Forest sustainability in Spain

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1. Introduction

The combustion of wood for energy purpose is not considered to contribute to the augmentation of greenhouse gases concentration in the atmosphere, as long as the CO2 emissions released during the combustion of wood are balanced by the growth of new trees. It is therefore essential to investigate if the forests in the region where the wood used for energy purpose are managed in a sustainable way, avoiding resources associated with overexploitation of forests, land use change, depletion of carbon stocks, etc...

In this framework, literature research was carried out to produce a summary of forest management in Spain, including general condition, management and sustainability assessment.

2. Spain forests overview

2.1. Location and distribution

The Kingdom of Spain is located in south-western Europe. It occupies the greater part of the Iberian Peninsula.

It is bounded on the north by the Bay of Biscay (Atlantic Ocean), France, and Andorra; on the east by the Mediterranean Sea; on the south by the Mediterranean Sea and the Atlantic Ocean; and on the west by Portugal and the Atlantic Ocean. The British dependency of Gibraltar is in the extreme south. The Balearic Islands in the Mediterranean and the Canary Islands in the Atlantic Ocean off the coast of Africa are provinces of Spain. Also, Spain administers two small exclaves in Morocco : Ceuta and Melillaas as well as three island groups near Africa : Peñón de Vélez de la Gomera and the Alhucemas and Chafarinas islands. The area of Spain, including the African and insular territories, represents 505 600 km^2.[1]

Fertile plains stretch along Spain's entire Mediterranean coast, broken by occasional hills.

Mountains extend across northern Spain from the Atlantic Ocean almost to the Mediterranean Coast. These begin with the mountains of Galicia in the west; extend through the Cantabrian Mountains in the central area to the Pyrenees Mountains in the east, which separate Spain from France. The mountains rise sharply from the sea along most of the Atlantic coast.

A huge dry plateau called the Meseta Central covers most of central Spain. It slopes downward gradually from north to south and from east to west, and has an average elevation of about 600 m. It is broken by hills and low mountains, including the Sierra de Guadarrama, the Sierra de Gredos, and the Montes de Toledo. Higher mountains rise on the north, east, and south. The highest peak reaches 3,478-meter high and stands in the Sierra Nevada range on the southern edge of the region.

[1] http://data.worldbank.org/indicator/AG.SRF.TOTL.K2

Most of Spain's major rivers originate in the Meseta. The Tagus (Tajo) flows 1,007 km through Spain to the Atlantic Ocean while the Guadalquivir flows 640 km to the Atlantic Ocean.

The Balearic Islands lie from about 80 to 240 km east of mainland Spain in the Mediterranean Sea. Five major islands and many smaller ones make up the group. The three largest islands, in order of size, are Majorca, Minorca, and Ibiza.
The Canary Islands lie in the Atlantic Ocean about 96 to 432 km off the north-west coast of Africa. They include seven major islands. The largest are, in order of size, Tenerife, Fuerteventura, and Gran Canaria. Pico de Teide.

Even if the districts divisions as presented on the map (Figure 1) are still relevant in to the local culture and society, the organization of the country can also be described on three statistical levels called NUTS (Nomenclature of Territorial Units for Statistics), which have been defined at the European level (Table 1).

Figure 1: General maps of Spain

Source: Ezilon.com

Table 1: Administrative regions and sub-regions of Spain (NUTS I, NUTS II, NUTS III)

NUTS 1	Code	NUTS 2	Code	NUTS 3	Code
 **NOROESTE**	ES1	Galicia	ES11	A Coruña	ES111
				Lugo	ES112
				Ourense	ES113
				Pontevedra	ES114
		Asturias	ES12	Asturias	ES120
		Cantabria	ES13	Cantabria	ES130
 **NORESTE**	ES2	Basque Community	ES21	Álava/Araba	ES211
				Guipúzcoa/Gipuzkoa	ES212
				Vizcaya/Bizkaia	ES213
		Navarre	ES22	Navarre	ES220
		La Rioja	ES23	La Rioja	ES230
		Aragon	ES24	Huesca	ES241
				Teruel	ES242
				Zaragoza	ES243
 **COM. DE MADRID**	ES3	Madrid	ES30	Madrid	ES300
 **CENTRO**	ES4	Castile-Leon	ES41	Ávila	ES411
				Burgos	ES412
				León	ES413
				Palencia	ES414
				Salamanca	ES415
				Segovia	ES416
				Soria	ES417
				Valladolid	ES418
				Zamora	ES419
		Castile-La Mancha	ES42	Albacete	ES421
				Ciudad Real	ES422
				Cuenca	ES423
				Guadalajara	ES424
				Toledo	ES425
		Extremadura	ES43	Badajoz	ES431
				Cáceres	ES432

 **ESTE**	ES5	Catalonia	ES51	Barcelona	ES511
				Girona	ES512
				Lleida	ES513
				Tarragona	ES514
		Valencian Community	ES52	Alicante	ES521
				Castellón/Castelló	ES522
				Valencia	ES523
		Balearic Islands	ES53	Eivissa i Formentera	ES531
				Mallorca	ES532
				Menorca	ES533
 **SUR**	ES6	Andalusia	ES61	Almería	ES611
				Cádiz	ES612
				Córdoba	ES613
				Granada	ES614
				Huelva	ES615
				Jaén	ES616
				Málaga	ES617
				Sevilla	ES618
		Region of Murcia	ES62	Murcia	ES620
		Ceuta	ES63	Ceuta	ES630
		Melilla	ES64	Melilla	ES640
 **CANARIAS**	ES7	Canary Islands	ES70	El Hierro	ES703
				Fuerteventura	ES704
				Gran Canaria	ES705
				La Gomera	ES706
				La Palma	ES707
				Lanzarote	ES708
				Tenerife	ES709

The
Table 2 shows the forested areas in Spain. About 36 % of Spain is forested.

Table 2 : Forested area in Spain, Balearic and Canary islands

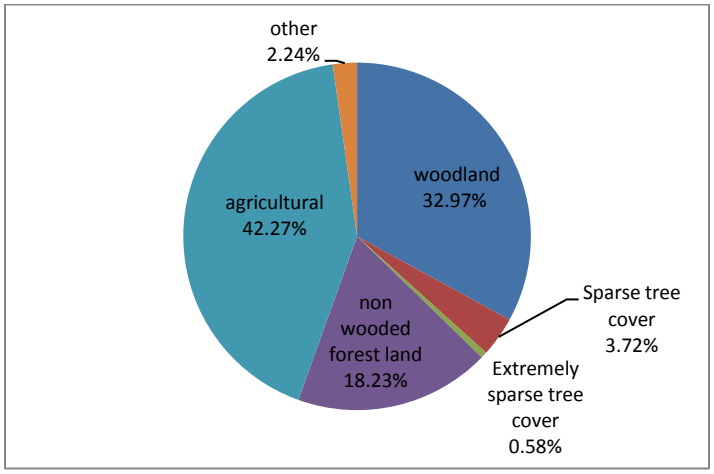
Area in 1000ha	Mainland	Balearic	Canary	Total
Forested Area	18.053,6	186,9	132,2	18.372,7
Other wooded land	8.869	35,3	434,3	9.338,6
Total wooded area	29.922,6	222,2	566,5	27 711,3
Total area	49.250	499,2	747	50 496

Source : Calculated from ANUARIO DE ESTADÍSTICA FORESTAL 2011

For peninsular Spain, these figures are similar to those reported by FAO in “State of Mediterranean Forests 2013”. In the National Forestry Inventory IFN3, the Spanish forest is divided into four categories: (i) forestal arbolado (woodland/tree cover over 20%), (ii) forestal arbolado ralo (sparse tree

cover/10-20%)[2] (iii), forestal arbolado disperse (extremely sparse tree cover/5-10%) and (iiii) forestal desarbolado (non-wooded forest areas i.e. scrubland and grasslands). We also find the terms "cultivos" for agricultural area and "improductivo" (others, including urbanized, wetlands and water bodies). The figures are not the same as the table 2 because this inventory has been realised between 1997 and 2007. Nevertheless it gives a good overview of the repartition of the different land uses.

Figure 2 : Distribution of land uses in mainland Spain



Source : Calculated from IFN3 (Inventario Forestal Nacional)

Figure 3**Error! Reference source not found.** presents the generalised land cover. As can be seen on this map, most of the forests are located in the Northern and central and Western parts of the country. This map also shows the dominance of agricultural areas and the forested areas in second position followed by the shrublands and grasslands.

