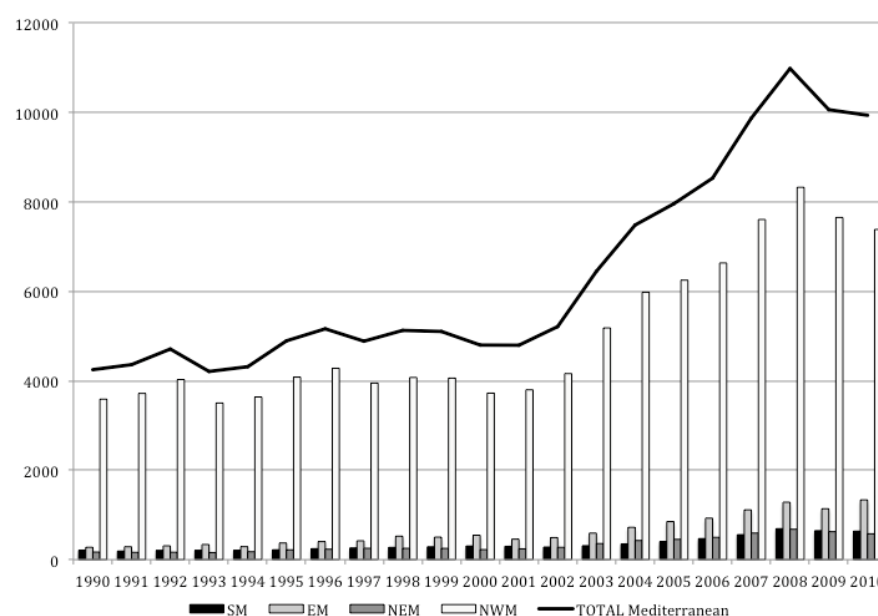


Source: own elaboration from FAOSTAT, 2013.

3.2.2 Macroeconomic features

As regards economic issues, total Gross Domestic Product (GDP) for the Mediterranean region in 2010 was €9,940 Bln, i.e. about 11% of the world's GDP, down from 16% in 1990 (WB, 2013) (Figure 3.14). Although total GDP at regional level has increased during the last decades (+134% between 1990 and 2010) differences among Mediterranean countries and sub-regions remain relevant. In 2010 one-third of the regional GDP was concentrated in one country (France) and three-quarters in the NWM sub-region.

Figure 3.14 - GDP in Mediterranean sub-regions in Euro2010, €Bln., 1990-2010

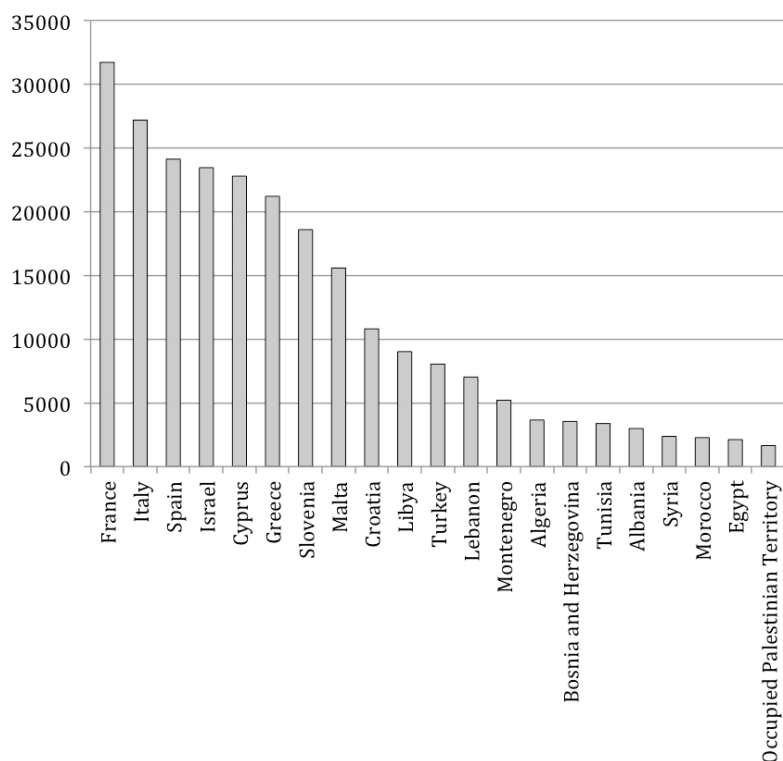


Source: own elaboration from WB, 2013.

With reference to 2010 figures GDP *per capita* in the Mediterranean region (€20,691) is almost twice the average GDP *per capita* at world level. Once again differences exist among different countries and sub-regions: the GDP *per capita* for

the NWM sub-region is twice the average GDP *per capita* at regional level, almost 3 times higher than the GDP *per capita* of the EM sub-region, 4 times higher than GDP *per capita* for the NEM sub-region and 11 times higher than the GDP *per capita* of the SM sub-region (WB, 2013) (Figure 3.15).

Figure 3.15 - GDP per capita in Mediterranean countries in Euro2010, 2010

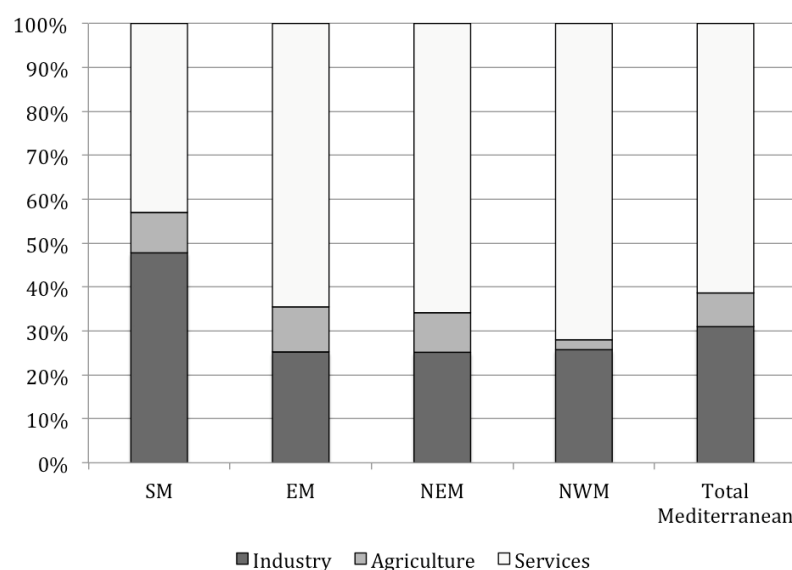


Source: own elaboration from WB, 2013.

In the Mediterranean region and especially in the Northern sub-regions economy is increasingly dominated by services, with a correspondent decline of the contribution of the agriculture and industrial sectors to the GDP. Considering 2010 figures provided by the World Bank (WB, 2013a and 2013b) in the NWM sub-region more than 70% of GDP derives from services, while agriculture on average only contributes with 2%. NEM and EM sub-regions have similar profiles: agriculture covers 9-10% of the GDP, while services represent 65-66%, and industry provides the remaining proportion. As for SM sub-region, agriculture represents about 10% of the GDP, but the industrial sector still provides a high contribution, covering 48% of the GDP (Figure 3.16). Despite a general increase in the added value it generates, in the four sub-regions agriculture is less dynamic than other economic sectors. The abovementioned decreasing rate in the variation of rural population as well as the general decrease in arable lands *per capita* observed by FAO (2013) are indirect confirmations of this trend. Socio-economic consequences of reduced production capacity by agriculture might be relevant. SM and EM sub-regions, indeed, import more food per capita than any other region (up to 25 to 50% of domestic consumption) being the world's largest cereal-importing areas. As a consequence they are particularly vulnerable to fluctuations in food supply and prices, at the point that this area has seen major food riots in the past and booming population growth together with changing diets have contributed to a growing food insecurity. These aspects have been seen as

aggravating factors of the recent Arab Spring and could become harsher in the next future (Johnstone and Mazo, 2013).

Figure 3.16 - Relative contribution of different sectors to GDP of Mediterranean sub-regions in 2010



Source: own elaboration from WB, 2013a and 2013b.

With regard to the forestry sector, the most recent data on gross value added production at international level have been published by FAO in 2008 and date back to 2006. They distinguish between forestry²⁸ and wood²⁹ sector (Figure 3.17). The total added value generated by the forestry sector in Mediterranean countries³⁰ totalizes €7.8 Bln. Additionally, the added value produced by the wood sector industry generated some €13.6 Bln. During the 1990-2006 period the added value created by the two sectors showed a negative trend, however some recovery was observed for forestry starting from 2004. As a result, forestry added value had a general 8% increase in the whole region, mostly because of a growth in SM (+21%) and NWM (+15%) sub-regions, while wood sector industry added value decreased by 18% and EM sub-region was the only one to show a positive variation (+60%).

During the same period employment figures for forestry and related sectors showed a general decrease, with only few exceptions (Table 3.5). The total number of people employed in forestry, furniture industry, wood industry, and pulp and paper sector was around 1.5 Bln units in 1990 and 1.4 Bln units in 2006.

The furniture sector was the only one to show a positive variation at regional level (+7%), mostly due to contributions by NWM (+7%) and above all EM (+65%) sub-regions. Forestry suffered the highest negative variation both at regional (-38%) and sub-regional level: only SM sub-region showed an increase, however, when reducing time span to the 1995-2006 period the variation becomes negative. Among different sub-regions, EM countries were the only ones showing positive

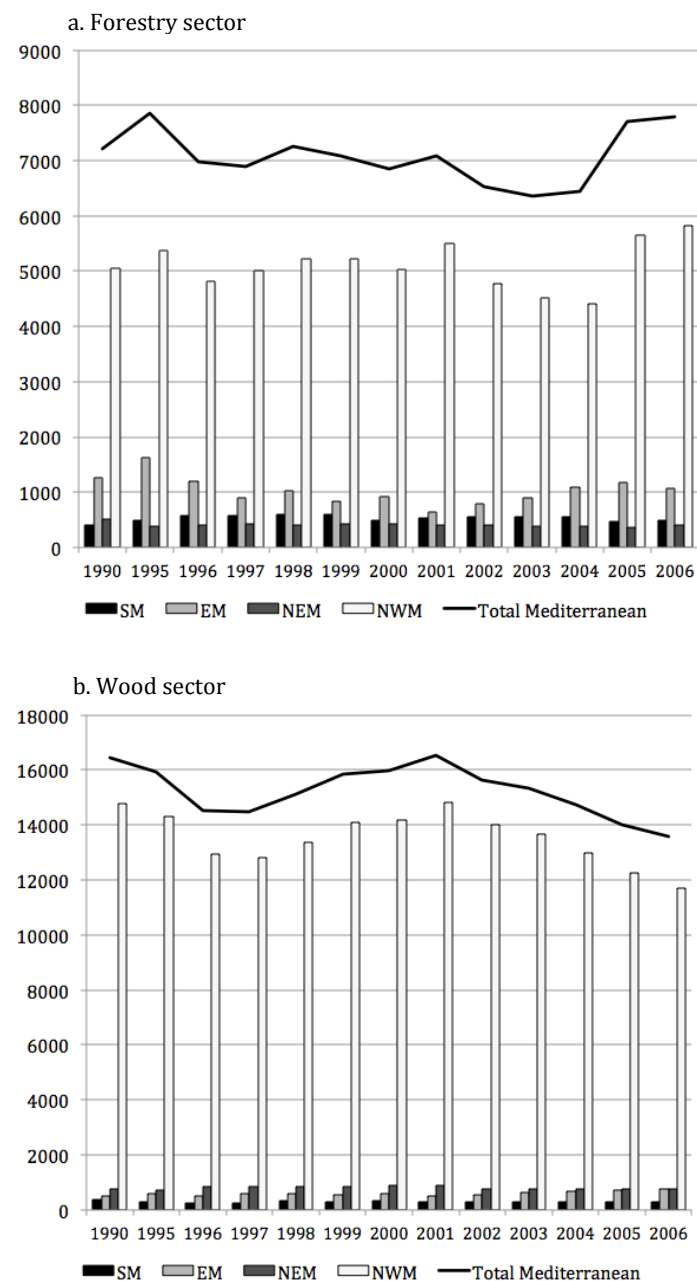
²⁸ i.e. 'Forestry and logging', according to the International Standard Industrial Classification of All Economic Activities (ISIC) category 02.

²⁹ i.e. 'Manufacture of wood and of products of wood and cork, except furniture' (ISIC 16)

³⁰ Data are available only for sixteen out of twenty-one countries.

variations for all sectors, except forestry. It shall be observed, however, that since data date back to 2006, they do not take into consideration the effects of the global economic crisis.

Figure 3.17 - Gross added value in the (a) forestry and (b) wood sector, per Mediterranean sub-regions, 1990-2006 (M€, 2006 prices)



Source: own elaboration from FAO, 2008.

Table 3.5 - People employed in forestry and related sectors in Mediterranean sub-regions (1,000 people), 1990 and 2006

Sub-region		1990	2006	% on TOTAL 2006 Mediterranean figures	% 2006- 1990 variation
SM	Forestry	15	18	11%	20%
	Furniture industry	28	28	7%	0%
	Wood industry	35	32	6%	-9%
	Pulp and paper	40	32	9%	-20%
	TOTAL	119	107	8%	-10%
EM	Forestry	71	36	21%	-49%
	Furniture industry	46	76	19%	65%
	Wood industry	33	62	13%	88%
	Pulp and paper	63	110	32%	75%
	TOTAL	236	294	20%	25%
NEM	Forestry	46	20	12%	-57%
	Furniture industry	50	29	7%	-42%
	Wood industry	76	42	9%	-45%
	Pulp and paper	31	15	4%	-52%
	TOTAL	203	106	8%	-48%
NWM	Forestry	140	95	56%	-32%
	Furniture industry	241	257	66%	7%
	Wood industry	404	358	72%	-11%
	Pulp and paper	214	191	55%	-11%
	TOTAL	999	901	66%	-10%
TOTAL Mediterranean	Forestry	272	169	100%	-38%
	Furniture industry	365	390	100%	7%
	Wood industry	548	494	100%	-10%
	Pulp and paper	348	348	100%	0%
	TOTAL	1.533	1.401	100%	-9%

Source: own elaboration from FAO, 2008.

3.2.4 Pressure on forest resources and illegal practices

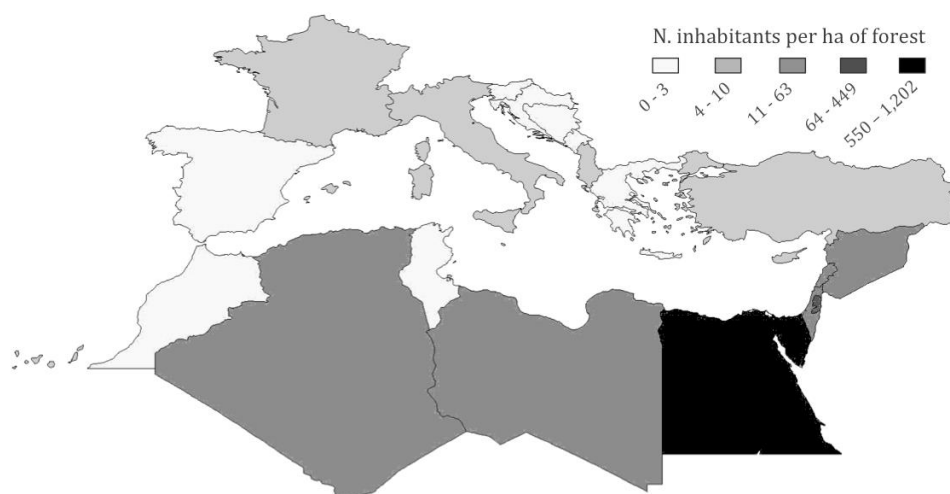
The growing demographic pressure, associated to relatively low income and limited diversification of activities have contributed to a high level pressure on forest resources especially in SM and EM sub-regions. A good indicator for this is represented by the number of inhabitants per hectare of forests (Figure 3.18). The highest values can be observed for Egypt (1,115 inhabitants/ha) and Occupied Palestinian Territories (446 inhabitants/ha) but Algeria, Libya, Israel, Lebanon and Syria present high values as well, ranging between 25 and 50 inhabitants/ha. On average SM sub-region presents 20.6 inhabitants/ha, i.e. a value that is more than twice compared to the value for EM sub-region and 5 to 6 times higher compared to the values for NWM and NEM sub-regions respectively.

In SM and EM sub-regions forest overexploitation for timber production, clearing for agriculture and grazing, growing urbanisation processes, and many other factors drove these dynamics to the current status of the forests in the region. This, associated to difficult climate conditions, caused negative effects like fertility loss, soil erosion, desertification, biodiversity loss, etc. In Northern countries increased income levels and low demographic growth favoured land abandonment especially in marginal and unprofitable areas. These include many forest areas, especially in mountainous regions. Among the negative outputs of such processes ageing of forest stands, loss of landscape quality, increased risk of forest fires and sometimes even loss of cultural identity can be listed.

Pressure on forests is sometimes connected to illegal practices. Relevant illegal logging levels are reported for many countries, including the most forested ones

such as Turkey (Gunes and Elvan, 2005) and Morocco. Although figures on illegal practices are mostly available via informal channels³¹, empirical evidence suggests these processes can strongly affect local forest resources, both in terms of quality and quantity. In the Southern sub-region the ecosystems - particularly fragile and vulnerable due to the reigning environmental and climatic conditions - are largely exposed to increasing anthropogenic pressure of clearing and cultivation in marginal lands, overexploitation of firewood and overgrazing. Evidence of illegal practices has been reported also for many NEM countries, including Albania, Bosnia Herzegovina and Serbia (Buriaud, 2005; Markus-Johansson *et al.*, 2010) while no study has taken into consideration Western Europe, where illegal harvesting is normally not discussed as an issue and forest crimes seem to represent a negligible problem (Ottitsch *et al.*, 2007). In the meanwhile many Western Europe countries are major importers of illegal wood (Hirschberger, 2008): NWM countries are among this importers, sometimes - as it is in the case of Italy - with strong commercial relationships with NEM countries.

Figure 3.18 - Number of inhabitants per hectare of forest in Mediterranean countries



Source: own elaboration from FAO, 2010, and UN, 2013.

Pressure on forest resources and illegal practices can be emphasized by extreme events such as economic crisis and general instability due to wars/riots. This is evident, for example, in the case of Greece - where media³² reported up to 30% increased firewood harvesting rates as a consequence of heating oil price rising, with many households unable to afford them and turning to wood to heat - and Syria - where deforestation practices in Idlib area (North of the Country) have been largely reported as a consequence of increasing prices and dramatic conditions due to the Syrian civil war. Similar processes were observed in the 1990s in Croatia and Bosnia Herzegovina, where several authors denounced forest resources depletion in the area due both to self-consumption by local people and export activities by warlords (Le Billon, 2001; FAO, 2005). Sometimes illegal

³¹ See for example: The Independent, 10th May 2011, Cedar mafia threatens Morocco's cherished wood.

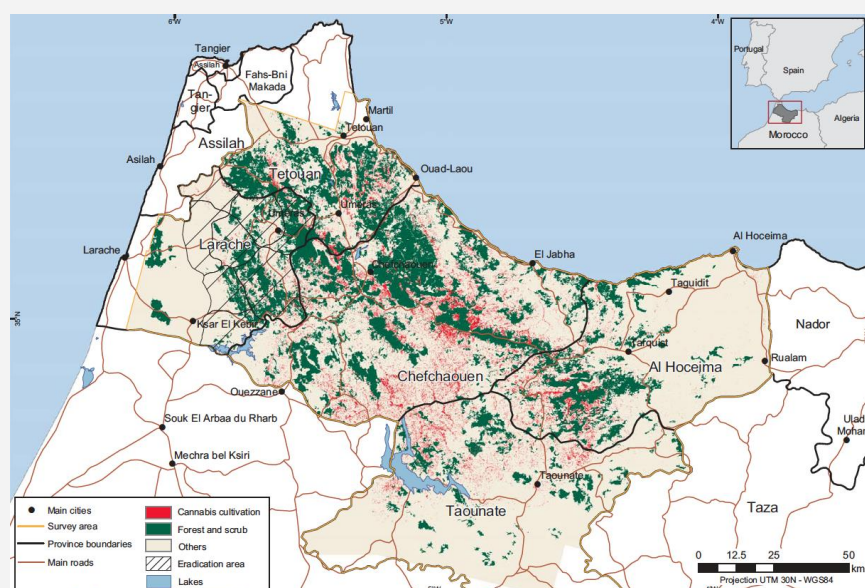
³² See for example: BBC News, 27th January 2013 - www.bbc.co.uk/news/world-europe-21202432 - and Guardian News, 28th November 2012 - www.theguardian.com/world/2012/nov/28/greeks-forests-fuel-winter-nears.

practices are not just linked to forest clearing and may feed illegal or informal economies for local communities, but can also get to relevant economic dimensions at local, national and international level. This is the case, for example, of cannabis cultivation in Morocco and a few other Mediterranean countries (Box 3.2).

Box 3.2 – Valuable but illegal: cannabis as one of the main NTFPs in the Mediterranean region

One of the most valuable NTFP produced in the Mediterranean region is likely to be an illegal one: cannabis (*Cannabis sativa*). While the region plays a strategic role in the logistics of many illegal drugs, some Mediterranean countries play (or have played) a crucial role also in cannabis (herb and resin) and opium production and trade. Europe is the world's largest market for cannabis resin (hashish), most of which traditionally comes from North Africa and in particular from Morocco. The Rif region of Morocco (Northern Morocco, including Chefchaouen, Taounate, Al Hoceima, Tetouan and Larache provinces figure 3.19) is home to the largest acreage of cannabis cultivation worldwide.

Figure 3.19 - Morocco Northern Provinces: Cannabis Cultivation, 2005



Source: UNODC and Government of Morocco, 2007.

Although in the 1960s Morocco was one of the very first destinations on the 'Hippie Hashish Trail', cannabis cultivation has expanded rapidly in the early 1980s, due the growing hashish demand from Europe and problematic supply from other regions as a consequence of conflicts in Afghanistan, Lebanon and Syria, and increased counter-narcotics efforts in Lebanon and Turkey (Chouvy, 2005). Increased demand favoured the shift of Moroccan cannabis economy from producing kief, i.e. resin glands (or trichomes) of cannabis, to producing hashish. The Rif region of Morocco is apparently unfit to intensive agricultural production: a rugged relief of steep slopes and poor soils, combined with heavy but irregular rainfall compounded by a lack of irrigation infrastructures. Cannabis cultivation often occurs at the expense of forest areas that are cleared for creating plantations. It has been estimated that about 8,000 ha of cork oak forests were eradicated in the Ketama region between 1984 and 1990 to be converted into cannabis cultivation for kief production (FAO, 2010). In other cases cannabis plantations and forests coexist because the latter are developed in the valley bottoms where better soils and better access to water are available. During the last ten years cultivated areas have decreased: from 134,000 ha in 2003 (UNODC, 2005), to 72,500 in 2005 (UNODC and Government of Morocco, 2007) and to 47,500 ha in 2010 (UNODC, 2012) (table 3.6). This negative trend suggests that the country's relative importance as a supplier could be on decline due to the emerging role of strong competitors such as Afghanistan, where between 9,000 and 29,000 ha were estimated to be under cannabis cultivation in 2010. These figures are lower than estimates for Morocco, however on average Afghan cannabis crop has larger yield (128 kg of cannabis resin per hectare) than Moroccan one (40 kg/ha) and this led to higher production. Seizures of cannabis in all its forms also decreased in Morocco that however remains a major producer: annual production is estimated 38,000 tons for cannabis herb and 760 tons for cannabis resin (UNODC, 2012). In 2005 UNODC and Government of Morocco (2007) estimated that about 90,000 households (i.e. about 760,000 persons) were involved in cannabis cultivation, with total income from cannabis sales of about €325M, i.e. around €3,600 per household. The annual turnover of international trade in cannabis resin of Moroccan origin was estimated around €4,600M.

Table 3.6 – Cannabis cultivation and production in Morocco (2003, 2004, 2005 and 2010)

	2003	2004	2005	2010
Cultivated area (ha)	134,000	120,500	72,500	47,500
Production (tons)	109,000	98,000	53,300	38,760

Source: UNODC and Government of Morocco, 2007; UNODC, 2012.

Apart from Morocco traditional cannabis producers in the Mediterranean region are Albania and Lebanon. In Albania during the 1990-2000 period cultivation was spread throughout most of the country, including many forest areas; more recently it has been reported to be located in a limited number of smaller areas, nevertheless Albania remains a country of origin for cannabis and its derivatives, mostly produced for the Greek and the Italian market (EMCDDA, 2010). Lebanon was once the world's leading red hashish suppliers with intense cultivation in the Beqaa Valley (East of Beirut). Continual eradication efforts by the Lebanese government, supported by international efforts³³, have helped to prevent cannabis cultivation and to eradicate illicit crops (including opium poppy). Lebanon however is still mentioned by UNODC (2012) among the five main source countries of cannabis resin for the period 2002-2010³⁴.

Illegality, however, can also occur in NWM countries and affect the forestry sector in multiple ways. Forest illegality is normally referred to as 'illegal logging' but - despite the prominent role played by wood and related trade - forest crimes include a wide range of activities (e.g. Tieguhong *et al.*, 2010; Global Witness, 2011). While economic and structural changes are pushing a multi-faceted demand for forest products and services, they are also affecting and differentiating illegality patterns.

Masiero *et al.* (2013)
(Annex 2)
Paragraph 5.5

The total economic value of illegality in the forestry sector in Italy, for example, has been estimated in a €1,876.9 – 3,947.3M range. While the largest part of this value depends on imports of illegally sourced timber from other countries (50 to 67%) a relevant proportion is associated to illegal practices directly referred to national forest resources: arson and culpable fires (€215.6 M), tax frauds for firewood (€ 126-176M) and mushroom trade (€1.3-1.7 M).

Masiero *et al.* (2013)
(Annex 2)
Paragraph 5

Illegal practices have been classified into three categories:

- (i) *historical illegality*, that refers to activities taking place for a long time and traditionally addressed by designated authorities. This category includes arson and culpable forest fires, irregular harvesting operations, tax fraud in firewood collection and trade, abusive grazing, illegal dumps and unauthorized building in forests, and poaching;
- (ii) *forgotten illegality* that covers widespread illegal practices, the incidence of which however is largely underestimated or even ignored. The two main types of illegality that may be considered are the violation of basic health and safety regulations for forest operators, and illegal wood product imports;
- (iii) *new illegality* that consists of emerging and largely unknown

³³ See for example UN Resolution 1292 of 23rd May 1968, "1968/1292(XLIV). Replacement of cannabis cultivation in Lebanon".

³⁴ Such data however must be treated carefully as they do not distinguish between transit countries and countries of origin.

forest crimes, including money laundering, fiscal irregularities in the pallet trade, illegalities in the mushroom and truffle trade, cannabis cultivation in forests and irregularities in the institutional carbon credit markets.

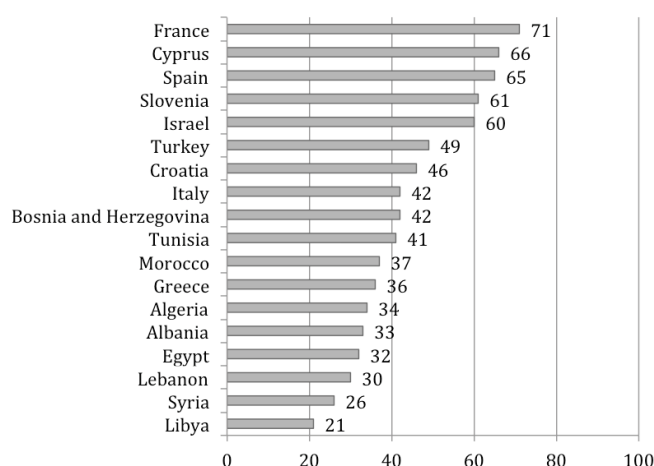
Masiero et al. (2013) (Annex 2) Paragraph 6

Traditional illegalities persist, but new ones are rapidly growing and still largely under-investigated. The forestry sector has marginal incidence on the national economy, but crucial importance at local scale. While informality of traditional production (firewood and NTFPs) facilitates illegality, emerging issues, like payments for environmental services, may represent new opportunities for the forestry sector, but also provide room for criminal practices.

Masiero et al. (2013) (Annex 2) Paragraph 1 and paragraph 3

Illegal practices in the forestry sector are often associated with the presence of high corruption levels. Mediterranean countries make no exception: in many cases they are characterised by strong perception of corruption processes, confirmed by low values of indicators such as the Corruption Perception Index (CPI) by Transparency International (Figure 3.20), and the Control of Corruption, that is one of the six dimensions of governance developed by the Worldwide Governance Indicators (WGI) project of the World Bank (Figure 3.21). As for the CPI, for example, only five countries show values higher than 50 (i.e. mid-ranking position). While SM and some EM countries show the worst performances, the problem is not limited to them and involves also Northern countries, especially NEM ones (in particular Albania and Greece) but NWM countries too. This is the case of Italy that shows CPI values lower than 50.

Figure 3.20 - Corruption Perception Index for Mediterranean countries (2012)

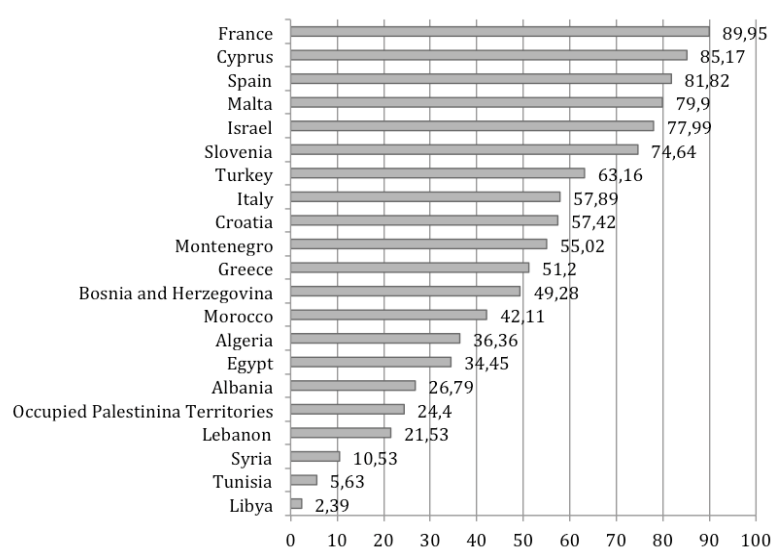


NOTE: Corruption Perception Index (CPI) ranks countries/territories based on how corrupt their public sector is perceived to be. Corruption is intended as the abuse of entrusted power for private gain. The CPI is a composite index and reflects the views of observers from around the world, including experts living and working in the countries/territories evaluated. The CPI ranges between 0 - highest perception of corruption - and 100 - lowest perception of corruption³⁵.

Source: own elaboration from Transparency International, 2013.

³⁵ For more information see: www.transparency.org.

Figure 3.21 - Control of Corruption for Mediterranean countries (2012), percentile rank



NOTE: Control of Corruption (CC) captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interest³⁶.

Source: own elaboration from WGI, 2013.

3.3 The economic value of Mediterranean forests: an overview of existing experiences

The most recent and comprehensive study aiming to estimate the value of different Mediterranean forest goods and services has been conducted by Merlo and Croitoru in 2005 in the frame of the Mediterranean Forest Externalities (MEDFOREX) initiative. An overview of the main findings is reported in Box 3.3. Forest benefits were classified according to the TEV concept, divided into use, option and non-use values while data were collected by means of questionnaires and elaborated through a wide range of methods and approaches. Analysed products and services included wood and NTFPs, recreation, hunting, grazing, carbon sequestration, watershed management and non-use values (e.g. biodiversity).

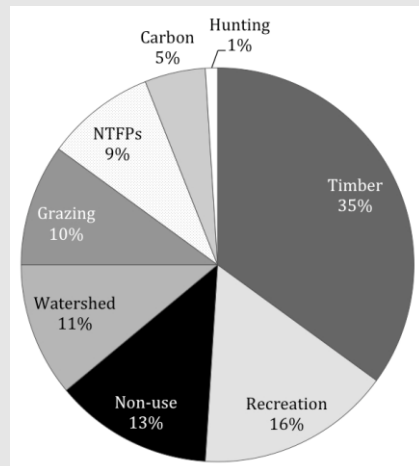
Box 3.3 – TEV for Mediterranean forests estimated by Merlo and Croitoru (2005)

The study performed by Merlo and Croitoru (2005) estimated an average TEV for Mediterranean forests of about €133 per hectare of forest. This estimate should not be taken as a fixed value since it can vary significantly in magnitude and composition between different countries. As commented by the two editors, the calculated figures are a substantial underestimate, as important benefits could not be estimated for several countries. Moreover, the average TEV in the Northern countries (about €173/ha) is more than twice higher than that in the Southern ones (about €70/ha); and more than three times greater than in the Eastern countries (about €48/ha). Such large differences are partly due to the underestimation of benefits particularly in the Southern and Eastern countries.

³⁶ For more information see: www.govindicators.org.

Only a minor part (i.e. 35%) of the total estimated value can be ascribed to wood forest products, with an average value estimated in €47/ha. However, their importance differs considerably among country groups. In the Northern sub-regions, wood forest products are relatively significant (€67/ha) due to extensive forest areas and fast timber growth. By contrast, wood (mainly given by firewood) is scarce and has a low market value in most Southern (€12/ha) and Eastern countries (€22/ha). Some 65% depends on NTFPs and services (Figure 3.22).

Figure 3.22 - Composition of the Total Economic Value of Mediterranean forests



NTFP: non timber forest products; non- use: bequest and existence value

Source: own elaboration from Merlo and Croitoru, 2005.

Recreation and hunting resulted significant benefits all over Mediterranean (€21/ha), as a result of growing tourism especially on coastal areas. High estimates in the Northern Mediterranean (€35/ha), and particularly in the Western Europe, arise from an increasing demand for outdoor activities supported by extensive availability of data. In contrast, the estimates for most Southern and Eastern countries are scarce and site-specific (mainly related to parks and other protected areas). Thus, the partial values do not allow to draw any strong conclusions at this stage. They only suggest the need for additional surveys for valuing the recreational and hunting benefits in most Southern and Eastern countries.

Grazing and NTFPs are the most important benefits in the Southern (€36/ha) and Eastern sub-regions (€10/ha), exceeding by far the wood forest products benefits. In reality, these estimates form only a part of the true value of grazing and NTFPs, as they fail to capture large amounts of those products which are self-consumed or informally traded. For the northern countries, these benefits tend to be less important (€26/ha).

Forests in the Mediterranean region provide benefits of about €50 *per capita* and per year. Average benefits are higher in Northern countries (more than €70 *per capita*) and lower in the Southern (less than €7 *per capita*) and Eastern ones (less than €10 *per capita*). In this case, the differences among the country groups depend not only on the high underestimation in the South and East, but also on the extension of forest area and the population size in each country.

Several attempts to estimate the economic value of forest services have been done: a preliminary research performed via keywords within databases of peer reviewed journals resulted in more than 150 studies on forest value estimation performed after 1990. Most of them are strictly site or service specific, while just few of them took into account forest resources at national (e.g. Ngwenya and Hassan, 2005; Bush *et al.*, 2006; Nahuelhual *et al.*, 2007; Anielski and Wilson, 2009; Pak *et al.*, 2010) or even international level (e.g. Giergiczny *et al.*, 2008; Chiabai *et al.* 2009; Kumar, 2010). Moreover only 25 of these studies directly or indirectly refer to Mediterranean countries, with three of them aiming to calculate the TEV at

national level: two refers to the NWM sub-region (Croitoru and Gatto, 2001; Riera and Mavsar, 2007), while one refers to the EM sub-region (Pak *et al.*, 2010). Studies for the Southern sub-region are even less common: Mavsar (2011) reported a couple of them. The first one consists in an evaluation of trade-offs of Tunisian forest plantations by means of a choice experiment application, while the second one refers to Bouhachem forest in the North-East of Morocco. Additional data can be found in Croitoru and Sarraf (2010) who estimated costs related to environmental degradation in Middle East and North Africa. Daly *et al.* (2012) have estimated the TEV for Tunisian forests, while Croitoru and Liagre (2013) have analysed the contribution of forests to Green Economy in the Middle East and North Africa.

Forests in Mediterranean countries have also been included in international studies aiming to estimate the economic value of selected ecosystem services for different forest biomes worldwide. They include EXIOPOL project³⁷ (Giergiczny *et al.*, 2008) and a study conducted at Fondazione Enrico Mattei by Chiabai *et al.* (2009) in connection to 'Cost of Policy Inaction (COPI)' project.

The two studies basically share the same methodological framework, i.e. the one developed by Markandya *et al.* (2007), running a meta-analysis on studies from around the world and transferring values to other countries by means of benefit transfer protocols. As for the EXIOPOL project, it was just limited to European Union Member States and covered wood and NTFPs, together with three selected services: recreation, carbon sequestration and biodiversity protection. Special attention was paid to identification of links between monetary values and physical characteristics of forests as well as to analyse different future scenarios, linking potential changes in land use to variations in the economic value of different forest goods and services. Data used for the estimation of these values were gathered from FAO (FAO FRA 2005 and FAOSTAT database), the (former) Ministerial Conference on the Protection of Forests in Europe (MCPFE) Report on the State of Europe's Forest for 2007, the European Environmental Agency's Green House gas database (for Carbon sequestration services), the Forestry Commission (for recreation), Braat and ten Brink (2008) (for biodiversity protection).

As for Chiabai *et al.* (2009), they estimated the TEV for the same five categories of products/services analysed by Giergiczny *et al.* (2008) with regard to six main different forest biomes proposed by the OECD GLOBIO2 model framework (Alkemade *et al.*, 2006) employed by COPI project (Braat and ten Brink, 2008). Values were computed across ten world macro-regions with regard to two different scenarios: 2007 and 2050. The study is relevant in terms of methodology but doesn't allow to collect specific data referred to the Mediterranean region because results are aggregated at biome and macro-regional level.

Forests in some European Mediterranean countries (France, Greece, Italy, Portugal and Spain) have been taken into account also in the frame of the Study on the Development and Marketing of Non-Market Forest Products and Services realised by EFIMED on behalf of the European Commission (Mavsar *et al.*, 2008). The report collected different studies from fifteen countries at European level on the economic value of biodiversity, watershed protection, carbon storage and

³⁷ EXIOPOL is a project funded by the European Commission under the 6th framework programme, priority 6.3 Global Change and Ecosystems. More information are available at: <http://www.feem-project.net/exiopoli/index.php>.

sequestration, recreation and tourism, amenity services and forest goods and services.

Some attention to services provided by Mediterranean forests ecosystems has been paid also by the already mentioned 'Cost of Policy Inaction (COPi)' project, specifically focused on biodiversity issues with regard to present and future (2050) scenarios. In the frame of the study different products and externalities (biochemical, water purification, cultural values and recreation/ecotourism) linked to various biomes have been analysed, including those provided by Mediterranean shrubs. The project final report highlights that for passive use values, i.e. biodiversity conservation, the highest estimates are registered in the Mediterranean countries, which have a tremendous potential for biodiversity and ecosystem conservation (Braat and ten Brink, 2008).

In their overview of estimates of monetary values of ecosystem services regarding 11 different biomes and developed within TEEB initiatives De Groot *et al.* (2010a) have also included specific figures for Mediterranean forests that however are sourced from Croitoru (2007).

Finally some figures on the economic value of Mediterranean forests are available on the State of Mediterranean Forests published by FAO in 2013. This publication, however, mostly collect and reports data developed in existing literature and studied rather than providing new estimates.

4. Results

In this chapter the results of the research are presented. Section 4.1 is dedicated to markets, i.e. to the presentation of estimated values for timber and non-timber forest products, as well as for a selection of services provided by Mediterranean forests. Section 4.2 includes an overview of governance tools that might be adopted to improve forest management and the delivery of products/services to the market.

4.1 Markets

When considering markets for Mediterranean forest outputs, a distinction has been done between products (4.1.1) and services (4.1.2). As for products, wide reference is made to Annex 3.

4.1.1 Products

Products have been further distinguished into timber (4.1.1.1) and non-timber (4.1.1.2) forest products. As for timber products, additional differentiation has been done between industrial timber and firewood. As for NTFPs, FAO FRA 2010 classification has been adopted as indicated in paragraph 4.1.1.2 and Appendix 1 to Annex 3.

4.1.1.1 Timber products

*Pettenella
and
Masiero
(2013)
(Annex 3),
Paragraph
2 and
Appendix 1*

The value for timber products from Mediterranean forests has been estimated based on data collected from FAOSTAT (2012), taking into account the 1990-2010 period. Data refer to the product aggregate 'Roundwood' and - with reference to value data - has been converted into €2010 real prices. Adjustments were adopted for Egypt and Former Yugoslavia Socialist Federal Republic (SFR) member countries, according to details provided in the Appendix 1 to Annex 3.

The economic value of roundwood production has been estimated as a unit (or marginal) value per hectare (ha) and year, adopting the approach used by EXIOPOL project and reported by Giergiczny *et al.* (2008). Details on the methodology can be found in the Appendix 1 to Annex 3.

*Pettenella
and
Masiero
(2013)
(Annex 3),
Paragraph
2.1*

On average 139.8 Million cubic meters (MCUM) of roundwood were produced every year in the selected countries between 1990 and 2010. During the same period production trends showed a slight decrease (-3%), as the net result of a 7% increase for industrial timber and a 10% decrease for firewood. The proportion between industrial timber and firewood production changed over time: while in early 1990s firewood covered around 50% of the overall wood

production in the region, it then decreased both in absolute and relative terms. As for the most recent available figures, about 125 MCUM were produced in 2010, 55% of which being represented by timber and 45% by firewood. Such amount of wood is equivalent to less than 2% of the total growing stock in the region as reported by FAO (2010) and corresponds to about 3.7% of total roundwood production at World level in 2010 (FAOSTAT, 2012).

*Pettenella
and
Masiero
(2013)
(Annex 3),
Paragraph
2.1, Figures
3 and 4*

More than 62% of roundwood production is concentrated in NWM countries that play a leading role both with regard to industrial timber (64% of overall production in the area) and firewood (62%) production. About 82% of industrial timber production is based in three countries only - France, Spain and Turkey - while four countries - France, Algeria, Turkey and Italy - contribute to 85% of firewood production.

*Pettenella
and
Masiero
(2013)
(Annex 3),
Paragraph
2.2*

The estimated total value for roundwood production in the Mediterranean region is €9,440.36M (2010), 76% of which depends on industrial timber. The average unit value corresponds to €136.28/ha, distinguished in €104.17/ha and €32.11/ha for industrial timber and firewood respectively. For the overall roundwood category, the EM sub-region (€158.15/ha) and the NWM one (€150/ha) show the highest average unit (or marginal) values, while the SM sub-region shows the lowest one (€40.71/ha) (Table 4.1).

*Pettenella
and
Masiero
(2013)
(Annex 3),
Paragraph
2.2, Figure
5*

The total value for roundwood production in the Mediterranean region fluctuated over time and different sub-regions show different trends. SM sub-region remained more or less stable in 2005 and 2010, with a slight decrease (-1.3%) with respect to 1990 estimated value. EM sub-region is the only one showing a continuous positive trend for both marginal and total value. The role of Turkey strongly influences such performances: it is the only country showing expanding values without any flexion, with a huge increase between 2005 and 2010. All the other countries in the sub-region show decreasing marginal values over time, reflected by diminishing to stable total values. The relative incidence of the EM sub-region on total Mediterranean wood production value doubled between 1990 and 2010, passing from 10 to 20%. NEM countries show a decreasing trend between 1990 and 2005, with a slight recovery between 2005 and 2010. As regards NWM countries, they show a decreasing (-24%) trend for marginal values between 1990 and 2010. The total value for the sub-region increased between 1990 and 2000, then diminished between 2000 and 2005 and had again a slight increase between 2005 and 2010. The relative incidence of the NWM sub-region on total Mediterranean wood production value reflects the dominant position in terms of total production. Such incidence, however, remained stable (75%) between 1990 and 2000, then diminished down to 67% in 2010.

Table 4.1 - Roundwood production value in Mediterranean countries (1990, 2000, 2005, 2010)

Countries	1990		2000		2005		2010	
	Marginal (€/ha)	Total (M€)	Marginal (€/ha)	Total (M€)	Marginal (€/ha)	Total (M€)	Marginal (€/ha)	Total (M€)
Algeria	74.69	124.50	86.50	136.58	88.50	135.94	99.09	147.84
Egypt*	306.47	13.49	540.64	31.90	476.29	31.92	456.08	31.92
Libya	102.34	22.21	126.27	27.40	131.29	28.49	136.10	29.53
Morocco	35.21	177.79	15.04	75.47	14.63	74.33	9.92	50.89
Tunisia	79.32	51.01	71.77	60.07	66.53	61.48	61.70	62.07
SM sub-region	51.04	388.98	42.99	331.42	42.45	332.16	40.71	322.25
Cyprus	36.75	5.91	10.95	1.89	4.34	0.75	4.01	0.69
Israel	90.93	12.00	57.09	8.74	19.18	2.97	19.31	2.97
Lebanon	15.57	2.04	9.06	1.18	8.65	1.18	8.64	1.18
Syria	13.31	4.95	10.06	4.34	10.88	5.02	10.58	5.19
Turkey	90.77	878.68	130.79	1,326.97	131.14	1,408.39	170.71	1,934.86
EM sub-region	86.18	903.59	121.63	1,343.12	121.48	1,418.31	158.15	1,944.89
Albania	89.86	70.90	20.43	15.70	12.99	10.15	17.50	13.58
Bosnia and Herzegovina	77.09	170.37	108.27	236.57	86.76	189.58	83.00	181.35
Croatia	115.24	213.19	104.10	196.23	116.30	221.32	127.52	244.84
Greece	32.12	105.97	22.19	79.91	15.32	57.49	20.49	79.97
Montenegro	31.92	17.33	33.05	17.95	29.13	15.82	31.49	17.10
Slovenia	120.69	143.38	99.91	123.19	110.63	137.50	115.49	144.72
NEM sub-region	73.00	721.14	65.54	669.56	60.71	631.87	64.42	681.56
France	340.68	4,952.51	361.00	5,542.50	269.98	4,242.43	280.30	4,471.92
Italy	85.48	648.78	82.25	688.33	71.04	622.23	56.20	514.23
Spain	110.96	1,533.24	83.07	1,411.10	87.21	1,508.18	82.84	1,505.46
NWM sub-region	198.48	7,134.53	187.72	7,641.93	152.58	6,372.84	150.00	6,491.61
Total Mediterranean	---	9,148.24	---	9,986.03	---	8,755.19	---	9,440.31

NOTE: data not available for Occupied Palestinian Territory and Malta

* data estimated as indicated in Appendix 1 to Annex 3

Source: own elaboration from FAO, 2010 and FAOSTAT, 2012.

Pettenella
and
Masiero
(2013)
(Annex 3),
Paragraph
2.2, Figure
6

Variations in terms of production value have also been analysed in relation to growing stock changes over time. The SM and the EM sub-regions show the lowest increase in growing stock values per hectare (about 3% and 2% respectively) between 1990 and 2010, with a negative trend from 2005 to 2010, that brought growing stock values back to those observed in mid 1990s. SM and EM sub-regions, however, show totally different trends with regard to production value during the same period: a decreasing trend can be observed in the first case (-5%), while an increasing trend can be observed in the second one (+83%). As regards Northern Mediterranean sub-regions, the growing stock per hectare has been increasing quite rapidly in the last twenty years, with a +20% variation in NEM and a +12% increase in NWM. In both sub-regions production value decreased during the same period, but dynamics are well differentiated. In NEM sub-region the overall decrease was around 12%, but considering just the 1997-2010 period (i.e. excluding the Balkan war period) a

positive variation can be observed (+11%). On the other hand, in NWM sub-region production value has been more or less restless decreasing since 1990, with an overall -24% variation between 1990 and 2010.

*Pettenella
and
Masiero
(2013)
(Annex 3),
Paragraph
2.2,
Figure7*

Preliminary analysis on the link between roundwood production value and growing stock per hectare was conducted on the basis of available data. Simple linear regression models were tested using gross growing stock per hectare as the explicative variable and roundwood production value as the response variable. Only the NWM sub-region shows a R-squared value (0.85238) that may confirm a linear relationship between the two variables: an increment in growing stock is linked to a decrease in roundwood production value per hectare. The second higher R-squared value is that of SM sub-region (0.59579) that once again suggests a negative link between the two variables. The existence of a link between roundwood production value and growing stock per hectare however is not yet fully clear and deserves further investigation.

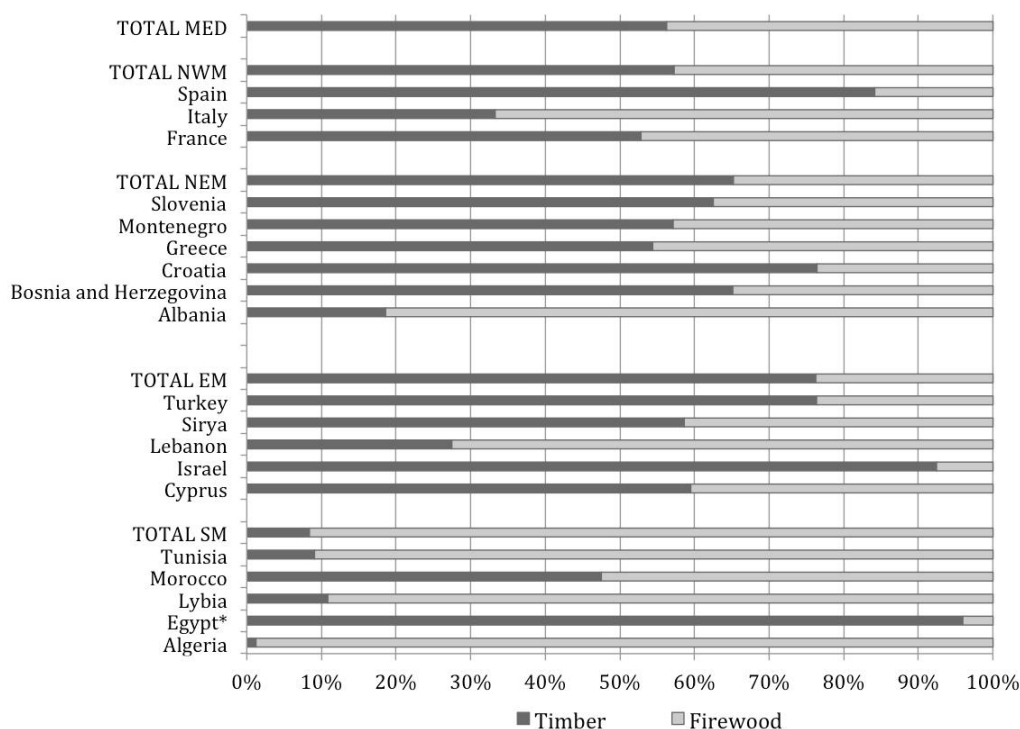
Because of ecological characteristics and climatic conditions, as well as socio-economic limitations (e.g. ownership fragmentation), in general terms Mediterranean forests are not characterised by a strong vocation towards timber production. This is confirmed by data on relative incidence of firewood production over total roundwood production in the region: according to FAOSTAT (2012) this represents 51% of total production (reference year: 2010). When adjusting data for Egypt³⁸, the relative incidence diminishes to 44%. Despite a decrease in total production, firewood importance remains high. It shall also be underlined that official statistics reflect firewood removals only in part, because a significant proportion is produced and marketed through informal channels (FAO, 2013). The incidence of firewood on total production varies depending on countries and sub-regions (Figure 4.1). For SM sub-regions it is higher than 90%, confirming firewood remains an essential source of energy in the area. In other sub-regions figures are lower, but remain higher than 20% and for NWM exceed 42%.

*Pettenella
and
Masiero
(2013)
(Annex 3),
Paragraph
2.3*

The relevance of firewood within the region is confirmed by the growing role of imports: overall wood imports in the Mediterranean region between 1990 and 2010 decreased (-9%) in the case of timber and increased (about five times) in the case of firewood. The relative importance of timber and firewood on global import volume changed accordingly: in 1990 timber represented 97% of total Mediterranean imports, while in 2010 it represented 84%. On the other hand firewood relative incidence passed from 3 to 16%. According to FAO (2012), the Mediterranean region hosts the first (Italy) and the fourth (Turkey) firewood importers worldwide.

³⁸ See Appendix 1 to Annex 3.

Figure 4.1 - Timber and firewood incidence on total roundwood production in Mediterranean countries and sub-regions (2010)



* data estimated as indicated in Appendix 1 to Annex 3

Source: own elaboration from FAOSTAT, 2012.

Table 4.2 reports data on firewood apparent consumption per capita for Mediterranean countries and sub-regions for the 1990-2010 period. The highest value can be observed for the SM sub-region, although values have diminished from 1990 to 2010 (-26.5%). On average France is the country showing the highest apparent consumption *per capita*, but values are on decrease and in 2010 the country has lost the leading position in favour of Slovenia.

However some doubts on data quality and reliability exist. The case of Morocco is emblematic: according to FAO (2013, p.80) firewood '*constitutes 30% of energy consumption in Morocco. Whether burnt as raw wood or converted to charcoal, woodfuel is the second largest source of energy after petroleum products and the first in terms of national production*'. It has been estimated that to meet such energy needs approximately 10 MCUM of wood are needed: this value exceeds the national forest's sustainable yield estimated at 3 MCUM of wood for all different purposes (World Bank, 2002). Nevertheless, according to official statistics available, *per capita* consumption passed from 0.263 CUM in 1990 - corresponding to the third highest value in the region - to 0.013 CUM in 2010 (-95%). When observing FAOSTAT (2012) data on firewood production in Morocco, however, a sudden and unjustified decrease (from 6.8 MCUM to 0.5 MCUM) can be observed between 1993 and 1994. This flexion is then reflected on the decrease in consumption *per capita*. Extrapolating Moroccan data for 1990-1993 and projecting them to 2010, the overall firewood production for SM sub-region would increase up to 16.4 MCUM, i.e. more than 30% of the total Mediterranean production in 2010.

FAOSTAT (2012) indicates a decrease in consumption per capita also for those countries - such as Greece and Syria - where during the last years massive irregular firewood

harvesting and removals took place in connection to economic crisis and/or civil war (see paragraph 3.2.3). While it is quite logic that illegal removals are not recorded within official statistics, there seems to be weak perception of the problem.

As for EU Mediterranean countries, data reported in Table 4.2 are significantly lower (up to 350%) than data on *per capita* consumption of primary energy from solid biomasses published by EurObserver in 2010³⁹.

In general terms, when considering statistics on firewood production in Mediterranean countries one gets the impression data could be strongly underestimated. National and international institutions seem not to be totally unaware of this. For example, the National FAO FRA Report 2010 for Italy (FAO, 2010b p.52) states that *'removals are regularly recorded, but the complexity and variability of administrative procedures in force in the 21 regional bodies responsible for cutting permit issuing and local statistics could lead to underestimation [...] Removal of wood fuel - mainly produced in coppice stands of oaks and other autochthonous species - has enormously increased in the last decade: likely more than what official statistics show'*.

Table 4.2 - Firewood apparent consumption per capita in Mediterranean countries and sub-regions (*CUM per capita*)

Countries	1990	2010	20 years Average 1990-2010	% 1990-2010 variation
Algeria	0.222	0.229	0.228	3.3%
Egypt	0.245	0.214	0.235	-12.6%
Libya	0.132	0.149	0.151	12.6%
Morocco	0.263	0.013	0.062	-95.1%
Tunisia	0.229	0.206	0.219	-9.9%
SM sub-region	0.239	0.175	0.195	-26.5%
Cyprus	0.019	0.003	0.009	-81.9%
Israel	0.003	0.000	0.002	-90.2%
Lebanon	0.024	0.005	0.013	-80.4%
Syria	0.001	0.001	0.001	0.0%
Turkey	0.180	0.070	0.112	-61.4%
EM sub-region	0.128	0.046	0.077	-63.8%
Albania	0.469	0.090	0.136	-80.8%
Bosnia and Herzegovina	0.112	0.200	0.187	79.0%
Croatia	0.113	0.179	0.161	57.6%
Greece	0.129	0.093	0.118	-27.5%
Montenegro	0.194	0.237	0.247	22.0%
Slovenia	0.165	0.444	0.228	169.5%
NEM sub-region	0.172	0.155	0.151	-9.9%
France	0.533	0.396	0.445	-25.7%
Italy	0.069	0.075	0.094	8.6%
Spain	0.045	0.000	0.000	13.5%
NWM sub-region	0.011	0.051	0.070	1,544.4%
Total Mediterranean	0.117	0.187	0.022	-27.9%

Source: own elaboration from FAOSTAT, 2012.

On the one hand the widespread use of firewood as fuel is linked to the strong rural dimension of the region - including some parts of Northern sub-regions; on the other it is associated to a growing demand for renewable energy sources in the general framework of policies for climate change mitigation. This is particularly evident when focusing on Mediterranean EU countries that are required to achieve targets defined

³⁹ New data, recently published by EurObserver, however, show a reduced gap.

within their National Renewable Action Plans, in compliance with EU targets to 2020. For example France and Italy have set 2020 targets for covering 45% and 54% (respectively) of their overall renewable energy production with the contribution of solid biomasses (Proforbiomed, 2012).

Masiero et al. (2013)
(Annex 4)

The setting of National Plans and related targets is the result of a wide set of policy developments at all geographical levels from international and national to local. When focusing for example on EU policies that are relevant for stimulating biomass energy from forests, attention should be paid (among others) to:

- › EU forest policy - including the newly approved EU Forest Strategy (2013) and the Legally Binding Agreement (LBA) on Forests in Europe currently under discussion;
- › EU Climate Policy, with special reference to the Climate and Energy Package, i.e. a set of binding legislation to ensure the EU meets the so-called '20-20-20' targets;
- › EU Energy Policy, with special reference to Directive 2009/28/EC (EU-RED), requiring that at least 20% of total EU energy consumption is generated from renewables by 2020;
- › EU Rural Development Policy and Common Agriculture Policy, that in the past defined some measures in favour of wood biomasses and for the 2014-2020 period include Priority 5 aiming to '*Promoting resource efficiency and supporting the shift towards a low-carbon and climate-resilient economy in the agriculture, food and forestry sectors*'. One of the areas of intervention under Priority 5 is facilitating the supply and use of renewable sources of energy, by-products, wastes, residues and other non-food raw materials for the bio-economy;
- › EU Trade Policy, with particular reference to initiatives and regulations aiming to prevent the import of illegally sourced wood, such as the Forest Law Enforcement Governance and Trade (FLEGT) Action Plan and Regulation (EU) 995/2010 (EU Timber Regulation).

Muys et al. (2013)
(Annex 5)

The development of a forest biomass sector can offer excellent opportunities for the mobilization of the production potential of Mediterranean forests ('*wood mobilisation*') and the development of a green economy, but at the same time holds a number of risks with regard to its sustainability.

As for EU-based Mediterranean forests potential impacts could affect European forest resources and social-ecological systems, and in the case of imported biomass, also those of third countries outside Europe. In this context there is a proposal for sustainability criteria for solid biomass, in addition to the Sustainability Criteria for Liquid Biofuels already in vigor (Article 17(2) to 17(5) and Article 18(1) of the EU Renewable Energy Directive), and its contents are currently

under debate.

With reference to SM and EM sub-regions, problems and dynamics are quite different and initiatives have mostly focused on stimulating an efficient use of forest resources by local communities, by introducing improved managing and harvesting techniques and efficient technologies for cooking and heating. Examples are given by the development of bio-energy for sustainable rural development in Egypt, and biomass pilot projects in Tunisia, both supported by the Global Environment Facility (GEF) of the World Bank (FAO, 2010a). In addition to this, the increasing trend in the establishment of new forest plantations can help filling the biomass gap, but this requires plantations are developed and managed according to robust sustainability criteria (see paragraph 4.2.3 and Annex 8).

Masiero et al. (2013) (Annex 6)

Among the tools that can support the sustainable mobilisation of wood biomass for energy, special attention has been given in recent years to 'short bioenergy supply chains'. While this concept is very promising, it needs further development to set-up appropriate criteria and requirements defining the core aspects of 'short supply chains', and linking them to valuable and measurable parameters. It is believed that by stimulating the shortness of biomass supply chains in a transparent way and according to robust requirements, it would be possible to benefit active and small-scale forest management in Mediterranean countries thus contributing to rural development at local and global scale.

There are already some on-going initiatives in this field, such as for example the standard for measuring performances of 'Short supply chains for Energy Biomass' developed and pilot-tested by the Italian Agroforestry Energy Association (AIEL) in Italy.

4.1.1.2 Non-timber forest products

Pettenella and Masiero (2013) (Annex 3), Paragraph 3 and Appendix 1

Data regarding NTFPs were collected from FAO FRA National reports for the twenty-one countries within the research area, and converted into €2010 real prices. Data are available for only fourteen countries: it was not possible to collect data for Libya, Israel, Occupied Palestinian Territories, Syria, Greece, Montenegro and Malta. With regard to Morocco, data on argan oil production have been collected from Romagny and Guyon (2011).

NTFPs have been distinguished according to NTFPs category defined by FAO and described in the Appendix 1 to Annex 3.

Pettenella and Masiero (2013) (Annex 3), Paragraph 3, Tables 4 and 5

The estimated total value for NTFP production by Mediterranean forests is about €822.4M. About 90% of this value is concentrated in the NWM sub-region, with Spain, Italy and France representing by far the most important producers (Table 4.3). Outside the NWM region Lebanon and Bosnia and Herzegovina are the only countries contributing for more than 2% of the total regional production value. On average the unit value corresponds to €11.96/ha, ranging from €16.91/ha for the NWM sub-region to €2.52/ha for the SM one.

Table 4.3 - NTFPs production value (€1,000) per Mediterranean country/sub-region and according to FAO FRA 2010 NTFP categories (2005)

Country/Sub-region	NTFP categories (as from FAO FRA 2010, see Table 2.13 for details) ^a														
	1 ^b	3	4	5	6	7	8	9	10	12	15	Total	% on Total		
Algeria	-	3,025.56	-	-	-	-	-	-	-	-	-	3,025.56	0.4%		
Egypt	1,001.72	-	-	-	-	-	-	-	-	-	-	1,001.72	0.1%		
Morocco*	-	582.18	-	-	-	-	6,880.38	-	-	-	-	7,462.56	0.9%		
Tunisia	50.41	135.36	-	49.02	-	-	7,421.54	-	-	-	277.26	7,933.60	1.0%		
SM sub-region	1,052.13	717.54	-	49.02	-	-	14,301.92	-	-	-	277.26	19,423.23	2.4%		
Cyprus	-	0.16	-	0.00	-	-	85.18	-	-	-	-	85.34	0.0%		
Lebanon	33,756.05	23.54	-	-	-	-	-	-	-	-	-	33,779.59	4.1%		
Turkey	767.16	-	-	-	2.12	-	-	-	210.87	-	-	980.15	0.1%		
EM sub-region	34,523.21	23.70	-	-	2.12	-	85.18	-	210.87	-	-	34,845.08	4.2%		
Albania	437.50	3,847.02	4.03	8.06	-	-	-	-	-	-	0.10	4,296.71	0.5%		
Bosnia and Herzegovina	16,057.18	5,745.64	-	-	-	-	-	-	-	-	165.95	21,968.77	2.7%		
Croatia	49.62	1.24	-	-	115.67	-	371.70	-	344.43	331.00	0.86	1,214.52	0.1%		
Slovenia	890.07	-	-	-	929.38	-	-	-	4,367.13	2,762.37	-	8,948.96	1.1%		
NEM sub-region	17,434.38	9,593.91	4.03	8.06	1,045.06	-	371.70	-	4,711.56	3,093.37	166.91	36,428.96	4.4%		
France	33,602.31	5,106.88	-	1,546.12	-	-	-	-	-	63,366.50	-	103,621.81	12.6%		
Italy	237,161.47	-	-	8,460.55	-	-	-	-	-	-	-	245,622.02	29.9%		
Spain	172,148.46	41.64	-	3.99	-	846.77	103,850.46	105,607.04	-	-	-	382,498.36	46.5%		
NWM sub-region	442,912.23	5,148.52	-	10,010.66	-	846.77	103,850.46	105,607.04	-	63,366.50	-	731,742.18	89.0%		
Total Mediterranean	495,921.95	15,483.66	4.03	10,067.73	1,047.18	846.77	118,609.26	105,607.04	4,922.43	66,459.87	444.17	822,439.65	100.0%		
% on Total	60.5%	1.9%	0.0%	1.2%	0.1%	0.1%	14.5%	12.9%	0.6%	8.1%	0.1%				

NOTES: * includes data for argan production sourced from Romagny and Guyon, 2011;

^a Please, refer to Appendix 1 to Annex 3 for further details on categories. Category 2 is estimated under grazing service (see paragraph 4.1.2.2 below). It is not reported here to avoid double accounting. No data available for category 14;

^b (1) Food; (2) Fodder; (3) Raw material for medicine and aromatic products; (4) Raw material for colorants and dyes; (5) Raw material for utensils, handicrafts & construction; (6) Ornamental plants; (7) Exudates; (8) Other plant products; (9) Living animals; (10) Hides, skins and trophies; (11) Wild honey and bee-wax; (12) Wild meat; (13) Raw material for medicine; (14) Raw material for colorants; (15) Other edible animal products; (16) Other non-edible animal products

Source: own elaboration from FAO, 2010

Pettenella
and
Masiero
(2013)
(Annex 3),
Paragraph
3, Figure
11

As regards the contribution by single product categories, acorns and nuts⁴⁰ represent more than 25% of the total value, followed by animal products⁴¹ (21%), cork (15%), mushrooms and truffles (15%), and honey (12%). In general different product types are differently distributed among sub-regions: for example aromatic and medicinal herbs, as well as seeds are relevant in the EM sub-region, while cork is concentrated in SM and NWM sub-regions, and animal products are mainly present in NEM and NWM sub-regions.

Pettenella
and
Masiero
(2013)
(Annex 3),
Paragraph
3, Figure
12

The total value estimated for NTFPs corresponds to 9% of the total value estimated for timber production. Relative figures, however, change from country to country. Lebanon shows the highest relative incidence of NTFPs (97%) - mostly due to low value associated with domestic timber production. Apart from Lebanon, only Italy and Spain show relative values higher than 20%, while only ten countries within the Mediterranean region show relative values higher than 10%. When comparing the incidence of NTFPs on the value of industrial timber production only, relative figures can be very high. Forest Europe (2011), for example, reported percentages higher than 150% for Italy and 50% for Spain.

FAO FRA data for NTFPs date back to 2005, cover only two-third of countries within the region and seem to be incomplete or a bit unclear for some product categories. For example data for argan oil in Morocco are missing, data for pine resin are reported only for Spain and data for cork are sometimes reported under different FAO NTFPs categories, depending on the country. In the light of these considerations, and assuming there is some risk that data on NTFPs could be underestimated, additional estimates have been performed for three selected NTFP categories - i.e. pine seeds, pine resin, and cork - by means of data and information available from existing literature. Results are presented below.

a. Pine nuts

Within the Mediterranean region, pine nuts are gathered from stone (or umbrella) pine (*Pinus pinea*) that covers some 0.57 Mha in the area (Table 4.4 and Figure 4.2). The Iberian Peninsula accounts for about 75% of stone pine area in the world: Portugal (not included in this research) and above all Spain (that hosts about 60% of the world stone pine forests) are the main pine nut producers, followed by Turkey, Lebanon and Italy. As for other countries, production in France and Greece is currently not relevant. In Greece there are just few stone pine forest remnants, the main example of which is the Natura 2000 site of Strofylia (i.e. literary *Pinus pinea*) forest in Western Peloponnesus, where however pine-nut gathering is a popular activity but it is not performed in an organised way (Shanley *et al.*, 2002). In France stone pine stands are concentrated in few regions, i.e. Provence, Le Muy-Fréjus and Camargue, but no reliable data on collection activities

⁴⁰ i.e. chestnuts and hazelnuts.

⁴¹ i.e. meat, skins and trophies.

are available (Perez *et al.*, 2004). During the 20th Century, the Mediterranean stone pine has expanded, especially in the Southern and Eastern parts of the Mediterranean basin. As for the EM sub-region, *Pinus pinea* is a native species in Lebanon where new plantations however took place in early 1900s. Afforestation projects with *Pinus pinea* for some 2,000 ha have been realised in Israel as well, both for production purposes and landscape improvement (Perez *et al.*, 2004). Stone pine is not present as a spontaneous species in the Maghreb region: it is supposed it was so in the past then it has partly disappeared and was reintroduced. Reforestation of coastal dunes and other areas during early 20th Century has been reported in Tunisia, with some 20,922 ha according to DGF (2010), as well as some plantation activities in Northern Morocco (around 3,000 ha) and Algeria (Perez *et al.*, 2004). With regard to Morocco, Wahid *et al.* (2010) report that semi-natural and planted stone pine stands cover approximately 12,000 ha in several regions, including the High and Middle Atlas, the Rif and the Mediterranean coastal region. There is no evidence, however, of systematic pine seeds-gathering collection in these countries, with the exception of data reported by Daly *et al.* (2012) for Tunisia, where also Aleppo pine seeds are traditionally gathered and used by traditional *cousine*.

Table 4.4 - Pine nuts production and gathering in Mediterranean countries

Country	Area (ha)	% on Total	Production (tons/year)		% on Total	
			Minimum	Maximum	Min.	Max.
Israel	^a 2,000	nr	[*] 120	[*] 120	2%	1%
Italy	^b 46,290	8%	^c 200	^d 1,500	4%	8%
Lebanon	^f 8,000	1%	^e 1,500	^e 1,500	28%	8%
Morocco	^f 12,000	2%	[*] 720	[*] 1,200	14%	6%
Spain	^g 450,000	79%	^c 850	^d 10,000	16%	53%
Tunisia	^h 20,922	4%	^h 1,255	^h 2,092	24%	11%
Turkey	ⁱ 30,000	5%	^c 650	^d 2,500	12%	13%
Total	569,842	100%	5,295	18,992	100%	100%

nr = not relevant

* estimated assuming production levels per hectare as defined by Daly *et al.* (2012) for Tunisia.

Source: own elaboration from ^aPerez *et al.*, 2004; ^bNFC, 2005; ^cINC, 2012; ^dMutke *et al.*, 2012; ^eSfeir, 2011 [Note: production figures refer to 2005 and assume an average production of 300-320 kg/ha of edible nuts]; ^fWahid *et al.*, 2010; ^gMutke *et al.*, 2013; ^hDaly *et al.*, 2012 [Note: production figures assume an average production of 400 kg/ha of cones, i.e. 60-100 kg/ha of edible nuts]; ⁱGDF, 2009.

Figure 4.2 - *Pinus pinea* distribution in the Mediterranean region



Note: no data available for the SM sub-region

Source: own elaboration from Euforgen, 2009.

On average stone pine annual cone production ranges between 200 and 600 kg/ha, with an average proportion of 15-25 kg of nuts with shell every 100 kg of cones (Perez *et al.*, 2004). Production follows a biennial cycle, depending on several factors among which weather factors and resource depletion play a crucial role, with the most notable limiting factor being water stress (Mutke *et al.*, 2005). Moreover, production has greatly diminished in recent years due to damages produced by many pathogens such as the western conifer seed bug (*Leptoglossus occidentalis*). This bug of the family *Coreidae* has rapidly spread from its natural habitat (North America) throughout many countries, including Mediterranean ones. Excessive drought seem to favour the spreading of such a bug that feeds mainly on the seeds and developing cones of several species of conifers, causing substantial losses of seed crop both in quantity and quality (Mutke *et al.*, 2013a). According to INC figures (2012) production in the Mediterranean region has fallen from 2,500 to 905 tons in 2011 because of conifer seed bug attacks. The decrease in production has caused price increasing at the point that media reported many cases of pine nuts thefts in supermarkets⁴² for feeding the black market and Bloomberg has classified them as a luxury item, stating that pine nuts rate *foie gras* prices⁴³. Reduced offer from Mediterranean pines has also created room for increasing imports from other areas, with some problems in terms of product quality. Pine nuts from species other than stone pine or regions other than the Mediterranean one are often not clearly labeled, or they are even mixed-up with Mediterranean nuts, although taste, appearance and organoleptic characteristics may be quite different. As for appearance, *Pinus pinea* nuts are slender and have a homogeneous smooth color. *Pinus koraiensis* (i.e. Chinese) pine nuts are broader and have a triangular shape, with a typical brown cap at the tip, while *Pinus gerardiana* (i.e. Pakistani or chilgoza) pine nuts are cylindrical and darker than Mediterranean ones, with brown tips. With regard to organoleptic characteristics, Mediterranean pine nuts have the richest content in protein, 35%, i.e. a figure similar to that of soybean, and they are rich in unsaturated fatty acids (up to 85%), while different pine nuts show lower figures in terms of dietary values (Destailats *et al.*, 2011).

Pine seed mingling is not just a matter of product quality, but it may also be relevant in terms of food safety and consumer's health. Pine nuts from some species such as *Pinus armandii* (Chinese white pine) and *Pinus massoniana* (Chinese red pine) include irritating terpenoids and other compounds that may be responsible of the so-called Pine Mouth Syndrome (Box 4.1). The lack of traceability and correct product labelling, identifying the botanical species and the country of origin, could represent a non-compliance with current legal requirements for food labelling and traceability in Europe (Regulation EC 178/2002), based on principles such as transparency, risk analysis and prevention, the protection of consumer interests and the free circulation of safe and high-quality products within the internal market and with third countries (Mutke *et al.*, 2013a)⁴⁴.

⁴² See for example: <http://espresso.repubblica.it/food/dettaglio/pinoli-boom-di-furti/2203174>.

⁴³ See: <http://www.bloomberg.com/news/2013-03-01/pine-nuts-rate-foie-gras-prices-as-bugs-to-drought-cut-harvests.html>.

⁴⁴ The trade in pine nuts can also endangered forest conservation and integrity. For example the forest of Korean and Siberian pine are threatened by logging operations and inappropriate nut gathering techniques (Sharashkin and Gold, 2004). Moreover over-collection of pine seed for human consumption and trade prevents the natural regeneration of the Asian chilgoza pine as well as some rare American pinyons limited to a few local populations (Ledig *et al.*, 2001). On the other hand, climate change effects on temperature and precipitations can cause uncertainty on Mediterranean pine forests, both natural and planted (Mutke *et al.*, 2005).

Box 4.1 - Pine Mouth Syndrome

The Pine Mouth (or Pine Nut) Syndrome (PNS) is a taste disturbance first documented by Mostin (2001) and consisting in a bitter or metallic taste appearing between 1 to 3 days after consuming pine nuts. Additional symptoms may appear as well, such as food aversion. Cases of PNS are not common, however since 2009 there appears to have been a peak in numbers at international level.

The actual mechanism of PNS has not been determined, however the Codex Alimentarius Commission of the Joint FAO/WHO Food Standards Programme (2011) has excluded *Pinus armandii* and *Pinus massoniana* from the list of edible tree nuts. The Standing Committee on the Food Chain and Animal Health (SCFCAH) for the European Commission confirmed that, batches of pine nuts containing the species *Pinus armandii* were considered to be unfit for human consumption (European Commission, 2011). They were therefore deemed to be unsafe in accordance with Article 14 of Regulation (EC) 178/2002 laying down the general principles and requirements of food law.

