

Forest sustainability in Portugal

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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 Portugal, including general condition, management and sustainability assessment.

2. Portugal forests overview

2.1. Location and distribution

The Republic of Portugal covers an area of 92.209 km² (including the Madeira and the Azores islands) and is bordered to the North and the East by Spain and to the South and the West by the Atlantic Ocean.

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.

- NUT I : this level includes three units : continental Portugal and the two autonomous regions of Azores and Madeira archipelagos;
- NUT II : 7 regions with a real administrative purpose including 5 regions in continental Portugal (Figure 2) and two archipelagos regions (Azores and Madeira);
- NUT III : 30 sub-regions with statistical relevance only.

Figure 1: General maps of Portugal



Source: Geology.com

Figure 2: Administrative regions and sub-regions of Portugal (NUTS II and NUTS III)

The Table 1 shows the forested about 35 % of Portugal is forested.

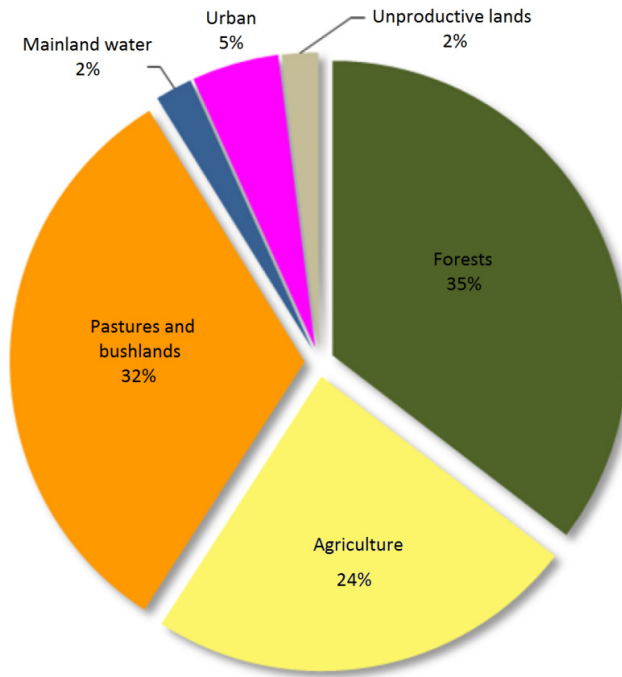
Table 1 : Forested area in Portugal, Madeira and the Azores (year 2010)

<i>Area in 1000ha</i>	<i>Mainland</i>	<i>Azores</i>	<i>Madeira</i>	Total
Forested Area	3 154,8	56	32,7	3 243,5
Total Area	8 879	232	80,1	9 209,1

Source : Inventário Florestal Nacional 6 (IFN6)

On Figure 3 we can see that those 35% forest are the dominant land use in continental Portugal, accounting for 35% of the territory¹. The shrublands and grasslands are the next class of land use with larger area. Agricultural areas comprise 24% of the mainland. Other non forested areas include urban areas (5%), inland water and wet land (2%) and unproductive lands (2%).

¹ Note that areas of forest use include wooded areas (corresponding to the designated forest stands) and temporarily treeless surfaces (surfaces burnt, cut and regeneration), for which is expected to regain its tree cover in the short term.

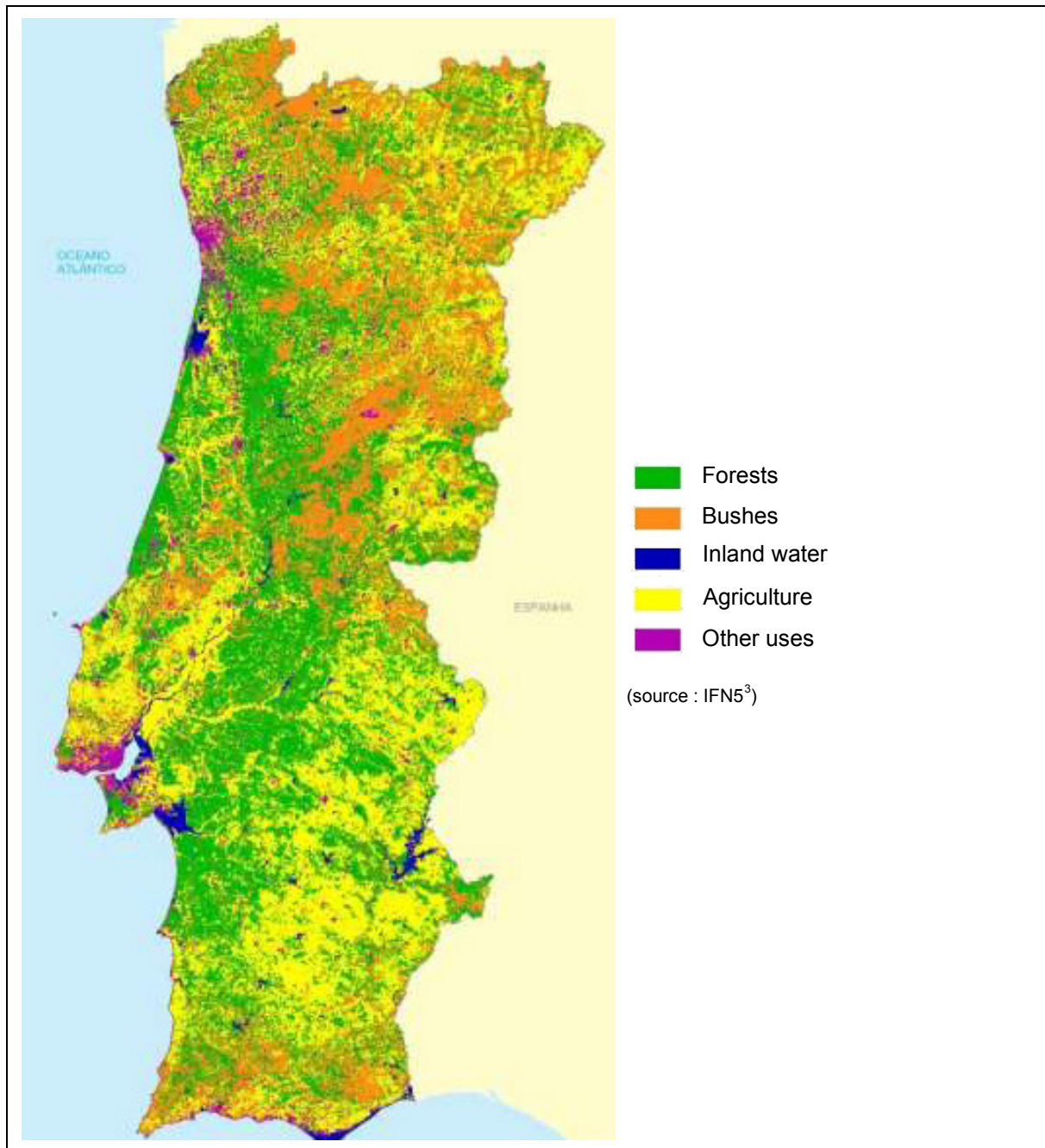
Figure 3 : Distribution of land uses in mainland Portugal for 2010

Source : Inventário Florestal Nacional 6 (IFN6)²

Figure 4 presents the generalized continental land cover. As can be seen on this map, most of the forests are located in the Northern and central parts of the country and along the coast.

