

Submission of information on forest management reference levels by Portugal

This submission by Portugal responds the request set out in paragraph 4 of Decision 2/CMP.6 on Land-Use, Land-Use Change and Forestry.

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1 Forest management reference level value

Portugal proposes two values for its Forest Management Reference Level, depending on how the accounting of harvested wood products is addressed, i.e., using the current accounting rules (considering the instant oxidation of wood at the moment of harvest) or accounting for domestically produced wood on the basis of emissions when they occur (using a first order decay function).

The proposed reference level was constructed to reflect the expected level emissions and removals originating from areas under 3.4 Forest Management during the period 2013-2020, and assumes neither forest policy changes introduced after mid 2009, nor introduction of possible policy changes in the future. In that sense, it can be characterized as a *business as usual* emission scenario for the areas under 3.4 Forest Management.

The proposed reference level is fully consistent with the data submissions of 2011, both for reporting of emissions and removals under the UNFCCC and the reporting of 3.3 and 3.4 activities under the KP.

Finally, these proposed values assume that future LULUCF accounting rules will contain provisions for the treatment of force majeure, generically understood as low probability large emissions beyond the control of Parties. The proposed reference level contains a background level of fire emissions, based on historical data. That level is expected to occur during the commitment period and explicitly excludes years with abnormally high fire emissions.

Table 1: Proposed Forest Management Reference Level

	Proposed Reference Level (HWP Instant Oxidation)	Proposed Reference Level (HWP First Order Decay)
PORTUGAL	-6.48	-6.83

Unit: million tonCO₂eq.

	RL	2013	2014	2015	2016	2017	2018	2019	2020
3.4 Forest Management (HWP Instant Oxidation)	-6.479	-5.639	-6.240	-6.362	-6.483	-6.603	-6.721	-6.839	-6.945
3.4 Forest Fire Emissions (included above)	1.357	1.379	1.373	1.366	1.360	1.354	1.347	1.341	1.335
HWP from 3.4 (FOD)	-348	-398	-381	-366	-352	-339	-327	-316	-305
3.4 Forest Management (HWP FOD)	-6.827	-6.037	-6.621	-6.727	-6.835	-6.942	-7.049	-7.155	-7.251

unit: 1.000 tonCO₂eq.

2 General description

2.1 Consideration of the Elements in Footnote 1 of Paragraph 4

2.1.1 Removals or emissions from forest management as shown in greenhouse gas inventories and relevant historical data

Historical data was the basis for the entire process of calculation of the proposed Reference Level.

The methodologies used for estimating future emissions and removals are exactly the same as the ones used in the National Inventory Report, submitted by Portugal in 2011.

All assumptions on future performance of Portuguese forests are transparently anchored in historical data, as outlined and explained in the sections below.

2.1.2 Age-class structure

Age-class structure, combined with rotation age, is usually a good proxy for estimating harvesting expectations in the future. This is certainly the case for the main wood producing species, Eucalypts (*Eucalyptus spp.*) and to a certain degree Maritime Pine (*Pinus pinaster*) although about 36% and 44%, respectively, of the stands of these species are irregular/uneven aged.

However, for many tree species occurring in Portugal, age class is less relevant for that purpose for a number of reasons:

- Some forest types are managed mostly for non-wood purposes. That is the case for species used for seed production for human and/or animal consumption;
 - Holm Oak (*Quercus rotundifolia*); Umbrella Pine (*Pinus pinea*); Carob Tree (*Ceratonia siliqua*); Strawberry Tree (*Arbutus unedo*); and partially Chestnut Tree (*Castanea sativa*); Walnut Tree (*Juglans regia*)
- Cork Oaks (*Quercus suber*) are managed mostly for cork (=bark) production, and harvestable surface, rather than volume is the correct production unit. There is no incentive for harvest, as wood has a very low value compared to cork, and cork production increases with tree size;
- Some species, notably Cork Oaks (*Quercus suber*) and Holm Oaks (*Quercus rotundifolia*), are protected by law, and it is illegal to harvest or deforest those areas without a special permit. Large areas of these forest types are managed in agro-forest systems, i.e., with agriculture or grasslands in their undercover.
- Some areas, e.g. protected areas or riparian corridors, are protected by law, and it is illegal to harvest or deforest those areas without a special permit.

Additionally, forest fires affect age class structure by increasing tree mortality in affected areas and by being indirectly responsible for harvesting at ages lower than rotation age, associated with post-fire salvaging and regeneration management. The nature of forest fires (future forest fire size and location impossible to model with reasonable accuracy) limits the use of age class structure for predicting future harvest levels.

For the reasons outlined above, age class structure was not a main driver for the construction of the Portuguese Forest Management Reference Level.

2.1.3 Forest management activities already undertaken

The impact of forest policies on emissions and removals was not estimated directly. It is assumed that the reported level of emissions and removals in recent years reflects the impact of the current

and past policies. An outline of the current policies and incentives affecting forest management is provided in section 5.2.1.1 Pre-2010 domestic policies included.