[2]Noted (i) and (ii) is considered as "forested area" by FAO, (iii) and (iiii) as "other wooded land" see EVALUACIÓN DE LOS RECURSOS FORESTALES MUNDIALES 2010, ESPAÑA

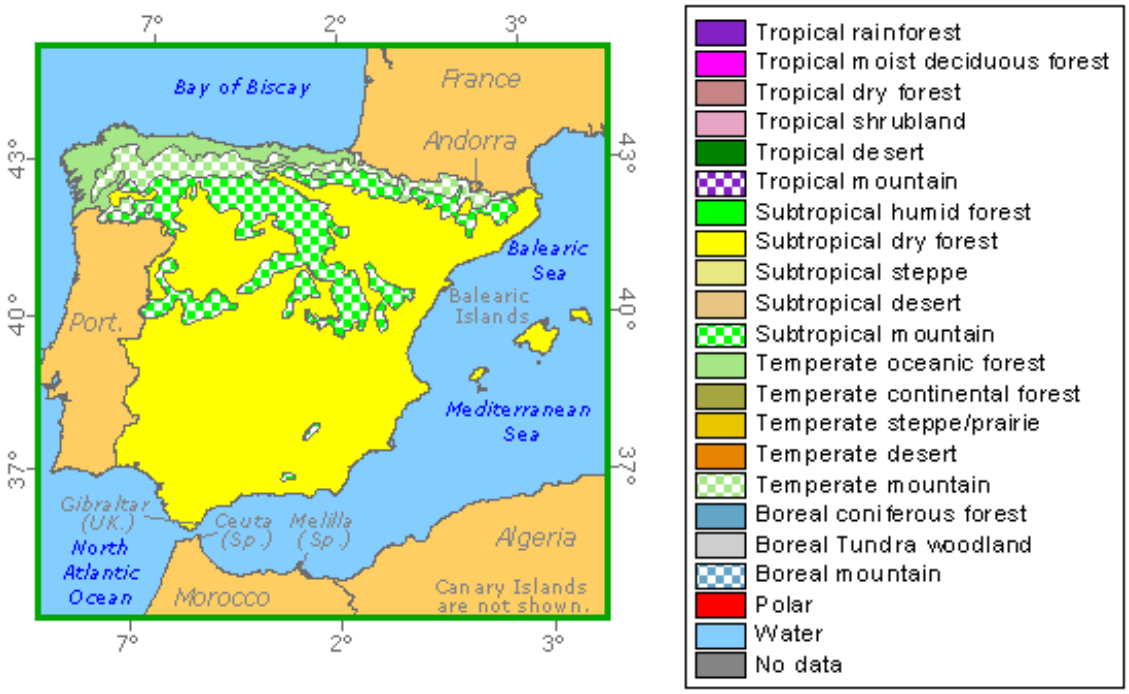
Figure 3 : Land cover in Spain

Source: http://www.magrama.gob.es

2.2. Ecological zones

The climate of Spain is marked by extremes of temperature and, except in the North, generally low rainfall. The Meseta and other inland regions have dry, sunny weather throughout the year with hot summers and cold winters. The average temperature for some areas rises above 27° C in July, the hottest month and may fall below -1° C in January, the coldest. Precipitation averages about 600 mm, occurring as snow on the higher peaks during the winter.

Figure 4 : Main ecological zones in Spain



Source : http://www.fao.org/forestry/country/19971/en/esp/

The biggest part of the country is considered as a subtropical dry forest (as well as the Spanish islands), the extreme north (north coast) is considered as temperate oceanic forest, then temperate mountain, and then a subtropical mountain zone cover the centre of the country.

In Table 3 we can see that an important part of the forest area is occupied by coniferous (55% of the total forest area compared with 37% for hardwood and 8% for mixed areas).

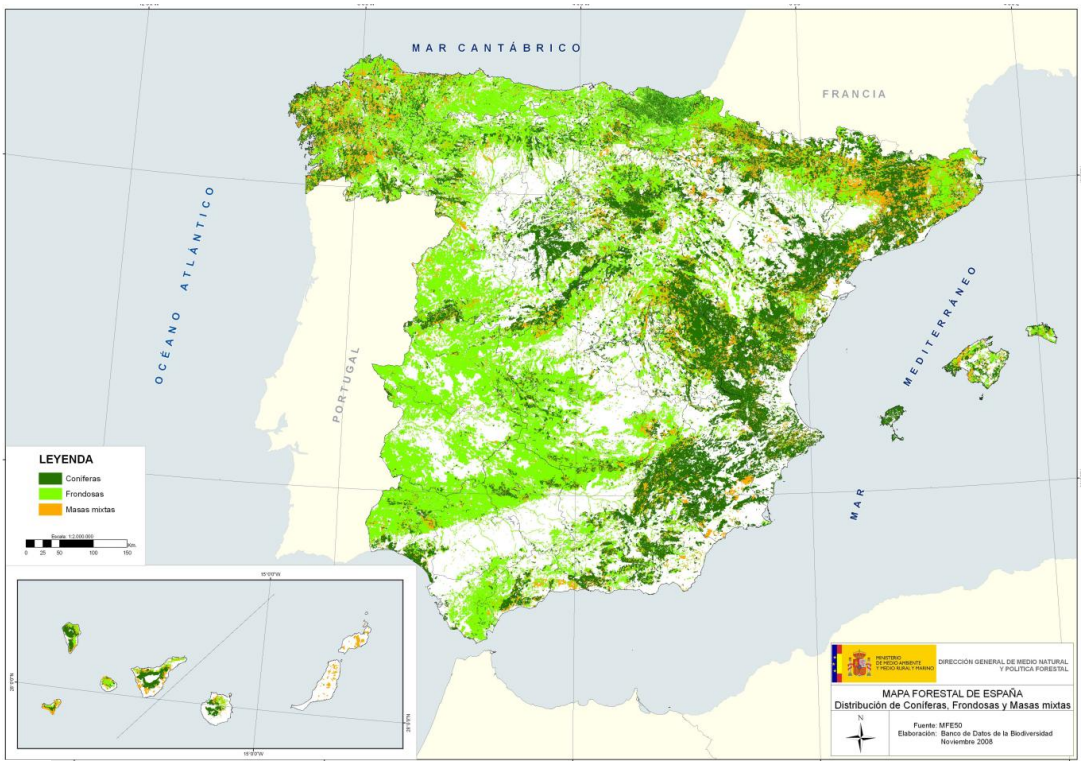
You can also see Figure 5 that the hardwoods (frondosas in Spanish) are located rather in the western part of the country compared with softwoods (coniferas in Spanish) which are located in the eastern part. We also observe mixed areas between these two types of wood in different part of the country.

Table 3 : Main forest types area in Spain, Balearic and Canary islands

Area in 1000ha	Mainland	Balearic	Canary	Total
Softwood	6.648,8	88,9	85	6.822,7
Hardwood	9.945,8	61,5	39	10.046,3
Mixed area	1.358,5	36,1	7,9	1.402,5

Source : Calculated from ANUARIO DE ESTADÍSTICA FORESTAL 2011

Figure 5 : Repartition of the different types of forest in Spain



coniferous
broadleaves
mixed forests

Source: http://www.magrama.gob.es

The repartition of the main tree species throughout the country is presented on Figure 6 and mapped on

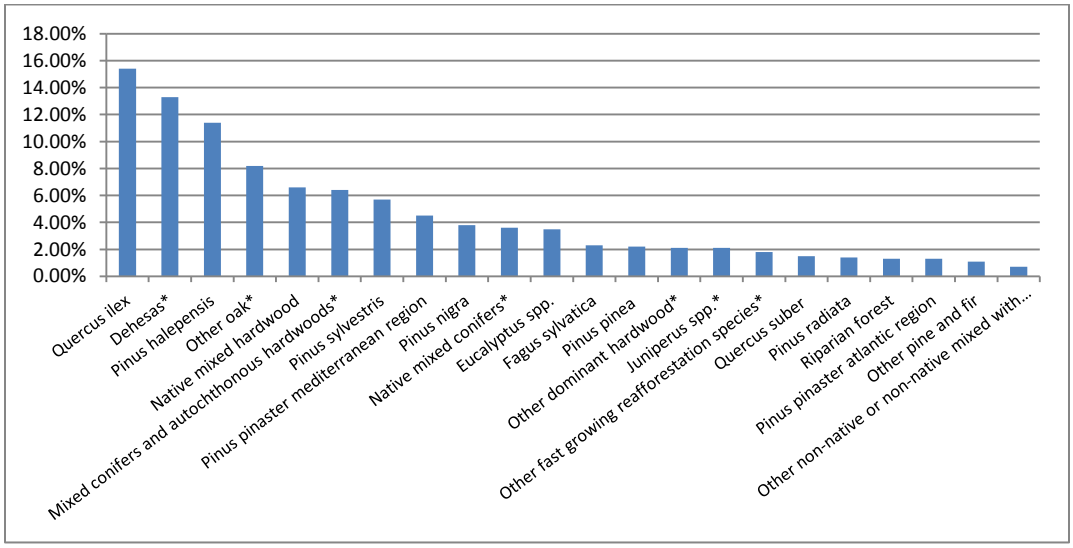
Dehesas	Formation managed by making clearing in oak, gall oak and cork oak groves, generally in valleys or plateau.
Other oak	Forests dominated by *Quercus robur* or *Quercus petraea*, or *Quercus humilis*, or *Quercus pyrenaica*, *Quercus faginea*, or *Quercus canariensis*.
Mixed conifers and autochthonous hardwoods	Mixed formation formed by the mixture of conifers and hardwoods, without any of them having presence sufficient to constitute a dominant formation. The most common different combinations of pine and *Quercus* species.
Native mixed conifers	Mixture of two or more groups of conifers, with none of them has enough presence to constitute a dominant formation.
Other dominant hardwood	It includes the following courses: birch (*Betula* spp.), holly (*Ilex aquifolium*) common hazel (*Corylus avellana*), sweet chestnut (*Castanea sativa*), Fraxinus spp.,wild olive (*Olea europaea* var. *Sylvestris*) and strawberry tree (*Arbutus unedo*).
Juniperus spp.	Formations dominated by *Juniperus phoenicea* L., or *Juniperus communis*, and/or *Juniperus oxycedrus* or *Juniperus* L. *thurifera*.