² <http://www.icnf.pt/portal/florestas/ifn/resource/ficheiros/ifn/ifn6-res-prelimv1-1>

Figure 4 : Land cover in Portugal



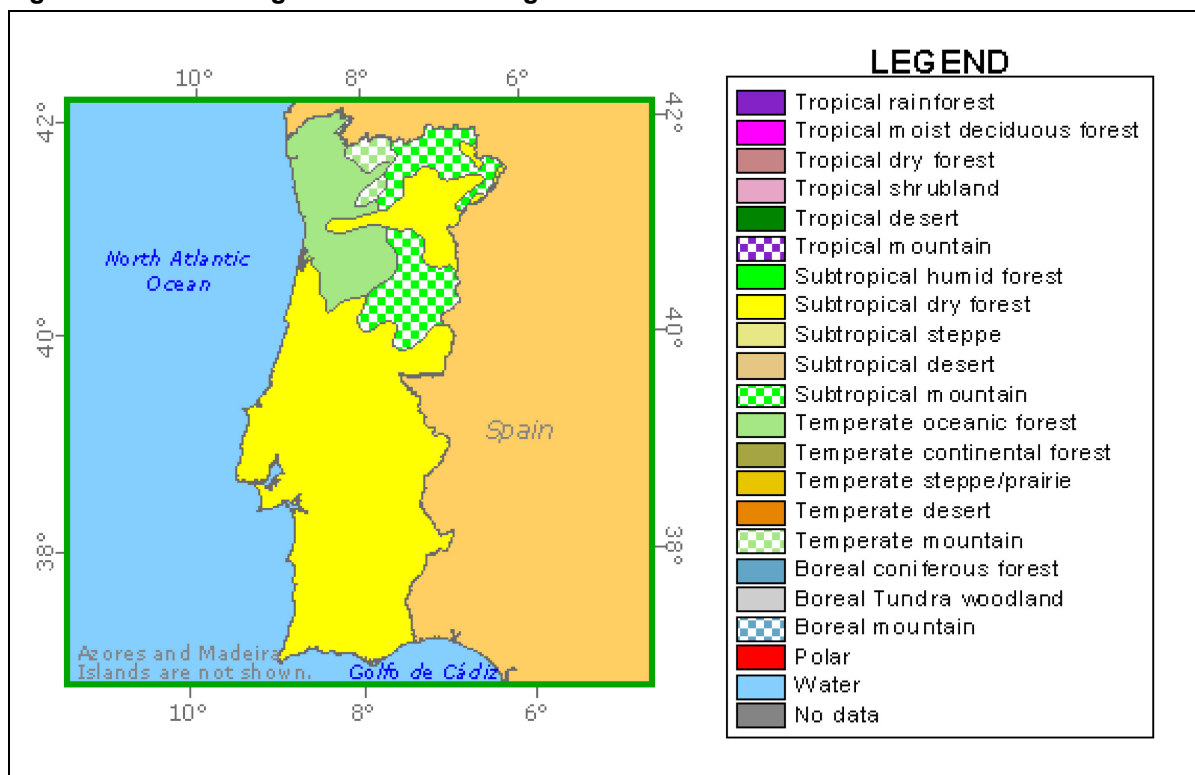
³ 5.º INVENTÁRIO FLORESTAL NACIONAL, Apresentação do Relatório Final 2010

2.2. Ecological zones

Portugal includes two main geographical parts: the eastern part is occupied by a mountainous region cut by several rivers (the upstream part of which being in Spain) and the western and southern part occupied by a large, intensively cultivated, coastal plain. The highest mountain, the Serra da Estrela, is located in the central part of Portugal and rise to 1 991 meters high.

The Portuguese climate is mild: warm and dry during spring and summer and cool with heavy rains during fall and winter. Average temperatures range from about 21°C in July to 10°C in January and annual average precipitation are about 1 400 mm in the northern part of the country and 500 mm along the southern coast.

Figure 5 : Main ecological zones in Portugal



Source : <http://www.fao.org/forestry/country/19971/en/prt/>

Portuguese territory is covered by four different ecological zones:

- the subtropical dry forest which covers most of the country;
- to the north, the subtropical mountain, the temperate oceanic forest and the temperate mountain.

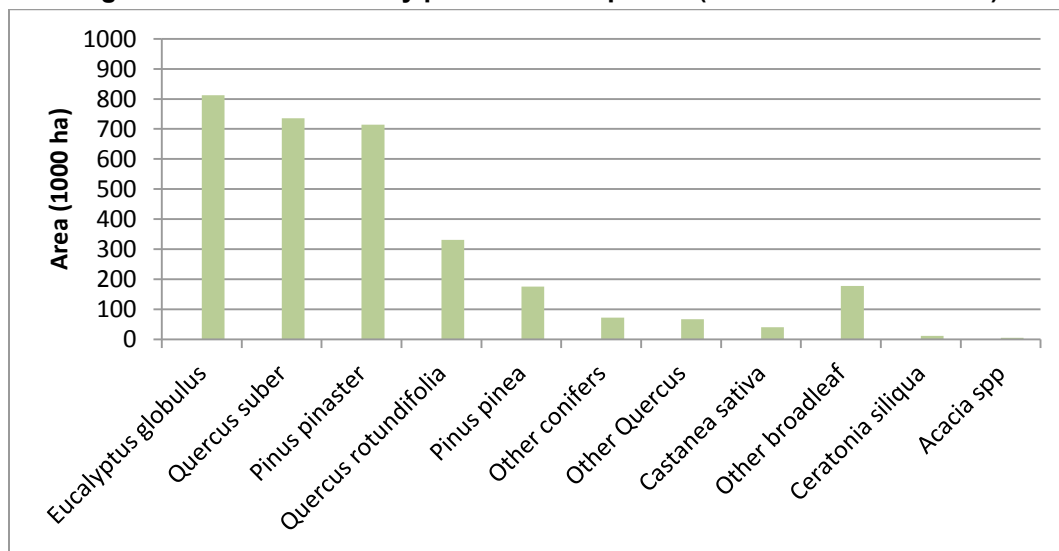
As we can see on this map, the ecological climax for most of the country is forest, even though a large part of it has been converted to agriculture, particularly in the Southern region.

The repartition of the main tree species throughout the country is presented on Figure 6 and mapped on Figure 7.

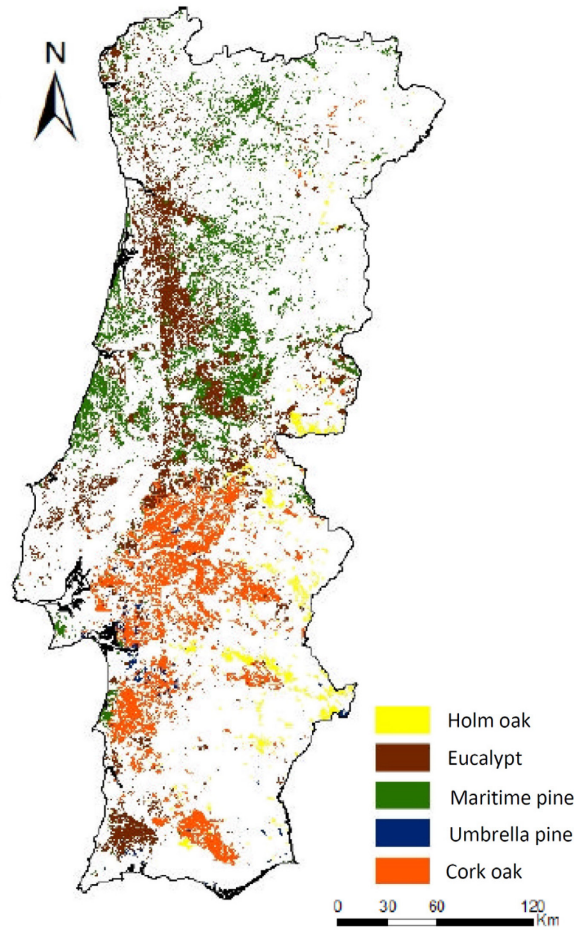
Three major tree species are found in Portuguese forests: the eucalyptus (*Eucalyptus globulus*), the cork oak (*Quercus suber*) and the maritime pine (*Pinus pinaster*). Each of those species covers about 812.000, 714.000 and 736.000 ha respectively. The holm oak (*Quercus ilex i.e. ex Quercus rotundifolia*) with about 331.000 ha is the fourth main specie of the Portuguese forest. Other broadleaf and Umbrella pines (*Pinus pinea*) are in Portugal with 178.000 and 176.000 ha respectively. In the rest of the forested areas stand we find other conifers (73.000 ha) and other Quercus (67.000 ha). There are also other less represented species like chestnut trees (*Castanea sativa*), carob tree (*Ceratonia siliqua*) and acacia spp.

Most of the maritime pines, the eucalyptus and the chestnut forest stands are in the northern half of the country while cork oaks, umbrella pines and holm and are most located in the southern half.

Figure 6 : Area of forest by predominant species (thousands of hectares)



Source : From IFN6

Figure 7: Repartition of the main tree species in Portugal (2005)

Source: http://old.ecmwf.int/newsevents/meetings/workshops/2009/ESF/presentations/Tue_PM/Pereira_Portugal.pdf

2.3. Forest ownership

Portuguese forests are characterised by the large predominance of the private ownership (87%), while public owned forests are not abundant (13%). Public owners include: State (3% of the country's forests) and communal land (10% of the country's forests)⁴.