2.1.4 Projected forest management activities under a business as usual scenario

Business as usual was interpreted by Portugal, for the purpose of constructing a Forest Management Reference Level, as the continuation of the main drivers of emissions and removals considered in the data reported to the UNFCCC and KP in 2011. These include:

- Assumption on the maintenance of deforestation rate (affecting area under 3.4 Forest Management) – see section 5.1.1 Area under forest management for details;
- Assumption on the maintenance of removals level – see section 5.1.2 Emissions and removals from forest management for details;
- Assumption on harvesting levels – see section 5.1.3.7 Assumed future harvesting rates for details;
- Assumption on production harvested wood products – see section 5.1.3.8 Harvested wood products for details;
- Assumption on a background level of emissions from forest fires – see section 5.1.3.9 Disturbances in the context of force majeure for details;

Assumption on the maintenance of removals and emissions levels from soil and litter – see section 5.1.3.5 Other relevant information for details;

2.1.5 Continuity with the treatment of forest management in the first commitment period

Not considered by Portugal.

2.1.6 Exclusion of removals from accounting in accordance with §1 of decision 16/CMP.1

Not considered by Portugal. As outlined in section 5.1.3.10, this is assumed to be a conservative approach to the Forest Management Reference Level.

2.1.7 Consistency with the inclusion of carbon pools

The carbon pools and greenhouse gases used for estimating future emissions and removals are exactly the same as the ones used in the National Inventory Report, submitted by Portugal in 2011, summarized in chapter 3 below.

2.1.8 Reference levels including and excluding force majeure should be provided

The proposed Forest Management Reference Level assume that future LULUCF accounting rules will contain provisions for the treatment of force majeure, generically understood as low probability large emissions beyond the control of Parties.

The proposed reference level contains a background level of fire emissions, based on historical data. The level that has been included is expected to occur during the commitment period and explicitly excludes years with abnormally high fire emissions, as explained in section 5.1.3.9.

In conclusion, the proposed reference level excludes force majeure (low probability large events beyond the control of Parties), but includes a background level of forest fire emissions.

3 Pools and gases

The treatment of pools and gases is fully consistent with the coverage of pools and gases reported in the NIR 2011. A summary table of the pools and gases considered is presented in Table 2 and Table 3.

Table 2: Carbon Pools Included in the Reference Level

Above ground biomass	Below ground biomass	Litter	Dead wood	Mineral Soils	Organic soils
Yes	Yes	Yes	Included Elsewhere* ¹	Yes	Not Occurring* ²

*¹ Emissions from dead wood resulting from harvesting were included as harvesting emissions, which consider the instant oxidation of the entire tree. Emissions from dead wood from forest fires were included as indirect CO₂ emissions from biomass burning. Other emissions and removals from the dead wood pool were not estimated.

*² Area of organic soils in Portugal is negligible

Table 3: Greenhouse Gas Sources Included in the Reference Level

Fertilization	Soil drainage	Liming	Biomass burning		
N ₂ O	N ₂ O	CO ₂	CO ₂	CH ₄	N ₂ O
Included Elsewhere* ¹	Not Occurring* ²	Not Occurring* ²	Yes	Yes	Yes

*¹ Included in Chapter 4 – Agriculture

*² Drainage and Liming are not common practices in forestry in Portugal

4 Approaches, methods and models used

Under the current reporting methodologies used by Portugal (as detailed in its National Inventory Report of 2011), forest emissions and removals result from the combination of the variables listed in Table 4. The reference level is based on the same list, and assumptions were made for the period 2013-2020 for each of those variables. These assumptions are described and explained in detail in the sections below.

Table 4: Main Variables Considered in the Construction of the Portuguese Forest Management Reference Level

<ul style="list-style-type: none"> • Total forest areas reported, including allocation of areas to forests under each Kyoto Protocol activity: 3.3 Afforestation and Reforestation; 3.3 Deforestation; 3.4 Forest Management; and allocation of areas to each forest type • Estimation of CO₂ removals from each forest type and KP activity • Estimation of CO₂ emissions from wood harvesting • Estimation of CO₂ emissions/removals from harvested wood products • Estimation of GHG emissions from forest fires • Estimation of CO₂ emissions/removals from soil and litter

5 Description of construction of reference levels

5.1 Description of how each of the following elements were considered or treated in the construction of the forest management reference level, taking into account the principles in decision 16/CMP.1

5.1.1 Area under forest management

In Portugal, all forests are considered managed and so the sum of areas reported under article 3.3 Afforestation and Reforestation and 3.4 Forest Management are equal to total forest area in any given year. The area considered for the period 2013-2020 is 3.7 million hectares, and the distribution per year and forest species is outlined in Figure 1 and Table 5.