Other fast growing reafforestation species	American oak and other coniferous afforestation (*Pseudotsuga menziesii*, *Larix* spp., Etc). Also included productive formations dominated by *Populus* x *canadensis* or *Platanus hispanica*, and mixtures species.
Riparian forest	Dominate, depending on the different conditions (geographical location and proximity to channel), willow, alder, poplar, ash and elm, basically. In the understory spiny *Rosaceae*. Climbers also play an important role.
Other pine and fir	Forests dominated by *Pinus uncinata*, *Pinus canariensis*, or *Abies alba* and *Abies pinsapo*.
Other non-native or non-native mixed with native	Included in this category mixtures of native and non-native in general (such as eucalyptus species of the genus *Quercus*), invasive non-native and non-native conifers management.

Figure 7: Repartition of the three main tree species and formations in Spain

. Three major tree species and formations are found in Spanish forests: the holm oak (*Quercus ilex*), the Dehesa (multifunctional agro-sylvo-pastoral system with holm, cork and gall-oak) and the Aleppo pine (*Pinus halepensis*). Each of those species covers about 15,4%, 13,3% and 11,4% of the total forested area. Dehesas are situated in the western part and the Aleppo pine is in the eastern part of the country.

Figure 6 : Percentage of area of forest by predominant species and formations



Source : From ANUARIO DE ESTADÍSTICA FORESTAL 2011

Table 4 : Definition of the terms in figure 6

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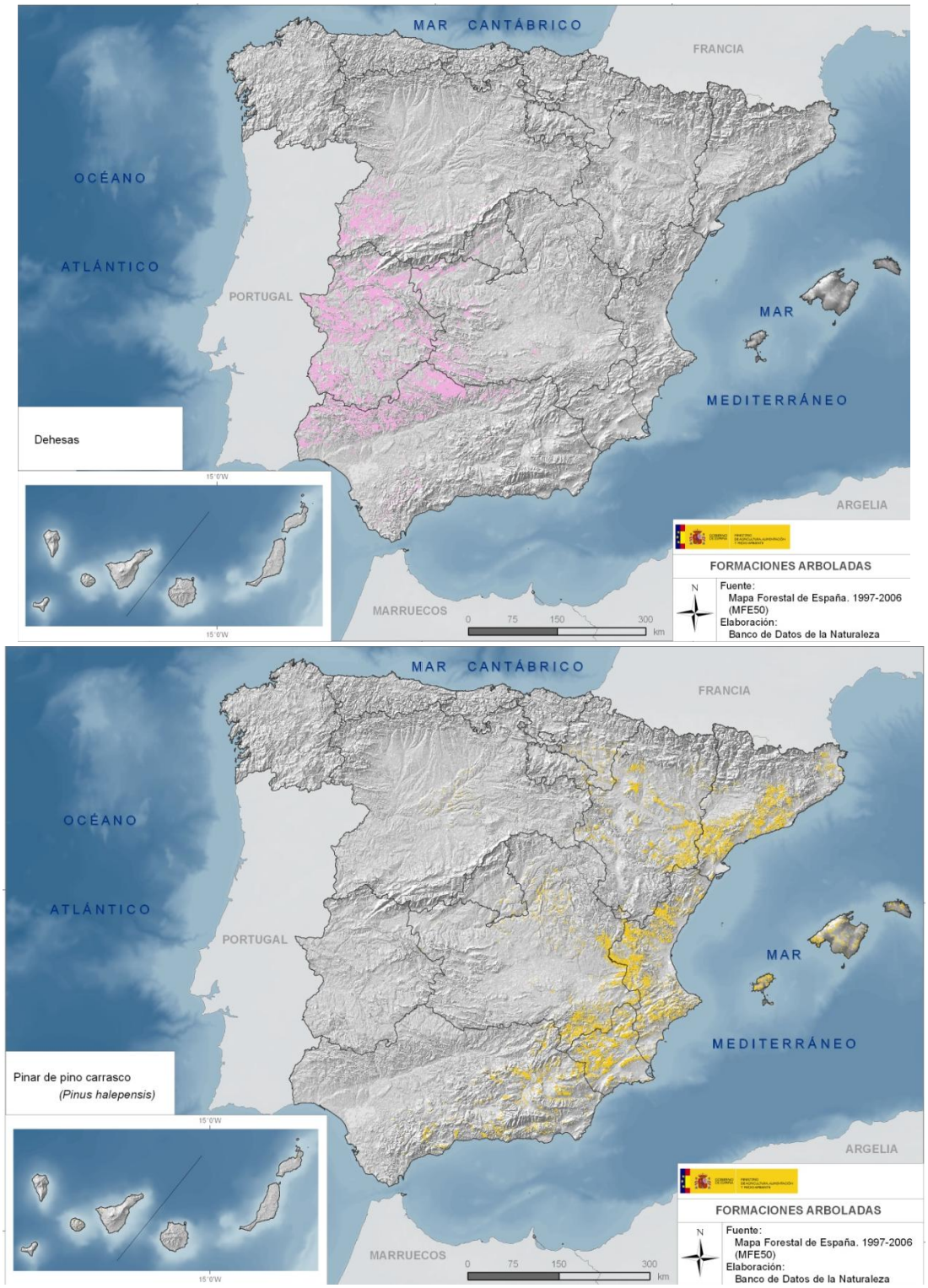


Source: http://www.magrama.gob.es

The other species and formations maps are available on the Ministerio de Agricultura, Alimentación y Medio Ambiente website: http://www.magrama.gob.es/es/biodiversidad/servicios/banco-datos-naturaleza/informacion-disponible/formaciones_arboladas.aspx

2.3. Forest ownership

Spanish forests are characterised by the large predominance of the private ownership (59,5%). Public owners include: local entities (22%), State (6,1% of the country's forests) and communal land (2,3% of the country's forests). A significant part of 12,3% included unknown property (some statistics report this figure in private ownership[3]).

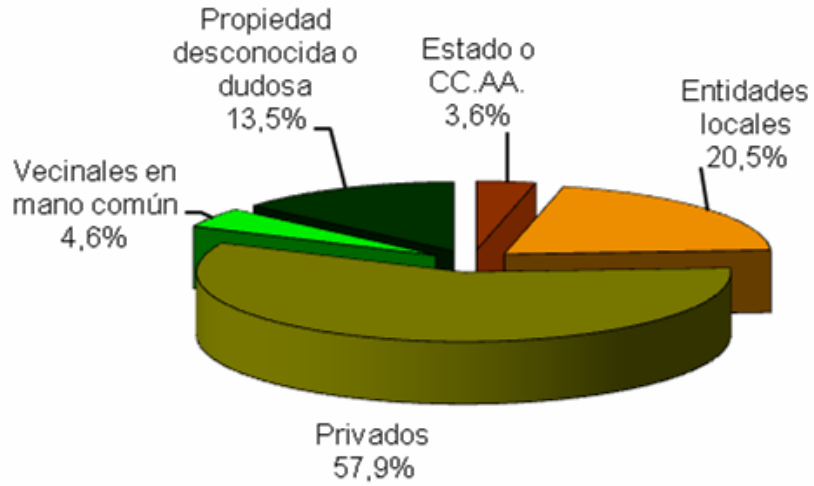
[3] PEFC Spain on website www.pefc.org

Figure 8 : Forested area ownership

Source : From ANUARIODE ESTADÍSTICA FORESTAL 2011. Public utility forests include : "Del Estado o de la C.C.A.A" (State forests) and "De Entidades Locales" (Forests owned by communities and public institutions). Private forest lands include : De particulars (Privately-owned land) , Montes vecinales en manocomún (Communal forest land). Peculiar o desconocida = Unknown property

Similar proportions are observed for other wooded area ownership (Figure 9).

Figure 9 : Other wooded area ownership



Source : From ANUARIODE ESTADÍSTICA FORESTAL 2011.