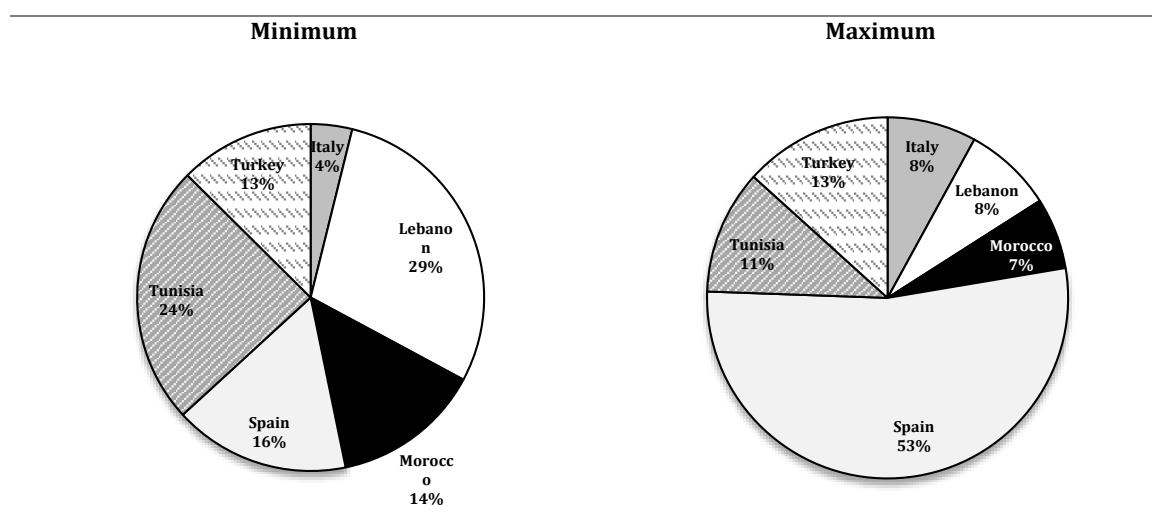
In response to the increased incidence of pine mouth cases, the Chinese authorities have implemented measures to accredit exporters of pine nuts and ensure *Pinus armandii* are no longer exported to the European Union, one of the major consumers of Chinese pine nuts (NSW Food Authority, 2012).

Based on estimations performed by Daly *et al.* (2012) and Mutke *et al.* (2012) the price for Mediterranean pine nuts on international markets can be assumed as €1.6/kg for nuts in the shell and between €16.2/kg and €24.2/kg for shelled nuts⁴⁵. Current retail prices range between €50/kg and €60/kg. Assuming such prices and matching them with production quantities given by Table 4.3, total values for production of nuts in the shell and shelled nuts in Mediterranean countries is reported in Tables 4.5 and 4.6 as well as in Figure 4.3. Two production scenarios have been assumed, i.e. minimum (based on INC 2012) and maximum (based on Mutke *et al.* 2012). In the case of Lebanon reference has been made to Sfeir (2011) because for this country no figures are reported by INC (2012) and Mutke *et al.* (2012). The total value for pine nuts in the shell ranges between €8.3M and €30M, while the value of shelled pine nuts falls between €83.8M and almost €454.8M. Considering current retail prices, the same quantities would correspond to a total value ranging between €258.7M and €1,127.5M. With regard to 2005 figures, FAO estimated a total value of €48.7M for pine seeds produced by four Mediterranean countries (i.e. Italy, Lebanon, Spain and Turkey). This value is quite close to estimates done assuming the minimum production scenario for the same countries, but almost 8 times lower than those done according to the maximum production scenario. As regards the relative importance of producing countries, Lebanon and Tunisia show the best performance within the minimum production scenario, while Spain leads under the maximum production scenario. In the case of Tunisia the economic value of Aleppo pine seeds should be considered as well, with some additional €1.38M.

Table 4.5 and Figure 4.3 - Pine nuts in the shell production value (€1,000) in Mediterranean countries

Country	Total production (tons)		Value (€1,000)			
	Minimum	Maximum	Minimum	% on total	Maximum	% on total
Israel	120	200	192	2%	320	1%
Italy	200	1,500	320	4%	2,400	8%
Lebanon	1,500	1,500	2,400	28%	2,400	8%
Morocco	720	1,200	1,152	14%	1,920	6%
Spain	850	10,000	1,360	16%	16,000	53%
Tunisia	1,255	2,092	2,008	24%	3,347	11%
Turkey	650	2,500	1,040	12%	4,000	13%
Total	5,295	18,992	8,472	100%	30,387	100%

⁴⁵ According to the same source, *Pinus koraiensis* nuts from China are normally traded at a price of about €8.1/kg.



Source: own elaboration.

Table 4.6 - Shelled pine nuts production value (€1,000) in Mediterranean countries

a. Unit price: €16.2/kg

Country	Total production (tons)		Value (€1,000)			
	Minimum	Maximum	Minimum	% on total	Maximum	% on total
Israel	120	200	1,944	2%	3,240	1%
Italy	200	1,500	3,240	4%	24,300	8%
Lebanon	1,500	1,500	24,300	29%	24,300	8%
Morocco	720	1,200	11,664	14%	19,440	6%
Spain	850	10,000	13,770	16%	162,000	53%
Tunisia	1,255	2,092	20,331	24%	33,890	11%
Turkey	650	2,500	10,530	13%	40,500	13%
Total	5,295	18,992	83,835	100%	307,670	100%

b. Unit price: €24.2/kg

Country	Total production (tons)		Value (€1,000)			
	Minimum	Maximum	Minimum	% on total	Maximum	% on total
Israel	120	200	2,904	2%	4,840	1%
Italy	200	1,500	4,840	4%	36,300	8%
Lebanon	1,500	1,500	36,300	28%	36,300	8%
Morocco	720	1,200	17,424	14%	29,040	6%
Spain	850	10,000	20,570	16%	242,000	53%
Tunisia	1,255	2,092	30,371	24%	50,626	11%
Turkey	650	2,500	15,730	12%	60,500	13%
Total	5,295	18,992	128,139	100%	459,606	100%

Source: own elaboration.

b. Pine resin

Pine resin extracted from different species of the *genus* Pine is used for the production of several products that are traditionally grouped under the inclusive term 'Naval stores'⁴⁶, normally distinguished into (Coppen and Hone, 1995):

⁴⁶ The term originates from the days when wooden sailing ships were waterproofed using pitch and tar and other resinous products from pine trees.

- › *gum naval stores* obtained by the tapping of living pine trees;
- › *sulphate naval stores*, also known as tall-oil, obtained from by-products recovered during the conversion of pine wood chips to pulp by the sulphate (*kraft*) pulping process;
- › *wood naval stores*, solvent extracted from resin-saturated pine stumps long after the tree has been felled.

The two major by-products within the 'Naval stores' family are turpentine and rosin, both obtained via steam distillation of crude oleoresin (Rezzi *et al.*, 2005). **Turpentine** is a volatile oil distilled from pine resin that traditionally has been employed as a solvent or cleaning agent for paints and varnishes, but also as an ingredient in the pharmaceutical industry. Today turpentine is mostly used as a source of chemical isolates that are then converted into a wide range of products, including fragrance and flavour use. **Rosin** is an involatile residue obtained from crude resin after distillation of the turpentine⁴⁷. It is used in the manufacture of adhesives, paper sizing agents, printing inks, solders and fluxes, surface coatings, insulating materials for the electronics industry, synthetic rubber, chewing gums, soaps and detergents. For both oleoresin by-products, the market value and end-use are defined according to their chemical composition and physical properties, such as relative density, refraction level, distillation, evaporation and volume residues, acid value, and flash point for turpentine (Rodrigues-Correa *et al.*, 2013); and acid and saponification numbers, colour, and the softening point for rosin (Silvestre and Gandini, 2008).

Tapping is normally performed for 6 to 7.5 months per year according to techniques that have evolved over time. Hugues de Tarnaux introduced the first tapping technique in 1848 in France. It consisted in slashing the bark off in straight stripes along trees; this technique has been used for more than one Century in France, Spain and Portugal, and is still in use in Indonesia (Cunningham, 2012). The fishbone technique was then introduced in the South-East of the USA by Steel and Hazard in 1869 and then improved in Austria by Mazek-Fialla in 1934 (Mazek-Fialla, 1949). Further improvements of Steel and Hazard's methods brought to modern techniques that include descending marks, not affecting timber, repeated with high frequency (up to twice per month) and supported by chemical stimulation through 2-chloro-ethyl-phosphonic acid. Borehole tapping has been developed as well to reduce impacts on trees and improve extraction yields. In Spain Cesefor and Stihl have recently developed and patented a new resin-tapping equipment that can be coupled with a traditional chainsaw engine and allows fully mechanised, quick cutting - saving about 20% of the time required by traditional tapping techniques - without requiring any debarking operation (Cesefor, 2009) (Figure 4.4). Pine species that are tapped for resin extraction vary according to the country/region. At world level nearly 60% of total oleoresin production originates from Chinese *Pinus massoniana*, with *Pinus elliottii* and *merkusii* covering another 25% (Cunningham, 2008). Within the Mediterranean basin Pine species used for resin production are those listed in Table 4.7 and shown in Figure 4.5, i.e. *Pinus pinaster*, *Pinus halepensis* and *Pinus brutia*: they cover less than 5% of total oleoresin production worldwide.

⁴⁷ Distillation of crude resin produces gum rosin and gum turpentine in varying ratios, usually between 4:1 and 6:1.

Figure 4.4 - Different resin tapping techniques



Source: own elaboration from Cunningham, 2008 and Cesefor, 2009.

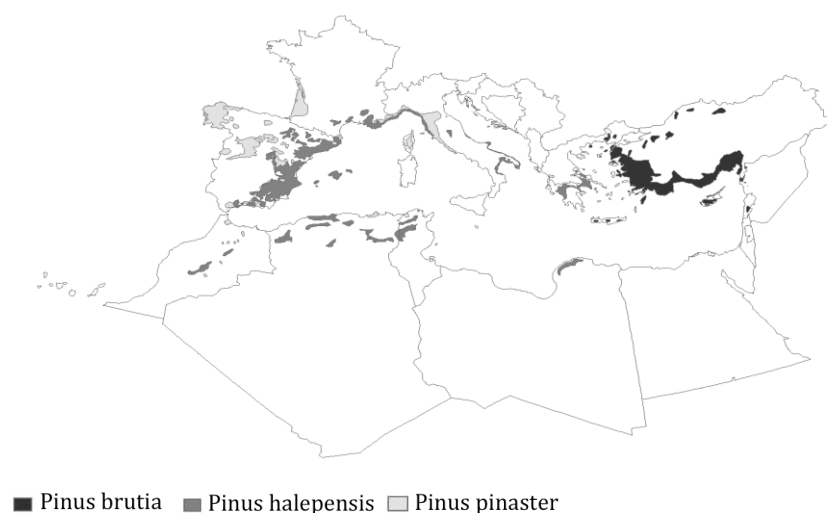
Table 4.7 - Areas and species used to Pine resin extraction in Mediterranean countries

Country	Pine specie ^a	Area (ha)	Production (tons/year)
France*	<i>Pinus pinaster</i> (Maritime Pine)	^b 1,082,000	na
Greece	<i>Pinus halepensis</i> (Aleppo Pine)	^c Actual: 147,500 ^c Potential: 327,500	3,900 - 5,000
Italy*	<i>Pinus pinaster</i> (Maritime Pine)	^d 62,522	na
Spain	<i>Pinus pinaster</i> (Maritime Pine)	^e 700,000	^e 1,443 - ^f 1,821
Turkey	<i>Pinus brutia</i> (Calabrian Pine)	^g 5,400,000	^h 3,000
Total		7,392,022	8,343 - 9,821

* tapping activities ceased

Source: own elaboration from ^aFAO,1995; ^bIGN, 2013; ^cSpanos *et al.*, 2010; ^dINFC, 2007; ^eCesefor, 2009; ^fMagrama, 2011; ^gGDF, 2009 [Note: calculated according to average figures for production forests and considering only non degraded pine forests]; ^hSatil *et al.*, 2011.

Figure 4.5 - *Pinus brutia*, *Pinus halepensis* and *Pinus pinaster* distribution in the Mediterranean region



Source: own elaboration from Euforgen, 2009a, 2009b and 2009c.

According to Cunningham (2012) the world oleoresin production in 2010 was about 1.1Mtons. While the total production of 'Naval stores' has remained more or less stable since the 1960s, the role of Mediterranean producers has decreased because of competition from petroleum-based synthetic resins and the displacement of natural

resin production to developing countries (Indonesia and Vietnam) or emerging economies (China, Brazil and Argentina) (Shanley *et al.*, 2002; Cesefor, 2009). Today China produces about 70% of total rosin and around 75% of total turpentine production worldwide although increasing production prices and new tapping techniques are creating some opportunities for other producers (Cunningham, 2012; Palma *et al.*, 2012). Spain and Greece (together with Portugal) are the only relevant producers in Europe, covering about 4% of total gum-rosin production at international level. Spanish production reached a 55,000 tons/year peak in early 1960s but since then has drastically decreased to 1,443 tons extracted in 2008 (Cesefor, 2009) and 1,821 in 2010 (Magrama, 2011). As for Greece, resin tapping was a traditional activity in the past as indirectly confirmed by the fact that resin is the only NWFP officially recognised by Greek national forest legislation⁴⁸. Production was reported to be around 20,587 tons in 1970s and 12,558 tons in 1980s (Greek Ministry of Environment, Energy and Climate Change cit. SFS, 2012), than it has diminished to 6,000 tons/year in early 1990s (Coppen and Hone, 1995; Shanley *et al.*, 2002) and between 4,000 and 5,000 tons/year more recently (Karaoglanoglou and Koukios quoted by Spanos *et al.*, 2010). These figures, however, are likely to result overestimated when comparing them to production trends in the Mediterranean region⁴⁹. According to the Greek Ministry of Environment, Energy and Climate Change quoted by SFS (2012) resin production in Greece was around 3,900 tons in 2010. In France, despite extended potential stands for resin production, extraction operations ceased in early 1990s. In Italy they were stopped in 1980s and just occur occasionally or are limited to few areas (Shanley *et al.*, 2002). Production of resin is reported to have almost ceased in Turkey as well, although in the late 1980s this Country produced about 3,000 tons/year from *Pinus brutia* stands (Coppen and Hone, 1995). As regards other Mediterranean countries occasional tapping is reported for many other Mediterranean countries including Albania, Lebanon, Cyprus, Syria, Algeria and Tunisia, but no significant production capacity is reported for them. In general resin extraction in the Mediterranean area has decreased due to diminished profitability linked to high labour costs. According to Cesefor (2009) these costs represent up to 80% of tapping total costs.

With reference to prices, available data mostly refer to Chinese production and export⁵⁰. Cunningham (2012) reported a price of €1.14/kg for Chinese gum rosin exports and €1.11/kg for Brazilian ones. Cesefor (2009) estimated a price of €0.89 /kg for Spanish domestic production and €0.95 /kg for imports. According to data published by the National Institute of Statistics in 2010 average value of extracted resin in Portugal ranged between €0.73 and €0.76/kg (INE I.P., 2011). In Greece resin prices paid to tappers are quite low - i.e. around €0.20/kg - but in many cases tappers can count on additional revenues under the form of State subsidy (€0.35/kg) for additional services they provide for example in terms of fire prevention/control (SFS, 2012).

In order to estimate the economic value of resin production in Mediterranean countries Cesefor (2009) figures were used for Spain and SFS (2012) ones for Greece and Turkey. No data have been found for Italy and France. Results are reported in Table 4.8 (and Figure 4.6) and indicate a total value ranging between €2.6M and €3.2M. With regard to 2005 figures, FAO estimated a total value of €0.9M for pine resin produced within the

⁴⁸ Parliamentary Directive 439/1968 and Presidential Directive 190/1981.

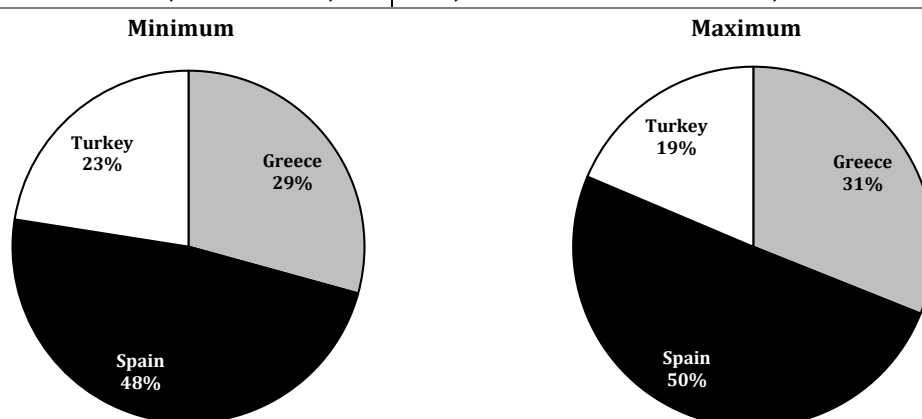
⁴⁹ As regards Portugal, a 100,000 tons/year production was reported in the 1980s, while Official National Statistics report a 7,248 tons production in 2009 (INE I.P., 2011) and recent studies report around a 5,000 tons/year production (Palma *et al.*, 2012).

⁵⁰ See for example: <http://areldorado.com.ar>, www.rosineb.com and www.rosinnet.com.

Mediterranean region. Spain was the only country reporting production data (1,705 tons). FAO estimated value is between 2.8 and 3.5 times lower than estimate developed according to data collected from literature. It shall be underline that data for Greece and Turkey are likely to be overestimated, but at the same time it should be noticed that potential production value is probably bigger that the estimated one because only a marginal part of potential pine forests are used for resin tapping. For example in the case of Spain Magrama (2011) reports that only 3.257 ha are exploited for production, i.e. less than 1% of total Maritime area pine in the country.

Table 4.8 and Figure 4.6 - Pine resin production value (€1,000) in Mediterranean countries

Country	Total production (tons)		Value (€1,000)			
	Minimum	Maximum	Minimum	% on total	Maximum	% on total
Greece	3,900	5,000	780	29%	1,000	31%
Spain	1,443	1,821	1,284.27	48%	1,620.69	50%
Turkey	3,000	3,000	600	23%	600	19%
Total	8,343	9,821	2,664.27	100%	3,220.69	100%



Source: own elaboration.

c. Cork

Cork is one of the most traditional forest products harvested and used in the Mediterranean region since ancient times⁵¹. Cork oak occurs in mixed forests and in open woodlands (called *dehesas*, *montados*, *azaghar*, etc.) in western Mediterranean (Figure 4.7), including Spain, France, Italy, Morocco, Algeria and Tunisia⁵². At world level cork oak forests cover about 2.1 Mha (FAO, 2013), 1.4 of which can be found in countries included in the present study (Table 4.9).

⁵¹ Some historical references witness the use of cork stoppers by the Ancient Egyptians already in the third millennium B.C. and later on Greeks and Romans used cork for the same purposes as well as for many other uses such as house building, to float anchor ropes and fishing nets, to seal vessels and to produce women's shoes for the winter. In his *Naturalis Historia* Pliny the Elder mentioned the capacity of cork oak to regenerate cork and bark after harvesting operations: '[...] Quae iniuria hominum constant, secundum . . . habent causas. pix, oleum, adeps inimica praecipue novellis. cortice in orbem detracto necantur, excepto subere, quod sic etiam iuvatur; crassescens enim praestringit et strangulat. nec andrachle offenditur, si non simul incidatur et corpus. alioqui et cerasus et tilia et vitis corticem mittunt, sed non vitalem nec proximum corpori, verum eum, qui subnascente alio expellitur' (Plin. Hist. Nat. Book XVI, 234).

⁵² Additionally 715,922 ha, i.e. 34% of cork oak stands worldwide, occur in Portugal that produces about 50% of global cork production (APCOR, 2012). Portugal however has not been included in the present research.

Figures 4.7 - *Quercus suber* distribution in the Mediterranean region



Source: own elaboration from Euforgen, 2009d.

Table 4.9 - Cork oak area (ha) and cork production (tons) in Mediterranean countries

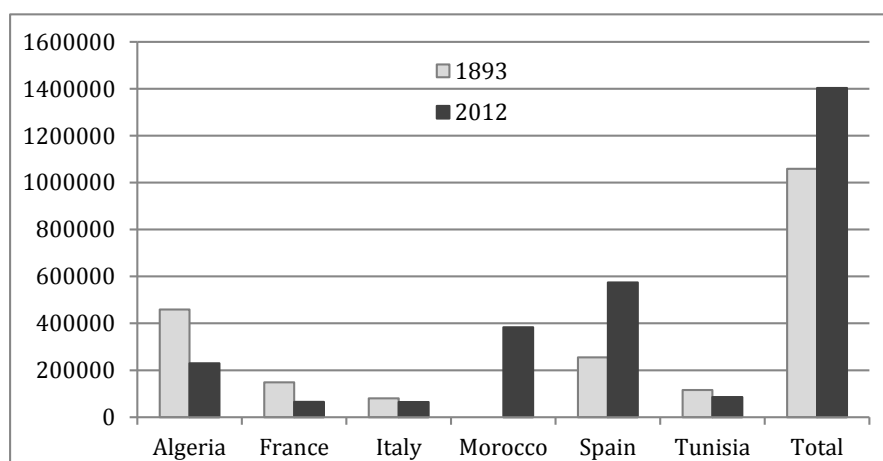
Country	^a Area (ha)	% on total	Production (tons/year)			
			^a 2005	% on total	^b 2007	% on total
Algeria	230,000	16.39%	9,915	10%	15,000	11%
France	65,228	4.65%	5,200	5%	3,400	2%
Italy	64,800	4.62%	6,161	6%	17,000	12%
Morocco	383,120	27.30%	11,686	12%	11,000	8%
Spain	574,248	40.93%	61,504	61%	88,400	62%
Tunisia	85,771	6.11%	6,962	7%	7,500	5%
Total	1,403,167	100.00%	101,428	100%	142,300	100%

Source: own elaboration from APCOR, ^b2010 and ^c2012; ^b FAO 2010c.

During the 20th Century cork oak has also been artificially introduced in non-Mediterranean countries with relatively good results in Bulgaria (Petrov and Genov, 2004), New Zealand (Macarthur, 1994), Australia, Chile and California (Pausas *et al.*, 2009). Cork oak distribution in the Mediterranean is very patchy and with the only exception of (South-West) Spain (and Portugal) has decreased during the last 110 years, especially in North Africa (Figure 4.8). There are multiple reasons for this negative trend, including overgrazing, plough agriculture, inappropriate cork stripping, tannins extraction and the replacement of cork oak with pine and eucalyptus plantations (Pausas *et al.*, 2009).

With reference to the surveyed countries APCOR (2012) reported a total cork production of about 101,428 tons. The same organization in 2007 reported a total estimated production of 142,300 tons (APCOR, 2010) (Figure 4.9). In both cases these figures correspond to around 50% of global cork production. It is worth noticing that North African countries host around 50% of cork oak forests in the Mediterranean area (33% worldwide) but provide only 24-29% of total cork production. When analyzing cork production in a historical perspective, it can be noticed that the two main producers worldwide, i.e. Portugal and Spain, have very similar trends, with a production peak in the 1960s, then a decline during the 1960-1990 period and a finally an increase. Algeria and Italy reached production peaks in the 1940s and then declined, showing some recovery capacity in recent years.

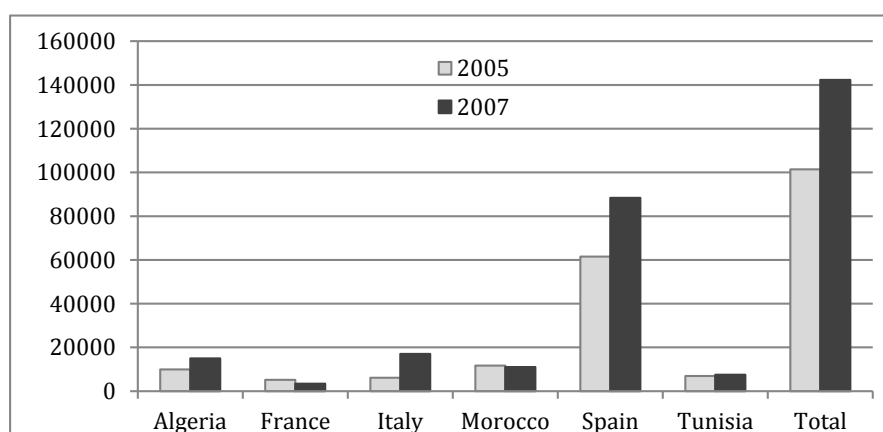
Figure 4.8 - Cork oak area (ha) in Mediterranean countries, 1893 and 2012



Note: 1893 data not available for Morocco

Source: own elaboration from Lamey, 1893, and APCOR, 2012.

Figure 4.9 - Cork production (tons) in Mediterranean countries



Source: own elaboration from APCOR, ^b2010 and ^a2012; ^a FAO 2010c.

The total value of the international market for cork in 2011 was estimated around €1,353M, while processed cork products generate approximately €1,600M in annual revenues (FAO, 2013). According to these figures, cork is the 6th most exported NTFP worldwide, mainly (i.e. 70%) under the form of cork stoppers (Berrahmouni, 2009). The competition between cork and alternative materials has strongly influenced the market share for cork stoppers during the last years (Box 4.2) and has stimulated the search for new market areas for cork industry. Outside the stopper sector, an emerging opportunity is represented by the building sector, and green building in particular, with the use of cork as an insulating material.

Box 4.2 - Cork and alternative materials for the market of stoppers

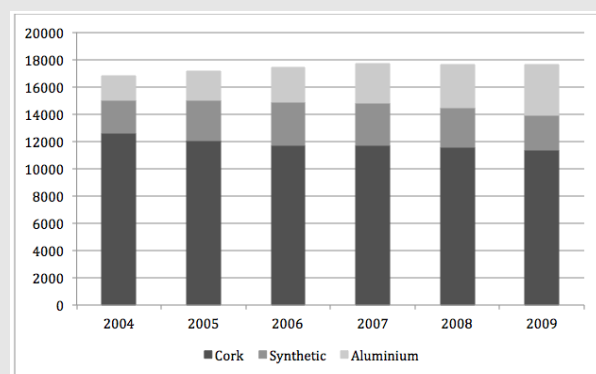
The use of cork for producing stoppers can be dated back to 1680 and attributed to the French Benedictine monk Dom Pierre Pérignon - the proctor of the Abbey of Hautvillers - who developed the *champanoise* method and tested cork as an alternative material for stoppers. The invention of glass bottles in the 17th Century and the introduction of mould-made cylindrical glass bottles one Century later allowed the standardization of bottle sizes, and hence of the cork stoppers as well. By then cork had become *de facto* the material for producing the stoppers for wine bottles and different stopper typologies were

developed by industry (Sarkar, 2012). A sudden and rude change from this close-to-monopoly situation occurred in the 1980s with the spreading of ‘cork taint’, i.e. a wine fault characterized by a set of undesirable smells or tastes affecting wine and turning it ‘corked’. Although many factors may be responsible for cork taint the main one is linked to the presence of 2,4,6-trichloroanisole (TCA) and/or 2,4,6-tribromoanisole (TBA) getting into the wine both from and through the stopper (Buser *et al.*, 1982; Dal Bo *et al.*, 2004). While cork industry was monopolizing the market of closures for medium to high quality wine, they always rejected any accusation on cork taint. Nevertheless the cork taint crisis created some room for alternative materials for wine closures such as synthetics and aluminium. Synthetic closures are stoppers made of either medical or food grade plastics. Uniform in terms of quality and neutral in terms of affecting the taste of wine, they quickly gained the support of many wine producers. Their main weakness is their excessive permeability to oxygen in the medium-long run. Aluminium scraps - in particular Stelvin screw caps launched in 1959 - are corrosion resistant, and have a treated and chemically inert facing that is completely compatible with wine (Mortensen and Marks, 2002).

The passage from cork stoppers to closures produced with different materials had also additional causes, such as a decrease in wine production due to the shift from quantitative-type consumption limited to countries with a strong wine tradition (southern Europe) to a geographically broader and more qualitative consumption, but quantitatively limited; and the rise of new wine-producing areas (America, Oceania) that are technologically inclined to use alternative systems and where cork is not a cultural issue (FAO, 2013). From an over 90% market share in 1980s, at the present cork stoppers have fallen to about 64%. The importance of aluminium screw caps is on increase (21%) - with a much stronger position in new wine producing countries such as New Zealand (90%) and Australia (80%) (Patterson, 2010) - while that of synthetic stoppers is stable to decreasing (14%) (Table 4.10 and Figure 4.10) and two of the main world producers have filed for bankruptcy in the last years (Sarkar, 2012).

Table 4.10 and Figure 4.10 – Market share by different wine stopper types (2004-2009)

Years	Cork		Synthetic		Aluminium	
	Units (M)	% on Total	Units (M)	% on Total	Units (M)	% on Total
2004	12,609	75%	2,372	14%	1,822	11%
2005	12,031	70%	2,951	17%	2,151	13%
2006	11,698	67%	3,204	18%	2,512	14%
2007	11,678	66%	3,143	18%	2,850	16%
2008	11,550	65%	2,900	16%	3,200	18%
2009	11,367	64%	2,542	14%	3,724	21%



(y-value: product units as reported in Table 4.9) - Source: own elaboration from Amorim cit. Sarkar, 2012.

The reaction of cork industry to ‘cork taint’ crisis and the raising of competitor materials have been multifaceted. On the one hand research quality control measures to prevent contaminated cork from being processed into closures have been adopted⁵³, on the other many marketing campaigns⁵⁴ have been developed to support cork towards wine industry and end consumers. Campaigns did not just make reference to the overcoming of ‘cork taint’ problem, but also on overall sustainability of cork as a material, with special reference to environmental and social benefits connected to the responsible management of

⁵³ As an example see: www.corkqc.com/currentresearch/research.htm

⁵⁴ Just to mention few of them: 100%Cork, ReCork, Intercork, MOR for Cork, Save Miguel.

cork oak forests. In particular benefits of cork stoppers in comparison to alternative materials were highlighted, including an environmental appraisal of different closures using the methodology of life cycle analysis (LCA). Cork stoppers resulted as the best alternative in comparison to the aluminium and plastic closures for all assessed indicators (i.e. non-renewable energy consumption, emission of greenhouse effect gases, contribution to atmospheric acidification, contribution to the formation of photochemical oxidants, contribution to the eutrophication of surface water and total production of solid waste) except for water consumption, where aluminium closer performances were higher (PwC/Ecobilan, 2008).

The 'cork taint' crisis has also stimulated research and development by cork industry. In 2013 Amorim, the European largest cork producer, and O-I, the world's biggest glass company, created 'Helix', a grooved agglomerated cork stopper that fits into specially-cast bottle with a matching thread in its neck.

Measures to defend the role of cork on the market included the expansion also in different sectors, such as the building sector for the production of insulating products, in parallel with the growth of green building.

In general terms about 80% of cork exported worldwide is manufactured/processed and only 20% is unprocessed. Portugal and Spain - the two main exporters - have quite different profiles: unprocessed cork represents only 6-7% of exports for the first country and up to 35% for the second one (Parejo Moruno, 2010). As for the most recent available figures, Spain, France and Italy covered about 24.3%⁵⁵ of world cork exports in 2011, for a total value of €316.5M. Only Spain, however, had a positive import-export balance (+€117.2M), while France and Italy resulted net importers (APCOR, 2012).

Cork prices have diminished dramatically in the last ten years, from €44.8 per *arroba* (i.e. 15 kg in Portugal) of piled cork in 2003 to €31 in 2008⁵⁶. In the meanwhile extraction costs have increased from €2.9 to €4 per *arroba* (APCOR, 2010).

For the purposes of estimating cork production value in Mediterranean countries, quantities reported by APCOR (2010) (see Table 4.8) were taken into consideration. As for prices, a range of €1-2.3/kg (APCOR, 2010) was assumed for France, Italy and Spain, while for North-African countries an average value of €0.35/kg was derived from Daly *et al.*, (2012)⁵⁷. Therefore total cork production value for Mediterranean countries would range between €120.5M and €261.9M, with Spain responsible for 73 to 78% of overall production value (Table 4.11 and Figure 4.11). FAO 2005 figures estimated a total value of €163.3 M cork within the Mediterranean region, covering France, Italy, Morocco, Spain and Tunisia. FAO estimated value lays between the values estimated according to the present research project, resulting 1.3 times bigger than the lower estimate and 1.6 times lower.

Table 4.11 and Figure 4.11 - Cork production value (€1,000) in Mediterranean countries

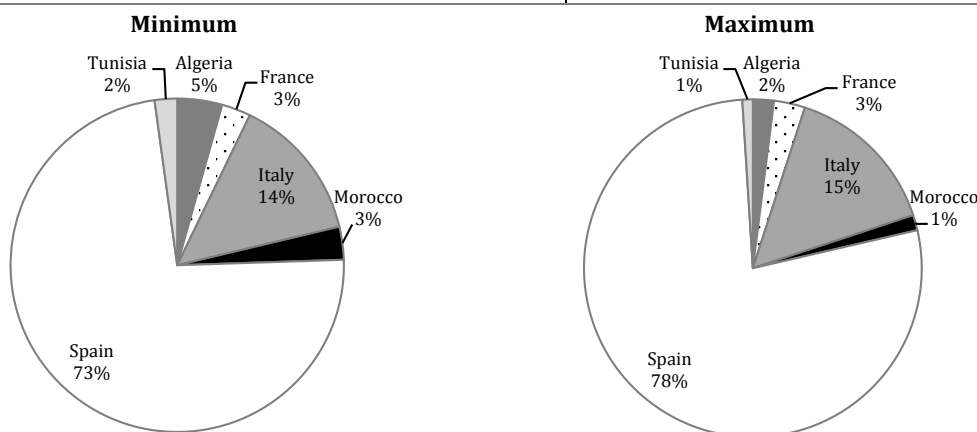
Country	Minimum <i>Unit price: €1/kg</i>	% on total	Maximum <i>Unit price: €2.3/kg</i>	% on total
	Value (€1,000)		Value (€1,000)	
Algeria*	5,250	4%	5,250	2%
France	3,400	3%	7,820	3%
Italy	17,000	14%	39,100	15%
Morocco*	3,850	3%	3,850	1%

⁵⁵ Up to 86% including Portugal.

⁵⁶ Including extraction costs.

⁵⁷ Daly *et al.* (2012) estimated an average value of about 73.6 Tunisian Dinar per 100kg.

Spain	88,400	73%	203,320	78%
Tunisia*	2,625	2%	2,625	1%
Total	142,300		327,290	100%



* Note: €0.35/kg (Daly *et al.*, 2012)

Source: own elaboration.

4.1.2 Services

Two forest services provided by Mediterranean forests have been analysed for the purposes of the present research: grazing (4.1.2.1) and carbon-related services (4.1.2.2). Details are provided below.

4.1.2.1 Grazing

Agro-silvo-pastoralism as a combination of agriculture, forestry and grazing is a traditional land use in the Mediterranean region, where the flora has co-evolved with large gregarious herbivores. Domestic animals have been grown for centuries for economic purposes - i.e. milk and meat production - while more recently grazing has also acquired an environmentally relevant role as a tool for the control of the understory vegetation, thus reducing fire risk and increasing forest structural diversity and biodiversity. This new approach is also known as conservation grazing, i.e. the implementation of grazing activities to improve ecosystem services such as biodiversity, nature conservation, cultural heritage, and fire prevention (WallisDeVries *et al.*, 1998) even in Mediterranean areas (Perevolotsky and Seligman, 1998; Etienne, 2005). On the other hand overgrazing is perceived as one of the most recurrent degradation factors in Mediterranean forests and rangelands, in particular for mountainous and upland (semi-mountainous) ecosystems (FAO, 2010a; Hadri and Guellouz, 2011; FAO, 2013). This is due to the large number of animals, the constant, throughout the year, grazing and the combination of stockbreeding with deforesting logging and fires for improving fit for pasture material (Christopoulou, 2011).

Livestock in the region totalises a total number of about 292 M heads (camels, cattle, goats, pigs and sheep) (Table 4.12).

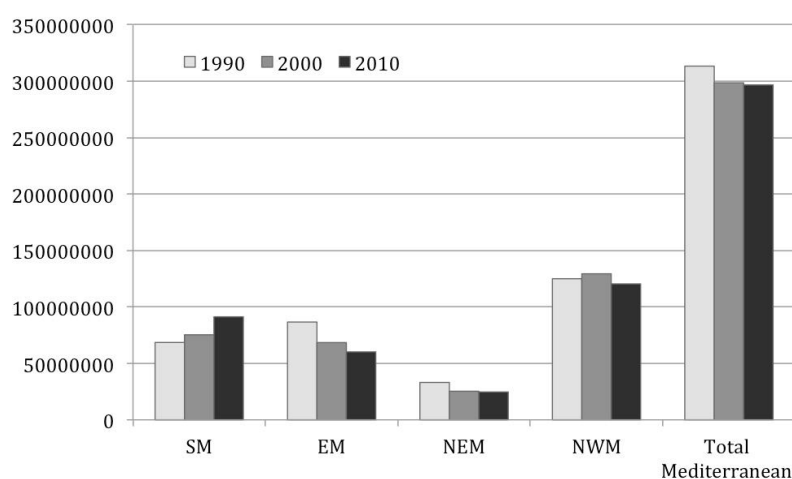
During the 1990-2010 period, the total number of live animals (heads) has diminished in the whole region (-5%) and in all sub-regions, except the SM one (+33%). In particular goats (44%) and sheep (+33%) showed the highest increase rates in the SM region (Figure 4.12).

Table 4.12 – Livestock in Mediterranean countries in 2010, number of heads per selected animal categories

Country	Camels	Cattle	Goats	Pigs	Sheep
Algeria	290,000	1,650,000	3,850,000	5,700	20,000,000
Egypt	110,571	4,530,000	4,200,000	12,000	5,650,000
Libya	56,000	195,000	2,700,000	-	7,000,000
Morocco	50,000	2,895,800	5,685,700	8,500	18,023,200
Tunisia	235,000	670,900	1,295,940	6,000	7,234,070
SM sub-region	741,571	9,941,700	17,731,640	32,200	57,907,270
Cyprus	-	55,522	208,571	463,932	226,641
Israel	5,300	430,000	100,000	223,500	445,000
Lebanon	450	77,000	450,000	9,500	335,000
Occupied Palestinian T.	-	33,000	219,364	-	613,000
Syria	50,000	1,010,000	2,057,000	-	15,511,000
Turkey	1,041	10,724,000	5,128,290	1,896	21,794,500
EM sub-region	56,791	12,329,522	8,163,225	698,828	38,925,141
Albania	-	493,000	775,000	164,000	1,806,000
Bosnia and Herzegovina	-	462,368	63,250	590,431	1,046,040
Croatia	-	444,000	75,000	1,231,000	630,000
Greece	-	624,800	4,850,000	950,000	8,966,000
Montenegro	-	118,833	-	11,533	220,653
Slovenia	-	472,878	29,896	415,230	138,108
NEM sub-region	-	2,615,879	5,793,146	3,362,194	12,806,801
France	-	19,620,900	1,349,030	14,531,900	7,976,550
Italy	-	6,103,000	961,000	9,157,100	8,012,600
Malta	-	14,954	5,110	70,583	12,379
Spain	-	6,075,100	2,933,800	25,342,600	18,551,600
NWM sub-region	-	31,813,954	5,248,940	49,102,183	34,553,129
Total Mediterranean	798,362	56,701,055	36,936,951	53,195,405	144,192,341

Source: own elaboration from FAOSTAT, 2012a.

Figure 4.12 – Livestock in Mediterranean countries in 1990-2000-2010, number of heads



Source: own elaboration from FAOSTAT, 2012a

Since fodder is generally un-priced, the value of grazing activities in Mediterranean forests has been estimated according to the substitution cost approach⁵⁸. Barley was used as a substitute input. Forage units (FU) were converted into units of the substitute good based on a comparison of nutrient content, and - after that - valued through the price of the substitute good itself. Based on existing literature (Merlo and Croitoru, 2005; Daly, 2012) it was assumed that 1 FU has the same nutrient contents as 1 kg of barley grain. Data on grazing were collected from different sources:

- › data on grazing forest area and potential forage units production were collected from different studies, including available FAO Country Pasture/Forage Resource Profiles⁵⁹ and additional studies for single countries e.g. Oztürk *et al.* (2009), Daly *et al.* (2012) etc.;
- › data on barley prices were collected from FAOSTAT (2012b) and refer to 2010. Reference to this year was due to the fact that it was the most recent year presenting full data availability for the countries within the research scope.

The overall estimated value for grazing activities is slightly lower than €1,342M (Table 4.13) with SM sub-region playing a major role. It shall be noticed, however, that it was possible to estimate grazing value just for twelve out of twenty-one countries, because for nine countries full and/or reliable data were not available. Unit value ranges between 10.7 (Lebanon) and 76.4 (Tunisia) €/ha, with an average value of 18.1 €/ha. SN sub-region covers about 45% of the total value, followed by NEM and NWM sub-regions (21% each) (Figure 4.13). Algeria (28%), Greece and Spain are the three countries with the highest total values: all together they represent more than 60% of the overall value for grazing in the Mediterranean basin.

Table 4.13 – Economic value of forest grazing in Mediterranean countries

Country	Grazing forest area (ha)	FUs/ha	Total FUs	Value			Sources
				FU value (€)	€/ha	Total (€)	
Algeria ^(a)	10,200,000	20 ^(b) – 500 ^(c)	1,530,000.000	0.25	37.2	378,967,091.30	Merlo and Croitoru, 2005; *Nedjraoui, 2006
Egypt	378,000	50	18,900,000	0.30	15.2	5,749,012.50	*El-Nahrawy, 2006
Morocco ^(d)	5,801,000	170	986,170,000	0.14	24.3	141,222,555.10	World Bank, 2002; *Berktat and Tazi, 2006
Tunisia	916,000	435; 50 ^(e) – 600 ^(f)	398,108,014	0.18	76.4	70,016,649.30	World Bank, 2002; *Kayouli, 2006; Haly et al, 2012
SM	17,295,000	-	2,933,178,014	-	-	595,955,308.20	
Cyprus	16,967	na	na	0.14	na	Na	Forest Department (2006)
Lebanon	134,000	70	9,380,000	0.15	10.7	1,433,019.30	*Asmar, 2011
Occupied	na	215	3,850,000	0.23	21.0	883,793.10	Al Baqain and

⁵⁸ In some cases the value of grazing activities could have been estimated on the basis of token tax paid by forest users or similar mechanisms. In some countries (e.g. Greece) grazing access to forests is subject to fees, in some other countries (e.g. Morocco) the protection of natural forest regeneration (e.g. by fencing) implies local communities are compensated by the State. As observed by Merlo and Croitoru (2005), however, making reference to fees or compensation money is likely to underestimate the real value of the forest service, because they are administered prices and do not proceed from interaction between supply and demand.

⁵⁹ See: <http://www.fao.org/ag/AGP/AGPC/doc/pasture/forage.htm>.

Palestinian T.							Valla Zarate, 2011
Turkey	5,800,000	159	920,000,000	0.19	29.9	173,389,393.40	*Karagöz, 2006; Ozturk et al., 2009
EM	5,934,000	-	933,230,000	-	-	175,706,206.80	
Albania	660,965	150	99,144,750	0.30	44.4	29,330,292.90	*Shundi, 2006
Bosnia and Herzegovina	1,050,000	na	na	0.12	na	Na	*Alibegovic-Grbic, 2009
Croatia	na	350	113,771,818	0.11		13,066,726.10	Merlo and Croitoru, 2005; Motik et al, 2005
Greece	4,124,800	419	1,730,000,000	0.14	59.2	244,130,982.20	Eleftheriadis, 1998; Zervas, 1998; Papachristou and Platis, 2011
NEM	5,835,765	-	1,942,916,568	-	-	286,528,001.20	
Italy	2,000,000	50-560	610,000,000	0.13	40.7	81,383,950.30	Corrado, 1984; Merlo and Croitoru, 2005; Goracci <i>et al.</i> , 2009
Spain ^(g)	5,800,000	280	1,624,000,000	0.12	34.9	202,410,535.60	FAO, 2008
NWM	7,800,000	-	2,234,000,000	-	-	283,794,486.00	
Total Mediterranean	36,864,765	-	8,043,324,582	-	-	1,341,984,001.10	

Source: own elaboration from quoted sources.

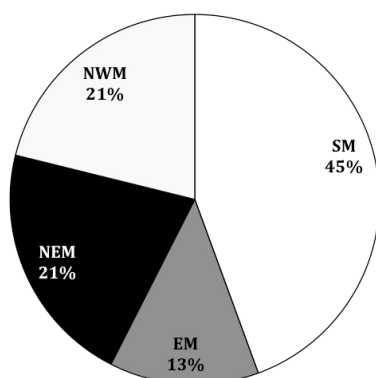
NOTES:

Data not available for: Libya, Cyprus, Israel, Syria, Bosnia and Herzegovina, Montenegro, Slovenia, France and Malta.

(a) Grazing lands of the steppes and the presaharan zone (probably overestimated); (b) remt steppes; (c) psammophytic steppes; (d) Eastern High Plateaux and the Moulouya Valley, Middle-High Atlas, Rif mountains, Zone of Mamora-Zaers, Plains and Plateaux North of the Atlas, Coastal Meseta, argan zone and some steppes in the presaharan zone; (e) Semi-arid areas in the South; (f) Northern part of Tunisia; (g) Dehesa areas

* FAO Country Pasture/Forage Resource Profiles.

Figure 4.13 – Relative incidence of economic value of forest grazing in different Mediterranean sub-regions



Source: own elaboration.

4.1.2.3 Carbon sequestration

According to FAO (2010) figures, in 2010 living biomass in Mediterranean forests stocked around 4Bln tons carbon⁶⁰, i.e. on average 56 tons/ha (Table 4.14). NWM sub-region accounts for more than 54% of the total stock: when considering also Turkey this figure grows up to 74%.

⁶⁰ Data for Lebanon, Occupied Palestinian Territories, Syria and Malta are not available.

Table 4.14 – Carbon stock in living biomass in Mediterranean forests in 2010 (Mtons)

Country	1990	2000	2005	2010	1990-2010 % Variation	2010, % on total	2010 (tons/ha)
Algeria	78	74	72	70	-10%	1.7%	47
Egypt	4	6	7	7	75%	0.2%	99
Libya	6	6	6	6	0%	0.1%	28
Morocco	190	212	224	223	17%	5.5%	43
Tunisia	6	8	8	9	50%	0.2%	9
SM sub-region	284	306	317	315	11%	7.8%	40
Cyprus	3	3	3	3	0%	0.1%	18
Israel	5	5	5	5	0%	0.1%	31
Turkey	686	743	782	822	20%	20.3%	73
EM sub-region	694	751	790	830	20%	20.5%	75
Albania	49	49	48	49	0%	1.2%	63
Bosnia and Herzegovina	96	118	118	118	23%	2.9%	54
Croatia	190	221	237	253	33%	6.3%	132
Greece	67	73	76	79	18%	2.0%	20
Montenegro	33	33	33	33	0%	0.8%	61
Slovenia	116	141	159	178	53%	4.4%	142
NEM sub-region	551	635	671	710	29%	17.6%	68
France	965	1,049	1,165	1,208	25%	29.9%	76
Italy	375	467	512	558	49%	13.8%	61
Spain	289	396	400	422	46%	10.4%	23
NWM sub-region	1,629	1,912	2,077	2,188	34%	54.1%	52
Total Mediterranean	3,158	3,604	3,855	4,043	28%	100.0%	57

Source: own elaboration from FAO, 2010.

Almost all countries in the region show a stable or positive variation of carbon stock during the 1990-2010 period (Figure 4.14). The only exception is represented by Algeria that shows a decrease (-10%). Globally considered, the total forest carbon stock in the region increased by about 0.9 billion tons between 1990 and 2010, with a rate of increase of 1.4% per year. This trend seems to be in contrast to the general global decrease in world forest carbon stock during the same period, as well as the average process of sink saturation described by Nabuurs *et al.* (2013) for European forests. According to the latter, such a saturation is the effect of a combination of factors, including increasing ageing of forests, reduced nitrogen deposition from the atmosphere and decreased summer air humidity, localised deforestation due to infrastructure expansion, and susceptibility to natural disturbances such as fires, storms and insects.

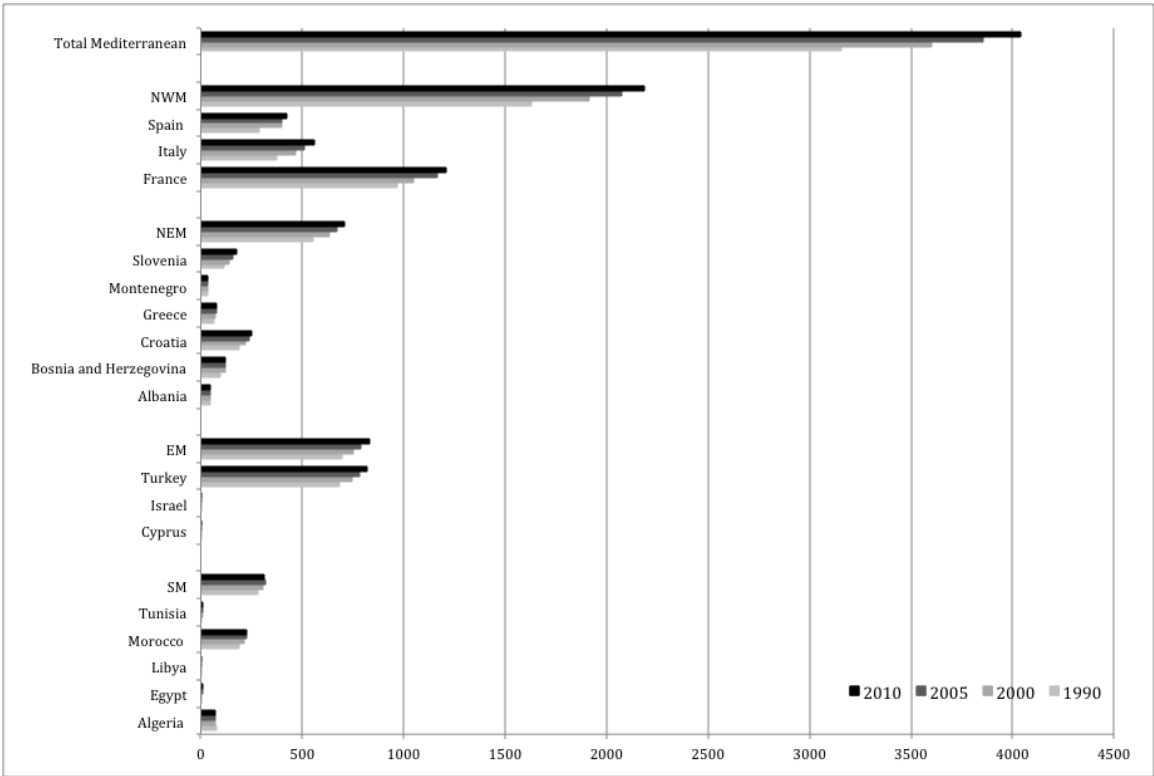
The value of carbon was calculated taking into consideration the average annual change of carbon stock in living biomass during the 1990-2010 period (FAO, 2010) (Figure 4.15). In line with the approach used for timber products, it was decided to consider the 1990-2010 period as a reference time frame. It should be observed, however, that when considering the 2000-2005 period annual changes in carbon stock would result negative not only for Algeria, but also for Morocco and, as a consequence, for the entire SM sub-region. This suggests there could be a decline in carbon stocking capacity in the area due to forest degradation and clearing, and this trend would deserve special attention.

A price range for carbon credits was identified considering a lower value, taken from Ecosystem Marketplace's State of the Forest Carbon Markets (2011 edition) as 2010 average price on global markets converted into €2010 (on average: €4.18/tCO_{2e}) (Table 4.15), and a higher value taken from van den Bijgaart *et al.* (2013) as the median social cost of carbon (€15/tCO_{2e}).

Carbon stock annual variations were improved using a biomass expansion factor (BEF) equal to 1.35 for conversion of merchantable volume to aboveground tree biomass. This value is consistent with average BEF values for temperate conifer and broadleaves forests recommended by IPCC (2006).

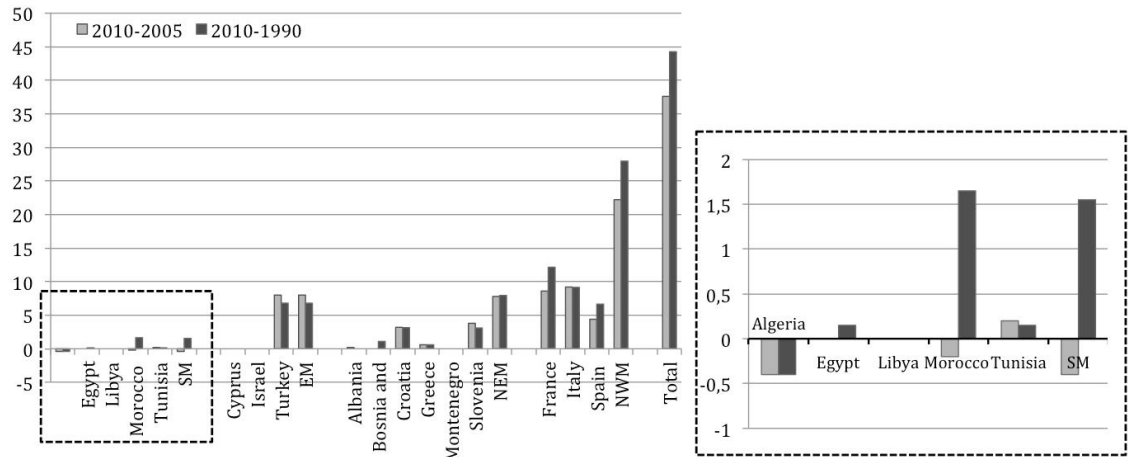
Carbon stocked in wood product pools was not considered because methodologies are still largely under debate and not well consolidated nor fully accepted at international level.

Figure 4.14 – Carbon stock in living biomass in Mediterranean forests in 1990-2010 (Mtons)



Source: own elaboration from FAO, 2010.

Figure 4.15 – Carbon stock in living biomass average annual variation in Mediterranean forests for 2010-2005 and 2010-1990 periods (Mtons), including highlights for SM countries and sub-region



Source: own elaboration from FAO, 2010.

Table 4.15 – Volume, value and prices in the forest carbon markets (primary and secondary)

Market	Reported volume (MtCO ₂ e)		Reported value (M€)		Average price (€/tCO ₂ e)	
	Historical total	2010	Historical total	2010	Historical total	2010
Voluntary OTC ^(a)	59.0	27.4	189,10	95,57	4,12	4,25
CCX ^(b)	2.9	0.1	3,92	0,15	2,13	0,89
Total voluntary markets	61.9	27.6	193,10	95,72	4,04	4,22
CDM ^(c)	9.0	1.4	28,36	4,75	3,23	3,39
NSW GGAS ^(d)	3.1	1.1	8,90	0,00	9,25	n.a.
NZ ETS ^(e)	0.6	0.0	6,71	0,23	10,49	9,77
Total regulated markets	12.8	2.6	43,98	4,90	4,23	3,48
Total global markets	74.7	30.1	237,00	100,62	4,07	4,18
Total primary markets ^(f)	71.6	29.0	219,28	97,00	3,94	4,14
Total secondary markets ^(g)	3.2	1.2	17,73	3,62	5,05	5,70
Total estimated value			325.93	133.96		

Source: own elaboration from Ecosystem Marketplace quoted by Diaz *et al.*, 2011.

NOTES: ^(a) Voluntary Over-the-Counter; ^(b) Chicago Climate Exchange; ^(c) (Kyoto Protocol) Clean Development Mechanism; ^(d) New South Wales Greenhouse Gas Reduction Scheme; ^(e) New Zealand Emission Trading Scheme; ^(f) The primary markets refer to original transactions of credits directly from a project; ^(g) The secondary markets refer to all ensuing transactions.

The total value of the carbon-related service provided by Mediterranean forests ranges between about €0.25Bln and about €0.90Bln, depending on the unit price (Table 4.16).

Table 4.16 – Total and unit value of carbon-related service provided by living biomass in Mediterranean forests in 2010

Country	Average annual change of carbon stock in living biomass during the 1990-2010 period (Mtons)*	Value of carbon stocked in forests (€1,000)		% on Total Value of carbon stocked in forests	Unit value of carbon stocked in forests (€/ha)	
		Unit price: €4.18/tCO ₂ e (A)	Unit price: €15/tCO ₂ e (B)		(A)	(B)
Algeria	-0.54	-2,257.20	-8,100.00	-0.9%	-1.47	-5.27
Egypt	0.20	846.45	3,037.50	0.3%	12.63	45.34
Morocco	2.23	9,310.95	33,412.50	3.7%	1.83	6.58
Tunisia	0.20	846.45	3,037.50	0.3%	0.92	3.29
SM sub-region	2.09	8,746.65	31,387.50	3.5%	1.12	4.01
Turkey	9.18	38,372.40	137,700.00	15.4%	3.57	12.82
EM sub-region	9.18	38,372.40	137,700.00	15.4%	**3.47	**12.44
Bosnia and Herzegovina	1.49	6,207.30	22,275.00	2.5%	2.84	10.19
Croatia	4.25	17,775.45	63,787.50	7.1%	9.34	33.52
Greece	0.81	3,385.80	12,150.00	1.4%	0.90	3.24
Slovenia	4.19	17,493.30	62,775.00	7.0%	14.07	50.50
NEM sub-region	10.73	44,861.85	160,987.50	18.0%	4.31	15.47
France	16.40	68,562.45	246,037.50	27.5%	4.36	15.66
Italy	12.35	51,633.45	185,287.50	20.7%	5.89	21.15
Spain	8.98	37,525.95	134,662.50	15.0%	2.17	7.79
NWM sub-region	37.73	157,721.85	565,987.50	63.2%	3.78	13.55
Total Mediterranean	59.74	249,702.75	896,062.50	100.0%	3.51	12.61

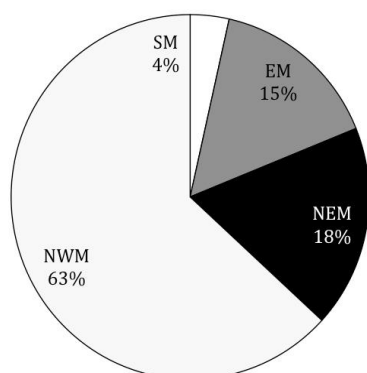
Data not available for: Libya, Cyprus, Israel, Occupied Palestinian Territories, Syria, Albania, Montenegro, and Malta

NOTE: *BEF = 1.35; ** forest area includes data for Cyprus and Israel.

Source: own elaboration.

More than 63% of the estimated value is concentrated in the NWM sub-region, with another 15% covered by the EM sub-region, i.e. Turkey (Figure 4.16). France and Italy together cover almost 50% of the overall value of the service, while, with the only exception of Morocco, the role of SM countries is marginal or - such as in the case of Algeria - even negative. NEM sub-region contributes with about 18% of the total value, mostly thanks to the contribution of Croatian and Slovenian forests. As for unit value per hectare of forest, it ranges between €3.51/ha and €12.61/ha.

Figure 4.16 – Relative incidence of economic value of carbon-related service in different Mediterranean sub-regions



Source: own elaboration.

An evaluation performed by Ding *et al.* (2011) using 2005 forest cover data as a baseline and adopting the International Panel on Climate Change (IPCC) scenarios A1 and B2, respectively, with 2050 as the horizon, quantified the economic value of carbon storage in European Mediterranean forests (latitude 35–45° N) in a range between €30 and 51 Bln. In that case - however - carbon-stock figures were used instead of carbon flow ones (i.e. variation of the stock). This choice is questionable: if the same approach was adopted, total estimation for the selected countries would grow-up to almost €16.9 Bln. More than 54% of this value would continue to remain concentrated in the NWM sub-region, with another 20.5% covered by the EM sub-region, i.e. Turkey. France and Turkey together would cover more than 50% of the overall value of the service. With the only exception of Morocco, the role of SM countries would be marginal also in this case.

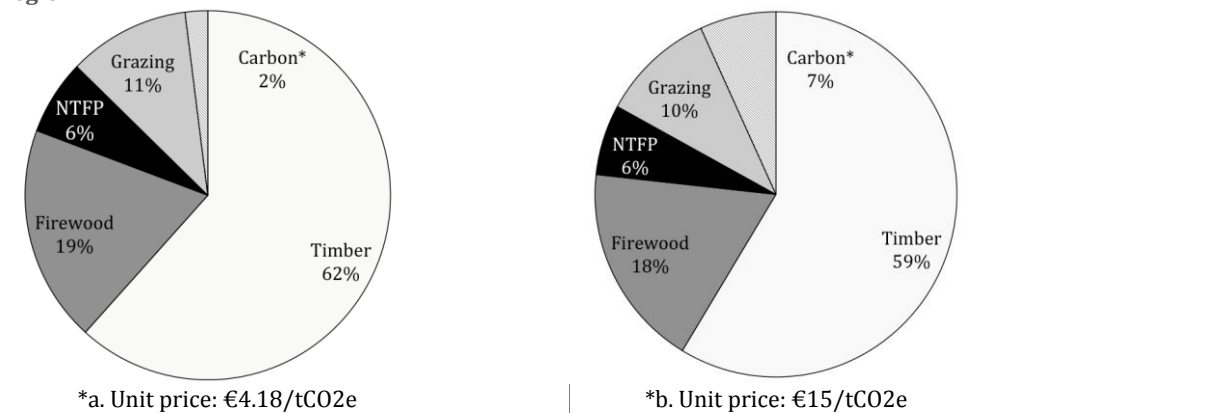
The value of carbon-related services, in any case, is just partly caught by the market: only one project has been implemented under the Clean Development Mechanism (CDM) of the Kyoto Protocol and - although information collection may be problematic - the number of initiatives in the voluntary market is still limited (see paragraph 4.2.2 dedicated to Payments for Ecosystem Services, PES).

4.1.3 Summary of value estimations for selected products and services

Value estimations for selected products (timber and non-timber ones) and services (grazing and carbon-related service) at regional level brought to a total estimation ranging between €12,508M and €13,155M, depending on unit price for carbon that is adopted. Timber (roundwood) products prevail on other products, representing 77-81% of the total value (Figure 4.17 and Table 4.17). Within timber products, industrial timber is the most relevant component, equivalent to about 59-62% of the total value

estimated for selected products/services and about 76% of the total value for wood products only, while the remaining proportion is covered by firewood. The total estimated value for grazing ranges between 10 and 11% of the total estimated value, i.e. almost twice the estimated value for NTFPs (6%). It shall be noticed, however, that figures for NTFPs are likely to be underestimated because data are not available for all product categories and countries. Indeed, when using alternative estimation methodologies/sources - as tested for pine nuts, pine resin and cork - the estimated value could increase of €36.8-572.4M depending on different scenarios. Finally, carbon-related services range between 2 and 7% of the total estimated value depending on unit price for carbon that is adopted.

Figure 4.17 – Relative incidence of economic value of selected forest products/services in the Mediterranean region



Source: own elaboration.

Table 4.17 – Estimated value of selected forest products and services in Mediterranean countries/sub-regions (2010), €1,000

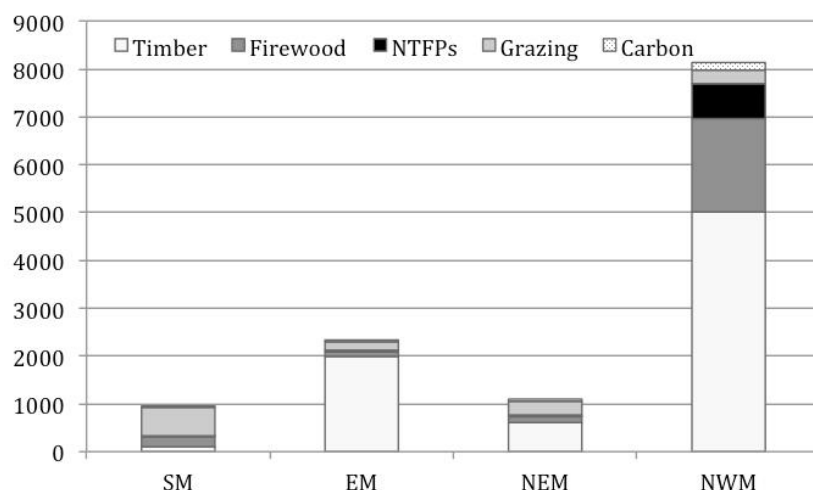
Countries and sub-regions	Roundwood		c. NTFP	e. Carbon			Total (Tot = a + b + c + d + e)		Unit value (€/ha)			
	a. Timber	b. Firewood		d. Grazing	(A) €4.18/tCO2e	(B) €15/tCO2e	(A) Total	(B) Total	(A)	(B)		
Algeria	12,150.76	1,356,89.24	3,025.56	378,967.09	-2,257.20	-8,100.00	538,350.77	4.30	532,507.97	4.05	360.82	356.91
Egypt	3,142.94	28,777.06	1,001.72	5,749.01	846.45	3,037.50	7,943.02	0.06	10,134.07	0.08	113.47	144.77
Libya	13,735.65	15,794.35	na	na	na	na	31,687.03	0.25	31,687.03	0.24	146.02	146.02
Morocco	44,069.13	6,820.87	7,462.56	141,222.56	9,310.95	33,412.50	212,592.81	1.70	236,694.36	1.80	41.43	46.13
Tunisia	25,816.94	36,253.06	7,933.60	70,016.65	846.45	3,037.50	145,391.85	1.16	147,582.90	1.12	144.52	146.70
SM	98,915.42	223,334.58	19,423.43	595,955.31	8,746.65	31,387.50	935,965.48	7.48	958,606.33	7.29	118.24	121.10
Cyprus	624.59	65.41	85.34	na	na	na	828.72	0.01	828.72	0.01	4.79	4.79
Israel	2,933.06	36.94	na	na	na	na	3,190.52	0.03	3,190.52	0.02	20.72	20.72
Lebanon	839.30	340.70	33,779.59	1,433.02	na	na	36,481.74	0.29	36,481.74	0.28	266.29	266.29
Occupied Palest. Territories	na	na	na	883.79	na	na	883.79	0.01	883.79	0.01	98.20	98.20
Syria	4,681.61	508.39	na	na	na	na	5,570.44	0.04	5,570.44	0.04	11.35	11.35
Turkey	1,846,894.13	87,965.87	980.15	173,389.39	38,372.40	137,700.00	2,288,625.58	18.30	2,387,953.18	18.15	201.93	210.69
EM	1,855,972.69	88,917.31	34,845.08	175,706.21	38,372.40	137,700.00	2,335,580.79	18.67	2,434,908.39	18.51	189.92	197.99
Albania	5,130.22	8,449.78	4,296.71	29,330.29	na	na	48,194.40	0.39	48,194.40	0.37	62.11	62.11
Bosnia and Herzegovina	150,935.16	30,414.84	21,968.77	0.00	6,207.30	22,275.00	222,739.88	1.78	238,807.58	1.82	101.94	109.29
Croatia	219,349.49	25,490.51	1,214.52	13,066.73	17,775.45	63,787.50	294,736.87	2.36	340,748.92	2.59	153.51	177.47
Greece	60,784.93	19,185.07	na	244,130.98	3,385.80	12,150.00	333,319.85	2.66	342,084.05	2.60	85.40	87.65
Montenegro	13,334.88	3,765.12	na	na	na	na	18,348.52	0.15	18,348.52	0.14	33.79	33.79
Slovenia	118,069.44	26,650.56	8948.96	na	17,493.30	62,775.00	181,705.47	1.45	226,987.17	1.73	145.02	181.15
NEM	567,604.12	113,955.88	36428.96	286,528.00	44,861.85	160,987.50	109,9045.00	8.79	1,215,170.65	9.24	103.88	114.86
France	3,050,401.43	1,421,518.57	103621.81	na	68,562.45	246,037.50	4,970,056.50	39.73	514,7531.55	39.13	311.52	322.65
Italy	251,416.27	26,2813.73	245622.02	81,383.95	51,633.45	185,287.50	930,353.67	7.44	1,064,007.72	8.09	101.69	116.30
Malta	na	na	na	na	na	na	na	na	na	na	na	na
Spain	1,370,768.91	134,691.09	382498.36	202,410.54	37,525.95	134,662.50	2,237,626.54	17.89	2,334,763.09	17.75	123.13	128.47
NWM	4,672,586.62	1,819,023.38	731742.19	283,794.49	157,721.85	565,987.50	813,8036.71	65.06	8,546,302.36	64.97	188.05	197.48
Total Mediterranean	7,195,078.84	2,245,231.16	822,439.65	1,341,984.00	249,702.75	896,062.50	12,508,627.98	100.00	13,154,987.73	100.00	168.88	177.60

Source: own elaboration.

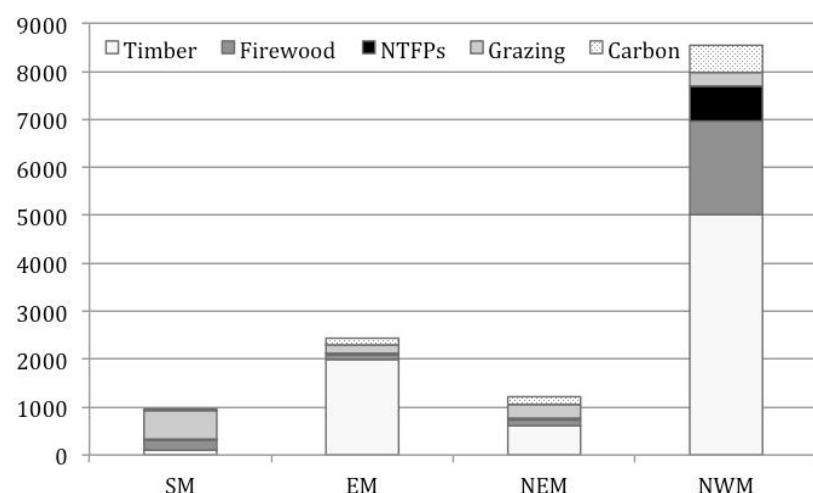
When analysing data on geographical basis, 65% of the total value for assessed products and services is referred to NWM sub-region (Figures 4.18).

Figure 4.18 – Estimated value of selected forest products and services in Mediterranean sub-regions (2010), M€

a. Carbon unit price: €4.18/tCO₂e



b. Carbon unit price: €15/tCO₂e



Source: own elaboration.

NWM sub-region hosts up to 87% of the total value for firewood and 92% for NTFPs in the Mediterranean region, but only 19% for grazing. The contribution of timber also prevails in the case of EM (88% of total value basically depending only on Turkey) and NEM (52%) sub-regions, while has a minor role (11%) for SM sub-region, where the main products/services mostly are firewood (23%) and, above all, grazing (64%). Such figures seem to confirm the relevance of forestry resources for local, rural communities especially in the South⁶¹, but at the same time raise concerns about potential risks for

⁶¹ According to Munir and Naggar (2012), for example, Moroccan forests cover around 20% of the national livestock feeding needs.

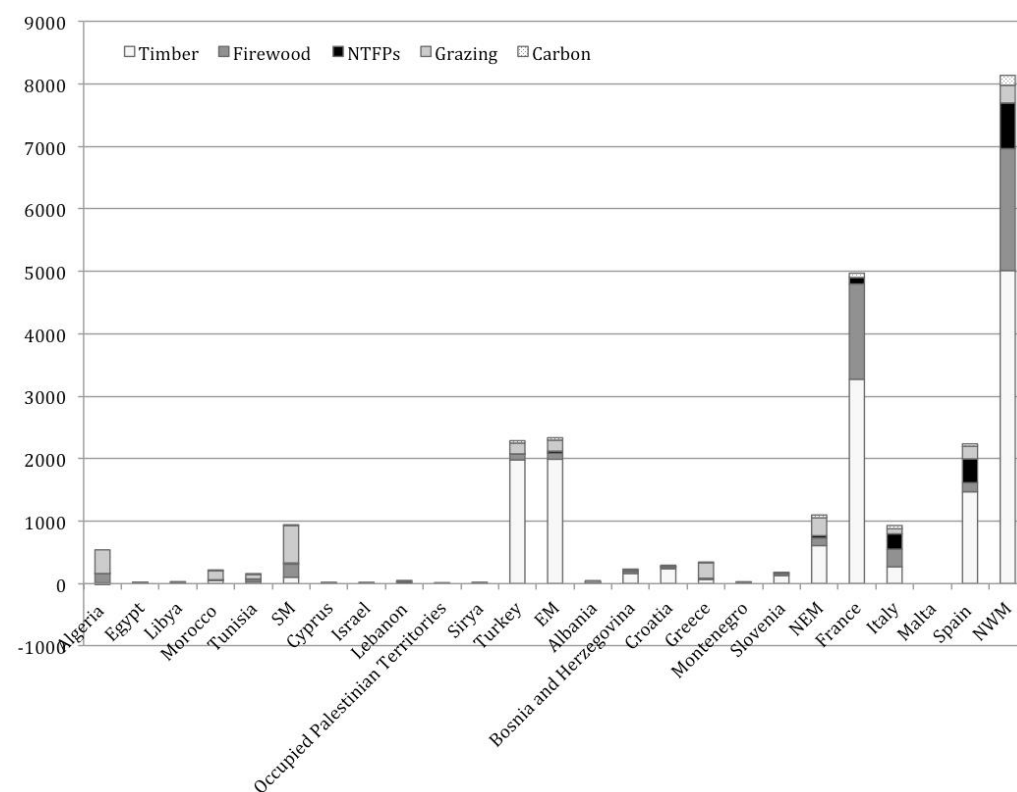
these resources. Overgrazing, for example, is a common phenomenon in many SM and EM countries, mainly linked to an increase in the stock of animals and the decline in the carrying capacity (Hadri and Guellouz, 2011). For example Munir and Naggar (2012) reported overgrazing activities for Morocco up to four times forests load capacity, while, according to official estimations by the local Department of Forests (2006), in Cyprus the number of sheep and goats grazing in the forests is about eight times higher than the number of animals officially allowed according to issued grazing licenses.

When considering data at country level (Figure 4.19) first of all high concentration can be observed: nearly 90% of the total value estimated is concentrated in five countries only, with different profiles. France plays a major role, contributing to 40% of the total value for the entire Mediterranean region. About 97% of the value for this country depends on timber products, both industrial timber (42% of the overall value for the Mediterranean region) and firewood (64%), while NTFPs show lower incidence on value at national level (2%) but still a relevant role at regional level (12.5%). As for services, grazing has not been estimated because of lacking data, while carbon-related services represent only 1% of total national value for forests, but almost half (47%) of carbon-related value at Mediterranean level. In a similar way, Spain (18% of total value) presents a predominant role of timber (66% of the total value of estimated products/services at national level), but NTFPs and grazing are much more relevant, covering about 26% of the total value estimated at national level. Timber provides a prevalent contribution (86%) also in the case of Turkey that is responsible for 26% of total timber production value at Mediterranean level. Grazing and firewood cover 8% and 4% of the value computed at national level respectively, while carbon contributes to 2%. Italy (7% of total value) and Algeria (4% of total value) present different situations compared to the three countries already presented because timber is not the main component in terms of value. In Italy timber, firewood and NTFPs are well balanced (ranging between 26 and 30% each) and altogether cover more than 85% of the total estimated value at national level. Conversely in Algeria 97% of the value is determined by grazing (70%) and firewood (27%), while carbon-related service is characterised by a negative value due to a negative variation of carbon stock.