FM-RL Assumption: Areas under Article 3.4 Forest Management

Reported area under 3.4 Forest Management in 2009 minus estimated annual deforested areas for the period 2010-2020

Deforestation rate in the period 2010-2020 is assumed to be equal to the annual average deforested area by forest type in the period 2005-2009

Methodological Consistency Issues

In order to maintain methodological consistency, the values presented in Figure 1 should be subject to a technical correction when one or more of the following changes are made to the historical time series:

- Changes in reported total forest areas by forest type, for the period 1990-2009
- Changes in reported 3.4 Forest Management areas by forest type in 2009
- Changes in estimates of annual deforestation rates by forest type in period 2005-2009

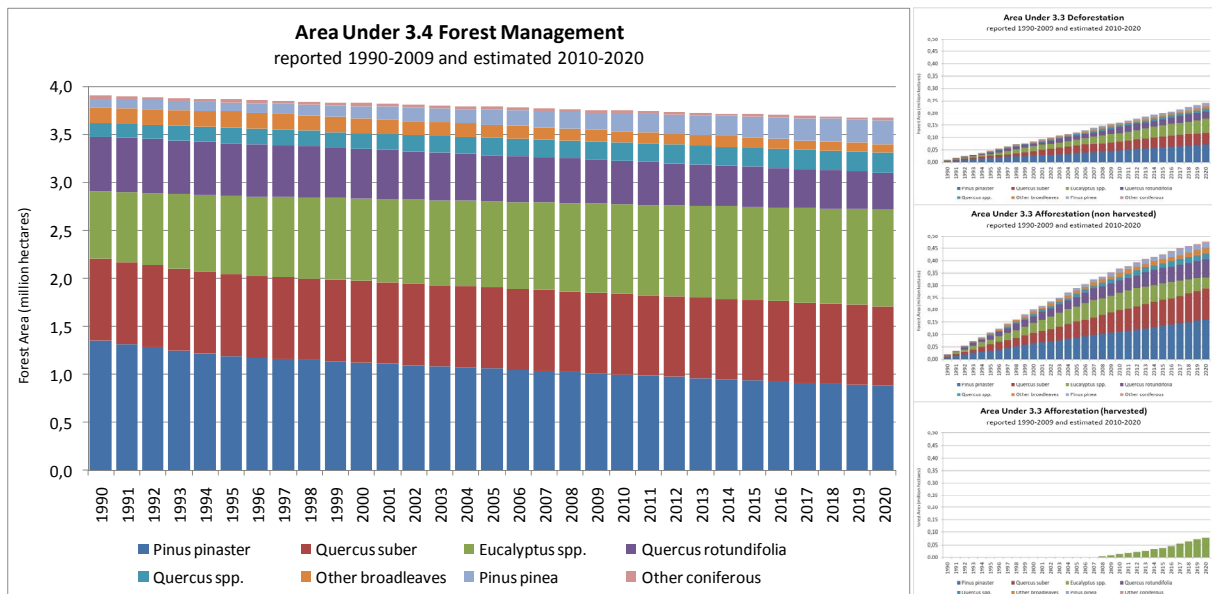


Figure 1: Areas under Articles 3.3ARD and 3.4FM of the Kyoto Protocol

Table 5: Areas considered in the Forest Management Reference Level, by forest species

	FM-RL	2013	2014	2015	2016	2017	2018	2019	2020
Pinus pinaster	920	962	950	938	926	914	902	890	878
Quercus suber	837	839	839	838	837	836	835	834	834
Eucalyptus spp.	981	956	963	971	978	985	992	999	1.006
Quercus rotundifolia	410	432	426	419	413	406	400	394	387
Quercus spp.	202	195	197	199	201	203	205	207	209
Other broadleaves	98	109	106	103	100	96	93	90	87
Pinus pinea	227	206	212	218	224	230	236	242	248
Other coniferous	26	27	27	26	26	26	25	25	25
3.4 Forest Management	3.700	3.727	3.720	3.712	3.704	3.696	3.689	3.681	3.673

unit: 1.000 ha

5.1.2 Emissions and removals from forest management

Portugal follows the Gains/Losses methodology as described in IPCC Good Practice Guidance for Land-Use, Land-Use Change and Forestry 2003, equation 3.1.1.

As explained in the National Inventory Report of 2011, removals are estimated using the annual increment per forest type. Given the high proportion of mixed forests in Portugal, growth rates for dominated species are also considered, as presented in Table 6.

FM-RL Assumption: Removals in Areas under Article 3.4 Forest Management

Same annual removals per hectare and forest type as those considered for the period 2005-2009

Methodological Consistency Issues

In order to maintain methodological consistency, the values presented in Figure 1 should be subject to a technical correction when one or more of the following changes are made to the historical time series:

- Changes in reported total forest areas by forest type, for the period 1990-2009
- Changes in methodology for estimating removals, including changes in relevant parameters (increment, BEF, R:S, etc.)

Table 6: Annual Increments Considered in the Forest Management Reference Level, by forest species

Annual Increment		Dominant Species							
		Pinus pinaster	Quercus suber	Eucalyptus spp.	Quercus rotundifolia	Quercus spp.	Other broadleaves	Pinus pinea	Other coniferous
Dominated species	Pinus pinaster	5,6	0,1	0,4	0,0	0,7	0,5	0,2	0,1
	Quercus suber	0,0	0,5	0,0	0,1	0,0	0,0	0,1	0,0
	Eucalyptus spp.	1,3	0,1	9,5	0,0	0,2	0,6	0,2	0,0
	Quercus rotundifolia	0,0	0,0	0,0	0,5	0,0	0,0	0,0	0,0
	Quercus spp.	0,1	0,0	0,0	0,0	2,9	0,5	0,0	0,1
	Other broadleaves	0,0	0,0	0,0	0,0	0,2	2,9	0,0	0,1
	Pinus pinea	0,1	0,3	0,0	0,0	0,0	0,0	5,6	0,0
	Other coniferous	0,0	0,0	0,0	0,0	0,1	0,2	0,0	5,0
Total		7,1	1,0	10,0	0,6	4,0	4,8	6,1	5,3
Pure & dominant		5,6	0,5	9,5	0,5	2,9	2,9	5,6	5,0