According to PEFC Portugal the forest are privately owned forests include 2.8 million hectares (84.2% of the forested area with 6.5% owned by industrial companies and 77,5% by smallholder family-oriented). Public areas correspond to 15.8% of the total, of which only 2% are the private domain of the State⁵. The small holders owned forest is extremely fragmented, as it is shared between an estimated 400 000 individuals.

⁴ Reboredo F., 2013. Forest Context and Policies in Portugal

⁵ <http://www.pefc.pt/certificacao-gfs/introducao/floresta-portuguesa>

2.4. *Competent authorities*

The implementation of forest policies in Portugal is complex because of the ownership, with a predominance of individual small holders.

The organization of the forest management can be summarized by different levels:

- National : National forest strategy⁶
- Regional : Regional forests plans (PROF)
- Local : Forest management plans, special forest intervention plans (ZIF) and forest projects

The Institute for the Conservation of Nature and Forest (ICNF; created by the fusion of Institute for nature conservation and biodiversity (ICNB) and the National Forestry Authority (AFN) in 2013) is the responsible governmental body for nature and forest policy, including the management of Protected Areas and state forested areas of Portugal. The missions of ICNF are:

- to promote sustainable development of forest resources and associated spaces, including hunting, apiculture and aquaculture of inland waters and others directly associated with forest and forestry activities, through knowledge of their development and enjoyment, ensuring their protection, conservation and administration.
- to promote inter-sectorial balances, accountability of different actors and a proper organization of forest areas.
- to promote the improvement of competitiveness of the industries that comprise the various ranks forest, as well as structural prevention, acting in concert in planning and seeking joint strategies in defense of the forest.

In order to renew the legal provisions and to take into account the practices leading to sustainable management, a new Forest Policy Act has been approved by the Portuguese Parliament in 1996. This act creates regional forest management plans (PROF) and forest management plans (PGF) as key instruments of forest policy.

Moreover, a specific plan, the Plan for the Sustainable Development of the Portuguese Forest (PSDPF), has been adopted in March 1999. The main strategic orientations are given in the same report:

- to develop and assure the competitiveness of the forest sector;
- to preserve nature and valorise the environment in forest areas;
- to link the forest strategy with industrial development;
- to optimise and rationalise the management of game resources;
- to optimise and rationalise the management of inland fisheries resources,
- to promote the economic and social sustainable development,
- to modernise the administration.

⁶ The National Forest Strategy (published in 2006) is the result of a public consultation process. It defines the strategic framework for the development of the forest sector in the short- and medium-term.

Each region has its own management plan where the intervention means, the soil occupation and the use of the different forest area are described. These plans are called “Planos Regionais de Ordenamento Florestal” (PROF) and have the following objectives:

- to evaluate the potentialities of the forest spaces for their main uses;
- to define the species to promote for the expansion or reconversion of some parts of the forests;
- to identify the best forestry models fitting with existing situations;
- to define some critical areas for burning risks, erosion and ecological, social and cultural matter as well as the specific norms of forestry and supported use of the resources applying to these areas.

The PROFs are binding for all forests, including privately owned forests.

The ZIF (forest intervention areas = “Zonas de Intervenção Florestal”) have been defined by law in 2005, and revised in 2009 for the development of integrated and participatory landscape management strategies. This is also a legal institution of the forest intervention areas.

The main objectives of the ZIF approach are as follows:

- 1) promote the efficient management of forests;
- 2) mitigate the current constraints to forest intervention, namely land structure and size;
- 3) develop structural measures to defend forests against fires;
- 4) give spatial coherence to the interventions;
- 5) apply national rules and guidelines, provided by the National Forest Strategy and the National Plan for the Protection of Forests against Fire (see below) and by the regional and municipal plans
- 6) promote sustainable forest management.

The process constitutes three major stages:

- 1) legal procedure;
- 2) planning stage;
- 3) implementation stage.

Each ZIF is managed by a single entity and approved by landowners and producers who are responsible for defining the Forest Management Plan (PGF), where the forestry operations and activities are defined following the guidelines of the Regional Forest Plan and the Specific Plan for Forest Intervention (PEIF).

Some specific legislation has been taken to protect and enhance biodiversity. Indeed, a specific strategy for biodiversity protection and the deriving program, the National Strategy for Nature Conservation and Biodiversity and the National Programme for Nature Conservation, has to be carried out by the ICNF.

As Portugal is facing more and more fires, a specific plan has been established to fight these fires: the National Plan for the Protection of Forests against Fire (Plano Nacional de Defesa da Floresta Contra Incêndios).

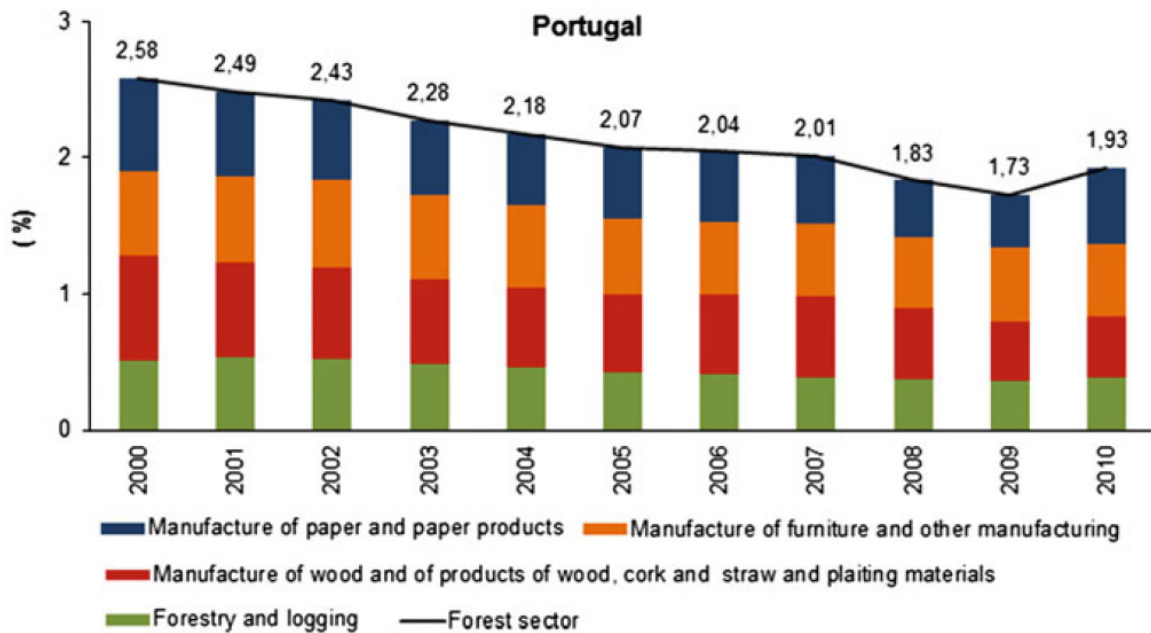
The main strategy lines of this plan are:

- to improve territory resilience against fires;
- to lower the fires' impacts;
- to improve the efficiency of fire fighting;
- to rehabilitate the burned areas;
- to adapt of a functional and efficient organic structure.

2.5. Overview of wood-related industry

The contribution of the forestry sector to Portugal's Gross Domestic Product in 2010 was 1.93%⁷ (Figure 8). This result is larger than the average for European Union.

Figure 8: Contribution of forest sector GAV to national GDP in Portugal



Source : . Louro G., Monteiro M., Constantino L. and Rego F., 2013. Forest Context and Policies in Portugal

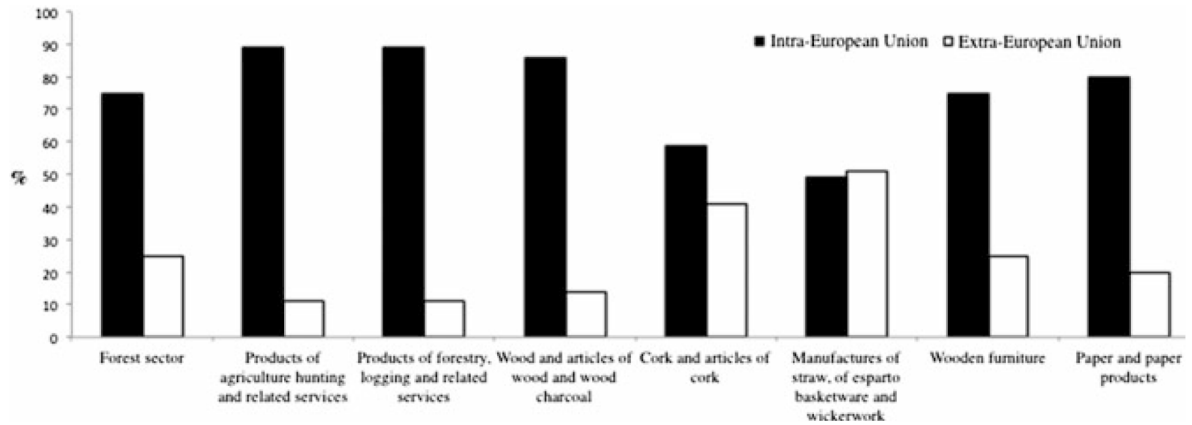
Approximately 10% of Portuguese wood products are exported to other countries. The majority of these exports are transformed products (2% of forest product exports are products of forestry, logging and related services; see Table 2). 75% of the wood products exported are made in the European countries (Figure 9).