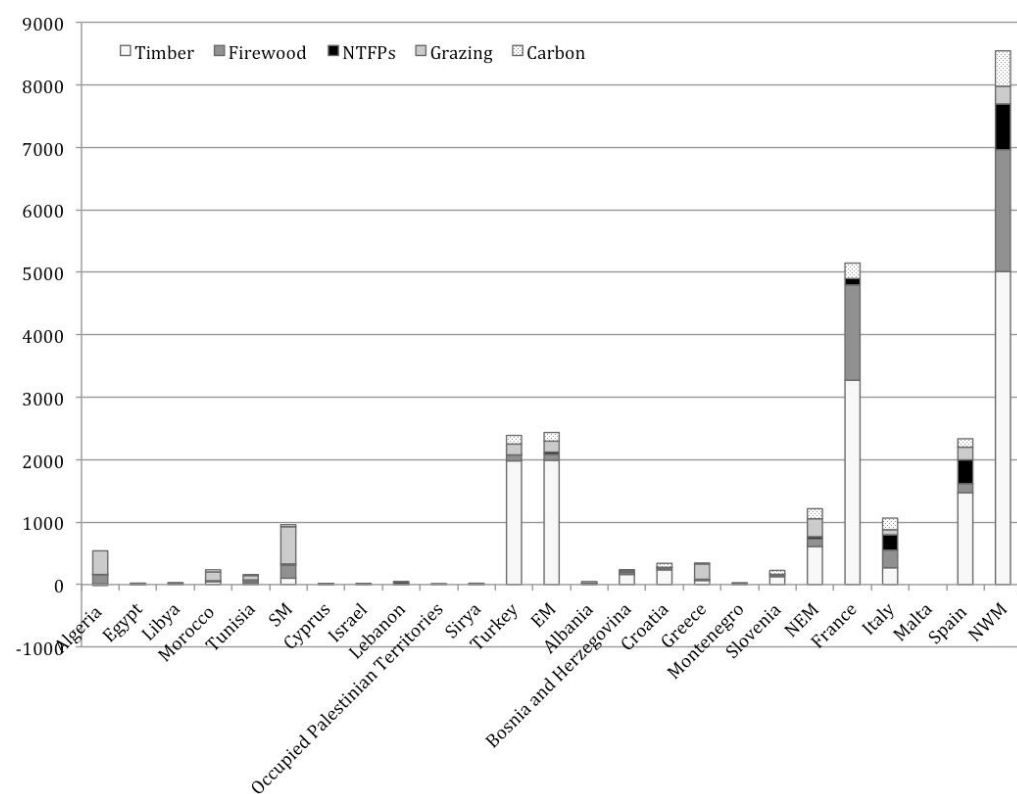
NEM sub-region contributes to 9% of the total estimated value at regional level, with Croatia and Greece as main contributors (57% of sub-regional total, 5% at Mediterranean scale). In the case of Croatia (as well as Bosnia Herzegovina and Slovenia) about 90% of the total value calculated at national level is linked to timber and firewood production. As for Greece, grazing has a dominating role, covering 73% of total national value, i.e. the highest relative incidence at Mediterranean scale, similar to relative values for Algeria and Egypt and higher of the average relative value for the SM sub-region.

Figure 4.19 – Estimated value of selected forest products and services in Mediterranean countries/sub-regions (2010), M€

a. Carbon unit price: €4.18/tCO₂e



b. Carbon unit price: €15/tCO₂e



Source: own elaboration.

4.2 Governance tools

When analysing different governance tools that might be adopted for Mediterranean forests three different sets of instruments have been taken into consideration: conventional funding initiatives for forestry, Payments for Ecosystem Services (PES) and Corporate Social Responsibility (CSR) initiatives.

These three sets are strictly interlinked: while conventional funding (i.e. direct payments, loans, financial and non-monetary compensations and tax reduction) represent one of the basis for allowing the active management of forest resources and their valorisation, PES represent one of the emerging tools to provide financial support to the sector. The development of PES mechanisms, indeed, may allow bringing to market some of the products/services that normally remain un-marketed. In the meanwhile, the increasing attention toward sustainable forestry requires that, also in the Mediterranean region, appropriate attention is given to the use of advanced CSR voluntary initiatives. For the Mediterranean region a shift from the conventional funding channels to new voluntary tools is much needed as an answer both to the growing maturity and responsibility of civil society and to the needs for more efficient and effective tools for dealing with natural resources management problems.

4.2.1 Conventional funding

Financing forest management remains a challenge, but it is crucial for ensuring the production of multiple goods and services, as well as sector innovation and development opportunities. Economies in Mediterranean countries are strongly interdependent and SM and EM countries (and to a certain extent many NEM countries as well) have a level of dependence on Northern countries for financial flows in terms of aid, investments and informal flows (e.g. remittances) (World Bank, 2011; FAO, 2013).

In general terms, when considering forest financing sources, they can be distinguished according to their type - i.e. public and private ones - and scale - i.e. national and international (Table 4.18).

Table 4.18 – Forest financing sources by type and scale

	National	International
Public	• General government revenues • Revenues from State-owned forests • Forest sector fiscal revenues	• Bilateral Aid Agencies • Multilateral/intergovernmental financing institutions • Targeted programs
Private	• Forest owners • Communities • Forest industry • Institutional and individual investors • Philanthropic funds and donors • Non-Governmental Organisations • Microfinance institutions	• Institutional and individual investors • Forest industry • Philanthropic funds and donors • Non-Governmental Organisations • Guarantees/Insurances

Source: own elaboration from Simula, 2008, UN CPF, 2012, and Matta, 2013.

The general trend observed at global level during the last years indicates that private funding sources are being increasingly used and, at the same time, new financing mechanisms - combining public and private actors and funds - are being developed and implemented. Forms of financing are dynamic over time and new types of investment

partnerships are being set up: between governments, international donor agencies, civil society, local community and the private sector forest investors. Conversion of public forest institutions into semi-autonomous commercial enterprises has been used to improve self-financing from the forest sector. In the meanwhile, the establishment of national forest funds for the mobilization of additional funds from other sources has emerged.

As for public funds, national public financing represents the major source for forestry activities in many countries, and in general includes government budgetary allocations to official forestry institutions/bodies as well as revenues generated from State-owned forests⁶². In general access to information on national flows for forest financing is difficult and more limited than external sources. National forest programmes offer one step in streamlining forest management and priorities, but at this point few analyses exist on aggregate national trends in forest financing. According to FAO (2010), in 2005 on average more than 90% of public expenditure for forestry in the Mediterranean countries was from domestic funding, with a 99% peak for EM sub-region. NWM countries are the only ones below a 90% threshold (Table 4.19).

Table 4.19 – Public expenditure in forestry in Mediterranean countries (2005)

Country	Public expenditure (€1,000)					
	a. Domestic funding		b. External funding		Total funding (a+b)	
	Expenditures	% on total	Expenditures	% on total	Expenditures	% on total
Algeria	82,757	4.1%	7,582	3.8%	90,338	4.0%
Egypt	4,902	0.2%	0	0.0%	4,902	0.2%
Morocco	138,546	6.8%	11,537	5.8%	150,082	6.7%
Tunisia	21,832	1.1%	4,366	2.2%	26,198	1.2%
SM sub-region	248,036	12.2%	23,484	11.9%	271,520	12.1%
Cyprus	30,965	1.5%	79	0.0%	31,044	1.4%
Israel	na	na	na	0.0%	10,279	0.5%
Lebanon	2,739	0.1%	3,053	1.5%	5,791	0.3%
Syria	27,699	1.4%	189	0.1%	27,888	1.2%
Turkey	372,396	18.3%	351	0.2%	372,748	16.7%
EM sub-region	433,799	21.3%	3,673	1.9%	438,306	19.6%
Albania	6,914	0.3%	846	0.4%	7,759	0.3%
Croatia	641	0.0%	0	0.0%	641	0.0%
Serbia	5,926	0.3%	618	0.3%	6,544	0.3%
Slovenia	18,737	0.9%	660	0.3%	19,396	0.9%
NEM sub-region	32,217	1.6%	2,124	1.1%	34,340	1.5%
France	309,621	15.2%	43,961	22.2%	353,583	15.8%
Italy	1,015,107	49.8%	124,883	63.0%	1,139,989	51.0%
NWM sub-region	1,324,729	65.0%	168,844	85.2%	1,493,572	66.8%
Total Mediterranean	2,038,780	100.0%	198,125	100.0%	2,236,905	100.0%

*Notes: na = not available; data not available for Libya, Occupied Palestinian Territories, Bosnia and Herzegovina, Greece, Montenegro, Malta and Spain.

Source: own elaboration from FAO, 2010.

⁶² Revenues might include (UN CPF, 2012): (i) fees and taxes collected for: (a) the allocation of land, forests and contracts to harvest timber and plant and animal wildlife, or on the circulation of such harvested wood, and (b) payments for licenses and stamp duty for the transporting, processing and marketing of wood, as well as stumpage from State-owned forests; (ii) taxes and charges (value added tax (VAT), export duties, social charges, etc.); (iii) imposition of fines, confiscation and damages for infringements of the law; (iv) sale of plants and plant material from nurseries and other forest products; (v) issuing of tour operators' licenses to harvest and market plant and animal wildlife; (vi) entrance fees paid by visitors to protected natural areas.

National public funding tends to be more present in those countries where State control - in terms of ownership and management - over forest resources is stronger. This is the case of most of countries within the SM sub-region, as well as Turkey. When considering Tunisia, for example, the proposal of a national tax on forest products dates back to 1936, while a National Forest Development Fund was proposed in 1988 but never implemented. Today 68% of direct investments in the forest programme of the Ministry of Agriculture depend on State budget. The remaining proportion of direct investments, as well as 100% indirect investments, rely on external (i.e. international) financing sources (Ministère de l'Agriculture, 2013). The case of Turkey is even more relevant and is described in Box 4.3. In Croatia the National Forest Law imposes since 1999 a 'green tax' of 0.07% of total earnings to all taxpayers. The tax rate has been reduced to 0.0265% in 2012 (Posavec, 2013). Revenues are then used to feed a national forest fund that supports sustainable forest management activities and are distributed according to forest ownership: 22% goes into funds for privately owned forests, 78% for state-owned forests. During the 1999-2004 period €30M have been collected on average every year (Coello, 2011).

Box 4.3 – National public financing for forests in Turkey

In Turkey around 99% of forests are public. The General Directorate of Forestry (GDF) is responsible for the management and operation of State forests, and the supervision of management operations in non-State owned ones. The GDF manages a *Special Budget*, consisting of revenues from forest rent and usufructs and other concessions (e.g. mining), as well as from afforestation (via credit support and direct project financing) and aids from the Ministry of Treasury, and a *Revolving Budget*, consisting of revenues from sales of wood and non-wood forest products, renting fees for recreational areas, sales of materials from nurseries, etc.

In 2012 total GDF funds amounted to €1.47Bln, €0.65Bln (44%) of Special Budget revenues, and €0.82Bln (56%) of Revolving Capital Budget revenues. Total funds for 2013 have been estimated around €1.60Bln, with €0.74Bln of Special Budget revenues and €0.86Bln of Revolving Capital Budget revenues.

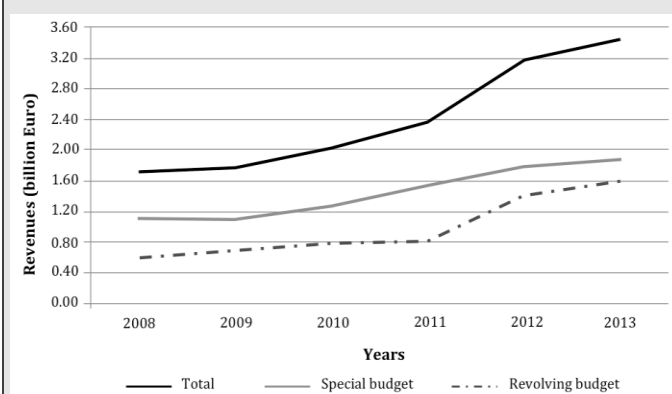
The main components of GDF total annual financing are revenues from wood sales and aids from the Ministry of Treasury that together cover more than 75%. Permission and tenure revenues increased very much during the last years and play a relevant role, being equivalent to a value close to the sum of all the remaining items of revenues (Table 4.20). Total National funds have grown during the last years (Figure 4.20): a +120% increase was observed between 2008 and 2013 as a result of a +50% increase for the Special Budget and +170% for the Revolving one.

Table 4.20 – Share of revenues in the GDF budget

Country	Revenues (Euro)	% on total Sub-Budget	% on total Budget
a. Special Budget			
Permission from forest areas	0,16	25%	12%
Afforestation	0,05	8%	4%
Supporting forest villages	0,03	5%	2%
Other Equity Revenues	0,02	3%	1%
Treasure Ministry Aid	0,38	59%	28%
Sub-total a	0,65	100%	47%
b. Revolving Capital Budget			
Roundwood sales	0,71	96%	51%
Sapling sales	0,02	3%	2%
Non-wood forest product sales & Recreational areas	0,01	1%	0%
Income, service and other	0,08	11%	6%
Sub-total b	0,74	100%	53%
Total budget (a + b)	1,39		100%

Source: own elaboration from Otrakçier, 2012.

Figure 4.20 – Turkish GDF National Budget trend, 2008-2013



Source: own elaboration from Otrakçier, 2012.

As a complement to national sources, Turkey also gets international contribution for forestry in the frame of both bilateral and multilateral Official Development Assistance (ODA) initiatives. In particular GDF is supported by multilateral funds from the GEF, World Bank, and European Union, as well as bilateral funds from Germany, Japan, Finland and other Countries. On average annual ODA contributions received by Turkey between 2008 and 2010 amounted to about €0.35M, i.e. about 25% of total revenues in the GDF budget. In the meanwhile Turkey is one of the 39 donor countries providing financial support to the GEF and in 2011 contributed with some €1.07Bln to ODA towards other countries.

Pettenella
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and
10.4.3.3)

Although national funding sources play an important role in many countries, the main component of public funds is represented by Official Development Assistance (ODA) i.e. flows of official financing that can be distinguished into bilateral, when finance is disbursed by a government development agency of one country, and multilateral, when finance is disbursed by government development agencies from two or more countries, or by multilateral institutions such as the World Bank or the United Nations. According to OECD (2008) public official aid to forestry has remained stable in real terms over the past decade, with an average value of about 500 MUS\$ between 1995 and 2008, and up to 800 US\$ between 2008 and 2010 (UN CPF, 2012). On the other hand, since total ODA has risen sharply, the share of aid to forestry has declined: it represented 0.8% of the development assistance funds in the mid-2000's compared to 1.1% at the end of the 1990s. It shall be noticed, however, that data provided by OECD through its Development Assistance Committee (DAC) Credit Reporting System may be incomplete, providing just a partial view because of the weaknesses in DAC members' reporting systems and the presence of several gaps in the past data (Simula, 2008).

Table 4.21 summarises ODA disbursements for forests in Mediterranean countries for the 2002-2010 period. While total ODA for the region show a waving trend, their relative incidence on total ODA at World level diminished from 3% to 1.4%. Mediterranean countries today play a marginal role among recipients of forestry ODA disbursements, while other regions show increasing trends: this is the case for example of South America, Sub-Saharan Africa and Asia, where forest investments are mostly linked to production activities (Figure 4.21). While in the past SM sub-region used to

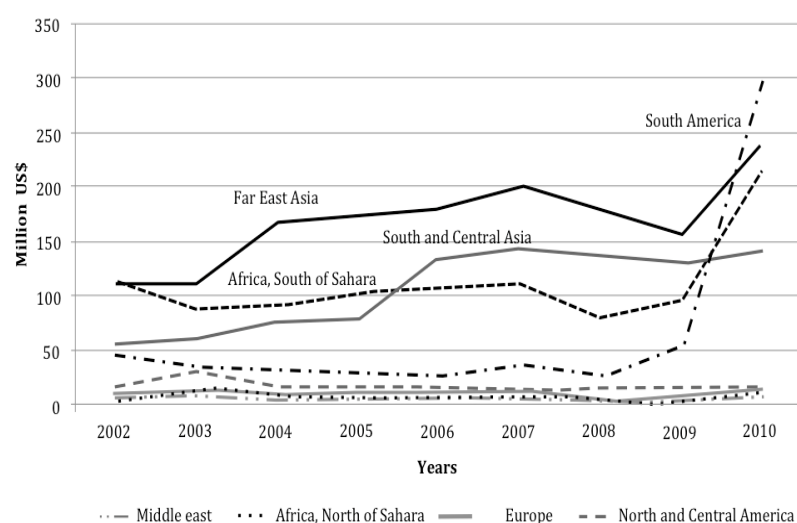
receive more than 60% of total ODA directed to Mediterranean countries, in the last years NEM sub-region prevailed.

Table 4.21 – ODA 3-year average disbursements in 2010 M US\$, per Mediterranean recipient country

Country	2002-2004	2005-2007	2008-2010
Algeria	0.01	0.19	0.08
Egypt	0.00	0.03	0.04
Morocco	0.38	1.82	0.76
Tunisia	7.03	7.59	2.70
North of Sahara, Regional	0.06	0.00	0.37
SM sub-region	7.48	9.63	3.95
Lebanon	0.01	0.05	0.94
Syria	0.02	0.00	0.03
Turkey	0.67	0.34	0.35
EM sub-region	0.70	0.39	1.32
Albania	0.69	1.02	3.08
Bosnia and Herzegovina	1.08	1.25	1.01
Montenegro	0.00	0.37	1.07
Serbia	2.09	2.09	1.01
NEM sub-region	3.86	4.73	6.17
Total Mediterranean	12.04	14.75	11.44

Source: own elaboration from UN CPF, 2012.

Figure 4.21 – Recipients of Forestry ODA Disbursements, 2002-2010 (MUS\$)



Source: own elaboration from OECD, 2013.

Private funding for forests remains limited in the Mediterranean region.

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and

The key actors under private funding are forest owners and enterprises, the owners of the natural resources on those lands, or users with customary or granted access to forest resources. They can be large landowners, small farmers and rural communities investing in natural and planted forests, mostly for productive purposes. Apart from self-financing, private financing includes two additional sources (UN CPF, 2012): (i) the capital market, including institutional

investors or loans from national or international banks, sometimes with subsidies; and (ii) the informal capital market, which comprises moneylenders and other intermediaries.

A crucial role in the private sector is played by Foreign Direct Investment (FDI) and Domestic Direct Investment (DDI). During the last 30 years FDI showed a steep increase in the forest sector (El Lakany *et al.* 2007, Simula 2008) and probably exceed ODA contributions. According to IADB estimations (2004) the global yearly amount of direct private investments in the forest sector (forestry, industry and trade) exceeds 60 billion US\$, representing about 1% of total direct investments worldwide.

The bulk of private forest investments remain domestic, however data on DDI are even less organic and clear than those for FDI. Therefore there is still a need for extensive coordinated efforts to collect and extract national data on the private sector's investments.

Although it is difficult to identify the share of FDI and DDI going toward the forestry sector, few doubts exist about the fact that FDI represent the main financial flow to the NEM sub-region, while remittances from people living abroad were the main financial flow to SM countries in 2007–2010. The importance of FDI is increasing also in the Maghreb area and EM countries, contributing to the balance of external accounts (FAO, 2013). Southern and Eastern Mediterranean countries⁶³ showed one of the highest FDI/GDP percentage ratio in the last years (4.19), just behind Europe & Central Asia (4.53%) and the European Union (4.65%). Notable differences can be observed across countries: Lebanon presents the highest ratio (14.27% respectively) while Algeria scores the lowest ratio (1.37%). In terms of trend, a similar picture emerges: Lebanon shows the highest increase (9% respectively) while Algeria shows the lowest increase (0.6%) (Sekkat, 2012).

As for remittances, FEMIP (quoted by Florensa and Aragall, 2012) has identified the main corridors of remittances between the EU and SM countries. The Spain-Morocco corridor is now emerging as a the most relevant one, in addition to traditional corridors such as France-Algeria, France-Morocco or Germany-Turkey ones. There are few specific studies on the investment of remittances in agriculture and forestry, and no unanimity exists when assessing the effects of transfers (Nyberg Sørensen, 2004). In Morocco, for example, Florensa and Aragall (2012) observed that on the one hand, investment priorities of migrants have focused more on the creation of small-sized businesses rather than on agricultural investment, on the other, migrants' investments have sometimes contributed to modernised certain traditional crops.

Apart from FDI and DDI, other private funding sources include many different finance tools for supporting forestry.

⁶³ Sekkat (2012) considered a set of 11 countries, including: Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Syria, Tunisia, Occupied Palestinian Territories, and Turkey.

Conventional finance instruments include grants, loans, credits, equity investments, co-funding, guarantees, insurances and savings. Moreover new instruments like microfinance, leasing, remittances, and payments for environmental services (PES) are emerging. Ecosystem services and non-wood forest products in particular represent innovative markets for the forest sector and are stimulating the development of new financial tools. In particular the case of PES will be analysed in detail in the next paragraph.

New forest financing tools involve both traditional (and for-profit) investors, and the so-called new 'soft' investors (UN CPF, 2012) i.e. organisations such as non-governmental organizations (NGOs), foundations, philanthropic organizations and others, aiming to social and economic returns rather than fiscal ones.

Due to the emergence of innovative instruments of forest finance based on payments for environmental services, some forest investments that were financed mainly by public institutions are becoming private sector investments. Projects aiming to Reducing emissions from deforestation and forest degradation (REDD projects) are probably the most remarkable example of this trend. At the moment they are financed by bilateral or multilateral ODA, however, this may partly change in the future: the interest of profit-oriented (private) investors will increase when REDD projects become eligible for credits for international carbon trading.

With regard to EU Mediterranean countries conventional funding resources for the forestry sector include EU Rural Development funds, in particular the European Agricultural Fund for Rural Development (EAFRD). According to estimations performed by the European Commission, during the programming period 2007-2013 forestry-specific measures (i.e. measure 122 and axis 2 measures) and forestry-related ones (i.e. other axis 1 measures and axis 3 actions) were supposed to make available up to €16Bln in total, 50% coming from the Community budget (EAFRD). These amounts correspond respectively to 9 % of the EAFRD funding for the same programming period and 7-8 % of the total amount of financial resources made available for implementation of forestry-related measures in the context of implementation of rural development programmes (EC, 2009). When analysing the real financial uptake of Rural Development measures, however, it can be observed that, at the end of the programming period, only 42% of the EU funding was realised (Table 4.22). The situation for forestry-specific measures is even worse. Taking into consideration Forest-environment payments (measure 225⁶⁴) as an example, had the lowest uptake among the forestry measures and, as highlighted by Figure 4.22, has been marginally activated in Mediterranean countries (Greece and Italy). Measure 224 (Natura 2000 payments⁶⁵) had a more frequent uptake and has been more frequently implemented also within Mediterranean countries (Cyprus, France, Italy, and Spain) (EC, 2009) nevertheless only 16% of the funding was used (CEPF, 2013). Figures might also be lower at single country scale: for example in Italy only 4.1% of expected expenditures for Measure 224 have been used

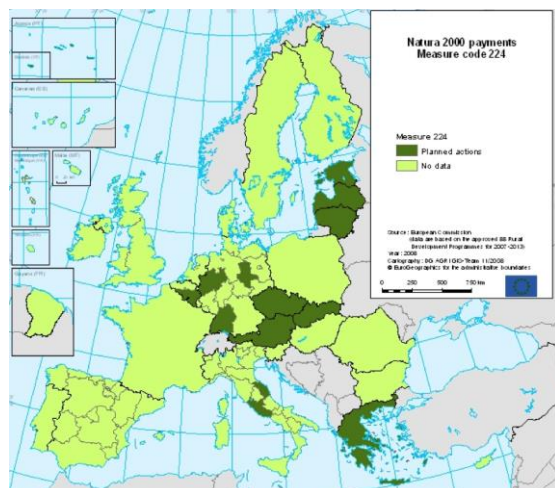
⁶⁴ Measure 225 aims to compensate forest-environment commitments going beyond relevant mandatory requirements (set by the Member States or Regions) and running for 5-7 years.

⁶⁵ Measure 224 aims to compensate costs incurred and income foregone resulting from the restrictions of the use of the forest land due to the implementation of Directives 79/409/EEC and 92/43/EEC in the area concerned.

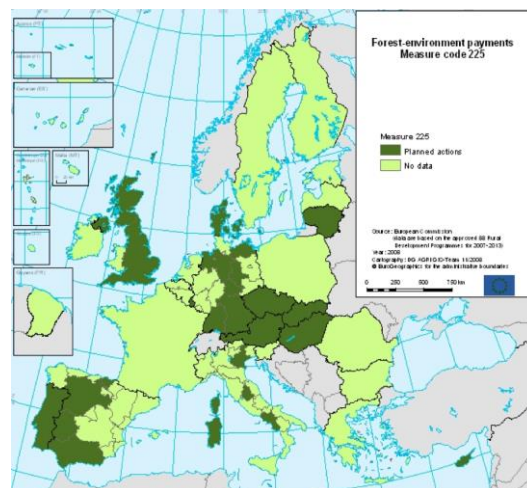
until now (Ottaviani, 2013). Low uptake rates and limited use of available funding could lead to the inclusion of a lower number of forestry-related measures in the future national programmes and the possibility that funding actually allocated is used differently (i.e. outside the forestry sector).

Figure 4.22 – Nature 2000 (Measure 224) and Forest environment (Measure 225) payments under the European Union Rural Development Regulation for the 2007-2013 period

Measure 224



Measure 225



Source: EC, 2009.

Table 4.22 – European Agricultural Fund for Rural Development (EAFRD) - Comparison of planned and realised uptake for forestry-specific measures (October 2013)

Expenditure plans in 2007 (€M)				Implementation of EAFRD expenses											
				2007-2009		2007-2010		2007-2011		2007-2012					
	Public	EAFRD	Private	Total	Realised by 2009 (€M)	% of planned (09/07)	Realised by 2010 (€M)	% of planned (10/07)	Updated plan 2011 (€M)	Realised by 2011 (€M)	% of planned (11/11)	Updated plan 2012 (€M)	Realised by 2012 (€M)	% of updated planned (12/12)	% of originally planned (12/07)
Axis 2 measures with relevance to forestry															
221 First afforestation of agricultural land	3,659.4	2,410.7	576.0	4,235.3	487.9	20.2%	682.1	28.3%	2,192.6	884.2	40.3%	2,068.4	1,102.1	53.3%	45.7%
222 First establishment of agroforestry systems	32.4	22.7	14.4	46.8	0.0	0.0%	0.0	0.1%	18.7	0.2	1.0%	11.0	0.4	3.6%	1.8%
223 First afforestation of non agricultural land	596.2	360.8	181.8	778.0	21.6	6.0%	48.7	13.5%	327.1	73.6	22.5%	265.8	101.0	38.0%	28.0%
224 Natura 2000 payments	158.6	110.6	0.0	158.6	3.7	3.3%	7.2	6.5%	92.5	12.9	13.9%	64.8	18.4	28.4%	16.6%
225 Forest-environment payments	438.8	265.3	6.4	445.2	10.9	4.1%	17.5	6.6%	218.2	25.4	11.6%	193.6	34.4	17.8%	13.0%
226 Restoring forestry potential and prevention	2,474.2	1,553.0	307.0	2,781.2	217.6	14.0%	389.6	25.1%	1,700.5	663.0	39.0%	1,578.2	862.2	54.6%	55.5%
227 Non-productive investments	1,379.8	808.9	216.9	1,596.7	71.2	8.8%	131.4	16.3%	746.9	212.5	28.5%	748.2	315.4	42.2%	39.0%
Axis 2 forestry measures	8,739.4	5,532.1	1,302.4	10,041.8	812.9	14.7%	1,276.5	23.1%	5,296.5	1,871.8	35.3%	4,930	2,434.0	49.4%	44.0%
Axis 1 forestry measures															
122 Improvement of the economic value of forests	1,000.6	652.1	1,010.0	2,010.7	50.8	7.8%	91.4	14.0%	591.7	136.8	23.1%	507.5	178.0	35.1%	27.3%
Total for eight forestry-specific measures	9,740.0	6,184.2	2,312.4	12,052.4	863.7	14.0%	1,367.9	22.1%	5,888.2	2,008.6	34.1%	5,437.5	2,612.0	48.0%	42.2%

Source: own elaboration from CEFF, 2013.

4.2.2 Payments for Ecosystem Services

Although many policy documents emphasize the potential of PES to enhance the role of Mediterranean forests and support rural development, PES initiatives are relatively infrequent in the region: most of them regard biodiversity, carbon and watershed services. A review of forest-based PES initiatives in the Mediterranean basin has been performed based on available literature. Results are reported below.

As highlighted by Bennet *et al.* (2013) six **water-related PES** initiatives have been inventoried by Ecosystem Marketplace: five of them are already implemented (three in France and two in Italy), while the last one is under development in Spain. They include some major examples that are largely reported by thematic literature (Box 4.4). According to the same source, in 2011 there were 205 programmes⁶⁶ for watershed services implemented worldwide (plus another 76 under development), covering a total area of 117Mha and generating transactions for a total value of about €6.6Bln. During the 1977-2011 period global transactions totalised around €53.4Bln and projects were developed over an area of 195Mha. An extensive literature review for the Mediterranean region allowed to identify a total number of 18 PES or quasi-PES initiatives in the Mediterranean region, 17 of which are concentrated in Northern countries (almost exclusively NWM ones). It is to be observed that only in few cases these initiatives really refer to Mediterranean forest ecosystems. It was possible to identify only one example for SM countries (Morocco) (Table 4.23). The potential for developing markets for watershed services in the SM and EM sub-regions is a very promising one, especially when considering the critical role played by mountain forests in the Near-East (the so-called water castles), nevertheless watershed PES in the area are still in their infancy (FAO, 2010a).

The list presented in Table 4.23 does not intend to be exhaustive as it is very difficult to monitor all the initiatives going on. At the same time many initiatives in place may have some similarities with PES mechanisms but do not fully qualify as PES.

Box 4.4 – Water-related PES in Mediterranean countries: the case of Vittel (France) and Romagna Acque SpA (Italy)

Mineral water bottler Vittel has launched a PES scheme for improving water quality in 1993. The scheme operates on a 5,100 ha catchment in the Vosges Mountains area (Eastern France) and provides 27 farmers with a combination of different payment tools - cash payments, technical assistance, reimbursements, etc. - in exchange for the adoption of best practices while performing dairy farming. The company has signed long-term contracts (18-30 years) with each farmer and payments are defined on a case-by-case basis, while land use and water quality are monitored over time. Not considering transaction costs, the total costs for the company in the 1993-2000 period were around €24.25 M, corresponding to €980/ha per year or €1.52/m³ of bottled mineral water (Perrot-Maître, 2006; Profokieva *et al.*, 2012).

Romagna Acque SpA is a consortium of municipalities offering tap water supply services in Romagna area (North-East of Italy). About 50% of water supplied by the company derives from Ridracoli dam, in the Appennines. In 2001 Romagna Acque SpA started a PES programme to co-operate with local forest owners and managers (both private and public) to adopt appropriate forest management practices that allow reducing soil erosion (up to 10,000 m³/year soil erosion is avoided) and dam sedimentation. Today the PES programme operates in almost all the catchment area, involving most of forest owners in the region and generating €0.5-1M per year. Initial payment amount was about €200/ha, then reduced to €100/ha, i.e. 3-7% of the water bill revenues (Pettenella *et al.*, 2012; Profokieva *et al.*, 2012).

⁶⁶ This number includes different types of projects in many sectors and is not limited to forest projects.

Table 4.23 – Water PES initiatives in the Mediterranean Region

Scheme name	Country	Year	Service provided	Voluntary (V)/ Mandatory (M)	Conditionality
Vittel ^a	France	1993	Improved water quality and lower business risk	V	Grazing control and limited use of chemical inputs
Naussac and Villerest dams schemes ^b	France	na	Improved stream flow, avoided sedimentation and flood protection	V	Dam operations supporting ecological flows in the Loire and Allier rivers
Syndicat de Distribution d'Eau de la Corniche des Maures ^{c, d}	France	2013	Tap water provision	V	Forest management and fire prevention
Centre Régional de la Propriété Forestière (CRPF) de Midi Pyrenees ^d	France	na	Improved water quality	V	Adoption of good forest management practices and less intensive harvesting operations
Municipality of Masevaux (Haut Rhin) ^d	France	na	Tap water provision	V	Adoption of good forest management practices to protect mountain spring catchments, e.g. bush clearing, cable logging, use of biodegradable chainsaw oil, etc.
Syndicat des Eaux des Moises (Haute-Savoie) ^d	France	na	Improved water quality	V	Adoption of good forest management practices to protect mountain spring catchments
Gestofo ^d	France	na	Improved water quality	V	Adoption of good forest management practices to protect spring catchments
Municipality of Saint Etienne and Société des Eaux de Volvic ^d	France	2012	Improved water quality and tap water provision	V	Adoption of good forest management practices to protect mountain spring catchments
Forest Infiltration Areas ^e	Italy	2008	Groundwater recharge	V	Establishment and maintenance of Forest Infiltration Areas
Veneto Region Tap water provision ^f	Italy	2010	Tap water provision	V	New hydraulic infrastructure or forest operations close to areas of slope instability, in order to protect the downstream population.
Piedmont Tap water provision ^f	Italy	1997	Tap water provision	V	Projects or infrastructures aimed to improve local land management practices
Romagna Acque Spa ^f	Italy	1999	Lower soil erosion, Avoided dam sedimentation, improved water quality	V	Forest management change towards close-to-nature silviculture
Hydroelectric power generation in Italy ^f	Italy	1953	Forest hydrological protection	M	Forest operations to reduce erosion, landslides and forest instability
Mineracqua (Mineral water company) ^f	Italy	na	Land management change to reduce pollutants within watershed	V	Set aside forest land to improve its natural evolution; to reduce the grazing intensity in the catchment areas, as well as to convert meadows into set-aside lands, to leave lands to their natural evolution or to change intensively cultivated farm- land to organic farming systems.
Comunità Montana Media Valle del Serchio ^f	Italy	na	Improved slope stability and flood control	V	Forest hydrology management practices including cleaning of water supply net, reforestation, deadwood collection, etc.
Sebou river basin ^{g, h}	Morocco	na	Water provision, additionally biodiversity conservation	V	Adoption of good forest/agriculture management practices and development of tourism and environmental education activities
Sela on Carst ^d	Slovenia	na	Forest hydrological protection and water provision	M	Regeneration of forest stands and abandonment of traditional coppice management
Special Plan for the Upper Guadiana (SPUG) ^e	Spain	2009	Groundwater recharge	V	Reforestation or forest plantation

NOTE: na = not available

Source: own elaboration from ^aPerrot-Maitre, 2006; ^bEPTB-Loire, 2013; ^cCRPF-Provence Alpes Côte d'Azur; ^dSylvamed, 2012; ^eLeonardi, 2013; ^fPettenella *et al.*, 2012; ^gFAO, 2010a; ^hWWF, 2011; Peters-Stanley *et al.*, 2012; Bennet *et al.*, 2013.

As for **Carbon-related PES**, Peters-Stanley *et al.* (2013) identified 162 different forest carbon projects worldwide, that allowed trading 28 MtCO₂e and totalised €174.8 M in

2012. It shall be remembered that within the EU the most relevant market tool intended for the reduction of Greenhouse Gasses (GHG) emissions is the European Union's Emissions Trading Scheme, EU ETS, adopted with Directive 87/2003 and operative since 2005. The scheme is organised as a cap-and-trade system and imposes an emission threshold (cap) to the most energy intensive economic segments. However, companies can reduce their emissions by energy savings or reducing their production levels, and selling (trade) to other companies emission credits they do not use. The EU-ETS scheme does not allow investments in the primary sector - including forestry - to generate credits to be sold on the EU market. This explains why European buyers purchase the largest volume of voluntary carbon credits from non-EU projects, while the proportion of credits transacted from voluntary forestry projects based in Europe represents about 2% of global market share (Peters-Stanley *et al.*, 2013). This marginal *quota* is due to European countries' obligation or voluntary commitment under articles 3.3 and 3.4 of Kyoto Protocol, to report some Agriculture, Forestry and Other Land Use (AFOLU) sector emissions within their national accounts. Since national emission performances are accounted and regulated at country level, most domestic project-level reductions help countries to meet their Kyoto Protocol targets. As a consequence such projects are not eligible to generate offsets in the voluntary markets, otherwise there might be the risk of 'double counting', i.e. selling twice the same offset⁶⁷. Nevertheless in some EU Mediterranean countries specific initiatives have been developed to produce and sell offsets from domestic forestry programs. This is the case for example of CARBOMARK Program⁶⁸ in Italy, while in France in 2010 the Government stated that voluntary forestry actions were to be considered in addition to national actions (Peters-Stanley *et al.*, 2013).

As for non-EU Mediterranean countries, with the only two exceptions of Croatia and Turkey, all of them are non-Annex I countries with reference to the Kyoto Protocol. At the present Albania hosts the only Europe-based project under the Clean Development Mechanism (CDM) of the Kyoto Protocol (Box 4.5). With reference to SM countries, in 2012 Morocco became a partner country of the United Nations REDD (UN-REDD) Programme, thus becoming eligible for receiving targeted support as well as knowledge sharing facilitated by the Programme. As a Partner country Morocco may also be invited to submit a request to receive funding for a National Programme in the future. For the purposes of this the Country has to finalise first a robust Monitoring, Reporting and Verification (MRV) system at national level. Tunisia too is listed under 'Other Partner Countries' receiving support from the UN-REDD Programme⁶⁹. Although these initiatives are still under the umbrella of multilateral ODA, in the future they might open the way for private investments operating in carbon projects as well as in PES projects in general.

Box 4.5 –CDM forest project in Albania

The 'Assisted Natural Regeneration of Degraded Lands in Albania' project is an Afforestation/Reforestation (A/R) CDM project implemented in Albania since 2004. Supported by the Italian Government, through the International Bank for Reconstruction and Development as Trustee of the BioCarbon Fund, the project is implemented in 5 different regions of Albania, covering 10 different districts mainly in the central and northern part of the country. It consists of

⁶⁷ In theory such offsets could be taken into consideration in countries/regions where government explicitly commits to recognize voluntary action by cancelling compliance units in equal measure to voluntary action – a provision that has not seen any government uptake to date (Peters-Stanley *et al.*, 2012).

⁶⁸ See: <http://www.carbomark.org/>.

⁶⁹ See: http://www.un-redd.org/Partner_Countries/tabid/102663/Default.aspx

reforestation activities, in particular it includes: (i) planting at 200-500 seedlings per ha to enrich species diversity and to stabilize highly eroded areas; (ii) silvicultural practices (vegetative cutting to promote growth such as coppicing, cleaning and thinning); and (iii) protection of land from grazing by fencing to promote natural seed sources to enable natural regeneration and regrowth. Activities cover a total area of 6,272.36 ha distributed over 24 communes: about 14% of this area consists of Mediterranean *maquis*. The project takes place on degraded pasture shrub areas that have been cleared from vegetation in the past. About 85% of the project land is located on mountainous and hilly areas and extend up to 30% slopes that cover more than two thirds of the project area.

The project is carried out within the context of the World Bank Natural Resources Development Project (NRDP) in Albania and is supposed to be based on a 20 years crediting period, renewable twice for a total crediting period of 60 years all over the project duration. The expected amount of reductions from the initiatives is 22,964 metric tons CO₂ equivalent per annum. Since the launching, additional Government partners have joined the project, i.e. Spain, Japan, France, Canada and Luxembourg (UNFCCC, 2013).

Some PES initiatives exist also with regard to **biodiversity conservation**. These initiatives rarely can be fully qualified as PES initiatives and they normally are considered as quasi-PES. Madsen *et al.* (2011) identified a total number of 45 active programmes and 27 initiatives under development, covering a total area of 187,000 ha and generating revenues between €1.9 and 3.2 Bln. Just one of the reported projects regards Mediterranean countries, i.e. CDC Biodiversité's Habitat Banking project taking place in Plaine de Crau (Provence-Alpes-Cotes d'Azur region) in the Western part of Marseille region. The pilot site however is not a forest and consists of the last semi-arid steppe in Western Europe (Eftic, 2010).

When considering other sources, some examples of biodiversity PES can be observed in Spain, under the form of quasi-PES such as in the case of forest reserves and land stewardship contracts (Russi *et al.*, 2011; Profokieva *et al.*, 2012) (Box 4.6).

Box 4.6 – Biodiversity PES in Mediterranean forests: the experience of forest reserves and land stewardship contracts in Catalonia (Spain)

Russi *et al.* (2011) reported different cases of **forest reserves** established in Catalonia (Spain). These are areas where active forest management are not performed in order to protect valuable ecosystems and conserve mature stands. Reserves can be established by land purchase or acquisition of logging rights, and are generally financed by public entities, non-government organisation and/or private entities (e.g. foundations). Examples in Catalonia include (Russi *et al.*, 2011; Profokieva *et al.*, 2012):

1. *Girona Provincial Government*: Girona Provincial Government has created a network of 43 mature forests (558 ha) that remained unmanaged during the last 50 to 100 years. Both private landowners and municipalities are involved and they receive a reward to compensate their profit loss due to avoided harvesting operations. Losses are calculated on the basis of approved forest management plans. The programme is co-financed by the Provincial Government and private donors;
2. *Montseny Natural Park*: private and public forest owners in the area of Montseny Natural Park (Girona) can participate to a PES programme financed by Caixa Girona - a regional financial institution - and get economic incentives for protection of mature forests for at least 25 years. Rewards are computed according to the opportunity cost of conservation and are provided through public tenders open to owners meeting specific basic - e.g. absence of exotic species, slopes lower than 60% - and prioritising requirements - e.g. number of old (i.e. > 100 years) trees, presence of dead-wood, etc. Payments are capped: the maximum funding for 25 years amounts to €133,000 for private owners and €200,000 for municipalities;
3. *Puigforniu forest*: the non-government organisation Acció Natura, supported by cofounding of a private enterprise, has bought logging rights for 25 years over 25 ha of Puigforniu forest (Soriguera village). The public owned forest was supposed to be cleared by local municipality for budget needs;
4. *Obra Social de Caixa Catalunya*: in the 1998-2003 period Obra Social de Caixa Catalunya - i.e. a foundation linked to a regional financial institution - has created a network of 25 sub-alpine forest reserves in the Pyrenees, covering a total area of 142 ha hosting public ancient forests with high ecological value. The foundation has acquired owners' logging rights for 35-40 years, for a total value of €213,258.

Another example of quasi-PES in Catalonia is represented by **land stewardship contracts**, i.e. voluntary agreements between a landowner and a stewardship entity to promote the sustainable management and protection of a certain

area and the associated ecosystem services, with special focus on conservation of critical and endangered habitats (Russi *et al.*, 2011). Land stewardship contracts have been launched in the USA at the end of the 19th Century and gained momentum in 1980s. In Europe there are several examples of land stewardship entities, such as the National Trust in the UK, Natuurmonumenten in the Netherlands, Oasi WWF or Custodia del Territorio by Legambiente⁷⁰ in Italy, and Conservatoires du Littoral in France⁷¹. In Spain land stewardship has been included into the National Law on Natural Heritage and Biodiversity. The Catalan Land Stewardship Network (Xarxa de Custòdia del Territori, XCT) includes more than 70 stewardships entities and around 630 stewardship agreements developed in Catalonia, Balearic Islands and Andorra. XCT operates over a total area of 211,337 ha, mostly represented by forests. Projects are financially supported by three Catalan foundations, as well as by public subsidies and funds from the private sector and non-government organisations (Puig i Sabé and Masó i Aguado, 2009). A successful example is given by a project in the Catalan Pyrenees (Parc Natural de l'Alt Pirineu) and establishing agreements over almost 160,000 ha. Agreements aim to support private farmers in protecting mountain and sub-alpine meadows by adopting good management practices. Payments vary according to practices adopted and results. The Park Administration operates as an intermediary, facilitating contract development and supervising compliance by farmers (Russi *et al.*, 2011).

With regard to SM and EM sub-regions, Morocco is the most advanced country. For example it is the only country within these sub-regions where the GEF has funded projects including explicit PES components and/or having PES as the core objective (Cavalier, 2010). A relevant case is the IFAD/GEF agro-biodiversity conservation project⁷² in the argan woodlands of the Souss-Massa Draa region in Morocco, aiming at scaling-up previous experiences on integrated community-based agro-forestry management by introducing innovative financing mechanisms. The project aims to rehabilitate and conserve *Argania* ecosystems through the development of income generating activities based on the sustainable exploitation of local and traditional products, such as argan oil, dates, figs, saffron rose and honey (FAO, 2010a).

4.2.3 Corporate Social Responsibility

Corporate Social Responsibility (CSR) aspects have been analysed according to different perspectives:

- › CSR tools and initiatives adopted by companies in the Mediterranean region with special focus on NTFPs: forest, fair trade and origin certification;
- › the role of forest plantations standards and guidelines (see Annex 8).

a. CSR tools and initiatives adopted by companies in the Mediterranean region with special focus on NTFPs: forest, fair trade and origin certification

With reference to the adoption of CSR tools by companies in the Mediterranean region, different initiatives have been assessed. Among them forest, fair trade and origin certification systems play a central role.

The total certified forest area in the Mediterranean region - as of September 2013 - totalises almost 12.2Mha (Table 4.24) corresponding to about 3% of the total certified area worldwide. This value, however, includes some double certified areas, i.e. areas that are certified according to both the Forest Stewardship Council® (FSC) and the

⁷⁰ www.custodiadelterritorio.it/

⁷¹ www.custodiaterritori.org.

⁷² MENARID Project, Participatory Control of Desertification and Poverty Reduction covering the Near-East Region and including a specific project-line for the Arid and Semi Arid High Plateau Ecosystems of Eastern Morocco. www.menarid.icarda.org/Projects/MARACSM/~/SitePages/Home.aspx.

Programme for the Endorsement of Forest Certification® (PEFC) scheme standards. Certified area is concentrated in NWM (59%) and NEM (30%) countries, while there is no certified forest in the SM sub-region. France, Croatia and Spain represent more than two-thirds of the total certified forest area. Certified forests include both private and public owned areas, and range from a few hectares, to more than 2Mha as in the case of *Hrvatske Sume* (Croatian State Forest Enterprise) that is the eighth largest FSC forest management certification worldwide.

Chain of Custody certificates are even more concentrated: more than 97% of them refer to NWM and NEM sub-regions. About 16% of FSC and 34% of PEFC certificates issued worldwide concern Mediterranean countries.

Table 4.24 - FSC and PEFC Forest management and Chain of Custody certificates issued in Mediterranean countries (September 2013)

Countries and sub-regions	Forest management - Area (ha)				Chain of Custody - N. certificates			
	FSC	PEFC	Total	% on Total	FSC	PEFC	Total	% on Total
Egypt	-	-	-	0,0%	11	2	13	0,2%
Morocco	-	-	-	0,0%	4	1	5	0,1%
Tunisia	-	-	-	0,0%	5	2	7	0,1%
SM	-	-	-	0,0%	20	5	25	0,3%
Cyprus	-	-	-	0,0%	6	-	6	0,1%
Israel	-	-	-	0,0%	10	5	15	0,2%
Lebanon	-	-	-	0,0%	13	2	15	0,2%
Turkey	1,380,123	-	1,380,123	11,3%	141	11	152	2,0%
EM	1,380,123	-	1,380,123	11,3%	170	18	188	2,4%
Bosnia and Herzegovina	1,344,339	0	1,344,339	11,0%	218	1	219	2,8%
Croatia	2,038,296	0	2,038,296	16,7%	197	-	197	2,5%
Greece	-	-	-	0,0%	12	-	12	0,2%
Serbia	-	-	-	0,0%	93	-	93	1,2%
Slovenia	256,096	10,209	266,305	2,2%	577	11	588	7,6%
NEM	3,638,731	10,209	3,648,940	29,9%	1,097	12	1,109	14,3%
France	19,463	4,577,023	4,596,486	37,7%	803	2,048	2,851	36,8%
Italy	33,724	773,199	806,923	6,6%	1,681	646	2,327	30,1%
Malta	-	-	-	0,0%	9	-	9	0,1%
Spain	164,042	1,590,639	1,754,681	14,4%	577	653	1,230	15,9%
NWM	217,229	6,940,861	7,158,090	58,7%	3,070	3,347	6,417	82,9%
Total Mediterranean	5,236,083	6,951,070	12,187,153	100,0%	4,357	3,382	7,739	100,0%

Source: own elaboration from FSC, 2013 and 2013a; PEFC, 2013.

Since the Mediterranean region hosts but a few big and production-oriented forest companies specialised in the wood sector, special attention has been paid to NTFPs. Table 4.25 reports FSC and PEFC certificates issued in Mediterranean countries including NTFP production within their scope. Not considering imported products manufactured by Mediterranean companies (e.g. bamboo), cork and barks are the most represented NTFPs and their production is concentrated in NWM countries. Many campaigns in favour of natural cork have been launched with the support of cork producers, environmental NGOs and wine producers as well (see box 4.2): many of these campaigns were linked to the promotion of forest certification as a tool to guarantee sustainable cork supply. Beside these products some niche food products from Mediterranean countries are already available as certified: this is the case for example of Italian white truffle from Muzzana del Turgnano and spiced beer from a small artisanal

brewery in Forni that uses only resins and pine needles from PEFC certified Friulian Dolomites Natural Park (Italy).

Table 4.25 - FSC and PEFC certificates including NTFPs within their scope (September 2013)

NTFPs	Countries	Forest management - Area (ha)			Chain of Custody - N. certificates		
		FSC	PEFC	Total	FSC	PEFC	Total
Barks	Italy	-	-	-	3	7	10
	Spain	-	-	-	4	-	4
Sub-total barks		-	-	-	7	7	14
Soil conditioners	Italy	-	-	-	2	-	2
	France	-	-	-	4	-	4
Cork	Italy	66.00	20.48	86.48	3	-	3
	Spain	103,285.62	75,000.00	178,285.62	18	2	20
	Turkey	-	-	-	1	-	1
		103,351.62	75,020.48	178,372.10	26	2	28
Straw, wicker, rattan*	Turkey	-	-	-	1	-	1
	France	-	-	-	1	-	1
Bamboo*	Italy	-	-	-	4	-	4
	Spain	-	-	-	3	-	3
	Turkey	-	-	-	1	-	1
Sub-total bamboo		-	-	-	9	-	9
Plants and parts of plants (a)	Spain	(a)26,768.64	-	(a)26,768.64	-	-	-
Natural gums, oils and derivatives (b)	Italy	-	-	-	-	4	4
	Spain	-	-	-	1	-	1
	Turkey	-	-	-	1	-	1
Sub-total natural gums		-	-	-	2	-	6
Other (c)	Italy	-	-	-	-	3	3
	Spain	(d)11,866.99	(d)30,000.00	(d)41,866.99	-	1	1
Sub-total other		-	-	-	-	4	4
Total		103,351.62	75,020.48	178,372.10	47	16	63

*imported NTFPs

(a) Pine cones (forest area already accounted under cork category); (b) Resin, essential oils

(c) Herbs, truffles, honey, etc.; (d) Game (forest area already accounted under cork category)

Source: own elaboration from FSC, 2013a; PEFC, 2013.

As regards food NTFPs from strictly Mediterranean forests, the main example is represented by the Ibérico ham (*hamon Ibérico*) from Ibérico pigs reared with a free-range system in the Andalusian *dehesas* of Sierra Morena (Spain), that have been declared a Biosphere Reserve by UNESCO in 2002. Pigs are fed by grasses and acorns during the '*montanera*' fattening period to produce the *Ibérico de bellota*, or 'acorn-fed' Ibérico ham that is largely acknowledged by experts as one of the best ham worldwide⁷³. According to a survey published by PEFC Spain (2012) with the support of the Spanish Ministry of Agriculture, Food and the Environment (Magrama) more than 50% of NTFP producers and processors for the *gourmet* market consider forest certification as a potentially strong tool to improve sector competitiveness in terms of image, access to market and transparency towards the consumers. However certified NTFPs still represent a niche market in global trade and certification is a challenging process for producers because it requires a certain organisation capacity, including management planning and record keeping, product tracing and marketing expertise. An important condition for achieving market access and/or price premiums for certified NTFPs and ecosystem services is label visibility and recognition by consumers. That's why such

⁷³ For more information: www.delaforesta.com/en/mediterranean-forest/ and www.joselito.com/es/happy-pig.

certifications may work best for those products with significant markets in countries with consumers willing to pay a premium to support social equity and environmental sustainability (Shanley *et al.*, 2002). The case of cork and the related networking capacity by relevant actors is quite paradigmatic (Box 4.7). Opportunities might also exist for *gourmet* products like mushrooms, truffles, ham, chestnuts or pine seeds.

Box 4.7 – Certified cork and networking promotional initiatives

One of the main advantages linked to certification may consist of networking and the creation of synergies within different actors. Good examples are provided by the cork-wine sector, especially in the USA and South Africa, but also in Europe. In the USA Willamette Valley Vineyards has been the first winery in the world to get a Chain of Custody certificate for the use of FSC certified cork for their Oregon Pinot Noir production (2007). X-Wine and Miracle One followed in 2009. These certification projects were supported by the co-operation of Amorim - the largest cork producer worldwide - and Cork Supply, both FSC certified and members of the WWF Global Forest and Trade Network (GFTN). In South Africa African Dawn Wines adhered to the Biodiversity & Wine Initiative (BWI) and is using FSC certified cork stoppers and paper-labels for its products. FSC cork stoppers are also used by Avondale in South Africa, and Bodegas Dagón in Spain. In 2011 the first Italian FSC certified cork has been harvested and entered the market through FSC certified processing companies. In 2007, thanks to the efforts of the WWF Mediterranean Programme, 11 major wine producers engaged themselves to the use of certified cork by publishing an advertisement on the magazine Decanter (Berrahmouni, 2009). In many cases the role of retailers has been of paramount importance: at the end of 2009 two leading supermarket chains in the United Kingdom (Sainsbury's and Co-operative Group) have committed to use FSC certified cork stoppers. Woolworths in South Africa has committed to similar procurement policies.

As a market-based mechanism for improving forestry management, certification originally promised incentives such as a price premium. This issue is a little bit controversial and probably to be investigated on a case-by-case basis. Many authors found evidences about premiums paid for certified products (Nevel *et al.*, 2005; Kollert and Lagan, 2006; Yuan and Estin, 2007; Hughell and Butterfield, 2008; FSC, 2009) some others did not (Ota, 2007; de Lima *et al.*, 2008). Almost all surveys/studies however refer to timber or timber-based products. With regard to NTFPs, the case of Forest Producers Association of Coruche (APFC) Group Certification in Central Portugal can be mentioned. The Group - created in 2006 to reply to the growing international market demand for certified cork stoppers - includes 12 members managing about 10,320 ha and producing 825 tons/year certified cork. The harvested material is sold with a premium of 0.5 € per unit over the same non-certified products (FSC and ProForest, 2010). Price premiums for certified NTFPs are also mentioned by Chevalier (2005), with reference to Christmas trees in Switzerland. Moreover, according to a survey conducted among 33 Fair Trade Organizations worldwide (Leonardi and Secco, 2010) a strong interest to market FSC certified products within the fair trade network exists. Such an interest can also lead to price premiums as this is one of the fair trade core principles.

Fair trade

Beyond forest certification *sensu stricto*, another interesting case study is the one of fair trade certification according to Fairtrade Labelling Organisation, (FLO) standards. At the moment argan oil production in Morocco, is the only FLO certification example for forest products in the Mediterranean area. The establishment of the UNESCO 'Arganerie Biosphere Reserve' in 1998, covering more than 850,000 ha of argan woodlands, created some opportunities for argan producers and farmers. Established in 2007, the Cooperative Tighanimine is an Agadir-based women cooperative that became FLO certified in 2011. It involves around 50 women and sells its products under Tounaroz label to the French, English, American, Italian and Spanish markets, although FLO

certified volumes are still limited (Fairtrade Africa, 2013).

It is worth to remember that between 2010 and 2011 FLO has developed and launched a Fairtrade standard for timber for forest enterprises sourcing from small-scale or community-based producers. The system is strictly linked to FSC certification: a forest enterprise can only apply for Fairtrade certification if its plantation or forest resources are certified as well-managed under the FSC system. So far these standards have been used to certify a community forestry operation in Honduras, and small/low-intensity producer groups in Chile and Bolivia. No forest operation in Mediterranean forests have been assessed and certified according to this standard until now, but it is potentially eligible for communities or single owners in SM and EM countries (FLO, 2013; FSC, 2013b).

FairWild certification

Founded in 2008, the FairWild Foundation⁷⁴ has developed and made available a standard and certification scheme covering ecological and social aspects dealing with the collection of products from the wild (e.g. medicinal and aromatic plants, berries, wild fruits, nuts and seeds, mushrooms). The system combines two different standards, i.e.:

- › the International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP), developed between 2001 and 2006 with the support of the German Federal Agency for Nature Conservation (BfN), TRAFFIC, WWF, and the International Union for Conservation of Nature (IUCN);
- › a standard based on the Fair Trade principles and ILO Standards and developed by SIPPO (the Swiss Import Promotion Programme) in cooperation with Forum Essenzia e.V. and the Institute for Marketecology (IMO).

The FairWild certification regards products collected from the wild, raw materials for finished products (e.g. essential and fatty oils) and products containing FairWild ingredients.

At the moment FairWild certificates have been issued in only two Mediterranean countries (FairWild, 2013):

- › Bosnia Herzegovina, for raspberry and blackberry leafs (*Rubus idaeus* and *R. fruticosus*), elder flower (*Sambucus nigra*), lime flower (*Tilia cordata* and *T. platyphyllos*), and nettle leaf and root (*Urtica dioica*);
- › Spain, for liquorice roots and rhizomes dried (*Glycyrrhiza glabra*).

Additional on-going projects are taking place in Slovenia (*Juglans regia*, *Sambucus nigra*, *Rubus idaeus* and *Urtica dioica*) and Morocco. As for the second case, the initiative is based on a three-year project, launched by the United Nations Development Programme in 2012, aiming to strengthen the capacity of Moroccan government institutions, non-governmental organisations and private sector operators to contribute to biodiversity conservation and poverty alleviation, by increasing the value of wild-collected medicinal and aromatic plants improving market access and ensuring resource production sustainability. Target species are *Rosmarinus officinalis*, *Thymus saturejoides*, *Anacyclus pyrethrum*, *Origanum elongatum* and *Origanum compactum*.

⁷⁴ For more information: www.fairwild.org.

One of the key-benefits connected with FairWild certification is the payment of an extra price to collectors and farmers by buyers. This extra price consists of two main components (FairWild, 2013a): (i) the FairWild Price that is paid by the buyer to the wild collection enterprise, based on cost calculations, and should normally be at least 5% higher than the price for conventional wild-collected crops in the area; and (ii) the FairWild Premium paid to the collectors/collectors' associations and reflecting the efforts made by the collectors and all other actors in the supply chain to arrive at sustainable wild collection, production and sales of the respective final products. It is agreed every year between the collectors/collectors' associations and the next actor in the supply chain (collection centre, trader, company), and is usually 10% over the individual collector's selling price. The Premium can be paid as a single annual contribution to the wild collection enterprise's fund or it could be a fixed agreed-upon amount that is added to each invoice as a separate line item.

FairWild certified distributors, processors and traders are mostly concentrated in central (Germany and Switzerland) and Northern Europe (United Kingdom), as well as North America.

EU Geographical indications and traditional specialities

A number of NTFPs are registered (or have applied for registration) for the EU schemes that promote and protect names of quality agricultural products and foodstuffs: protected designation of origin (PDO), protected geographical indication (PGI) and traditional speciality guaranteed (TSG).

Table 4.26 reports a summary of registered products according to different product categories and countries for the Mediterranean region.

Table 4.26 - Forest products with geographical indications and traditional specialities within Mediterranean countries

Country	Dried fruits	Honey	Meat	Mushrooms	Oils	Spices	Total
Morocco	-	-	-	-	1	--	1
SM	0	0	0	0	1	0	1
Cyprus	1	-	-	-	-	-	1
EM	1	0	0	0	0	0	1
Greece	2	1	-	-	2	1	6
Slovenia	-	3	-	-	-	-	3
NEM	2	4	0	0	2	1	9
France	4	4	-	-	-	-	8
Italy	17	4	-	1	-	3	25
Spain	3	4	2	-	-	1	10
NWM	24	12	2	1	0	4	43
Total	27	16	2	1	3	5	54

Source: own elaboration from EC DOOR, 2013.

About 80% of registered products are concentrated in NWM countries. In particular Italy⁷⁵ has a leading position with a total number of 25 registered products (i.e. 46% of total), including Borgotaro mushrooms (*Boletus edulis*) and many varieties of chestnuts, maroons (*marrone*-chestnut), and hazelnuts. The only non-EU country on the list is Morocco that has applied for a PGI registration of argan oil.

Dried fruits represent 50% of registered products, followed by honey (30%). Meat products only include Spanish ham (*hamon*) produced from pigs grown in Mediterranean *dehesas*. As regards oils, apart from argan from Morocco, mastic oil from *Pistacia lentiscus* is registered for Greece. Finally spices only include saffron varieties from Italy, Spain and Greece.

It is important to notice that in some cases these products are specialised niche products, characterised by high added value, limited availability due to environmental or seasonal conditions, small target market, direct association of marketing mix with quality issues (including environmental and certification labels, such as for example organic agriculture or forest certification) and the need for alternative merchandising channels to protect the products and reduce imitation risks. Specialised products also present strong links and synergies with complementary products/services (e.g. tourism, recreation) that differentiate them, and huge potential as territorial marketing tools. Complementary products might include also services like accommodation, food and wine, local customs and traditions, creating marketing networks (Gios and Rizio, 2013). The complementarity between NTFPs and some services play a strategic role in the promotion of local rural development strategies that make local businesses and networks more robust and effective (Pettenella and Maso, 2009). When the traditional 4Ps of marketing mix (i.e. product, place, price and promotion) (Kotler, 1980) are integrated by two additional 'Ps' - i.e. political power and political participation - the complementarity between NTFPs and related services becomes very strong with participation, political support and strong interaction between public and private stakeholders (Pettenella and Secco, 2006). Some interesting examples are given by mushroom and chestnut networks in Italy and are shortly reported in Box 4.8.

Box 4.8 – Mushroom and chestnut networks in Italy: some examples

The **Borgotaro Mushroom Trail** (*Strada del Fungo Porcino di Borgotaro*) is a network of companies and municipalities in the Borgotaro area (between Tuscany and Emilia Romagna, in Central Italy) providing services for PGI-registered *Boletus* mushroom picking and complementary services (e.g. food, accommodation, etc.). The network has been promoted by local enterprises (endogenous network) - not just limited to those performing mushroom processing and commercialisation - and includes some local municipalities too. Municipalities have played a key-role in achieving PGI certification that allows local mushrooms to be distinguished from other *Boletus* and get higher market recognition. All these elements, combined together, turned Borgotaro *Boletus* into a valuable NTFP to be commercialised and facilitated the creation of a network of local small and medium-small enterprises (Maso *et al.*, 2011). According to the classification proposed by Varamäki and Vesalainen (2003) Borgotaro Mushroom Trail can be described as a Project Group. Indeed enterprises involved in the initiative present the key-features and characteristics of this network type: resources and products of the partners are combined into a joint business; there are written agreements among the partners that are all members of the '*Strada del Fungo Porcino di Borgotaro*' association; partners closely cooperate in order to maintain a common image; partners present different but complementary resources, capabilities and skills (food, accommodation, etc.); all partners share a common aim that is to achieve new market channels through each participating enterprise (Maso *et al.*, 2011).

Networking and promotion activities play a central role also in the case of **chestnut production**. Examples include the National Association of 'Towns of Chestnut' (*Associazione Nazionale Città del Castagno*) created in 1998 by four Mountain Communities of Toscana and Emilia Romagna regions. Besides providing technical assistance and visibility

⁷⁵ Italy is the leading country in terms of registered products according to the PDO, PGI and TSG schemes at world level.

to chestnut producers, the association organises events and fairs to promote chestnut products and related activities (Pettenella *et al.*, 2004). Another interesting initiative is that of Chestnut Trails similar to the Borgotaro one, although less developed. A quite-well structured example is that of the Marrone Chestnut Trail in Marradi⁷⁶ (Tuscany) that links together several agri-tourism activities in the Mugello area, where PGI maroon (*marrone*-chestnut) is produced.

b. The role of forest plantations standards and guidelines

About 5% of the total certified forest area in the Mediterranean region is represented by forest plantations, mostly concentrated in Spain (84%) and Italy (12%). As already observed in chapter 3, productive forest plantations in the region are prevalent in NWM countries (and Turkey), while afforestation and reforestation projects in SM and NEM countries are mostly intended to have protective and environmental roles rather than productive functions (World Bank, 2002). Planted forests have been a common land use since ancient times and a very important resource for centuries, but while plantation forestry has a long history in some countries, the development of a globally significant plantation estate and the establishment of large scale planted areas is a relatively new phenomenon (Evans, 2009). In general there is increasing concern regarding sustainable management and restoration of planted forests and forest plantations at world level, including the Mediterranean Basin (Ruiz-Benito, 2012). Mediterranean forest plantations are currently under an intense debate related to their ecological function, sustainability and future performance (González-Moreno *et al.*, 2011).

Forest plantation issues and their relationships with natural forests are complex (White, 2003; Bull *et al.* 2006) and sometimes controversial, feeding strong debates within forestry stakeholders. On the one hand, plantations are considered to contribute to full-fill the growing global demand for timber and wood fibre and provide a wide range of other social, economic and environmental benefits - assuring forage, wildlife habitats, watershed protection, recreational settings, aesthetic vistas, carbon sequestration and ecological conditions for many other forest values (Boyle, 1999; Evans and Turnbull, 2004; UNEP, 2009). On the other hand, forest plantations are often described as '[...] *biological deserts, water guzzlers, livelihood saboteurs and carbuncles on the landscape*' (IUCN and WWF, 2006 – p.1), replacing diversity with monocultures, local species with exotic ones, by causing or fastening soil erosion and loss of fertility and excessive water consumption. In this perspective, while subsidising forest plantation has been a common practice (Szulecka *et al.*, in press), its effectiveness is debatable, since this may act as a disincentive to sustainable management of natural forests.

The issue of standard setting and certification of forest plantations has been controversial from the very beginning and is still widely debated.

Masiero *et al.* (2013)
(Annex 8,
Paragraph
1)

In the last fifteen to twenty years the efforts for developing standards and guidelines to guarantee sustainable forest management have grown strongly. Most of these efforts, however, have been formulated for natural forests only, while those designed specifically for forest plantations are relatively few (Marjokorpi and Salo, 2007). At the same time many differences can be identified among existing initiatives at least in terms of origins, involved actors and stakeholders, purposes, approaches and spread.

⁷⁶ For more information: www.stradadelmarrone.it.

It can be argued that not enough attention is given by policy makers and scientists to forest plantations, both in developing standards and guidelines for assessing progresses towards sustainability and management performances and in evaluating their effects and effectiveness.

*Masiero et al. (2013)
(Annex 8,
Paragraphs
2 and 3)*

In this perspective, building on a previous study by Holvoet and Muys (2004), a total number of 42 standards and guidelines for sustainable forest management (SFM) and sustainable development (SD) have been analysed according to a methodology based on 4 steps: (1) existing standards/guidelines identification and classification; (2) creation of a 'reference standard'; (3) standards/guidelines selection; (4) standards/guidelines assessment and comparison. Details about methodology and the main results are reported in Annex 8.

It shall be highlighted that none of the 42 analysed standards and guidelines are specifically intended for Mediterranean forests, and only a few explicitly refer to Mediterranean countries/areas (e.g. FSC and PEFC standards for Spain) nevertheless the exercise is believed to be useful also for this region at least to stimulate future debate on this issue.

Although the setting of forest management standards grew very much in the last 20 years, it mostly concentrated on natural forests. Just 11 out of 42 cases assessed within our study are plantation-specific while 15 standards and guidelines do not include any single indicator for plantations and 9 of them dedicate to forest plantations less than 5% of their indicators. Not only initiatives are rarely plantations-specific but also they normally include few and quite generic indicators related to this topic, indirectly suggesting an underestimation of forest plantations increasing role in forestry, environment and social sustainability. The analysed standards and guidelines in many cases are focused on environmental or socio-economic topics, but forest plantation issues are seldom addressed and even quoted within them.

*Masiero et al. (2013)
(Annex 8,
Paragraph
4)*

Clear differences exist among the surveyed set of standards and guidelines in terms of quality of their contents. The biggest gap has been identified in the area of maintenance, protection and restoration of biodiversity and ecological processes. In particular gaps have been identified with reference to monitoring of natural ecosystems components, the maintenance of intact ecosystems and landscapes - including the avoidance of primary/natural forest conversion into forest plantations - the use of exotic species and of GMOs.

Minor gaps deal with protective functions of plantations, with special reference to soil protection against erosion and losses in general and water quality maintenance and improvement. Additional minor gaps include socio-economic and cultural well-being of stakeholders, with special reference to workers conditions and the role of local communities in forest management planning and, in broader terms, in benefiting from the presence of plantations. The establishment of

plantations might imply conflicts with local communities. This has been experienced in some SM countries (Morocco and Tunisia) where reforestation activities on degraded land have sometimes caused serious conflicts with local people who previously used such areas as free grazing land (World Bank, 2002).

Some specific areas of improvement emerged as well, as for instance for the inclusion of landscape issues in planning activities. Also carbon issues could represent a new area of development: until now, with few exceptions, they played a complementary role within some standards and guidelines, being in many other cases just a general topic on the background. The growing attention paid to climate change issues and the increasing number of carbon projects in the forest sector, acting as one of the most relevant driving forces for the expansion of forest plantations, should lead to the inclusion of specific requirements to link carbon standards with forest management standards as a form of warranty. The partnership agreement signed by FSC and the Gold Standard Foundation in 2012 goes in this direction, trying to combine the FSC approach to social and environmental safeguards and the Gold Standard approach to carbon certification, respectively⁷⁷. Finally, some room for improvement seems to exist even with reference to the exploitation and value of NTFPs: they are just marginally considered by standards and guidelines and could provide useful and interesting opportunities for companies and local communities. In the case of the Mediterranean region this could be a relevant aspect for example for pine planted forests for the production of pine seeds or resin extraction. This could also be linked to the provision of NTFP-related services: as an example Tunisia and Morocco have started the establishment of silvo-pastoral plantations, primarily for forage production (World Bank, 2002).

*Masiero et al. (2013)
(Annex 8,
Paragraph
4)*

The overall impression is that in many cases the productive function still gets bigger attention and catalyses most of indicators and measures. Although argumentations supporting forest plantations strongly stress aspects dealing with multi-functionality, they seem to remain on discourses rather than being explicitly reported on the standards or guidelines text.

⁷⁷ For more information: www.cdmgoldstandard.org/the-gold-standard-announces-partnership-with-the-forest-stewardship-council and <https://ic.fsc.org/newsroom.9.160.htm>

As recently recommended by Clark and Kozar (2011) in the case of forest certification systems credible and useful comparisons among effects and effectiveness of sustainable forest management standards should be based on empirically collected data rather than on the wording of principles, criteria and indicators. However, by highlighting weaknesses of existing standards and guidelines, our gap analysis contributes to improve the understanding and the governance of forest plantation sector in the future.

5. Conclusions and future research needs

Mediterranean forests provide multiple goods and services that are crucial for the socio-economic development of the region. Many of these are marketed goods - such as timber, firewood, cork, pine seeds, resins, mushrooms, etc. - important for both rural and urban population. Many other are high-value but nonmarket services, such as landscape quality, soil protection, watershed protection and water regulation, and recreation opportunities. Mediterranean forests are also unique ecosystems and a world natural heritage in terms of biodiversity richness: they play a crucial role in the availability and quality of soil and water resources that are strategic for Mediterranean societies.

Analysis performed with regard to markets show that the value of forest products and services provided by Mediterranean forests could be underestimated by existing statistics. This is due to several reasons, including: (i) the public-good nature of many products/services and consequent difficulties in estimating them; (ii) the fact that data recorded within official statistics are not always complete (for example they do not always cover all countries in the region or - such as in the case of NTFPs - all product types); and (iii) the fact that a certain proportion of the Total Economic Value is not mirrored by official data because some products are traded through informal channels and markets. At the same time it should be remembered that some overestimation could derive from the present research when considering that it does not refer to Mediterranean forest ecosystems *sensu stricto*, rather to all forests within Mediterranean countries. When considered altogether, these aspects confirm the importance and the urgency of improving quality of available data and performing appropriate estimate of the Total Economic Value of Mediterranean forests.

Policy and research attention on the value of Mediterranean forests is recommendable for many reasons, including the fact that: (i) the region is highly sensitive to climate change effects; (ii) forest ecosystems are characterised by the supply of good and services of mixed, private and public, nature; (iii) the area is dynamic also in socio-economic terms, with abrupt changes taking place and many links and interdependences between Northern and Southern countries.

These ecosystems are under severe threats. While the presence of man has shaped Mediterranean landscapes over centuries, demographic growth is putting pressure on the use and conservation of natural resources. South and East Mediterranean countries are the most affected and population growth in urban and coastal areas is turning into strong impacts on environment, causing major challenges to local communities in terms of food and water supply. At the same time the Mediterranean area is especially sensitive to any climate change because it represents a transition zone between the arid and humid regions of the world. Mediterranean forests are experiencing the effects of climate change that will more and more alter temperature and precipitation patterns, thus inducing changes in vegetation ranges and distribution, but also on human settlements and economic activities. Among the effects linked to climate change increased forest fires, desertification processes and the spread of new pests and diseases are the most evident ones and are likely to influence socio-economic and demographic dynamics as well.

The distribution of forests among Mediterranean countries/regions and effects deriving from these changes are uneven and do not occur on equity basis. The Southern and Eastern parts of the Mediterranean basin are more vulnerable to climate and socio-

economic changes than the Northern ones for at least three reasons: (i) the economies of South-East Mediterranean countries rely much more on rural activities and agriculture is more climate-sensitive than the industrial and service sectors; (ii) many activities in the Southern Mediterranean, like those connected with the use of water resources or located in coastal areas, already operate close to environmental tolerance levels; (iii) richer countries are able to invest more in adaptation, reducing their overall vulnerability, being less dependent on climate. While poorer countries on the average will be net losers, some areas in Northern Mediterranean countries could gain something from a moderate global change thanks to some direct effects (shifting of some tree species – like Aleppo pine – upslope, increased average annual increments, etc.) as well as from some indirect impacts such as prolonged tourist season, increased food production, reduced heating expenditure, etc.

In order to mitigate effects on Mediterranean forests, there is an urgency to tackle all these issues. Three main dimensions can be pointed out as key elements for informing sector policies and addressing future research needs in the region.

› **Enhancing economic value for forest goods and services**

The economic value of Mediterranean forest goods and services is just partly reflected on the market and recorded by official statistics. This is true both for ‘traditional’ products - such as wood and some NTFPs - and new ones. Enhancing the offer of Mediterranean market products and increasing their role in the rural economy could help reducing the costs of forest protection: a well structured forest economy able to provide stable flows of incomes is functional to provide a fundamental set of public non-market services and social values to both local people and the global community. Understanding the true value of natural resources is, both for the land users and policy makers, an essential step for promoting their protection and sustainable use. In this respect the lack of comparative analysis and country case studies especially in the Southern Mediterranean sub-region on the value of wood and NTFPs supply is a useful and worrying indicator of the marginal importance given to forestry in understanding social and climate change impacts, adaptation strategies and their links to sustainable development. At the same time, since markets are not taking into consideration all values flowing from Mediterranean forests, further research is needed for a better understanding of the link between ecosystem functioning and the delivery of services, as well as their appropriate economic evaluation. As a third point, we are aware that synergies and trade-offs exist between market products and non-market services, as well as among different ecosystem services. Accurate TEV estimations would significantly contribute to the identification of management conditions and choices, as well as the setting of priorities that allow achieving social optimum.