unit: m³/ha

Table 7: Removals Considered in the Forest Management Reference Level

Above Ground Removals									
	FM-RL	2013	2014	2015	2016	2017	2018	2019	2020
Pinus pinaster	1.815	1.897	1.873	1.850	1.826	1.803	1.779	1.756	1.733
Quercus suber	445	447	446	446	446	445	445	444	444
Eucalyptus spp.	2.954	2.879	2.900	2.922	2.943	2.965	2.986	3.007	3.028
Quercus rotundifolia	129	136	134	132	130	128	126	124	122
Quercus spp.	224	216	218	221	223	225	227	229	232
Other broadleaves	133	148	143	139	135	130	126	122	117
Pinus pinea	793	720	741	762	783	804	824	845	865
Other coniferous	37	39	38	38	37	37	37	36	36
3.4 Forest Management	6.530	6.482	6.496	6.510	6.523	6.537	6.550	6.563	6.576
Below Ground Removals									
	FM-RL	2013	2014	2015	2016	2017	2018	2019	2020
Pinus pinaster	244	255	252	249	245	242	239	236	233
Quercus suber	119	120	120	119	119	119	119	119	119
Eucalyptus spp.	717	699	704	709	714	719	725	730	735
Quercus rotundifolia	54	57	56	55	54	54	53	52	51
Quercus spp.	80	78	78	79	80	81	81	82	83
Other broadleaves	46	52	50	48	47	45	44	42	41
Pinus pinea	51	46	47	49	50	52	53	54	55
Other coniferous	4	4	4	4	4	4	4	4	4
3.4 Forest Management	1.315	1.310	1.312	1.313	1.315	1.316	1.318	1.319	1.321

unit: GgC

5.1.2.1 Historical emissions and removals from forest management

Net removals from 3.4 Forest Management is different from those reported for Forest Land Remaining Forest Land, mostly due to the differences in areas reported for each category (see next section).

The full time series of emissions and removals from areas under the forest definition provided by 3.4 forest management for the period 1990-2020 is presented in Figure 2. The values for 2008 and 2009 correspond to those officially reported for KP 3.4 Forest Management in 2011.

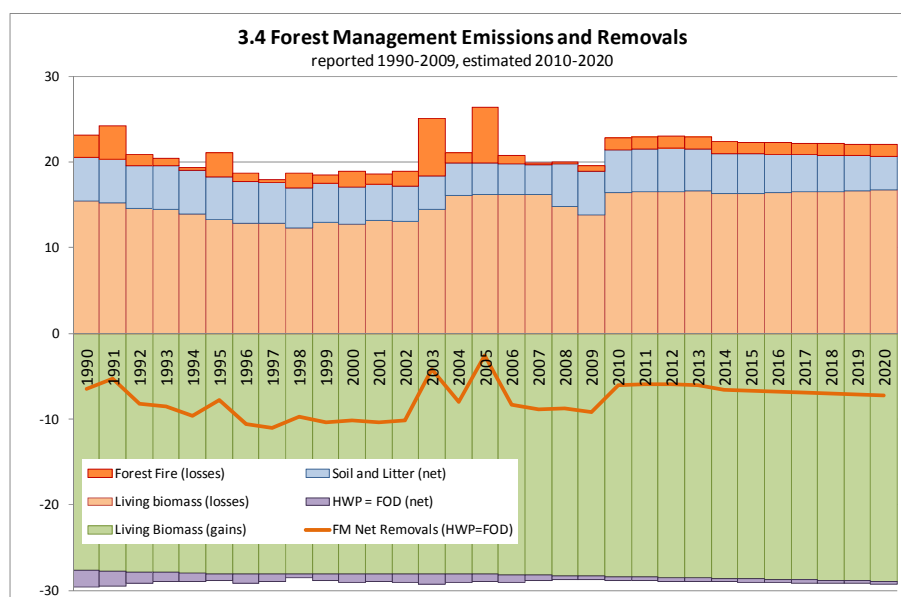


Figure 2: Net Removals from Areas under 3.4 Forest Management, for the period 1990-2020

5.1.2.2 Relationship between forest management and forest land remaining forest land

“Forest management” refers to areas that have been forest since 1990, while “Forest land remaining forest land” refers to areas that have been forest for more than 20 years. Thus, the areas being reported under each category in the National Inventory Report of 2011 (see Figure 3) are different.