⁷ Louro G., Monteiro M., Constantino L. and Rego F., 2013. Forest Context and Policies in Portugal. Chapter 2. *The Portuguese Forest Based Chains: Sector Analyses*. Graça Louro, Maria Monteiro, Luís Constantino and Francisco Rego

Table 2 : Structure of Portuguese forest sector exports

Paper and paper products	51 %
Wooden furniture	12 %
Cork and articles of cork	20 %
Wood and articles of wood and wood charcoal	15 %
Products of forestry, logging and related services	2 %

Source : Louro et al, 2013, op.cit.

Figure 9: Destination of the Portuguese forest sector exports

Source : Louro et al, 2013, op.cit.

In 2012 the forest sector show a positive commercial balance greater than 2 million € i.e. 1 million more than 2000s (Table 3).

Table 3 : Portuguese, national and forest sector, commercial balance

Commercial balance (Million €)	2006	2007	2008	2009	2010	2011	2012
Portugal	-20,654	-21,632	-25,347	-19,682	-21,379	-16,373	-10,667
Forest sector	1,079	916	1,033	1,030	1,485	1,718	2,248
Products of agriculture, hunting and related services	-1,459	-1,863	-2,007	-1,518	-1,745	-2,044	-1,913
Products of forestry, logging and related services	-4	-11	3	-28	-71	-93	-75
Wood and articles of wood and wood charcoal	102	107	68	2	-72	9	155
Cork and articles of cork	713	717	700	607	661	676	713
Manufactures of straw, of esparto basketware and wickerwork	-6	-7	-6	-6	-7	-5	-3
Wooden furniture	-32	-14	26	111	165	220	308
Paper and paper products	308	123	241	344	809	911	1,150

Source : Louro et al, 2013, op.cit.

The employment in the forest sector decrease since 2000 and was estimated to be 94 550 jobs in 2011 (Table 4). Employment in the forest sector is larger in coastal areas but is also significant in the remaining territory⁸.

⁸ Louro G., Monteiro M., Constantino L. and Rego F., 2013. Forest Context and Policies in Portugal. Chapter 2. *The Portuguese Forest Based Chains: Sector Analyses*. Graça Louro, Maria Monteiro, Luís Constantino and Francisco Rego

Table 4 : Forest sector employment

	2000	2008	2010	2011
Products of forestry, logging and related services	3,962	6,660	5,908	6,093
Sawnwood	9,499	6,830	5,241	5,163
Particle board	1,384	793	674	671
Fibreboard	625	612	346	443
Other panels	814	647	736	727
Builder's joinery and carpentry of wood	14,692	10,133	8,397	7,708
Wooden wrapping and packing	948	1,122	1,066	1,108
Wooden furniture	38,487	33,185	28,159	26,277
Other manufactured wood products	3,285	3,000	2,384	2,288
Wood pulp	2,251	1,339	1,524	1,538
Construction paper and paperboard	4,183	3,485	2,662	663
Packaging and wrapping paper and paperboard	5,207	5,340	4,803	5,028
Sanitary and household papers	346	422	1,190	1,168
Printing and writing paper	488	632	460	2,461
Straw and plaiting materials	80	80	44	50
Cork	12,780	10,667	8,147	8,335
Resins and resin products	510	172	205	208
Forest sector (without wholesale and retail trade)	99,541	85,119	71,946	69,929
Wholesale of logging products	3,082	4,817	4,145	3,965
Wholesale of cork, resin and others	293	223	190	256
Wholesale of furniture	4,063	3,966	2,815	2,289
Retail sale of furniture	11,439	11,989	10,113	9,453
Wholesale of builder's joinery and carpentry of wood	697	1,548	1,214	1,096
Wholesale of printing and writing paper	3,493	2,819	2,377	2,019
Retail sale of printing and writing paper	6,606	6,880	5,756	5,540
Forest sector (with wholesale and retail trade)	129,214	117,361	98,556	94,547

Source GEP (2012) Quadros de Pessoal, Lisboa, Gabinete de Estratégia e Planeamento (GEP), Ministério da Solidariedade e Segurança Social (MSSS)

3. Sustainability of Portugal forest

3.1. Evolution of forest area and risk of conversion

According to PEFC, Portugal has performed one of the largest afforestation programmes over the 20th century, One of the biggest large scale afforestation programmes of the 20th century. Indeed the forest cover has increased from under 2 million to over 3.4 million ha during the 20th century⁹.

It is more difficult to have a clear picture of the most recent evolution of forest cover, after 2000, because sources and methodologies differ.

According to FAO, in 2010¹⁰; forested area has increased in recent years:

- between 1990 and 2000, Portugal gained about 93.000 ha of forest a year (+0.28%/year).
- between 2000 and 2005 the forest's increase was a little bit lower and reached 0.10%/year.
- between 2005 and 2010, an increase of 0.11%/year is observed.

Table 5 : Forest area evolution from 1990 to 2010

Area (1000 hectares)	Period			
	1990	2000	2005	2010
Forest	3327	3420	3437	3456
Other wooded land	45,3	101	155	155
Total area	9212	9212	9212	9212
Percentage of forested area	36,12%	37,13%	37,31%	37,52%
Evolution of forest area (between period)	/	+93	+17	+19
Annual change	/	+9,3	+3,4	+3,8
Annual rate change	/	+0,28%	+0,10%	+0,11%

Source : Calculated from FAO (Global Forest Resources Assessment 2010)

These figures are included in the majority of European forest reports^{11 12 13}. However those statistics include interpolated and extrapolated figures, based on previous inventories (for example “*The year 2010 forest forecasted figures were extrapolated from the NFI4 (1995 inventory) and NFI5 (2005 inventory)*”).

Unfortunately these figures cannot be compared with the recent inventories made in Portugal in 2010 and reported in 2013 (IFN6) for many reasons¹⁴.

- IFN6 is based only on mainland territory (this is a preliminary version but the updated rapport will included the two other regions).

⁹ <http://www.pefc.org/component/pefcnationalmembers/?view=pefcnationalmembers&Itemid=48/14-Portugal>

¹⁰ Global Forest Resources Assessment 2010. Country Report Portugal Forestry Department FAO

¹¹ State of Europe's Forests 2011 Status and Trends in Sustainable Forest Management in Europe

¹² The State of Mediterranean Forests 2013

¹³ http://www.europarl.europa.eu/aboutparliament/en/displayFtu.html?ftuld=FTU_5.2.10.html