When dealing with TEV computation, valuation and study scale might represent a problem. Additional efforts should be done in developing spatial econometrics via GIS tools in order to allow economic evaluation at proper scale and to facilitate scaling-up operations. This is not a technical problem *per se*, rather a matter of information access, sharing and networking. In this perspective, the use of specific open-access software tools or applications, such as InVEST⁷⁸, ARIES⁷⁹ and Costing Nature⁸⁰, might provide a

⁷⁸ www.naturalcapitalproject.org/InVEST.html

valid support both in performing economic assessment and informing policies and decision-making processes. Such tools, indeed, allow combining physical data that may influence the potential provision of ecosystem services and socio-economic information that contribute to determine the economic value of such services.

› **Developing forest governance issues**

Enhancing the economic value of forest goods and services is not just a technical issue, but has strong policy implications. On the one hand this implies the development of proper mechanisms for remunerating service providers, i.e. forest owners and managers, on the other this requires the definition of specific tools for assuring equity and avoiding resources are overexploited and depleted.

In South and East Mediterranean sub-regions, the difficult socio-economic conditions, the land tenure systems (mainly public forests with some right access for grazing and forest products collection), competition from other land uses (agriculture, urbanisation, etc.), together with the lack of awareness of the value of non-market forest services. the lack of well-defined property rights, the absence of markets and compensation measures for non-market forest services prevent forests from being managed in a sustainable way and fail to protect them from being converted to other land uses.

In this context, the traditional command and control type of policies used in the region confirmed to have numerous drawbacks. In addition, the process of decentralising forest policy and the increased dependence of forest resources on other related sector policies (biodiversity protection, renewable resources, tourism development, climate, etc.) do not favour the process of sharing knowledge of all the positive and negative experiences gained in dealing with the above-mentioned problems.

Future research needs imply proper understanding of the motivations and perceptions of forest owners and society at large regarding forests and forestry. Apart from sociological research on motivations, accurate mapping of stakeholders is needed in order to identify their interests and interactions, as well as different responsibilities in managing and using forest resources. Network analysis could represent an approach for this as well as a preliminary step to adequate stakeholders' involvement in future programming and decision making. This represents the basis for new modes of sector governance in the region, based on public-private partnership rather than traditional top-down approach.

Governance issues do not just matter at local scale and within single countries, but also on a North-South perspective. Indeed another raising key-issue connected with changes within the region is represented by the unbalanced impacts on Mediterranean forests and the equity concerns arising from the cost and benefit distribution. Southern Mediterranean countries (with the main exceptions of Libya and Israel) have much lower CO₂ emissions than other Mediterranean nations. EU Mediterranean countries have 3-4 times higher *per-capita* emissions than countries like Algeria, Morocco, Tunisia and Egypt. As commented by Osman-Elasha (2009) *'those who contributed least to the atmospheric build-up of greenhouse gases, are the least equipped to deal with the negative impacts of climate change'* and, as already mentioned, the most negatively affected and vulnerable to climate change. Addressing these equity concerns is therefore not only an

⁷⁹ www.ariesonline.org

⁸⁰ www.policysupport.org/costingnature

issue of conserving forest resources and the social and environmental benefits they offer within a strategy of climate change mitigation and adaptation, but is a concern related to the balancing of historical responsibilities among countries and designing a future of cooperation between the Northern and Southern regions of the Mediterranean basin.

› **Improving resources mobilisation**

Accurate evaluation of forest value and the development of appropriate mechanisms for their remuneration is a way for helping the mobilisation of resources in support of Mediterranean forests. While (traditional) international public funding is on decrease, there is a growing potential for private sources of funding and public-private co-operation opportunities. These are connected both to wood production - for example in relation to 'wood mobilisation' policies and tools - and markets for 'new' forest products and services. The creation of funding opportunities is linked both to the improvement of profitability of Mediterranean forests by reinforcing traditional forest production, and the internalisation of non-market goods and services, in order to attract new investors. At the same time attention should be paid in assuring social and environmental responsibility are taken into consideration by funding opportunities and public values are conserved. Thirdly, appropriate tools and mechanisms (both in technical and financial terms) shall be identified for supporting smallholders and overcoming problems linked to ownership fragmentations and limited resources.

A practical proposal for future (applied) research

Estimated values for Mediterranean forests could be used together with additional inputs to create background information for a public online platform - hereinafter called TEVmed - that will allow information sharing on the TEV of forests within Mediterranean countries. For each of the analysed countries the platform will include a country-profile with regard to the forest sector, reference studies and a summary of the TEV calculated for national forests. Data will be reported in a format consistent with environmental accounting rules set-out by the United Nations SEEA and the Regulation (EU) No 691/2011. Moreover the platform will include highlights on the adopted estimation methodology and relevant literature on the topic.

Inspired by the GeoWiki Project⁸¹ and other similar experiences (e.g. Map Action⁸² and other projects listed within the Biodiversity of British Columbia⁸³ system, like eBird and eFlora BC), TEVmed system is intended as an interactive tool, based on a **crowdsourcing** approach, in order to allow a continuous update by registered users according to specific feedback-based mechanisms to be defined. As commented by Fritz *et al.*, (2009), terms such as crowdsourcing (Hudson-Smith *et al.*, 2008), collaboratively contributed geographic information (Bishr and Mantelas, 2008), web based public participation geographic information system (Carver *et al.*, 2001), web mapping 2.0 (Haklay, *et al.*, 2008), neogeography (Walsh, 2008) and volunteered geographic information (VGI) (Goodchild, 2008) have been recently used to indicate the development of geospatial user-created content. More precisely, following experiences in the field of volunteered geographic information (VGI), TEVmed will work as a

⁸¹ See: <http://geo-wiki.org>

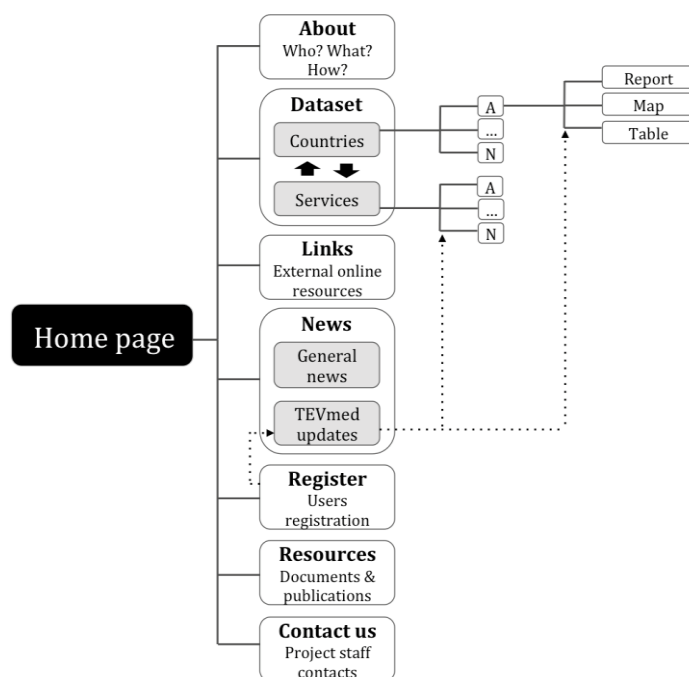
⁸² See: <http://www.mapaction.org>

⁸³ See: <http://www.geog.ubc.ca/biodiversity/VGI--VolunteerGeographicInformation.html>

facilitated volunteered economic information (F-VEI) because a set of criteria will be defined as part of a pre-established design process in order to facilitate and verify contributions by users (Fritz *et al.*, 2009). Moreover backstage facilitators will organise information inputs and contributions.

A draft general structure and a general and illustrative concept/graphic idea for the TEVmed platform are shown in Figure 5.1 and Figure 5.2 respectively.

Figure 5.1 - TEVmed online platform: general structure



Source: own elaboration.

Figure 5.2 - TEVmed online platform: illustrative concept idea

a. Homepage



b. Example of country dataset page



Source: own elaboration.

A brief description of the platform is provided below. The mechanisms behind the functioning of TEVmed platform, however, deserve additional development and should be further investigated. The platform could be organised into seven main sub-areas, nested in the homepage (Figure 5.1):

- › *About* - this session will provide an overview of the TEVmed platform, presenting the scope, the aims, the adopted methodologies, and developers. Information about how to use the platform will be provided as well;
- › *Dataset* - this session will be the core part of the platform, including: (i) a general summary (table) of TEV data for the entire Mediterranean region and the four sub-regions and a summary report available for download in portable download format (pdf) or equivalent format; (ii) the possibility to navigate and search data per forest service and country through an internal search engine. As regards countries, a dedicated sub-page will be available for all of them, reporting key data on the forest sector at national level, a summary table of TEV data at country level (Quick TEV), a map showing values for different forest services and a report available for download in pdf format (Figure 5.2b). A summary version of this report will be available to all users, while a full version will be available only for registered users (see below);
- › *Links* - the session will include links to online resources useful for TEVmed users (e.g. Natural Capital Project, Sylva Mediterranea, FAO FRA etc.);
- › *News* - the session will report news on forestry and forestry economics in the Mediterranean area, periodically collected from different sources. The most recent/relevant pieces of news will be highlighted in the home page. The session will also include a dedicated area listing all changes and contributions to TEVmed contents done by registered users (see next point) that can be navigated and selected according to different criteria and parameters (e.g. author, country, service, period, etc.);
- › *Register* - the session will allow users to register their profile (identified by login and password) in order to fully access the system and contribute to the improvement process. Registration will be free of any charge. Basic data relating to each registered user will be public available (e.g. nickname, picture, country, field of activity and organisation) while full profile will be accessible just to registered users and will include additional information (e.g. contact details, list of TEVmed improvements, etc.). Registered users will be allowed to edit TEVmed Dataset by reporting and uploading new studies, improving data, adding new information according to a specific editing-form. New data will be published just after an appropriate embargo period during which TEVmed staff will check data consistency as well as appropriateness in order to prevent disruption or vandalism. Data could be re-edited by any registered user at any time, following the above-mentioned procedure. National and regional reports will be periodically reviewed, up-dated and published on the basis of new inputs;
- › *Resources* - the session will list (and whenever possible made directly available for download) literature sources used for the development and up-dating of TEVmed - mostly mentioned within different country reports - as well as additional publications useful for TEVmed users;
- › *Contact us* - the session will provide contacts to TEVmed developers and staff.

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Common International Classification for Ecosystem Services - CICES	www.cices.eu
EFI Mediterranean Regional Office – EFIMED	www.efimed.efi.int/portal/
FAO FRA 2010	www.fao.org/forestry/fra/fra2010/en/
MEDFOREX	www.medforex.ctfc.cat/
Mediterranean Model Forest Network (MMFN)	www.medforetmodele.mmfinfo.info/
The Economics of Ecosystems and Biodiversity - TEEB	www.teebweb.org/
UNEP Plan Bleu	www.planbleu.org/

Annexes

Annex 1 - Forests in the Mediterranean region

Masiero, M., Calama, R., Lindner, M., Pettenella, D. (2013). Forests in the Mediterranean region. In: Lucas-Borja, M.E. (ed). Mediterranean forest management under climate change: building alternatives for the future. Nova Science Publishers, Inc., New York. (p. 3-11)

FORESTS IN THE MEDITERRANEAN REGION

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Abstract

The Mediterranean region presents specific climate and ecological characteristics determined by geographical position, morphology and socio-cultural issues. Variety and diversity represent two of the main features, fully mirrored by high biodiversity rates, the large number of endemisms and the multiple functions played by forests. Today forest cover is the result of deep interactions between abiotic (e.g. climate and limiting soil-relief) and biotic factors. Among the second ones human activity has contributed to the transformation and shaping of forest landscapes, leading to degradation and fragmentation of forest ecosystems. Traditional wood and non-wood uses of forests, together with the predominance of grazing activity within the forests and the repeated occurrence of natural and/or human induced fires have modeled a patchy landscape, composed of different types of vegetation in different states of maturity. However different forest characteristics in terms of cover, trends, ownership and dependency can be observed in different Mediterranean sub-regions. Around 73% of Mediterranean forests are concentrated in the Northern sub-regions that also host nearly 79% of the total wood volume and 75% of the total biomass. Outside the Northern sub-regions no country with a forest cover rate higher than 20% can be found. Moreover, while in north Mediterranean area forests are normally expanding, in the south, particularly in the Maghreb, the ecosystems remain very fragile and vulnerable.

1. The Mediterranean region and Mediterranean climate

When identifying the Mediterranean region and forests several criteria can be adopted. Depending on this, the total area of the Mediterranean basin region is not clearly characterized, ranging from the bioclimate based estimate of 2.3 million of km² [1] to 8.8 million km² computed as the total sum of the areas of the 26 Mediterranean countries according to FAO classification [2]. Climatic conditions represent a key issue for the identification and analysis of the Mediterranean region. The connotation of “Mediterranean climate” is included in many qualitative climate-type classifications adopted worldwide (e.g. [3]) and identifies climate characteristics of many regions, including areas outside the Mediterranean basin, located between 32° and 41° north or south of the equator. When focusing on the Mediterranean basin, however, the presence of the Mediterranean Sea constitutes the most critical climate and environmental factor, acting as a moisture source and heat reservoir for the surrounding lands [4]. A second relevant feature is high internal variability, ranging from areas with permanent glaciers in the Alpine regions to areas of subtropical, semiarid regions in the south. Because of latitude, the Mediterranean climate is under the influence of both tropical and mid-latitude climate dynamics, being mainly characterized by a dry and warm summer season, rainy and cold fall to spring seasons and the existence of effective physiological drought [5]. Native plants often experience a period of summer dormancy, induced by heat and lack of soil moisture. Winters are mild, with sub-freezing temperatures not occurring more than 3% of the total time [6]. According to [3] the Northern part of the Mediterranean region presents a Maritime West Coastal Climate, while the Southern part shows a Subtropical Desert Climate [7]. The European climatic stratification of [8] distinguishes three zones: Mediterranean south, Mediterranean north, and Mediterranean mountains.

Precipitation is primarily from rainfall though in some areas coastal fog contributes to the precipitation totals. The presence of a large marginal and almost fully closed sea, the proximity to three continents hosting high mountains ridges, the complex morphology and the strong influence of many local factors implies sub-regional differences in precipitation patterns. In general, rainfall distribution among the region is uneven, resulting scarce and irregular in many south Mediterranean countries. The total annual precipitation in the region ranges between 1,200 - eastern coasts of the Adriatic Sea - and 400 mm - north African coasts and south-east Mediterranean. Daily distributions may differ depending on local features [4].

Due to its position as a transition region between different climate regimes, intrinsic morphological characteristics and correlations with variations of meteorological parameters in other areas, the Mediterranean region is potentially very sensitive to global climate change. Many studies identify this area as a climate change hotspot for the coming years.

2. Forests in the Mediterranean Region: ecological features

The Mediterranean vegetation includes 25,000 plant species, representing 10% of the world's flowering plants on just over 1.6% of the Earth's surface. It is also the second world leader in plant endemism, with an estimated 50% (13,000) of these species found nowhere else on Earth. Apart from its role as biodiversity hotspot, Mediterranean forest ecosystems provide multiple wood and non-wood (cork, pine nuts, mushrooms) goods, as well as high value services, including biodiversity conservation, recreation, CO₂ sequestration, and two key resources for Mediterranean societies: soil protection

against erosion and water regulation. Multifunctionality is therefore a key characteristic of Mediterranean forest management.

Despite the small extent of Mediterranean forest area compared with other types of forests in the world, within-region climate variability in climate, relief, soil and anthropogenic factors result in a mosaic-type landscape of a high variety of forest types [9]. Within the region, different bioclimatic zones have been identified. In [10] average annual rainfall, average maximum temperature of the warmest month and average minimum temperature of the coldest month are used to define a pluviometric index. This index, together with the existing vegetation, was used to identify five bioclimatic zones: arid, semiarid, sub-humid, humid and high mountain.

Climate conditions in arid zones prevent the existence of high forest, leading to the formation of the *maquis* and *garriga* woodlands as the most common plant formation, dominated by species such as *Pistacia lentiscus*, *Quercus cocifera*, *Rosmarinus officinalis* and *Cistus sp.* These formations can also be the result of forest degradation in semiarid or even more favorable zones. . In the Southern-Western Mediterranean region arid and semiarid zones are also mainly dominated by the highly degraded forest coppices of *Tetraclinis articulate*. In the semiarid zone the landscape is dominated by *Pinus halepensis*, substituted in eastern areas by *Pinus brutia*. The subhumid zone is the common habitat for the main sclerophyllous Mediterranean species, the holm oak, *Quercus ilex*. The species *Quercus suber*, *Olea europaea* and *Pinus pinea* are also representatives of this zone. Natural dynamics of forests in the arid to sub-humid zones has been largely linked with the occurrence of natural fires, and species show adaptations to these conditions through masting following fire, cone serotiny, and sprouting capacity. Humid Mediterranean forests are mainly composed by deciduous and marcescent oaks, e.g. *Quercus pubescens*; *Quercus faginea*; *Quercus cerris* and *Quercus fraineto*, accompanied by the conifers *Cedrus sp.* or Mediterranean *Abies* (e.g. *A. pinsapo* or *A. cephalonica*). In mountain areas these species are accompanied by different *Pinus* species, including *P. nigra* or *P. sylvestris*, and it is possible to find islands of humid oceanic forests, including beech (*Fagus sylvatica*, *Fagus orientalis*), common oak (*Quercus robur*) or silver fir (*Abies alba*).

After thousands of years of intensive human use of the Mediterranean landscape for agriculture, forests are mainly confined to the less fertile soils located on steep slopes, which are a common orographic element in the Mediterranean relief. Main exceptions are agroforestry systems, e.g. open *dehesas* woodlands, providing agricultural, livestock and firewood production, which are usually located in flat downhill areas. The loss of forest canopy on the most prominent slopes (due to natural or anthropogenic disturbances) have led to dramatic soil loss and land erosion, resulting in large areas with rachitic and impoverished soils where forest restoration is a challenging task.

Apart from climatic and limiting soil-relief factors, human activity in the Mediterranean basin has transformed and shaped the forest cover of the Mediterranean basin, leading to degradation and fragmentation of the forest ecosystems. Traditional wood and non-wood uses of forests, together with the predominance of grazing activity within the forests and the repeated occurrence of natural and/or human induced fires have modeled a patchy landscape, composed of different types of vegetation in different states of maturity.

3. Mediterranean forest resources: general features

Twenty-one Mediterranean countries have been considered in this overview chapter, i.e. all the countries overlooking the Mediterranean Sea. They have been divided into four sub-regions (Figure 1 and Table 1):

- Southern Mediterranean (SM) countries, including Algeria, Egypt, Libya, Morocco and Tunisia;
- Eastern Mediterranean (EM) countries, including Cyprus, Israel, Lebanon, Occupied Palestinian Territory, Syria and Turkey;
- North-Eastern Mediterranean (NEM) countries, including Albania, Bosnia and Herzegovina, Croatia, Greece, Montenegro and Slovenia;
- North-Western Mediterranean (NWM) countries, including France, Italy, Malta and Spain.

According to FAO Global Forest Resources Assessment (FRA) [11] figures forest cover in these countries totalizes about 74 Million hectares (Mha). Purely Mediterranean forests, *garriga* and *maquis* cover about 7.5% of the total countries land [9]. Recently published data from [12] with regards to the European context indicate “Broadleaved evergreen forest” and “Coniferous forests of the Mediterranean, Anatolian and Macaronesian regions” types cover around 9% of the total forest area in Southern East, Southern West and Central West Europe as defined by Forest Europe¹ [13].

Distribution of forest area across the Mediterranean region is uneven: around 73% of forests are concentrated in the Northern sub-regions (58% just in the NW sub-region), while 16% lay in the EM region and nearly 11% in the Southern one. More than 63% of the global Mediterranean forest area is hosted in only four countries of the Northern sub-regions: Spain, France, Italy and Greece. Outside these sub-regions, Turkey and Morocco are the only countries with relevant forest areas: they represent more than 80% of the forest coverage outside the Northern sub-regions, with Turkey alone representing around 92% of the overall forest area in the EM region [11].

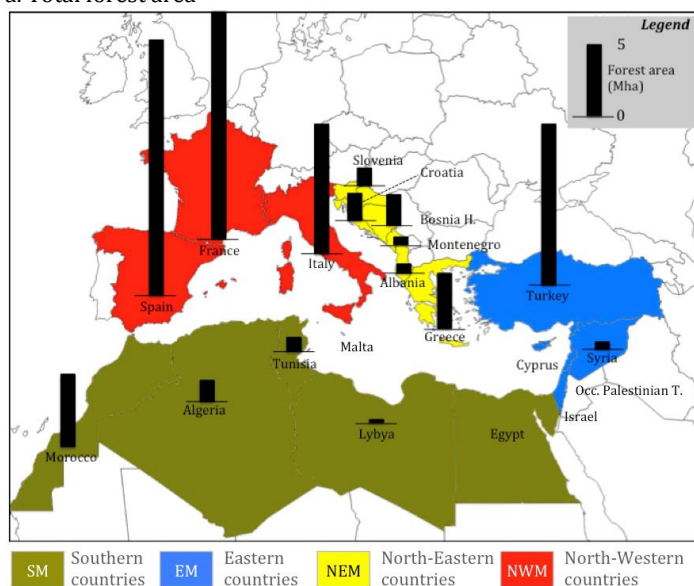
Reasons for such a clear prevalence of forests in the North can be explained naturally by variations in aridity - the main feature of the Mediterranean climate being the severity of the summer drought - but also by historical, ecological and socio-economic differences [15]. The Northern sub-regions host a forest area of about 54 Mha, corresponding to 33% of the land. These forests host nearly 79% of the total wood volume and 75% of the total biomass in the region. Such high stock figures are partly due to the fact that many of the countries in the Northern sub-regions (e.g. Croatia, France, Italy, Slovenia, Spain), include relevant quantities of temperate forests. As for SM sub-region, forests cover about 7.9 Mha, i.e. 9.7% of the total forest area in the Mediterranean basin, but just 1.4% of the total land area within the sub-region. Finally EM sub-region presents a forest cover of about 12.3 Mha, equivalent to 15% of the total forest area in the Mediterranean and to 12.3% of the total land area within the sub-region. With few exceptions, in both SM and EM sub-regions forests are mainly represented by sparse, pre-desert shrub vegetation, with low levels of wood volume and biomass. With the only exception of Morocco (11%), the SM sub-region presents the lowest forest cover rates (0.6% for Algeria, around 0.1% for Libya and Egypt). The higher rates can be found in the Balkans - with Slovenia showing a 62%, Bosnia and Herzegovina 43% and Montenegro 39% - and in Spain (36%). Outside the Northern sub-regions no country with a forest cover

¹ Southern-East Europe includes Portugal (excluded from the present chapter), Spain and Italy; Southern-West Europe includes the Balkans and Turkey; Central-West Europe includes several countries but with regard to the two considered forest types it may be assumed reference is to be made to France only [13].

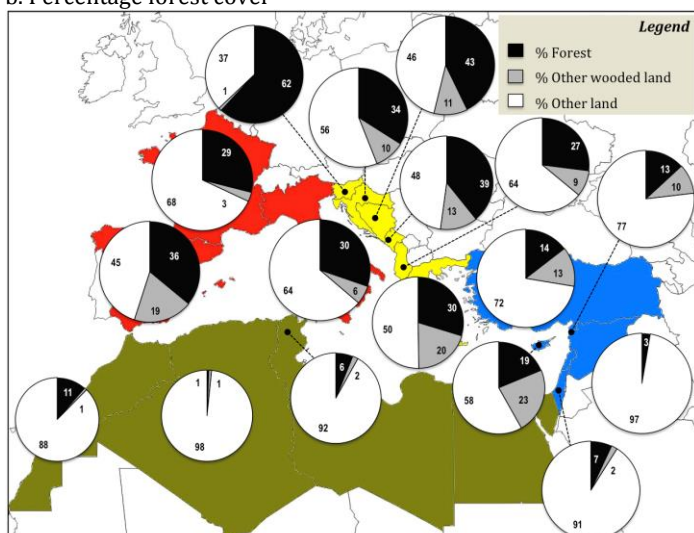
rate higher than 20% can be found, while only four (Cyprus, Turkey, Lebanon and Morocco) show figures higher than 10% (Figure 1).

Figure 1 – Total forest area (a) and percentage forest cover (b) in the twenty-one selected Mediterranean countries divided in 4 sub-regions (2010)

a. Total forest area



b. Percentage forest cover



Source: own elaboration from [11] and [14].

Differences among the sub-regions can be observed even with regard to forest trends over time. During the last twenty years almost all the countries in the Northern sub-regions experienced a huge increase in forest area, with annual rates up to 1% (or even more) for Italy and Spain. Such trend is in relationship with the decline of agriculture and grazing activities, and the consequent abandonment of marginal areas that are being colonised by expanding new forest formations. Another reason of the increasing trend can be found in reforestation campaigns, especially in flat areas. While improving very much the forest area and the wood-stock, this conditions can also induce negative impacts, resulting detrimental for open spaces, grasslands and meadows, leading to some loss of biological and landscape diversity as well as increased fire risks. Exceptions can be observed with regard to some NEM countries: Albania and, to a certain extent,

Bosnia and Herzegovina show some decline in their forest area that is particularly evident in the 1990-2000 period (Table 1). Apart from few cases (Algeria and - for 2005-2010 - Israel) FAO figures confirm an increase in forest areas also with regard to SM and EM sub-regions. However in the SM sub-region, particularly in the Maghreb, the ecosystems - very fragile and vulnerable due to the reigning environmental and climatic conditions - are largely exposed to increasing anthropogenic pressure of clearing and cultivation in marginal lands, overexploitation of firewood and overgrazing.

A clear distinction among Mediterranean sub-regions can be done also in institutional and policy terms, including forest ownership conditions [16] and forest dependency. In Northern Mediterranean countries, and especially in NWM ones, most of the forest area is privately owned. While public forests are efficiently managed, many private forests suffer from a certain lack of care or poor management, quite often connected with small-holding conditions. This situation proceeds from the abandonment of primary activities in marginal areas in favor of more profitable activities. As a result, several negative impacts occur, such as increased risk of erosion, forest fires, loss of biodiversity and landscape quality.

In the SM and EM sub-regions the situation of forests is quite different. In many countries most forests are publicly (i.e. Stately) owned. Forest communities have some free usage rights (e.g. collection of firewood, grazing, etc.) but often have little incentive to preserve forests. Moreover poverty is largely present and a large share of the rural population depends on forest resources as the major source of income. The result is very often high human pressure on forests, leading to overexploitation of both wood and (sometimes) non-wood forest products, and consequent depletion of forest resources. In other words, forests are regarded mostly as a source of consumptive direct uses, which are intensively exploited. At least six SM and EM countries host indigenous people depending from forests and their resources. According to various studies and sources quoted by [17] their total number ranges between 18.3 and 34.3 Million, i.e. about 3.9-7.3% of the total population in the twenty-one countries surrounding the Mediterranean Basin [18]. When referring to single countries relative figures are even higher: this is, for example, the case of Algeria where forest dependent indigenous people represent around 28% of the national population.

Different ecological, management and socio-economic characteristics as well as trends in forest coverage imply a wide range of perspectives when addressing climate change challenges for Mediterranean countries. While a common view and joint efforts are needed, specificity and diversity – as values per se – shall not be neglected.

Table 1 – Forest area and forest area changes in the twenty-one selected Mediterranean countries (1990, 2000, 2005 and 2010)

Region/Country	Forest area (1 000 ha)				Annual change rate											
	1990	% on T	2000	% on T	2005	% on T	2010	% on T	1990-2000				2000-2005			
									1 000 ha/yr	%	1 000 ha/yr	%	1 000 ha/yr	%	1 000 ha/yr	%
Southern (SM)	7,620.0	11.92	7,709.0	11.06	7,825.0	10.92	7,916.0	10.69	8.9	0.12	23.2	0.30	18.2	0.23	14.8	0.19
Algeria	1,667.0	2.61	1,579.0	2.27	1,536.0	2.14	1,492.0	2.01	-8.8	-0.53	-8.6	-0.54	-8.8	-0.59	-8.8	-0.52
Egypt	44.0	0.07	59.0	0.08	67.0	0.09	70.0	0.09	1.5	3.41	1.6	2.71	0.6	0.86	1.3	2.95
Libya	217.0	0.34	217.0	0.31	217.0	0.30	217.0	0.29	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Morocco	5,049.0	7.90	5,017.0	7.20	5,081.0	7.09	5,131.0	6.93	-3.2	-0.06	12.8	0.26	10.0	0.19	4.1	0.08
Tunisia	643.0	1.01	837.0	1.20	924.0	1.29	1,006.0	1.36	19.4	3.02	17.4	2.08	16.4	1.63	18.2	2.82
Eastern (EM)	10,485.0	16.40	11,043.0	15.85	11,675.0	16.29	12,298.0	16.60	55.8	0.53	126.4	1.14	124.6	1.01	90.7	0.86
Cyprus	161.0	0.25	172.0	0.25	173.0	0.24	173.0	0.23	1.1	0.68	0.2	0.12	0.0	0.00	0.6	0.37
Israel	132.0	0.21	153.0	0.22	155.0	0.22	154.0	0.21	2.1	1.59	0.4	0.26	-0.2	-0.13	1.1	0.83
Lebanon	131.0	0.20	131.0	0.19	137.0	0.19	137.0	0.18	0.0	0.00	1.2	0.92	0.0	0.00	0.3	0.23
Occupied Palestinian Territory	9.0	0.01	9.0	0.01	9.0	0.01	9.0	0.01	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Syrian Arab Republic	372.0	0.58	432.0	0.62	461.0	0.64	491.0	0.66	6.0	1.61	5.8	1.34	6.0	1.22	6.0	1.60
Turkey	9,680.0	15.14	10,146.0	14.56	10,740.0	14.98	11,334.0	15.30	46.6	0.48	118.8	1.17	118.8	1.05	82.7	0.85
North-Eastern (NEM)	9,879.0	15.45	10,216.0	14.66	10,408.0	14.52	10,580.0	14.28	33.7	0.34	38.4	0.38	34.4	0.33	35.1	0.35
Albania	789.0	1.23	769.0	1.10	782.0	1.09	776.0	1.05	-2.0	-0.25	2.6	0.34	-1.2	-0.15	-0.7	-0.08
Bosnia and Herzegovina	2,210.0	3.46	2,185.0	3.14	2,185.0	3.05	2,185.0	2.95	-2.5	-0.11	0.0	0.00	0.0	0.00	-1.3	-0.06
Croatia	1,850.0	2.89	1,885.0	2.71	1,903.0	2.66	1,920.0	2.59	3.5	0.19	3.6	0.19	3.4	0.18	3.5	0.19
Greece	3,299.0	5.16	3,601.0	5.17	3,752.0	5.23	3,903.0	5.27	30.2	0.92	30.2	0.84	30.2	0.77	30.2	0.92
Montenegro	543.0	0.85	543.0	0.78	543.0	0.76	543.0	0.73	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Slovenia	1,188.0	1.86	1,233.0	1.77	1,243.0	1.73	1,253.0	1.69	4.5	0.38	2.0	0.16	2.0	0.16	3.3	0.27
North-Western (NWM)	35,945.0	56.23	40,710.0	58.43	41,766.0	58.27	43,276.0	58.43	476.5	1.33	211.2	0.52	302.0	0.70	366.6	1.02
France	14,537.0	22.74	15,353.0	22.03	15,714.0	21.92	15,954.0	21.54	81.6	0.56	72.2	0.47	48.0	0.30	70.9	0.49
Italy	7,590.0	11.87	8,369.0	12.01	8,759.0	12.22	9,149.0	12.35	77.9	1.03	78.0	0.93	78.0	0.85	78.0	1.03
Malta	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Spain	13,818.0	21.61	16,988.0	24.38	17,293.0	24.13	18,173.0	24.53	317.0	2.29	61.0	0.36	176.0	0.97	217.8	1.58
TOTAL (T) = SM+EM+NEM+NWM	63,929.0	100.00	69,678.0	100.00	71,674.0	100.00	74,070.0	100.00	574.9	0.90	399.2	0.57	479.2	0.65	507.1	0.79

n.s. = not significant

Source: own elaboration from [2].

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Annex 2 - Historical, forgotten and new illegal activities: the changing patterns in the Italian forestry sector

Masiero, M., Pettenella, D., Secco, L., Florian, D. (2013). Historical, forgotten and new illegal activities: the changing patterns in the Italian forestry sector. Global Environmental Change. [submitted 2013]

Historical, forgotten and new illegal activities: the changing patterns in the Italian forestry sector

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Abstract

Forest illegality is mainly referred to as 'illegal logging' and associated to Southern countries. Emerging regulations, such as Regulation (EU) 995/2010, and economic/structural changes, are calling for growing attention on Northern countries and non-wood forest products/services. Due to intrinsic forestry and socio-economic characteristics Italy represents an interesting case-study. National forest illegality has been analysed by means of primary and secondary sources, identifying three main categories - historical, forgotten and new - of illegal practices. While illegal timber imports continue to play a major role, forest illegality goes beyond them: it includes a wide range of crimes/offences, covering many products and services delivered by national forests. Illegality prevails in southern regions, where criminal organisations are deeply rooted and corruption is highly perceived. The estimated value of these activities ranges between USD 1.88 and 3.95 billion, i.e. 2.4–5 times the total GDP generated by the sole national forestry sector.

1. Introduction

Illegality in the forestry sector and its affinity with corruption have been widely investigated (Callister, 1999; Seneca Creek Associates, 2004; Marmon, 2009) and debated in the international policy arena (Rademaekers *et al.*, 2010). Forest illegality is normally referred to as 'illegal logging' but - despite the prominent role played by wood and related trade - forest crimes include a wider range of activities (Tieguhong *et al.*, 2010; Global Witness, 2011). While economic and structural changes are pushing a multi-faceted demand for forest products and services, they are also affecting and differentiating illegality patterns.

Based on multiple evidence (deforestation rates, socio-economic conditions, etc.) forest crimes are normally associated to Southern countries and research has mostly concentrated on them. Relatively few studies have analysed illegality in Europe, mainly with a focus on Central-Eastern and Baltic countries (Buriaud, 2005; Kuemmerle *et al.*, 2009; Markus-Johansson *et al.*, 2010) while no study has taken Western Europe into consideration, where illegal harvesting is normally not discussed as an issue and forest crimes seem to represent a negligible problem (Ottitsch *et al.*, 2007).

In the meantime many Western European countries are major importers of illegal wood (Hirschberger, 2008) and the European Union (EU) has adopted specific measures. Among the most relevant are the Forest Law Enforcement Governance and Trade (FLEGT) Action Plan - approved in 2003 and then implemented by two Regulations in 2005 and 2008 - and Regulation (EU) 995/2010, also known as the EU Timber Regulation (EUTR). The former concentrates on relatively few product types and on EU partner countries signatory to Voluntary Partnership Agreements (VPA); the latter

covers a wide range of wood-based products, including EU domestic wood production. The forthcoming implementation of EUTR will directly affect local forest owners/managers, imposing reflections on legality at EU level.

Within the EU Italy represents an interesting case study for several reasons:

- (i) it is a major player on the international wood market, as one of the most significant wood importers worldwide due to high internal demand for industrial supply and increasing wood bioenergy consumption (Baudin *et al.*, 2005; ISPRA, 2009);
- (ii) it hosts expanding forest resources within a poorly dynamic forestry sector (Gasparini and Tabacchi, 2011);
- (iii) it is a "*country addicted to the culture of corruption*" (Ristuccia, 2011, p.64) showing the lowest Corruption Perception Index (Transparency International, 2012) and Control of Corruption Indicator (World Bank, 2012) values among Western EU countries;
- (iv) it stands out among high-income countries in terms of organised criminal activities (Pinotti, 2012). Although there are no forestry-specific studies, environmental crimes in Italy mainly occur in the four regions - Campania, Calabria, Sicily and Apulia - where criminal organisations are traditionally rooted (Legambiente, 2012);
- (v) civil society has already denounced the presence of criminal organisations infiltrating the forestry sector, while national institutions are now starting to react, as confirmed by the recent agreement between the National Forestry Corps (*Corpo Forestale dello Stato*, CFS) and the National *Anti-Mafia* Directorate (CFS, 2012).

This paper has been developed within the framework of the European Commission co-financed 'Stop Crimes on Renewables and Environment' (SCORE) project². After a brief description of the forestry sector and related industry, as well as of the perceived corruption level in Italy, the study identifies, presents and classifies the most common forms of illegality in the Italian forestry sector. Some examples of corruption are presented as well. Finally a preliminary estimation is made of the economic dimension of forest illegality at national level.

While organised crime in Italy has been a research topic for decades, the study of environmental crimes directly or indirectly depending on criminal organisations is quite a new issue. The relevance of this topic seems to be confirmed by the introduction of neologisms like '*ecomafia*' (Legambiente, 1994), '*zoomafia*' (LAV, 2011), and '*agromafia*' (CIA, 2012). Within such a context, the forestry sector is still an unexplored niche that has never been systematically investigated until now.

2. The Italian forest-wood sector

For a better understanding of forest illegalities in Italy, a short overview of the national forestry sector and related industry is provided below.

2.1 Forestry sector

Showing growth since the late 1940s, Italy's total forest area reported in the last National Inventory of Forests and Carbon Sinks (NIFCS) amounts to nearly 10.5 Million (M) hectares (ha), i.e. approximately 34.7% of the entire national land (Gasparini and Tabacchi, 2011). Recent studies based on the National Land Use Inventory, however, indicate Italian forests cover 11.8 Mha, i.e. 39% of national territory (Marchetti *et al.*, 2012). Many factors contribute to forest expansion; among them a prominent role is

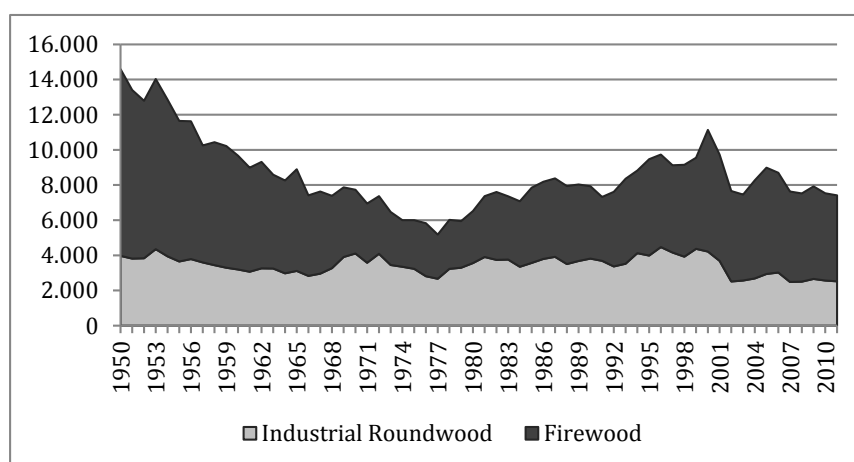
² For more information visit: www.euscore.eu.

played by natural recolonization of marginal lands due to agricultural abandonment in mountain areas. Almost two thirds (63.5%) of forests are privately owned, and 32.4% are public (Gasparini and Tabacchi, 2011). Forest land property structure is poorly dynamic, thus, despite forest expansion processes, the average size of forest companies remains very small. About 60% of companies own less than 5 ha and, all together, they cover just 6.4% of the national forest area. Their average size is 0.76 ha and it may be assumed many of their forests are just occasionally or never managed (APAT, 2003).

While forests cover more than one third of the country, the forestry sector plays a marginal role in the national economy. The Gross Domestic Product (GDP) from forestry represents only 1.3% of the primary sector GDP and 0.05% of total GDP (Croitoru *et al.*, 2005). The average value of national primary forest production over the last twenty years corresponds to 1% of the total primary sector production³ (MIPAAF, 2008).

The NIFCS classifies 81% of national forests as productive (Gasparini and Tabacchi, 2011) but due to steep slopes, inadequate forest roads, labour costs, property fragmentation and many other factors, forest management operations take place on only a small portion of these forests. According to official data published by the National Institute of Statistics (ISTAT) wood removals are very limited and - in the case of industrial roundwood - in decline since early 1980s (figure 1). Firewood shows a different trend: after World War II it represented more than 70% of total removals (i.e. 9-10 Mm³ on a total of 12-14 Mm³ removed). This percentage decreased until the early 1970s, then increased again to 7M m³ in 1999. After a slight decrease in 2002–2003, firewood removals in 2010 totalled 4.9 Mm³, i.e. 66% of total removals in Italy. Such a trend may be interpreted as a progressive shift from industrial roundwood production to low value products, back to a timber/firewood ratio close to the one observed in the 1960s. While in the past energy wood harvesting was often linked to the overexploitation of forest ecosystems, today harvesting operations remove only a small portion of forest increments, favouring a continuous increase of the average growing stock per hectare. In prospect, firewood seems to be bound to dominate forest production in Italy. This may be positive from an energy policy perspective, but when considering the added value of Italian silviculture and industrial supply needs, productive conditions in forestry result as being quite problematic. In the last fifty years the forest area has doubled, while the value of wood production has halved (APAT, 2003).

Figure 1 – **Wood removals in Italy (1,000m³), 1950-2010**



Source: Authors' elaboration from ISTAT data, various years.

³ Italian Primary Sector Production is equivalent to about 2.5% of national GDP.

Non-timber forest products (NTFPs) play an increasingly important role in the national forestry economy and stimulate active forest management both by individual forest owners and their associations. Hunting, harvesting of wild mushrooms and truffles, cork stripping, gathering of chestnuts, hazelnuts, blueberries, strawberries and raspberries, medicinal and aromatic herbs, pine kernels and other products contribute to the welfare of local rural communities and represent relevant niches for marketing strategies at different scale. According to ISTAT figures the total value of NTFPs harvested in 2008⁴ was about €85 M (table 1). Even in production-oriented forest areas, where wood harvesting operations are traditionally performed, the market value of recreation services connected to NTFPs (e.g. harvesting wild mushrooms) may be higher than timber production. Data on NTFPs, however, should be considered with caution because they widely refer to informal activities.

Table 1 – NTFPs production in Italy, quantity (tons) and value (€1,000), 2005-2008

Years	Chestnuts	Pine kernels	Mushrooms (a)	White truffles	Black truffles	Hazelnuts (b)	Blueberries	Strawberries	Raspberries	Acorns	Dried cork (c)	Raw cork (c)
Quantity (tons)												
2005	57,527.4	1,274.9	3,465.8	18.8	81.7	36,819	120.7	41.1	43.2	3,151.3	5,205.2	955.5
2006	52,615.1	968.4	3,306.7	19.3	68.8	47,534.7	201.6	41.6	33.4	3,449.3	9,324	1,181.5
2007	13,757.3	389.8	662.8	9.7	63.5	56,401.2	191.6	43	41.1	1,666.2	7,332.4	1,624.5
2008	30,217.5	350.3	996.1	9.6	58.9	8,879	108.1	33.6	29.2	528.4	6,193.6	1,517.9
Value (€1,000)												
2005	84,943	1,363	42,888	12,199	10,651	99,580	845	346	283	2,666	8,765	264
2006	55,515	1,816	39,985	15,370	10,804	70,378	1,714	376	252	3,287	17,326	300
2007	18,749	823	8,048	7,489	9,439	114,069	1,689	429	340	458	12,069	564
2008	36,532	694	11,365	7,578	8,018	15,217	582	297	204	199	3,892	406

(a) does not include cultivated products; (b) dried; (c) raw commercial material

Source: Authors' elaborations from ISTAT data, various years.

Bollettino mensile di statistica, <http://www.istat.it/dati/catalogo/>

There is a scarcity of information on **forest employment** in comparison with other forest management issues like forest areas, fires, removals, etc. ISTAT annual publications do not provide detailed figures on forest labour. The most recent and complete data available are those published in the 2001 Industry and Services Census that reported a total of 3,164 timber harvesting companies and 6,617 employees. Companies are very small (on average 2 employees/company), mostly family-owned and poorly equipped. The number of employees has halved since 1990, while the number of companies remained stable: as a consequence operative capacity has reduced. Besides private companies, cooperatives and public employment play a relevant role (table 2).

⁴ 2008 figures on a selected group of 12 NTFP categories are the most recently available ones. ISTAT hasn't published these figures since that year.

Table 2 – Italian forest operators: summary framework

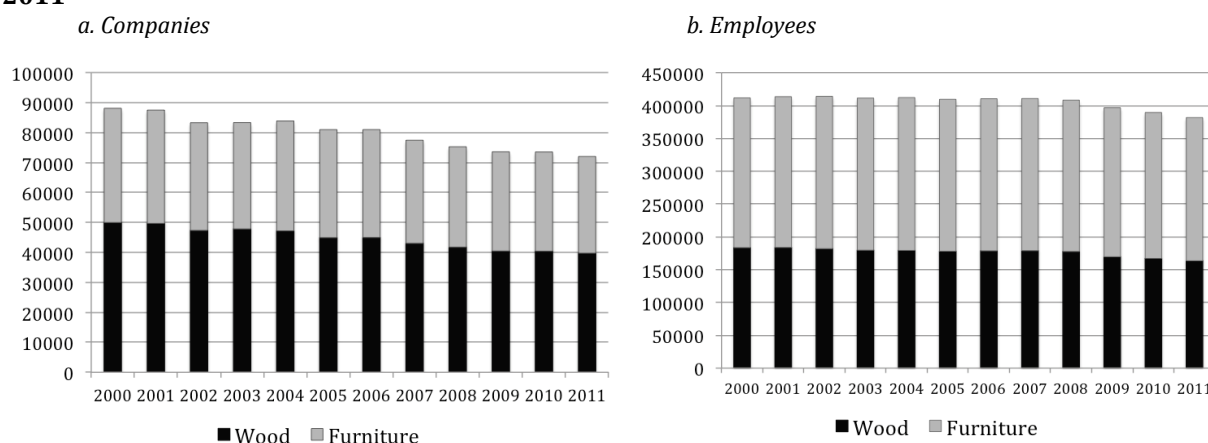
Sector dimensions	Main activity	Professionalism and productivity	Safety	Regularity	Notes
A. Forest operators employed by public bodies					
Several Public Bodies, 65-70,000 operators	Forest maintenance and improvement, afforestation, reforestation, and fire prevention/control	Limited professionalism and risks, low productivity	Good conditions, limited problems	Regular contracts	Mainly in southern regions (85-92% of grand total), in particular Sicily (27,000 operators) and Calabria (8,500). Strong presence of seasonal operators; ageing process. Incidence of women higher than in other sectors.
B. Forest cooperatives					
500 companies 4-6,000 operators	Forest maintenance and improvement, afforestation, reforestation, and harvesting	Heterogeneous conditions depending on activities; in general higher professionalism and productivity than category A.	Similar condition to previous category but higher risks	Regular contracts, but influenced by work load and conditions of any single company	High incidence of young and seasonal operators.
C. Forest companies					
8-9,000 local units (of which 6-7,000 specialised); 24-28,000 operators plus unprofessional operators	Harvesting	Heterogeneous conditions depending on contracting body (public vs. private) and work conditions (high stands vs. coppices)	Basic safety conditions largely not respected; high accident risks.	Growing presence of irregular operators, including migrant ones	No or few women; ageing process. Weak or lacking public control on work conditions.

Source: Authors' elaboration from Pettenella and Secco, 2004.

2.2 Wood processing and furniture industry

The national wood processing and furniture industry includes 72,042 companies and 381,835 employees, with a total annual turnover of €32 billion (2011) i.e. about 5% of the total turnover of the national manufacturing sector. After a huge turnover collapse in 2009 (-18%) and a slight recovery in 2010 (+1.9%) the sector showed a new slump in 2011, with a 4.8% turnover drop in the furniture segment and a 3.1% decrease in the wood one (Federlegno-Arredo, 2012). Due to growing competition and the global economic crisis, both companies and employees have decreased in the last ten years (Figure 2). The furniture sector represents the main segment: it generates 63% of the total turnover and covers 57% of all companies. After China and Germany, Italy is the largest furniture exporter worldwide; together with fashion and food industry, furniture is one of the pillars (the so called 4 “A’s”) of “Made in Italy”.

Figure 2 – Number of companies (a) and employees (b) in the wood-furniture sector in Italy, 2000-2011



Source: Authors' elaboration from Federlegno-Arredo, various years.

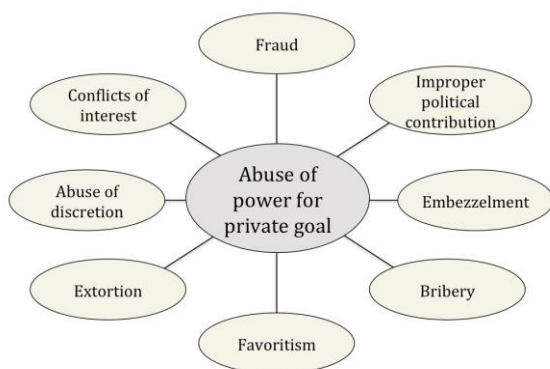
The wood-furniture industry is largely based on medium-small businesses, mainly operating as craft enterprises (up to 88%) characterised by low investment capacity in research and development. The main competitive advantages are represented by the design quality and the flexibility offered by the specialised industrial districts. High value (hard)wood imports play a central role for the sector: Italy remains one of the main markets for several countries experiencing deforestation and illegal logging (ISPRA, 2009). In order to compete with countries presenting competitive advantages in terms of labour and wood supply costs, production has been partly delocalised at national and then at international level. Moreover, instead of consolidating production cycles in large corporate structures, Italian companies have mainly specialised and developed as sub-contractors (Bernetti and Romano, 2007).

The national forest industry also includes the paper sector with 134 companies and around 20,900 employees producing 9.5 M tons of paper/paperboards per year (Assocarta, 2012). The national paper industry is largely different from the wood-furniture one in terms of average company size, technology and investment capacities. Nevertheless the two industrial sectors share a common issue: a growing gap between national forest production and industrial wood demand. While industry is increasingly dependent on wood imports and domestically recovered wood waste, the forestry sector has focused on low value products (firewood) mainly for self or local consumption.

3. Corruption in Italy

The United Nations (2001, p. 15) define corruption as “[...] *an abuse of public power for private gain that hampers the public interest*”. When examining the literature, however, it becomes clear that corruption is a complex collection of different phenomena (figure 3). In the Italian legal system corruption and related crimes (e.g. bribery) are prosecuted according to the penal code, but Italy remains one of the few EU Member States having not ratified the Criminal Law Convention on Corruption and its Additional Protocol.

Figure 3 – Forms of corruption

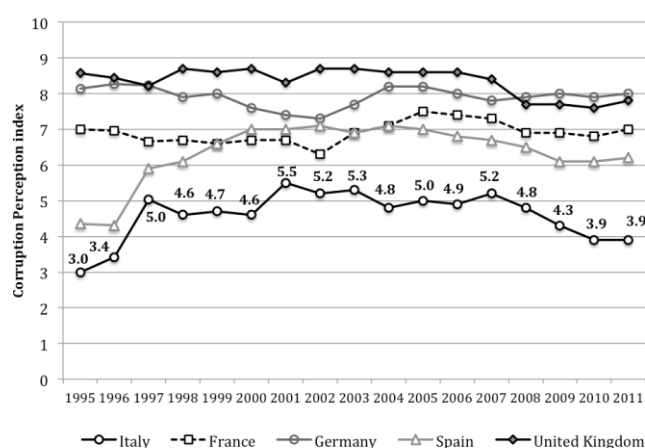


Source: Authors' elaboration from Langseth and Vlassis, 2002.

Corruption represents an historical component in the Italian political and socio-cultural system. Del Monte and Papagni (2007) analysed corruption crimes per capita detected by Italian law for the 1963-2001 period, showing that they began to spread in the early 1970s and reached their peak in 1995, when, due to a strong anti-corruption campaign called *Mani Pulite*, they diminished. Prosecutions for crimes against the Public Administration have remained stable in the last seven years, with around 3,300

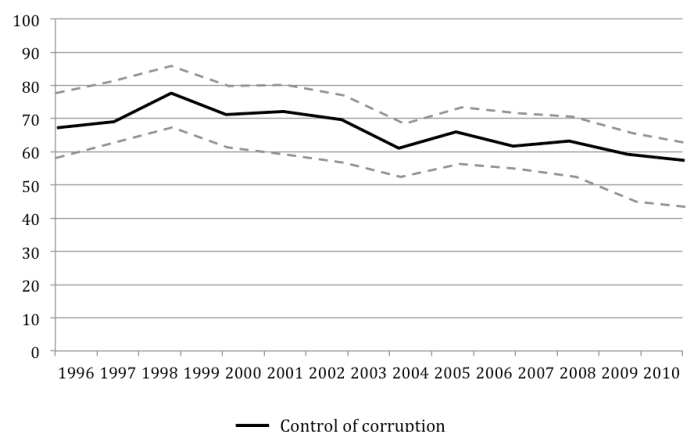
cases/year, 10% of which specifically refers to bribery and corruption (SAeT, 2011). It should be noted, however, that when reference is only made to complaints/prosecutions, this means “emerged” corruption, but most likely part of the phenomenon remains hidden (Fiorino and Galli, 2010). While 67% of Europeans consider corruption as a major problem, 87% of Italians believe that corruption is part of their country’s business culture (Eurobarometer, 2012). Moreover, 13% of them declare they have been victims of bribery in the past 12 months and 65% perceive that corruption has increased in the past three years (Transparency International, 2012a). Corruption indexes developed by independent bodies confirm this general perception. The CPI for Italy has shown a negative trend during the last ten years passing from 5.5 in 2001 to 3.9 in 2010 (figure 4). According to 2011 data Italy ranks 69th (within 182 countries) showing the lowest value in Western Europe. Similarly, the World Bank Control of Corruption Index has decreased over time (figure 5) and qualifies Italy in the middle percentile, with a total 57.4 score, corresponding to a ranking of 24th out of 27 EU Member States (World Bank, 2012). Analogous results emerge from the International Country Risk Guide (ICRG) developed by PRS Group. As regards the Bribe Payers Index (BPI), which expresses the likelihood of companies headquartered in a given country to pay bribes abroad, in 2011 Italy scored 7.6, ranking 15th out of 28 surveyed countries (Transparency International 2012b).

Figure 4 – CPI trend for Italy and selected West European countries, 1995-2011



Source: Authors’ elaboration from Transparency International, various years.

Figure 5 – Control of corruption for Italy, percentile rank (0-100), 1996-2010

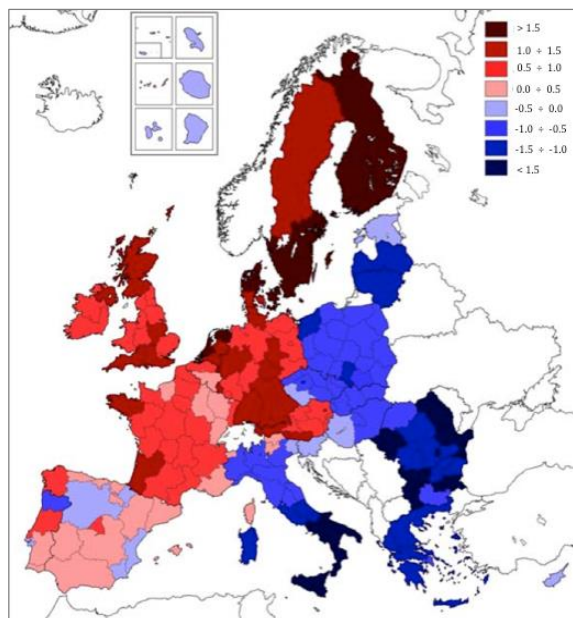


Source: World Bank, 2012.

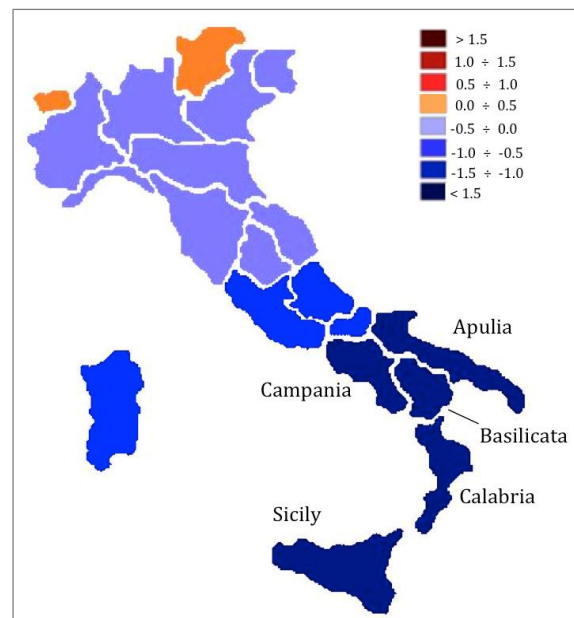
Some of these indicators have been criticised by international bodies (OECD, 2011) but when carefully considered they provide consistent information on corruption in Italy (University of Gothenburg, 2010). Nevertheless they are all measured at national level, while the scale of corruption varies not only across countries, but also in time and space within a given country (Treisman, 2000). The University of Gothenburg (2010) has created a Quality of Government (QoG) EU regional index based on the Worldwide Governance Indicators developed by the World Bank. The index takes into consideration four pillars - corruption, rule of law, bureaucratic effectiveness, and government voice and accountability - and has been developed through a survey involving 34,400 respondents in 172 NUTS 1 and 2 regions all over the EU. Italy displays the most within-country QoG variation in Europe, and has been clustered in the same group as Eastern EU countries. With reference to corruption pillar, Italian southern regions show the highest corruption values at national and EU level (figure 7), thus confirming official data on prosecutions for corruption-related crimes.

Figure 7 – Corruption QoG pillar at regional level in 27 EU countries (a) and Italy (b)

(a) 27 EU countries



(b) Italy



Source: Authors' elaboration from University of Gothenburg, 2010.

QoG findings are confirmed by additional studies that analysed corruption within Italian regions. Del Monte and Papagni (2007) and Fiorino and Galli (2010) studied determinants of corruption at regional scale in Italy and found that, at empirical level, the main corruption drivers are the level of per capita income (negative correlation) and education (positive correlation). Southern Italian regions, such as Apulia, Basilicata, Calabria, Campania and Sicily, are characterised by low income and (on average) high levels of education, because this often represents a substitute for job opportunities in structurally weak economies. Moreover, Fiorino and Galli (2010) observed a strong link between corruption and associative crimes for which Campania, Calabria and Sicily show the highest average annual number of prosecutions.

Although decentralized (or federal) systems have been considered alternatively either as a potential source of corruption or as a source of honesty and efficiency (Fiorino and Galli, 2010), many authors (Fisman and Gatti, 2002; Freille, *et al.*, 2007; Lessman and

Markwardt, 2010) emphasized the role of federalism - when improperly implemented - as a potential determinant for corruption. In the last 30 years, Italy has gone through many institutional reforms from a highly centralized model to a decentralized one. Decentralization of functions and central allocation of resources made politicians irresponsible and reduced incentives to allocate resources efficiently. Starting from early 1970s administration and legislative functions on agriculture and forestry issues have been transferred to Italian Regional governments that have full competence for defining/adopting Forest Laws and - more generally - full responsibility over forest management regulation activities, control and funding within their territories.

4. Research methodology

For the purposes of the research, primary and secondary sources have been considered. The first include semi-structured interviews with five CFS officials and fifteen experts, including forest technicians, university researchers, forest owners, etc. Interviewees were selected among people with some familiarity with forest and environmental crimes and their geographical distribution covered a wide range of national regions, with a prevalent focus on the south. Twenty-five wood processing companies and traders were also interviewed in order to assess their perception of illegality issues.

Secondary sources include an extensive literature review covering laws and norms, official judgments by the Supreme Court and other judgment databases, official acts, annual reports and press releases published by the CFS, documents from the Observatory on Forest Labour (OLAB), publications by forest and wood sector federations (e.g. Federlegno-Arredo), official figures from ISTAT, analytical documents prepared by Institutional bodies, reports from environmental and social non-government organisations and other studies, including scientific papers, reports by media and grey literature.

The collected information has been used to classify illegalities into three different categories, describing present trends and trying to foresee future developments. Corruption issues have also been analysed on the basis of both international and national studies. Finally, a tentative estimation of the economic value of the main illegality types has been made. Data identification and collection resulted as quite problematic because the topic had never been systematically investigated until now. While the literature on certain types of crime is quite abundant, in other cases information is very scarce, fragmented and sometimes derived from empirical experience.

5. Results and discussion

Illegal practices have been classified into three categories: (i) **historical**, (ii) **forgotten**, and (iii) **new** illegality. Each category is presented in detail, making reference to selected illegality sub-types.

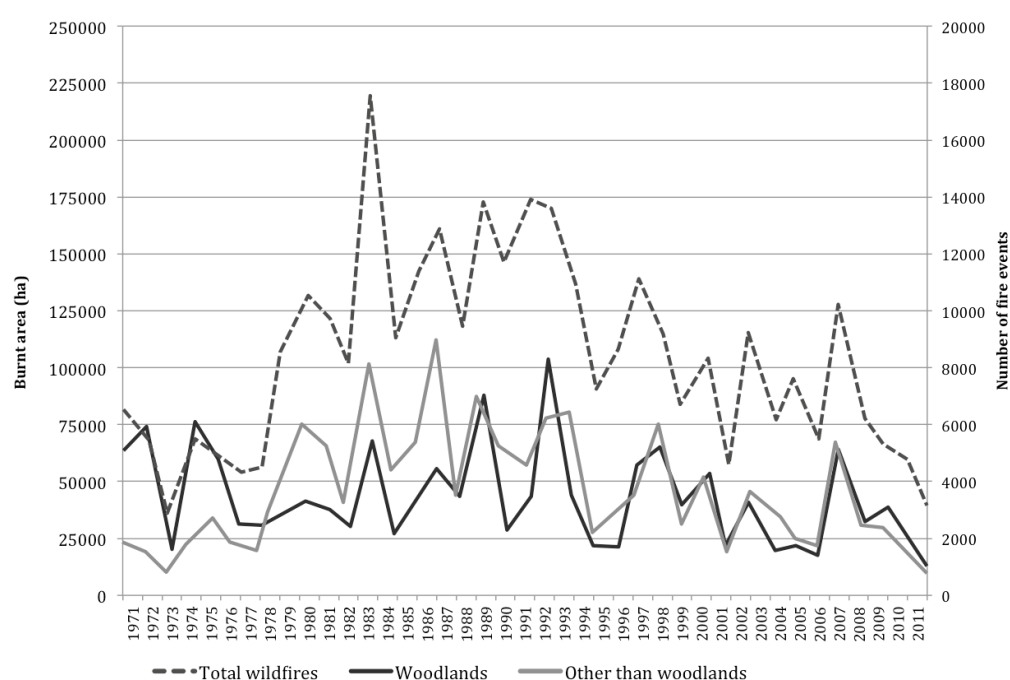
5.1 Historical illegality

Historical illegality covers activities taking place for a long time and traditionally addressed by designated authorities such as the CFS. It includes arson and culpable forest fires, irregular harvesting operations, tax fraud in firewood collection and trade, abusive grazing, illegal dumps and unauthorized building in forests, and poaching.

a. Forest fires – In the last ten years on average more than 45% of fires in Italy occurred on forestlands. The phenomenon is not generalized throughout the country: about 50 of the 110 national provinces are the most affected (JRC, 2011) and 75% of forest fires occur in 26 provinces, mostly located in Central-Southern Italy (Lovreglio *et al.*, 2012). The total number of forest fires per year has fluctuated over time: on average 6,964 events occurred in the 1970s, 11,348 in the 1980s, 10,576 in the 1990s and 6,857 between 2001 and 2010 (Lovreglio *et al.*, 2012) (figure 8).

In the 1970-2010 period the average area burnt per fire event decreased, passing from 13.5 ha in the 1970s, to 11.6 ha in 2000-2010 (ISTAT, 2010)⁵. On the contrary the relative incidence of arson on the total number of fires has gradually grown from 49% in 1999 to almost 60% in 2010 (CFS, 2002 and 2010).

Figure 8 – Wildfires in Italy: burnt area (ha) and number of events, 1971 – 2011



Source: Authors' elaboration from Lovreglio *et al.*, 2012.

The Mediterranean region accounts for the largest proportion of human-induced fires worldwide (95%) (FAO, 2007) and Italy is no exception. It has been estimated that only 2% of forest fires in Italy occur naturally, while 98% of them are induced. The first study on wildfires in Italy published by the CFS in 2002 indicated that 59.3% of fires were classified as arson, while 17.8% of them were the result of negligent conduct. Similar figures are given by data reported in the Italian fire database (Lovreglio *et al.*, 2010). Depending on the socio-economic and productive profile of the territory, about 42 different potential causes for human-induced forest fires have been identified (CFS, 2002). Arson causes can be grouped into three categories: (i) profit-seeking, (ii) protest, and (iii) lack of environmental sensitivity. Nearly 70% of arsons, i.e. 42% of total forest

⁵ Some exceptions exist: 2007 was defined as the “*annus horribilis*” for forest fires in Italy, with 10,614 events on a global forest area of about 116.602 ha (WWF, 2008). Moreover, preliminary data for 2012 published in August indicate a growth in terms of both fire events (+79%) and burnt areas (+104%). The increase of forestlands destroyed by fires is much more evident than that regarding other lands (+146% and +61% respectively) (CFS, 2012a).

fires in Italy, can be attributed to the first category (Lovreglio *et al.*, 2010). Examples include shepherds' acting to increase fodder production, poaching (e.g. to clear vegetation or flush out wild animals), speculation about potential land use changes or reforestation operations, etc. (IIA, 1993; Vadalà, 2009). A Delphi method investigation by Lovreglio *et al.* (2010) highlighted that profit-seeking in terms of employment opportunities represents one of the most relevant causes for arson in Italy. The case of seasonal forest workers employed by the state for fire prevention and protection in Sicily is paradigmatic. In 2007, while a trade dispute was going on to extend their annual employment period, a few of them were found setting fire to woodlands to create favourable employment conditions.

b. Harvesting – Illegalities consist of administrative offences - such as insufficient number of stems left on coppice stands, and environmental damage resulting from forest operations - rather than criminal ones. The last figures published by ISTAT refer to 2005 and indicate a total number of nearly 7,000 offences against forest, hydrogeological and landscape laws, equivalent to 7.5% of the total forest operations performed every year in Italy. Offences are mostly concentrated in central (40%) and southern (30%) regions. About 4,276 administrative offences (but no criminal ones) were reported in 2009 by the CFS (2010). The same source, however, highlights an increasing trend in illegal logging. Although this is normally limited to small amounts of wood (mainly firewood) impacts may be quite relevant, especially when harvesting is done in protected areas. For example in May 2012 more than 120 tons of firewood illegally harvested in the Gargano National Park (Apulia) were seized by CFS (CFS, 2012b). In the Sila National Park (Calabria), recently added to the UNESCO World Heritage Centre Tentative Lists, illegal logging has been largely reported under the form of overexploitation rates and unauthorised harvesting. A Parliamentary Question highlighted that the CFS denounced the presence of organised crime behind some of the forest companies involved (Camera dei Deputati, 2011).

c. Firewood collection/trade and tax fraud - While it is probably not possible to speak about illegality *tout-court*, a lot of evidence casts legitimate doubts on the full regularity of firewood harvesting operations and trade flows. A key element is the incongruity between official figures on forest removals published by ISTAT and estimations provided by several models based on consumption levels. In the last years the tendency to underestimation by ISTAT data has been observed by many researches (APAT, 2003; Magnani, 2005). Corona *et al.* (2007) compared the size of coppice clearcuts in some regions in Central-Southern Italy as reported by administrative statistics with data resulting from interpretation of high-resolution satellite images. The latter provided significantly higher values, with an average ratio of 1.45 between clearcut area observed by satellite images within each sample unit and the corresponding administrative statistics.

It may be assumed that the underestimation of harvested areas implies the underestimation of firewood removals as well. Removals are regularly recorded, but the complexity of procedures implemented by the regional bodies responsible for harvesting permit issuing could lead to underestimation. Firewood removals have strongly increased in the last decade: likely by more than official statistics show (FAO, 2010a). While ISTAT data indicate annual removals ranging between 3 and 5 Mm³, depending on the year, several studies based on firewood consumption levels suggest higher values. Taking into account surveys performed by ENEA in the late 1990s

(Gerardi *et al.*, 1998; Gerardi and Parrella, 1999), Hellrigl (2002) estimated household consumption levels between 16 and 20 M tons/year in the 1997-1999 period. Such values would be in line with production and consumption figures shown by other European countries (Hellrigl, 2002a). A survey on domestic firewood consumption in Italy conducted by ARPA Lombardia and APAT calculated consumption values around 19 M tons/year (APAT-ARPA Lombardia, 2007). Assuming 1 m³ of wood corresponds to 0.5 tons (Mantau, 2010) this would imply household consumption levels between 32 and 43 M m³. Estimations made by Pettenella and Andrighetto (2011) on the basis of data from Steierer *et al.* (2007) and Mantau *et al.* (2008) led to 23 and 16.5 M m³ of consumption respectively. According to FAOSTAT figures, in 2010 Italy imported about 3.5 M m³ of firewood, charcoal and wood residues⁶. Even considering this contribution, ISTAT figures on national forest removals are absolutely inadequate to account for domestic energy wood consumption. Of course this doesn't automatically imply that unreported and missing quantities are illegal; nevertheless, by confirming that official data on domestic harvesting are largely underestimated, it suggests that the sector is opaque. Empirical experience indicates that an informal market for firewood exists, with more than plausible consequences in terms of Value Added Tax (VAT) frauds. The growing demand for energy biomasses and the relentless increase in oil prices could exasperate this trend as confirmed by the growing number of firewood theft cases reported in the media.

d. Poaching - Crimes against wild fauna represent one of the most common and profitable forms of illegality perpetrated in forests. In 2009, 938 crimes and 2,300 offences were prosecuted by CFS, for a total amount of €2.4 M in fines (CFS, 2010). Poaching shows an increasing trend and strong connections with organised crime. The business is so huge that - especially in the case of birds - poachers traverse Italy following animal migration flows. The existence of poaching tourism has been highlighted by several CFS reports that indicate an increasing number of poachers from northern Italian regions hunting in Sicily and other southern or central regions like Calabria, Lazio and Tuscany. The general picture, however, still remains somewhat unclear and only isolated information was collected through interviews and secondary sources. Legambiente (2005) estimated that in at least 50% of cases poaching is carried out as a for-profit activity and takes place within parks and protected areas. Prices for prey range from €50-100 for a single skylark or quail, or for one kilogramme of dormouse meat, to €10,000 for a single Bonelli's eagle or one albino goldfinch specimen. Poaching is not restricted to Southern Italy. According to data reported by Furlan (2009), in Brescia and Bergamo provinces (Lombardy), illegal bird hunting is a common practice that allows a single poacher to earn up to €20,000/year. Baretta (2008) analysed poaching dynamics in Friuli Venezia Giulia where illegal practices are quite common because of the geographical position of the region that on the one hand forms a natural corridor for migration flows from Central-Eastern Europe to the Mediterranean Basin, and on the other represents a convenient gateway for much illegal traffic from the Balkans.

The relevance of poaching however is not just limited to business opportunities: traditional and symbolic connections with organised crime can also be identified. For example this is the case of dormouse that is part of the '*ndrangheta* ritual symbolism as a dish used by competing '*ndrine* to make peace (LAV, 2011).

⁶ In detail: Firewood: 0.95 M m³; wood residues: 2.35 M m³; charcoal: 0.18 M m³ (FAO, 2012).

In addition to domestic poaching, illegalities also regard trafficking in wildlife species, including those listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). In 2010 the CFS CITES Investigative Division detected 202 crimes and 277 administrative offences, imposing sanctions for about €370,000. In the same year live animals and animal products for a total value of €3 M were seized (CFS, 2011). Data reported for the first semester of 2012 are even higher: 571 crimes and 2,470 offences were detected and fines totalled €1.87 M (CFS, 2012a). Italy represents one of the most important markets for protected species of flora and fauna, and investigations have shown the existence of forged documents to hide the illegal origin of products (CFS, 2011). Illegal game imports from the Balkans are also growing. In this case illegality may not refer to the origin of specimens/meat but the violation of public health laws regulating imports of animals and animal products from extra-EU countries (CFS, 2010).

5.2 Forgotten illegality

This category includes widespread illegal practices, the incidence of which however is largely underestimated or even ignored. Two main types of illegality are discussed here: the violation of basic health and safety regulations for forest operators, and illegal wood product imports.

a. Violation of basic health and safety regulations – Health and safety issues and, more generally, employment conditions represent a cone of shadow in the Italian forestry sector. Notwithstanding the presence of a robust normative framework that, in theory, should safeguard workers, irregular labour is a common phenomenon. Because of similarity with the black market, it is informally called '*lavoro nero*' (i.e. black labour), but most cases seem to qualify as 'grey labour', i.e. opaque labour conditions that are formally correct but irregular in substance (Costanzo, 2010). Available data are scarce and their quality is low, but there is a common perception that forestry in Italy is moving towards "[...] *unskilled, badly equipped, irregularly employed and underpaid workers, highly exposed to the risk of work accidents*" (Consiglio Editoriale della Rivista Sherwood, 2002).

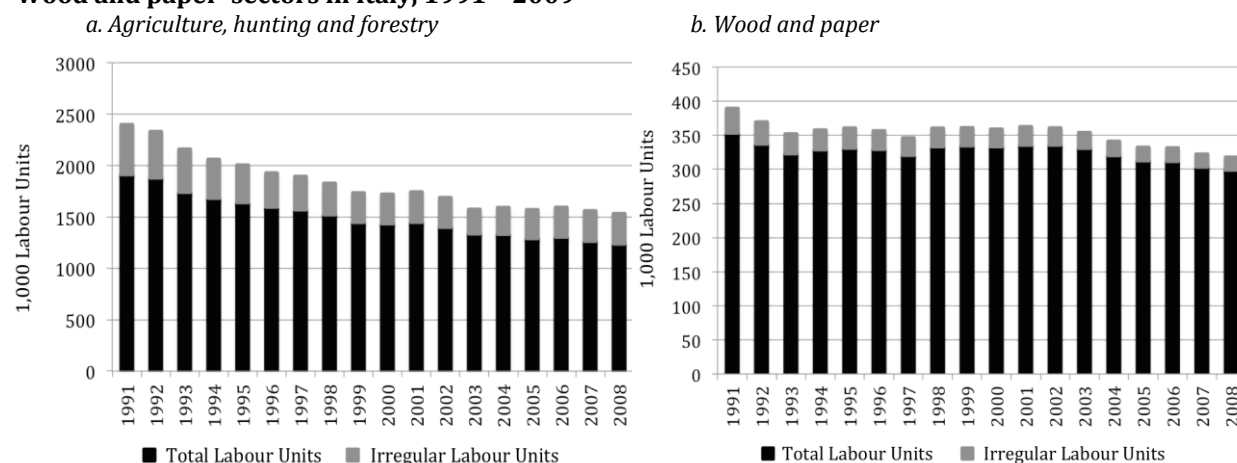
ISTAT statistics on irregular labour include the forestry sector under 'Agriculture, hunting and forestry' macro-category, therefore isolating forestry-specific data is not possible. In 2009 about 290,700 labour units - i.e. 24% of total units⁷ in the macro-category - were irregularly employed. Relative figures are quite different when considering employees and self-employed workers: in the first case the incidence of irregular labour is around 44% but on the decrease, while in the second it is 13% and expanding (ISTAT, 2011) (figure 9a). Considering the 1991-2009 period, figures on total employees and irregular workers had similar decrease rates (-37% and -40% respectively) but showing different trends. While the total number of employees had continuously decreased, irregular employees decreased until 2000 and then (with a few fluctuations) had increased again. As a consequence, their incidence has grown from 2003, reaching the values already observed in the early 1990s. The relevance of irregular labour is also spatially differentiated and ranges from a maximum of 31% (Lombardy and Friuli Venezia Giulia) to a minimum of 14% (Bolzano Autonomous

⁷ i.e. the amount of labour provided by a fulltime employee in one year, or the equivalent amount of labour provided by part-time employees or multiple employees.