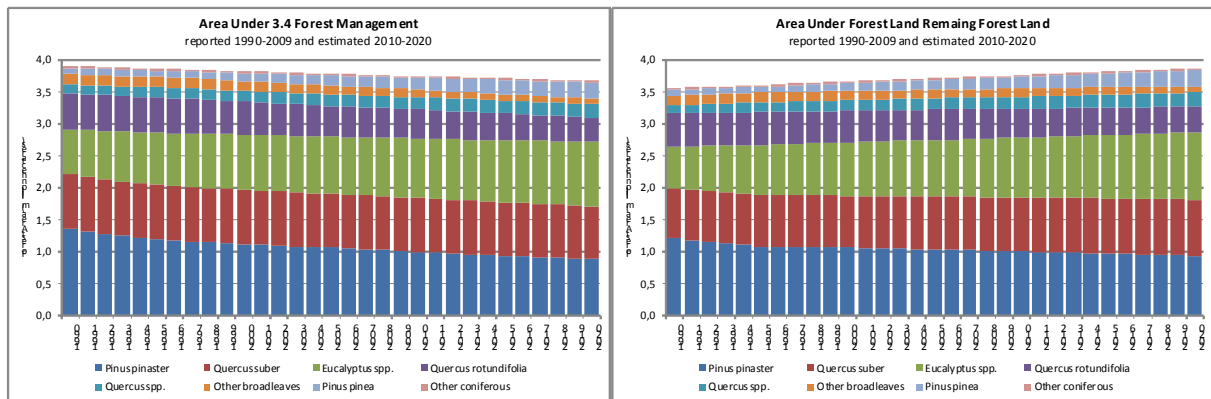


Figure 3: Areas under Kyoto Protocol 3.4 Forest Management and UNFCCC Forest Land Remaining Forest Land

However, as Figure 4 shows, the total forest areas reported under Kyoto tables 5(KP-I)A.1.1 and 5(KP-I)A.1.2 (3.3 afforestation and reforestation) and table 5(KP-I)B1 (3.4 forest management) are equal to the total forest areas reported under the convention tables 5A.1 (Forest land remaining forest land) and 5A.2 (Land converted to forest land).

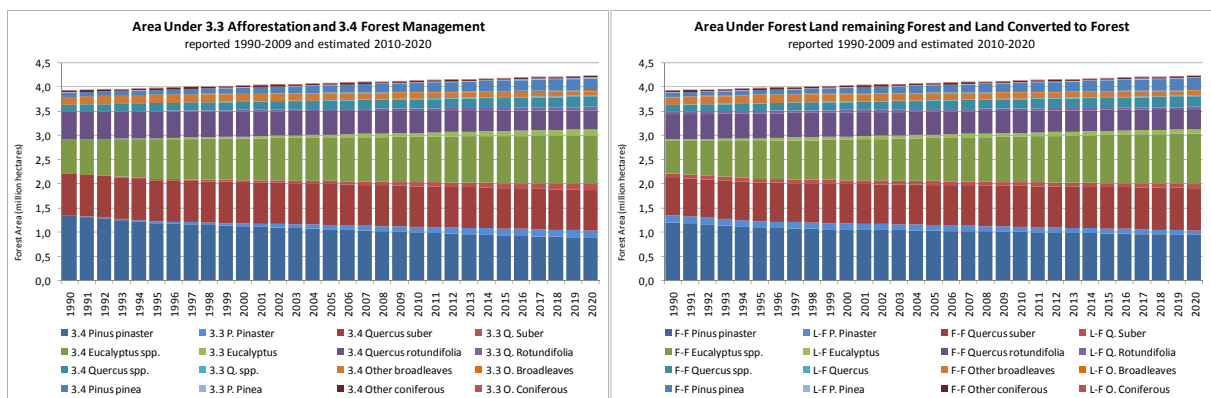


Figure 4: Total Forest Areas reported under Kyoto Protocol and UNFCCC

5.1.3 Forest characteristics and related management

5.1.3.1 Age class structure

Portuguese forests are dominated, in all forest species, by stands of irregular age. Cork and Holm oak stands are dominated by older trees, reflecting their interest for cork production (older trees have larger producing surface) and their presence in agri-forest systems, valued mostly for acorn production for animal feeding. The much skewed age structure of eucalypt plantations is a consequence of its rotation age (of about 12 years).

Table 8: Age Class Structure of the Portuguese Forest According to the latest National Forest Inventory (2005)

Age class structure	<10	10-20	20-30	30-40	40-50	50-60	>60	irregular
<i>Pinus pinaster</i>	18%	11%	8%	8%	6%	3%	2%	43%
<i>Quercus suber</i>	1%	1%	7%	7%	3%	4%	16%	61%
<i>Eucalyptus</i> spp.	43%	22%	3%	0%	0%	0%	0%	33%
<i>Quercus rotundifolia</i>	0%	1%	2%	4%	3%	4%	14%	72%
<i>Quercus</i> spp.	1%	1%	5%	3%	3%	2%	1%	85%
Other broadleaves	3%	15%	2%	4%	4%	2%	2%	69%
<i>Pinus pinea</i>	4%	15%	12%	10%	3%	4%	2%	50%
Other coniferous	0%	13%	18%	12%	8%	2%	0%	48%

5.1.3.2 Increment

Annual increments by forest species in pure stands have been reported as constant throughout the period 1990-2009. Growth rates in mixed stands have been estimated using the data on area and wood volume of mixed stands from the National Forest Inventories of 1995 and 2005. Increment rates for the period 1990-1995 were considered equal to those of 1995. Increment rates for the period 1996-2004 were interpolated from those of 1995 and 2005. Increment rates for the period 2005-2020 were considered equal to those of 2005 (see Table 6, pg.9).