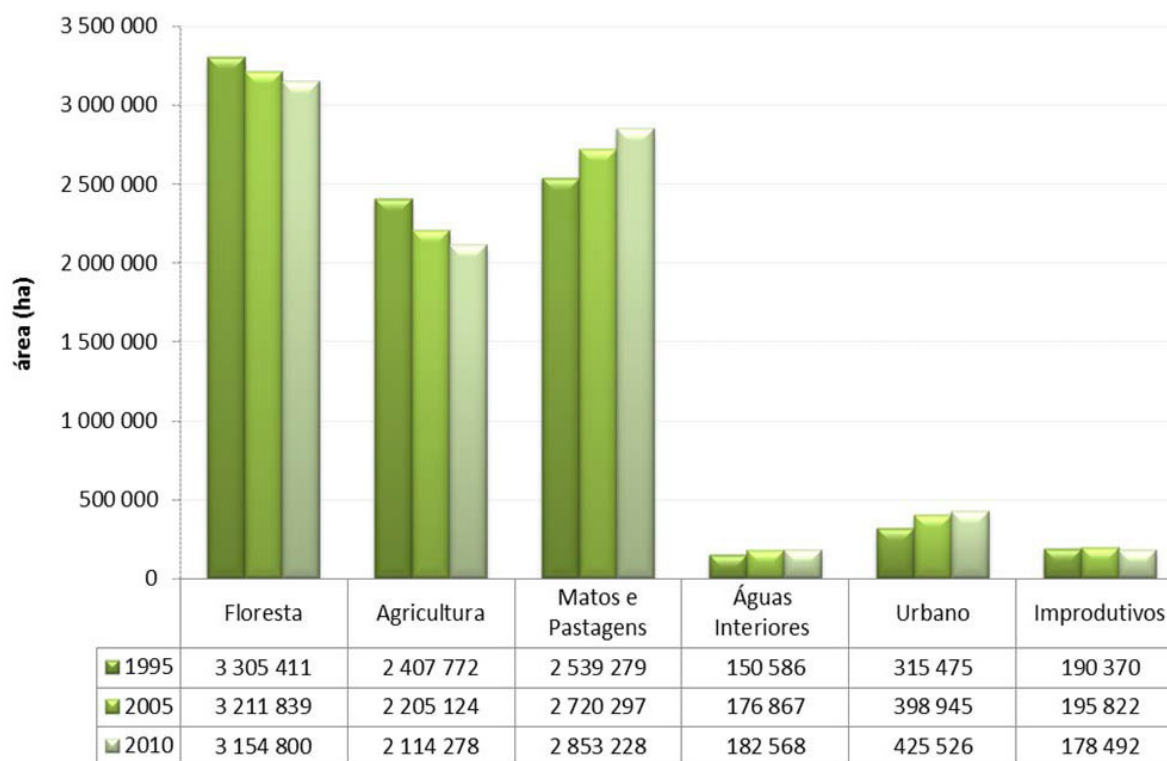
¹⁴ ICNF (2013) IFN6—Áreas dos usos do solo e das espécies florestais de Portugal continental. Resultados preliminares. [pdf]. Instituto da Conservação da Natureza e das Florestas, I.P., Lisboa, p 33

- some methodological changes were applied, because of which the new figures are not comparable to previous results (it is described in the rapport)¹⁵
- the results for 1995 and 2005 appear to have been recalculated in IFN6 because they don't match the FOA figures any longer.

The results from IFN6 are presented in Figure 10. It is important to note that conclusions are not the same compared with the FAO report. In fact forest area evolution operates in the opposite direction. Conclusions from the IFN6 are the following :

Over the period 1995-2010 forest areas exhibit a decrease of 4.6%, which corresponds to a rate of net loss of -0.3%/year (10 000 ha/year). The net decrease in forest areas (-150 611 ha) is mainly due to its conversion to use class "shrubland and grassland» (85%). Note also that a significant amount of area in forest land use are converted to urban use between 1995 and 2010 (28 000 ha).

Figure 10: Evolution of land use in continental Portugal



Source : IFN6

Noted : "Floresta" is "forest", "agricultura" is "agriculture", "Matos e Pastagens" is "shrubland and grassland", "aguas interiores" is "Inland waters and wetlands"¹⁶, "urbano" is "urban" and "improdutivos" is "improductive"¹⁷

¹⁵ "It is important to note however that, compared with previous inventories and despite aerial photographic coverage is the same, the sampling methodology and classification now used was distinct... so the data now available for 1995 and 2005 are not directly comparable with published official figures". (translated)

¹⁶ Ground covered or saturated with water during the whole or a significant part of the year.

¹⁷ No vegetation growth or very limited (less than 10%), or because of natural limits of the soil, or as a result of anthropogenic actions.

The difference between the FAO results (which conclude to a slight augmentation of forest cover in Portugal between 1995 and 2005) and the IFN6 results (which conclude to a slight diminution of the forest cover in Portugal between 1995 and 2005) mainly reflects a switch of some IFN forest land category into the IFN "shrubland and grassland" category. It is unclear however to what extent this change reflects a new definition and methodology to differentiate forests from shrublands or if it reflects the actual evolution of forest cover after 1995. Both forestlands and shrublands are wooded areas, with differences in terms of trees high and canopy cover, and it can be quite delicate to tell them apart. In some instances, areas recovering from forest fires are categorized as shrubland when the highest storey can't regenerate or have not been able to regenerate yet.

In terms of evolution of the species cover (the surface occupied by maritime pine has significantly decreased (from 978.000 ha down to 714.500 ha in fifteen year). All oak areas tend to decrease. On the other side we observe an important increase of Eucalyptus and stone pine¹⁸ area about 94 700 ha and 55 000 ha respectively.

Table 6 : Evolution of forested area by species (ha)

<i>Tree species</i>	<i>1995</i>	<i>2010</i>	<i>Net change</i>
Maritime pine	977 883	714 445	-263 438
Holm oak	366 687	331 179	-35 508
Other oak	91 897	67 116	-24 781
Cork oak	746 828	736 775	-10 053
Acacia	12 278	11 803	-475
Carob tree	2 701	5 351	2 650
Sweet chestnut	32 633	41 410	8 777
Other softwoods	61 340	73 217	11 877
Other hardwoods	155 187	177 767	22 580
Stone pine	120 129	175 742	55 613
<i>Eucalyptus</i>	717 246	811 943	94 697

Source: Calculated from IFN6

The FSC risk assessment platform www.globalforestregistry.org considers that Portugal 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.

¹⁸ Also named umbrella pine

3.2. Living wood volumes and removals

Table 8 shows the evolution volume of live trees in Portugal (1990 to 2010). According to the available data, the growing stock volume has consistently decreased between 1990 and 2005 and then shows a slight increase between 2005 and 2010. The growing stock in other wooded lands remains small compared to the growing stock in forests, but has been consistently increasing since 1990. As the volumes of annual increments and fellings have been rather stable over the considered period of time, it seems that other losses made the difference. In particular, as previously mentioned, forest fires are the main cause of the recorded decrease of wood volume (see also section 3.7). The latest trend (2005-2010) shows an augmentation of the annual volume increment, a slight reduction of the annual harvestings and a slight increase of estimated standing volume in forests.

Table 7 : Evolution of wood volume from 1990 to 2010 (volume in 1000m³)

	1990	2000	2005	2010
Growing stock in forests and on other wooded land	203.276	197.759	186.790	187.800
Growing stock of forests	203.000	197.000	185.000	186.000
Growing stock of other wooded land	276	759	1.790	1.800
Growing stock in forests available for wood supply	166.000	163.000	152.000	154.000
Increment in forests available for wood supply	18.564	19.054	18.870	19.086
Fellings in forests available for wood supply	13.852	12.650	14.229	13.042
Fellings in percent of net increment (%)	74,6%	66,4%	75,4%	68,3%
Fellings in percent of net increment for EU 28 (%)	56,1%	61,0%	65,0%	62,7%

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

Softwood is mainly used for logs and veneer, while hardwood (eucalyptys) is mainly used for pulp and paper (Table 8).

Table 8 : Roundwood removals by type of wood and assortment (volume in 1000m³)

		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Coniferous	Fuelwood, including wood for charcoal	200	200	200	200	200	200	200	200	200	200	
	Industrial roundwood	Sawlogs and veneer logs	2.194	2.369	2.396	2.568	2.266	2.459	2.482	2.342	1.704	NA
		Pulpwood	1.633	749	955	919	700	811	818	1.030	664	NA
		Total	3.977	3.268	3.501	3.637	3.116	3.419	3.452	3.515	2.433	3.221
	Total roundwood	4.177	3.468	3.701	3.837	3.316	3.619	3.652	3.715	2.633	3.421	
Non-Coniferous	Fuelwood, including wood for charcoal	400	400	400	400	400	400	400	400	400	NA	
	Industrial roundwood	Sawlogs and veneer logs	52	114	114	106	103	96	96	91	93	NA
		Pulpwood	6.210	6.733	6.559	6.450	6.320	5.419	5.470	6.727	7.046	7.288
		Total	6.292	6.878	6.704	6.586	6.453	5.545	5.597	6.846	7.151	7.410
	Total roundwood	6.692	7.278	7.104	6.986	6.853	5.945	5.997	7.246	7.551	7.810	
Total removal		10.869	10.746	10.805	10.823	10.169	9.564	9.648	10.961	10.184	11.231	

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

Since the public forest ownership is very limited, the harvested volumes from state land are unsurprisingly very small compared to harvesting from private land (Table 9).