2.4. Competent authorities

The Ministry of Agriculture, Food and the Environment is the government department responsible for the proposal and execution of the policy of the Spanish Government with respect to the conservation of nature, sustainable development, environmental impact and management of the flora, the fauna, habitat and ecosystems, as well as for the collaboration of the various independent organizations

involved in these matters. The web-site contains a lot of information related to forests and forestry in Spain. Much of the information is under the topic heading Biodiversity.

Forest policy is applied at all territory excepted residential, industrial, commercial and agriculture areas. It includes forested areas but also desert areas and pastures.

The legislative instruments are based on Law 43/2003, 21 November, Forests (Ley 43/2003, de 21 de noviembre, de Montes[4] amended by Law 10/2006 of 28 April) and was approved by the autonomous communities. This Law establishes a regulatory legislative framework for the forests, and for the reorientation of the conservation, management and development of the forest resources in Spain.

According to the Law 43/2003 of 21 November, Forestry forest planning in Spain is articulated in three different dimension : at the strategic level through the Spanish Forestry Strategy (Estrategia Forestal Espanola), in the Spanish Forest Plan (Plan Forestal Espanol) and tactical level called Management Plans of Forest Resources (Planes de Ordenación de los Recursos Forestales).

- **Spanish Forest Strategy**
  Spanish forestry strategy (1999), which was formulated through a highly participatory process, is based on principles established at the global and European levels, the reference point being the sustainable forest management criteria and indicators adopted by the Lisbon Ministerial Conference on the Protection of Forests in Europe. One of the first results of this strategy was the creation of a National Forest Council in 1999 made up of public and private stakeholders and with forest conservation and sustainable management as its objectives. The strategy has paved the way for new basic forest legislation[5]

- **Spanish Forestry Plan**
  The Forest Plan application in time and space of the Spanish Forest Strategy, to structure the actions necessary for the development of a Spanish forest policy based on the principles of sustainable development, multifunctionality of the wooded areas, contribution to territorial cohesion and ecological and public and social participation in the formulation of policies, strategies and programs, proposing the responsibility of society in the conservation and management of forests. It was approved by Cabinet in July 2002, a next review being planned. The Spanish Forest Plan has a 30-year timespan (2002-2032), and within this period it is planned that there will be two in-depth revisions of the document.

- **Management Plans of Forest Resources**
  These plans constitute an essential tool for forest planning. Those plans are developed and approved by the Autonomous Communities and its territory will be representing all of its woodlands.

[4] Montes is a widely used Spanish term for forests (including wooded and non-wooded forest lands)
[5] http://forestportal.efi.int

2.5. Overview of wood-related industry

Forestry sector contributes to 0,2% of the Gross domestic product[6]. The structure of the Spanish forest sector is summarised is the Table 5.

Table 5 : Production and trade of main groups of wood products in Spain (2011)

Product	Unit	Production and extraction	Importation		Exportation	
			Quantity	Value (thousand euro)	Quantity	Value (thousand euro)
Extraction						
Fuelwood	**1000 m^3 u.b.**	**3.900**	**5**	**283**	**77**	**3.204**
Industrial roundwood	**1000 m^3 u.b.**	**11.528**	**3.561**	**111.507**	**1.967**	**103.456**
Conifers	1000m^3 u.b.	4.616	2.372	31.109	448	15.402
Hardwood	1000 m^3 u.b.	6.912	1.189	80.398	1.519	88.054
Production						
Charcoal	**1000 t**	**-**	**38**	**12.533**	**27**	**9.332**
Chips and particles	**1000 m^3**	**2.080**	**924**	**67.519**	**30**	**4.067**
Wood residue	**1000 m^3**	**2.113**	**51**	**3.554**	**379**	**20.028**
Sawn timber	**1000 m^3**	**2.162**	**1.103**	**267.671**	**195**	**46.136**
Conifers	1000 m^3	1.706	879	160.473	113	21.972
Hardwood	1000 m^3	456	224	107.198	83	24.164
Wood-based panels	**1000 m^3**	**2.993**	**958**	**328.674**	**2.125**	**580.762**
Veneer sheets	1000 m^3	111	83	91.873	39	72.120
Plywood	1000 m^3	299	65	37.473	165	134.916
Particle board include OSB	1000 m^3	1.584	377	64.809	874	155.077
Fibreboard	1000 m^3	999	432	134.519	1.046	218.648
Wood pulp	**1000 t**	**1.976**	**969**	**546.802**	**1.140**	**710.226**
Mechanical	1000 t	90	23	13.790	-	-
Semi-chemical	1000 t	0	44	19.084	4	1.295
Chemical	1000 t	1.862	900	510.810	1.105	665.446
Unbleached sulphate pulp	1000 t		3	1.759	0	0
Bleached sulphate pulp	1000 t		839	478.035	1.105	665.380
Unbleached sulphite pulp	1000 t		0,0046	6	0	0
Bleached sulphite pulp	1000 t		58	31.010	0,0369	66
Soluble	1000 t	24	2	3.118	31	43485
Other types of pulpwood	**1000 t**	**5.200**	**15**	**5.705**	**21**	**50.097**
Other fibber pulp	1000 t	900	4	2.821	21	50.005
Fibber pulp recovered	1000 t	4300	11	2.885	0,2627	92
Recovered paper	**1000 t**	**4.723**	**1.154**	**231.931**	**783**	**130.410**
Paper and paperboard	**1000 t**	**6.203**	**3.042**	**2.310.184**	**2.701**	**2.029.560**
Graphic purposes	1000 t	1.582	1.451	1.085.002	1.125	819.652
Household and sanitary paper	1000 t	734	48	68.412	93	97.032
Packaging	1000 t	3.044	1.488	1.084.975	1.440	947.789
Other paper and paper board	1000 t	843	55	71.795	43	165.086

Source : ANUARIODE ESTADÍSTICA FORESTAL 2011. Note: u.b. = under bark

In Spain, the extraction of wood in 2011 was 15.1 million m³ (11,5 million m³ of industrial roundwood and 3,9 million for firewood). The trade balance for firewood shows a positive value of 72.000 m³. By contrast, the industrial roundwood has a negative balance of 1.594.000 m³. The extracted wood

[6] Ortuiio, S., 2001. El sector forestal en la economia espaniola,. Revista Montes 63, 72-78.

products were imported for 111,79 million euros and were exported for an amount of 106,66 million euros.

The pulp & paper sector and cardboard sector are two important sectors in Spain. They are made up of medium and large sized companies. Average wood consumption by this type of industry is approximately 50% of national logging rates[7]. Paper and paperboard production in 2011 reached 6.203 thousand tonnes, while the pulp industry in the same year produced more than 1.976 thousand tonnes.

Another sector, the wood-based panel take also a great place in the trade of wood. Particle board production volume reached 1.584.000 m^3 in 2011, while fibreboard production was about 1000 cubic meters.

In terms of commercial balance, the sectors with the higher positive trade are wood-based panels and wood pulp (i.e. 252,1 million euros and 163,4 million euros respectively). On the other hand the sectors with the higher negative commercial trade are paper and paperboard, sawn timber and recovered paper (i.e. 280,6 million euros, 221,5 million euros and 101,5 respectively).

This sector generates in 2013 120.000 employees but this number has been decreasing in recent years.

Table 6 : Employment evolution

Sector/Year	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*
Forestry and logging	32,0	31,6	32,5	31,8	24,9	23,3
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	104,4	79,0	67,7	70,3	61,5	52,3
Manufacture of paper and paper products	44,0	46,2	45,7	41,2	42,0	44,4
Total employment	180,4	156,8	145,9	143,3	128,4	120,0

Source : http://appsso.eurostat.ec.europa.eu

This industry, mainly comprising small and medium-sized enterprises, has been seriously hit by the crisis: from 2008 to 2011, the number of companies in the wood-furniture sector has dropped by 18.3% (6,616 fewer firms), employment in the sector has gone down by 46.5% and turnover fell 44.1% between 2007 and 2010[7].

[7] http://www.pefc.org

3. Sustainability of Spain forest

3.1. Evolution of forest area and risk of conversion

According to EUROSTAT (2010) forested area has increased in Spain over recent years:

- between 1990 and 2000, Spain gained about 93.000 ha of forest per year on average (+1.23%/year).
- between 2000 and 2005 the forest increase was much slower and reached 0.22%/year on average.
- between 2005 and 2010, an increase of 0.64%/year on average is observed.