5.1.3.3 Rotation length

As outlined in section 2.1.2, the concept of rotation length is restricted to the two wood producing species: *Eucalyptus* spp. and *Pinus pinaster*.

Eucalypts are harvested mostly for the production of wood pulp and wood panels, although it can also be used for other industrial and energy uses. The rotation length depends on productivity of the site and forest owner decisions, varying from 11 to 15 years, with 12 years being the most representative value.

Maritime pine is more plastic in terms of industrial use, ranging from wood for poles, wood pulp, wood panels, wood packaging and sawnwood. The rotation length depends on productivity of the site, forest owner decisions and intended wood use, varying from 20 to 80 years, with 40 years being the most representative value. Smaller diameters usually result from thinning activities rather than final felling.

5.1.3.4 Information on forest management activities under “business as usual”

The impact of forest policies on emissions and removals was not estimated directly. It is assumed that the reported level of emissions and removals in recent years reflects the impact of the current and past policies. An outline of the current policies and incentives affecting forest management is provided in section 5.2.1.1 Pre-2010 domestic policies included.

5.1.3.5 Other relevant information

Soil carbon and dead organic matter have a material influence in the overall carbon balance of areas under article 3.4 Forest Management. Therefore, an assumption on the emissions and removals from those carbon pools was also included.

FM-RL Assumption: Emissions and Removals from Soil and Dead Organic Matter in Areas under Article 3.4 Forest Management

Same annual emissions or removals per hectare and forest type as those considered for the period 2005-2009

Methodological Consistency Issues

In order to maintain methodological consistency, the values presented in

Table 11 should be subject to a technical correction when one or more of the following changes are made to the historical time series:

- Changes in reported total forest areas by forest type, for the period 1990-2009
- Changes in methodology for estimating removals and emissions from dead organic matter and soil

5.1.3.6 Historical harvesting rates

In the period 1990 to 2009 total harvesting levels in Portugal have ranged between 9.2 and 11.8 million cubic meters underbark, with an average of about 10.5, with Eucalypts and Maritime pine being the main wood producing species, responsible for about 94% of total harvest.

Eucalypts are harvested after 12 years, and so harvesting in 3.3 Afforestation and Reforestation areas during the commitment period corresponds to areas planted 12 years before (1997-2001).

Harvesting in 3.3 Deforestation areas was estimated from the annual deforestation areas and average standing volumes per forest type.

Harvesting in 3.4 Forest Management areas was estimated from the difference between total harvesting and 3.3 harvesting.

Table 9: Historic Harvest Levels in Portugal 1990-2009

Total Harvesting	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Pinus pinaster	6.684	5.726	5.311	5.283	5.107	5.117	4.760	4.760	4.384	4.380	3.974	3.958	3.285	3.532	4.177	3.468	3.701	3.837	3.316	3.619
Quercus suber	107	108	108	109	109	110	110	111	111	111	112	112	113	113	113	114	114	115	115	115
Eucalyptus spp.	4.521	5.083	4.967	4.924	4.712	4.233	4.218	4.218	4.164	4.598	4.709	4.988	5.457	6.141	6.692	7.278	7.104	6.986	6.853	5.945
Quercus rotundifolia	72	72	71	71	71	71	70	70	69	69	68	68	67	67	66	66	65	64	64	63
Quercus spp.	102	105	108	111	114	117	119	121	123	125	128	130	132	134	136	138	140	142	145	147
Other broadleaves	120	121	123	124	126	127	125	123	121	119	117	115	113	111	109	107	105	103	101	99
Pinus pinea	127	129	130	131	133	134	144	153	163	173	183	193	203	212	222	232	242	252	261	271
Other coniferous	40	40	41	41	42	42	42	42	41	41	41	41	41	40	40	40	39	39	39	39
Total 3.3 Afforestation Harvesting	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Pinus pinaster																				
Quercus suber																				
Eucalyptus spp.																			389	393
Quercus rotundifolia																				
Quercus spp.																				
Other broadleaves																				
Pinus pinea																				
Other coniferous																				
Total 3.3 Deforestation Harvesting	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Pinus pinaster	266	261	256	251	246	241	238	235	232	229	226	223	220	217	214	211	209	208	206	205
Quercus suber	61	61	61	61	62	62	61	61	61	61	61	61	60	60	60	60	60	60	60	60
Eucalyptus spp.	80	82	84	86	88	90	93	95	97	99	101	104	106	108	110	113	113	114	115	116
Quercus rotundifolia	21	21	20	20	20	20	20	20	20	19	19	19	19	19	19	18	18	18	18	18
Quercus spp.	11	11	11	11	12	12	12	12	12	12	13	13	13	13	13	13	13	14	14	14
Other broadleaves	17	18	18	18	18	18	18	19	19	19	20	20	20	20	20	21	20	20	20	19
Pinus pinea	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	10	11	11	11	12
Other coniferous	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Total 3.4 FM Harvest	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Pinus pinaster	6.418	5.465	5.055	5.032	4.861	4.876	4.522	4.525	4.152	4.151	3.748	3.735	3.065	3.315	3.963	3.257	3.492	3.109	3.415	
Quercus suber	46	47	47	47	48	48	49	49	50	50	51	52	52	53	53	54	54	55	55	55
Eucalyptus spp.	4.441	5.001	4.883	4.838	4.624	4.143	4.125	4.123	4.067	4.499	4.608	4.884	5.351	6.033	6.582	7.165	6.990	6.872	6.349	5.436
Quercus rotundifolia	51	51	51	51	51	51	50	50	50	49	49	49	48	48	48	47	47	47	46	46
Quercus spp.	91	94	97	99	102	105	107	109	111	113	115	117	119	121	123	125	127	129	131	133
Other broadleaves	102	104	105	106	108	109	107	105	102	100	98	95	91	89	87	85	83	82	80	80
Pinus pinea	115	117	118	119	121	122	132	142	152	162	171	181	191	201	211	222	231	241	250	260
Other coniferous	36	36	36	37	37	38	38	37	37	37	37	37	36	36	36	36	36	35	35	35
Total 3.4 FM Harvest	11.300	10.913	10.392	10.330	9.951	9.491	9.130	9.140	8.721	9.161	8.877	9.150	8.957	9.898	11.105	10.993	11.062	11.090	10.058	9.459