Table 9 : Roundwood removals under bark by type of ownership (volume in 1000m³)

Roundwood removals (thousand cubic metres)						
	Type of wood/year	2007	2008	2009	2010	2011
State ownership	Coniferous	294	/	58	93	88
	Non -coniferous	534	/	95	117	111
	Total	828	/	153	201	199
Private ownership	Coniferous	3.543	/	3.562	3.559	3.370
	Non-coniferous	6.452	/	5.849	5.880	5.571
	Total	9.995	/	9.411	9.439	8.941

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

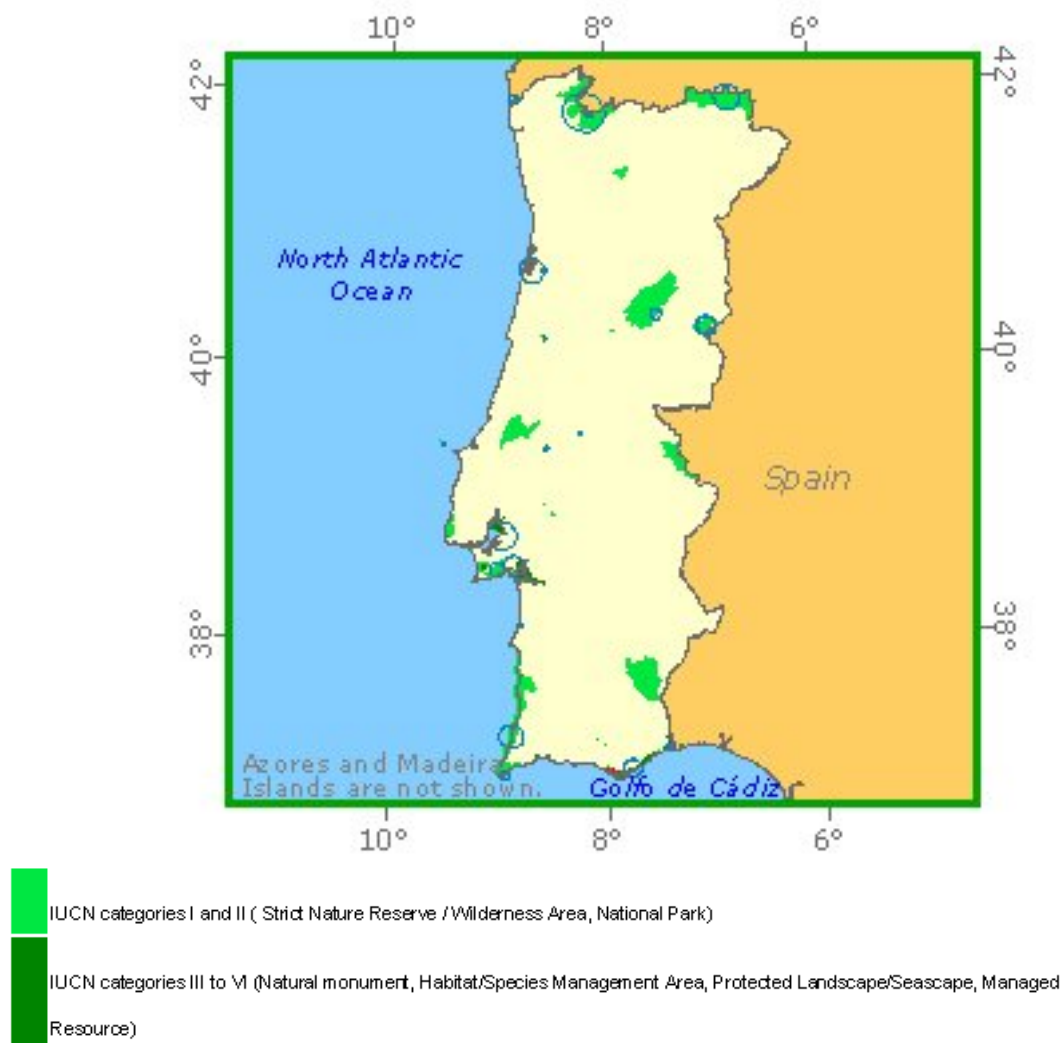
3.3. *Protection of ecosystems and biodiversity*

Locations of the main protected areas of Portugal are presented at the figure below. As we can see these protected areas are distributed throughout the country.

These protected areas are divided into five categories:

- one National Park created in 1972 and located in the North of the country (Parque Nacional);
- 13 Natural parks (Parques Naturais);
- 9 Nature Reserves (Reservas Naturais);
- 6 Landscape Protection Areas (Paisagens Protegidas);
- 5 Nature Monuments (Monumentos Naturais).

These locations are given at the following figures.

Figure 11 : Location of the protected area of Portugal

Source: <http://www.fao.org/forestry/country/61589/en/prt/>

National Park



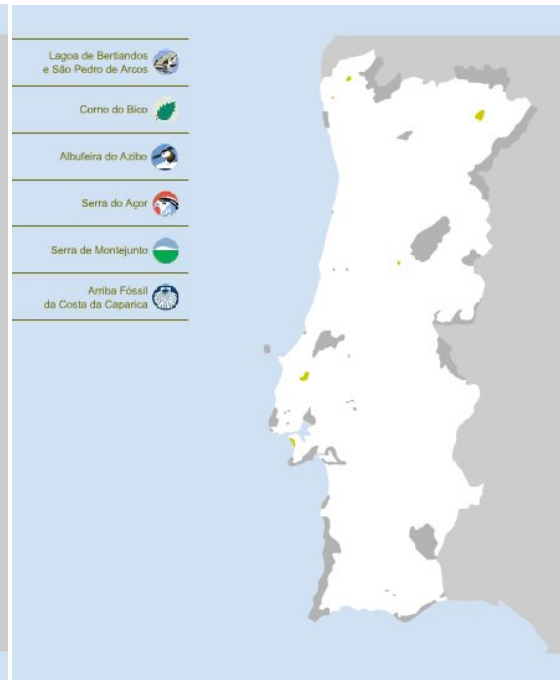
Natural Parks



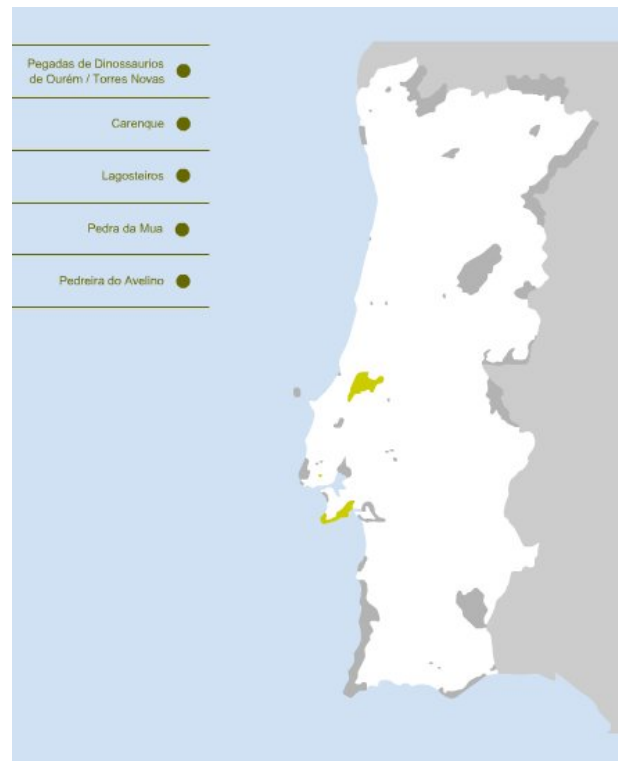
Nature Reserves



Protected Landscape area



Nature Monuments



Source: ICNB

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 protected area in Portugal register by MCPFE is around 1.544.000 ha (classes 1.1.- 1.3 & 2.)¹⁹. This is about 45% of the forest land.