Province and Tuscany). About 44% of irregular workers operate in southern regions, but this percentage has decreased since 2000 (when it was 55%), while the incidence of northern regions has increased from 31% to almost 43%.

‘Agriculture, hunting and forestry’ macro-category ranks third among categories with the highest irregular employment rate in Italy, but, as mentioned, ISTAT data do not allow specific figures to be extrapolated for forestry. A rough preliminary estimate has been made by Pettenella and Secco (2004) based on two different scenarios: (i) forest removals reported by ISTAT; and (ii) forest removals estimated on the basis of real firewood consumption levels. Assuming 24-28,000 regular fulltime employees in forestry, scenario (ii) would lead to 2-3 occasional employees for each regular employee. It is not unrealistic to assume that these occasional workers are largely employed in violation of basic health, safety and labour rules: this would make forestry the main economic activity in terms of irregular labour in Italy. As regards the forest industry, in 2009 about 19,400 units, i.e. 7% of total units in the industry, were irregularly employed, with different values for the wood (10%) and paper (5%) sectors.

Figure 9 – Total and irregular labour units in the (a) ‘Agriculture, hunting and forestry’ and (b) ‘Wood and paper’ sectors in Italy, 1991 – 2009

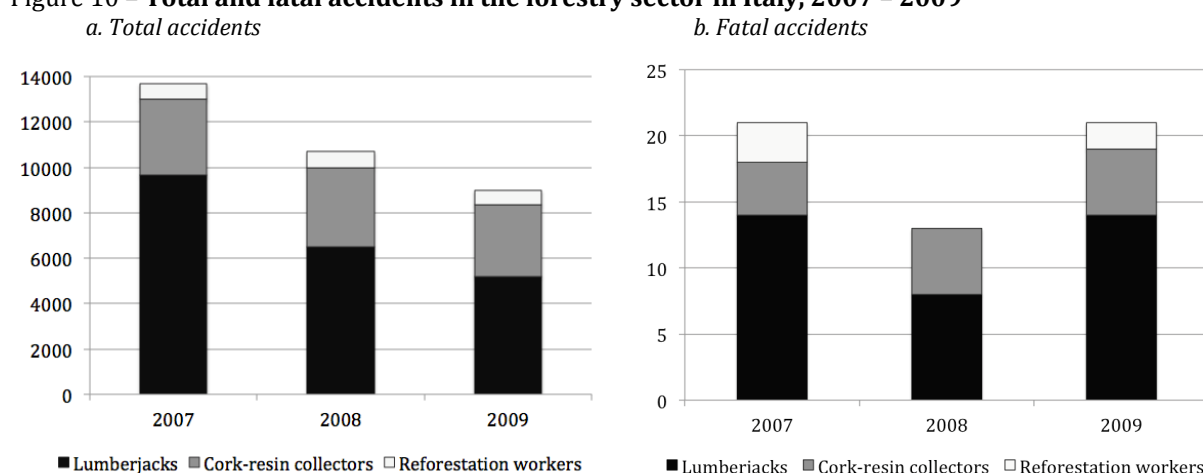


Source: Authors' elaboration from ISTAT, 2011.

Irregular labour is also linked to the presence of (irregular) migrant workers and increased accident risk. Many studies report a process of ‘Californisation of agriculture’ in Italy since the 1980s (Martin, 1985), i.e. the creation of an agriculture system strongly dependant on low-cost workers and seasonal immigrants. According to INEA (2009) there are around 161,000 migrant workers operating in agriculture, i.e. 16% of total employees. Although official figures referring to the sole forestry sector are not available at national level, interviews conducted for this study and reports at local scale indicate that in many areas migrant forest workers prevail over local ones. They are mainly from the Balkans and Eastern Europe, often skilled in forestry, and do not only represent a resource in terms of labour force, but are also creating their own enterprises that operate as sub-contractors. Migrant forest workers are often irregularly employed as piece-workers by small companies that sign regular contracts with forest owners and then outsource their activities (Costanzo, 2010). Irregular contracts, piece-working, seasonality and illegal immigration - together with isolated worksites - are all factors that increase the number of working hours per day, worsening labour conditions and exacerbating accident risks.

Statistics on work accidents based on preliminary results of the National Agriculture Census and published by the National Insurance Institute for Employment Injuries (INAIL) report 50,180 accidents in 2010. About 5% (i.e. 2,719) are due to silviculture practices: 40% of these involve migrant workers. Figures are probably underestimated because forest workers are largely employed in activities different from silviculture (e.g. forest roads construction, public parks and gardens management etc.). INAIL Occupation Database (2012a), indeed, reports 8,996 accidents involving forest workers in 2009, 21 of which were fatal. The total number of accidents has decreased since 2007 for lumberjacks, but remained more or less stable for other categories (figure 10). It cannot be excluded that minor accidents occurring to illegal immigrants are not reported to avoid deportation or other sanctions. Moreover an analysis of medical certificates revealed that the average prognosis for recovery from forest accidents is longer than for agriculture ones (14.5 vs. 8.6 days) (ISPELS quoted by Costanzo, 2010). As for the forest industry, it should be noted that wood-processing remains one of the four economic sectors with the highest accident risk in Italy (INAIL, 2012b).

Figure 10 – Total and fatal accidents in the forestry sector in Italy, 2007 – 2009



Source: Authors' elaboration from INAIL, 2012a.

b. Illegal wood product imports - As the 6th wood importer at international level and the 2nd at European level, Italy imports both added-value products - such as sawnwood (5th importer) and veneers (3rd) - to supply the national furniture industry, and low value products - such as firewood (1st) and wood residues (4th) - mainly used for energy and wood panels production (FAO, 2012).

Italy maintains close relationships with countries where a lot of evidence exists of forest illegality, being the main commercial partner (importer) for Cameroon, Côte d'Ivoire, Romania, Bosnia and Herzegovina, Albania and Serbia (FAO, 2012). A conservative estimate by ISPRA (2009) indicates illegal wood represents 7 to 10% of total wood imports at national level, for a global value ranging between €0.9 and €2.7 Billion.

The implementation of EUTR may represent a good chance for contrasting illegal wood imports and helping national companies to responsibly select their suppliers. As for the FLEGT programme and related Regulations, however, the Italian Government remains quiescent and doesn't act proactively. Italy is not directly involved in any of the signed VPAs or in those currently being negotiated (Torta, 2012) and remains one of the three EU countries that have not yet fully identified and appointed national EUTR Competent Authorities (EC, 2012).

It should also be remembered that some Italian companies and their associates have been found to be involved in illegal practices while managing forest concessions outside Italy. Forest Monitoring reports by REM (2012), for example, highlight several infractions by at least two Italian companies operating in Cameroon.

5.3 New illegality

Emerging and largely unknown forest crimes constitute the third category. The main types are: money laundering, fiscal irregularities in the pallet trade, illegalities in the mushroom and truffle trade, cannabis cultivation in forests and irregularities in the institutional carbon credit markets.

a. Money laundering - Money laundering is increasingly recognised as a relevant component of illegal forest processes at international level (Pereira Goncalves *et al.*, 2012) and widely reported as a crime in Italy. A study conducted by the Central Bank of Italy estimated laundering practices between 1981 and 2001 grew to 12% of the GDP, i.e. twice the average incidence estimated by the International Monetary Fund at world level (Tarantola, 2012). Although there are no official investigations yet underway, CFS officials interviewed for this study declared that money laundering through forest investments is becoming common practice not just in the south, but also in Central Italy. 'Dirty' money is invested to create and equip forest companies or to favour high bids in forest auctions, in order to wrong-foot regular enterprises. Organised crime control over forest operations is traditionally strong in Calabria. In 2009 a criminal cartel made up of four different '*Ndrine* exercised control over harvesting operations and forest auctions by asking local companies to pay up to €5,000 as protection money (*pizzo*) (Legambiente, 2010). A recent inquiry on the criminal gang *Lo Giudice* identified several companies managed by figureheads and used as a front for money laundering: at least two of these companies operate in the wood sector. Money from laundering practices is sometimes invested also in forestlands, for example for the creation of hunting reserves, or in NTFPs international trade. As witnessed by interviewed stakeholders, some Italian companies reinvest money from illegal traffic in the purchase of mushrooms from the Balkans, Central-Eastern Europe and even Scandinavia (Sweden and Finland). Mushrooms are then re-sold on other markets - including the Italian one - sometimes by means of triangulation with third countries (e.g. Romania) in order to make traceability difficult. A similar mechanism can be adopted for VAT frauds.

b. Fiscal irregularities in the trade of pallets - According to the Italian Association of wood packing, pallet, cork and logistics services (Assoimballaggi) three main types of illegality can be identified (Assoimballaggi, 2006): (i) the trade of pallets irregularly marked as compliant with technical requirements; (ii) imports of wood packaging produced with illegal timber from Eastern Europe; (iii) the trade of pallets stolen from the pallet interchange mechanism. These pallets are then sold to commercial operators that reintroduce them on the market, causing many negative impacts. Among them VAT frauds for a total value of about €396 M/year have been reported (Fava *et al.*, 2009). Similar dynamics can be observed for pallet imports from EU Member States. In some cases *ad hoc* companies are created: pallets are imported with an Intrastat declaration and exempted from VAT. The same products are then sold on the Italian market with the VAT added on: instead of handing the VAT over to tax authorities, traders pocket the money. These companies normally operate for one or two years at a maximum and,

avoiding VAT payments, can offer their products at a very competitive price. The evasion of the interchange mechanism implies improved costs for regular industrial and trade companies that have to reintegrate stolen pallets and which may be induced to do so by unqualified operators offering cheap products and using legal loopholes.

c. Illegality in the mushroom and truffle trade - Many different types of illegality can be listed under this category. Apart from the previously mentioned money laundering practices, another common form of illegality is represented by tax fraud due to self-invoicing. Under certain conditions, in fact, mushroom pickers are exempt from ordinary documental and accounting obligations (e.g. invoicing, periodic payments, annual declarations, etc.). Those who buy mushrooms from pickers are required to self-invoice their purchases and to record self-invoices separately: the corresponding VAT can then be deducted accordingly (Agenzia delle Entrate, 2004). Empirical experience and reports from key informants indicate over-self-invoicing is a common practice among mushroom buyers (traders, processors, etc.) in order to reduce due VAT payments. Similar dynamics have been reported for other NTFPs like wild asparagus and pine kernels.

A new and expanding area of illegality is represented by the truffle trade and related frauds. Many truffle surrogates belonging to the genera *Tirmania*, *Terfezia* and *Picoa* are grown in China and Maghreb and then illegally traded as real truffles. These imported tubers are not included in the Annex 1 to Law 752/1985 that lists all nationally tradable truffles. Surrogates do not present the same organoleptic characteristics as real truffles, but their collection is much easier and cheaper; furthermore they are extremely porous, so suitable for artificial aromatisation. *Tuber indicum* Cooke et Massee from China is a surrogate of fine black truffle (*Tuber melanosporum*). Although not allowed, imports of this product to Italy are quite common and *Tuber indicum* is widely claimed as fine black truffle. In 2006 China exported more than 800 tons and increased *Tuber indicum* cultivation, suggesting exports towards Europe will grow in the next years (Zambonelli and Iotti, 2011). Similar problems exist for Transylvanian Big White Truffle (*Choiromyces meandriiformis*) and *Tuber oligospermum* (Tul & Tul.). The former grows in Central and Northern Europe and is similar to the fine white truffle. Since it is considered toxic, it cannot be commercialised in Italy, nevertheless it is sometimes mixed with the (apparently) similar fine white truffle. The latter is grown in Morocco and largely used in place of the domestic *Tuber magnatum*.

d. Irregularities in the voluntary carbon credit markets - Although property rights on carbon credits generated by afforestation/reforestation (A/R) and improved forest management (IFM) activities are still under debate, there is an increasing fraud risk linked to forest investments for the generation of carbon credits for the voluntary market. A/R and IFM initiatives in Italy are already accounted by the State (on a sample basis and without specific reference to single areas) and included in the National Registry for Forest Carbon Sinks to meet Italy's commitments under the Kyoto Protocol. As many other European countries, in fact, Italy accounts carbon stock improvements due to these activities according to articles 3.3 and 3.4 of the Protocol. The inclusion of IFM activities - optional under the Kyoto Protocol - is a consequence of the fact that the Italian Government succeeded in negotiating relatively high quotas: 10.2 M tons CO₂ equivalent per year, i.e. 2.78 M tons carbon (Federici *et al.*, 2008). These quotas are extremely high, corresponding to 30% of the global national commitment in terms of reduction of CO₂ emissions. When accounting the sink capacity of IFM, Italy has

considered all current national forests as being actively managed, including also naturally recolonized meadows and pastures (Brotto and Pettenella, 2010). Within such a scenario there seems to be no or limited room for the use of national forests as a source for carbon credits for the voluntary market: there would be a concrete risk of double accounting. Given the importance of this issue it is rather anomalous that neither the Central Institutions nor the magistrates have intervened. In the United Kingdom (UK), for example, a Carbon Code has been approved by DEFRA to avoid any potential fraud in this field.

It should be remembered that there is a lot of evidence of illegalities taking place in the carbon markets, even outside the forestry sector. One of the most relevant cases emerged in early 2010, when Interpol detected a €5 Billion tax fraud linked to the trade of offset credits within the EU Emissions Trading Scheme (ETS). It was discovered that in some countries up to 90% of the entire market volume in EU emissions permits was due to fraudulent activities. The fraud consisted of buying carbon permits in a EU Member State where the purchase is exempt from VAT (e.g. UK, France) and then selling them to another Member State, but with the VAT added on. Based on this evidence Interpol warned that inclusion of carbon credits from forestry activities would surely exacerbate the risk of fraud and bribery linked to the carbon trade (FERN, 2010).

5.4 Corruption practices in the forestry sector: some examples

Corruption is deeply intertwined with illegal activities in the management of natural resources (including forests) especially in cases of monopoly (or very strong) powers (e.g. through licenses or concessions), and where transparency, accountability and intra-institutional competition are low (Lederman *et al.*, 2001; Marmon, 2009). The stronger the public role, the higher the risk of corruption, even under the form of excessive patronage, nepotism, job reservations, 'favor-for-favors', and suspiciously close ties between politics, criminal organisations and business (PRS Group, 2012). While it is difficult to draw a global picture of corruption in relation to the forestry sector in Italy, empirical evidences are quite common. We focused on three examples: public employment in forestry, links between corruption and criminal organisations in public authorities, and public competitions for CFS staff hiring.

Public employment in forestry sometimes responds to welfare needs - under the form of employment opportunities in poor marginal areas - rather than technical ones. It is difficult to take a clear general picture because a wide range of situations exists: many of these workers are just seasonally employed for a number of working days per year that may depend on funds availability. Moreover in many cases they do not perform just forest activities, being, for example, employed in agriculture or other fields. In many Southern regions (e.g. Calabria, Basilicata, and Campania) and in the Islands (Sicily and Sardinia) public employment in forestry plays a relevant role within overall employment status at regional level. In some cases it may also take the form of patronage (*clientelismo*) and has brought to hiring of a very large number of people with no or limited attention to efficiency, budget constraints or professional expertise. In many cases well-founded suspicions that public employment is linked to political purposes, through voting engagement (*voto di scambio*) of employed people, exist. In 1996 Sicily Region defined by law (Regional Law 16, 6th April 1996) a threshold for public forest workers (including fire-prevention): 15,145 units, 875 of which represented by full time employees. The same law, however, gives room for additional hiring depending on specific needs and in proportion to forest area managed in each regional district. Although transparent and undoubted figures do not exist, most of

sources and experts agree on the fact that there are around 27,000 public forest workers in Sicily where the total forest area is 0.34 Mha. Around 6,000 of these workers operate in fire prevention, nevertheless in 2010 most of arsons that have occurred at national level took place in Sicily and in 2011 the region ranked second in Italy in terms of fire events. In France less than 1,000 people are employed for managing and protecting about 7Mha Mediterranean forests and operate in strict coordination with 'ordinary' firemen (JRC, 2011). Calabria presents a profile very similar to Sicily: in 1983 the number of public forest workers reached a maximum of 29,000 units (Milella, 1989) and in 2003 negotiations between the Regional Government and the main sector unions have led to an engagement to stable employment conditions for about 11,200 full-time workers (Presta, 2004). According to the most recent figures, the total number of regional public workers should be 8,500 units (CGIL-Calabria, 2012).

Sometimes corruption practices proceed from a direct **link between criminal organisations and local public authorities**. In 2011 the city council of Nardodipace (in Calabria) was dissolved because of strong evidences of infiltrations by organised crime. The Report by the Minister of Interior⁸ highlighted a central role for forestry-related activities that highly contribute to local economy. In particular high corruption and illegal mechanisms allowed the fixing of timber allotments procedures, favouring a limited number of forest companies with well-known connections to local criminal gangs. One of the most relevant cases regarded a public tender for the creation of fire protection buffers that were then realised in public forest areas subject to hydrogeological and landscape constraints without any authorisation released by competent public authorities. The forest company selected for performing the operations was controlled by a local criminal gang, moreover the timber harvested was sold by the Municipality to another organised crime-controlled company at a price below market average value.

Corruption practices - in a broad sense - can be identified not only in public tenders for timber allotments and forest works, but also in **staff hiring public competitions**, including those for CFS staff. For example, in 2008 and 2009 two different Parliamentary Inquiries and a report published by the Italian newspaper La Stampa casted doubts on regularity of at least two open competitions launched in 2004. In one case a competition for 500 cadet positions saw a large number of people with family relationships (including direct line of descent) with top-level officers among successful candidates. These candidates where not only selected, but - in many cases - also assigned to positions under the direct control of their relatives. Moreover written memoranda and requests for job positions have been found in the CFS offices, while phone tapping allowed identifying some politicians and their staff trying to manipulate competition results (Festuccia, 2009). In another case, an internal competition for 182 vacant vice-inspector positions saw an unusual concentration of successful candidates from certain CFS offices. For example among 752 candidates who passed the written test, 143 were already employed at CFS General Inspection Office in Rome; within 29 candidates who got the highest scores (i.e. between 29 and 30), 21 were from the same General Inspection Office (Fugatti, 2009) and many of them were part of the Director General staff. Lack of transparency and nepotism in public competitions are a common issue in Italy, including for example competitions for university staff hiring (researchers and professors). Carlucci and Castaldo (2009) published a rich collection of cases, denouncing a wide range of abuses, frauds, nepotistic practices and - sometimes -

⁸ See: Official Journal nr. 8, 11th January 2012. Presidenza della Repubblica, Decreto del Presidente della Repubblica 19th December 2011. Scioglimento del consiglio comunale di Nardodipace e nomina della commissione straordinaria.

connections with organised criminality. Paris (2005) analysed hiring processes of academic personnel in Italian universities and - by means of statistics - he found evidences of fixing mechanisms consisting in some 'piloting' scheme and a control of voters and their votes within hiring committees. Although there is no explicit reference to forestry disciplines, it shall be remembered that in Italy there are no less than 13 university courses in forestry: it would be at least unrealistic to assume the forest sector is totally free from these risks.

5.5 A preliminary economic estimation of illegality in the Italian forestry sector

It has been estimated that criminal activities in national agriculture (including forestry) generate around €50 Billion/year, i.e. one third of the national illegal economy (CIA, 2012). Based on the available literature and figures reported in this study a preliminary estimation of the economic value of illegality in the Italian forestry sector has been made (table 3). The analysis is not intended to be exhaustive because it was not possible to collect and estimate data for all illegality types and many data are likely underestimated. The total estimated value ranges between €1,876.9 and €3,947.3 M, representing 4–8% of the "criminal turnover" for the national primary sector and 2.4–5 times the total GDP generated by the sole forestry sector. This value is mostly dependant on illegal wood imports (50-67%). Illegal wildlife trade and poaching rank second (13-27%) but not all offences listed in this group regard forest species or the forestry sector. The disproportion between the total estimated value and the value of detected illegalities (seized products/materials) - however - remains enormous. Arson and culpable fires show a relative incidence ranging between 6 and 12%, i.e. slightly more than the incidence of VAT frauds in the pallet sector (5-10%). Illegalities connected to firewood collection and trade represent 4–7% of the total value: this is probably an underestimation because a precautionary approach has been adopted by assuming that domestic firewood quantities reported by ISTAT statistics are regularly traded. Finally, the incidence of tax frauds in the mushroom trade is still limited, but the role of other NTFPs should also be taken into account, and the value of illegalities linked to imported products would deserve additional studies.

Table 3 – Estimated value of illegal forest activities in Italy

Illegal activity	Estimated value (M €)*	% on Total value*	Source(s)
Arson and culpable fires ^(a)	215.6	11.5-5.5%	AIB, 2008, WWF, 2008 CFS, 2010
Illegal wildlife trade and poaching (including CITES species)	500	26.6-12.7%	CFS, 2011a, LAV, 2011
Tax frauds for firewood trade ^(b)	126 - 176	6.7-4.5%	Authors' estimation on ISTAT data (various years)
Illegal timber import	934 – 2,658	49.8-67.3%	ISPRA, 2009
Tax frauds for pallet trade ^(c)	100 - 396	5.3-10%	Assoimballaggi, 2006; Fava <i>et al.</i> , 2009
Tax frauds for mushroom trade ^(d)	1.3 – 1.7	0.1%	Authors' estimation on ISTAT data (various years)
Total value	1,876.9 – 3,947.3	100%	

* where two percentages are reported they represent the extreme values of a reference interval. The first percentage is calculated on the corresponding lower (monetary) value, while the second is calculated on the corresponding higher (monetary) value

Source: Authors' elaboration.

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^(a) Assumed burnt forest area: 98% of the average burnt area in the last ten years. Assumed unitary reconstruction cost: €5,500/ha.

^(b) Assumed values: (i) domestic consumption 18-22 M tons; (ii) domestic removals 3 M tons (as reported by ISTAT); (iii) imports and other domestic sourced wood (e.g. residues and waste) 5 M tons. It has been assumed all domestic sourced wood is properly traded and VAT is regularly paid. As a consequence 10-14 M tons are traded irregularly. Assuming an average roadside price of €60/ton a total value of €600-840 M is calculated. The corresponding evaded VAT value at a 21% rate corresponds to €126-176 M.

^(c) Assumed values: 4 pallet cycles/year per inhabitant, i.e. 240,000,000 pallet cycles/year. It has been assumed that 30% of cycles is irregularly managed, with an average value of €5.50/pallet.

^(d) The average production values for mushrooms and truffles have been calculated on the basis of 2006-2008 ISTAT data. Assuming a tax fraud range of 70-90% and considering a 4% VAT rate, VAT frauds total €1.3-1.7 M.

6. Conclusions

It is difficult to identify, monitor and estimate illegal practices because under-the-counter activities are by definition unknown. When considering forest illegality in Italy a key problem is access to/quality of data. Information is mostly available informally from experts and operators under the form of empirical evidence rather than from official sources. Moreover, even when officially reported, forest-specific illegalities may not be classified separately from other illegalities so their identification results as problematic. Finally, borders between different illegal forestry practices are not always clear and many crimes overlap. Despite this, a substantial convergence of collected information emerges, allowing the drawing of a global picture for the forestry sector, with some opaque areas and clearly illegal ones.

Forestry illegality in Italy is a dynamic and flexible system, assuming different forms and changing over time and space. Traditional illegalities persist, but new ones are rapidly growing and still largely under-investigated. The forestry sector has marginal incidence on the national economy, but crucial importance at local scale. While informality of traditional production (firewood and NTFPs) facilitates illegality, emerging issues, like payments for environmental services, may represent new opportunities, but also provide room for criminal practices. In geographical terms, illegalities have been surveyed nationwide, but they seem to prevail in southern regions, where organised crime is well established and socio-economic conditions are more critical. These regions are also characterised by a higher perception of corrupt practices, mainly under the form of excessive patronage and collusion. Corruption is not just illegal per se, but favours and, sometimes, determines additional illegalities.

While illegality is plastic, national policies/acts are often unspecific and sometimes anachronistic. Italy has solid experience in combating organised crime outside the forestry sector by adopting the 'follow the money' approach that could be successfully adapted to forestry. The recent agreement between CFS and the National Anti-Mafia Directorate seems to take this direction. As the first systematic study on forest illegality at national level the research could represent a preliminary step towards raising awareness and stimulating stakeholders debate for future action.

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Annex 3 - Traditional markets for Mediterranean forest products

Masiero, M., Calama, R., Lindner, M., Pettenella, D. (2013). Traditional markets for Mediterranean forest products. In: Lucas-Borja, M.E. (ed). Mediterranean forest management under climate change: building alternatives for the future. Nova Science Publishers, Inc., New York. (p. 93-118)

TRADITIONAL MARKETS FOR MEDITERRANEAN FOREST PRODUCTS

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Abstract

Forests represent a key-resource for the Mediterranean region and provide wood and non-wood forest products since centuries; nevertheless little attention has been given to the economic evaluation of market goods they provide. Tentative estimations of the economic impacts of climate change over Mediterranean forests and their provisioning functions should start from the evaluation of the resource stocks and forest-related products.

Wood production in the region shows different patterns depending on product type (timber/firewood), time and sub-region. About 73% of wood production is concentrated in Northern sub-regions, while the contribution of Southern and Eastern sub-regions is much lower. Globally considered, roundwood production represents about 0.2% of the total Gross Domestic Product (GDP) in the Mediterranean area, while its relevance on primary sector GDP has diminished from around 8% (1990 and 2000) to around 6% (2005 and 2010). The Southern and Eastern sub-regions show the lowest increase in growing stock values per hectare, while in North-Western countries the increment in growing stock is linked to a decrease in roundwood production value per hectare. If timber production has increased and firewood production decreased, imports followed an opposite trend: the region hosts two of the top four firewood importers worldwide (Italy and Turkey).

As regards non-wood forest products, Spain, Italy and France are responsible for about 90% of the overall production value (US\$1.1 billion). Non-wood forest products production is equivalent to 9% of the estimated roundwood production value in the whole Mediterranean region, with notable differences within countries. The relative incidence of the value for these products on total forest production exceeds 20% just in the case of Lebanon, Spain and Italy.

Although additional research is needed, the economic importance of traditional provisioning functions of Mediterranean forests seems to be confirmed. Enhancing the offer of Mediterranean market products and increasing their role in the rural economy could help establishing a stable income flow, thus reducing the forest protection costs.

1. Introduction

Although large extensions of dense forest may not represent a typical Mediterranean picture, forests are a fundamental part of this region and provide a wide array of products and services [1]. The present chapter focuses on market products – timber and non-timber ones – produced by forests in Mediterranean countries. Such products represented a fundamental factor in the life of local inhabitants for centuries, but few studies focused on them on a large scale, especially with regards to Southern Mediterranean areas. Even though today Mediterranean forests are gaining increased relevance on the international policy and research agenda, little attention has been given by international organizations and single scholars to the economic evaluation of their role in providing basic market goods.

Even today these products represent a basic source of income for many people, especially for those living in the Southern part of the Mediterranean region, and their supply is affected by climate change, in a synergic relation to the process of over-exploitation and the consequent forest degradation [2].

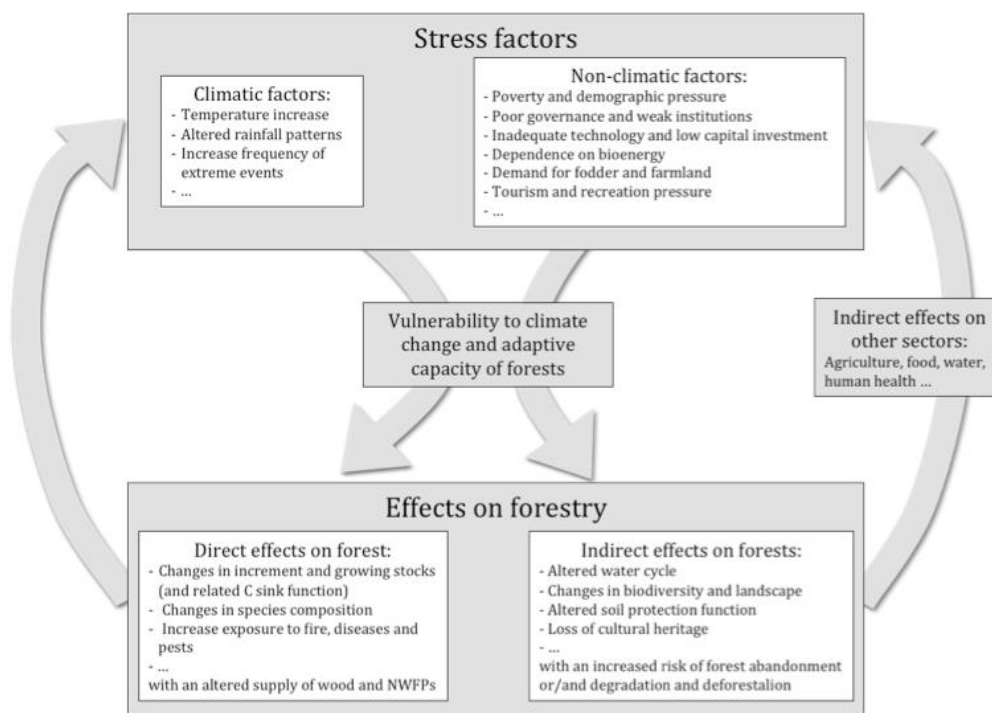
The Southern part of the Mediterranean area is more vulnerable to climate change than the Northern for at least three reasons [3]: (i) the economies of the North African countries rely much more on rural activities and agriculture is more climate-sensitive than the industrial and service sectors, (ii) many activities in the Southern Mediterranean, like those connected with the use of water resources or located in coastal areas, already operate close to environmental tolerance levels, (iii) richer countries are able to invest more in adaptation, reducing their overall vulnerability, being less dependent on climate.

The large variety of environmental and socio-economic systems of the region and also inside each country is adding an element of complexity to the evaluation of climate change effects. As stressed by [3], *“aggregation necessarily hides differences”*, so describing impacts of climate change on Mediterranean forest activities may hide opposite effects in the coastal areas and the inner mountain zones. If poorer countries on the average will be net losers, some areas in rich Northern Mediterranean countries could gain something from a moderate global change thanks to some direct effects (shifting of some tree species – like Aleppo pine – upslope, increased average annual increments, etc.) [4] as well as from some indirect impacts (prolonged tourist season, increased food production, reduced heating expenditure, etc.).

Among non-climatic factors poverty and the associated demographic trends represent paramount factors for the pressure on natural resources, increasing the vulnerability of forest to climate change (Figure 1). The Mediterranean had 285 Million (M) inhabitants in 1970 and 378 M in 1990 [5]. Today the population of the region is 470.5 M inhabitants and is likely to be around 520 M in 2020: it is not far from doubling in the space of just half a century [6]. Evident differences exist between different countries. In Northern countries population is now scarcely increasing, while in Southern and Eastern ones population is almost exploding. Countries within these regions, however, are not all growing at the same pace. The population is growing much faster in the Near East than in the Maghreb, where the demographic transition is now well established. Peak values in terms of annual population growth are registered for Occupied Palestinian Territory (+3.8%), Syria (+2.6%) and Israel (+2.4%). While until the 1980s, the North Mediterranean more or less equalled the South-East Mediterranean, in 2020 two thirds of Mediterranean people will be located on the Southern shores [6]. While growing population is expected to put additional pressure on forest resources, improving their exploitation and potential degradation, climate change effects (particularly in terms of

extreme events such as drought, desertification, etc.) could emphasize both urbanisation processes and South-North migration flows. In Northern countries increased income levels and low demographic growth already favoured land abandonment especially in marginal and unprofitable areas. These include many forest areas, especially in mountainous regions. Among the negative outputs of such processes ageing of forest stands, loss of landscape quality, increased risk of forest fires and sometimes even loss of cultural identity can be listed.

Figure 1 – Climatic and non-climatic stress factors and related effects on Mediterranean forests



The picture is however very indeterminate: indirect economic effects of climate change on Mediterranean forests (like the reduced forage availability for grazing activities due to the loss of forest cover) and interlinkages (like the relationship between forest-based ecosystem services and Gross Domestic Products) are poorly known and understood but they reasonably seem much more relevant than the direct economic effects.

Moreover, we are trying to understand the climate change effects on the present society, but we should take into consideration that the effects on forests of the present level of emissions will be probably more relevant in the future and that there is a growing evidence that climate change dynamics will not be linear, as most of the forecasting models predict.

Bearing in mind all these problems, a starting point of any tentative evaluation of the economic impacts of climate change on Mediterranean forest is the evaluation of the resource stocks and of the forest-related products and services. In this chapter the focus will be on market products, considering both wood and non-wood forest products, while in the following chapter attention will be given to environmental services.

The chapter is organized as follows: in the first part we analyze roundwood production and trade to make an estimate of the economic value of the main market activities connected with the use of forest resources. In the following section we try to complement this picture with data related to non-wood forest products (NWFPs). In the

conclusions we try to highlight which are the main impacts of climate change on the traditional markets for Mediterranean forests. Methodological details are reported in Appendix 1.

For the purposes of the present chapter twenty-one Mediterranean countries have been considered, i.e. all the countries overlooking the Mediterranean Sea. They have been divided into four sub-regions:

- › **Southern Mediterranean (SM)** countries, including Algeria, Egypt, Libya, Morocco and Tunisia;
- › **Eastern Mediterranean (EM)** countries, including Cyprus, Israel, Occupied Palestinian Territory, Syria and Turkey;
- › **North-Eastern Mediterranean (NEM)** countries, including Albania, Bosnia and Herzegovina, Croatia, Greece, Montenegro and Slovenia;
- › **North-Western Mediterranean (NWM)** countries, including France, Italy, Malta and Spain.

2. Roundwood production and trade

2.1 Roundwood production

Taking into account the 1990-2010 period, on average 139.8 Million cubic meters (MUCM) were produced every year in the selected countries (Table 1). The global production from 1990 to 2010 showed a slight decrease (-3%), as the net result of a 7% increase for timber and a 10% decrease for firewood (Figure 2). The proportion between timber and firewood production changed over time: while in early nineties firewood covered around 50% of the overall wood production in the region, it then decreased both in absolute and relative terms. Since 1994 timber production exceeded firewood one. As for the most recent available figures, about 125 MCUM were produced in 2010, 55% of which being represented by timber and 45% by firewood. Such amount of wood is equivalent to less than 2% of the total growing stock in the region. More than 62% of wood production is concentrated in NWM countries⁹ that play a leader role both with regard to timber (64% of overall production in the area) and firewood (62%) production (Figure 3). About 82% of timber production is based in three countries only - France, Spain and Turkey - (Figure 4a) while four countries - France, Algeria, Turkey, and Italy - contribute to 85% of firewood production (Figure 4b). The prominent position of Northern Mediterranean countries depends on several reasons, among which the fact that their forest resources include relevant quantities of temperate forests with quite high production potential. Wood productivity and profitability in Southern and Eastern sub-regions are much lower and this is in connection with the fact that their forests fall mostly in semi-arid areas with poor soils and scarce water. Production figures and trends are quite different when considering data for the four sub-regions. Moreover, the relative importance of such regions changed over time revealing interesting dynamics in the last twenty years: they will be described in the next paragraphs.

SM countries host 10% of the Mediterranean forests and provide 10% of the overall wood production in the region, covering just 1% of timber production but 21% of firewood one. Around 90% of production in these countries is represented by firewood, mostly (90%) concentrated in Algeria, Tunisia and Morocco. During the 1990-2010 period both timber and firewood production decreased: in the first case production had

⁹ These include France, Italy and Spain, while no data are reported for Malta.

a relative variation of about -12%, while in the second case of about -20%. It shall be underlined, however, that data for firewood production in Morocco show a sudden and unjustified decrease (from 6.8 MCUM to 0.5 MCUM) between 1993 and 1994. Extrapolating Moroccan data for 1990-1993 and projecting them to 2010, the overall firewood production for SM sub-region would increase to 16.4 MCUM, i.e. more than 30% of the total Mediterranean production in 2010. Moreover it is to be noticed that firewood production data for Egypt have been estimated according to modalities described in Appendix 1.

EM countries showed relevant changes in wood production during the last 20 years. The area is characterised by the biggest (both in absolute and relative terms) increase in timber production within the Mediterranean basin, while firewood production was halved. Turkey represents the leader country in the sub-region, hosting more than 92% of the forests and covering almost the entire wood production. The shift from firewood to timber production is linked to several factors, including the strong growth in forest plantations. Half of Turkish forests are currently classified as degraded (tree canopy cover <10%) due to overexploitation occurred in the past [7]. Intensive rehabilitation initiatives have been launched in the last decades, mostly emphasizing monoculture conifer plantations [8]. Today Turkey hosts 2.5 Mha forest plantations – i.e. about 9% of the national forests [7] – ranking 11th among countries with the largest area of forest plantations worldwide and 1st among Mediterranean countries [9][10]. All other EM countries experienced a reduction in both timber and firewood production between 1990 and 2010, with the only exception of Syria that slightly improved the second one.

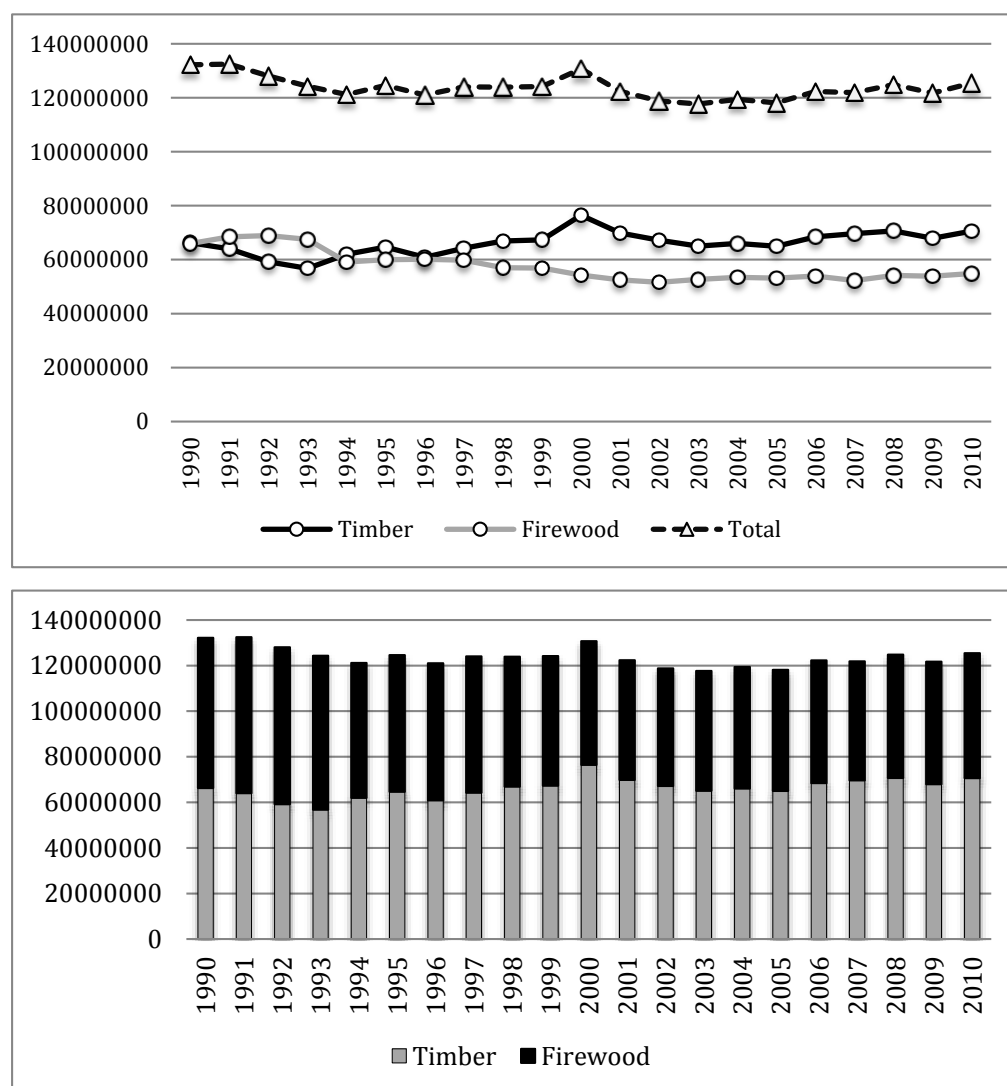
Table 1 – Roundwood production in Mediterranean countries, 1,000 CUM (1990, 2000, 2005, 2010)

Countries	1990		2000		2005		2010	
	Timber	Firewood	Timber	Firewood	Timber	Firewood	Timber	Firewood
Algeria	261.0	5,639.6	162.0	7,074.1	73.3	7,668.8	102.6	8,176.5
Egypt*	112.0	13.3	268.0	9.6	268.0	10.4	268.0	11.3
Libya	107.0	574.6	116.0	823.4	116.0	888.9	116.0	951.9
Morocco	583.0	6,552.5	569.0	487.0	574.0	383.0	372.1	411.0
Tunisia	166.0	1,889.0	213.8	2,094.0	218.0	2,148.7	218.0	2,184.6
SM sub-region	1,229.0	14,669.0	1,328.8	10,448.1	1,249.3	11,099.8	1,076.7	11,735.3
Cyprus	48.0	14.8	15.2	5.4	5.8	3.9	5.3	3.6
Israel	100.0	13.0	73.0	8.0	25.0	2.0	25.0	2.0
Lebanon	7.0	67.1	7.1	19.1	7.1	19.0	7.1	18.9
Syria	40.7	8.9	34.5	15.9	39.8	18.3	39.8	28.1
Turkey	5,960.0	9,796.0	10,429.0	5,510.3	11,202.0	4,983.0	15,695.0	4,859.0
EM sub-region	6,155.7	9,899.8	10,558.8	5,558.7	11,279.7	5,026.2	15,772.2	4,911.6
Albania	520.0	1,556.0	123.0	324.0	75.2	221.0	80.0	350.0
Bosnia & Herzegovina	2,442.0	571.5	3,332.0	950.0	2,444.0	1,362.0	2,354.0	1,260.0
Croatia	3,103.7	587.6	2,693.0	976.0	3,110.0	908.0	3,421.0	1,056.0
Greece	1,146.0	1,346.0	643.5	1,601.4	518.5	1,004.3	948.1	794.8
Montenegro	224.1	122.9	215.7	170.6	179.5	178.4	208.0	156.0
Slovenia	2,092.5	381.9	1,721.0	532.0	1,789.5	943.3	1,841.4	1,104.0
NEM sub-region	9,528.3	4,565.9	8,728.2	4,554.0	8,116.7	4,617.0	8,852.5	4,720.8
France	31,199.0	31,389.0	39,476.0	26,338.9	27,943.7	24,555.0	29,303.7	26,173.7
Italy	4,335.0	3,637.0	3,649.0	5,680.0	3,017.4	5,673.5	2,415.2	4,839.1
Spain	13,790.0	1,800.0	12,721.0	1,600.0	13,351.0	2,180.0	13,168.3	2,480.0
NWM sub-region	49,324.0	36,826.0	55,846.0	33,618.9	44,312.1	32,408.5	44,887.2	33,492.8
Total Mediterranean	66,237.0	65,961.6	76,461.8	54,269.8	64,957.8	53,889.8	70,558.6	54,860.6

NOTE: data not available for Occupied Palestinian Territory and Malta; * data estimated as indicated in Appendix 1

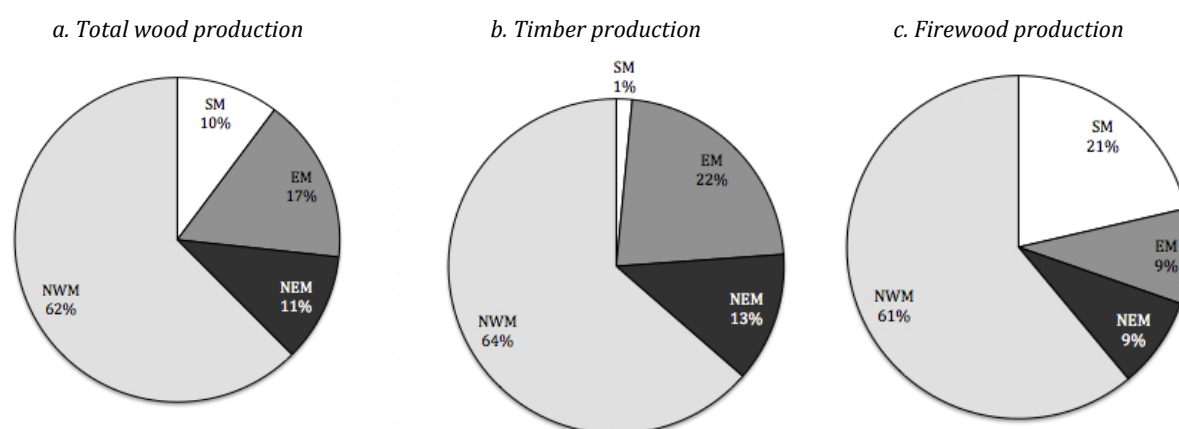
Source: own elaboration from [11].

Figure 2 - Wood production in Mediterranean countries (CUM) - 1990-2010



Source: own elaboration from [11].

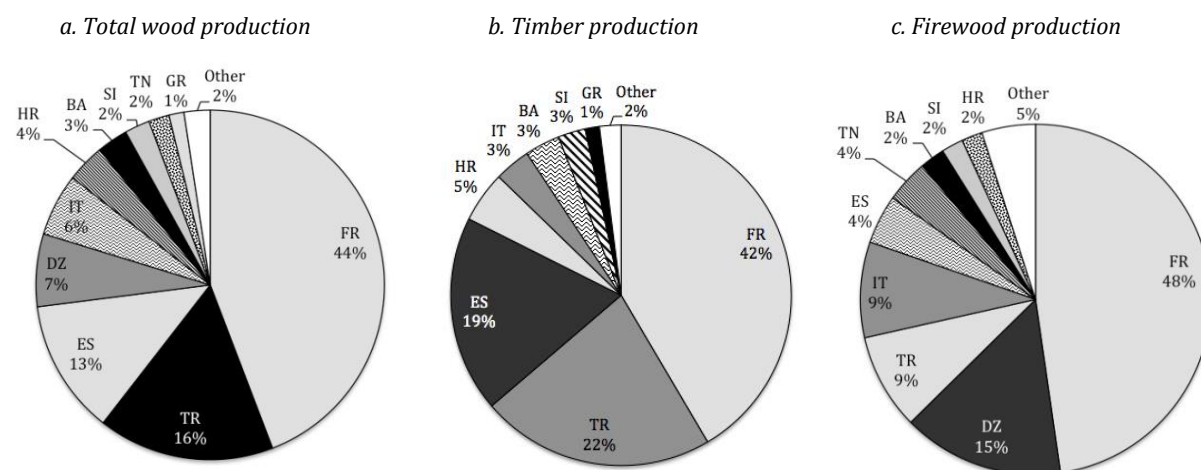
Figure 3 - Relative incidence of Mediterranean sub-regions in wood production, 2010



Note: EM = Eastern Mediterranean countries; NEM = North-Eastern Mediterranean countries; NWM = North-Western Mediterranean countries; SM = Southern Mediterranean countries (see Introduction for details).

Source: own elaboration from [11].

Figure 4 – Relative incidence of Mediterranean countries in wood production, 2010



Note: BA = Bosnia and Herzegovina; DZ = Algeria; ES = Spain; HR = Croatia; FR = France; GR = Greece; IT = Italy; SI = Slovenia; TN = Tunisia; TR = Turkey
Source: own elaboration from [11].

NEM countries slightly improved firewood production (+3%) and reduced timber production (-7%) between 1990 and 2010. The NEM sub-region is characterised by a well-balanced distribution of production figures between three (Croatia, Bosnia and Herzegovina, and Slovenia) out of six countries. The contribution of Greece is lower and ranges between 11% (industrial wood) and 17% (firewood), while Montenegro and Albania have marginal roles. In the case of Albania, however, firewood production is still quite relevant, covering about 8% of the overall production in the sub-region. Production data show an evident drop (up to -60%) between 1991 and 1996, especially in the case of timber: this should be put in connection with Yugoslav wars and consequent reduction in forest operations, although several authors denounced forest resources depletion in the area due both to self-consumption by local people and export activities by warlords [12][13]. As a consequence production figures are likely to be underestimated at least in the case of Bosnia and Herzegovina for which an official timber production of just 40,000 CUM/year and a nil firewood production are reported for the 1992-1996 period. This is even more relevant when considering that according to FAO data [10] Bosnia and Herzegovina is one of the three countries¹⁰ among the twenty-one taken into consideration showing some decline in their forest area, especially in the 1990-2000 period.

NWM countries host more than 58% of total forests and - as already observed - provide more than 55% of the overall wood production in the Mediterranean region. The sub-region however is the only one that experienced a reduction (-9%) for both industrial wood and firewood production between 1990 and 2010. France is the leader country in the sub-region, producing 68% of timber and 75% of firewood. The contribution of Spain (29% and 7%) and Italy (6% and 15%) is relevant as well, while that of Malta is negligible. As already commented, however, these figures cover the overall forest production in these countries, including that from non-Mediterranean forests.

It shall be observed that - at least for certain countries - production figures may be strongly underestimated. This could be, for instance, the case for Italy, where many

¹⁰ The other two countries that experienced a reduction in forest coverage are Albania (in 1990-200, and 2005-2010) and Algeria (continuously between 1990 and 2010).

studies/reports - including FAO FRA 2010 Country Report¹¹ - casted doubts on reliability of official statistics on forest removals¹². Moreover official statistics do not include illegally harvested forest products for which high figures are reported for many countries, including some of the most forested ones such as Turkey [15][16] and Morocco [17]. Illegalities do not just refer to harvesting operations and wood products: they are increasingly expanding in other areas and products, including non-wood forest products and forest environmental services. Although figures on illegal practices are mostly available via informal channels, common experience suggests these processes can strongly affect local forest resources, both in terms of quality and quantity.

2.2 Wood production value

Roundwood production value for the twenty-one selected Mediterranean countries has been estimated according to the methodology described in Appendix 1. Results are summarised in Table 2 and Figure 5.

Table 2 – Roundwood production value in Mediterranean countries (1990, 2000, 2005, 2010)

Countries	1990		2000		2005		2010	
	Marginal (US\$/ha)	Total (M US\$)	Marginal (US\$/ha)	Total (M US\$)	Marginal (US\$/ha)	Total (M US\$)	Marginal (US\$/ha)	Total (M US\$)
Algeria	99.01	165.05	114.67	181.06	117.33	180.22	131.36	195.99
Egypt*	406.29	17.88	716.72	42.29	631.42	42.31	604.63	42.32
Libya	135.67	29.44	167.40	36.33	174.05	37.77	180.43	39.15
Morocco	46.68	235.69	19.94	100.05	19.39	98.54	13.15	67.46
Tunisia	105.16	67.62	95.14	79.64	88.20	81.50	81.80	82.29
SM sub-region	67.67	515.67	56.99	439.36	56.27	440.34	53.97	427.22
Cyprus	48.72	7.84	14.51	2.50	5.76	1.00	5.31	0.92
Israel	120.55	15.91	75.68	11.58	25.43	3.94	25.60	3.94
Lebanon	20.64	2.70	12.01	1.57	11.47	1.57	11.45	1.57
Syria	17.64	6.56	13.34	5.76	14.42	6.65	14.02	6.88
Turkey	120.34	1,164.86	173.39	1,759.17	173.85	1,867.10	226.31	2,565.04
EM sub-region	114.25	1,197.89	161.24	1,780.58	161.05	1,880.26	209.66	2,578.35
Albania	119.13	93.99	27.08	20.82	17.22	13.46	23.20	18.00
Bosnia & Herzegovina	102.20	225.86	143.53	313.62	115.02	251.32	110.03	240.41
Croatia	152.77	282.62	138.00	260.14	154.18	293.41	169.05	324.58
Greece	42.58	140.48	29.42	105.94	20.31	76.21	27.16	106.02
Montenegro	42.32	22.98	43.82	23.79	38.62	20.97	41.75	22.67
Slovenia	160.00	190.08	132.45	163.31	146.66	182.29	153.11	191.85
NEM sub-region	96.77	956.02	86.89	887.63	80.48	837.67	85.40	903.53
France	451.64	6,565.54	478.58	7,347.69	357.91	5,624.19	371.59	5,928.42
Italy	113.32	860.09	109.04	912.52	94.18	824.89	74.51	681.72
Spain	147.10	2,032.62	110.12	1,870.70	115.62	1,999.40	109.82	1,995.79
NWM sub-region	263.13	9,458.25	248.86	10,130.91	202.28	8,448.48	198.86	8,605.93
Total Mediterranean	---	12,127.82	---	13,238.48	---	11,606.75	---	12,515.02

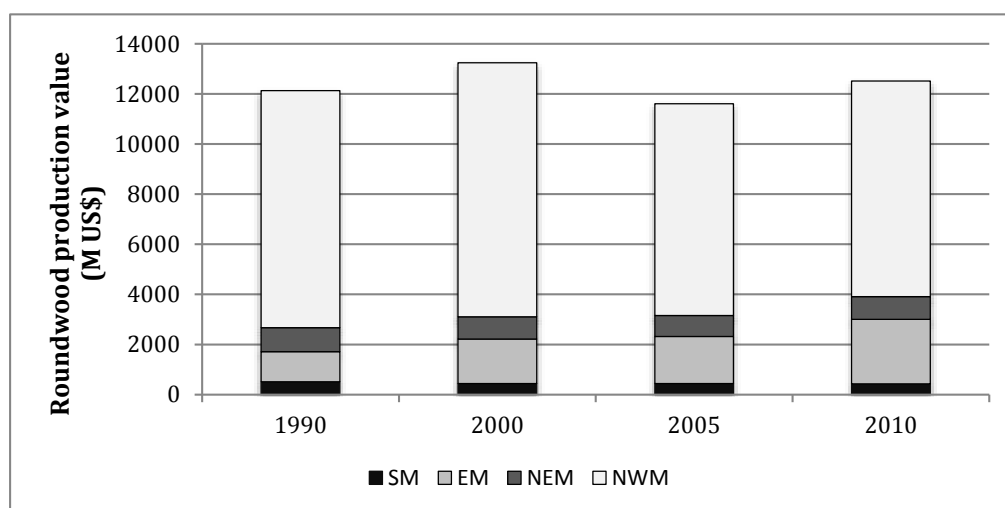
NOTE: data not available for Occupied Palestinian Territory and Malta ; * data estimated as indicated in Appendix 1

Source: own elaboration from [10] and [11].

¹¹ “[...] Removals are regularly recorded, but the complexity and variability of administrative procedures in force in the 21 regional bodies responsible for cutting permit issuing and local statistics could lead to underestimation. Removal of wood fuel - mainly produced in coppice stands of oaks and other autochthonous species - has enormously increased in the last decade: likely more than what official statistics show. This is partially due to the corresponding raise of oil price” [14], p. 52.

¹² Such statistics are not published anymore since 2009.

Figure 5 – Roundwood production value (M US\$) in Mediterranean sub-regions (1990, 2000, 2005, 2010)



Source: own elaboration from [10] and [11].

The total value for the entire Mediterranean region fluctuates over time and, once more, different sub-regions show different trends. SM countries remained more or less stable in 2005 and 2010, with a slight decrease (-1.3%) with respect to 1990 estimated value. EM sub-region is the only one showing a continuous positive trend for both marginal and total value. The role of Turkey influences such performances: it is the only country showing expanding values without any flexion, with a huge increase between 2005 and 2010. All the other countries in the sub-region show decreasing marginal values over time, reflected by diminishing to stable total values. The relative incidence of the EM sub-region on total Mediterranean wood production value doubled between 1990 and 2010, passing from 10 to 20%.

NEM countries show a decreasing trend between 1990 and 2005, with a recovery between 2005 and 2010. In terms of total value, Albania and Greece experienced the most impressive decrease between 1990 and 2005, as well as the most relevant recovery (+34 and +39% respectively) between 2005 and 2010.

As regards NWM countries, they show a decreasing (-24%) trend for marginal values between 1990 and 2010. The total value increased between 1990 and 2010, then diminished between 2000 and 2005 and had again a slight increase between 2005 and 2010. The relative incidence of the NWM sub-region on total Mediterranean wood production value reflects the dominant position in terms of total production. Such incidence, however, remained stable (75%) between 1990 and 2000, then diminished down to 67% in 2010.

Globally considered, roundwood production represents about 0.2% of the total Gross Domestic Product (GDP) in the Mediterranean area, while its relevance on primary sector¹³ GDP passed from around 8% (1990 and 2000) to around 6% (2005 and 2010) (Table 3). The relative incidence of wood production value varies according to sub-regions: the maximum incidence is observed in NEM sub-region, where wood production represented up to 1.2% of sub-regional GDP and around 20% of primary sector GDP in 1990 and up to 0.8% and 15% respectively in 2010. Historical trends have

¹³ This includes agriculture, hunting, forestry and fishing (ISIC A-B).

changed over time: for SM and NEM sub-regions the incidence on both total and primary sector GDP decreased; for NWM sub-region the incidence on total GDP remained stable in the last twenty years, while that on primary sector GDP decreased between 2000 and 2005; for EM sub-region, the incidence on total GDP remained stable but that on primary sector GDP grew from 1990 to 2010, confirming the increasing importance of the forest sector in this area.

Table 3 – Relative incidence of roundwood production value in Mediterranean countries on total gross and primary sector GDPs (1990, 2000, 2005, 2010)

Sub-regions	1990		2000		2005		2010	
	% on total GDP	% on primary sector GDP	% on total GDP	% on primary sector GDP	% on total GDP	% on primary sector GDP	% on total GDP	% on primary sector GDP
SM sub-region	0.3%	2.4%	0.2%	2.1%	0.1%	1.3%	0.1%	1.1%
EM sub-region	0.3%	2.9%	0.3%	3.5%	0.3%	3.4%	0.3%	4.5%
NEM sub-region	1.2%	19.2%	1.0%	17.8%	0.8%	15.3%	0.8%	15.0%
NWM sub-region	0.2%	10.1%	0.2%	10.8%	0.2%	7.6%	0.2%	7.5%
Tot. Mediterranean	0.3%	7.5%	0.2%	7.8%	0.2%	5.7%	0.2%	5.7%

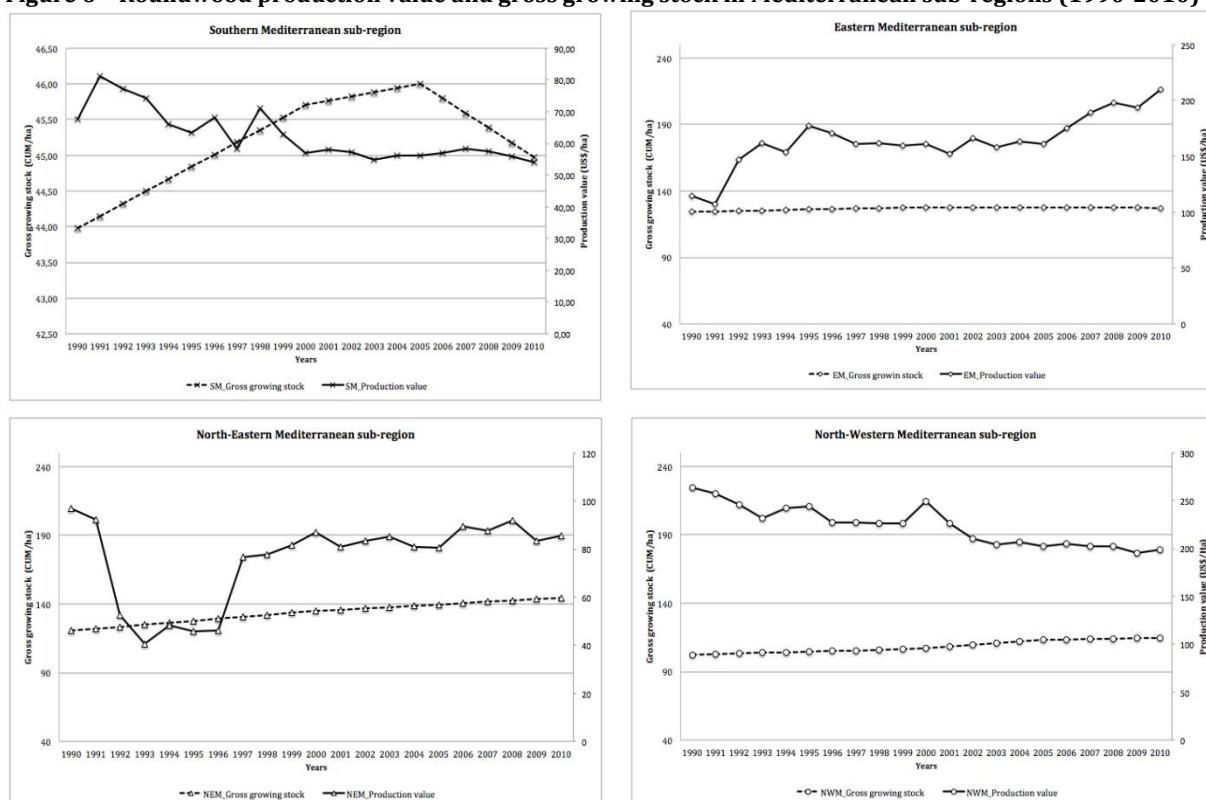
Source: own elaboration from [11] and [18].

The link between roundwood production value and forest gross growing stocks has been analysed as well. Figure 6 shows the trends for these two variables during the 1990-2010 period in the four Mediterranean sub-regions. A clear distinction between Northern and Eastern-Southern countries may be observed.

The SM and the EM sub-regions show the lowest increase in growing stock values per hectare (about 3% and 2% respectively). In both sub-regions such values started decreasing from 2005 and got back to levels comparable to those reached in mid 1990s. In the case of Tunisia and Egypt, growing stock per hectare has been restless decreasing since 1990. SM and EM sub-regions, however, show totally different trends with regard to production value between 1990 and 2010: decreasing (-5%) in the first case, increasing (+83%) in the second one. Such results may be interpreted in different ways for the two sub-regions. As regards SM sub-region observed conditions seems to result from increasing pressure on forest for firewood removals, i.e. for production of low value products. In the case of EM sub-region, the limited growth in growing stock and its recent decrease are to be put in connection with an increasing rate of timber production, both from natural and planted forests.

As regards Northern Mediterranean sub-regions, the growing stock per hectare has been increasing quite rapidly in the last twenty years, with a +20% variation in NEM and a +12% increase in NWM. In both sub-regions production value decreased between 1990 and 2010, but dynamics are well differentiated. In NEM sub-region the overall decrease was around 12%, but considering just the 1997-2010 period (i.e. excluding the Yugoslav wars period) a +11% change can be observed. On the other hand, in NWM production value has been more or less restless decreasing since 1990, with a -24% variation between 1990 and 2010.

Figure 6 – Roundwood production value and gross growing stock in Mediterranean sub-regions (1990-2010)

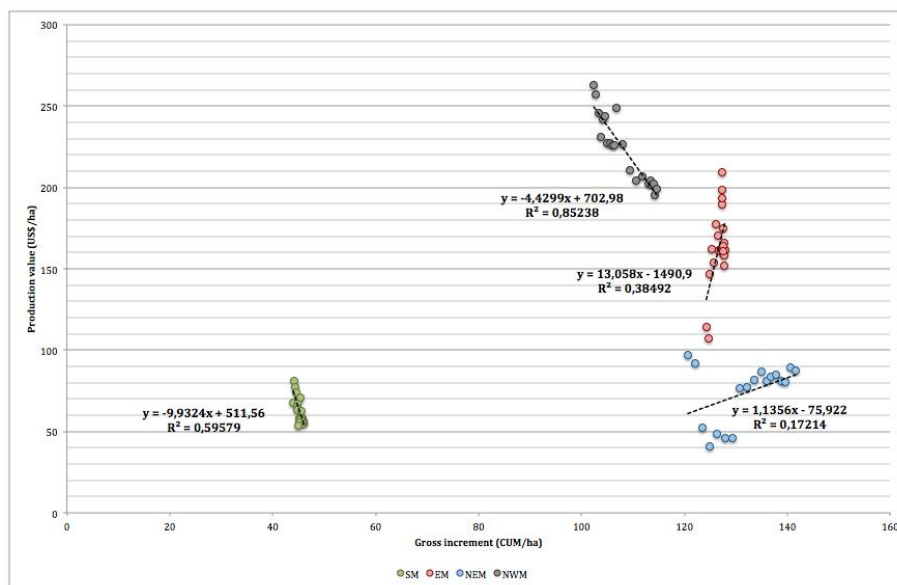


Source: own elaboration from [10] and [11].

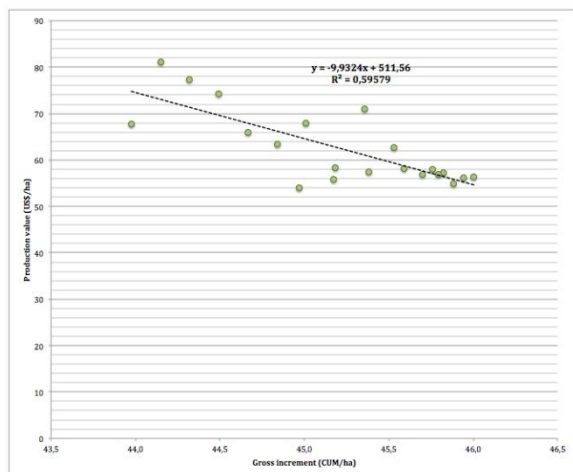
Preliminary analysis on the link between roundwood production value and growing stock per hectare was conducted on the basis of available data. Simple linear regression models were tested using gross growing stock per hectare as the explicative variable and roundwood production value as the response variable (Figure 7a to 7e). The responses for the four sub-regions are well differentiated and only the NWM sub-region shows a R-squared value (0.85238) that may confirm a linear relationship between the two variables. As shown by Figure 7e an increment in growing stock is linked to a decrease in roundwood production value per hectare. The second higher R-squared value is that of SM sub-region (0.59579) that once again suggests a negative link between the two variables. For EM and NEM sub-regions R-squared values are even more lower (0.38492 and 0.17214 respectively) suggesting there is no (or weak) linear relationship between the two variables. The existence of a link between roundwood production value and growing stock per hectare however is not yet fully clear and deserves further investigation.

Figure 7 – Simple linear regression models (roundwood production value x gross growing stock per hectare) for Mediterranean sub-regions

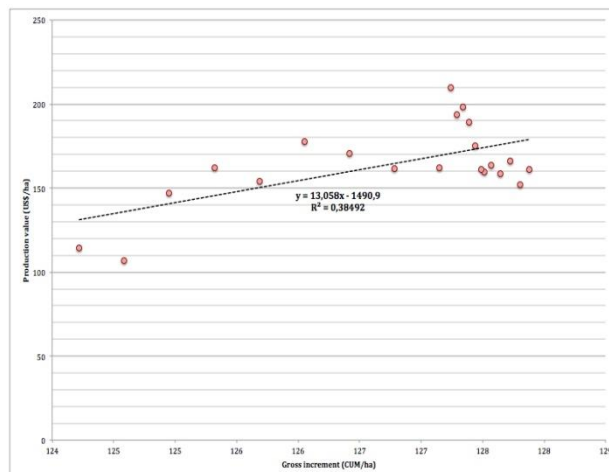
a – Mediterranean sub-regions



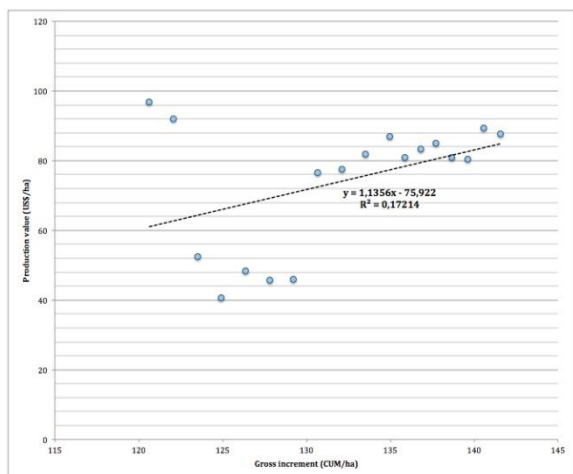
b - SM sub-region



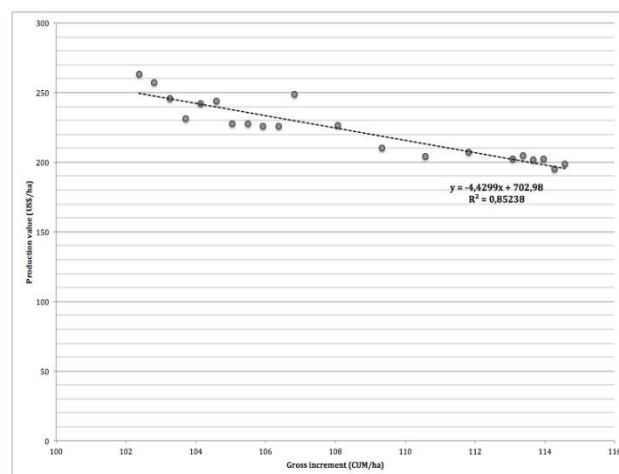
c - EM sub-region



d - NEM sub-region



e - NWM sub-region



Source: own elaboration from [10] and [11].

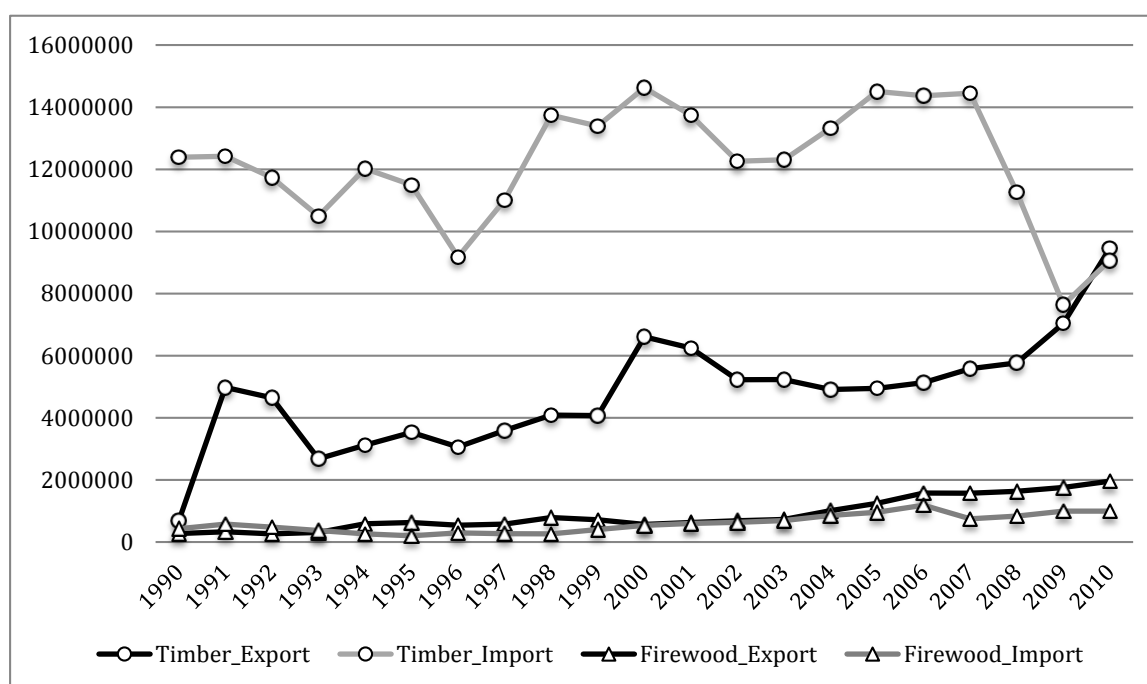
2.3 Roundwood trade

On average 10.1 MCUM of roundwood were imported every year by the twenty-one surveyed countries between 1990 and 2010. In the same period 4.5 MCUM/year were exported. When considering the value of imports and exports and the balance of trade, a trade deficit can be observed - with few isolated exceptions just in the case of firewood - during the analysed twenty years. Such a deficit, however, decreased (-65%) over time passing from 1,106.8 MUS\$ in 1990 to 405.7 MUS\$ in 2010, with opposite trends for timber (+73%) and firewood (-63%). Considering the balance of trade in terms of quantities the situation is rather different: a gap between exports and imports can be observed for roundwood as a whole aggregate for most of years, but a trade surplus exists since 2006 in the case of firewood and since 2009 in the case of timber.

Generally speaking, overall wood **imports** in the Mediterranean area between 1990 and 2010 decreased (-9%) in the case of timber and increased (about five times) in the case of firewood (Figure 8). The relative importance of timber and firewood on global import volume changed accordingly: in 1990 timber represented 97% of total Mediterranean imports, while in 2010 it represented 84%. On the other hand firewood relative incidence passed from 3 to 16%. This data are not surprising when considering that, according to [11], the Mediterranean region hosts the first (Italy) and the fourth (Turkey) firewood importers worldwide.

As regards **exports**, their increase in quantity between 1990 and 2010 was huge both in the case of timber (12 times increase) and firewood (6 times increase). Changes in value were positive as well but much more limited (58% and 14% respectively). The relative importance of timber and firewood on global export volume followed opposite trends compared to that of imports: globally considered, the Mediterranean area increased timber exports (from 71% in 1990, to 83% in 2010) and reduced firewood ones (from 29% to 17%).