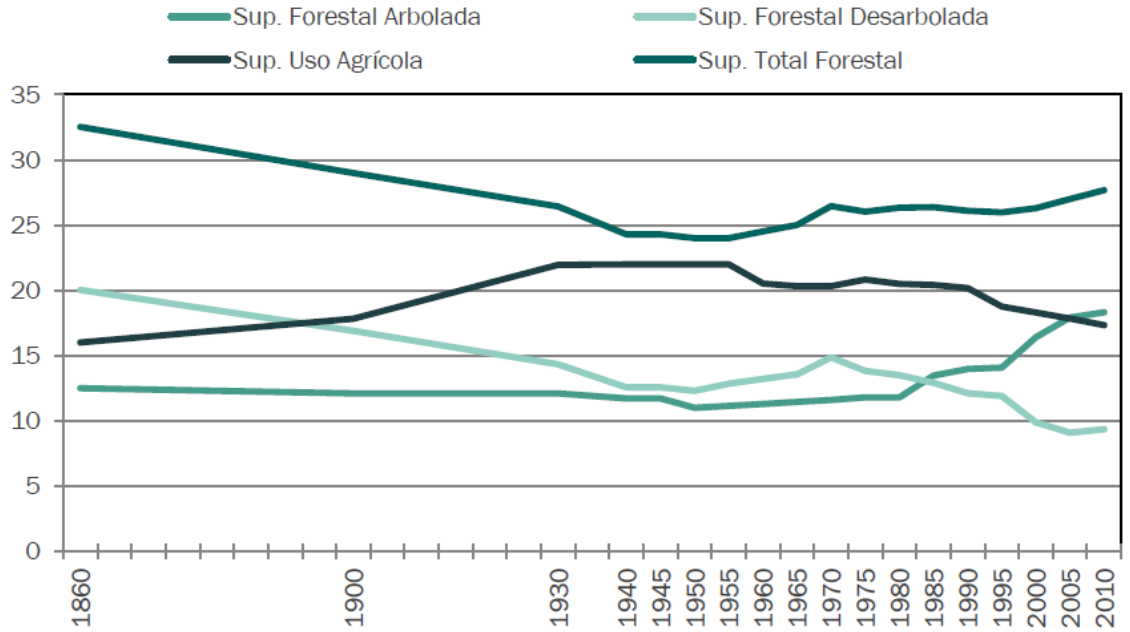
Table 7 : Forest area evolution from 1990 to 2010

Area (1000 hectares)	*Period*			
	1990	**2000**	**2005**	**2010**
Forest	13.818	16.988	17.293	18.173
Other wooded land	12.004	10.367	10.265	9.574
Total area	25.823	27.355	27.558	27.748
Percentage of forested area	53,51%	62,10%	62,75%	65,49%
Evolution of forest area (between period)	/	3.169	305	880
Annual change	/	316,9	61,1	176,0
Annual rate change	/	1,23%	0,22%	0,64%

Source : http://appsso.eurostat.ec.europa.eu

The following figure shows the evolution of forested area from 1860 to 2010. We see that after 1950, the forest area increases continuously until current year. This is linked to natural expansion and to the forest plantation program that has been under way for more than 50 years, with soil protection and erosion prevention as its main aims.

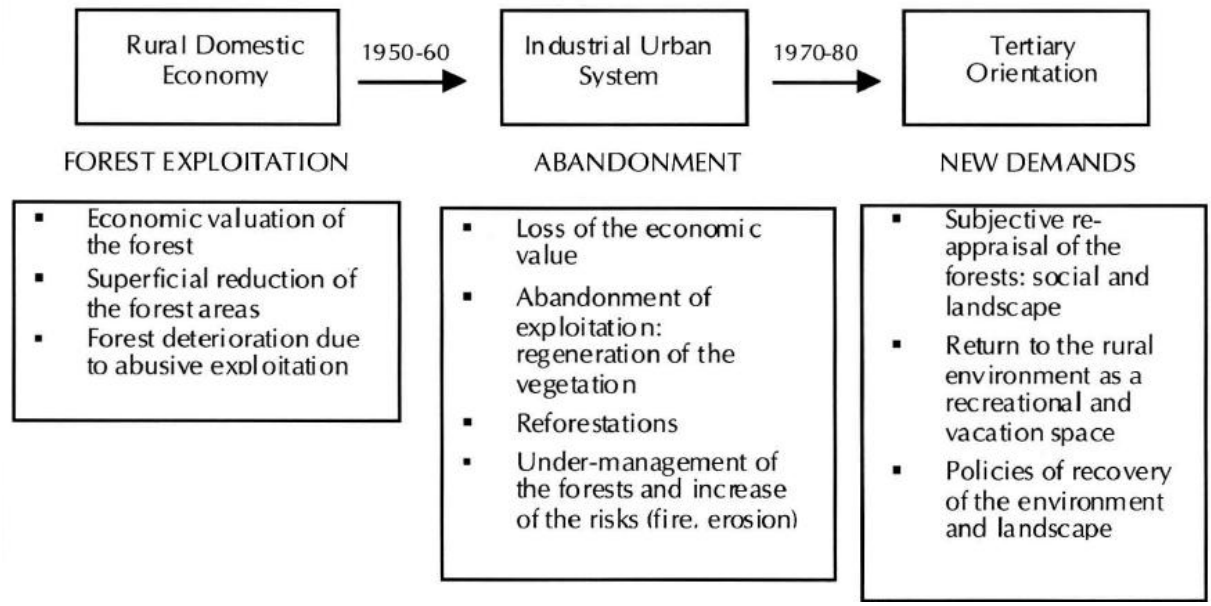
Figure 10 : Evolution of land use area between 1860 and the present (million hectares)



Source : MONTERO, G. y SERRADA, R.; 2013. La situación de los bosques y el sector forestal en España - ISFE 2013. Edit. Sociedad Española de Ciencias Forestales. Lourizán (Pontevedra).

In fact the evolution of the forest in Spain can be summarised as three periods (see Figure 11). The concept of sustainable management of forests is more significant in the recent year in Spain[8]

Figure 11 : Socio-economic, natural and cultural evolution of the Mediterranean Spanish forest



Source : Montiel 2001 [9]

The FSC risk assessment platform www.globalforestregistry.org considers that Spain is at low risk in terms of conversion of forest to other land uses, because the following criterion is verified at the country level:

- There is no net loss AND no significant rate of loss (> 0.5% per year) of natural forests and other naturally wooded ecosystems such as savannahs taking place in the eco-region in question.

3.2. Living wood volumes and removals

Error! Reference source not found. shows the evolution volume of live trees in Spain (1990 to 2010). According to the available data, the growing stock volume has consistently increased between 1990 and 2010. The growing stock in other wooded lands is small compared to the growing stock in forests and has remained stable since 1990. Since 1990, increment in forests available for wood supply increase and in the other hand the fellings in forests available for wood supply slightly decrease. Therefore the fellings in percent of net increment decrease by 28.2% for the period 1990-2010 and reach the value of 30% in 2010. This figure is much lower than the European value.

[8] Ortuno *Perez*, S. F.; Montiel *Molina*, C., 2003: *Forest policy and economics in Mediterranean Spanish forests*.

[9] Montiel, c., 2001b, Mission report of the Short-Term Scientific Mission "The specificities of N/RFPs in Mediterranean Europe", CEMAGREF Aix-en-Provence Centre, 1-8 December 2001, COST Action E19 (www.metla.fi/eu/cost/e19/)

Table 8 : Evolution of wood volume from 1990 to 2010 (volume in 1000m3)

	1990	*2000*	*2005*	*2010*
Growing stock in forests and on other wooded land	594.180	871.170	878.690	915.130
Growing stock of forests	592.620	869.650	877.160	913.540
Growing stock of other wooded land	1.560	1.520	1.530	1.590
Growing stock in forests available for wood supply	535.440	746.240	752.680	783.900
Increment in forests available for wood supply	30.088	43.795	43.889	45.841
Fellings in forests available for wood supply	17.741	16.873	17.369	16.576
Fellings in percent of net increment	59,0%	38,5%	39,6%	36,2%
Fellings in percent of net increment for EU 28	56,1%	61,0%	65.0%	62,7%

Source : http://epp.eurostat.ec.europa.eu

The Table 9 shows the roundwood removals by type of wood and assortment. The softwood removals have decreased constantly since 2004 to 2010 and remained stable after. This trend is explained mainly by the diminution of sawlogs and veneer logs. The decrease of sawlogs and veneer logs removals is also observed for hardwood. Nevertheless the removals of hardwood have increased because the other sectors of removals (i.e. fuelwood, including wood for charcoal and pulpwood) are in constant augmentation. We also observed after the year 2005 that the hardwood removals are greater than softwood removals. On these ten years the total removals has slightly increased in 2008 and decreased 2009 but remain stable around an average of 15.000.000m^3.