Table 10 : 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

Amongst those protected areas, Natura 2000 network covers 746.000 ha of forests (i.e. 23% of the country forests). The location of the terrestrial part of this network is given on the following link

¹⁹ The State of Mediterranean Forests 2013

http://ec.europa.eu/environment/nature/natura2000/db_gis/pdf/PTn2k_0802.pdf

Protected areas are regulated by Decree-Law 142/2008 (24 July 2008), and can be classified by the national authority, or even by public or private institutions. This decree defines strategic guidelines and its own instruments, targeting the following objectives²⁰:

- 1) ensure the conservation of natural values and promote their recovery and sustainable use;
- 2) promoting nature conservation and biodiversity as a fundamental dimension of sustainable development, particularly through the integration of the policy of nature conservation and biodiversity in policy planning and the various sectoral policies;
- 3) include criteria for nature conservation and biodiversity in social systems, business and economics;
- 4) define and delimit a basic infrastructure for nature conservation, the aforesaid RFCN;
- 5) contribute to the achievement of the objectives of international cooperation in conservation of nature, particularly those defined in the Convention on Biological Diversity;
- 6) to promote scientific research and knowledge about the natural heritage as well as monitoring species, habitats, ecosystems and geosites;
- 7) promote education and training of civil society in nature conservation and biodiversity and provide information, awareness and public participation by encouraging visitation, communication, contact between the public interest and with nature;
- 8) promote recognition by society of its assets, inter-generational, economic and social components of biodiversity and geological heritage.

Forest management plans are compulsory at holding level and rely the orientation of the applicable regional plans (PROFs). The content of the FMP includes²¹:

- *Brief social and territorial context (including existing restrictions);*
- *Characterization of the resources, namely on forest stands, grazing areas, hunting and inland fisheries activities and other resources;*
- *The exploitation model: programs for the management of wood and non-wood production, other services and a **biodiversity management program** whenever the forest holding overlaps with a designated area for nature conservation (Natura 2000 sites, protected areas at national level and other areas protected for nature and biodiversity reasons such as under Ramsar Convention).*

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 10). It is based on the surface of forest land specifically dedicated to protective functions, as defined by the following criteria²²:

²⁰ ICNB 2009. Portugal fourth national report to the Convention on Biological Diversity

²¹ http://ec.europa.eu/environment/forests/pdf/fmp_table.pdf

²² 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>

- *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*

Table 11 : 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	232	6.7%
2005	232	6.8%
2000	216	6.3%
1990	n.a.	n.a.

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

The protection of water resources is considered as a function in the Regional Forest management plans (PROFs)²³ : 81 % of forests have this function as one of the 3 priority functions – this includes protection of hydrological basins, protection against water erosion and floods.

According to the Ministerial Conference on the Protection of Forests in Europe²⁴ , Portugal has published good practice guidelines for forest projects (consistent with the guidelines of Lisbon Resolution L2 by MCPFE), including provisions on water and soil protection. However, we have not been able to find a copy of those guidelines and it is not clear to what extent they are promoted or enforced in practice.

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 10). The conservation areas are presented on Table 10.

As described in the previous section, the conservation of soil (in particular erosion aspects) is included in the objectives of the Regional Forest management plans (PROFs) and also addresses in

²³ Implementation of the Forest Europe commitments - National and Pan-European Actions 2008–2011 http://www.foresteurope.org/documentos/FOREST_EUROPE_Implementation_Report_web.pdf

²⁴ Implementation of the Forest Europe commitments - National and Pan-European Actions 2008–2011

Portugal's good practice guidelines for forest projects (consistent with the guidelines of Lisbon Resolution L2 by MCPFE).

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 Portugal to the Ministerial Conference on the Protection of Forests in Europe (MCPFE) in the framework of Full State of Europe's Forests 2011 Report²⁵. Even though only carbon stocks in living biomass has been quantified, we can see a depletion of the carbon stocks, especially between 2000 and 2005, which is obviously associated with major forest wildfires in Portugal during this period.

Table 12 : 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	72.5	29.9	n.a.	n.a.	n.a.
2005	72	29.8	n.a.	n.a.	n.a.
2000	79	n.a.	n.a.	n.a.	n.a.
1990	n.a.	n.a.	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

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. The reference period for LUC in the UNFCCC inventories is 20 years. The latest version available for Portugal refers to the 2012, i.e. the changes between 1992 and 2012.

Based on those data, we can see that the Portuguese forest has been a significant carbon sink during the period 1992 to 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. The impact of the major forest wildfire, especially after 2000, is not visible here, presumable because it is largely compensated by large carbon sequestration related to afforestation and growth.

²⁵ http://www.foresteuropa.org/full_SoEF

Table 13 : estimated carbon stock changes and CO2 emissions from Portuguese forestry and forest-related land use change between 1992 and 2012

	Area (kha)	CHANGES IN CARBON STOCK				Net CO ₂ emissions (+) or removals (-)
		Carbon stock change in living biomass			Net carbon stock increase(+) or losses (-) in dead organic matter	
		Stock gains (+)	Stock losses (-)	Net increase (+) or losses (-)		
		(Gg C)				
Emissions from forest Land remaining Forest Land	3 864.30	7 630.50	-4 426.32	3 204.17	-10.02	-11 824
Emissions from LUC : land converted to Forest Land	497.28	1 198.05	-229.83	968.23	3.09	-4 827
Cropland converted to Forest Land	200.04	507.84	-63.07	444.76	18.07	-2 789
Grassland converted to Forest Land	94.06	188.56	-26.65	161.90	8.47	-867
Wetlands converted to Forest Land	0.08	0.17	-0.02	0.16	0.01	-2
Settlements converted to Forest Land	2.09	5.53	-1.74	3.79	0.24	-53
Other Land converted to Forest Land	201.01	495.96	-138.34	357.61	-23.70	-1 116
Emissions from LUC : forest land converted to another land use	277.88	63.31	-158.08	-94.77	-9.07	1 844
Forest Land converted to Cropland	52.42	10.27	-45.00	-34.72	-5.32	440
Forest Land converted to Grassland	50.42	0.72	-10.37	-9.65	-4.99	216
Forest Land converted to Wetlands	14.86	NO	-2.95	-2.95	-1.51	206
Forest Land converted to Settlements	80.09	NO	-59.21	-59.21	-5.61	1 102
Forest Land converted to Other Land	80.09	52.32	-40.55	11.77	8.35	-120
Total emissions from forestry and LUC associated to forestry						-14 807

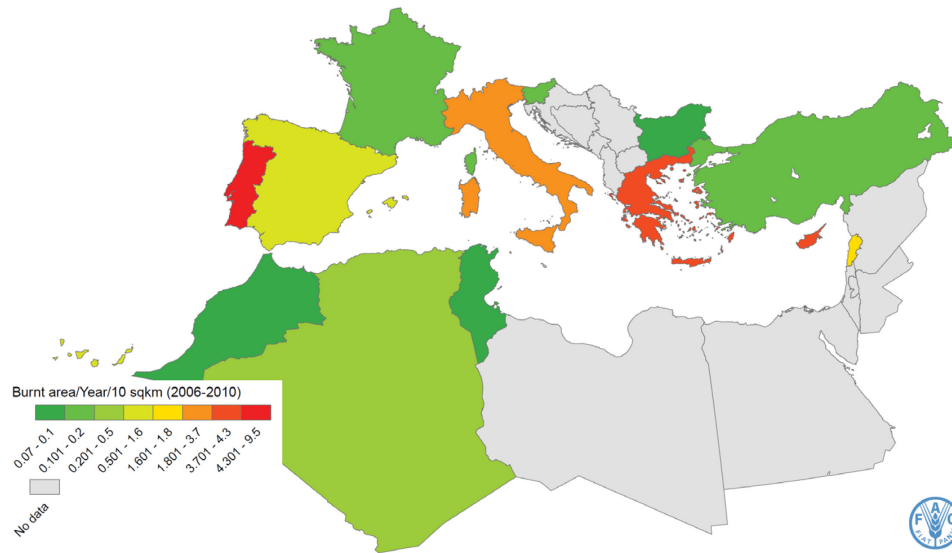
calculated from : UNFCC, national GHG inventories, Common Reporting Format, Portugal 2012, version 2014

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 Portugal. However with Greece, it is one of the Mediterranean countries that are the most affected by wildfires (Figure 12).