unit: 1.000m3 under bark

Table 10: Total Harvest in Portugal, expressed as percentage of total standing volume

Total Harvesting	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Pinus pinaster	4,9%	4,3%	4,1%	4,1%	4,0%	4,1%	3,9%	3,9%	3,6%	3,7%	3,4%	3,4%	2,9%	3,1%	3,7%	3,1%	3,3%	3,5%	3,0%	3,3%
Quercus suber	0,3%	0,3%	0,3%	0,3%	0,3%	0,3%	0,3%	0,3%	0,3%	0,4%	0,4%	0,4%	0,4%	0,4%	0,4%	0,4%	0,4%	0,4%	0,4%	0,4%
Eucalyptus spp.	11,1%	12,1%	11,5%	11,1%	10,4%	9,1%	8,8%	8,6%	8,3%	8,9%	8,9%	9,2%	9,8%	10,8%	11,5%	12,2%	11,8%	11,5%	11,2%	9,6%
Quercus rotundifolia	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%
Quercus spp.	1,8%	1,8%	1,9%	1,9%	1,9%	1,9%	1,9%	1,9%	1,9%	1,9%	1,9%	1,9%	1,9%	1,9%	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%
Other broadleaves	1,3%	1,4%	1,4%	1,4%	1,4%	1,4%	1,3%	1,3%	1,2%	1,2%	1,1%	1,1%	1,1%	1,0%	1,0%	1,0%	1,0%	1,0%	1,0%	1,0%
Pinus pinea	2,1%	2,1%	2,1%	2,1%	2,2%	2,2%	2,3%	2,5%	2,7%	2,9%	3,1%	3,3%	3,5%	3,7%	4,0%	4,2%	4,3%	4,3%	4,3%	4,4%
Other coniferous	1,8%	1,8%	1,8%	1,8%	1,9%	1,9%	1,9%	1,9%	1,9%	1,9%	1,8%	1,8%	1,8%	1,8%	1,8%	1,8%	1,8%	1,8%	1,8%	1,8%

unit: % of harvested volume in total standing volume

5.1.3.7 Assumed future harvesting rates

Forest industries, in particular in the pulp and paper and bioenergy sectors, have been expanding in Portugal. As a consequence, wood demand is expected to increase. Under a *business as usual* scenario, harvesting levels were assumed to increase by 6% from the levels observed in the period 2005-2009.

Due to changes in areas under 3.4 Forest Management, the expression *Harvesting levels* is to be understood as the share of harvesting in total standing volume (see Table 10 above). The increase in 6% comes from a modelling exercise from JRC, where wood demand was expected to increase by that amount in the absence of new policies introduced after mid-2009, in particular without considering the new Climate and Energy package of the European Union (which will, i.a., increase the demand of wood for energy).

FM-RL Assumption: Emissions from Harvesting in Areas under Article 3.4 Forest Management

Average harvest levels of the period 2005-2009, expressed as percentage of harvested wood over total standing volume + 6% (JRC estimate for average increase in demand in the EU without policies post-2009)

Methodological Consistency Issues

In order to maintain methodological consistency, the values presented in Table 11 should be subject to a technical correction when one or more of the following changes are made to the historical time series:

- Changes in reported total forest areas by forest type, for the period 1990-2009
- Changes in reported volumes per ha by forest type, for the period 2005-2009
- Changes in wood harvesting by tree species, for the period 2005-2009
- Changes in allocation method for distributing total harvesting between in 3.3 Afforestation and Reforestation; 3.3 Deforestation and 3.4 Forest Management
- Changes in modelled increase in wood demand by JRC for the period 2013-2020