Table 9 : Roundwood removals by type of wood and assortment (volume in 1000m^3)

			2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Coniferous	Fuelwood, including wood for charcoal		345	523	315	259	600	580	620	700	530	530
	Industrial roundwood	Sawlogs and veneer logs	5.875	5.507	4.395	3.258	3.776	2.406	2.460	1.882	2.440	2.558
		Pulpwood	2.170	2.083	3.209	3.156	3.265	2.764	2.659	2.617	2.391	2.510
		Total	8.725	8.191	7.710	6.612	7.271	5.349	5.285	4.625	4.935	5.172
	Total roundwood		9.070	8.714	8.025	6.871	7.871	5.929	5.905	5.325	5.635	5.702
Non-Coniferous	Fuelwood, including wood for charcoal		1.710	1.657	1.292	1.723	2.000	1.500	4.500	3.200	2.500	2.500
	Industrial roundwood	Sawlogs and veneer logs	1.920	1.836	1.465	1.274	1.497	926	994	733	973	1.023
		Pulpwood	3.350	3.124	4.335	4.375	5.301	5.355	4.439	5.962	5.552	6.208
		Total	5.510	5.160	6.399	5.934	7.156	6.551	5.684	6.903	6.691	7.398
	Total roundwood		7.220	6.817	7.691	7.657	9.156	8.051	10.184	10.103	9.891	9.898
Total removal			**16.290**	**15.531**	**15.716**	**14.528**	**17.027**	**13.980**	**16.089**	**15.428**	**14.657**	**15.600**

Source : http://epp.eurostat.ec.europa.eu

The volumes of timber harvesting per type of ownership is presented on Table 10. The decrease of coniferous removals is also confirmed for private and other public ownership.

Table 10 : Roundwood removals under bark by type of ownership (volume in 1000m^3)

Type of wood/year		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Private ownership	Coniferous	6.581	6.322	5.244	4.858	5.189	3.913	3.897	3.514	3.719	3.764
	Non-coniferous	6.517	6.153	6.917	5.414	7.880	6.924	8.758	8.688	8.507	8.512
	Total	13.098	12.475	12.160	10.273	13.068	10.837	12.656	12.203	12.226	12.276
State ownership	Coniferous	238	229	366	1.849	321	237	236	213	225	228
	Non - coniferous	106	100	94	2.061	172	161	204	202	198	198
	Total	344	329	460	3.910	493	398	440	415	423	426
Other public ownership	Coniferous	2.251	2.163	2.415	164	2.361	1.779	1.772	1.597	1.691	1.711
	Non - coniferous	597	564	681	182	1.105	966	1.222	1.212	1.187	1.188
	Total	2.848	2.727	3.096	346	3.466	2.745	2.994	2.810	2.878	2.899

Source : http://epp.eurostat.ec.europa.eu

Since 1975 we noted a positive net change of forested volume for all the main species (Table 11). The three species showed the most significant increase are the Scots pine (*Pinus sylvestris*), *Eucalyptus globulus* and the maritime pine (*Pinus pinaster*).

Table 11 : Evolution of forested volume by the main species (million m3)

Species/year	1975	2011	Net change
Pinus sylvestris	61.951	142.673	80.722
Eucalyptus globulus	14.685	87.569	72.884
Pinus pinaster	90.893	151.002	60.109
Pinus halepensis	23.498	76.553	53.055
Quercus ilex	26.360	69.052	42.692
Quercus pyrenaica/Q.humilis	14.299	51.828	37.529
Pinus nigra	37.228	71.704	34.476
Fagus sylvatica	42.472	76.210	33.738
Pinus radiata	20.982	52.803	31.821
Quercus robur /Q.petraea	19.636	48.598	28.962

Source: 1) For 1975 numbers : MONTERO, G. y SERRADA, R.; 2013. La situación de los bosques y el sector forestal en España - ISFE 2013. Edit. Sociedad Española de Ciencias Forestales. Lourizán (Pontevedra). For 2011 numbers : ANUARIODE ESTADÍSTICA FORESTAL 2011.

3.3. Protection of ecosystems and biodiversity

The Autonomous Communities have powers to protect territory and have created denominations, regions :

- National Park
- Natural Park
- Regional Park
- Rural Park

In Spain there are 14 National Parks and alongside them there are over a hundred regional parks.

There locations are given at the following figures.

Figure 12 : Location of the parks in Spain

Source: http://www.ign.es

The MCPFE (Ministerial Conference on the Protection of Forests in Europe) has produced Assessment Guidelines for Protected and Protective Forest and Other Wooded Land in Europe. The total extend of forested protected area in Spain register by MCPFE is around 3.284.000 ha (classes 1.1.-1.3 & 2.)[10]. This is about 18% of the forest land.

Table 12 : Identification of the MCPFE Classes

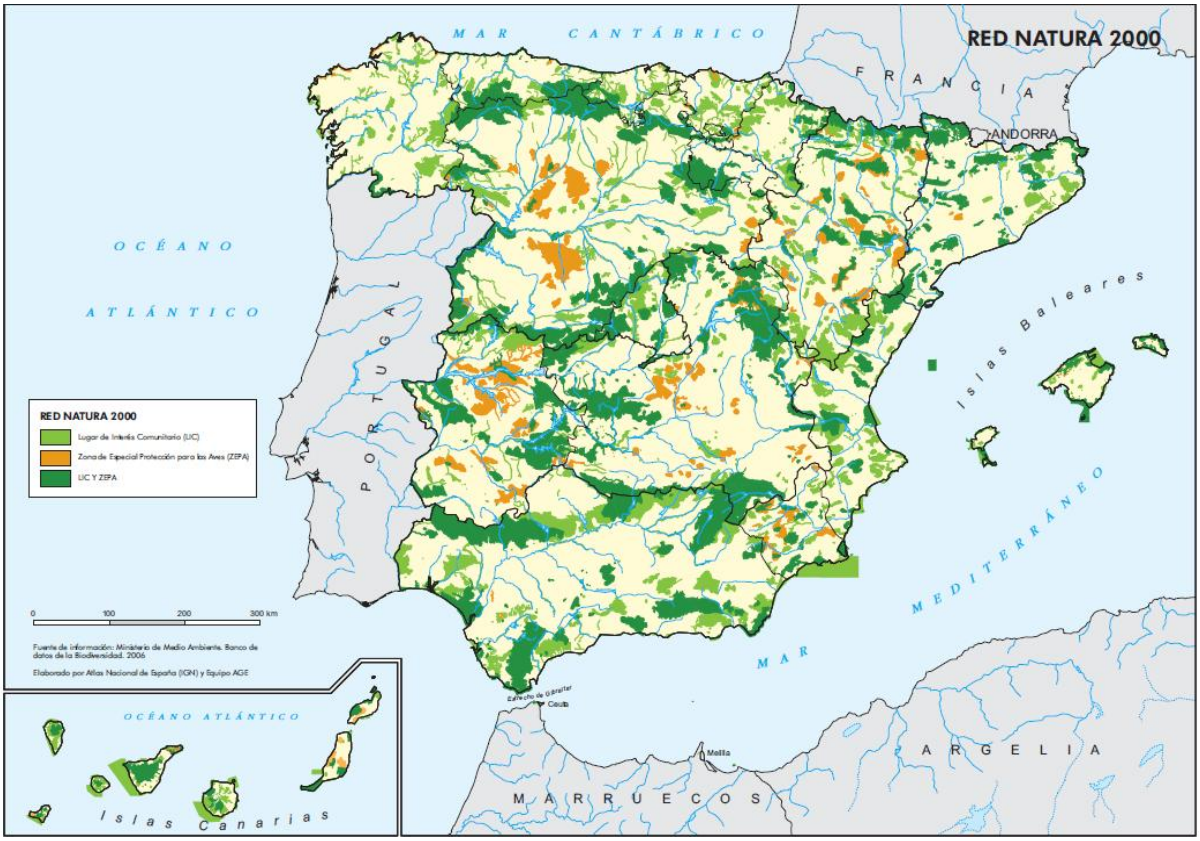
1. Main Management Objective "Biodiversity"	1.1: "No Active Intervention"
	1.2: "Minimum Intervention"
	1.3. "Conservation Through Active Management"
2. Main Management Objective: "Protection of Landscapes and Specific Natural Elements"	
3. Main Management Objective : "Protective Functions"	

Source: MCPFE assessment guidelines for protected and protective forest and other wooded land in Europe

[10] The State of Mediterranean Forests 2013

However, the forest land covered by Natura 2000 is much larger : 7.998.000 ha of forests (i.e. about 43% of the country forests) are covered by the Natura 2000 network according to EU-27 DG Environment. This is because a significant proportion of the Natura 2000 nework does not qualify as MCPFE sites.

Figure 13 : Location of the Natura 2000 areas in Spain



Source: http://www.ign.es/espmap/patri_bach.htm

The information from http://www.cbd.int summarised the Protection of ecosystems and biodiversity.

The Council of Ministers adopted the Strategic Plan on Natural Heritage and Biodiversity In September 2011, approved by Royal Decree 1274/2011, which is the national response to the Strategic Plan for Biodiversity 2011-2020, as well as a fundamental element in support of the Law on Natural Heritage and Biodiversity 42/2007 adopted on 13 December 2007. It includes a number of goals, 39 objectives and 281 actions for the conservation and sustainable use of biodiversity and also considers the targets set out in the EU Biodiversity Strategy for 2020.