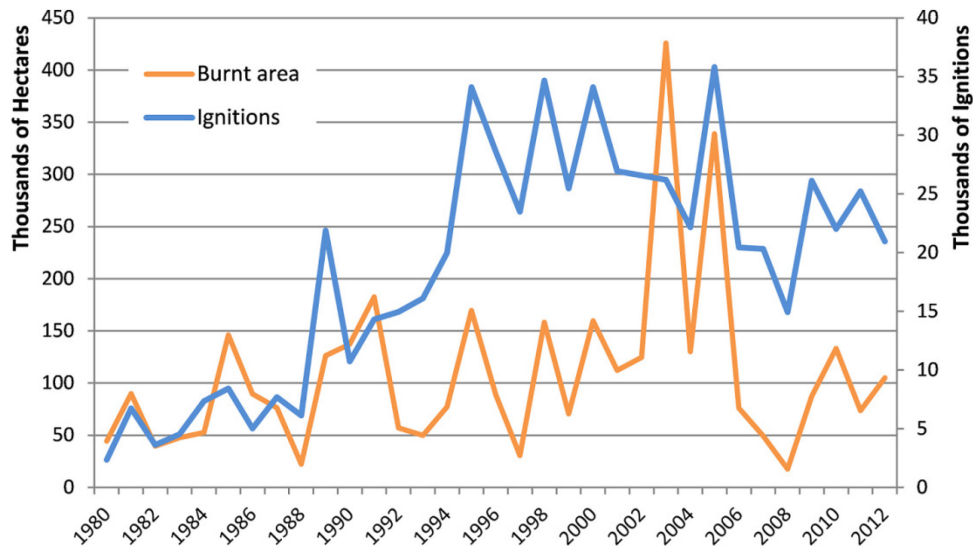
Figure 12 : Burnt area per year and per 10 square kilometres between 2006 and 2010



Source : The State of Mediterranean Forests 2013

About 3.5 million hectares were lost in Portugal from 1980 to 2012. The number of ignitions has increased with time and two major cases occurred in 2003 and 2006 with more than 760.000 ha burned.

Figure 13 : Evolution of burnt area and number of ignitions with time



Source : Verde J., 2013. The impact of an ever-changing territory on wildfire hazard assessment

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 Portuguese and Spanish pine forests (early 1980s). Today, this practice is applied in other species (Table 12).

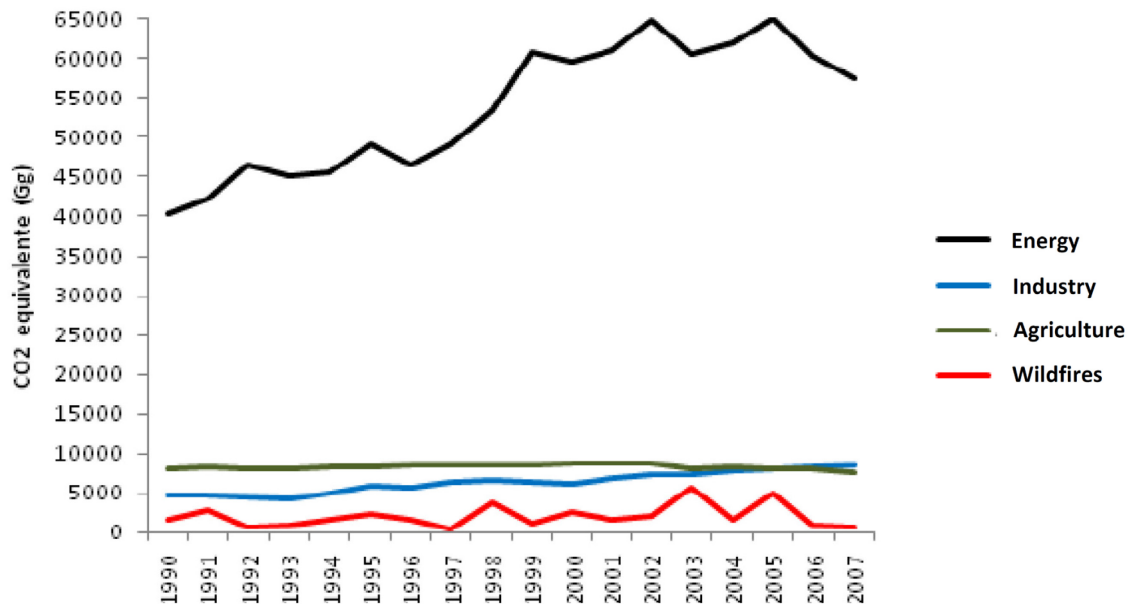
Table 14 : Established prescribed fire practices by vegetation in southern Europe

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

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

As we see on the following graph, GHG emissions are not negligible but still lower than those of other sectors.

Figure 14 : CHG emissions from various sectors and from wildfires in Portugal



Source : http://old.ecmwf.int/newsevents/meetings/workshops/2009/ESF/presentations/Tue_PM/Pereira_Portugal.pdf

3.8. Illegal logging

The FSC risk assessment platform www.globalforestregistry.org considers Portugal 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 ²⁶
- 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 ²⁷
- 1.3 There is little or no evidence or reporting of illegal harvesting in the district of origin ²⁸
- 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 ²⁹

3.9. *Civil rights and traditional rights*

The FSC risk assessment platform www.globalforestregistry.org considers Portugal 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

3.10. *Forest certification*

The main forest certification schemes used in Portugal are:

- PEFC (Programme for the Endorsement of Forest Certification), a global certification system that ensures sustainable forest management
- FSC (Forest Stewardship Council³⁰), which is specifically suitable for small private owners

Portugal had a total certified forest area of 570.000 hectares, including

- 340.000 hectares certified against FSC ³¹
- 230.000 hectares were certified against PEFC³².

In total, 17% of the forest area in Portugal was certified³³: 10% under FSC and 7% under PEFC.

²⁶ www.illegal-logging.info ; www.eia-international.org ; <http://www.ahec-europe.org/>

²⁷ www.illegal-logging.info ; www.eia-international.org ; <http://www.ahec-europe.org/>

²⁸ www.illegal-logging.info ; www.eia-international.org ; <http://www.ahec-europe.org/>

²⁹ <http://www.transparency.org/cpi2012/results>

³⁰ www.fsc.org

³¹ <http://pt.fsc.org/>

³² <http://www.pefc.org/component/pefcnationalmembers/?view=pefcnationalmembers&Itemid=48/14-Portugal>

³³ Calculated from the area of forest in 2010 in the last inventory

4. Conclusions

Portugal's forest land is estimated to cover more than 3.2 million hectares, which is about 35% of the country land area. The broadleaf species are dominant (with mostly eucalyptus and cork oak), although very large pine forests are also present, particularly in the northern part of the country.

As much as 87% of the forest land is private and owned by a very large number of individuals smallholders, while only 13% of the forest land is public (3% State-owned and 10% community owned).

An intensive afforestation programme has been conducted in Portugal during the 20th century, resulting in an increase of forest land by more than 50%. The trend during the last two decades is less clear because of divergent information sources and methodological issues. According to FAO's Global Forest Resources Assessment, there has been an average annual increase by 0.1% (between 2000 and 2010) while according to the latest (partial) analysis of Portugal's forest inventory programme IFN6, there would have been an average yearly decrease by -0.3% (between 1995 and 2010). The difference reflects the categorisation of former forest land into the category "shrubland and pastures" in IFN6, reflecting methodological changes and actual vegetation changes (in particular reclassification of zones recovering from wildfires).

Even though the annual harvesting have been rather stable since 1990 (ranging between 12 and 14 millions m³ per year), the estimated volume of standing trees has slightly decreased, obviously as a result of the severe wildfires recorded in the early years 2000. Between 2000 and 2005, the annual loss in terms of volume of standing trees was in excess of 1% yearly. It was stable between 2005 and 2010.

Because of the diminution of the volume of live trees in the period 2005-2010, a depletion of the estimated carbon stock in forests has been recorded. A 6% decrease of the above ground living biomass was recorded between 2000 and 2005, then a stabilisation between 2005 and 2010. The quantification of underground living biomass, litter, dead organic matter and soil carbon is not available throughout this period.

Despite this diminution of carbon stock between 2000 and 2005, it is estimated in the UNFCCC national inventory report that the Portuguese forests have been a significant carbon sink between 1992 and 2012, with the removal of over 14 million tonnes CO₂.

Portugal 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 plans (PROFs). According to the Ministerial Conference on the Protection of Forests in Europe, about 45% of the Portuguese forests have a protection status in terms of biodiversity, including 23% protected as Natura 2000.

The protection of water resources is considered as a function in the Regional Forest management plans (PROFs) : 81 % of forests have this function as one of the 3 priority functions. It includes protection of hydrological basins, protection against water erosion and floods. 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 6.7% of the forests in Portugal.

Even though controlled fires are regularly used in forest management practices in Portugal, the use of fire is subject to permit and carefully monitored in order to preserve air quality. Significant wildfires have spread throughout Portugal in recent years, particularly between 2000 and 2005.

The FSC risk assessment platform www.globalforestregistry.org considers Portugal 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 Portugal, with about 17% of the forest land certified under FSC (10%) or PEFC (7%).

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