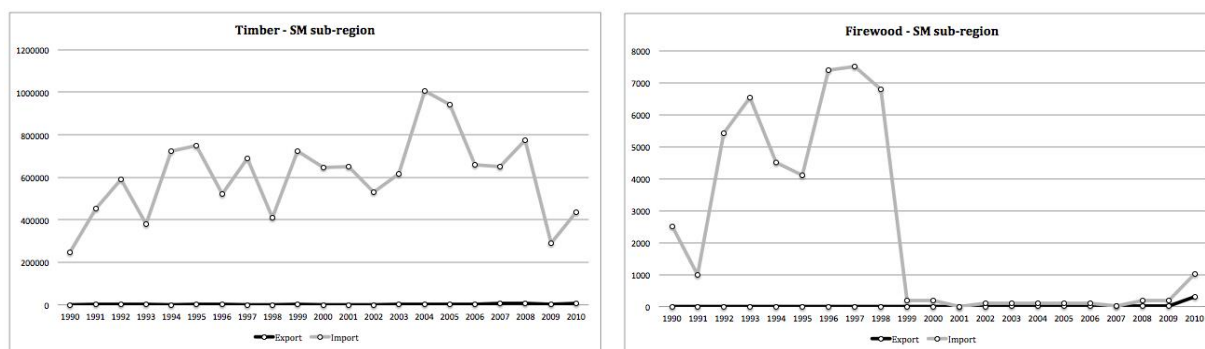
Figure 8 - Timber and firewood import and export (CUM) in Mediterranean countries (1990-2010)



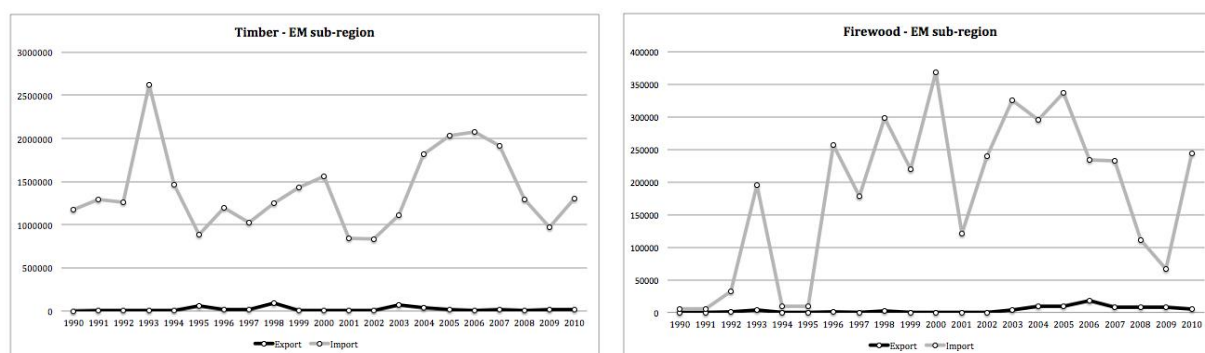
Source: own elaboration from [11].

Figure 9 - Timber and firewood import and export (CUM) in Mediterranean countries (1990-2010)

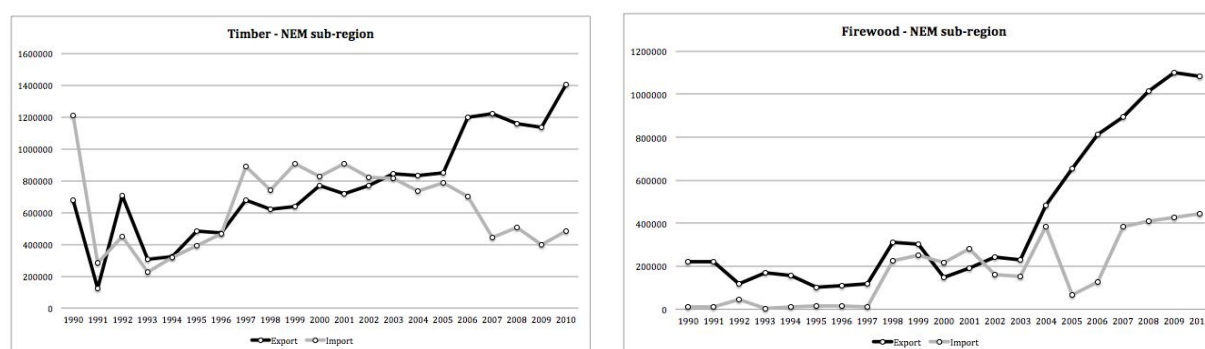
a. SM



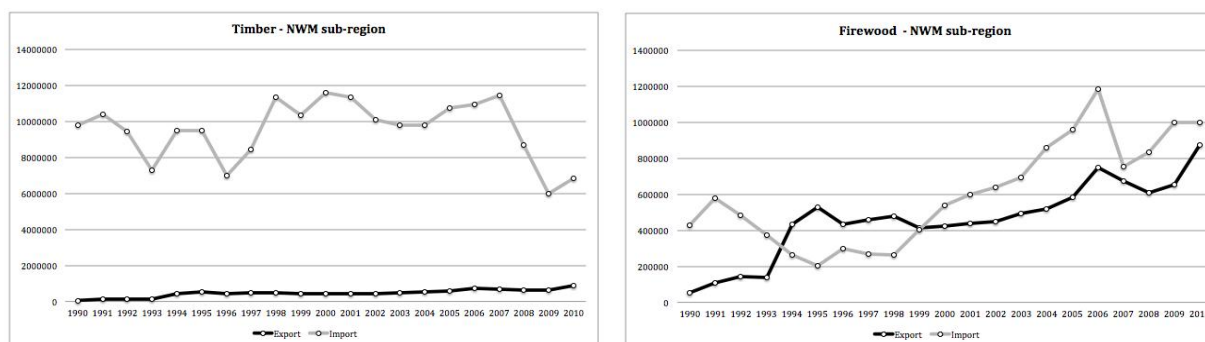
b. EM



c. NEM



d. NWM



Source: own elaboration from [11].

In SM and EM countries roundwood imports exceed exports and a trade deficit exists. In the case of SM countries, imports are more concentrated on timber - with Morocco and Egypt covering 90% of total imports in 2010 - while firewood production seems to be more aimed to domestic consumption. It is to be noticed that firewood imports suffered

a strong decrease in late 1990s and re-started to increase just in the last two-three years. In EM countries firewood imports, although lower than timber ones, have quite a relevant role, representing 24% of imports in the whole Mediterranean region, with Turkey in a dominant position. As regards NEM sub-region, exports became more and more relevant since 2004-2005. The growing difference between exports and imports is reflected in the growing gap between production and apparent consumption that suggests the sub-region is acting as an export-oriented area. Croatia and Slovenia are the leading exporters for timber, covering around 12% of total timber export in the Mediterranean region, while Bosnia and Herzegovina leads firewood exports from the sub-region and - with the only exception of 2010 data - in the whole Mediterranean basin. On the other hand, Greece is the main roundwood importer in the sub-region, covering 72% of total firewood imports.

NWM countries are by far the main wood importers in the region, with Italy ranking first both for timber and for firewood. Exports are largely dominated by France, that in 2010 covered more than 65% of the overall exports from the Mediterranean area. Spain ranked second, covering about 12%. The sub-region, however, suffered a huge timber import decrease - well highlighted by Figure 9d - due to the global economic crisis.

3. Non wood forest products production

The estimated total value of NWFPs production in the twenty-one¹⁴ Mediterranean countries is about 1,097.8 MUS\$ (Tables 4 and 5). The value refers to 2005 data as collected from country reports prepared in the frame of [10].

Table 4 reports value for NWFPs per country. NWFPs have been classified according to the 15 NWFPs categories identified by [10] (see Appendix 1 for details) and then according to main single product types (Table 5). The NWM sub-region produces nearly 90% of the overall production value, with Spain, Italy and France representing by far the most important producers. Outside the NWM region Lebanon and Bosnia and Herzegovina are the only countries contributing for more than 2% of the total regional production value (Figure 10).

As regards products (Figure 11), acorns and nuts¹⁵ represent more than 25% of the total value, followed by animal products¹⁶ (21%), cork (15%), mushrooms and truffles (15%), and honey (12%). In general different product types are differently distributed among sub-regions: for example fodder is highly concentrated in the SM sub-region, while aromatic and medicinal herbs, as well as seeds are relevant in the EM sub-region; cork is concentrated in SM and NWM sub-regions, while animal products are mainly present in NEM and NWM sub-regions.

¹⁴ Data on NWFPs production were available just for fourteen out of twenty-one countries.

¹⁵ i.e. chestnuts and hazelnuts.

¹⁶ i.e. meat, skins and trophies.

Table 5 – NWFPs production value (1,000 US\$) per Mediterranean country/sub-region and according to FAO FRA 2010 NWFP categories (2005)

Country/Sub-region	NWFP categories (as from FAO FRA 2010, see Appendix 1 for details)														
	1	2	3	4	5	6	7	8	9	10	12	15	Total	% on Total	
Algeria			4,010.98										4,010.98	0.4%	
Egypt	1,327.98	94.48											1,422.46	0.1%	
Morocco*		3,377.62	771.79					9,121.32					13,270.73	1.2%	
Tunisia	66.83	90.35	179.45		64.98			9,838.74				367.57	10,607.92	1.0%	
SM	1,394.81	3,562.45	4,962.22	0.00	64.98	0.00	0.00	18,960.06	0.00	0.00	0.00	367.57	29,312.09	2.7%	
Cyprus			0.21					112.92					113.13	0.0%	
Lebanon	44,750.39		31.21										44,781.60	4.1%	
Turkey	1,017.03					2.81				279.55			1,299.39	0.1%	
EM	4,5767.42	0.00	31.42	0.00	0.00	2.81	0.00	112.92	0.00	279.55	0.00	0.00	46,194.12	4.2%	
Albania	580.00		5,100.00	5.34	10.68							0.13	5,696.15	0.5%	
Bosnia and Herzegovina	21,287.00		7,617.00									220.00	29,124.00	2.7%	
Croatia	65.78	616.78	1.64			153.35		492.76		456.61	438.81	1.14	2,226.87	0.2%	
Slovenia	1,179.97					1,232.08				5,789.51	3,662.07		11,863.63	1.1%	
NEM	23,112.75	616.78	12,718.64	5.34	10.68	1,385.43	0.00	492.76	0.00	6,246.12	4,100.88	221.27	48,910.65	4.5%	
France	44,546.58		6,770.19		2,049.69								137,371.43	12.5%	
Italy	314,404.96	3,310.56			11,216.15						84,004.97		328,931.67	30.0%	
Spain	228,217.21		55.20		5.29		1,122.56	137,674.56	140,003.25				507,078.07	46.2%	
NWM	587,168.75	3,310.56	6,825.39	0.00	13,271.13	0.00	1,122.56	137,674.56	140,003.25	0.00	84,004.97	0.00	973,381.17	88.7%	
Total															
Mediterranean	657,443.73	7,489.79	24,537.67	5.34	13,346.79	1,388.24	1,122.56	157,240.30	140,003.25	6,525.67	88,105.85	588.84	1,097,798.04	100.0%	
% on Total	59.9%	0.7%	2.2%	0.0%	1.2%	0.1%	0.1%	14.3%	12.8%	0.6%	8.0%	0.1%	100.0%		

* includes data for argan production sourced from [20].

Source: own elaboration from [19].

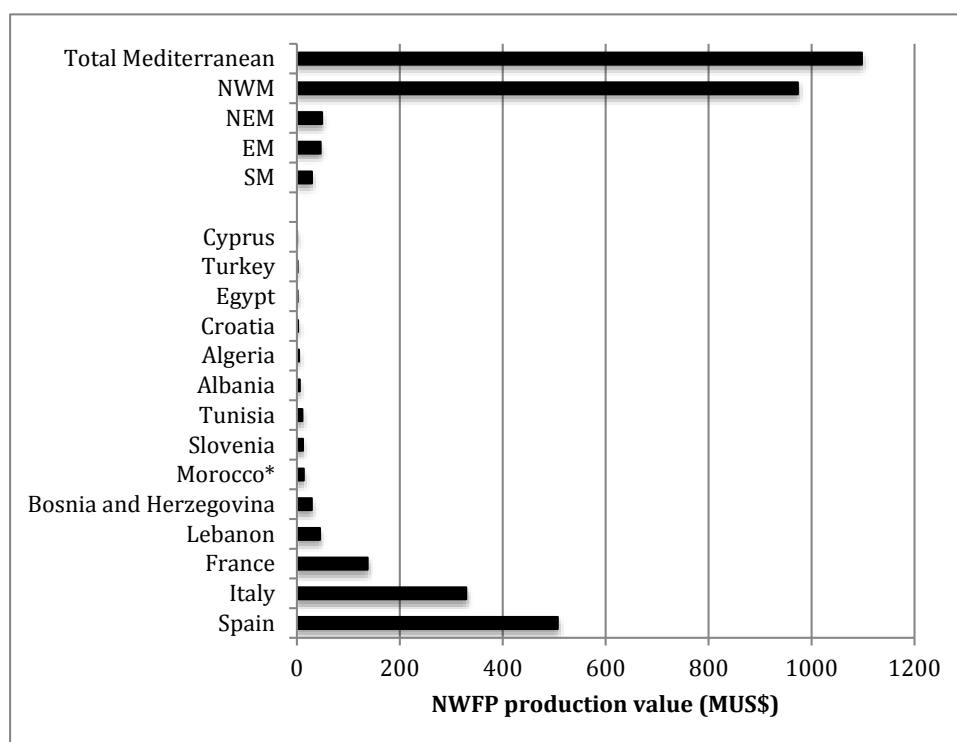
Table 6 – NWFPs production value (1,000 US) per Mediterranean country/sub-region and main NWFP types (2005)

Country/Sub-region	Main NWFPs types											% on Total
	Animal products	Cork	Fodder and hay	Fruits	Herbs	Honey	Mushrooms and truffles	Acorns and nuts	Seeds	Other	Total	
Algeria	0.00	4,010.98									4,010.98	0.4%
Egypt	0.00			663.99	76.65					681.82	1,422.46	0.1%
Morocco*	0.00	8,411.62	3,377.62	640.00	530.85					310.64	13,270.73	1.2%
Tunisia	367.57	3,938.74	90.35	3.09	176.36				66.83	5,851.38	10,607.92	1.0%
SM	367.57	16,361.34	3,467.97	1,307.08	783.86	0.00	0.00	0.00	66.83	6,843.84	29,312.09	2.7%
Cyprus	0.00				0.21					112.92	113.13	0.0%
Lebanon	0.00				15,965.92				27,489.67	1,326.00	44,781.60	4.1%
Turkey	279.55				128.40		210.28	7.01	768.24	116.19	1,299.39	0.1%
EM	279.55	0.00	0.00	0.00	16,094.53	0.00	210.28	7.01	28,257.91	1,555.11	46,194.12	4.2%
Albania	0.13				5.34					5,690.68	5,696.15	0.5%
Bosnia and Herzegovina	220.00			3,848.00	1,748.00		17,439.00			5,869.00	29,124.00	2.7%
Croatia	896.56		616.78		1.64	1.78	32.89		492.76	184.46	2,226.87	0.2%
Slovenia	9,451.58							462.03		1,950.02	11,863.63	1.1%
NEM	10,568.27	0.00	616.78	3,848.00	1,754.98	1.78	17,471.89	462.03	492.76	13,694.16	48,910.65	4.5%
France	84,004.97	2,049.69			6,770.19	31,180.12	13,366.46				137,371.43	12.5%
Italy	0.00	11,216.15		1,831.05			81,660.87	232,530.43	1,693.17		328,931.67	30.0%
Spain	140,003.25	137,674.56			55.20	101,560.65	52,389.53	44,039.27	30,227.76	1,127.86	507,078.07	46.2%
NWM	224,008.22	150,940.40	0.00	1,831.05	6,825.39	132,740.77	147,416.86	276,569.70	31,920.93	1,127.86	973,381.17	88.7%
Total												
Mediterranean	235,223.61	167,301.74	4,084.75	6,986.13	25,458.76	132,742.55	165,099.03	277,038.74	60,738.44	23,220.97	1,097,798.04	100.0%
% on Total	21.4%	15.2%	0.4%	0.6%	2.3%	12.1%	15.0%	25.2%	5.5%	2.1%	100.0%	

* includes data for argan production sourced from [20].

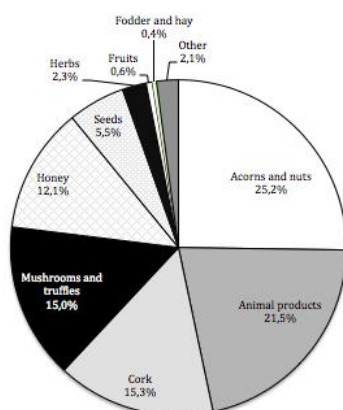
Source: own elaboration from [19].

Figure 10 - NWFP production value (MUS\$) per country in Mediterranean countries (2005)



Source: own elaboration from [19].

Figure 11 - Relative incidence of main NWFP types on total NWFP production value in Mediterranean countries (2005)



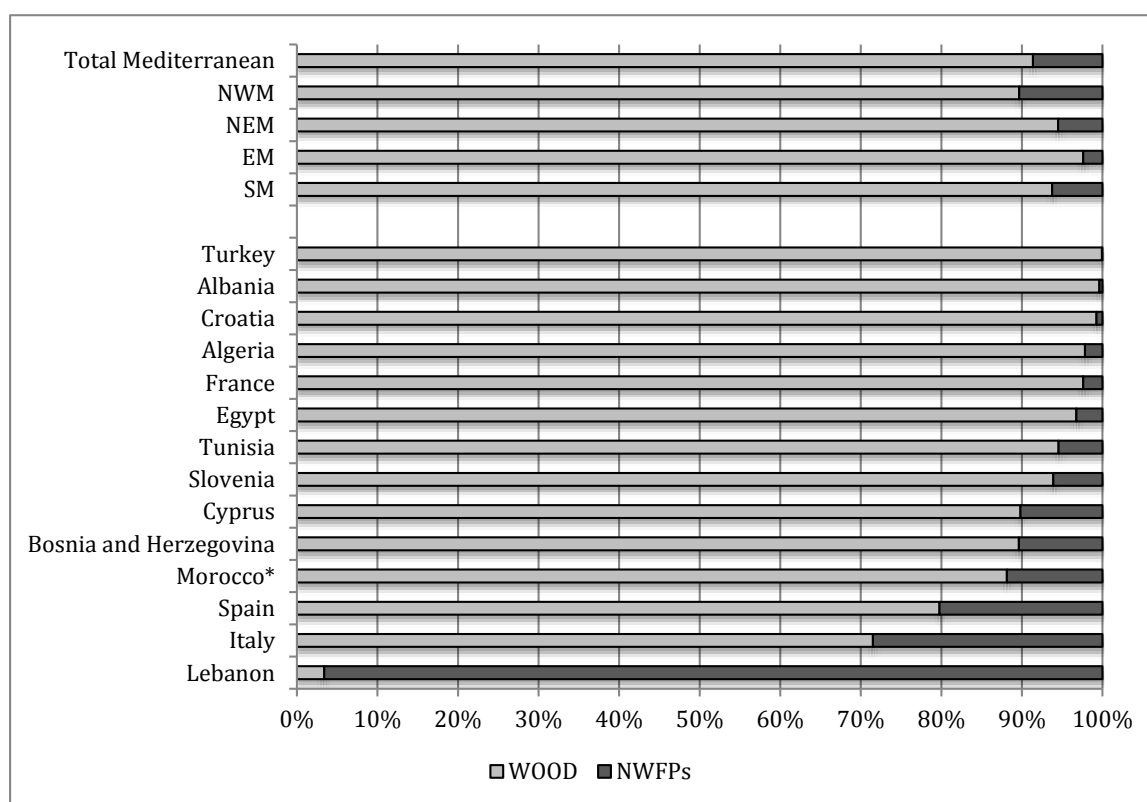
Source: own elaboration from [19].

The estimated value of NWFPs production is equivalent to 9% of the estimated roundwood production value in the whole Mediterranean region in 2005 (Figure 12).

The country with the highest relative incidence of NWFPs is Lebanon (97%), where the high performance of NWFPs is mainly determined by the marginal relevance of roundwood production. On total, ten countries show NWFP percentages higher than 10% and only three (i.e. Lebanon, Italy and Spain) show figures higher than 20%. The NWM sub-region is once more the front-runner, being the only one with a NWFP relative incidence higher than 10%. It may be assumed, however, data for SM sub-region are underestimated because FAO FRA country reports for Algeria, Libya, Morocco and

Tunisia do not indicate value figures for all of the products they list. This is the case, for example, of mushrooms and truffles, and many aromatic and medicinal herbs.

Figure 12 – Relative incidence of roundwood and NWFPs production value in Mediterranean countries and sub-regions (2005)



* includes data for argan production sourced from [20].

Source: own elaboration from [19].

4. Conclusions

Understanding the true value of natural resources is, both for the land users and the policy makers, an essential step for promoting their protection and sustainable use. In this respect the lack of comparative analysis and country case studies especially in the Southern Mediterranean region on the value of wood and NWFPs supply is a useful and worrying indicator of the marginal importance given to forestry in understanding climate change impacts, adaptation strategies and their links to sustainable development.

Enhancing the offer of Mediterranean market products and increasing their role in the rural economy could help to reduce the costs of forest protection: a well structured forest economy able to provide stable flows of incomes is functional to provide a fundamental set of public non-market services and social values to both the local people and the global community. This is a relevant issue in the case of the Mediterranean region that represents one of the areas where the systems of Payments for Environmental Services (PES) have been less implemented. As highlighted for water-related PES schemes by [21] and the inventory updated by Ecosystem Marketplace¹⁷,

¹⁷ www.foresttrends.org

Southern Europe and North Africa have very limited cases of PES implementation. The same conditions are characterizing the state of Carbon-related PES schemes¹⁸. For the Southern Mediterranean region the situation is however worst: not only the most advanced instruments of payments for non-market services have not yet been implemented, but also there is an extremely limited use of the traditional instruments of subsidies and compensations, quite developed in Southern Europe to support forest economy.

There is however another raising key-issue connected with climate change: the unbalanced impacts on Mediterranean forests and the equity concerns raising from the cost and benefit distribution. Southern Mediterranean countries (with the exception of Libya and Israel) have much lower CO₂ emissions. EU Mediterranean countries have 3-4 times higher *pro-capita* emissions than countries like Algeria, Morocco, Tunisia and Egypt. Quoting [2] (p. 15) *“those who contributed least to the atmospheric build-up of greenhouse gases, are the least equipped to deal with the negative impacts of climate change”* and, as stressed in the introduction of the chapter, the most negatively affected and vulnerable to climate change. Addressing these equity concerns is therefore not only an issue of protecting forest resources and their offer of social and environmental benefits within a strategy of climate change mitigation and adaptation, but is a concern related to the balancing of historical responsibilities among countries and designing a future of peaceful cooperation between the Northern and Southern regions of the Mediterranean.

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¹⁸ www.forestcarbonportal.com

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Appendix 1 - Data sources and methodology

Forest area and growing stock

Forest area and growing stock figures for the twenty-one Mediterranean countries studied in this chapter have been collected from [10].

Roundwood production and trade figures

FAOSTAT database 1990-2010 data have been taken into consideration with reference to the product aggregate “Roundwood” that includes all roundwood felled or otherwise harvested and removed [11]. It comprises all wood obtained from removals, i.e. the quantities removed from forests and from trees outside the forest, including wood recovered from natural, felling and logging losses during the period, calendar year or forest year. In the production statistics, the aggregate is inclusive of the following categories: (a) “Wood Fuel, including Wood for Charcoal”, (b) “Sawlogs and Veneer logs”, (c) “Pulpwood, Round and Split”, (d) “Industrial Roundwood - Wood in the Rough” and (e) “Other Industrial Roundwood”. In the trade statistics, the aggregate represents the sum of: “Industrial Roundwood-Wood in the rough, and “Wood fuel, including wood for charcoal” [22]. For the purposes of the present chapter a general distinction into two broad categories, namely *firewood* (category a) and *timber* (categories from b to e), was done. Collected data cover the following elements: production (quantity), import (quantity and value) and export (quantity and value).

Some adjustments were done for the following countries/areas:

- **Egypt:** annual firewood production data for Egypt reported by [11] for the 1990-2010 period indicate a production level ranging between 14 and 17.5 MCUM. It is believed such data are largely overestimated, because forest area in Egypt is very limited and reported figures would result in a annual production level two times bigger than the total growing stock for the country as reported by [10]. Therefore, firewood production for Egypt was estimated by calculating the yearly average firewood *pro-capita* consumption for SM sub-region and multiplying this value for the corresponding Egyptian total population figures as reported by [11]. Such estimation was repeated for any single year between 1990 and 2010;
- **former Yugoslavia SFR member countries:** 1990 and 1991 data have been estimated on the basis of average figures, taking into consideration the total figures for Yugoslavia SFR as reported in [11] and dividing them proportionally among different countries. For the purposes of this, average relative proportions calculated on the basis of post-1992 figures were used. As for Montenegro, data have been calculated based on 1993-2005 figures for Serbia and Montenegro, considering the average proportion of Montenegro and Serbia figures for 2006-2010.

Roundwood production value

The economic value of roundwood production has been estimated as a marginal value per hectare (ha) and year. In the case of roundwood, the approach adopted in the frame of EXIOPOL project and reported by [23] was adapted. As a first step the marginal value for volume unit (US\$/CUM) was calculated according to (1) as an average of the marginal value of exported and imported roundwood values reported in [11] for the twenty-one surveyed countries. Such marginal value was calculated for the 1990-2010 period: since results showed oscillations between years, an average value for the selected period was calculated.

$$(1) \quad mVi = \frac{\left(\frac{EV_i}{Eq_i} + \frac{IV_i}{Iqi} \right)}{2}$$

where:

mVi = marginal value (US\$/CUM) of roundwood in year by country

EV_i = roundwood export value per year by country i

Eq_i = roundwood export quantity per year by country i

IV_i = roundwood import value per year by country i
 Iq_i = roundwood import quantity per year by country i
 i = country

Marginal values were calculated separately for timber and firewood and then used to calculate the value of total production per country according to (2). Total values are expressed in 2010 US\$.

$$(2) \quad TV_i = (P_i)(mVi)$$

where:

Tv_i = total value per year by country i
 mVi = marginal value (US\$/CUM) of roundwood in year by country i
 P_i = annual roundwood quantity (CUM) produced in country i
 i = country

Total values were finally divided by forest area in each country as reported by [10], in order to get marginal values per hectare and year¹⁹.

Gross growing stock per hectare

The gross growing stock per hectare in each country was estimated in three different steps. First of all the total growing stock per hectare was calculated according to (3).

$$(3) \quad TGS_i = \frac{(GSI) + (P_i)}{A_i}$$

where:

TGS_i = total gross growing stock per hectare (CUM/ha) by country i
 mVi = growing stock (CUM) by country i
 P_i = roundwood quantity (CUM) produced in country i
 A_i = forest area (ha) by country i
 i = country

Since [10] reports growing stock and forest area figures just for four years (1990, 2000, 2005 and 2010) the [3] was calculated separately for these years. Production values (P_i) were therefore defined as average values²⁰ for the corresponding years. The total gross growing stock variation was calculated by difference for 1990-2000, 2000-2005 and 2005-2010 periods and average variation figures per year (i.e. the mean annual increment, MAI) were calculated for each period simply by dividing the stock variation for the number of years. Finally the gross growing stock per hectare was estimated on yearly basis by summing up growing stocks and estimated mean annual increments along each of the three periods.

Non wood forest products production figures

Data on NWFPs were collected from FAO FRA 2010 national reports for the twenty-one investigated countries. FAO FRA 2010 data for NWFPs refer to 2005 figures (quantities and values) and are available just for fourteen out of twenty-one countries. Data were first classified according to the 15 NWFPs categories identified by FAO FRA 2010 (see table below) and then further analysed and re-arranged in order to highlight the main NWFPs. This was due also to the fact that some NWFPs (e.g. cork) are reported as cross-cutting products with respect to FAO FRA 2010 NWFP categories.

¹⁹ EXIOPOL project referred just to productive forest area in each country. Moreover, net income was used instead of pure Total value by adopting a 5.6% net return from forestry. Since this value was estimated with reference to Sitka spruce plantations in the United Kingdom, it was considered totally inappropriate for Mediterranean forests.

²⁰ i.e. 1990 roundwood production quantity reported by FAOSTAT database was used as such, while 2000 value was calculated as the average roundwood production quantity reported by FAOSTAT database for 1991 and 2000. In a similar way, 2005 value was calculated as the average for 2001-2005 production quantities and 2010 value as the average for 2006-2010 production quantities.

General category	Category number	Description
Plant product/raw materials	1	Food
	2	Fodder
	3	Raw material for medicine and aromatic products
	4	Raw material for colorants and dyes
	5	Raw material for utensils, handicrafts & construction
	6	Ornamental plants
	7	Exudates
	8	Other plant products
Animal products/raw materials	9	Living animals
	10	Hides, skins and trophies
	11	Wild honey and bee-wax
	12	Wild meat
	13	Raw material for medicine
	14	Raw material for colorants
	15	Other edible animal products
	16	Other non-edible animal products

Annex 4 - Sustainability and land use impact of using forests as bioenergy resource

Masiero, M., Muys, B., Solberg, B. (2013). Policy implications. In: Pelkonen, P. (ed). Forest bioenergy for Europe: What Science Can Tell Us. European Forest Institute, Joensuu.

[Accepted 2013]

1.3 Policy implications

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Introduction

The increasing interest in the use of forest biomass as a renewable energy source has activated policy developments at all geographical levels from international and national to local. Given their high relevance for actors in the sector we focus in this chapter on giving an overview of policies at the EU level that are relevant for the development of sustainable biomass energy from forests.

EU forest policy

Forests and wood were not explicitly mentioned in the Treaty of Rome (1957) and for many decades they were just included as complementary measures in other policies. This so-called 'shadow' forest policy can be found back under policy domains as varied as environment, rural development, industry, trade, etc. With the transition to the CAP reform in 2005 - that integrated the forest sector into rural development policies - many EU initiatives were launched to develop a specific set of strategic objectives for the forest sector and coordinate them with those of other sectoral policies (e.g. Forestry Action Programme, Standing Forestry Committee, European Forest Information and Communication System, protection against forest fires, etc.). The Amsterdam Treaty (1997) introduced a relevant change in the EU approach to environmental protection and sustainable development. Articles 2 and 6 defined that EU has responsibility over impacts produced by economic development on environmental resources, including forests. Given all these intermediate steps, it was only in 1998 that the EU adopted a Forestry Strategy representing the first significant attempt to create an EU-wide framework for forestry. A mid-term evaluation of the Strategy in 2005, however, revealed the need for strengthening coherence between different EU policies and for improving coordination between the European Commission and the Member States. In this perspective, the EU Forest Action Plan for the period 2007-2011 was adopted in 2006. While trying to define practical aspects of policy action, through 4 main objectives and 18 key-actions (including the promotion of the use of forest biomass for energy generation), the Plan remains rather general and could have only indirect effects in terms of improving coordination among national policies. In 2013 a new version of the EU Forest Strategy was launched. The document reckons the role of energy biomass and stresses the importance of wood mobilisation, encouraging Member States to use forest resources in a way that minimises impact on the environment and climate, and prioritising the forest outputs that have higher added-value, create more jobs and contribute to a better carbon balance. The focus, therefore, is on cascade approach and active forest management.

In 2011 EU Member States also entered a Pan-European process for the negotiation of a Legally Binding Agreement (LBA) on Forests in Europe. For the purposes of this a

Intergovernmental Negotiating Committee (INC) was established with the mandate to develop such an agreement that aims to promote sustainable management of forests in Europe. Once approved, the LBA will represent an absolute *premiere* worldwide.

"The EU forest policy sensu stricto has only limited impact on the development of bioenergy from the forest, as a consequence of the EU legislative framework that is providing only quite a marginal role to the European Commission in policy design, financing and implementation."

Climate policy

The EU took climate change prevention as a strategic priority. In this perspective, investments in green technologies and good practices that cut emissions represent a priority that could also boost the economy, create jobs and strengthen Europe's competitiveness at global level. For the first commitment period of the Kyoto Protocol (2008-2012) the 15 countries that were EU members before 2004 ('EU-15') committed to reduce their collective emissions to 8% below 1990 levels. According to EC strategies, 1% out of 8% of the EU15 target was supposed to be reached through forest activities.

Within EU the most relevant market tool for the reduction of GHG emissions is the European Union's emissions trading scheme (EU ETS), adopted with Directive 87/2003 and operative since 2005. The scheme is organised as a cap-and-trade system and imposes an emission threshold (cap) to the most energy intensive economic segments. However, companies can reduce their emissions by energy savings or reducing their production levels, and by selling (trade) emission credits they do not use to other companies. The EU-ETS scheme does not allow investments in the primary sector to generate credits. But companies can use biomass - and other renewables - for producing their own energy, thus reducing their GHG emissions and indirectly valorising agro-forestry activities at EU level.

Climate policy is closely connected to energy policy, where the role of biomass is paramount. In its efforts to become a highly energy-efficient, low carbon economy, the EU has adopted the so-called Climate and Energy Package in 2009, i.e. a set of binding legislation which aims to ensure the EU meets its ambitious climate and energy targets for 2020. These targets, known as the '20-20-20' targets, set three key objectives for 2020: (i) 20% reduction in EU greenhouse gas emissions from 1990 levels; (ii) raising the share of EU energy consumption produced from renewable resources to 20%; and (iii) 20% improvement in the EU's energy efficiency.

The link between Climate and Energy Policies can also be found with regard to energy efficiency initiatives in the building sector. The Buildings Energy Performance Directive (EPBD) (Directive 2002/91/EC), for example, is intended to promote the improvement of the energy performance of buildings within the EU through cost-effective measures. Among them the adoption or enhancement of low and zero carbon technologies (LZCT) such as micro-CHP (combined heat and power) and biomass boilers can be a valid solution.

"Through incentives for the private sector and procurement policies for the public sector aiming at the adoption of low carbon technologies, the EU climate policy is strongly stimulating the demand for biomass."

Energy policy

As already mentioned, Directive 2009/28/EC (EU-RED) requires that at least 20% of total EU energy consumption is generated from renewables by 2020, and is in this perspective confirming forest biomass as the most important renewable energy source in Europe in the 20-20-20 EU's strategy: wood and wood wastes represent 47% of gross consumption of renewable energy and 67% of bioenergy use. The EU-RED also includes a set of mandatory sustainability criteria, including monitoring and reporting requirements for liquid biofuels. Also second generation biofuels such as Fisher-Tropsch biodiesel from forest biomass fall under this regulation. Biofuels are required to fulfil all sustainability criteria to count towards EU targets and to be eligible for financial support. For example the EU-RED excludes several land categories, with recognised high biodiversity value, from being used for biofuel production: (a) primary forests and other wooded land; (b) areas designated for nature protection or for the protection of rare, threatened or endangered ecosystems or species; (c) highly biodiverse grass-land, either natural or non-natural.

In 2013 a proposal for a Directive on 'sustainability criteria for solid and gaseous biomass used in electricity and/or heating and cooling and biomethane injected into the natural gas network' has been published. The mentioned sustainability criteria are very similar to those defined for liquid biofuels. In the future only biomass that will meet the criteria will be eligible for financial support. The proposal has received many comments and has raised concerns among different stakeholders. One of the aspects that need to be reinforced is the focus on 'cascading approach', see chapter 1.4 for more explanation. This approach would help creating synergies between the industry and energy sector in accessing wood resources and, above all, would be in line with the EU Resource Efficiency Initiative, which emphasises resource use in the most efficient way.

"The ambitious targets of the EU energy policy imply the need of criteria to assure that bioenergy production and trade are sustainable and not detrimental for society and the environment. New rules for forest biomass are underway that should be in line with the existing rules for liquid biofuels"

Rural Development Policy and Common Agriculture Policy

With the CAP reform of 2005 forest measures became a fundamental part of Rural Development Policy. As for the 2007-2013 period, 9 forestry-specific and 6 forestry-related measures were defined within this policy. As a consequence 1-1.5% of the CAP funding was originally intended for forestry measures, i.e. 7-9% of the EU Rural Development Policy funding (Agricultural Fund for Rural Development, EAFRD). Many of these measures were directly linked to wood mobilisation and, in many cases, production of biomass for energy as well. Biomass-specific measures have been introduced and co-financed in several countries (e.g. support for machinery, short rotation coppice, diversification of rural economy). As for wood mobilisation, measures include subsidies to thinning, pruning and other forest operations for improving the economic value of forests, as well to improvements of road network and infrastructures (at least 16,000 km of forest roads are expected to be built) (table 1).

Table 1: Examples of Rural Development measures for biomass and wood mobilisation during the CAP2007-2013 programming period. B = biomass specific; WM = wood mobilisation in general

Measure			B	W M
N.	Description	Examples and notes		
121	Modernisation of agricultural holding	Short rotation coppice for biomass production, mostly with reference to bioenergy production (minor part of total allocated amounts)	X	
122	Improving the economic value of forests	Pre-commercial thinning and replacement of low value forest stands		X
123	Adding value to agricultural and forestry products	For micro-enterprises only: support for harvesting machinery, (portable) sawing mills, and other processing facilities (e.g. woodchip and pellet production)	X	X
124	Cooperation for development of new products processes and technologies in the agriculture and food sector and the forestry sector	Initiatives for the substitution of fossil fuels	X	
125	Infrastructure related to the development and adaptation of agriculture and forestry	Forest roads building and/or improving		X
221	First afforestation of agricultural land	Afforestation for productive or protective purposes <i>Ex-ante</i> or <i>ex-post</i> forestry practices such as vegetation control, thinning, diversification of vegetation structure		X
223	First afforestation of non-agricultural land			X
225	Forest-environment payments			X
226	Restoring forestry production potential and introducing prevention actions			X
227	Non-productive investments	Thinning and pruning to improve the ecological value of forests		X
311	Diversification into non-agricultural activities	Bioenergy production as one of the possible actions.	X	
312	Support for business creation and development	It may cover processing of forest products, and bioenergy production and related actions	X	
321	Basic services for the economy and rural population	Increase of the share of decentralised produced and used heat energy out of biomass.	X	

In line with the Europe 2020 growth strategy and the overall CAP objectives the European Commission proposal for Rural Development Policy in the 2014-2020 period is organised according to 6 priorities. Among them, Priority 5 reads as '*Promoting resource efficiency and supporting the shift towards a low-carbon and climate-resilient economy in the agriculture, food and forestry sectors*'. One of the areas of intervention under Priority 5 is facilitating the supply and use of renewable sources of energy, by-products, wastes, residues and other non-food raw materials for the bio-economy. In addition to this, Member States may include within their rural development programmes thematic sub-programmes, contributing to the Union priorities for rural development, aimed to address specific needs identified. These include amongst others short supply chains, which might represent an interesting future development opportunity for the woody biomass sector. The European Commission has defined a short supply chain as 'a supply chain involving a limited number of economic operators, committed to co-operation, local economic development, and close geographical and social relations between producers and consumers'. Although the concept has been originally introduced with reference to the agro-food supply chains, it has huge potential for extension to the bioenergy sector in order to encourage local production and use of energy from renewable sources, in compliance with sustainability criteria.

When looking at the new Rural Development policy, moreover, a strong focus on environmental services and greening is expected. For many years, following the so called *Kielwasser theory* developed by Rupf (1960), forest management focused almost exclusively on wood production, considering all other functions as secondary values

depending on the former. Today forestry is expected to be more and more multifunctional, i.e. to support the provision of a wide range of products and services in an economically as well as socially and ecologically sustainable way. There can be both positive interactions and trade-offs between wood mobilisation in general and the provision of other ecosystem services such as - for example - recreation, biodiversity conservation, carbon sequestration and landscape amenities.

“The EU CAP and Rural Development Policy hold a large variety of opportunities for countries and regions to stimulate wood mobilisation in their forests in an optimized balance with other development opportunities and ecosystem services, providing the most appropriate job, income and wellbeing opportunities for rural communities.”

Trade policy

Achieving the renewable energy target by 2020 will encourage wood mobilisation from domestic forest resources, but also increase imports from other regions. In the last years traditional trade policy has been completed by new initiatives aiming to tackle illegal logging practices and, in particular, the international trade in illegally harvested wood. As a major wood importer, the EU has been a frontrunner in this arena and adopted different specific initiatives. The Forest Law Enforcement Governance and Trade (FLEGT) Action Plan - approved in 2003 and then implemented by two Regulations in 2005 and 2008 - defines several measures, the most prominent being the negotiation of Voluntary Partnership Agreements (VPA) with wood producing countries that export their products to the EU. By signing a VPA partner countries engage in reinforcing their law system and enforcement procedures, in order to guarantee the wood they export to EU is legal. At present, however, only six countries have signed a VPA with the EC and a number of negotiation processes are taking place. A second initiative launched by the EC is Regulation (EU) 995/2010, also known as the EU Timber Regulation (EUTR). EUTR has come into force in March 2013 and prohibits the placing on the EU market of illegally harvested timber or products derived from such timber, including firewood, pellets and wood chips. In this perspective, those who place timber on the market are called operators and shall exercise the so called Due Diligence, i.e. a set of procedures for collecting information, performing risk assessment and - in case - mitigating illegality risks. While the FLEGT Action Plan only applies to imported wood, EUTR covers both imported and domestically sourced wood, thus affecting also EU forest owners and forest service companies, as well as energy plants fed with woody biomass. The Due Diligence system might also imply increased supply costs for the EU forest owners, with unequal effects in relation to the scale of their activity, affecting micro and small enterprises.

“The new European trade regulations will help to avoid illegal trade flows of woody biomass for bioenergy, but may have side effects in terms of increased supply costs, in particular for small forest enterprises.”

Conclusions

It has become clear that actors in the forest biomass for bioenergy sector are influenced not only by forest policies, but also by an extremely complex governance setting involving several other policies such as climate policy, energy policy, Rural Development Policy and Common Agricultural Policy (CAP), and trade policy. Each of these policy groups and sub-groups has different characteristics and peculiarities, and might

influence the development of the bioenergy sector both within and outside European borders.

New scenarios emerging from the expansion of the biomass sector will require due considerations of the impacts and future challenges they may impose on present and future EU policies.

Further readings

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Annex 5 - Sustainability and land use impact of using forests as bioenergy resource

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[Accepted 2013]

1.4 Sustainability and land use impact of using forests as bioenergy resource

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Introduction

Forest biomass constitutes the major renewable energy source of the European Union (EU) (see 1.3). With the **EU Renewable Energy Directive (2009/28/EC)** in place it will continue to play a dominant role in the substitution of fossil fuels in the decades to come. Considering the elevated cost for investments in solar, wind and geothermal, the **National Renewable Energy Action plans** in execution of this Directive consider implementing their respective renewable targets predominantly with solid biomass from the forest. The development of a forest biomass industry offers excellent opportunities for the mobilization of the production potential of European forests and the development of a green economy, but at the same time holds a number of risks with regard to its sustainability. Potential impacts could affect European forest resources and social-ecological systems, and in the case of imported biomass, also those of third countries outside Europe. In this context there is a proposal for **sustainability criteria for solid biomass**, in addition to the Sustainability Criteria for Liquid Biofuels already in vigor (Article 17(2) to 17(5) and Article 18(1) of the Renewable Energy Directive), and its contents are currently under debate.

In this chapter we discuss the main sustainability issues that need consideration when developing forest biomass use for bioenergy as a successful and **sustainable business**. We adopt a broad and widely accepted sustainability concept, considering the environmental, social and economic pillars of sustainability, although most of the socio-economic issues are discussed under 1.2 and 1.4. We start with the need to maintain a certain standing stock in the forest (sustained yield) and continue with the maintenance of long-term site productivity (sustainable yield) and biodiversity. We then discuss the carbon emissions and energy use associated with bioenergy production and consumption, including the risks for direct and indirect land use change. Finally socio-economic dimensions have been taken into consideration, including competition with other industries for material supply, sectorial governance, and implications for forest owners.

Sustained yield

European forests have a large and increasing extent (157.2 million hectares in EU27, which is about 35% of the land surface), and a large accumulated biomass stock (estimated 24 billion m³ of stem wood), and are characterized by problematic wood mobilization. Geographers describe such a context as the last stage of the forest transition to 'more people more forests'. In this land of plenty, the resource looks inexhaustible and sustained yield seems some theoretical concept from old forestry handbooks. It is, however, crucial to understand that this situation should be largely accredited to fossil fuels. As a consequence, a transition to a bio-based economy, as it is now boosted by the EU Renewable Energy Directive, will most likely increase pressure on the forest biomass stock, at least in parts of Europe, like it used to happen in

populated areas before the arrival of fossil energy. A recent unpublished study by EFI shows that the execution of the National Renewable Energy Action Plans, as they are now, would inevitably lead to increasing imports of biomass from outside the EU (see 1.4 for the issues related to this effect), or to harvest rates substantially surpassing increments. A forthcoming EFI Technical Report considers however that such a gap between supply and demand is unlikely to occur in the short term, as there is a downward trend in demand of forest biomass for industrial purposes. This trend also tempers energy wood consumption, as pulp mills are major producers of bioenergy. It is also true that a controlled increase of harvest levels closer to the increment levels would decrease the overall risk of storm and fire damage, contributing to long-term biomass stock stability.

“From a historical perspective large bio-based economies have often been a threat to forest growing stock and area; the sustainable bio-based economy of the 21st century must demonstrate to have its tools and methods ready to guarantee sustained yield.”

This illustrates that bioenergy developers often make too optimistic estimations of the provisioning potential of the forest, confusing large stocks with large increments. The reality is that many EU forests are growing on marginal sites having marginal increments (30 million hectares with less than 3m³/ha/year, as projected by EFISCEN in the EFSOS II study, UNECE and FAO 2011). Although there is undoubtedly a huge potential for biomass resources from the forest, we learn from this that keeping a reasonable biomass stock over time and space is, and will stay, an important management objective of sustainable forest management. Considering the current large stocks and low harvesting rates, sustained yield is currently well ensured in the EU domestic forest sector, but what tools do we have at our disposal to ensure this, if the demand would strongly increase? Scientists have developed sophisticated planning and control tools, but they are hardly implemented. Many European countries or regions have some form of legislative framework, but how functional are these to ensure sustained yield? A stress test on the control tools in every European country is strongly recommended. At the landscape level, many forest management units (FMUs) have some kind of management plan, but how operational are these to ensure sustained yield? Voluntary tools such as forest certification could play an important role in ensuring this, but there is currently also a trend towards more strict regulation at national or European level.

“A transition to a bio-based economy in the coming decades will unavoidably make forest biomass a scarcer and more valuable resource than what it is now, for which sustained yield in or outside Europe will be at stake, and yield regulation will become a policy and a management challenge. A stress test on the control tools in every European country is therefore recommended.”

Sustainable yield

In addition to securing the standing stock, sustainable yield aims at maintaining the long-term productivity of the forest site. This is a challenge considering that increased harvest for bioenergy purposes will occur in a context of global environmental change, with first indications of growth decline after decades of increased growth. A hot topic is the question if intensive forest biomass extraction will lead to long-term productivity loss, especially now that stump extraction for bioenergy use is becoming common practice in Scandinavia. The issue is less simple than it looks like. It is known since long time that whole tree utilization exports more nutrients than stem-only exploitation, because the nutrient concentration of leaves, bark, small branches and roots is much

higher than of stem wood. Intensive biomass extraction from forests is also known to contribute to soil acidification and leads to decreased organic carbon stocks in the long term. Extraction machinery if not carefully used may cause soil compaction. The detrimental effects on site productivity of repeated intensive biomass extraction from poor soils with low weathering capacity are well documented (cf. litter raking effects in central Europe). On the other hand stump extraction may bring less acidified un-weathered soil to the surface, which may temporally improve the site productivity. A recent Europe-wide study commissioned by the European Environment Agency shows that intensive residue harvesting and stump extraction from the forest holds a serious risk for nutrient depletion, but that this risk is very site dependent.

"It is good practice to extract as few nutrients from the forest as possible, and to compensate for losses wherever needed. Limitations on stump and harvesting residues extraction are due for specific vulnerable sites."

Biodiversity

Biodiversity loss being one of the major threats to planetary stability, the inclusion of biodiversity safeguards in large-scale forestry operations is a priority issue for sustainable practice.

"Safeguarding biodiversity is a shared responsibility of forest management Europe-wide, whatever the management purpose is."

Only, there is limited knowledge on the overall effects of increased forest biomass extraction on biodiversity, because its effects are multiple and site specific. In the case of biodiversity it is not always straightforward to interpret if effects must be considered beneficial or harmful, but in general terms, we can consider an intervention harmful when species richness or genetic diversity goes down, or when rare species requiring specialized habitats disappear. In general terms, extraction of living or dead biomass causes a certain perturbation for the forest ecosystem food web, which can be quantified by the "free net primary production" as an indicator, i.e. the amount of produced biomass resources not appropriated by human beings and thus available for the food web. In this context, increased biomass extraction for bioenergy may be a threat for big (not necessarily old) trees and for the continuous availability in the landscape of standing and lying dead wood of different dimensions, both of which are key habitats for forest biodiversity.

"Simple measures to maintain a sufficient share of large trees and dead wood of different dimensions in the forest landscape is effective to create opportunities for biodiversity conservation."

Increased biomass demand may motivate forest managers to intensify forest management, with a tendency towards conversion of (semi-)natural forests, ancient woodlands, and other forests with high conservation value into single species plantations, use of exotic trees, higher tree densities, shorter rotation lengths, all of which may have negative impacts on biodiversity values.

But increased wood mobilization may also have positive effects on biodiversity. There is accumulating evidence that the overall darkening of European forests as a result of decreased management intensity, often coupled to conversion from coppice or coppice with standards to high forest, and from mixed to single species conifer stands has a disastrous effect on European forest biodiversity. In this context, increased wood mobilization if characterized by more frequent and intensive thinnings and restoration

of coppice systems could meet the requirements of the intermediate disturbance hypothesis for maximizing biodiversity and is expected to have a beneficial effect on biodiversity. If it would however lead to denser tree plantations with shorter rotations, the opposite might happen. There is not much experience yet with the biodiversity effects of short rotation coppice systems established on former agricultural land. In general, they lead to less management interventions, which is beneficial for wildlife. They may lose vegetation elements of open habitats, while needing time to obtain typical forest species. Their establishment should not take place on high diversity open habitats, like semi-natural grasslands.

“While the unique heritage of (semi-) natural forests should be effectively protected from intensive biomass extraction, the biodiversity of many secondary forests might benefit from decreasing canopy density and biomass stock.”

In short, forest use for bioenergy holds as well risks as opportunities for biodiversity conservation. Increased wood mobilization from European forests needs explicit and controlled biodiversity safeguards. No go zones need to be installed in virgin forests and other sensitive areas with high conservation value. On the other hand a large share of Natura2000 habitats needs management and some level of biomass extraction, but in this case, the conservation objectives must prevail over the harvesting purpose (LiHD or Low intensity High Diversity systems).

Finally, as a strong motivation for integrating biodiversity as an essential part of sustainable forest management, a solid piece of upcoming new research is increasing our understanding on the importance of biodiversity to support ecosystem productivity and resilience, and to provide a continuous flow of ecosystem services in a context of increasing risks of fire, wind damage and pests and diseases. Sustainable biomass production is ensured by mixed forests with varying structure in time and space.

“In a context of global change, mixed forests with varying structure offer the best insurance for long-term forest productivity.”

Other land use impacts

In life cycle assessment (LCA) the most simple approach to quantify land use impact is to multiply the amount of land used with the time of occupation per functional unit of a product, based on the reasoning that the used land is not, or less available, for other purposes during that period. It must be emphasized that bioenergy production is very land intensive. Based on the National Renewable Energy Action Plans of EU countries we roughly calculated that by 2020 the forest biomass for bioenergy needs of EU27 would require a productive land area with the size of Germany. When considering land use impacts linked to bioenergy production in Europe it should be underlined that impacts can also take place outside Europe, because the quantity of wood required to satisfy the EU Renewable Energy target for 2020 is too large to be met by domestic resources and will require huge imports, which are already underway. The effect of forest biofuel consumption on land use change patterns in Europe and third countries is subject of intensive study. The most prominent consequences mentioned are deforestation and forest degradation, land grabbing, and endangered food security.

With regard to deforestation, the European Commission (EC) recently published a study on the effects of EU consumption on deforestation, based on the concept of ‘**embodied deforestation**’, i.e. the deforestation associated with the production of a certain good, commodity or service. When looking at deforestation embodied in total final consumption, the EU is consuming 0.732 Million ha (2004) or 10% of the global

embodied deforestation (7.29 Million ha per year). Today, deforestation embodied in EU consumption is almost entirely due to imports, as deforestation within the EU is negligible. The energy sector embodied 3% of that deforestation, mainly due to the crop products used in this sector. Wood and associated products contributed with another 5%. Recent developments in European bioenergy have the potential to reinforce deforestation and forest degradation trends. While it is not clear up to what extent the additional quantity of required bioenergy will be sourced from outside the EU borders, the EC stated that the bulk of this bioenergy will be in the form of wood pellets from forest-based industries, increasingly coming from outside the EU. At the moment the USA and Canada are the main pellet exporters towards the EU. The growing demand for pellets in Europe has led to a fast growth in wood pellet-manufacturing facilities across the Southern USA that have been sourcing wood from high biodiversity value wetland forests. Several USA based NGOs and scientists have raised concerns against the EU renewable energy policy, stating that the current sustainability rules are inadequate and this policy poses a serious threat to forests outside the EU. European markets are currently searching more non-traditional suppliers in the global South. For example experts indicate Brazil as one of the most promising future partners for Europe as a source of wood pellets, thanks to its good infrastructure and relative proximity.

Deforestation and forest degradation represent **direct land-use changes (dLUC)** linked to woody biomass production, but also **indirect land-use changes (iLUC)** should be taken into consideration. As for direct land-use changes, the most evident one is the conversion of (semi-)natural forest into plantations, which has taken place on large scale for the production of oilseed crops and for timber or pulp production. So far wood energy production has been mainly based on residues from the forest but forest conversion to short rotation coppice for bioenergy purposes might emerge in the future. Indirect land use change refers to the displacement of a current by a new land use (e.g. biofuels) which results in a land use change somewhere else, and is also referred to as 'leakage'. For example, if the development of a short rotation coppice plantation results in the displacement of farmland, and if the farmer makes up for the shortfall in agricultural production by bringing previously uncultivated land into production, this latter land use change would be considered as an indirect land use change effect of the short rotation coppice plantation and its products. The related consequences in terms of CO₂ emissions, decreased prosperity or increased competition with food, local energy supply, and other materials could therefore be burdened to the energy produced from the plantation. At present iLUC is not properly addressed by the proposed biomass criteria developed by the EC in 2013. Article 17 of the Renewable Energy Directive prohibits conversion of natural ecosystems for biofuel production, however no similar restrictions limit the conversion of natural ecosystems to agricultural production that may result from iLUC from increased biofuels production. Problematic is that iLUC is an ill-defined concept based on immature methodologies with a high risk for double counting that would become superfluous if direct land use change could be fully accounted for.

We can assume that part of the land occupation worldwide caused by current and future European wood fuel needs will be considered **land grabbing** practices. According to the Tirana Declaration by the International Land Coalition (2013), land grabbing occurs in case of acquisitions or concessions in violation of human rights, not based on free prior and informed consent of the affected land-users, in disregard of social, economic and environmental impacts, not based on transparent contracts specifying commitments about employment and benefits sharing, or not based on effective democratic planning and participation. It provokes increased competition for land that could in its turn

increase social tensions and cause conflicts, especially in areas that are already characterized by food insecurity and vulnerable land rights (e.g. south-East Asia and Africa).

Food security can be threatened by energy wood production for export to the EU in different ways. First of all in terms of direct competition between biomass plantations and food crops for fertile lands with high yields and good infrastructure and market accessibility. When bioenergy plantations displace food crops, it may generate competition for land between international concerns and local communities, e.g. marginalizing smallholder farming. If biomass production is export-oriented then local energy security can be negatively affected as well. Land-use conversion of so-called marginal lands to biomass plantations often represents an opportunity cost for local communities in terms of grazing, collecting firewood or gathering/selling non timber forest products, as well as a loss of local traditions and cultural identity. On the other hand, biomass plantations and food crops do not necessarily exclude each other. They can co-exist and even strengthen each other in highly resilient agroforestry systems.

“Europe’s renewable energy policies have a responsibility that reaches wider than domestic forests, and that should develop effective regulations and follow-up to avoid negative impacts on social-ecological systems worldwide, including deforestation, forest degradation, land grabbing and food insecurity.”

Energy and Carbon Balances

The long-term sustainability of energy provisioning systems is secured if their **energy return on investment (EROI)**, it is the ratio between harvested and invested energy, is sufficiently high. Interestingly, the EROI of first generation liquid biofuels is often only 0.8-1.6, while the actual average EROI of petrol is ± 17 but gradually declining, nuclear 5-15, wind ± 18 , photovoltaics ± 7 , and an EROI of 3.5 in the late-Roman bio-economy was not sufficient to avoid collapse. Note that an EROI of less than 1 means that the fuel production process consumes more energy than it yields. The EROI of wood-based bio-energy is not well documented, but generally above 2, and can be kept sufficiently high if using optimized systems in terms of harvesting and conversion technologies, transport distances, etc. In general EROI values of bioenergy from wood increase from second generation liquid biofuel, over electricity production, to heat or combined heat and power systems (CHP).

“The energy return on investment of energy systems including wood-based bioenergy should be thoroughly evaluated and optimized on a case by case basis, preceding any new investment in the sector.”

Probably the biggest sustainability issue of all is the **greenhouse gas (GHG) balance** of the wood-based bio-energy system. This is because human induced climate change has become the major threat to the global social-ecological system, and bioenergy systems have been promoted and subsidized precisely for their ability to mitigate climate change, but this ability has been recently questioned. At first sight the carbon balance of a forest-based bioenergy system looks pretty straightforward to calculate. Early accounting practices assumed a 100% substitution of wood energy for fossil fuels leading to large accumulating greenhouse gas savings, at least if the biomass was harvested from so-called regulated forests with sustained yield. Recently we are discovering that things might be less simple than they appeared, and carbon balance outcomes depend very much on the actual processes used to convert forest biomass to bioenergy, and on the calculation rules one is adopting.

In the framework of the EU energy policy, carbon dioxide (CO₂) tail-pipe emissions from combustion of forest biomass used for energy and transport purposes are set to zero. Biomass is thus considered as a 'carbon neutral' source, i.e. a source generating net zero carbon emissions to the atmosphere during the combustion. This so-called **carbon neutrality** assumption is based on current UNFCCC accounting systems and assumes that the carbon (C) released while burning biomass will be recaptured by future tree regrowth, and that any excess of releases over regrowth would result in a loss of C stock and will be accounted for in the land use sector. From this perspective forest biomass appears as one of the most promising renewable resources for substitution of fossil fuels and climate mitigation. The assumption is, however, based on an incomplete accounting mechanism for the land use sector, that was designed for a system where all countries account for all C stock changes from land use, whereas only few countries currently account for a limited number of C stock changes. This flaw in carbon accounting goes along with a number of additional concerns several scientists have raised related to the carbon neutrality assumption. Most of these concerns are related to **time and space issues**. For example, the validity of the carbon neutrality assumption is challenged by a potential increase in harvesting levels to achieve renewable energy targets defined within national or regional policies. Such subtle land use changes release C to the atmosphere that would otherwise have been stored in the biosphere. The emission benefits of bioenergy are therefore time-dependent. While in the case of annual crops emissions and regrowth occur within short time (e.g. 1 year), the carbon cycles of wood have a long time span and a time delay between emissions and subsequent regrowth exists. This delay between emission and re-sequestration in new biomass is believed to have a warming potential, which is not captured in calculations when using the carbon neutrality assumption.

Concerning these time issues, recent literature sources suggest that the assumption of carbon neutrality is not valid under policy relevant time horizons (10 to 40 years), if carbon stock changes in the forest are not accounted for. This is because in such short time horizons the timing of emissions or e.g. the temporary storage of carbon in wooden products can have a relevant effect. Other voices are questioning the relevance of the timing of emissions and sequestrations on the overall long term climate change impact. The term '**carbon debt**' which was originally introduced to highlight the large GHG emissions caused by land use change for establishment of biofuel crops (like peatland forest destruction for palm oil cultivation) is being used now in the context of biomass energy from the forest to underline that compensating for the additional emissions from bioenergy takes time. The term 'debt' has negative connotations, but also implies that it can be 'paid off' over time, i.e. within a certain **payback time** that quantifies the time-lapse between C emissions and C recapture via tree re-growth. The size of the carbon debt and the length of payback time depend on several factors. Carbon debt is mostly affected by the type and amount of biomass harvested and whether land-use change emissions need to be accounted for. Payback time is mainly determined by plant growth rates, i.e. the forest biome, tree species, site productivity and management, and the energy conversion efficiency. Carbon debt and payback time are generally reported in parallel to LCA results, where the LCA results describes the GHG emission of the biofuel production and use as such (without land use change) and where the carbon debt and repayment time are used to communicate on the size of the land use change impact, as such avoiding to incorporate the temporal and spatial dimension in LCA. But the whole carbon debt discussion probably needs some relaxation: depending on the time window we look at, it could as well be argued that biomass harvests for bioenergy, rather than

causing a carbon debt to be paid back, release a carbon credit that has been built up by forest management efforts in the past. This second thought illustrates the limitations of the carbon debt concept when using it in a context of more or less continuous land use. And similar to the chosen time window, the spatial scale of analysis influences the result. In general C sequestration is treated differently among bioenergy LCAs as a result of different system boundaries and methods. A stricter harmonization of evaluation tools is recommendable.

In addition to the carbon neutrality issue, correct estimation of the greenhouse gas impact of bioenergy from the forest compared to fossil energy has more challenges. The real fossil fuel **substitution effect** of the bioenergy supply chain will depend on several factors that are currently not fully accounted for. It must be considered that the substitution is influenced by elasticities in supply-demand and price elasticities, direct and indirect rebound effects, etc.

“Realistic estimations of the climate mitigation potential of bioenergy use from the forest imply explicit modeling of the carbon balance in time and space based on real world data of ecosystem carbon stock changes and product life cycles, using standardized procedures.”

It is not desirable to promote the use of forest biomass for energy with public funds if it is not contributing to a climate neutral society. It makes therefore perfect sense to require a significant greenhouse gas saving compared to fossil fuels, whenever subsidies or public funds are used. The adoption of a **cascading** approach is an excellent option to improve the climate mitigation potential of the forest. Cascading means that biomass is first used for a certain material application that fits its quality characteristics best, then it may be recycled for further material or bio-refinery applications and ultimately it is used for energy recuperation. Cascading use offers mitigation potential in a clear win-win with material efficiency, and creation of added value. The trend to procure biomass energy directly from stemwood harvested in the forest rather than from harvest residues or from the wood chain is not optimal and needs coherent action.

“The forest-wood chain and the bioenergy sector have a common responsibility to actively stimulate cascading use of wood in order to create added value with maximum greenhouse saving effects.”

Other sustainability issues

In discussions on the sustainability of bioenergy systems the social and economic pillars of sustainability are often forgotten. Also the enabling conditions for sustainability need to be considered, including institutional reforms and improvement of governance structures.

One of the arguments used to question the sustainability of energy wood supply chains is the **competition for wood resources** with the traditional forest industry. Indeed, during the last years the EU market for woody biomass for energy has grown faster than wood-panel or paper markets. This is partly due to policy support and financial incentives for biomass-based renewable energy at national and European levels. Also the growth of connected markets, such as that of bio-liquids has stimulated the use of wood as an energy source, including the development of bio-refineries for the production of biodiesel from wood and ethanol from cellulose. This competition has positive effects in terms of a higher price for the primary producer, but it also results in increasing prices of raw material costs, which may reduce profitability in some wood processing sectors like pulp and paper, and the wood-panel industry. On the other hand,

there is also a trend towards the development of large integrated forest industry bio-refineries, where no competition between industrial wood and energy wood takes place.

While it is obvious that increased wood mobilization for biomass energy will lead to additional **job creation**, the various reports available do not provide robust evidence for the scale of those impacts. The bioenergy sector and traditional forest industry might have different performances in terms of labor intensity, with more employment and value added in the material use systems. New synergistic opportunities of **industrial symbiosis** may be created with bio-refineries integrated with pulp and paper plants to use the entire potential of forest raw materials and by-products, and to diversify their set of products. In a conventional Kraft pulping process only up to 45% of woody biomass is converted into pulp, while the remaining proportion, mainly represented by lignin and hemicelluloses, is combusted in the recovery boiler. This fraction could be better exploited to increase the revenue margin of the mills, by conversion into higher marketable products such as liquid biofuels, synthetic gas, fine chemicals, heat and power.

When speaking about biomass for energy, **wood mobilization** is a key challenge. A considerable part of the available unlocked biomass stocks in Europe is located in small privately owned forests and mobilization of these resources is difficult because of ownership fragmentation, lack of appropriate infrastructures and high operational costs. While the growing demand for energy biomass represents a market opportunity for forest owners to receive income for their efforts as primary producers, concerns exist as well. In general biomass for energy has low quality requirements, potentially drying up the motivation to apply silvicultural treatments which envisage quality timber, but which often have multiple co-benefits.

Conclusions

Forests are a valuable natural heritage serving multiple ecosystem services for the European population. Increased use of forest biomass for bioenergy purposes touches upon a large range of sustainability issues, from ecological to socio-economic. Biomass extraction for bioenergy has to inscribe itself in multifunctional management, and recognize that it may have trade-offs with other forest ecosystem services. In this chapter we showed that despite its promising prospects, a growing global wood for bio-energy market may hold sustainability risks. We also showed that most of these risks can be reasonably well addressed, if the issues are well understood. This implies operating within the boundaries of sustainability and strictly respecting safeguards for biodiversity. Doing so, bio-energy sustainability can become a powerful development opportunity for the forest sector in Europe. Special attention needs to go to developing opportunities for smallholders and creating synergies rather than competing with the traditional forest industries.

Forest management in Europe has a long tradition of sustainability, which is supported by high capacity of forest owners and managers, institutionally anchored in agreements and regulations at pan-European, EU and national level, and strengthened by voluntary schemes like forest certification. Sustainability issues of biomass for bioenergy are not fundamentally different from forest use for other wood products. In principle this would suggest that existing tools are sufficient, and use of solid biomass from forests does not need specific rules. However, given the ambitious targets of the renewable energy directive, the scale and intensity could be of another magnitude, which motivates a dedicated EU initiative to guarantee forest biomass sustainability.

A subsidiarity approach is due to implement sustainable biomass use from the forest with local and national measures wherever possible, and with initiatives at international level where needed. In general, stimulation of forest owners to have a management plan dealing with yield regulation, biodiversity conservation, and other sustainability issues, is strongly recommended. The very different situation across the EU countries should be taken into account when designing new directives at EU level, in order not to increase unnecessary bureaucracy where the sustainability issues are already taken care of by existing practices or national policies.

“A European directive on solid biomass from the forest would be a good opportunity to support and strengthen existing regulations and governance instruments related to forests (management plans, certification schemes, sustainability criteria, Legally Binding Agreement on Forests), but imposing rules only valid for forest biomass for bioenergy and not for other forest or energy products would be counterproductive.”

Recommended reading

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Annex 6 - Misurare la filiera corta: linee-guida per una valutazione sistematica della filiera delle biomasse legnose a fini energetici

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Misurare la filiera corta: linee-guida per una valutazione sistematica della filiera delle biomasse legnose a fini energetici

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Secondo il Piano d'Azione Nazionale per le Energie Rinnovabili (PAN) entro il 2020 le biomasse costituiranno la prima fonte energetica rinnovabile in Italia, coprendo il 44% dei consumi da fonti rinnovabili (MSE 2010). In particolare i biocombustibili legnosi dovranno fornire 5 Milioni di tep (Mtep) di energia termica. I dati Eurostat indicano già per il 2011 un consumo di biomasse legnose pari a 3,6 Mtep, equivalenti a oltre il 70% del contributo atteso dal PAN al 2020 (EurObserv'ER 2012), mentre stime recenti (Pettenella e Andrichetto 2011) suggeriscono che il legno potrebbe rappresentare già oggi la prima fonte energetica rinnovabile in Italia.

A fronte di un ruolo così rilevante per le biomasse legnose nel panorama nazionale delle rinnovabili, si riscontrano alcuni elementi di scarsa chiarezza o di manifesta criticità che suggeriscono alcune riflessioni. In primo luogo si rileva un problema di non piena attendibilità delle statistiche esistenti sulla disponibilità attuale delle risorse. In particolare il dato relativo ai prelievi forestali interni - stimato in 2,2 milioni (M) t di sostanza secca dal PAN - è da più parti considerato fortemente sottostimato (Cicarese *et al.* 2003; Corona *et al.* 2007). Lo stesso *report* nazionale predisposto per l'edizione 2010 del Forest Resource Assessment della FAO dichiara espressamente che le statistiche ufficiali non sono con ogni probabilità in grado di cogliere le dimensioni reali dei prelievi di legna da ardere in Italia (FAO 2010). Ciò appare ancora più evidente laddove i dati relativi ai prelievi siano confrontati con le stime riferite ai consumi e ai dati del Bilancio Energetico Nazionale che, nato come base statistica per un Paese importatore di energia, ha prestato minore attenzione alle fonti interne (Tomassetti 2010). La mancanza di una base dati pienamente attendibile se da un lato pone seri problemi di stima e adeguata programmazione, dall'altro potrebbe sottendere anche ad altre problematiche. Come evidenziato dai risultati del Progetto *Stop crimes on Renewables and Environment* (SCORE - www.euscore.eu), il settore forestale è tutt'altro che esente da fenomeni di irregolarità e manifesta illegalità, quali l'evasione fiscale legata al commercio della legna da ardere o condizioni diffuse di lavoro irregolare, che possono trovare terreno particolarmente fertile in un quadro di sostanziale incertezza dei dati e di sottostima della dimensione economica del fenomeno (Pettenella *et al.* 2012): un settore percepito come marginale tende ad avere un'area di azione politica secondaria.

Nonostante i prelievi forestali nazionali siano prevalentemente orientati alla produzione di legna da ardere e sebbene il PAN non riporti alcun dato in merito alle importazioni di biomasse legnose a uso energetico, il ruolo dell'import italiano è in realtà non trascurabile. Secondo i dati FAOSTAT (2013) l'Italia è, infatti, il primo importatore mondiale di legna da ardere e il terzo di residui e scarti di legno, con un import complessivo di circa 3 M t. E' bene precisare che tali materiali non sono destinati esclusivamente all'impiego energetico, nondimeno tanto i valori assoluti, quanto i *trend* crescenti dell'import rimangono rilevanti. Le potenziali criticità legate al ruolo delle importazioni sono molteplici. Se analisi condotte da Favero (2011) evidenziano livelli medi di emissioni di CO₂ associati al trasporto di tali biomasse inferiori rispetto a quelli che si avrebbero in caso d'impiego di combustibili fossili, restano invece attuali le preoccupazioni per altre possibili esternalità negative. In particolare deve essere prestata attenzione alla gestione delle risorse forestali, ricordando come si stimi che il 5-9% di legna da ardere e cippato importati in Italia possano provenire da tagli illegali nei

Paesi di origine (ISPRA 2009). Tali preoccupazioni sembrano trovare ulteriore ragione d'essere alla luce del crescente numero di *partner* commerciali extra-europei dell'Italia e dell'instabilità delle nostre relazioni commerciali con i diversi paesi fornitori di biomasse. Questo *turnover* suggerisce, in molti casi, strategie commerciali "mordi-e-fuggi" orientate volta per volta alla ricerca del materiale a minor costo piuttosto che alla reale volontà di instaurare rapporti commerciali consolidati, e potrebbe essere interpretato anche alla luce di condizioni di scarsa sostenibilità dell'offerta. L'importazione di biomasse, ancorché limitata in proporzione ai prelievi interni, rischia di enfatizzare una frattura tra l'impiego di tali materiali e la gestione delle risorse locali, riducendo le potenzialità di sviluppo legate alla crescita del comparto delle rinnovabili. Ciò a maggior ragione laddove si consideri che spesso le biomasse importate sono destinate a rifornire grandi impianti - che difficilmente possono servirsi della produzione interna, troppo frammentata e dispersa (Tomassetti 2010) - con il rischio di favorire la creazione di soluzioni sproporzionate, nella scala, alla disponibilità effettiva in loco di biomasse. In tal senso la recente tendenza al gigantismo degli impianti in numerosi paesi europei (*in primis* il Regno Unito) è stata già sottolineata da più voci (EurObserv'ER 2012), alimentando in molti casi dure reazioni dell'opinione pubblica, delle organizzazioni ambientaliste e dello stesso mondo industriale. Rappresentanti delle industrie dei pannelli in legno e delle paste per carta - e in genere dei settori che impiegano biomasse ad uso industriale - hanno, infatti, in sede nazionale ed europea, manifestato forte opposizione agli impianti energetici a biomasse. Tale opposizione è fondata su una critica agli effetti distorsivi sui prezzi delle biomasse dovuti agli incentivi pubblici alla produzione di energia da rinnovabili (Confindustria 2007).

La riattivazione della gestione forestale sul territorio nazionale, la razionalizzazione degli impianti e la promozione di filiere corte locali, ispirate a criteri di gestione sostenibile della risorsa legno, sembrano poter contribuire alla soluzione delle problematiche sopra elencate. Il presente contributo intende analizzare tale approccio, presentando un esempio di linee-guida per la definizione e la valutazione delle filiere corte e proponendo i risultati preliminari di alcuni *test* in campo.

La filiera corta e gli strumenti per la sostenibilità delle filiere per i biocombustibili

Il concetto di filiera corta si è andato affermando nel corso degli ultimi anni, soprattutto con riferimento al settore agroalimentare (*short food supply chain*, SFSC), anche se non esiste ancora una piena convergenza di pareri verso una definizione chiara e univoca. Nella Proposta di Regolamento sul sostegno allo sviluppo rurale (2011) la Commissione Europea ha definito la filiera corta come una "*filiera di approvvigionamento formata da un numero limitato di operatori economici che si impegnano a promuovere la cooperazione, lo sviluppo economico locale e stretti rapporti socio-territoriali tra produttori e consumatori*". In tale sede si è anche prevista la possibilità che singoli Stati Membri, nell'ambito dei propri programmi di sviluppo rurale, possano sviluppare sottoprogrammi tematici dedicati alle filiere corte.

Un'approfondita rassegna delle definizioni di filiera corta condotta da Fondse *et al.* (2012), pur evidenziando diverse possibili denominazioni in uso (quali ad esempio filiere locali o alternative), ha identificato quattro criteri fondamentali per la definizione di questo concetto: (i) la vicinanza geografica tra produttori e consumatori; (ii) la capacità di generare valore aggiunto e profitti su scala locale; (iii) l'equità sociale e un'equilibrata redistribuzione del valore lungo la filiera; (iv) la sostenibilità ambientale.

Ne deriva un quadro articolato, imperniato sul tema della provenienza locale dei materiali trasformati, ma comprensivo di molteplici aspetti complementari²¹.

Con riferimento ai biocombustibili (e ai bioliquidi in particolare) il concetto di filiera corta è implicitamente presente già nella Direttiva 2009/30/CE relativa al controllo e riduzione delle emissioni dei combustibili fossili, che richiede il rispetto di criteri di sostenibilità della filiera affinché l'energia derivante da tali prodotti possa concorrere al raggiungimento degli obiettivi nazionali sulle rinnovabili. In particolare si fa riferimento alla riduzione delle emissioni di gas a effetto serra lungo l'intero ciclo di vita e alla garanzia che le materie prime non provengano da aree che presentino un elevato valore in termini di biodiversità o un elevato *stock* di carbonio. Tali criteri si ritrovano comunemente anche in molte delle numerose iniziative di carattere volontario finalizzate a certificare/promuovere la sostenibilità delle filiere per i biocarburanti, quali ad esempio Biosucro, per l'etanolo da canna da zucchero, e il *Roundtable on Sustainable Biofuels*, per l'olio di palma. Come emerso da recenti studi di carattere comparativo (Scarlat e Dallemand 2011; Johnson *et al.* 2012) alcune di queste iniziative non si limitano a valutare solamente aspetti ambientali, ma prendono in considerazione anche elementi di carattere socio-economico legati alla gestione della filiera, quali ad esempio gli aspetti di salute e sicurezza sul lavoro e quelli legati al rispetto dei diritti di proprietà/uso della terra.