Targets are:

- *improving the knowledge base on biodiversity and ecosystem service;*
- *protecting, conserving and restoring Spain's natural capital while reducing the main drivers of loss;*
- *fostering the integration of biodiversity into sectoral policies, particularly in regard to agriculture, fisheries, water management, forestry and tourism, and enhancing synergies with climate changes policies;*

- *conserving global biodiversity and contributing to poverty alleviation;*
- *promoting the participation of the people and the private sector in nature conservation while strengthening awareness and commitments;*
- *reinforcing environmental governance for biodiversity conservation;*
- *contributing to green growth and mobilizing financial flows from all sources for achieving biodiversity objectives.*

The timeframe for implementing the Spanish Strategic Plan is from 2011 to 2017.

Trends in protected areas have been positive. Between 2009 and 2012, there was an increase of 3.1% in the surface covered by protected areas. Protected areas in Spain cover 17.3 million hectares and are established under different legal regimes: terrestrial protected areas represent 92.45% of this protected area estate, while marine protected areas represent 7.55% of this total area.

In terms of Natura 2000 designation and management, there are 598 Special Protection Areas and 1448 Sites of Community Importance, out of which 299 are Special Areas of Conservation, covering 27.2% of the Spanish terrestrial surface (which almost completes the terrestrial Natura 2000 network). A significant number of these Special Areas of Conservation have management plans and/or other measures in place, while management measures are under development for the remaining Natura 2000 sites. Under these circumstances, Spain is the first EU Member State contributing to the European Natura 2000 network.

3.4. Protection of water

The MCPFE (Ministerial Conference on the Protection of Forests in Europe) has defined a quantitative indicator to assess the performances of the reporting countries in terms of conservation of the forests' protective functions, especially regarding soil and water (MCPFE class 3 as per Table 12). It is based on the surface of forest land specifically dedicated to protective functions, as defined by the following criteria[11]:

- *The management is clearly directed to protect soil and its properties or water quality and quantity or other forest ecosystem functions, or to protect infrastructure and managed natural resources against natural hazards*
- *Forests and other wooded lands are explicitly designated to fulfil protective functions in management plans or other legally authorised equivalents*
- *Any operation negatively affecting soil or water or the ability to protect other ecosystem functions, or the ability to protect infrastructure and managed natural resources against natural hazards is prevented*

[11] MCPFE assessment guidelines for protected and protective forest and other wooded land in Europe http://www.unece.org/fileadmin/DAM/timber/publications/2002-guidelines-protected-forest.pdf

Table 13 : Forest land dedicated to soil, water and other forest ecosystem functions as per MCPFE class 3

Year	Land dedicated to soil, water and other forest ecosystem functions (1000 ha)	Percentage of the forest land
2010	4631	25.2%
2005	4407	24.0%
2000	4329	26.6%
1990	3260	17.7%

Source : Full State of Europe's Forests 2011 Report, by the Ministerial Conference on the Protection of Forests in Europe

3.5. Protection of soils

As described in the previous section, the MCPFE (Ministerial Conference on the Protection of Forests in Europe) has defined a quantitative indicator of to assess the performances of the reporting countries in terms of conservation of the forests' protective functions, especially regarding soil and water (MCPFE class 3 as per Table 12). The conservation areas are presented on Table 13.

3.6. Protection of carbon stocks

In forest land the carbon stocks mainly includes:

- living above ground and below ground woody biomass,
- soil organic carbon,
- carbon in litter.

The following data were reported by Spain to the Ministerial Conference on the Protection of Forests in Europe (MCPFE) in the framework of Full State of Europe's Forests 2011 Report[12]. Even though only carbon stocks in living biomass have been quantified, we can see a constant augmentation of carbon stock between 1990 and 2010 (Table 14).

Table 14 : Estimated carbon stock in Portuguese forests between 1990 and 2010

Year	Carbon in above-ground and below-ground living biomass		Carbon in deadwood and litter		Soil carbon
	Above-ground	Below-ground	Deadwood	Litter	
	Million metric tonnes				
2010	314,8	107,03	n.a.	n.a.	n.a.
2005	298,18	101,38	n.a.	n.a.	n.a.
2000	295,62	100,51	n.a.	n.a.	n.a.
1990	203,85	85,3	n.a.	n.a.	n.a.

Source : Full State of Europe's Forests 2011 Report, by the Ministerial Conference on the Protection of Forests in Europe

[12] http://www.foresteurope.org/full_SoEF

Furthermore, we can check the estimated release of CO2 into the atmosphere from forestry and forest-related land use changes. Estimates are available in the National GHG Inventories submitted to UNFCCC by the parties of the Kyoto Protocol.

Based on those data, we can see that the Portuguese forest has been a significant carbon sink between 1992 and 2012, mainly because of the appropriate management of the existing forest land, and also because of the afforestation resulting in the augmentation of forest land.

Table 15 : CO_2 emissions/removals from Spanish forestry and forest-related land use change

Sources and sinks of GHG related to forest sector	Net CO2 emissions/removals (Gg CO2) 1992 to 2012
Afforestation and Reforestation	-8.558,41
Deforestation	650.79
Forest Management	-23.594.55
Total	-31 502.17

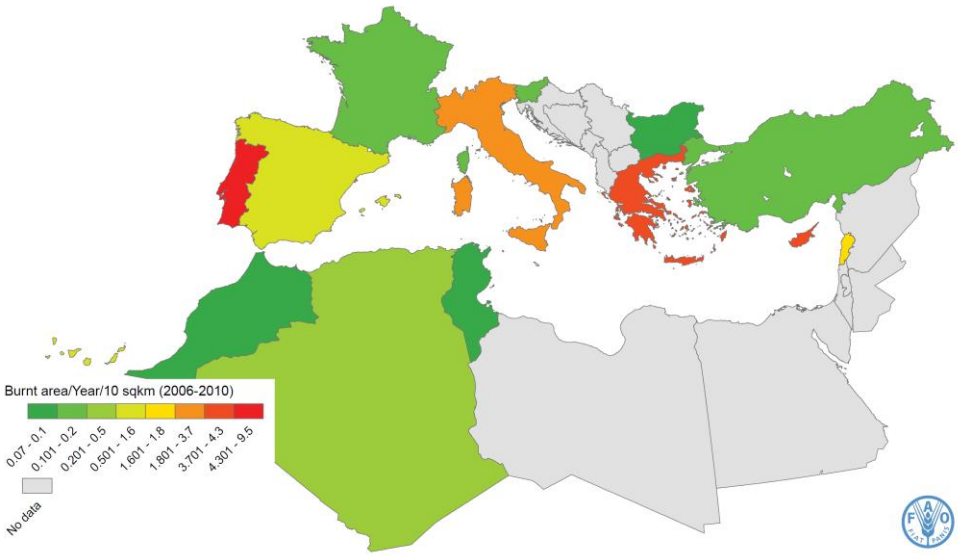
Calculated from : UNFCC, national GHG inventories, Common Reporting Format, KP LULUCF Spain 2012, version 2014

3.7. Protection of air quality

The main impact of forestry on air quality relates to fire. It includes wild fire (which are unintended) and prescribed fire (which is used as part of forest management under controlled conditions).

Forest fires are a common phenomenon in Spain. Nevertheless the area burned is less important than Portugal, Greece or Italy (Figure 14).

Figure 14 : Burnt area per year and per 10 square kilometres between 2006 and 2010

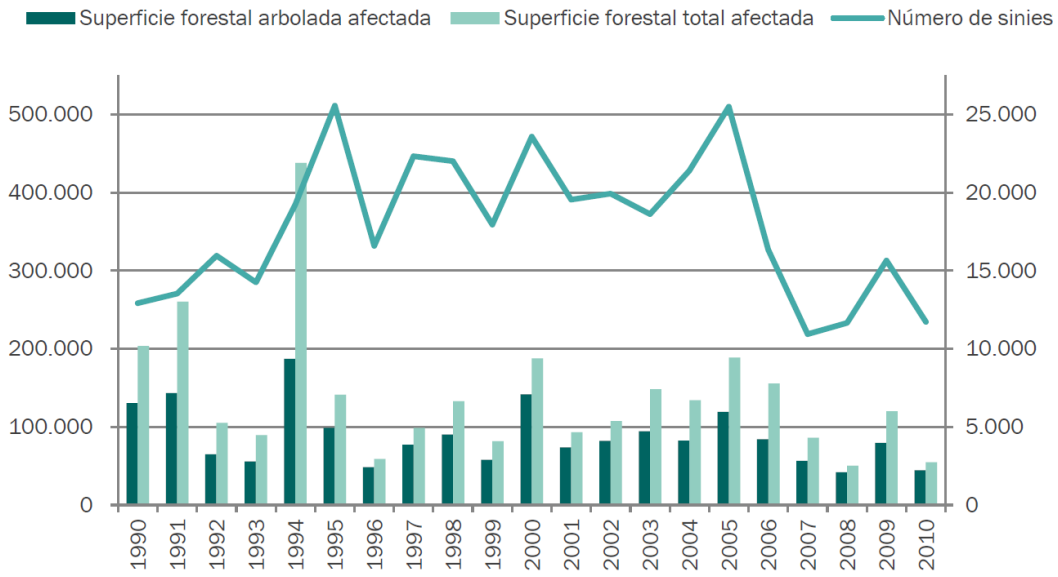


Source: The State of Mediterranean Forests 2013

From 1960 to 1990, an average of 5,144 ignitions was identified. These fires affecting a total area of 146,523 ha of forest, of which 40.6% are forest land and other wooded land for the rest.