Anche per le biomasse legnose di origine forestale si registrano iniziative volte a fornire garanzie di sostenibilità della filiera e trasparenza nei confronti del mercato. Si possono ricordare, tra le altre, le certificazioni secondo gli standard del *Forest Stewardship Council* (FSC) e del *Programme for the Endorsement of Forest Certification schemes* (PEFC) per la gestione forestale sostenibile e la rintracciabilità dei prodotti lungo la filiera (catena di custodia), o ancora le norme EN della serie 14961, che definiscono le caratteristiche e le classi qualitative di differenti tipologie di biocombustibili solidi, e della serie 15234, che, per gli stessi materiali, definiscono i criteri per il controllo e l'assicurazione della qualità. Più recentemente è stato avviato il progetto "Enplus green" (<http://www.enplus-pellets.eu/pellcert/>), che mira a promuovere un approccio di sostenibilità di filiera per i *pellet*. In generale tuttavia si riscontra una sostanziale incompletezza delle iniziative in corso che, da un lato, non sono in grado di assicurare la copertura dell'intero spettro di criteri di sostenibilità che appaiono di rilievo per il settore delle biomasse, e dall'altro rivolgono attenzioni marginali ai prodotti a minor grado di industrializzazione quali legna da ardere e cippato (Francescato *et al.* 2011).

Rispetto al contesto italiano, il concetto di filiera corta per le biomasse a fini energetici ha trovato un riconoscimento e una qualificazione normativa con il Decreto Ministeriale (DM) 2 marzo 2010, approvato in attuazione della legge finanziaria 2007 (n. 296) e del collegato Decreto Legge 1 ottobre 2007, n.159. Secondo tale disposizione - che integra il DM 18 dicembre 2008 - si considerano da filiera corta biomasse prodotte entro il raggio di 70 km dall'impianto di produzione dell'energia elettrica²². Tali disposizioni si

²¹ Si noti che la presenza di limitate transazioni lungo la catena di valore tra produttore e consumatore, criterio che si ottimizza nella vendita diretta, non rientra tra questi criteri (un mobile prodotto in Russia in una fabbrica IKEA e venduto in USA in un grande magazzino della stessa catena potrebbe, infatti, rientrare nella definizione di filiera corta).

²² La lunghezza di tale raggio è da intendersi come la distanza in linea d'aria che intercorre tra l'impianto di produzione dell'energia elettrica e i confini amministrativi del Comune in cui ricade il luogo di produzione della biomassa.

applicano anche a biomasse derivanti da gestione forestale, colture agro-forestali dedicate e residui di trasformazione di prodotti forestali. L'adozione di un mero criterio di distanza geografica per la qualificazione di una filiera come corta appare tuttavia non sufficiente a coprire la molteplicità di aspetti cui questo concetto rinvia e, nel contempo, pone un problema di coerenza e univocità di parametri per i medesimi materiali. A titolo di esempio si ricorda che, per l'uso di legno in edilizia, il sistema volontario di classificazione dell'efficienza energetica (iniziativa *Leadership in Energy and Environmental Design*, LEED®, dello US *Green Building Council*), adottato anche in Italia, definisce materiali provenienti da filiera corta quelli approvvigionati entro un raggio massimo di 350 km (fino a 1.050 km se il trasporto dei materiali avviene su rotaia o via mare - GBC-Italia 2012).

In generale, mentre in letteratura esistono numerosi studi e modelli incentrati sulla valutazione della convenienza commerciale e degli impatti ambientali della filiera foresta-legno-energia, si ravvisa sempre più l'esigenza di includere nelle valutazioni anche parametri relativi alla dimensione sociale, di *governance* e di pubblica utilità, al fine di assicurare un reale approccio multidimensionale in sede di definizione e implementazione di progetti (Shabani *et al.* 2013). La definizione di criteri chiari e univoci per l'identificazione e la valutazione delle filiere corte per le biomasse legnose appare dunque un'esigenza prioritaria per il corretto sviluppo e l'efficace implementazione di progetti di valorizzazione su scala locale di queste risorse.

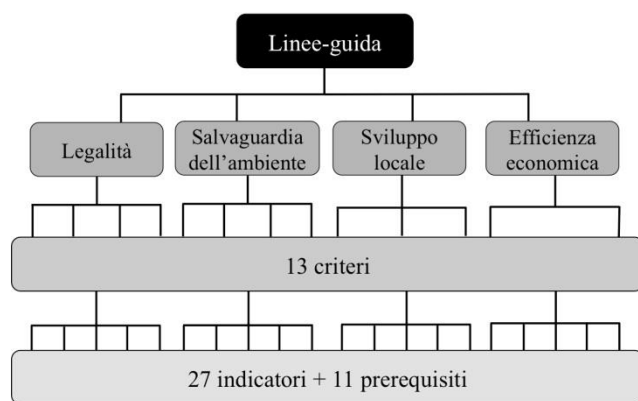
Una proposta di linee-guida per valutare le filiere corte delle biomasse legnose

Nell'ambito del progetto *Biomass Trade Center II* (IEE/10/115 - <http://www.biomasstradecentre2.eu>), cofinanziato dal Programma *Intelligent Energy Europe*, Etifor (*spin-off* dell'Università di Padova) e AIEL (Associazione Italiana Energie Agroforestali) hanno sviluppato delle linee-guida per la valutazione della sostenibilità della filiera legno-energia, con particolare attenzione alla produzione di cippato e legna da ardere. L'ambito di applicazione del documento include tutti i passaggi, a partire dall'origine e gestione del materiale, sino alla bocca dell'impianto, mentre non comprende - al momento - aspetti legati all'efficienza dell'impianto in sé²³. All'interno della filiera sono inclusi sia operatori del segmento produttivo (proprietari forestali, ditte boschive, segherie), sia operatori che conducono attività di distribuzione (commercianti).

Le linee-guida sono articolate secondo una struttura logica e gerarchica che comprende 4 principi dettagliati in 13 criteri, a loro volta definiti per mezzo di 38 indicatori, 11 dei quali assumono il carattere di prerequisiti (figura 1 e tabella 1). Il documento è di seguito presentato in sintesi: per maggiori dettagli è possibile fare riferimento al sito web dedicato al progetto *Biomass Trade Center II*.

²³ E', comunque, implicita la preferenza verso impianti su piccola-media scala a produzione di energia termica e CHP a prevalenza di produzione di energia termica, gli unici in grado di collegarsi con le caratteristiche forestali dei territori dell'Europa centro-meridionale, secondo un'impostazione peraltro ampiamente condivisa in altri contesti territoriali (vd. il *Biomass Energy Resource Center* del Vermont <http://www.biomasscenter.org/about-berc.html>).

Figura 1 - Struttura logica e gerarchica delle linee-guida



Fonte: Ns. elaborazione.

Tabella 1 - Principi e Criteri proposti dalle linee-guida

Principi	Criteri
1. Legalità e responsabilità socio-ambientale	1.1 Garanzia della sicurezza nei luoghi di lavoro
	1.2 Dipendenti regolari e qualificati
	1.3 Rispetto delle norme ambientali
	1.4 Tracciabilità del materiale in entrata
2. Salvaguardia dell'ambiente	2.1 Ridotte emissioni di gas serra
	2.2 Gestione sostenibile delle foreste
	2.3 Evitato degrado di aree forestali
	2.4 Promozione di prodotti in possesso di certificazioni di qualità
3. Sviluppo locale	3.1 Coinvolgimento di <i>stakeholder</i> locali
	3.2 Riduzione del numero di passaggi lungo la filiera
	3.3 Destinazione locale del materiale venduto
4. Efficienza economica	4.1 Ottimizzazione della destinazione d'uso dei prodotti
	4.2 Continuità nei rapporti con i fornitori

Fonte: Ns. elaborazione.

Principi e criteri

I quattro principi alla base del documento, così come i criteri correlati, riguardano aree tematiche (legalità, ambiente, sviluppo locale, efficienza economica) che consentono un approccio sistematico alla descrizione di una filiera corta legno-energia. In particolare il primo principio, “Legalità e responsabilità socio-ambientale”, include riferimenti al rispetto delle vigenti norme in materia ambientale, occupazionale e di sicurezza sul lavoro. Il tema della legalità nel settore foresta-legno ha del resto acquisito forte rilevanza e priorità negli ultimi mesi a seguito dell’entrata in vigore del Regolamento (EU) 995/2010 - meglio noto come *EU Timber Regulation* - che obbliga chiunque immetta legno e derivati sul mercato dell’Unione Europea a dimostrarne la provenienza legale.

Con il secondo principio vengono valutati gli impatti ambientali associati alla filiera legno-energia. Anzitutto le linee-guida pongono attenzione alle emissioni medie di CO₂ associate alla produzione e al trasporto delle biomasse. Si prende in esame inoltre la

provenienza del materiale, in particolare valorizzando la presenza di legno proveniente da foreste certificate secondo gli standard FSC o PEFC. Oltre a ciò sono valutate le caratteristiche (accessibilità, pendenza, ecc.) delle particelle forestali di origine della biomassa, con l'obiettivo di premiare la gestione attiva delle particelle sottoutilizzate e contribuire pertanto alla diminuzione dei processi di invecchiamento e conseguente degrado, comuni in molti boschi italiani. Da ultimo, per ridurre gli impatti ambientali in fase d'impiego delle biomasse, si tengono presenti anche certificazioni di qualità dei combustibili (contenuto idrico, ceneri, potere calorifico, ecc.) così come definite, ad esempio, dalle norme della serie EN 14961.

Con il terzo principio viene valutata la capacità della filiera di promuovere una valorizzazione delle produzioni locali e di creare, più in generale, condizioni di sviluppo per la comunità residente su scala locale. In tale prospettiva si considerano importanti sia il coinvolgimento nella filiera di attori (non necessariamente produttori) locali, sia la possibilità di destinare su scala locale il materiale prodotto e venduto.

Infine, al fine di valutare l'efficienza economica (quarto principio), anche al di là della contingente presenza di incentivi pubblici alla filiera, si considera importante la capacità delle imprese di ottimizzare la destinazione d'uso delle materie prime legnose, favorendone, laddove possibile, l'impiego industriale per prodotti a maggiore valore aggiunto (evitando di "bruciare" materie prime che possono generare impieghi a maggior valore aggiunto) e il conseguente recupero degli scarti per fini energetici. Altrettanto importante è la possibilità di basare la programmazione degli investimenti su rapporti consolidati con i fornitori, al fine di garantire condizioni di maggiore stabilità e una diminuzione dei possibili *trade-off* con altri settori produttivi, quale ad esempio il settore dei pannelli a base di legno.

Prerequisiti, indicatori e valutazione complessiva della filiera

Per ognuno dei 13 criteri individuati sono stati definiti specifici prerequisiti (11 totali) e indicatori (27 totali).

I prerequisiti riguardano per lo più il rispetto di norme vigenti in materia ambientale e di lavoro (regolarità contrattuale, formazione, salute e sicurezza) e devono essere tutti necessariamente rispettati per poter raggiungere un livello di sufficienza nella valutazione della sostenibilità.

A ciascuno dei ventisette indicatori, invece, è associato uno specifico punteggio: la somma dei punti ottenuti in base alle prestazioni valutate permette di attribuire a ogni singola impresa un punteggio finale che corrisponderà a una classe di sostenibilità della corrispondente filiera (figura 2).

Figura 2 – Quadro di sintesi di punteggi e classi di prestazione della filiera biomasse secondo le linee-guida

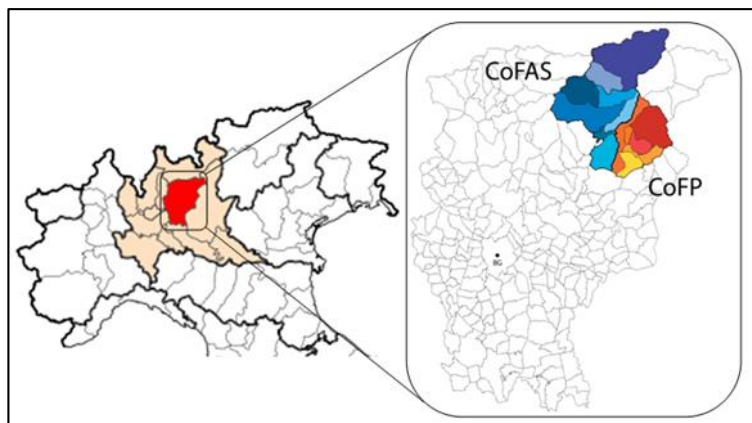
Punteggio	Classe	Giudizio
Sopra 40 punti	Classe A	ECCELLENTE
Tra 20 e 40 punti	Classe B	BUONO
Tra 0 e 20 punti	Classe C	SUFFICIENTE
Prerequisiti non soddisfatti	Classe D	INSUFFICIENTE

Fonte: Ns. elaborazione.

Test in campo: risultati preliminari

Le linee-guida sinteticamente descritte sono state testate in campo al fine di verificarne l'applicabilità e identificare possibili ambiti di miglioramento. I risultati preliminari al momento disponibili si riferiscono all'analisi delle filiere per l'approvvigionamento di cippato relative al Consorzio Forestale Alto Serio (CoFAS) e al Consorzio Forestale Presolana (CoFP) nel territorio di competenza della Comunità Montana Valle Seriana (Provincia di Bergamo) (figura 3).

Figura 3 – Localizzazione geografica Consorzio Forestale Alto Serio (CoFAS) e del Consorzio Forestale Presolana (CoFP)



Fonte: Mologni 2012.

I due Consorzi gestiscono aree forestali pari rispettivamente a 3.050 e 4.300 ettari, e, pur trovandosi in aree limitrofe, hanno modalità di organizzazione delle filiere ampiamente differenti. Il CoFAS deriva poco più del 62% della biomassa da superfici di proprietà pubblica gestite direttamente dal Consorzio, mentre il restante 37% circa è acquisito dalla gestione di superfici private limitrofe a opera di ditte boschive locali. Al momento il materiale è venduto a un solo impianto pubblico (minirete di teleriscaldamento) con una potenza installata di 130 kW e un fabbisogno di circa 150-200 t/anno di cippato. Il CoFP, di contro, deriva il cippato esclusivamente dalla gestione diretta delle superfici pubbliche di proprietà dei soci consorziati e rifornisce due impianti pubblici per una potenza totale installata di 580 kW e un consumo complessivo di circa 750 t/anno di biomassa legnosa.

L'applicazione delle linee-guida ha evidenziato come in entrambi i casi esistano delle carenze di tipo documentale/formale nel sistema di gestione interno. In particolare è stata rilevata l'assenza di registri relativi ai fornitori e al materiale in ingresso, richiesti al fine di dimostrare l'origine e la provenienza legale del materiale acquistato ai sensi del Reg. 995 del 20 ottobre 2010, che impone un sistema di *due diligence* nel valutare l'origine del legname²⁴. Queste mancanze si configurano come mancato rispetto di prerequisiti e dovrebbero pertanto classificare entrambe le filiere in Classe D. Si tratta peraltro di non conformità che potrebbero creare difficoltà anche ai fini del rispetto del Regolamento (UE) 995/2010. Ciononostante, nell'intento di testare le linee-guida nella loro interezza, si è deciso di proseguire con la valutazione di tutti gli indicatori

²⁴ In effetti, al momento dell'indagine presso i due Consorzi, il Regolamento, entrato in vigore il 1.3.2013, non imponeva l'obbligo di una *due diligence*.

applicabili. Al netto delle considerazioni precedenti, entrambi i Consorzi hanno ottenuto complessivamente una valutazione finale buona, corrispondente alla classe B (tabella 2). Le due filiere possiedono le caratteristiche fondamentali per essere definite corte soprattutto con riferimento al Primo e al Secondo Principio. In particolare le buone prestazioni sono imputabili a: provenienza locale della materia prima, limitate emissioni associate al trasporto, impiego di materiale proveniente da boschi sottoutilizzati e da aree difficilmente accessibili e ridotto numero di intermediari coinvolti. Di contro, sembrano mancare requisiti di eccellenza - quali certificazioni di parte terza della gestione forestale e adozione di piattaforme logistiche per la gestione delle biomasse - che potrebbero far fare un salto di qualità importante rispetto a criteri di sostenibilità e capacità competitiva.

Tabella 2 – Risultati, distinti per Principio, e giudizi complessivi relativi ai due Consorzi analizzati

Consorzio	Principio 1	Principio 2	Principio 3	Principio 4	Totale	Classe	Giudizio
CoFAS	3/3	10/15	12/18	7/14	32/50	B	Buono
CoFP	3/3	10/15	13/18	9/14	35/50	B	Buono

Fonte: Ns. elaborazione da Mologni 2012.

Conclusioni

L'espansione del settore delle biomasse legnose sta attirando un numero crescente di operatori e investitori, rendendo quanto mai attuale il dibattito circa la definizione di criteri chiari e univoci per la sostenibilità del comparto. In particolare, con riferimento al contesto italiano, s'impongono riflessioni circa le modalità più corrette per sostenere l'offerta interna, orientandola verso criteri di responsabilità, e facendone un volano per un più ampio processo di sviluppo del settore forestale su scala locale.

Nei paragrafi precedenti sono stati presentati i risultati preliminari relativi alla definizione e al *test* in campo di nuove linee-guida per la verifica delle filiere corte per le biomasse legnose a fini energetici. Ulteriori *test* sono attualmente in corso e maggiori risultati saranno disponibili nei prossimi mesi. Alla luce di questi sarà possibile disporre di un quadro informativo più completo e di apportare eventuali integrazioni allo strumento.

Le prime valutazioni possibili in questa fase del progetto evidenziano come le linee-guida sembrino essere tarate su un livello prestazionale medio, con la possibilità di premiare, in termini di giudizio e punteggio, eventuali filiere realmente eccellenti. Sebbene tali condizioni non siano state riscontrate nei due *test* in campo e, più in generale, potrebbero essere poco comuni nel contesto nazionale, esse sembrano rappresentare reali sfide per il miglioramento e la maggiore competitività della filiera legno-energia soprattutto in aree montane.

Un aspetto cruciale emerso già in questa fase è che la sfida per lo sviluppo sostenibile del settore delle biomasse legnose non è meramente di carattere tecnico, ma coinvolge aspetti di *governance* e di organizzazione che sembrano rappresentare il vero banco di prova per la piena maturità del settore.

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Annex 7 – Financing forests for rural development

Pettenella, D., Masiero, M. (2013). Chapter 10. Financing forests for rural development. In: Pretzsch, J., Uibrig, H., Darr, D. (eds.). Forests and rural development. Springer - Tropical Forestry Series.

[In press, publication expected in 2014]

10 Financing forests for rural development

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Rural development strategies often neglected forests in the past, but in the last two decades the attitude of policy makers and the interests of public and private investors have changed considerably. Although the forestry sector has inherent characteristics that increase the complexity of investments, forest financing has grown in importance and became a focal point for the implementation of rural development policies. Financial actors are conventionally distinguished as private, i.e. profit oriented investors, or public, i.e. development oriented investors. As regards finance instruments in use, they could be distinguished as conventional (i.e. also utilized outside forestry), or innovative ones (i.e. forestry-specific). According to UNEP figures, USD 64 billion have recently been invested in the forest sector every year, but global need for funding for sustainable forest management is estimated by the Collaborative Partnership on Forestry to be between USD 70 and USD 160 billion per year. While direct public sector investments in forestry played a decisive role in the past, recent figures show that they are generally stable or declining, especially with regard to bilateral flows. At the same time private sector direct investments are on the increase, but they remain concentrated in a few countries. In the near future private forest investments will probably be mainly in planted forests. A consequent global shift in the industrial wood supply from temperate to tropical zones and from the Northern to Southern hemisphere is predicted by several studies. Financial flows for investments in the timber sector will shift accordingly: this progress is not free of social and environmental risks. While the forestry sector presents new business opportunities for private operators, specific international and national policy tools for the governance of the changes are greatly needed.

10.1 Introduction

Rapid structural changes in society and the economy – such as demographic and consumption growth, globalization of the market and policy, improved communication, changes in trade patterns for commodities, and the emergence of important non-farm activities – have led to some evident threats, but also significant opportunities for rural development. It is widely recognized that traditional sectoral policies need to be upgraded and, in some cases, substituted with more appropriate instruments (OECD 2006). While rural development strategies often neglected forests in the past because they were mistakenly viewed as being outside the mainstream of agricultural development (World Bank 2008), in the last years the importance of forests in rural development has been increasingly recognized in both developed and developing countries. The issue of forest finance has thus become a focal point for the implementation of rural development policies. This is reflected in objectives and tools related to forest strategies defined by major international institutions:

- The United Nations Forum on Forests established Four Global Objectives on Forests (UNFF 2006) which member states agreed to achieve by 2015 and the fourth objective deals with forest finance: *“Reverse the decline in official development assistance for sustainable forest management and mobilize significantly increased new and additional financial resources for the implementation of sustainable forest management”*;
- The Forest strategy of the World Bank (2004) is aimed to foster rural development providing *“institutional and policy support for community joint forest management, governance and control of illegal activities, building markets, and financial instruments in support of private investment in sustainable forest conservation and management”*;
- The Food and Agriculture Organization’s Strategy for forest and forestry (FAO 2010) recognized forest finance in two of its priorities: *“the support of the development and*

implementation of national and international financial mechanisms to support sustainable forest management” and the “increased use of financial mechanisms to facilitate information sharing and database development, and to build capacity to strengthen forest management and to reduce deforestation and forest degradation”;

- The United Nations Development Programme and the United Nations Environment Programme have based their pro-poor growth strategy on sustainable natural resources management. Forest products and services are recognized as key assets in the household economies of the poor. When properly financially supported, the productivity of these assets can be raised substantially, leading to increased income and livelihood opportunities (WRI 2005, UNDP 2010).
- In addition, public institutions have declared the need for investments in forest-based rural development as a strategy for accelerating progress toward the Millennium Development Goals (MDGs).

As a consequence of these official commitments the question of broadening and diversifying the financial basis for forest management has emerged as a key theme in the international forest policy dialogue (Savenije et al. 2008). However, looking at the concrete actions undertaken in the last years by many developing countries, it could be stated that the role of forests in rural development and poverty reduction has been marginalized (Simula 2008). A clear illustration of that is given by the Poverty Reduction Strategy Papers (PRSPs). As a requisite for receiving external development funds, the World Bank and International Monetary Fund required less developed countries to develop PRSPs. These are prepared independently by governments in order to define objectives and develop actions such as budget and policy priorities for development and poverty reduction. Contreras-Hermosilla and Simula (2007) reviewed PRSPs of 43 countries in order to determine how they address various forest issues. Although two-thirds of countries (28) had significant representations of forest links to poverty reduction and development, the remaining third of countries that did not discuss forests in relation to poverty reduction and developments include some countries where forests represent a significant source of income, and countries with substantial forest cover such as Indonesia and Vietnam. Countries that set forest-specific priorities in their PRSP and other national development strategies are less likely to attract funding for forest-based rural development.

This might explain why, notwithstanding the formal commitments by many intergovernmental and national institutions, in recent years a general trend towards a stagnation of public financing for sustainable forest management has been observed in recent years, including investments from international aid agencies (Gutman 2003). In the meanwhile, integration of the forest sector into the capital market is still limited as well as access to private capital, although private financing already exceeds that of the public sector (Canby and Raditz 2005) and interest from private financial institutions in forestry investments is growing.

10.2 Some definitions

Except in the sections that describe the more conventional understanding of these concepts, the following connotations will be used throughout this book:

Domestic Direct Investment (DDI) is a category of investment that reflects the objective of establishing a lasting interest by an enterprise (direct investor) in an enterprise (direct investment enterprise) that is resident in the same economy (i.e. country) than the direct investor. Direct investment involves both the initial transaction

between the two entities and all subsequent capital transactions between them and among affiliated enterprises, both incorporated and unincorporated (OECD and IMF 2004).

Foreign Direct Investment (FDI) is a category of investment that reflects the objective of establishing a lasting interest by a foreign enterprise (direct investor) in an enterprise (direct investment enterprise) that is resident in an economy other than that of the direct investor. The lasting interest implies the existence of a long-term relationship between the direct investor and the direct investment enterprise and a significant degree of influence on the management of the enterprise. The direct or indirect ownership of 10% or more of the voting power of an enterprise resident in one economy by a foreign investor is evidence of such a relationship (OECD 2008b).

Microfinance is a specific branch of finance that involves the delivery of traditional and new financial services, such as loans, savings, insurance, transfer services and other products, targeting them at low-income clients. Pioneered by Mohammad Yunus who founded the Grameen Bank in Bangladesh in the 1970s, microfinance institutions today are spread all over the world (including in developed countries such as the United States) and count millions of the world's poor among their clients. This segment of the population has often not had access to traditional banks (Agrawala and Carraro 2010).

OECD Development Assistance Committee (DAC) is an international forum of many of the largest funders of aid, including 24 members. The World Bank, International Monetary Fund and United Nations Development Programme participate as observers. The DAC has the mandate to promote development co-operation and other policies so as to contribute to sustainable development, including pro-poor economic growth, poverty reduction, improvement of living standards in developing countries, and a future in which no country will depend on aid (OECD, 2010a).

Official Development Assistance (ODA) includes flows of official financing administered with the promotion of the economic development and welfare of developing countries as the main objective, and which are concessional in character with a grant element of at least 25% (using a fixed 10% discount rate). By convention, ODA flows comprise contributions of donor government agencies, at all levels, to developing countries ("bilateral ODA") and to multilateral institutions. ODA receipts comprise disbursements by bilateral donors and multilateral institutions (IMF 2003).

10.3 Old constraints and new driving forces

The forestry sector has inherent characteristics that increase the complexity of financing in addition to conventional challenges of rural development investments. Problems related to investments in the forestry sector include undervaluation of the multifunctionality of forests, perceived high risks of forest investments, the long-term nature of the forestry cycle - which introduces extra risk to the investment - and the uneven distribution of costs and revenues over time (Simula 2008). As regards multifunctionality their translation into financing mechanisms is not easy and may not be possible in many cases. The driving forces behind forestland misuse are subsistence and direct financial revenues and they cannot be curtailed by mere theoretical calculations of forest values (Lammerts van Bueren 2002): this is why undervaluation of forests multifunctionality is one of the reasons for the continuation of unsustainable practices leading to deforestation and forest degradation (Savenije et al. 2008, Indufor 2010). On the other hand, if a more multifunctionally-oriented forestry is desirable and can contribute to diversification of revenues, this can also lead to conflicts arising amongst

different objectives and stakeholders (Solberg and Miina 1997, Hellström 2001, Niemelä et al. 2005, Janse and Ottitsch 2005).

Problematic aspects related to forest investments may also include advance payments of relatively high amounts, as in the case of forest plantations. Since opportunity costs of such capital may be very high, tree planting has been strongly subsidized by governments and development agencies in the past. For example, in many parts of Latin America, Oceania and Asia, plantation programs paid more than 75% of the establishment costs with additional allowances made for land, maintenance and many others costs (Brown 2000). According to one estimate, around 2 billion USD were granted each year in subsidies to industrial forest plantations: this sum is four times greater than the annual development assistance given to forest conservation (White et al. 2006, UNEP 2009). In the last years the role of subsidies has been integrated by direct investments from large industrial and financial institutions attracted by new business opportunities in the forest sector.

Increasing demand for wood and wood-based products, especially in fast growing nations like Brazil, China and India, have caused a relevant growth in forest plantations investments. Planted forests constitute about 7% of the global forest area, covering around 264 million hectares, with a steady increase in all regions and sub-regions since 1990 (FAO 2010). Plantation products play an increasingly important role in the secondary product industry (especially for pulp, paper and reconstituted panels) and they constitute the majority of the value of the aggregate tropical timber trade (Scherr et al. 2004).

Critics have observed that both public policies and private financial institutions have favoured big companies and encouraged large-scale planting of monocultures, with a limited involvement of any stakeholders other than industry and government (Bass et al. 1996). As a matter of fact small and medium forest enterprises have normally been excluded from access to financial support; thus, when external finance is available, it is normally from informal or non-institutional credit suppliers, many enterprises being too small to benefit from significant access to capital and other resources, even if under the same rules as the large companies in delivering their products to the market. However, with the increased role of microfinance, small-scale investments are developing also in the forest sector, benefiting forest-based small scale enterprises and communities, especially in those cases where basic requirements related to food security are satisfied: most small scale enterprises operate their forest-based activities jointly with other processing, service or agricultural activities, so they seldom occur as separate enterprises (FAO 2005a). Microfinance is partly linked to another fast developing financial sector, represented by the so called ethical finance, basically intended as finance in which returns are in accordance with social and environmental concerns. Many private financial operators are aware of the risks that investments in unsustainable forest management can pose on financial and reputational liabilities. At the same time they widely acknowledge new business opportunities for forest investments such as green and low carbon solutions (PwC and WBCSD 2010).

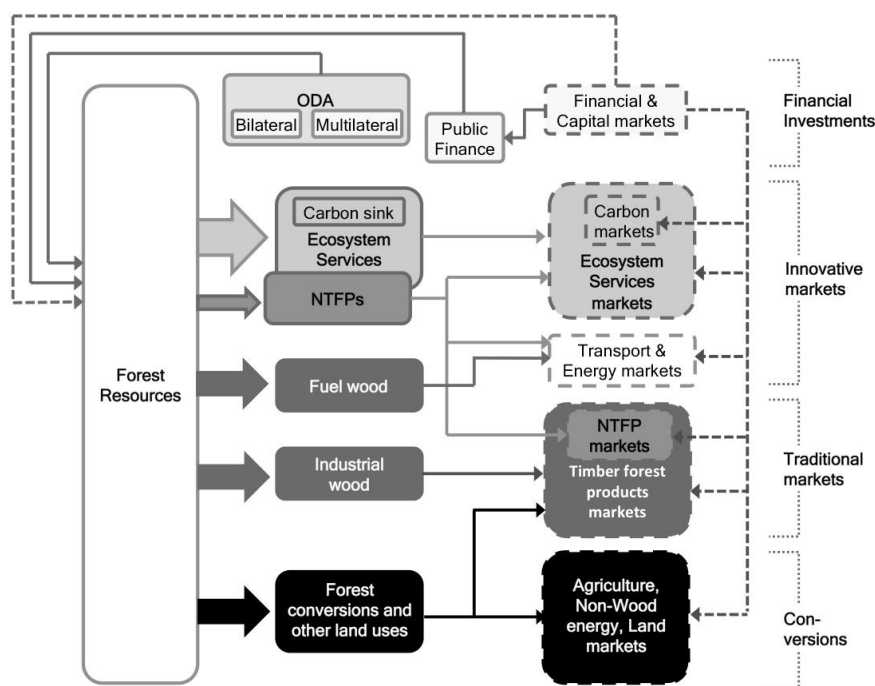
In accordance with Corporate Social Responsibility principles and tools, producing timber and timber-based products is not the only reason for investing in forest management. Traditional wood production still remains important, but is complemented (and sometimes surpassed) by a wider recognition of the economic role of Non-Timber Forest Products (NTFPs) and of the functions based on ecosystem services like biodiversity, landscape, recreation and, above all, carbon sequestration. Carbon offsetting forest projects have received keen global attention with the establishment of the Clean Development Mechanism and Joint Implementation projects

within the framework of the Kyoto Protocol. Moreover, the development of Reduced Emission from Deforestation and Forest Degradation (REDD) projects will undoubtedly increase the interest of potential investors in the forestry sector.

The enhanced attractiveness of forests as investment opportunities is encouraging for the whole sector. The parallel growth of environmental and social concerns and investing opportunities feeds a real need for tools allowing reliable and transparent assessment of financing channels as well as proper rating systems of different investments options on the basis of environmental and social performances of all actors involved in the process.

Finance instruments utilized for forest-based rural development could be distinguished as conventional finance instruments utilized in numerous other types of investments besides forestry, or innovative finance instruments that are specifically designed for forest finance. Both traditional and innovative finance instruments can be used in traditional and innovative markets for forest products (Fig. 10.1 Forest resources, markets and financial institutions).

Fig. 10.1 Forest resources, markets and financial institutions



Source: Adapted from UNEP (2011)

Markets for timber and to a certain extent NTFPs are well known, and are utilized (or could be better utilized) to sustain the forestry sector. Market mechanisms that encourage the user of other, currently not marketed, environmental goods and services to pay (to the producer/resource manager) are less known but are worth exploring for their potential to contribute to the sustainable financing of national forest programs.

10.4 Funding for forest-based rural development

10.4.1 A general classification of forest finance resources

According to FAO (2005b), more than 600 large financial actors invest in forest-based activities worldwide. Investors are conventionally distinguished as private, i.e. profit oriented investors, and public, i.e. development oriented investors (Holopainen and Wit 2008, Simula 2008).

When considering existing financial flows a distinction between public and private investments is again normally made. Public funds include domestic public investments and Official Development Assistance (ODA). Private funds include Foreign Direct Investment (FDI) and Domestic Direct Investments (DDI), even under the form of private investments by institutional investors, commercial banks and export credit agencies.

Forest financing also includes contribution from NGOs and philanthropy, as well as other funding forms that may be classified as mixed, public and private, since they are characterized by the co-existence of public and private sources of funds.

Forms of financing are dynamic over time and new types of investment partnerships are being set up: between governments, international donor agencies, civil society, local community and the private sector forest investors. These partnerships have significant potential to enable forest-based rural development, because they include a wide array of stakeholders. Due to the emergence of innovative instruments of forest finance based on payments for environmental services, some forest investments that were financed mainly by public institutions are becoming private sector investments. The REDD projects are probably the most remarkable example of this trend. At the moment they are financed by bilateral ODA and multilateral ODA, however, this may partly change in the future: the interest of profit-oriented (private) investors will increase when REDD projects become eligible for credits for international carbon trading.

10.4.1.1 Public and predominantly public funding

ODA funds are the main source for rural development funding, a flow of official financing administered to promote economic development and welfare of developing countries (IMF 2003). ODA can be bilateral when finance is disbursed by a government development agency of one country, and multilateral, when finance is disbursed by government development agencies from two or more countries, or by multilateral institutions such as the World Bank²⁵ and the United Nations. There are many multilateral ODA initiatives focused on forests and rural development, such as the Program on Forests (PROFOR) at the World Bank, or the Collaborative Partnership on Forests developed by 14 international organizations and secretariats with substantial programs on forests. ODA supports institutional capacity building, forest policy reform, promotion of sustainable forest management and rural development in national

²⁵ There are five World Bank agencies: the International Bank for Reconstruction and Development (IBRD) provides debt financing funds and advice on the basis of sovereign guarantees; the International Finance Corporation (IFC) provides primarily to the private sector; the International Development Association (IDA) provides interest-free loans or grants; the International Centre for Settlement of Investment Disputes (ICSID) works with governments to reduce investment risk; and the Multilateral Investment Guarantee Agency (MIGA) provides insurance against certain types of risk, including political risk, primarily to the private sector.

development plans, and creation and implementation of economic, social and environmental incentives for sustainable forest management.

Public funding includes regional development banks, which are particularly focused on rural development and poverty alleviation. In the 2002-2006 period the International Bank for Reconstruction and Development and International Development Association invested USD 517 million in “stand-alone forest projects” and “projects with dominant forest components” (Contreras-Hermosilla and Simula 2007). Two World Bank bodies, the International Finance Corporation (IFC) and the Multilateral Investment Guarantee Agency (MIGA), finance forestry through predominantly public investments in the private sector. Particularly, MIGA is involved in FDI in developing countries, by providing risk insurance (guarantees) against country, political and other non-commercial risks. The main criticism of FDI in relation to rural development regard the fact they are typically channeled into infrastructure and larger-scale investments, rather than small or medium-scale enterprises that might to a larger extent benefit the poor. The number of forest related projects financed by MIGA is still negligible. However this might change with the establishment of agribusiness, manufacturing and services sector, and of programs such as micro-financing and small investment program (World Bank 2010a, World Bank 2010b).

10.4.1.2 Private and predominantly private finance

The most significant example of private forest finance is the activity of timberland funds. The United States has the most developed finance mechanism specialized in timberland investments: Timberland Investment Management Organizations (TIMOs), and Timberland Real Estate Investment Trusts (T-REITS) (Box 10.1). These are private companies who buy, manage and sell timberland on behalf of institutional investors such as pension funds, insurance funds, endowments, conventional banks, etc. They mainly operate in the USA, but also in Canada, New Zealand, Australia, South Africa and many countries in South America (FAO 2007).

Box 10.1 TIMOs and T-REITs

Timber Investment Management Organizations (TIMOs) are private companies acting as investment managers with the primary aim to maximize the growth in the value of timberland assets. Timberlands are owned as illiquid direct investments or partnership shares, generally in separate accounts, but frequently in pooled funds. Investors in TIMOs are interested in total return and capital appreciation. Two main types of investment models for TIMOs exist. The first one is named “separate accounts model”: an investor buys and manages timberland for returns over an indefinite term. The second one is called “closed-end funds”: multiple investors purchase timberland jointly and intend to hold it for a set period, such as 10 to 15 years, before selling it.

The TIMO vehicle suits many institutional investors, who may not want to directly buy and manage planted forests, or may want to put only small amounts of their funds into investment, so need to have a structure which can accumulate funds from many organizations to provide large funds.

Timberland Real Estate Investment Trusts (T-REITs) are private or public companies owning and operating income-producing real estate. Historically REITs manage apartment buildings, shopping centers, offices, hotels or warehouses, but they recently started to pay growing attention to timberland assets. Their primary business is managing groups of properties to produce income, and they are required to distribute most of their profits as dividends. They have high degree of liquidity through the public trading of shares on a stock exchange.

The number of TIMOs has grown significantly in the last 30 years: from only 2-3 in the early 1980s to more than 25 in 2007. Today the largest private planted forest owner in the world (Plum Creek, USA) is a T-REIT. It has been estimated that the total value of such tools grew from USD 2.0 billion in 1990 to USD 50 billion in 2007.

The institutional investors tend to include timber in their investment portfolio because timber has low-to-negative correlation with other asset classes such as stocks and bonds. This is because the majority of returns come from biological growth, which is not correlated with any economic factor and is, in normal investment conditions, positive. Trees grow regardless of the economic and capital market conditions. Therefore, the institutional investors tend to increase returns and lower risks by adding timberland management activities to their investment portfolio (Healey et al. 2005).

Pension funds are one of the main institutional investors in the forest sector. Usually, pension funds dedicate 1-3% of their financial assets to timberland investments. This is still a large amount as for example, PGGM pension fund from the Netherlands has an overall financial asset over USD 100 billion, and the typical amount dedicated to forest investments is between USD 75 and USD 150 million (Plomp 2010).

10.4.2 Finance instruments for forest-based rural development

Conventional finance instruments include grants, loans, credits, equity investments, co-funding, guarantees, insurances and savings. Moreover new instruments like microfinance, leasing, remittances, and payments for environmental services (PES) are emerging.

Grants are the most common finance instrument disbursed by ODA. Unlike loans or credits, grants do not usually have to be repaid. *Loans* can be obtained from most banks, but development banks usually provide privileged rates of interest, with an initial interest free period, repayable over the long term. To justify a loan, the forest project has to be developed in a strong business case. Loans can be distributed to a variety of beneficiaries, including governments, projects, forest companies, individual forest farmers etc. under several forms of funds that cover a wide range of mechanisms to raise money through national/international transfer payments. National Environmental Funds, for example, use collected revenues as disbursements for environmental and conservation purposes. They can have a public or private nature (or even mixed) and can be site/issue specific or multi-issue. In the second case they address environmental management and sustainable development in a broader sense. Different kind of funds exist (NFP Facility 2011):

- Endowment funds that use exclusively revenues from capital investments to finance activities;
- Sinking funds that gradually disburse their capital and investment income over a fixed period of time, taking the revenues into account;
- Revolving funds that receive regular – and in ideal cases fixed – income, e.g. from taxes and levies, which complements and replenishes the original capital, to provide a source of finance for specific activities.

Equity investments enable persons and institutions to invest in shareholding of a company managing or implementing a sustainable forest management project. The investment may make an enterprise viable or enable it to expand, while the new shareholder will benefit through shareholder voting rights and dividends on profits. Several examples may be mentioned. Precious Woods Ltd. is a Swiss company with FSC certified forest operations in Brazil, Costa Rica and Gabon, whose main shareholders are banks, insurance companies and Swiss pension funds (Precious Woods 2011). The Terra Capital Fund is a USD 15 million private equity fund that invests in private

enterprises generating conservation benefits through sustainable use of biodiversity in Latin American countries, which have ratified the Convention on Biological Diversity (Argentina, Bolivia, Brazil, Chile, Ecuador and Paraguay). The Fund is a 10 years venture capital fund launched with a USD 5 million Global Environmental Facility (GEF) grant and participated in by several actors including the International Finance Corporation, the Swiss Government, Triodos Bank, and others. Investment fields cover organic agriculture, native species aquaculture, native species reforestation, NTFPs and nature tourism (Terra Capital 2000). Another relevant example is the Lignum Fund in Chile (see Box 10.2).

Box 10.2 Lignum Fund in Chile

In 2003 Fundación Chile joined the investment bank Asset and the real estate investment fund Independencia to create an investment vehicle that would allow financial investors to invest in the Chilean forestry sector. The result of such co-operation was the Lignum Fund, a publicly listed fund whose sole purpose is to invest in the forestry sector in Chile. Being the first forestry fund set up in Latin America, Lignum Fund became effective after the approval of the Internal Regulations by the Chilean Securities and Insurance Commission, which took place on January 3rd, 2006 and is renewable for an additional four-year period. Asset raised a total of USD 39 million for the Lignum Fund, and negotiated forestry management contracts and off take with the two large Chilean forestry companies, CMPC and Arauco. Fund investors include the Chilean pension funds, Chilean life insurance companies and family offices. The Lignum Fund, managed by Foresta AFI, a joint venture between Asset and Independencia, is fully invested and is now in its divestment process. The Lignum Fund acquired approximately 12,000 hectares of immature pine and eucalyptus forests, and planted approximately 15,000 hectares of land with pine and eucalyptus under long-term land-use right agreements with small and medium landowners. These forestry assets will be managed, harvested, and commercialized under long-term agreements signed with selected Chilean forest companies. On the basis of these contracts, the Lignum Fund intends to issue a securitized financial instrument backed entirely by net cash flows generated from the harvest and commercialization of its forestry assets. Fund investors will receive cash proceeds as both dividends and a return of capital. Upon the final liquidation of the Lignum Fund, the fund investors will also receive an in-kind distribution of the subordinated tranche of the securitized bonds.

Source: Asset (2011), Independencia (2011)

Guarantees are obligations of one party (the guarantor) to assume responsibility for the debt obligation of a borrower if that borrower defaults, as in the case of MIGA investments where the World Bank provides country and political guarantee for private investors. A special form of guarantee is represented by bonds, such as the so-called Environmental Performance Bonds, i.e. payments made by an operator prior to the commencement of project activities. Such bonds are then returned to the operator at the end of the project if certain predetermined environmental performance standards are met. If not, the money is to be used to support mitigation measures to restore appropriate environmental conditions. Environmental Performance Bonds are normally held on deposit by government bodies.

Similarly to the previously described items, *insurances* are also a form of financial risk management, in which a company can insure itself against uncertain financial or other losses by buying an insurance based on a specific investment risk assessment. Insurance products for investors in the forest sector commonly cover aspects like losses of growing trees, fruits and yield due - for example - to fire and allied perils or wind storms, business interruption due to increased costs of working, etc.

Savings represent the income not spent, or deferred consumption. They mainly refers to personal finance, but besides benefiting poor people, they are important for small-scale

enterprises as a strategy to mitigate income fluctuations, overcome unexpected expenditures and emergencies, and similar.

Leasing is a transaction in which the owner (the lessor) of a productive asset allows another party (the lessee) to use an asset for a predefined period against a rent (lease payment). The lessee becomes responsible for all operational costs including maintenance and repairs of the asset. Examples include the leasing of degraded public forestlands to private companies in India, and to poor households in Nepal. Land tenure through leasing can facilitate access to microfinance services and credit, thus improving benefits for lessees.

Remittances are transfers of money back home from seasonal and long-term migrants. For many developing countries migrants' remittances represent a major source of income for local households. IFAD (2009) estimates a global value of remittances over USD 300 billion a year, which surpass FDI and ODA combined. It is also estimated that one third of remittances go directly to rural areas and, although they are mainly used to cover household expenses, they can also be used as start-up capital for small livelihood activities such as forest-based enterprises.

Some of the conventional finance instruments can be designed to target especially low-income people and small enterprises; this is the case of *microfinance*, an innovative set of instruments that is particularly significant for forest-based rural development (FAO 2005a), see also Box 10.3.

Box 10.3 Microfinance in forestry

Microfinance has been successfully implemented in the forestry sector both with regard to traditional activities related to timber production, as well as to NTFPs and services. Examples include:

- *Nepal*: NTFPs are a basic resource for livelihoods in Nepal, especially for people in mountain areas. In Parbat district (western Nepal) 91% of population is dependent on agriculture and forestry, while NTFPs provide more than 12% of local GDP. Although several banks, microfinance institutions, NGOs, savings and credit groups have been operating in Parbat for a long time, only a few of them provide credit to forest-based enterprises. It has been estimated that the total amount of microcredit investment needed in forest-based enterprises in the district would be around USD 325,000. In order to improve microfinance in forestry two dedicated programs were launched between 1998 and 2001: Micro-Enterprise Development Program (MEDEP) – funded by the Nepalese Government and UNDP - and Livelihoods and Forestry Programme (LFP) – funded by the Nepalese Government and DFID. MEDEP and LFP played a major role in promoting forest-based enterprises in Parbat district. With a total microcredit of about USD 60,000 nearly 280 new forest enterprises were created. An average net increase of 380% in the income of the entrepreneurs from the 1.5 year or older enterprises was observed. As a result, the average net income per day became significantly high in comparison to other districts in west Nepal.

- *Senegal*: the Project de Gestion Intégré des Ecosystems Senegalaises (PGIES) was launched in 2002 with funding from GEF, UNDP and the Government of Senegal. The project aims to promote community based integrated ecosystem management in the four most important eco-regions within Senegal, to reduce deforestation, forest degradation and biodiversity loss. PGIES involves the establishment of a network of villages responsible for the management of a community nature reserve. Upon transfer of these forest reserves from the local government to the community, a management plan for the reserve was developed, which includes activities such as the creation of fire breaks, surveillance by specially appointed eco-guards and active fire prevention by the community. Livelihood activities were also supported, including vegetable gardening, animal husbandry and fruit tree planting. Pressure on the forest was reduced, thereby avoiding emissions from further deforestation and capturing carbon by allowing the forests to regenerate. PGIES has established microfinance institutions to support communities' members. Such institutions provide

low interest rate loans (10%) for eligible “environmental activities”, as determined by the microfinance institutions governing body. 5% of all interest payments are used to finance an Environment Fund which in turn is used to support the protection and rehabilitation activities undertaken within the reserve.

Source: Binayee et al. (2004), FAO (2005a), UNEP (2011)

Innovative finance instruments that are specifically designed for forest investments are mainly oriented towards PES. Carbon sequestration is the environmental service that currently receives the majority of public and private funds. Macqueen (2010) studied the 16 most substantial funds for forest climate change mitigation, mainly focused on REDD projects. The study estimates that these funds attracted pledges of USD 21.78 billion, mainly derived from bilateral and multilateral ODA, with the high predominance of the Hatoyama Initiative of the Government of Japan. However, forest rural people, and indigenous groups still do not have enough decision-making power and control over these funds, as the funding is received mainly by governments. REDD projects could have a greater role in forest-based rural development if rural people and indigenous groups' access to these funds is improved, together with their property rights, rights to free, prior and informed consent, recognition of traditional knowledge and the forest stewardship role (UNFCCC 2010).

10.4.3 Forest finance for rural development: where are we going?

The issue of the quantification of resources needed for sustainable forest management is controversial and has been part of the international agenda since the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992. UNCED (1992) estimated that the annual flows to the forestry sector required for the 1993-2000 period were approximately USD 31.2 billion, a figure revised upwards to USD 33 billion per year in 1996 (Chandrasekharan, 1996).

According to more up-to-date and detailed estimates by UNEP (2011), USD 64 billion have recently been invested in the forest sector every year: USD 18 billion for forest management and USD 46 billion in forest product processing and trade. The majority of this is domestic investment (90%) mainly concentrated in developed countries and associated with plantations and processing facilities for pulp, paper and biofuel. ODA accounts for only around 7% of the total investment in forestry worldwide (Tomaselli 2006). Overall, the picture for developing countries is that, apart from official development assistance, financing is primarily domestic and relies heavily on internal cash flows, since lending and equity capitals are, as already noted, difficult to access (Streck et al. 2010).

While direct public sector investments in forestry played a decisive role in the past, recent figures show that they are generally stable or on a declining trend in most countries, although still important - especially when considering the ODA contribution - for low-income ones. In particular, with few exceptions, bilateral flows remained more or less steady, while an increasing engagement of multilateral sources has been observed. At the same time private sector direct investments, both domestic and foreign, are on the increase, but they remain concentrated in few countries (Tomaselli 2006). By 2005, about a third of the stock of global foreign direct investments had gone to developing countries (Borregaard et al. 2008), but those countries that hold relevant forest resources and have good potential for forest industry did not manage to attract any substantial amounts of these investments. There are several reasons for this, one of the main being that the majority of investments are cross-border mergers and

acquisitions geared towards augmenting technological assets or accessing new markets by purchasing existing firms (Laaksonen-Craig 2004). The introduction of new investment opportunities, even outside timber production, could probably invert this trend. As commented by UNCTAD (2010), the relative weight of developing and transition economies as both destinations and sources of global FDI is expected to keep increasing: these economies, which absorbed almost half of FDI inflows in 2009, are leading the FDI recovery after the global economic crisis.

Compiling a quantitative historical assessment of the external sources of forest funding and investments worldwide is not an easy task: difficulties involving data collection, compilation and analysis of information are widely recognized. This is due to several reasons, mainly including reliability and completeness of available data. Reliability is strongly related to effectiveness and transparency of official reporting systems, while completeness refers to the existence of gaps both in chronological terms and in sectoral ones. For example, with the exception of FDI, little information exists about investment by the private sector. Problems may also exist in terms of considerable annual variations in the financing flows: this is particularly evident in the case of sources that record commitments rather than real disbursements (e.g. OECD) because decision making in the case of large projects can create wide variations in the data.

A tentative overview of trends in forest financing is presented in the following pages, basically distinguishing between public investments (bilateral and multilateral ODA) and private ones.

10.4.3.1 Forest sector ODA

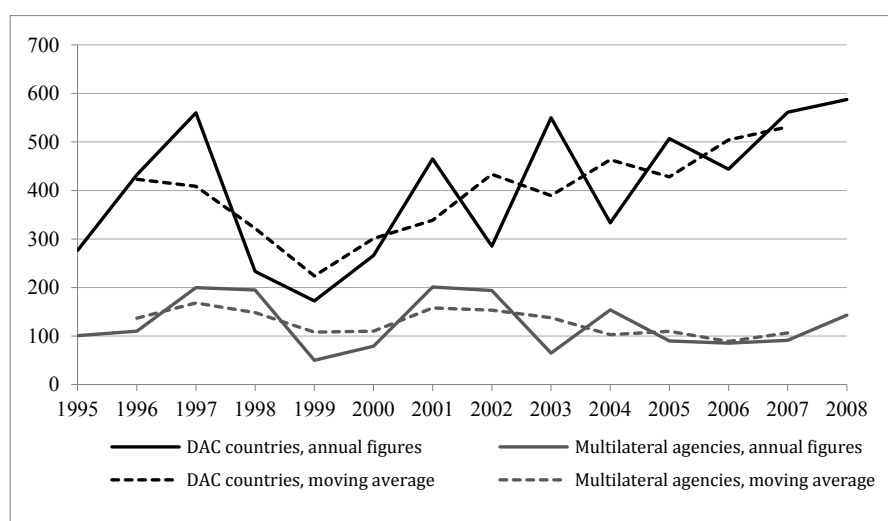
The relevance of forest sector ODA reduced in the last years: this is witnessed by Resolution 2006/49 of the Economic and Social Council of the United Nations that, as an outcome of the sixth session of the United Nations Forum on Forests, called on governments to reverse the decline in ODA for sustainable forest management. While there are no precise data on forest sector ODA, annual estimates range from USD 0.5 to USD 1.7 billion (OECD and World Bank quoted in Savcor Indufor 2006). According to OECD (2008b) public official aid to forestry has remained stable in real terms over the past decade, with an average value of about USD 500 million between 1995 and 2008 (Fig. 9.2). On the other hand, since total ODA has risen sharply, the share of aid to forestry has declined: it represented 0.8% of the development assistance funds in the mid-2000's compared to 1.1% at the end of the 1990s, when figures were probably higher due to the effect of the 1992 UNCED Summit in Rio de Janeiro. However, with reference to bilateral investments, Simula (2008) observed that data made available by OECD through its Development Assistance Committee (DAC) Credit Reporting System may be incomplete, providing just a partial view because of the weaknesses in DAC members' reporting systems and the presence of several gaps in the past data. As commented directly by OECD (2000), annual DAC data on aid to forestry are available from 1995 onwards²⁶. Prior to that year, forestry activities are included, but are not separately identifiable within the wider "Agriculture, forestry and fishing" sector.

²⁶ The Credit Reporting System permits aid to forestry to be examined over a longer period as specific forestry sector codes have existed from the outset of the system. Analyzing the evolution in aid to forestry in 1973-98, OECD (2000) observed it was similar to that of ODA in general. A constant growth in the 1970s and 1980s could be observed as aid to forestry increased from a few tens of millions of US dollars a year to over half a billion a year. When converting data to constant dollars, however, it can be observed there was a real growth only up to the early 1980s, after which flows remained broadly stable. DAC countries' commitments of bilateral aid to forestry over the whole period amounted to a total of US\$ 5 billion (current), and ODA lending to forestry by the multilateral development banks to US\$ 3 billion.

Furthermore the definition of aid to forestry excludes aid to forest industries, which is coded elsewhere in the classification (industrial sector) but not identifiable (OECD 2008d). Finally, although specific figures for the forest sector are reported²⁷ by the DAC Credit Reporting System, forest components in multisector projects and programs primarily aiming at rural development, natural resource management, biodiversity or environmental management are not recorded separately and this may lead to additional underestimation of global invested values. As regards biodiversity, it has been estimated that for the 2003-2006 period forest-related DAC bilateral aid covered about 13% of the overall biodiversity-related aid, i.e. about USD 313 million per year on a grand total of about USD 2.7 billion per year (OECD 2008d).

A survey carried-out by PROFOR (2003) showed DAC-reported bilateral donors' contribution record was just about half of the total funding volume. Based on this, PROFOR estimated that during the 1986-1997 period, bilateral and multilateral ODA resources dedicated to the forest sector grew from USD 784 million in 1986 to USD 1,270 million in 1997 (Tomaselli 2006). A study by El Lakany *et al.* (2007) calculated the annual volume of ODA financing at a level of about USD 1.5 billion, while in 2008 Simula estimated an amount of about USD 1.9 billion. It should be remembered that in its estimations on the annual flows of funds to the forest sector for the years 1993 to 2000 UNCED calculated that 18% of the overall value - i.e. USD 5.7 billion - were to be covered through concessionary funding from ODA budgets.

Fig. 10.2 Annual ODA in the forest sector (1995-2008), million USD



Note: 3-year moving averages and annual figures in current prices. DAC countries include EU institutions. Source: our elaboration from OECD (2008c, 2010).

10.4.3.2 Bilateral ODA

²⁷ According to OECD DAC Credit Reporting System classification, aid to forestry is divided in six sub-sectors: (sub-code 31210) Forestry policy and administrative management (including: forestry sector policy, planning and programs; institution capacity building and advice; forest surveys; unspecified forestry and agro-forestry activities); (31220) Forestry development (including: afforestation for industrial and rural consumption; exploitation and utilization; erosion control, desertification control; integrated forestry projects); (31261) Fuelwood/charcoal (including: forestry development whose primary purpose is production of fuelwood and charcoal); (31281) Forestry education/training; (31282) Forest research (including artificial regeneration, genetic improvement, production methods, fertilizer, harvesting); (31291) Forestry services.

Bilateral ODA to forests comes from a limited number of sources. About 90% originates from a short list of donors, including European Union (EU) institutions, Finland, France, Germany, Japan, the Netherlands, Switzerland, the United Kingdom, and the United States. Although flows are quite irregular, the overall trend is positive with the total contribution from DAC countries doubling between 1995 and 2008. Japan plays a major role: in the same period it contributed to more than 45% of the global DAC members' ODA value on average, reaching nearly 75% in 2003. Not considering the Japanese contribution, the global bilateral ODA calculated in 2008 would be more or less identical to that calculated in 1998. Increases can be observed even with reference to other countries, but only EU institutions and Finland show relevant volumes in absolute terms, and sudden growth can be observed in 2008 for Australia and Norway. In many other cases forest ODA declined, especially in the cases of the Netherlands, Sweden and the United Kingdom. Several reasons can explain this decline (El Lakany et al. 2007; Simula 2008): on the one hand there is a widely reduced allocation to project and program funding with, on the other, a shift from sectoral approaches to budgetary support and broader development strategies that respond to the Millennium Development Goals, the sectoral allocation of which is done by the recipient country. A general trend to no longer consider forests as a self-standing priority, but as part of the climate change and other environmental agendas is consolidating. There is an increasing use of multilateral agencies as funding channels because they have a competitive advantage in those recipient countries where bilateral donors cannot effectively operate because of governance constraints.

When considering recipients of forestry bilateral ODA, Asia plays a prevalent role, receiving more than 60% of total aid to the sector, with a 80% peak in 2003. India has been the major recipient in the last years (31% of total ODA to the forestry sector), followed by China (13%) and Vietnam (12%). Africa receives about 20% and Central-Latin America about 11%. In terms of sectoral funding, the thematic area "forestry development" (OECD code 31220) in the last years received almost two-thirds (63%) of the total bilateral ODA, followed by "policy and administrative management" (33%), while remaining activities only obtained marginal contributions (OECD 2008c).

In addition to traditional grant financing for targeted projects and programs, bilateral donors have introduced new instruments such as sector-wide approaches, program support, budgetary support, debt-for-nature swaps, etc. (Simula 2008). It can be expected that bilateral ODA will not increase or will even decrease in the next years, and a higher fraction of the ODA will probably be channeled through multilateral institutions. In the meanwhile investments will focus on new forest-related instruments of the climate change initiatives.

10.4.3.3 Multilateral ODA

Commitments to forestry among the multilateral agencies are mainly provided by the World Bank - represented primarily by IFC, IDA and IBRD - with a total of nearly USD 200 million in average over the 1996-2004 period (Tomaselli 2006). In the period 2002-2006 the IBRD and IDA invested USD 517 million in "stand-alone forest projects" and "projects with dominant forest components" (Contreras-Hermosilla and Simula 2007). Simula (2008) estimated that between 2000 and 2006 development banks invested USD 457 million in forests, of which the African Development Bank (AFDB) invested USD 352, followed by the Asian Development Bank with USD 65.6 million. Although there are no official statistics for forest-based rural development finance, according to AFDB (2010), USD 31.6 million were invested in 2009 for 14 environment sector projects that

are directly (stand-alone forest project) or indirectly (projects with forest components) related to forest-based rural development. Because of their structure multilateral sources have a much broader geographic scope than bilateral agencies and when reporting their funding allocated to forest-related projects do not indicate whether or not some of the amounts are duplicated across agencies. Moreover, OECD seeks to collect data on aid activities by multilateral organizations only on the same basis that for bilateral donors, but at present, sufficient data are received from the World Bank group, the regional development banks and IFAD, which together account for approximately 40% of multilateral ODA. Sectoral data for the European Commission and United Nations, each of which represents some 30% of multilateral ODA, are largely incomplete (OECD 2000 and 2008a). Multilateral ODA registered by OECD Credit Reporting System showed a quite irregular pattern between 1995 and 2008, with a couple of peaks in 1997-1998 and 2001-2002 and an average value around USD 125 million (OECD 2010b).

As for other sources, online information on forestry financing by regional development banks indicate their combined funding volume in 2000–2006 as USD 457 million, i.e. about USD 65 million per year (Simula 2008). Another relevant component is that of the Global Environment Facility (GEF). Since 1991 the GEF has allocated approximately USD 1.5 billion to forest initiatives, supplemented by more than USD 4.5 billion in co-financing (GEF 2009). GEF is planning to expand its support to actions reducing deforestation and provide up to USD 1 billion for the implementation of a dedicated REDD Program throughout the period 2010–2014 (GEF 2010).

Important contributions have also been provided by the International Tropical Timber Organization (ITTO), that since 1987 has made USD 314 million available to finance around 800 projects and activities through the Administrative Account, based on contributions by ITTO members, and the Bali Partnership Fund, again mainly from voluntary contributions. From 2000, the yearly allocations range between USD 15 million and USD 20 million, the three main contributors being Japan, Switzerland and the United States, which have collectively accounted for 90% of the cumulative voluntary contributions since 1987. Their role as contributors has decreased, but this has been offset by contributions from other donors. The number of recipients of ITTO contributions increased over time, up to the inclusion of 33 producer members and 3 developing consumer members. Specific figures suggest a high degree of concentration because more than 50% of the total investments are absorbed by seven countries – Indonesia, Malaysia, Ghana, the Philippines, Brazil, China and the Republic of Congo – while the share of 12 developing member countries has been 1% or less of the total for each (Hardcastle and Umali 2007).

As for the FAO National Forest Program (NFP) Facility, by mid-2006 nine donors had committed USD 15.5 million, while for the 2007-2012 phase the proposed budget is USD 33.7 million (Savcor Indufor 2006), with USD 2 million extra requested in 2010 to continue operations as planned through mid-2012 (NFP Facility 2010).

10.4.3.4 Private sector FDI in forestry

Although there is no systematic information available on domestic or foreign direct private investments in the forest sector, many authors agree on the fact that they play and will play a key role. Since the late 1980s, the world has experienced a strong expansion of direct investments flows mainly under the form of FDI as a result of the globalization process, associated to the financial markets liberalization. In the second half of the 1990s, the direct investments intensified even more, due to different driving

factors such as the extension of bilateral and multilateral commercial treaties, the intensification of privatization processes and the growing trend of fusions and trans-frontier acquisitions, mainly in the USA, EU and Japan (IADB 2004). This trend was maintained until the end of the 1990s, then inverted until 2003 when a new increasing period started, reaching a peak in 2007. FDI then experienced a drastic decline in 2008 and 2009 in line with global economic crisis: global FDI then inflows fell a further 37%, while outflows fell some 43% (UNCTAD 2010). It can also be noticed that in the last few years FDI declined in value and share, and domestic Direct Investments (DDI) became even more important.

Forest industries may not have been the forerunners in this field, but during the last 30 years FDI shown a steep increase in the forest sector (Laaksonen-Craig 2004, El Lakany et al. 2007, Simula 2008) even with reference to developing countries (Savcor Indufor 2006, Borregaard et al. 2008). FDI considerably exceed ODA contributions and remain important for foreign exchange earnings, skills and technology transfer. According to IADB estimations (2004) the global amount of direct private investments in the forestry sector (forest, industry and trade) exceeds USD 60 billion a year, representing about 1% of total direct investments worldwide, while - on the basis of UNCTAD figures - Savcor Indufor (2006) calculated the forest and wood products sector accounts for about 2.6% of total FDI stock in developing countries, especially in Asia and the Latin America/Caribbean region. The World Bank estimates that direct investments for developing countries may range between USD 8 and USD 15 billion (Profor 2003). It should be underlined, however, that in the case of developing countries most of the increase in forest sector FDI concentrated in the plantations, and pulp and paper sectors, rather than in natural forests. According to El Lakany et al. (2007) the present growth rates for forest plantations results in investment requirements of about USD 4 billion per year, while Spek (2006) commented that in the pulp and paper sector developing countries account for a small proportion of total capacity, but they dominate capacity growth, also with a view to meeting rising domestic demand as in the case of China and India. Whereas in industrialized countries forestry FDI are dominated by the manufacturing and processing sectors, in developing countries the emphasis is on primary sector activities. Private foreign direct investment to forest industries in developing countries has grown at a rapid rate since 1990. It should be mentioned that UNCTAD figures for FDI in the forest sector are aggregated with those of agriculture and fisheries; moreover, forestry investments may only be a segment of a large multilevel manufacturer or conglomerate and will therefore not be listed under the forestry sector. Finally, FDI figures track only equity investment with at least 10% control of the voting stock in the company, and ignore domestic finance, minority participation, loans and other non-equity cross-border flows. The figures also ignore foreign remittances to the families of expatriate workers, which represent a value almost double the flows of ODA and might support investments in informal or small-scale operations (Canby and Raditz 2005).

10.4.3.5 Private sector DDI in forestry

The bulk of private forest investments remains domestic (Profor 2003, Canby and Raditz 2005, Tomaselli 2006) but information on these is even less clear than that related to FDI. According to Tomaselli (2006) domestic investment constitutes over 90% of private sector flows to the forest sector. Domestic private investment can be divided between company and community or farmer investment. Company investment can also be divided between larger scale industrial forestry enterprises (whether for natural forest concessions or plantations) and small and medium forest enterprises (Mayers 2006).

According to Molnar et al. (2004) community investment in their own resources may amount to USD 1.3 - 2.6 billion per year, equivalent to annual ODA flows to forestry.

10.5 Outlook

As observed by UNEP (2011), the forest sector will be able to face the future increasing demand for products and services through a combination of changes in the external driving forces and internal efficiency gains. In particular through:

- Reducing the external pressure to forest conversion (e.g. higher efficiency in the use of existing farmland);
- Enhancing efficiency in the production of traditional forest products (timber and NTFPs), also with new plantations;
- Establishing new markets for forest-based environmental services.

Private investors and financial institutions are all involved in such development. As a matter of fact in the last years private funding initiatives have already grown to a large extent bringing new opportunities. Private funds can fill the gap left by traditional public funding mechanisms that are on the decrease, providing a relevant support to rural development strategies.

Quite a lot of forecasting exercises are underlining the increasing focus that will be placed on planted forests by future private forest investments. Studies and forecasts may differ in specific figures, but they all agree on the developing role of planted forests in wood supply. Production could increase to 44% of the overall wood production by 2020 (Carle et al. 2002) and 75% by 2050 (Sohngen et al. 1999 and 2001). Dick (quoted by Evans and Turnbull 2004) estimated that forest plantations would take over the whole industrial timber supply by 2050. More recently, Carle and Holmgren (2008) calculated that plantations will be able to provide from 66% to 80% of the world's industrial wood supply by 2030. Almost all the previously mentioned studies predicted a global shift in the industrial wood supply from temperate to tropical zones and from the Northern to Southern hemisphere. Financial flows for investments in the timber sector will shift accordingly.

This development is not free of social and environmental risks. Some profit-oriented initiatives based on monocultures are already giving no or limited attention to the protection of local communities and natural resources (Fernholz et al. 2007). While the approach of integrating rural development in forest finance is widely present among public institutions, the majority of private sector investors are still reluctant to acknowledge this concept.

On the other hand, natural forests will most probably enter new market opportunities linked to PES. While methodologies for estimating the economic value of ES have still to be refined, and mechanisms to reward them are largely perfectible, the opportunity to market a broader range of products and services could have a remarkable impact on forests. The growth of the "green economy" and the demand for "green" products - for the sake of profit, reputation needs or legal constraints - will probably attract an increasing amount of capital and investments. New actors and operators will also enter the forestry sector.

While the forestry sector presents new business opportunities for private operators, specific international and national policy tools for the governance of the changes are greatly needed. With proper policies, based on a mix of command and control instruments and provision of financial and technical support, it is possible to ensure that

forests and their services are attributed their real values. Only in this way they can directly and increasingly contribute to rural development.

Acknowledgments: the authors wish to express their gratitude to Dragana Stojkovic who has provided useful insight on the paper during her stage at the University of Padova.

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Annex 8 - Standards and Guidelines for forest plantations management: a global comparative study

Masiero, M., Secco, L., Pennella, D. Standards and Guidelines for forest plantations management: a global comparative study.

[To be submitted to Forest Policy and Economics]

Standards and Guidelines for forest plantations management: a global comparative study

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Highlights

- › We analysed 42 standards for sustainable development/sustainable forest management
- › We analysed how forest plantation issues are addressed and considered
- › Only 11 out of the 42 analysed standards/guidelines are plantation-specific
- › Main gaps regard ecosystems/landscapes maintenance and the use of exotic species
- › Improvement areas regard social aspects, carbon issues and non-wood forest products

Keywords

Forest plantations, planted forests, forest management standards, guidelines.

Abstract

Forest plantation creation and management are controversial issues. Many argumentations in favour or against forest plantations fuel debates within forestry experts, scientists and different stakeholders. The increasing area covered by forest plantations fed the demand for clear and trustable mechanisms to assure they are created and managed in a responsible way - i.e. their management is in line with international policies and initiatives aiming to protect forest resources and promote their responsible management in environmental, social and economic terms. In the last twenty years the efforts for developing standards and guidelines as voluntary-based instruments and policy tools to guarantee sustainable forest management have grown strongly. However, most of them are focused in an exclusive or prevalent way on natural or semi-natural forests, while only few of them are specific for planted forests and forest plantations. Many differences can be identified among existing initiatives for developing or consolidating sustainable management standards that can be applied to planted forests and forest plantations. The paper is based on a comparative analysis of 42 standards/guidelines for sustainable development and sustainable forest management that might be applied to planted forests. These standards/guidelines are classified and assessed on the basis of their purpose (for forest management certification or not), level of application (FMU or Regional/National), area of origin (North or South of the world), specificity (formulated for natural forests and plantations, or specifically for plantations) and other aspects. They are also compared in terms of types and number of indicators included in the documents for addressing the various environmental, economic and social issues connected with planted forests creation and management. The main aim of the paper is to assess whether and to which extent planted forests issues are properly addressed and considered within the selected standards/guidelines. The main gaps among standards/guidelines contents and societal demands, the problems of lack of homogeneousness and coordination among them and areas for future improvements that might be of special interest for investors and other stakeholders are also presented and discussed.

1. Introduction

Planted forests have represented a common land use and a very important resource since centuries. While plantation forestry has a long history in many countries, the development of a globally significant plantation estate and the establishment of large-scale planted areas is a relatively new phenomenon (Evans, 2009). Today, planted forests constitute about 6-7% of the global forest area, covering around 264 million (M) ha, with a steady increase in all regions since early 1990s. In the last ten years, the worldwide area covered by planted forests has increased by an average of almost 5 M ha/year: East-Asia, Europe and North America report the greatest coverage, together accounting for about 75% of global planted forest area. East-Asia alone makes up 35% of the ground total, mainly thanks to the contribution of China (FAO, 2010). Planted forests provide about 50% of the global wood production (FAO, 2007) and 32% of the industrial wood production (Buongiorno *et al.* 2012) with forecasts suggesting an increase up to 80% by 2050 (Carle and Holmgren, 2008). Planted forests vary strongly, not only in terms of species, location and size, but also for their main purposes, from primarily protective functions towards exclusive timber production. In particular, forest plantations - i.e. "forests of introduced and/or native species established through planting or seeding either for productive or protective purposes" (FAO, 2006) - cover about half of the total planted area (140 M ha) and are mostly (80%) intended for timber productive goals (FAO, 2007). However, they often deliver NTFPs and substantially contribute to the provision of important environmental services, such as carbon sequestration and protection against soil erosion.

Forest plantation issues and their relationships with natural forests are complex (White, 2003; Bull *et al.* 2006) and sometimes controversial, feeding strong debates within forestry stakeholders. On the one hand, plantations are considered to contribute to full-fill the growing global demand for timber and wood fibre and provide a wide range of other social, economic and environmental benefits - assuring forage, wildlife habitats, watershed protection, recreational settings, aesthetic vistas, carbon sequestration and ecological conditions for many other forest values (Boyle, 1999; Evans and Turnbull, 2004; UNEP, 2009); they can directly or indirectly create employment, boosting the development of the wood-paper working industry at local/national level; moreover, especially in Southern countries, plantation projects are often developing healthcare programmes (e.g. HIV/AIDS programmes), providing resources and opportunities for children's education (schools, etc.), assuring job training for poor people, etc. (Bull *et al.*, 2006). Moreover, although plantation forests are typically assumed to be poor substitutes for natural ones, according to many authors and several studies (e.g. Parrotta, 1995; Parrotta *et al.*, 1997; Sedjo and Botkin, 1997; Bernhard-Reversat, 2001; Carnus *et al.*, 2003; Montagnini *et al.*, 2003; Toma, 2004; Kanowski *et al.*, 2005; Montagnini *et al.*, 2005) they can play an important role in the provision of a variety of ecosystem services, when compared to agriculture and other forms of land use or when natural forests have been degraded (Pawson *et al.*, 2013). Forest plantations, for example, represent the bulk of the 15 afforestation and reforestation projects implemented so far under the Clean Development Mechanism (CDM) of the Kyoto Protocol (UNCFF, 2013). Plantations also play a central role in the voluntary carbon market: although the market share of afforestation/reforestation (A/R) projects dropped significantly compared to 2011, together with Reducing Emissions from Deforestation and forest Degradation (REDD) projects they remain the most transacted forest offset type. Across regions, Asia experienced the most pronounced growth in A/R transactions (Peters-Stanley *et al.*, 2013). Moreover, according to FAO figures (2010)

about 25% of the world's forest plantations are established for protective purposes. These figures might be even higher because in the last years a large proportion of the increase in planted forests has taken place in China where many plantations are established for protective purposes, including desertification control and protection of soil and water resources. More in general, plantations help to relieve pressures on natural forests, contributing to reduce the harvest of about 20% in Africa, 23% in North-central America, 33% in Europe (on average, -26% at global level) and thus supporting the maintenance of the same level of ecosystem services from natural areas.

On the other hand, forest plantations are often described as “[...] *biological deserts, water guzzlers, livelihood saboteurs and carbuncles on the landscape*” (IUCN and WWF, 2006 – p.1), replacing diversity with monocultures, local species with exotic ones, by causing or fastening soil erosion and loss of fertility and excessive water consumption. In this perspective, while subsidising forest plantation has been a common practice (Szulecka et al. 2013?), its effectiveness is debatable, since this may act as a disincentive to sustainable management of natural forest. Moreover, by filling the market with cheap timber and fibres they can either make natural forest management uncompetitive or, on the opposite, help raising consumer demand for wood products from planted and natural forests alike (IIED, 2004; Buongiorno et al. 2012). In many cases, a lack of due diligence in financing forest plantation initiatives and connected investments (Spek, 2006) has been demonstrated, with public funds used to establish plantations in wrong sites, using poor genetic material, poorly managed or placed too far from markets. For plantation investment these mistakes can lead to an erosion of investment value over time, that, when coupled with time-related uncertainty and risk, creates new challenges for raising capital for plantations (Cossalter and Pye-Smith, 2003; Brotto and Pettenella 2012?). More recently, afforestation/reforestation projects established for the purpose of carbon sequestration under both the CDM or REDD+ mechanisms have been associated in many countries to land grabbing (e.g. Uganda and many other African countries) and/or unsustainable land uses/management (Görger *et al.*, 2009; Cotula, 2010; Oxfam, 2011; Deininger and Beyerlee, 2011; Anseeuw *et al.*, 2012; FOEI, 2012).