From 1990-2010, there were 25,557 ignitions per year. The average of these twenty years was 17,864 ignitions per year. The average forest area affected by forest fires in the same period was 139,775 ha per year (51,405 ha of forested area and 88,370 ha of other wooded land). For 2011 and 2012 there were 16.414 and 15.902 ignitions respectively. These ignitions affected 102.161 ha wooded land (18.847 ha forested and 83.414 ha other wooded land) and 209.855 ha respectively (82.201 ha forested and 127.654 ha other wooded land).

Figure 15 : Evolution of burnt area (forested and total wooded area) and number of ignitions



Source : MONTERO, G. y SERRADA, R.; 2013. La situación de los bosques y el sector forestal en España - ISFE 2013. Edit. Sociedad Española de Ciencias Forestales. Lourizán (Pontevedra)

Prescribed burning is an important and useful silvicultural tool which can have different objectives:

- Prepare sites before seeding and planting
- Reduce hazardous fuels under tree stands to prevent wildfires
- Improve wildlife habitat
- Improve forage for grazing (through changes in underbush vegetation)
- Manage competing vegetation
- Control insects and disease
- Enhance appearance (refresh forest appearance, improve flowering....)
- Improve access (clear underbush before harvesting or other operations)

Prescribed was implemented in Spanish and Portuguese pine forests (early 1980s). Today, this practice is applied in other species (Table 16).

Table 16 : Established prescribed fire practices by vegetation in southern Europe

Broad vegetation type	*Species*	*Countries*	*Burn objective*
Mediterranean pine forest	*Pinus canariensis, Pinus halepensis, Pinus nigra, Pinus pinaster, Pinus pinea*	Portugal, Spain, France	Hazard reduction; range or biodiversity management as secondary objectives
Mediterranean shrubland	Variable, but usually dominated by *Cistus* spp or *Quercus coccifera*	France, Portugal	Hazard reduction; range and/or biodiversity management
Heathland	*Ulex* spp, *Erica* spp, *Calluna vulgaris, Pterospartum tridentatum, Cytisus* spp, *Genista* spp	Portugal, Spain	Hazard reduction; range management
Mountain shrubland and grassland	*Cytisus oromediterraneus, Cytisus scoparius, Spartium junceum*	France, Spain	Range management; biodiversity management and hazard reduction as secondary objectives
Eucalypt plantations	*Eucalyptus globulus*	Portugal	Hazard reduction; post-harvesting slash disposal

Source : Fernandes and al., 2013. Prescribed burning in southern Europe: developing fire management in a dynamic landscape.

Illegal logging

The FSC risk assessment platform www.globalforestregistry.org considers Spain as at low risk in terms of illegal logging, because the following criteria are all verified:

1.1 Evidence of enforcement of logging related laws in the district [13]

1.2 There is evidence in the district demonstrating the legality of harvests and wood purchases that includes robust and effective system for granting licenses and harvest permits [14]

1.3 There is little or no evidence or reporting of illegal harvesting in the district of origin[15]

1.4 There is a low perception of corruption related to the granting or issuing of harvesting permits and other areas of law enforcement related to harvesting and wood trade[16]

[13] www.illegal-logging.info ; www.eia-international.org ; http://www.ahec-europe.org/
[14] www.illegal-logging.info ; www.eia-international.org ; http://www.ahec-europe.org/
[15] www.illegal-logging.info ; www.eia-international.org ; http://www.ahec-europe.org/
[16] http://www.transparency.org/cpi2012/results

3.8. Civil rights and traditional rights

The FSC risk assessment platform www.globalforestregistry.org considers Spain as at low risk in terms of violation of civil and traditional rights, because the following criteria are all verified:

- There is no UN Security Council ban on timber exports from the country concerned
- The country or district is not designated a source of conflict timber (e.g. USAID Type 1 conflict)
- There is no evidence of child labor or violation of ILO Fundamental Principles and Rights at work taking place in forest areas in the district concerned
- There are recognized and equitable processes in place to resolve conflicts of substantial magnitude pertaining to traditional rights including use rights, cultural interests or traditional cultural identity in the district concerned
- There is no evidence of violation of the ILO Convention 169 on Indigenous and Tribal Peoples taking place in the forest areas in the district concerned

3.9. Forest certification

The main forest certification schemes used in Spain are:

- PEFC (Programme for the Endorsement of Forest Certification), a global certification system that ensures sustainable forest management
- FSC (Forest Stewardship Council[17]), which is specifically suitable for small private owners

FSC website reports that there were 196.946 ha and 28 certificates regarding FSC forest management in Portugal as per November 2014 [18]. There were also 657 COC certificates.

Reported by PEFC:"1.7 million ha are certified and 1,060 companies have a PEFC *Chain of Custody. Regarding Sustainable Forest Management certification, the certified area accounts for the 8.7% of forest area in Spain and is managed by roughly 12,000 owners. 72% of certified areas account for regional certificates, while 18% of certified forests belong to individual certificates and 10% belong to group certificates. Concerning the Chain of Custody certification, there are 1,060 certified companies: sawmills and timber traders (31.3%), primary building and wood processing industries (30.1%), printing companies (16.1%), pulp and paper industry (14.4%), retailers and wood products traders (4.6%), energy producers (2.5%), cork industry (0.7%) and non timber products industry (0.3%)"*[19].

Spain had a total certified forest area of 1.900.000 hectares or 10% of the forested areas (1% under FSC and 9% under PEFC).

[17] www.fsc.org
[18] http://pefc.org/about-pefc/membership/national-members/11-Spain
[19] http://es.fsc.org/

4. Conclusions

Spain's forest land is estimated to cover more than 18.37 million hectares, which is about 36% of the country land area. The broadleaf species are dominant (a majority of *Quercus spp.*) and are located rather in the western part of the country compared with softwoods (dominated by *Pinus spp.*) which are located in the eastern part. Dehesa, a multifunctional agro-sylvo-pastoral system with holm, cork and gall-oak), is also present in the western part and covers about 13,3% the total forested area.

In 2011, as much as 59.5% of the forest land is private and owned by a very large number of individuals smallholders, while only 28.2% of the forest land is public (6.1% State-owned and 2.3% community owned). A significant part of 12.3% included unknown property (some statistics report this figure in private ownership.

Natural expansion and forest plantation program that has been under way for more than 50 years, with soil protection and erosion prevention as its main aims helped to increased to forested area. According to FAO's Global Forest Resources Assessment, there has been an average annual increase by 0.43% (between 2000 and 2010).

The estimated volume of standing trees has increased since 1990 to reach more than 900.000.000 in 2010. It reflects the augmentation of forestland and a slight diminution of harvesting during the same period.

Because of the augmentation of the volume of live trees in the period 2005-2010, an increased of the estimated carbon stock in forests has been recorded. A 30% increase of living biomass was recorded between 1990 and 2010. As a result, the Spanish forests are estimated to have been a significant carbon sink between 1992 and 2012, with an estimated removal of 31.5 million tonnes CO_2.

Spain has various types of conservation lands dedicated to the protection of biodiversity, including natural reserves, national parks, Natura 2000 and other protection status, such as forests that have biodiversity in the objectives of their management plan. According to the Ministerial Conference on the Protection of Forests in Europe, about 18% of the Portuguese forests have a protection status in terms of biodiversity (MCPFE Classes 1.1-1.3 and Class 2). Protected areas as Natura 2000 have been accounted by EU-27 DG Environment and covers 7.998.000 ha of forests (i.e. about 43% of the country forests). Between 2009 and 2012, there was an increase of 3.1% in terms of surface of he protected areas (as defined in the Decree 1274/201).

According to the Ministerial Conference on the Protection of Forests in Europe, forest land specifically dedicated to soil, water and other forest ecosystem functions (in accordance with MCPFE class 3 definition) covers about 25.2% of the forests in Spain.

Even though controlled fires are used in forest management practices in Spain, the use of fire is subject to permit and carefully monitored in order to preserve air quality.

The FSC risk assessment platform www.globalforestregistry.org considers Spain is at low risk in terms of violation of illegal logging and in terms of violation of traditional and civil rights.

The forest certification systems are moderately developed in Spain, with about 10% of the forest land certified under FSC (1%) or PEFC (9%).

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