Indeed, there are many reasons to better understand potentials and challenges connected with the expected growing importance of forest plantations worldwide: their growing role in providing timber and globally-sensitive environmental services the conflicting positions of stakeholders about their effects on natural forests and people (namely, forest industries vs. environmental/social movements), the real impacts they might have on environment and people, the high and increasing amount of forest plantation investments worldwide. Despite these considerations, relatively few scientific papers have been published on these issues, mostly with reference to medium to small scale cases (Turnbull, 2007; Gomez-Aparicio *et al.*, 2009; Paquette and Messier, 2010; Landry and Chirwa, 2011; Ferraz *et al.*, 2013) and a limited number of policy documents specific for plantations have been developed so far²⁸. The most spread policy instruments currently available for addressing the establishment, management, monitoring and evaluation of forest plantations and improving their governance as soft laws are sustainable forest management standards (STDs) and guidelines (GLs). But, among the several STDs and GLs developed in the last 20 years (Muys and Holvoet 2004; Marjokorpi and Salo, 2007; Clark and Kozar, 2011), which are fragmented, not enough harmonized, overlapping each other or missing key issues, the majority are focused on

²⁸ As reported by Boscolo at the Scientific workshop “Governance, Economics and Trade, Markets, Profitability of Planted Forests” held in Porto (15-17th April 2013) a Sustainable Forest Management toolbox is currently under development at FAO.

natural or semi-natural forests while planted forests and forest plantations are marginally considered. We argue that not enough attention is given by policy makers and scientists to forest plantations, both in developing standards and guidelines for assessing progresses towards sustainability and management performances and in evaluating their effects and effectiveness. Our paper, on the basis of a comparative analysis among selected documents, has three main objectives: i) to investigate whether and to which extent existing standards and guidelines for sustainable development (SD) and sustainable forest management (SFM) are specifically taking into consideration forest plantations; ii) to highlight similarities and differences among existing standards/guidelines in order to assess their different (potential) effectiveness in assuring sustainable management of forest plantations; and iii) to identify the main gaps existing between the analysed STDs/GLs and an “ideal list” of requirements for sustainable forest plantations which take into consideration all environmental, social, economic and procedural issues of their management, with the aim of identifying possible areas of improvement. In the following sections, our methodology, our results and related discussion, as well as our conclusions are presented.

2. Methodology

Our methodology is based on 4 steps: (1) existing STDs/GLs identification and classification; (2) creation of a “reference standard”; (3) STDs/GLs selection; (4) STDs/GLs assessment and comparison. These research steps are described in the following paragraphs.

2.1 Standards and guidelines identification and classification

We have identified a total number of 42 standards and guidelines for SFM and SD, following a previous study by Holvoet and Muys (2004). The list of standards provided by these Authors were reviewed and up-dated, in order to include both new initiatives and changes occurred within those already considered. In the list, forest certification standards developed by the Forest Stewardship Council (FSC) and the Programme for Endorsement of Forest Certification schemes (PEFC), standards from intergovernmental processes for SFM (e.g. Pan-European process, Tarapoto proposal, etc.), guidelines developed by international organisations such as FAO and ITTO, and by research institutes such as CIFOR have been included. These 42 standards and guidelines have been categorized into two main categories: “standards for certification” and “guidelines”. For the purpose of this study a *standard* is defined as “[...] a document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context” (ISO/IEC, 2004). They are typically used for assessing management practices and verify whether they can be certified as respecting the established rules (or not). According to the Oxford Dictionary of English a *guideline* can be defined as a general rule, principle, or piece of advice providing guidance to appropriate behaviour. Various guidelines have been developed to assist managers to design and undertake operations to meet more specific requirements defined by standards (Marjokorpi and Salo, 2007). Guidelines cannot be used as the basis for certification processes; they can only be used as recommended actions to address management decisions. Both standards and guidelines can be expressed as a set of principles and indicators (ITTO, 1993). This first criterion of

classification - i.e. the distinction between STDs and GLs - was functional to the selection of a limited number of STDs and GLs for the gap analysis (see par. 2.3).

Standards and guidelines have been classified also according to their purpose, level of application, geographical location of origin, type of forest and approach, as suggested by Lammerts Van Bueren and Blom (1997) and Holvoet and Muys (2004). This second group of classification criteria was functional to the understanding of attention devoted by policy makers and practitioners towards forest plantations in the different regions of the world and for the different purposes, while also updating the interesting analysis carried out by Holvoet and Muys about 10 years ago. An important characteristic for understanding the type of STD/GL is the prevailing approach of their Indicators, which can be mainly a system-based approach (SA) or a performance-based approach (PA). In the first case, there is a substantial prevalence of “descriptive Indicators”, which are used to describe forest resources and assess their changes over time (e.g. area covered by forest, number of endangered species, etc.), thus evaluating progresses towards more sustainability or reversion towards degradation of forest resources. Often, in a STD with a system-based approach, typical of ISO standards (such as ISO 14001 on Environmental Management System), there are several Indicators requiring the presence of management tools such as management plans, monitoring system, data file systems, etc. (without specifying the quality of such tools). In a performance-based approach, “prescriptive Indicators” are prevailing, i.e. they refer to pre-defined thresholds to be reached/respected (e.g. limitations in the use of exotic species, prohibition in the use of GMOs, etc.) (Franc *et al.*, 2001).

Each STD and GL has been analysed through their indicators in order to identify other 4 characteristics: 1) its *forest specificity* i.e. whether the STD or GL is specifically defined for the forest sector (or not). It is calculated as the ratio between the number of forest related indicators and the total number of indicators within the STD/GL; 2) its *plantations specificity*, i.e. relative importance of plantations-specific indicators within the STD/GL. It is calculated as the ratio between the number of plantations-specific indicators and the total number of indicators within the standard; 3) its *socio-economic relevance* and 4) its *environmental relevance*, i.e. the relevance and relative importance of respectively socio-economic and environmental aspects within the STD/GL. They are calculated as the ratio between the number of socio-economic or environmental indicators and the total number of indicators within the STD/GL.

2.2 Creation of a “reference standard”

A reference standard can be defined as a “*standardized object or system which is used as a measurement base for similar objects or systems*” (ISO/IEC, 2005). For the purpose of our study, the reference standard has been developed as a tool for the gap analysis, i.e. the comparison of a selected number of standards and guidelines which apply to forest plantations with respect to an ideal, full comprehensive list of existing SFM requirements. The reference standard is not intended for direct use for forest management assessment and field verification. It has been built up according to a structured hierarchical framework based on Principles, Criteria and Indicators (Lammerts van Bueren and Blom, 1997; CIFOR, 1999), which include also legal and institutional requirements at the level of principle (Ruitenbeek and Carter, 1998; Holvoet and Muys, 2004)²⁹. The reference standard was structured in 7 Principles, from

²⁹ Although someone (Lammerts van Bueren and Blom, 1997) strongly advises against this approach, the incorporation of legal and institutional requirements at the level of principle, as suggested by Ruitenbeek and Carter

A to G, 49 Criteria and a total number of 384 Indicators, which include the 308 Indicators identified by Holvoet and Muys in their study in 2004 and 76 other Indicators deducted from the 42 STD/GL explored for our study. In Table 1 a summary of the reference standard structure is reported; in Table 2, examples are reported as excerpts from the full list of Indicators.

Table 1 - Summary of the reference standard developed for our study

#	Principle	Number of Criteria	Number of Indicators
A	Policy and planning strive for sustainable and multifunctional forest management, and are being supported by legislation and facilities.	9	65
B	The surface, vitality and state of the forest resources will be maintained and protected, and where possible even improved.	5	55
C	The productive forest function will be maintained, by sustainable forest exploitation and by reassuring forest regeneration	5	37
D	Biodiversity and ecological processes will be maintained and protected, and where possibly strengthened.	17	94
E	Protective forest functions shall be maintained and protected, and where possible strengthened.	5	34
F	The sustainable forest management shall be economically viable and shall improve the conditions of local communities and local economies.	3	47
G	The social and cultural wellbeing of all stakeholders shall be maintained and protected, and shall be improved when necessary	5	52
Total		49	384

Source: own elaboration.

Table 2 – Examples of Indicators: excerpts from the reference standard

#	Indicator	Principle	Criteria
1	H. Forest management plan public accessible	A	A
2	D. Monitoring of land use change	B	A
3	D. Harvested volume by species	C	A
4	D. Monitoring of the use of exotic tree species and their impacts on the environment	D	G
5	D. Percentage of borders of water resources protected by a buffer	E	D
6	S. Workers rights to organise and negotiate	F	C
7	A. Existence of clearly defined and legal property rights and rights of use	G	A

Source: own elaboration

2.3 Standards and guidelines selection

Amongst the 42 STDs and GLs identified, three STDs and three GLs have been selected for a detailed analysis according to the aim of our study. Selection criteria included plantations specificity, purpose, geographical scope and relevance, and endorsement. First of all, STDs/GLs with a high plantations specificity index (equal to 1) were identified. The list included 11 potential “candidates”: CIFOR C&I for Sustainable

(1998) as well as by Holvoet and Muys (2004) is accepted in our framework for three main reasons: they are essential in achieving SFM; the majority of the considered standards or guidelines include elements related to legislation or institutional support at the highest level; and the topic of legality recently assumed a major role in forestry issues, in the wake of initiatives like the EU FLEGT Regulation and Timber Regulation, as well as the US Lacey Act.

Development of Industrial Tropical Tree Plantations, FAO Voluntary Guidelines for Responsible Management of Planted Forests, FSC standards for Brazil and Chile, ITTO Guidelines for the establishment and sustainable management of planted tropical forests, LEI SPFM standards, MTCC C&I for forest plantations and PEFC standards for Brazil, Chile, Italy and Spain. This list was divided into 2 groups, on the basis of STDs/GLs purposes: 1) standards intended for forest certification (such as FSC, PEFC, MTCC and LEI); and 2) guidelines (not intended for certification (CIFOR, FAO and ITTO)). All the GLs have been selected for our study. Amongst certification STDs, LEI standard was selected because it is the only forest certification initiative laying outside the FSC and PEFC systems with specific STDs for forest plantations; while MTCC was excluded being PEFC endorsed. Among FSC and PEFC STDs, priority was given to fully endorsed STDs³⁰ for forest plantations and relevance of forest plantations at country level in terms of both planted area and certified planted area³¹: STDs developed for Chile were chosen because of the importance of certified planted area in the country.

2.4 Standards and guidelines assessment and comparison (gap analysis)

Each of the 3 selected STDs or 3 selected GLs has been assessed - Indicator by Indicator - and compared both with the “reference standard” and with the other STDs or GLs. For this purpose, two different aspects for each Indicator have been taken into consideration. First of all, the *approach of the Indicator*, distinguishing between a prevailing performance-based approach (PA) or system-based approach (SA). A score (0, 0.5 or 1) was assigned to each Indicator: when the considered approach is lacking, “0” is given; when STD/GL covers the considered reference standard indicator partly by means of performance-based Indicators and of system-based Indicators, “0.5” is given; when the considered approach is predominant, “1” is given. Secondly, the *quality of the Indicator*, in terms of its coherency, consistency and completeness³² with respect to the relevant criterion. A score ranging from 1 (i.e. low coherence, consistency and/or completeness) to 5 (i.e. high coherence, consistency and/or completeness)³³ was given to each Indicator. In addition to Authors' evaluation, independent experts (n=3) were asked to run the same evaluation procedure by using the same scoring criteria. A mean value was calculated among the 4 evaluations for each Indicator; all Indicators values were finally summed up at the criterion level and plotted in bubble-charts. The relative position of bubbles on the chart indicates whether the correspondent criterion adopts a prevalently performance-based or system-based approach, while bubbles dimensions express the estimated quality for each analysed criterion. Assessment results have been summarised also at principle level and plotted on radar graphs to observe differences and similarities among the surveyed STDs/GLs. Finally, a gap analysis (e.g. Ferrucci,

³⁰ FSC *ad interim* standards, e.g. those under development for Brazil, were excluded.

³¹ The collection of data on certified forest plantations was quite difficult because available information are sometimes inaccurate. Mistakes were found in figures reported by the FSC international database. The PEFC international database was widely inconsistent since no specification exists about tree species in certified areas and type of certified forest (i.e. plantation or natural forest). Whenever possible, data were collected from websites belonging to national standard setting bodies (especially in the case of PEFC) and accredited certification bodies (in the case of FSC, data from the database were matched with those reported in public summaries of certification reports available online).

³² “Coherency” means whether the surveyed Indicator is in line with issues covered by the relevant criterion; “consistency” means whether it is in line with the purpose of the relevant criterion; “completeness” means whether it is able to cover all aspects raised by the relevant criterion.

³³ The terminology used to describe forest related subjects can differ strongly between standards and regions of the world (Dobbertin and Prüller, 2002). In our study, attention was mainly given to the presence/absence of elements, and not to their exact wording, except for the use of forms like “*shall/shall not*” or “*should/should not*”, where the first one was considered stricter and thus associated to a higher score.

2004; Hickey and Innes, 2005) has been conducted at criterion level, in order to identify the present position of STDs or GLs with respect to an “ideal position” represented by a defined benchmark. The final aim of this exercise is the identification of gaps between actual and potential performances of STDs/GLs, in order to suggest opportunities and future improvement areas to enhance operational efficiencies within an existing situation (Franklin, 2006). Two different benchmark standards, one for certification STDs and one for GLs, have been developed by extracting from the “reference standard” those Indicators covered by at least one of the surveyed certification STD (or GL). Each indicator within the benchmark standard has been given a default quality score equal to 5. Each surveyed certification STD (or GL) has been matched with the relevant benchmark standard and the gap value for each Indicator (i.e. the difference between the ideal maximum value of the indicator (5) and the value of the indicator as resulted from the assessment) has been calculated. Calculated gaps were summed-up at criterion level and normalized on a 1-100 scale; complementary values were then calculated for all of them. Results have been plotted on bar charts and analysed in details.

3. Results and discussion

Results are reported and discussed in the following sub-paragraphs: STDs/GLs classification (3.1); certification STD assessment and gap analysis (3.2); GLs assessment and gap analysis (3.3). Because of the need to maintain the length of the paper into acceptable limits, only part of the results are reported in detail as an example of the full analysis. In particular, Principles D (biodiversity) and G (social and cultural well-being of stakeholders) are presented and discussed for the certification standards; Principles A (legal framework) and F (economic viability and sustainable exploitation) for the Guidelines. Their analysis is enough complete to understand the general situation.

3.1 Standards and guidelines classification

The main characteristics of the 42 identified STDs and GLs are provided in Table 3. Only 11 STDs are specifically intended for forest plantations (26% of the total); even less are specifically for natural forests (4, corresponding to about 10% of the total), while the larger set of STDs (27, i.e. 64% of the total) are designed for natural forests but they also include Indicators for plantations. The number of STDs/GLs with a prevailing system-based approach (22) is slightly more high than the number of those with a dominant performance-based approach (20). Regarding their geographical location, 43% of STDs/GLs are from the North, 40% from the South, and 17% are for both areas. In terms of purpose, 48% of them are designed to be used as management requirements by forest certification schemes (e.g. assessing management practices in the field); 52% are intended for other uses (e.g. assessing changes in forest resources at country level). Being the purpose directly connected with the level of application, 47% of STDs/GLs are designed to be applied at forest management unit level (FMU), while 53% are to be applied at regional or national level (RN).

Table 3 – Main characteristics of the 42 identified standards and guidelines

#	STD or GL	Geographical location			Type of forest	Approach	Indicators (number)					F/T	E/T	S/T	P/T*
		Purpose	Level of application	Forest-related (F)			Total Indicators (T)			Plantations related (P)					
							Environmental (E)	Socio-Economic (S)							
1	CCBA	C	FMU	N	NF+P	PA	86	65	30	34	Potentially 1 to 13	0.756	0.349	0.395	0.012
2	CIFOR C&I generic template	I	RN	S	NF+P	SA	98	98	24	59	0	1.000	0.245	0.602	0.000
3		I	RN	S	P	SA	52	52	16	32	52	1.000	0.308	0.615	1.000
4		I	RN	S	NF+P	SA	49	49	16	26	2	1.000	0.327	0.531	0.041
5		I	RN	S	NF+P	SA	47	47	17	28	3	1.000	0.362	0.596	0.064
6		I	RN	S	NF+P	SA	48	48	16	30	2	1.000	0.333	0.625	0.042
7		I	RN	N	NF+P	SA	169	4	115	54	0	0.024	0.680	0.320	0.000
8		I	RN	N+S	P	SA	95	95	33	51	95	1.000	0.347	0.537	1.000
9	FLO generic HL	C	FMU	N+S	NF+P	PA	156	5	51	105	0	0.032	0.327	0.673	0.000
10	FLO generic SPO	C	FMU	N+S	NF+P	PA	104	5	51	53	0	0.048	0.490	0.510	0.000
11	FLO Timber	C	FMU	N+S	NF+P	PA	100	90	14	68	5	0.900	0.140	0.680	0.050
12	FSC P&C	C	FMU	N+S	NF+P	PA	56	56	23	24	56, 9 specific	1.000	0.411	0.429	0.161
13	FSC Brasil	C	FMU	S	P	PA	143	143	45	62	143	1.000	0.315	0.434	1.000
14	FSC Chile	C	FMU	S	P	PA	224	224	93	88	224	1.000	0.415	0.393	1.000
15	FSC Italy	C	FMU	N	NF+P	PA	162	162	64	66	162, 28 specific	1.000	0.395	0.407	0.173
16	FSC Spain	C	FMU	N	NF+P	PA	164	164	77	52	164, 38 specific	1.000	0.470	0.317	0.232
17	IFOAM Basic standards	C	FMU	N+S	NF+P	PA	103	5	53	15	2	0.049	0.515	0.146	0.019
18	IFOAM Draft BoD-Landscape.	C	FMU	N+S	NF+P	PA	30	9	24	6	Potentially 10 to 12	0.300	0.800	0.200	0.667
19	ILO	I	FMU	N	NF+P	PA	732	732	0	732	3	1.000	0.000	1.000	0.004
20	ITTO Guidelines Planted For.	I	RN	S	P	SA	75	75	33	28	75	1.000	0.440	0.373	1.000
21		I	RN	N	NF+P	SA	21	4	21	0	0	0.190	1.000	0.000	0.000
22		I	RN	S	NF+P	SA	85	85	47	32	7	1.000	0.553	0.376	0.082
23	LEI-SPFM	C	FMU	S	P	PA	67	67	20	40	67	1.000	0.299	0.597	1.000
24	Lepaterique (C. America) NL	I	RN	S	NF+P	SA	53	53	13	28	3	1.000	0.245	0.528	0.057
25	Lepaterique (C. America) RL	I	RN	S	NF+P	SA	40	40	10	24	2	1.000	0.250	0.600	0.050
26	Montreal Process	I	RN	N	NF	SA	64	64	20	31	0	1.000	0.313	0.484	0.000
27	MTCC	C	FMU	S	P	PA	105	105	45	41	105	1.000	0.429	0.390	1.000
28	Near-East Process	I	RN	N	NF+P	SA	65	65	17	37	8	1.000	0.262	0.569	0.123
29	OECD	I	RN	N	NF+P	SA	64	7	40	24	0	0.109	0.625	0.375	0.000
30	ATO/ITTO PCI	C	RN	S	NF	SA	80	80	15	40	0	1.000	0.188	0.500	0.000
31	PEFC C&I (PAN-EU)	C	RN	N	NF	SA	27	27	15	11	0	1.000	0.556	0.407	0.000
32		C	FMU	S	P	PA	100	100	37	33	100	1.000	0.370	0.330	1.000

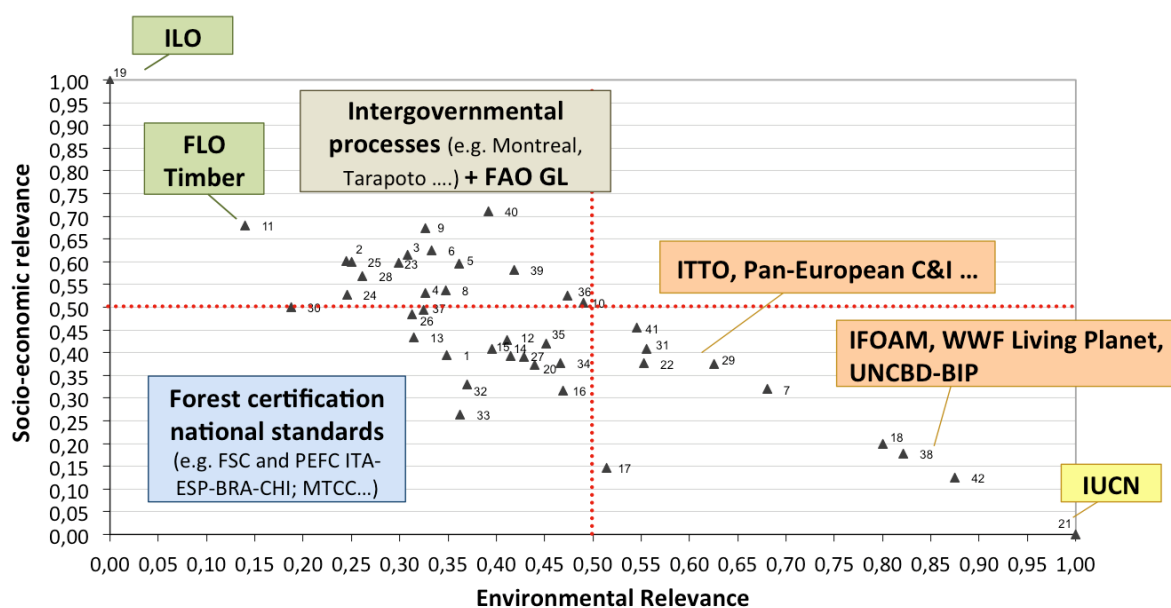
33		PEFC Chile	C	FMU	S	P	PA	193	70	51	193	1.000	0.363	0.264	1.000
34		PEFC Italy	C	FMU	N	P	PA	45	21	17	45	1.000	0.467	0.378	1.000
35		PEFC Spain	C	FMU	N	NF+P	PA	31	14	13	Potentially 31	1.000	0.452	0.419	1.000
36		Rainforest Alliance SAN	C	FMU	N	P	PA	500	237	263	8	0.044	0.474	0.526	0.016
37		Tarapoto Process	I	RN	S	NF	SA	77	25	38	0	1.000	0.325	0.494	0.000
38		UNCBD-BIP	I	RN	N	NF+P	SA	28	23	5	0	0.214	0.821	0.179	0.000
39		UNCTAD - Bio Trade	I	RN	N	NF+P	PA	55	23	32	Potentially 1 to 8	0.109	0.418	0.582	0.018
40		UNDSO	I	RN	N	NF+P	SA	97	38	69	0	0.031	0.392	0.711	0.000
41		WB (WDI)	I	RN	N	NFP	SA	99	54	45	0	0.071	0.545	0.455	0.000
42		WWF Living planet	I	RN	N	NFP	SA	8	7	1	0	0.375	0.875	0.125	0.000

Legend: C = certification; I = intergovernmental processes or other purposes; RN = regional/national level; FMU = forest management unit level; N = North; S = South; N+S = both North and South; NF = natural forests; P = only forest plantations; NF+P= both natural forests and forest plantations; PA = performance based approach; SA = system based approach. * P/T: the ratio has been calculated considering the lowest within P possible values (e.g. in the case of CCBA, a P = 1 value has been considered). Acronyms of STDs/GLs names: (1) Climate, Community and Biodiversity Alliance, CCBA; (2) Center for International Forestry Research Criteria and Indicators; (3) Center for International Forestry Research Criteria and Indicators; (4); (31) Program for the Endorsement Forest Certification, Pan-European Criteria and Indicators, PEFC C&I (PAN-EU); (36) Rainforest Alliance Sustainable Agriculture Network, Rainforest Alliance SAN; (37) Tarapoto Process; (38) United Nations Convention on Biological Diversity and Biodiversity Indicators Partnership, UNCBD-BIP; (39) United Nations Conference on Trade and Development Bio Trade Initiative, UNCTAD - Bio Trade; (40) United Nations Commission for Sustainable Development, UNDSO; (41) World Bank World Development Indicators, WB (WDI); (42) World Wildlife Conservation Living Planet, WWF Living Planet.

Source: own elaboration.

The STDs/GLs can also be analysed in terms of their environmental (ER) and socio-economic relevance (SR) (Figure 1). Three clusters (A, B and C) can be identified. Cluster A includes standards or guidelines with a clear focus on socio-economic issues (SER value from 0.264 to 0.625), such as ILO standards, FLO Timber standards, several standards developed by Intergovernmental processes (e.g. Montreal, Tarapoto) and the FAO Guidelines for planted forests. Cluster B includes STDs designed for forest certification, where the attention towards socio-economic and environmental aspects is more balanced (ER from 0.327 to 0.680; SER from 0.320 to 0.711); this cluster includes FSC international and national standards, with the exception of Smartwood *ad interim* FSC standards for Brazilian plantations, PEFC national standards for Brazil, Chile, Italy and Spain and the MTCC standards for plantations. Cluster C, where the focus of the STDs/GLs is on environmental issues rather than on socio-economic issues, includes the ATO/ITTO Guidelines for the establishment and sustainable management of planted tropical forests and the Pan-European C&I. Others are even more focused on environmental issues, such as the IFOAM Basic standards, WWF Living Planet, IUCN-ITTO standards.

Figure 1 - Distribution of the 42 standards/guidelines according to their socio-economic (SER) and environmental relevance (ER)



Source: own elaboration.

ILO Code of Practice on Safety and Health in Forestry Work is totally included within FSC Principles and Criteria and shall be part of national standard setting process and certification assessment (FSC, 2002 and 2002a). It is also "[...] recognised as a helpful document, which should be considered when developing national and regional certification criteria" by the PEFC Technical Document (PEFC, 2007). FLO standards for timber can be used only together with FSC standards for smallholders (i.e. the so called Small and Low Intensity Managed Forests (SLIMF) standards) (FLO, 2010). As for CCBA, it is the only carbon standards included in the list. It is quite well balanced in terms of both environmental and socio-economic relevance, but both ER and SER show values between 0.35 and 0.4 because a relevant amount of indicators within the standard is

dedicated to the definition of requirements that are specific for carbon projects (e.g. methodologies for calculating carbon stocks).

3.2 Certification standards assessment and gap analysis

In Table 4, the Indicators distribution of the three surveyed certification STDs (FSC-Chile, LEI and PEFC-Chile³⁴ i.e. Certfor) respectively in absolute values and percentage is summarized. Their distance from the “reference standard” list in terms of number of indicators is reported per Principle. While FSC-Chile STD Indicators cover 50.3% of all the Indicators listed in the “reference standard”, PEFC-Chile STD cover 45.8% and LEI STD only 19.3%. Figures, however, vary significantly depending on the Principle. For example, in Principle E (Protective functions of forests) the 10 FSC Indicators cover only 29.4% of the reference standard Indicators, with a gap of 70.6% with respect to an ideal set of standards for forest plantations; in Principle C (Productive function of forests and sustainable exploitation), the 25 FSC Indicators cover 67.6% of the 37 reference standard Indicators (with a gap of 32.4%). In the same way, in Principle G (Social and cultural well-being of stakeholders), the 25 PEFC-Chile indicators cover 48.1% of the 52 total indicators in the reference standard, while the 23 FSC-Chile indicators cover 44.2% of them. In general terms, FSC-Chile has a leading position (i.e. less gaps with respect to the ideal reference standard) in 5 out of 7 Principles, while PEFC-Chile in 2 of them (Principles E and G). LEI STD shows the highest gaps with respect to both FSC and PEFC standards in all Principles except Principle E, which relevance is underestimated by FSC-Chile STD. Even if these preliminary observations are merely quantitative (e.g. based on analysis of differences in terms of number of Indicators per Principle in the various standards), they already provide an idea of the general orientation of each certification standard with respect to the main environmental, social and economic issues connected with sustainable management of forest plantations.

³⁴ Unless differently stated, when speaking about PEFC reference is made to Certfor (i.e. PEFC-Chile) and corresponding standards, while when speaking about FSC reference is made to FSC-Chile and corresponding standards.

Table 4 - Indicators in the 3 assessed certification standards with respect to the “reference standard” indicators, per Principle

Principle	Reference standard indicators (RI) (number)	FSC-Chile				LEI				PEFC-Chile			
		In absolute values		In %		In absolute values		In %		In absolute values		In %	
		Total (T)	RI-T	T/RI	(RI - T)/RI	Total (T)	RI-T	T/RI	(RI - T)/RI	Total (T)	RI-T	T/RI	(RI - T)/RI
A	65	40	25	61.5	38.5	7	58	10.8	89.2	33	32	50.8	49.2
B	55	31	24	56.4	43.6	5	50	9.1	90.9	27	28	49.1	50.9
C	37	25	12	67.6	32.4	8	29	21.6	78.4	22	15	59.5	40.5
D	94	44	50	46.8	53.2	12	82	12.8	87.2	34	60	36.2	63.8
E	34	10	24	29.4	70.6	14	20	41.2	58.8	16	18	47.1	52.9
F	47	20	27	42.6	57.4	15	32	31.9	68.1	19	28	40.4	59.6
G	52	23	29	44.2	55.8	13	39	25.0	75.0	25	27	48.1	51.9
Total	384	193	191	50.3	49.7	74	310	19.3	80.7	176	208	45.8	54.2

Source: own elaboration.

Detailed assessment results are reported only for Principle D on biodiversity and the role of forests and forest management in ecological processes and Principle G on social and cultural well-being of stakeholders (Table 5). In the case of Principle D, due to the high number of criteria, overlapping is frequent (see for example criteria DE, DJ and DL). As for the latter (waste removal from the ecosystem), the three standards have similar results, with LEI showing a (slightly) lower quality output. In the case of accidental introduction or spreading of non-indigenous species (criterion DJ) and management of game and fish populations (DE), LEI does not have Indicators, while FSC-Chile and PEFC-Chile are almost coincident, with the first showing larger bubbles because it includes indicators like the existence of clear and strict procedures and protocols to prevent introduction and spreading of non-indigenous species (indicator DJA); and the implementation of control on illegal hunting and fishing. Criterion DE is in connection with criterion DG, where FSC-Chile is the only standard providing specific indicators for regulations concerning the mixture of species and the use of exotic ones in regeneration activities. Criteria DA and DK show similar situations with PEFC prevailing on the other standards mainly because of the presence of specific requirements for staff training on biodiversity issues and the presence of a person in charge for both biodiversity aspects and the control of pests and diseases. In the case of DK, however, FSC is the only standard asking for priority given in the use of organic and biological fertilization methods. As for criteria DC and DA, they represent two relevant gaps for LEI that does not explicitly ask for avoiding the establishment of forest plantations in primary/native forest areas nor for the conservation and preservation of primary/native forests remnants. In a country, as Indonesia, with high deforestation rates and a growing pressure from forest plantations this seems to be a strong deficiency. These seems to be confirmed by the fact that both FSC and PEFC Chilean standards stress on the point of designing plantations in order to reduce pressure over natural forests, by carefully selecting and managing the project site, the layout and species composition, while LEI has just a general system-based requirement for careful selection of sites, species and genotype adapted to local conditions. Finally a remarkable aspect is that none of the standards shows indicators for criteria from DM to DP. This is probably due to the fact that this set of criteria refers to very technical aspects dealing with microclimate

parameters, silvicultural practices (e.g. crown cover density or natural stem reduction) and ecological issues (monitoring of climatic parameters), that in many cases are covered by best practices, technical codes/manual or even normative requirements.

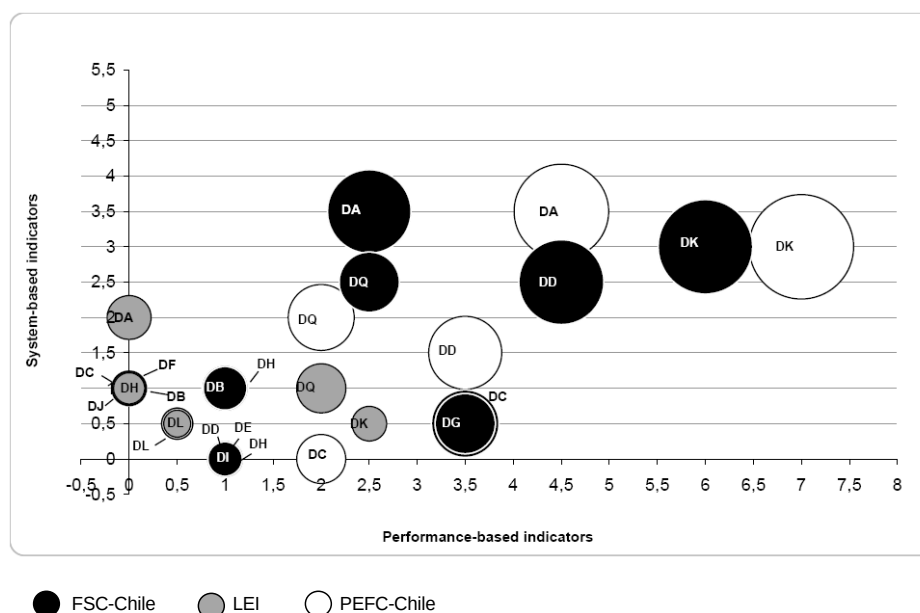
Table 5 - Assessment of the 3 surveyed certification standards against the reference standard per Criterion - Principles D and G

Reference criterion	FSC-Chile			LEI			PEFC-Chile		
	P	S	Q	P	S	Q	P	S	Q
Principle 4 - D. Biodiversity and ecological processes shall be maintained and protected, and where necessary restored									
DA	2.5	3.5	29	0	2	8	4.5	3.5	37
DB	1	1	9	0	0	0	0	1	5
DC	3.5	0.5	19	0	1	5	2	0	10
DD	4.5	2.5	30	1	0	4	3.5	1.5	22
DE	1	0	5	0	0	0	1	0	3
DF	0	1	5	0	0	0	0	0	0
DG	3.5	0.5	15	0	0	0	0	0	0
DH	1	1	8	0	1	4	1	0	5
DJ	0	1	5	0	0	0	0	1	4
DK	6	3	37	2.5	0.5	5	7	3	45
DI	1	0	5	0	0	0	0	0	0
DL	0.5	0.5	4	0.5	0.5	3	0.5	0.5	4
DM	0	0	0	0	0	0	0	0	0
DN	0	0	0	0	0	0	0	0	0
DO	0	0	0	0	0	0	0	0	0
DP	0	0	0	0	0	0	0	0	0
DQ	2.5	2.5	15	2	1	10	2	2	18
Sub-Total	27.00	17.00	171	6.00	6.00	29	21.50	12.50	135
Principle 7 - G. Social and cultural well-being of stakeholders									
GA	6.5	2.5	38	4	1	17	2.5	2.5	19
GB	1.5	1.5	13	0	2	6	2	2	17
GC	1.5	1.5	10	2	0	6	3.5	1.5	21
GD	1.5	0.5	10	0	0	0	2.5	1.5	12
GE	3.5	2.5	25	2	2	10	5	2	31
Sub-Total	14.50	8.50	96	8.00	5.00	39	15.50	9.50	100

Legend: P= performance-b. approach; S = system-b. approach; Q = general quality in terms of coherence, consistency and completeness with respect to the reference standard,

Source: own elaboration.

Figure 2 - Assessment and comparison of the 3 surveyed certification standards against the reference standard, per Criterion - Principle D



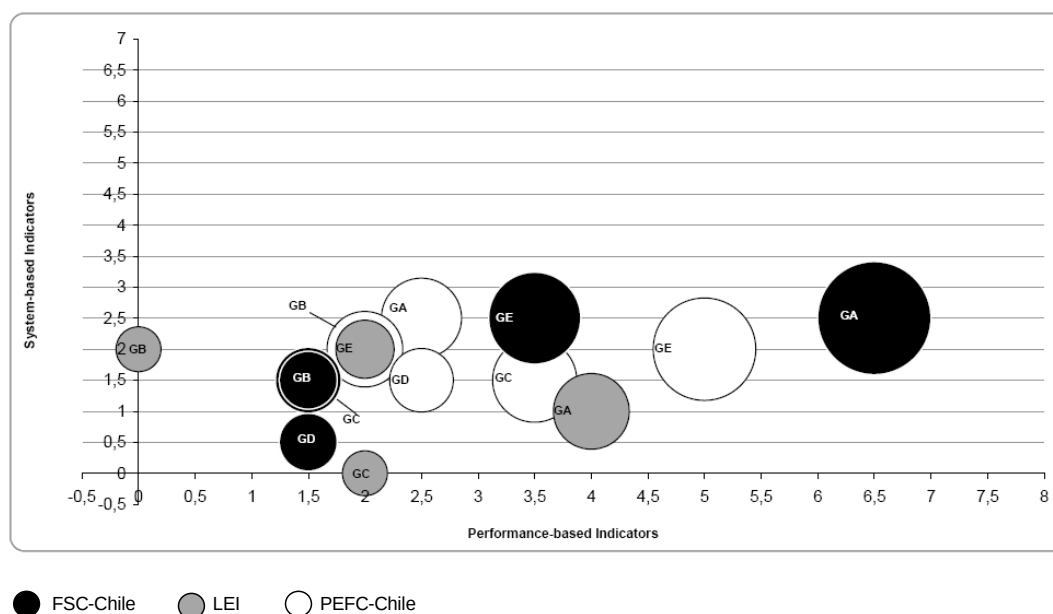
Notes - Overlapping of the following bubbles: (0,1) FSC: DF and DI; LEI: DC and DH; PEFC: DB and DJ; (1,0) FSC: DE and DI; LEI: DD; PEFC: DE and DH; (1,1) FSC: DB and DH; (3.5, 0.5) FSC: DC and DG.

Source: own elaboration

For Principle G (social and cultural well-being of stakeholders), relevant differences among the three standards can be identified (Table 5 and Figure 3). In land use and property rights issues (criterion GA), for example, FSC-Chile shows higher values in terms of both performance-based indicators and quality of indicators. This is mainly due to the strong relevance given to land property and use rights, with reference to both legal and traditional ones, including rights for accessing the forest and collecting products. FSC-Chile STD states that, on the basis of agreed mechanisms, forest managers shall allow neighbouring communities to profit harvest residues and other forest associated products if they do not interfere in the forest management activities. As for efficient communication between stakeholders (criterion GC), while all standards have requirements for distributing information on adopted forest management activities, as

well as for the definition and implementation of procedures for conflicts resolution within stakeholders, LEI and PEFC-Chile ask forest managers to produce periodic reports on forest management practices. In the issue of absence of negative consequences for the health and well-being of people (criterion GE), FSC-Chile and PEFC-Chile show better results in comparison to LEI, which is basically focused on the existence of procedures for guaranteeing health and safety and statistics on accidents in the forest area. FSC and PEFC are almost super-imposable, but PEFC includes an extra indicator asking forest managers to develop and implement a strategy to protect the lives and properties of local inhabitants from fire in plantations. As a final remark, LEI has no indicators for Criterion GD that reads: Forest management pays sufficient attention to cultural, recreational, spiritual and archaeological values.

Figure 3 - Assessment and comparison of the 3 surveyed certification standards against the reference standard per Criterion - Principle G



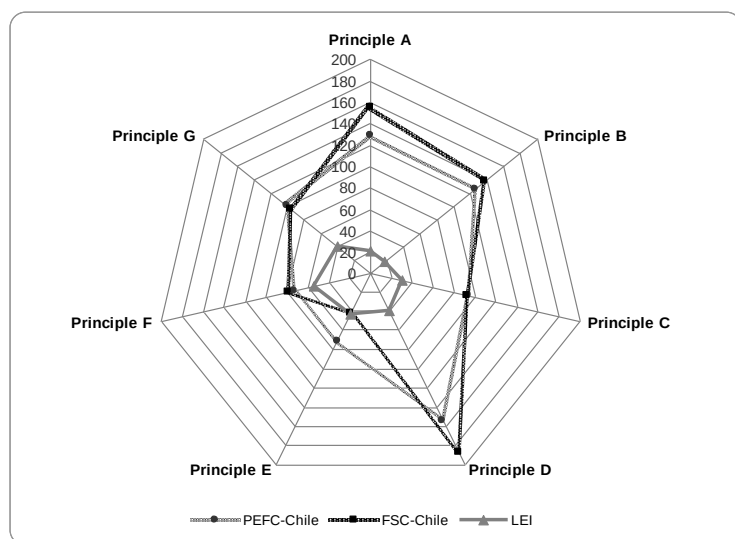
Notes - Overlapping of the following bubbles: (1.5,1.5) FSC: GB and GC; (2,2) LEI: GE; PEFC: GB.

Source: own elaboration

The comparison of the 3 selected STDs, summarised at Principle level, in terms of the overall quality of Indicators is reported in Figure 4. The quality of FSC-Chile STD prevails in Principles A (compliance with law and policy), B (forest health, vitality and extent), D

(biodiversity). The quality of PEFC-Chile STD is higher in Principle G. While these two STDs show very similar profiles for Principle C (Productive forest function and sustainable exploitation), and limited difference can be noticed also for the other Principles, LEI shows the lowest results, with the only exception of Principle F (Economic viability and improvement of local communities and economies). The analysis shows that the key-issues where all the 3 selected STDs for plantations should be improved, both in terms of number of indicators and their quality, are those covered by Principles C, E (Protective forest functions), F and G.

Figure 4 - Quality of indicators for the 3 surveyed forest certification standards with respect to the “reference standard”, per Principle



Source: own elaboration.

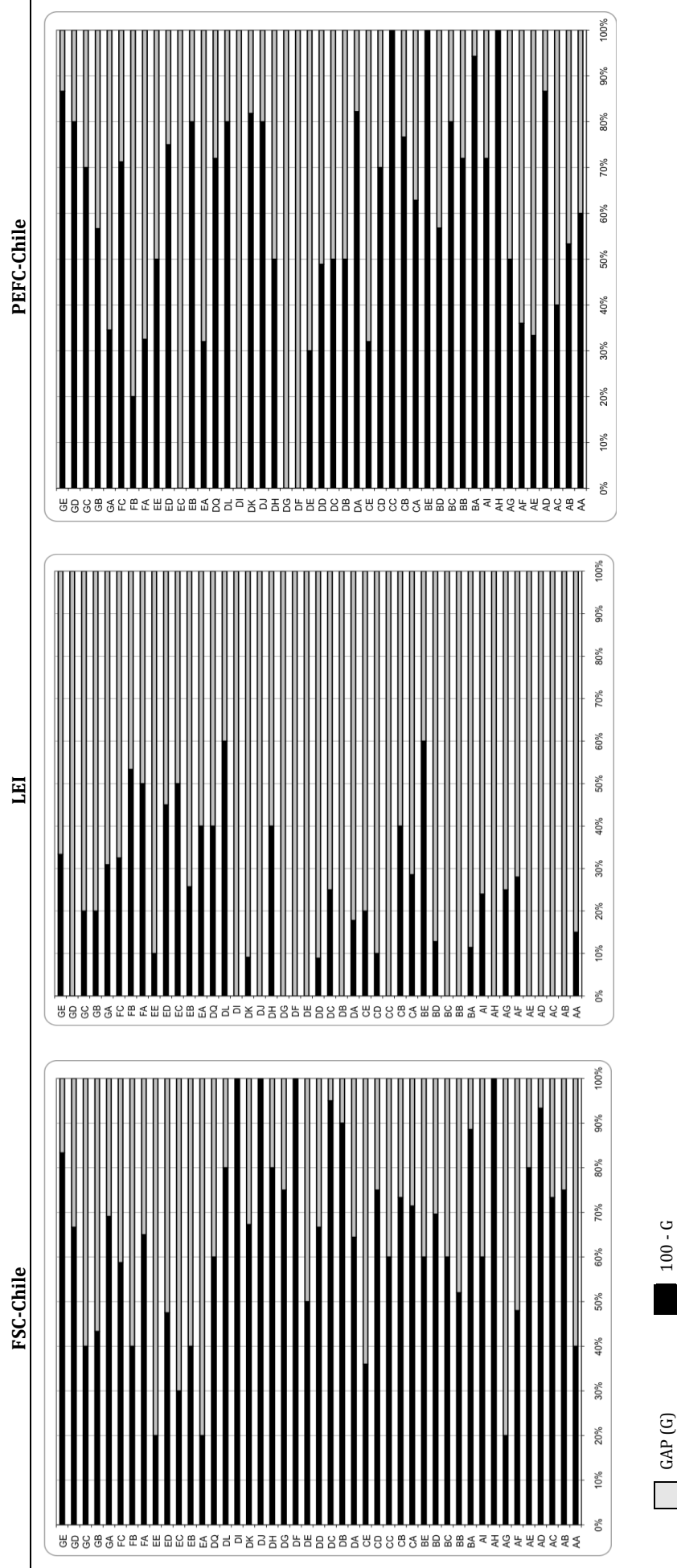
Finally, the *gap analysis* results for certification STDs is summarized in Figure 5. LEI standards for plantations show the biggest gaps. On a total of 45 criteria included in the benchmark standard, LEI covers 30, while no indicators are developed for 15 criteria, mainly referring to Principles A (4 full gaps) and D (5 full gaps), i.e. indicators are lacking with reference to the legal, policy and institutional framework and to biodiversity and forest ecological services. In particular, with reference to Principle A, LEI appears to be devoid of clear requirements about forest planning (e.g. with reference to minimum contents of forest management plans, as well as to revision of the plan itself), monitoring (e.g. frequency and accuracy of monitoring activities, as well as inclusion of forest results in planning activities), clear definition of forest management objectives and mechanisms to manage possible conflicts between certification requirements and law. As for Principle D, LEI is missing effective mechanisms for the identification of ecosystems and landscapes with high biodiversity value and measures for managing fauna resources (game and fish). Procedures to help natural regeneration are also missing: this may seem quite obvious when speaking about forest plantations, where regeneration is, by definition, artificial, but it may suggest a different conception of forest plantations if compared to the one adopted by other forest certification STDs, where forest plantations are only allowed when they lower the pressure on existing natural forests and when they are not replacing them, and/or when they create socio-economical benefits without significant negative impacts. This is confirmed also by the fact that LEI standards miss requirements to prefer the use of local species instead of exotic ones and measures to control and minimize the (accidental) introduction of non

indigenous plants, animals, plagues or diseases. No indicators at all are available for prevention and monitoring with reference to potential forest damages (criteria BB and BC); monitoring of forest regeneration (criterion CC) and attention to cultural, recreational, spiritual and archaeological values (criterion GD). Even where indicators are available, there are evident weaknesses as in the case of several criteria within Principle D as for example biodiversity conservation through proper plantation planning, sound use of chemicals and protection/restoration of natural ecosystems. For example no requirement exists about the presence of an area within the forests estate to be released for natural evolution. Serious gaps can be noticed also in the adoption of sound harvesting and planting techniques (Principle C) and in the stakeholders involvement and participation, transparency and efficiency in communication (criteria GB and GC).

In the case of *PEFC standards for Chile*, full gaps regard 4 criteria, 3 of which belong to Principle D (biodiversity) and one to Principle E. With regard to the first, PEFC-Chile is completely missing indicators regarding the support to natural regeneration, the use of native species and the strict control over the use of biological agents. Another full gap is related to maintenance of water quality through forest management (criterion ED), although other criteria cover descriptive requirements for this issue (e.g. percentage of forest area managed for restoration or protection of water quality). Minor gaps can be identified with reference to economic and financial planning related to forest management, basically in terms of active and direct promotion of forest products on the market, including market analysis and marketing practices (criteria FA and FB), protection and maintenance of soil quality (EA), management of fauna (DE), adoption of sound operations for forest plantation establishment and management (CE) with special reference to planning of site preparation to minimize negative impacts and the use of vegetation strips to contain the spread of diseases. Minor gaps can be identified also with reference to a couple of criteria included in Principle A and dealing with modalities for conducting monitoring activities (i.e. accuracy, frequency and reporting) and mechanisms for resolving potential conflicts between certification requirements and law. Finally, 3 criteria reached the benchmark level: AH (area use and use intensity of existing infrastructures), CA (sustainable production of wood forest products) and CC (forest regeneration).

With reference to *FSC standards for Chile*, no full gaps can be identified, while on the contrary 4 criteria fulfilled the benchmark requirements: 3 of them regard Principle D, i.e. biodiversity issues, an area where - contrary to what has been observed for LEI and PEFC - no significant gaps seem to exist. The last fulfilled criterion is about the adequacy of infrastructure, as in the case of PEFC. Minor gaps are mainly concentrated in Principle E, with special reference to criteria EA, EC and EE. In the case of EA (soil quality is maintained and protected), gaps regard availability of clear data about areas within the forest estate characterised by soil loss and erosion, and a similar situation can be observed in the case of EC (lack of percentage figures about water bodies with significant change in water quality). Criterion EE, dealing with the role of forests in the carbon cycle, represents a potential area of future improvement. Another minor gap regards the increased use of research outputs and new technologies within forest management (criterion AG), which however seems more an institutional gap rather than a technical one. Finally it shall be observed that some space for improvement exists in the case of Principle G, where for example FSC could adopt one of the tools already implemented by PEFC in Chile, i.e. a periodic public report on forest management activities and results provided by the forest managers.

Figure 5 – Gap analysis of the 3 surveyed forest certification standards with respect to the “reference standard” for forest plantation management



Source: own elaboration.

3.3. Guidelines assessment and gap analysis

The three selected Guidelines for forest plantations management are those developed respectively by CIFOR, FAO and ITTO. According to the first part of analysis (Table 7), none of the GLs' number of Indicators overcomes 35% of the total number of reference standard Indicators, with CIFOR covering less than 20% (with 77 Indicators out of 384), FAO covering 34.9% (134 indicators out of 384) and ITTO covering 32.8% (126 Indicators).

Table 7 - Indicators in the 3 assessed guidelines with respect to the "reference standard" indicators, per Principle

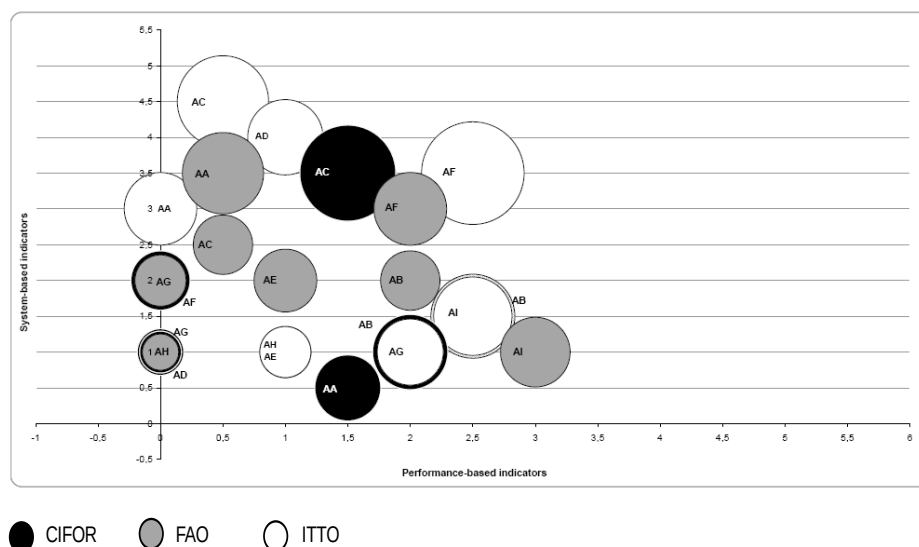
Principle	Reference standard indicators (RI) (number)	CIFOR				FAO				ITTO			
		In absolute values		In %		In absolute values		In %		In absolute values		In %	
		Total (T)	RI-T	T/RI	(RI - T)/RI	Total (T)	RI-T	T/RI	(RI - T)/RI	Total (T)	RI-T	T/RI	(RI - T)/RI
A	65	14	51	21.5	78.5	30	35	46.2	53.8	34	31	52.3	47.7
B	55	6	49	10.9	89.1	13	42	23.6	76.4	20	35	36.4	63.6
C	37	12	25	32.4	67.6	14	23	37.8	62.2	13	24	35.1	64.9
D	94	12	82	12.8	87.2	30	64	31.9	68.1	28	66	29.8	70.2
E	34	4	30	11.8	88.2	12	22	35.3	64.7	8	26	23.5	76.5
F	47	13	34	27.7	72.3	17	30	36.2	63.8	9	38	19.1	80.9
G	52	16	36	30.8	69.2	18	34	34.6	65.4	14	38	26.9	73.1
Total	384	77	307	19.8	80.2	134	250	34.9	65.1	126	258	32.8	67.2

Source: own elaboration.

Principle A covers a relevant role in all the three selected GLs. Bubbles (Figure 6) are concentrated on the down-left corner of the chart, i.e. on average they lay on medium-low system-based values and low performance-based ones. Three groups of criteria (Table 8) can be identified. In the first one, including criteria AA and AC, CIFOR shows higher performance-based values than FAO and ITTO (low or null values), but for criterion AA the overall quality of its indicators is lower and for criterion AC it is higher. This is due mainly to the fact that, while asking for policy and planning to include all necessary elements for monitoring and evaluation of current forest management, it requires the availability of historical data on forests management in the area, the incorporation of outcomes from studies and analyses related to all forest functions into planning and the definition of a plan for resources requirement and allocation. The second group includes criteria AF and AB, with different situations. In the case of criterion AF, ITTO prevails for all three dimensions, with FAO and CIFOR having similar sizes but different positions: the first one shows higher values in terms of performance-based indicators, while the second one is characterised by pure system-based approach indicators. The prevalence of ITTO is mainly connected to the request for the presence of an administration responsible for forest management of all forest resources, with adequate capacities in terms of financial resources, staff, expertise and equipments. As for criterion AB (presence and implementation of a forest management plan), the three guidelines are quite similar to each other, but ITTO prevails because it asks for a periodic revision of the plan on the basis of monitoring results. The third group includes criteria AE, AH and AI, for which indicators are available only in FAO and ITTO GLs, not in CIFOR. For criterion AE both GLs show the same performance level, but FAO has both

a bigger system-based dimension and size, due to the fact that its GLs ask for the definition of mechanisms for conflict solving between legislation and standard demands as well as for regular revision of policy and legislation. This might be due to the fact that while CIFOR and ITTO GLs date back to the Nineties, FAO GLs were published in 2006 thus taking advantage of new knowledge about forest policy and practices effectiveness developed in the meanwhile.

Figure 6 - Assessment of the 3 surveyed guidelines against the reference standard, Principle A



Notes - overlapping of the following bubbles: (0,1) CIFOR: AD and AG; FAO: AH; (1,1) ITTO: AE and AH; (0,2) CIFOR: AF; FAO: AG; (2,1) CIFOR: AB; ITTO: AG.

Source: own elaboration.

Table 8 - Assessment of the 3 surveyed guidelines against the reference standard, Principles A and F

Reference criterion	CIFOR			FAO			ITTO		
	P	S	Q	P	S	Q	P	S	Q
Principle 1 - A. Legal, policy and institutional framework, forest planning									
AA	1.5	0.5	10	0.5	3.5	15	0	3	12
AB	2	1	13	2	2	8	2.5	1.5	16
AC	1.5	3.5	21	0.5	2.5	8	0.5	4.5	19
AD	0	1	5	0.5	3.5	12	1	4	13
AE	0	0	0	1	2	9	1	1	6
AF	0	2	8	2	3	12	2.5	3.5	24
AG	0	1	4	0	2	6	2	1	10
AH	0	0	0	0	1	3	1	1	6
AI	0	0	0	3	1	11	2.5	1.5	14
Sub-Total	5	9	61	9.5	20.5	84	13	21	120
Principle 6 - F. Forest management shall be economically viable and shall improve the conditions of local communities and local economies									
FA	0	1	4	3	3	20	1.5	3.5	19
FB	0	0	0	0	3	11	0	0	0
FC	10	2	51	6.5	1.5	23	3	1	14
Sub-Total	10	3	55	9.5	7.5	54	4.5	4.5	33

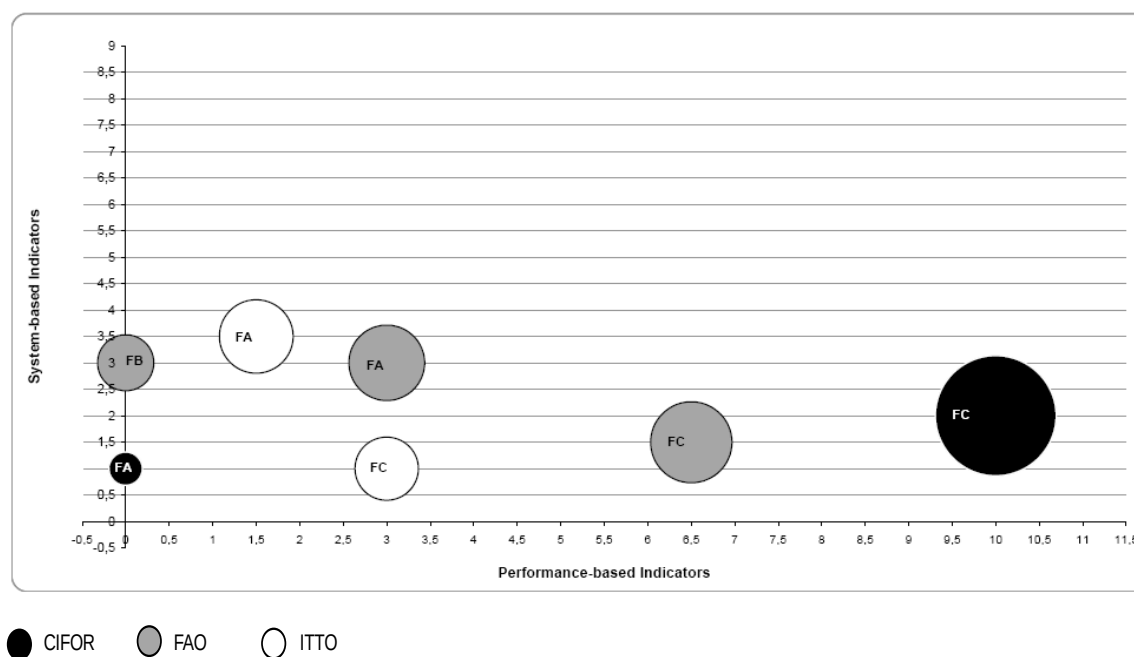
Legend: P= performance-b. approach; S = system-b. approach; Q = general quality in terms of coherence, consistency and completeness with respect to the reference standard,

Source: own elaboration.

When considering Principle F (Table 8 and Figure 7), no overlapping can be observed and three groups can be clearly identified. Criterion FA has a prevalent system-based approach, including requirements for economic viability of forest management and

improvement of conditions for local communities and local economies. FAO and ITTO show similar results, clearly prevailing on CIFOR that only covers requirements for the maximisation of the efficiency of management operations. Criterion FB is only covered by FAO, by asking for economic incentives to promote sustainable forest management at local/national level, including investments in research, development and education on forestry issues. The approach of indicators in this case is clearly system-based. With reference to criterion FC, CIFOR dominates the scene from any point of view. While ITTO guidelines limit themselves to ask for compliance with existing labour laws and regulation (without directly mentioning ILO conventions³⁵) and to assure the right to employment and training for local and/or indigenous communities, FAO also includes requirements for safety and health and for guaranteeing negotiation and association rights. CIFOR extends these requirements by including indicators dealing with a clear definition and communication of rights and responsibilities of both forest manager and local communities, as well as the development and real improvement of operational guidelines and training for health and safety procedures. These include cooperation with public health authorities regarding illnesses related to forest management, the use of equipment and the establishment of camps for forestry workers, with special reference to hygiene issues. CIFOR also includes a requirement for equitable distribution and presence of economic rent.

Figure 7 - Assessment of the 3 surveyed guidelines against the reference standard, Principle F



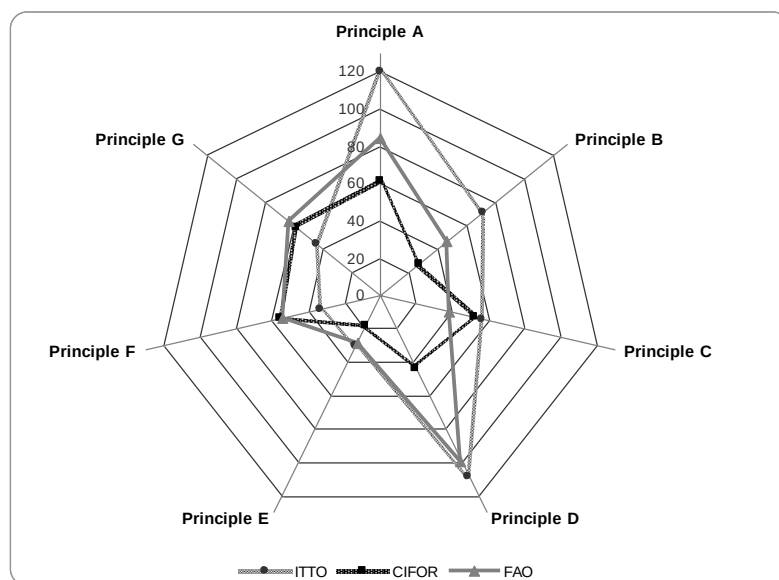
Source: own elaboration

GLs assessment results have been summarised at principle level and plotted on a radar chart (Figure 8). ITTO guidelines play a leading role with reference to Principles A to D, although in the case of Principle C CIFOR guidelines are very closed to them, and in the case of Principles D and E FAO GLs show similar results. In other words, ITTO GLs seem to prevail when speaking about compliance with law and general descriptive

³⁵ Contrary to ITTO, both FAO and CIFOR directly mention ILO conventions and regulations.

requirements to define a global picture of forest resources, including figures on extent, general conditions, health *status* etc. The relatively low results of FAO GLs with reference to these same principles can be justified by the different reference-scale - broader in the case of FAO – and by the fact that FAO GLs include direct and continuous links to regional, national or local legislation and regulations. In the case of Principles F and G, ITTO GLs are quite far from FAO and CIFOR ones, with CIFOR showing a prevalent development of its indicators in the field of social and socio-economic issues.

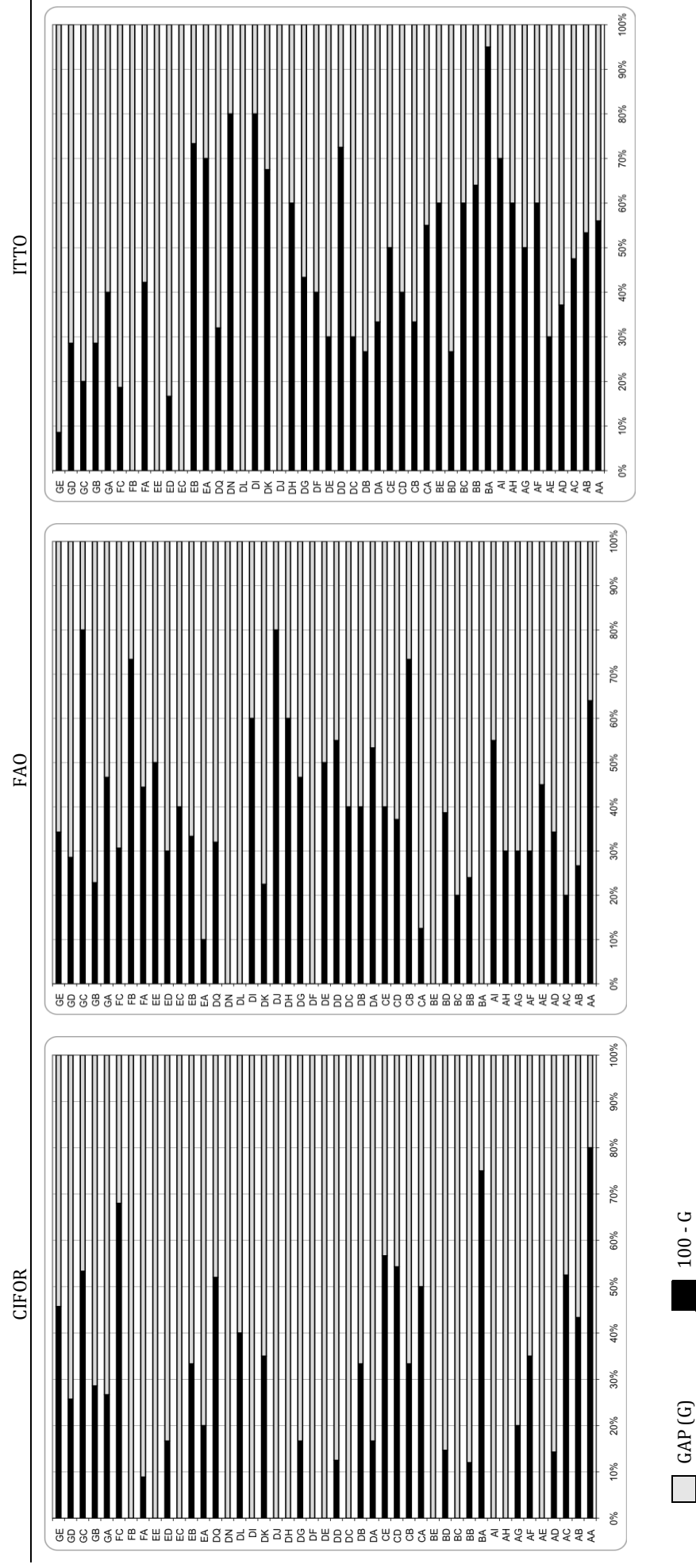
Figure 8 - Quality of the Indicators for the 3 surveyed guidelines, per Principle



Source: own elaboration.

Finally, the *gap analysis results for guidelines* show that all the 3 surveyed GLs have full gaps, with none of them succeeding in totally fulfilling the requirements of the benchmark standards for at least one criterion. *CIFOR guidelines* show the higher gap figures with 15 criteria (on 45) characterised by a full gap (Figure 9). Most of them (7) are concentrated in Principle D, with special reference to aspects like the use of GMOs, the introduction of exotic species, natural regeneration and management of fauna. Principle A is characterised by full gaps with reference to the existence of mechanisms for managing conflicts between guidelines requirements and law, the implementation of environmental, social and economic assessments when conducting plantation projects and the presence of procedures for assessing whether forest infrastructures are adequate and efficiently used. A third big area of full gap regards Principle B, with special reference to the opportunity to include a scientific monitoring system for the evaluation of forest damages. Finally, full gaps can be observed in the case of criteria EC (water quality maintenance and protection) and FB (with reference to the presence of indicators to assess whether investments in forest management are adequate and they can ensure full sustainability over time). Another area of strong weakness for CIFOR guidelines is related to Principle F, where an improvement would be strongly useful at least with reference to water management issues and soil protection. The only Principles where CIFOR guidelines seem to cover quite well the requirements of the benchmark standard are C and G, where only minor improvements can be suggested. In the case of Principle C they regard management and production of non timber forest products, an issue that is almost fully not considered by the guidelines, while in the case of Principle G they include increased attention for minorities and gender issues within stakeholders

Figure 9 – Gap analysis of the 3 surveyed guidelines with respect to the benchmark standard calculated for forest plantation management



Source: own elaboration.

consultation processes and public availability of information on the managed forest area.

In *FAO guidelines* for planted forests, 5 full gaps can be observed with respect to the benchmark: 3 regarding Principle D and Principle B. Again biodiversity appears as a problematic area, although in this case the lack of indicators regard very specific issues - such as the request for silvicultural treatments aiming at stability, uneven aged and complex forest structures - that can be partly delegated to lower level regulations completing guidelines at local level. Regarding Principle B, full gaps mainly refer to descriptive indicators asking for availability of figures on extension of planted areas, as well as monitoring of land use change, including afforestation and reforestation activities. Minor gaps within guidelines regard the presence of clear indications for the development, updating and improvement of forest management plans (criterion AB) and definition of specific procedures for monitoring (AC). Moreover, considering criterion CA, clear requirements for collection and availability of data regarding harvesting and timber production (e.g. harvested volumes by species, balance between harvested volumes and increment, realism of used harvesting cycles, etc.) should be included in the guidelines. Minor gaps can be identified also in Principles E and G. In the first case improvements are possible with regard to maintenance of soil fertility, for instance by asking for the development and implementation of regulations related to soil work and tillage. In the second case, improvements would be recommendable with regard to specific attention and measures to improve stakeholders inclusion and participation in the forest planning and management process, even by encouraging the use (or recuperation) of indigenous knowledge and/or techniques and defining fair compensation mechanisms for their use by forest managers (criterion GB). Improvements are possible also in supporting the recreational function of plantations (mainly in terms of data availability, for instance with reference to number of accesses, kinds of infrastructures, etc.) as well as the definition and implementation of measures to avoid damage to third part properties and infrastructures.

In *ITTO guidelines*, 4 full gaps can be observed: 2 on Principle D and one each for Principles E and F. As for Principle D, specific requirements for controlling and minimising the accidental introduction and/or spreading of non-indigenous plants or animals, plagues or diseases (criterion DJ) are missing. Clear requirements for assuring waste is systematically and timely removed from forest ecosystems are also missing. Indicators asking for the availability of data that can help in assuring maintenance and protection of water quality (criterion EC) and for a clear planning of economic and financial resources in the long term (criterion FB) are lacking as well. Additionally three areas of relevant gaps can be identified within Principles F and G. As for the first one, the most critical point is criterion FC, that should be improved by including specific indicators regarding at least: the degree of equity in the distribution of economic benefits proceeding from forest management; full recognition of workers rights to organise and negotiate; clear definition of rights and responsibilities of both forest manager and local communities; development and implementation of operational guidelines and training for health and safety procedures and equipment of forestry workers, including aspects related to forest camps for workers. Regarding Principle G, additional efforts are needed to improve efficiency and effectiveness of communication between stakeholders, including the definition and implementation of mechanisms for the resolution of conflicts and complaints, and an increased attention on potential negative consequences of forest management activities for the health and well-being of people, even by introducing clear requirements for monitoring and minimising accidents and injuries within forest plantations. ITTO guidelines meet quite well the

requirements of the benchmark standard with reference to Principles A, B and - partly - C, where just minor gaps can be observed. Among them, the enlargement of monitoring activities to cover additional aspects (such as illegal activities), damages from bad harvesting practices, pests/diseases and the presence of invasive species. Additional gaps also interest Principle D, when considering for instance the opportunity to reinforce protection and conservation measures for natural ecosystems, landscapes and habitats within the plantation, starting from the introduction of a clear requirement for avoiding the establishment of forest plantations at the cost of primary or natural forests. Indicators should also be added with reference to protection of key-species, even by a growing use of native trees, to encourage diversity in composition (size, spatial distribution, number of species and genetic, ages, structures) of forest plantations and favour monitoring of the use of exotic tree species and their impacts on the environment.

4. Conclusions

Different opinions on the relevance, effects and effectiveness of forest plantation and related investments persist nowadays, with a continuous strain between supporters and detractors and provision of opposite argumentations. Despite this debated and conflicting background, no doubts exist about the fact that forest plantations - especially in certain countries, like for example China - have expanded rapidly during the last decades, also because of financial resources allocated by national forest policy and international investments. Recent data and analysis show they are likely to continue to grow in the next years.

When analysing initiatives aiming at supporting sustainable development and responsible forest management what strikes most is the contrast between the relevance of forest plantation issues within the international debate and the marginal role the same issues are often given by these initiatives. Few specific initiatives exist. Although the setting of forest management standards grew very much in the last 20 years, it mostly concentrated on natural forests. Just 11 out of 42 cases assessed within this study are plantation-specific while 15 standards and guidelines do not include any single indicator for plantations and 9 of them dedicate to forest plantations less than 5% of their indicators. Not only initiatives are rarely plantations-specific but also they normally include few and quite generic indicators related to this topic, indirectly suggesting an underestimation of forest plantations increasing role in forestry, environment and social sustainability. The analysed standards and guidelines in many cases are focused over environmental or socio-economic topics, but forest plantation issues are seldom addressed and even quoted within them.

Clear differences exist among the surveyed set of standards and guidelines in terms of quality of their contents. In all of them, the biggest gap has been identified in the area of maintenance, protection and restoration of biodiversity and ecological processes. In particular gaps have been identified with reference to monitoring of natural ecosystems components, the maintenance of intact ecosystems and landscapes - including the avoidance of primary/natural forest conversion into forest plantations - the use of exotic species and of GMOs. There seems to be a kind of overlapping between the main weaknesses of standards/guidelines and the areas of biggest concern towards forest plantations, so that - although generalisations are not possible - these concerns appear to be fully well-grounded. Other common (though minor) gap-areas are those of protective functions, with special reference to soil protection against erosion and losses

in general and water quality maintenance and improvement. Moreover gap-areas also interest socio-economic and cultural well-being of stakeholders, with special reference to workers conditions and the role of local communities - including indigenous people - in forest management planning and, in broader terms, in benefiting from the presence of plantations. Some specific areas of improvement emerged as well, as for instance the idea of including landscape issues in planning activities. Another “new” area could be that of carbon issues: until now, with few exceptions, they played a complementary role within some standards and guidelines, being in many other cases just a general topic on the background. The growing attention paid to climate change issues and the increasing number of carbon projects in the forest sector, acting as one of the most relevant driving forces for the expansion of forest plantations, should lead to the inclusion of specific requirements to link carbon standards with forest management standards as a form of warranty. The partnership agreement signed by FSC and the Gold Standard Foundation in 2012 goes in this direction, trying to combine the FSC approach to social and environmental safeguards and the Gold Standard approach to carbon certification, respectively. Finally, some room for improvement seems to exist even with reference to the exploitation and value of NTFPs: they are just marginally considered by standards and guidelines and could provide useful and interesting opportunities for companies and local communities. The overall impression is that in many cases the productive function still deserves bigger attention and catalyses most of indicators and measures. Although argumentations supporting forest plantations strongly stress aspects dealing with multi-functionality, they seem to remain on discourses rather than being explicitly reported on the standards or guidelines text.

Different initiatives show different quality outputs level: for instance, FSC standards for Chile are the only forest certification-based instrument without any full gap in comparison to the benchmark standard, and at the same time they show the higher number of fulfilled criteria, while LEI standards have the lower level of quality. Differences in the standards are likely to be connected to the approach of national policy toward forest certification initiatives and the international market for certified products. Chile and Indonesia, for example, are both leading countries in the field of forest plantations and related industries, but their national standards have totally different consistency. In the future, research should focus on exploring the situation in other countries and possibly in identifying the internal and external factors influencing the forest plantation standards contents and their different performances. We expect that standards' weaknesses and gaps are more related to the basic structure of the standards formulation rather than to the specific national context.

Amongst guidelines, the FAO ones seem to be the most well-balanced, and able to take into consideration also the more recent trends about the need of innovative governance mechanisms based on strengthening stakeholders involvement and introducing conflicts resolution procedures as well as legal and institutional framework adaptation processes. As mentioned, one of the possible reasons for FAO guidelines leading position with respect to CIFOR and ITTO guidelines is the period of their development: about 20 years divide FAO GLs from the other two, which in the meanwhile have not been updated. While standards for certification are typically revised and updated every few years to take into consideration innovations in technology, knowledge and stakeholders demands, guidelines are not periodically revised/updated even if they might play a relevant role in orienting policy makers and practitioners. With the actual trend towards a global forest governance, especially forest plantations guidelines – with their potential relevant role as policy instruments – should be innovated and globally harmonized.

We are aware - as recently recommended also by Clark and Kozar (2011) in the case of forest certification systems – that credible and useful comparisons among effects and effectiveness of sustainable forest management standards should be based on empirically collected data rather than on the wording of principles, criteria and indicators. However, we believe that by highlighting weaknesses of existing standards and guidelines, our gap analysis contributes to improve the understanding and the governance of forest plantation sector in the future. On the one hand, we are aware that our method of analysis can be improved. For example, by introducing a systematic peer-review procedure to be run by a panel of experts by means of a Delphi method approach to reduce subjectivity and divergences of judgement when assessing the quality of indicators (the weakest point of our study). On the other hand, we believe that our analysis allows harmonisation and simplification in standards comparison, providing a quick analysis and easy visualisation of results. Our results offer a proxy of the extent to which the standards and guidelines for forest plantation management can indicate sustainability, highlighting gaps and areas for future improvements (e.g. biodiversity and carbon issues), common themes (e.g. forest management plans and fire management), innovative aspects (e.g. visual impacts of forestry activity) and neglected ones (e.g. the role and importance of NTFPs).

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