Table 11: Harvesting Levels Considered in the Forest Management Reference Level

Total Harvesting	2013	2014	2015	2016	2017	2018	2019	2020	
Pinus pinaster	3.693	3.675	3.656	3.638	3.619	3.601	3.582	3.564	
Quercus suber	124	125	125	126	126	127	127	128	
Eucalyptus spp.	7.655	7.723	7.790	7.858	7.926	7.993	8.061	8.128	
Quercus rotundifolia	66	65	65	64	64	63	63	62	
Quercus spp.	158	159	161	162	163	164	165	166	
Other broadleaves	100	98	96	95	93	92	90	88	
Pinus pinea	312	320	327	335	342	350	357	365	
Other coniferous	40	40	40	40	39	39	39	39	
3.3 Afforestation Harvesting	2013	2014	2015	2016	2017	2018	2019	2020	
Pinus pinaster	0	0	0	0	0	0	0	0	
Quercus suber	0	0	0	0	0	0	0	0	
Eucalyptus spp.	410	737	753	769	784	800	815	824	
Quercus rotundifolia	0	0	0	0	0	0	0	0	
Quercus spp.	0	0	0	0	0	0	0	0	
Other broadleaves	0	0	0	0	0	0	0	0	
Pinus pinea	0	0	0	0	0	0	0	0	
Other coniferous	0	0	0	0	0	0	0	0	
3.3 Deforestation Harvesting	2013	2014	2015	2016	2017	2018	2019	2020	
Pinus pinaster	199	197	196	194	193	191	190	189	
Quercus suber	60	60	61	61	61	61	61	61	
Eucalyptus spp.	119	120	120	121	122	123	123	124	
Quercus rotundifolia	17	17	17	16	16	16	16	16	
Quercus spp.	14	14	14	14	14	14	14	14	
Other broadleaves	18	18	17	17	17	16	16	16	
Pinus pinea	13	13	13	14	14	14	14	15	
Other coniferous	4	4	4	4	4	4	4	4	
3.4 Forest Management Harvesting	FM-RL	2013	2014	2015	2016	2017	2018	2019	2020
Pinus pinaster	3.435	3.494	3.477	3.460	3.443	3.426	3.409	3.392	3.375
Quercus suber	65	64	64	65	65	65	66	66	67
Eucalyptus spp.	7.034	7.126	6.866	6.917	6.968	7.019	7.071	7.122	7.180
Quercus rotundifolia	48	49	48	48	48	47	47	47	46
Quercus spp.	148	144	145	146	148	149	150	151	152
Other broadleaves	77	82	81	79	78	77	75	74	73
Pinus pinea	325	299	307	314	321	328	336	343	350
Other coniferous	36	36	36	36	36	36	35	35	35
3.4 Forest Management	11.167	11.295	11.025	11.066	11.107	11.148	11.189	11.230	11.279

Unit: 1.000m³ under bark

5.1.3.8 Harvested wood products

Changes in the Carbon stock in Harvested wood products pool were estimated using IPCC methodologies, as described in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 4: Agriculture, Forestry and Other Land-Use; Chapter 12 Harvested Wood Products.

Data for production, imports and exports was derived from UNECE for the period 1964-2009 (last updated July 2010)¹. Production estimates from 1900-1963 were produced using IPCC equation 12.6. The production of HWP that came from domestic harvest was estimated using equation 12.4.

Product grades considered were wood pulp (UNECE product code 7, half-live of 2 years); wood panels (UNECE product code 6, half-live of 25 years) and sawnwood (UNECE product code 5, half-live 35 years).

The results of the exercise are presented in Figure 5: Estimated and Reported Annual Production of Harvested Wood Products and Figure 6: Evolution of Carbon Stocks and Carbon Stock Changes in Harvested Wood Products.

¹ <http://timber.unece.org/fileadmin/DAM/statsdata/flatfile-2010-07.zip>

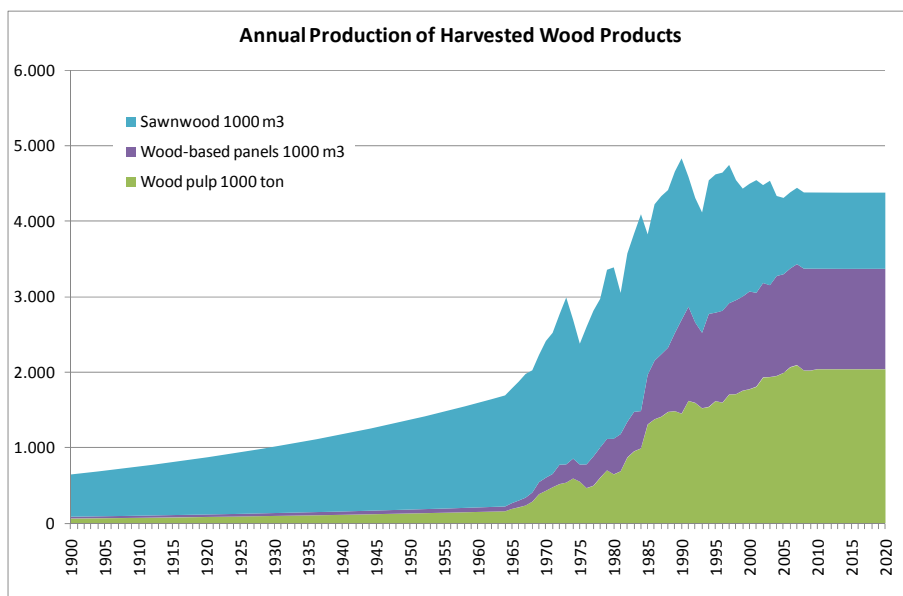


Figure 5: Estimated and Reported Annual Production of Harvested Wood Products

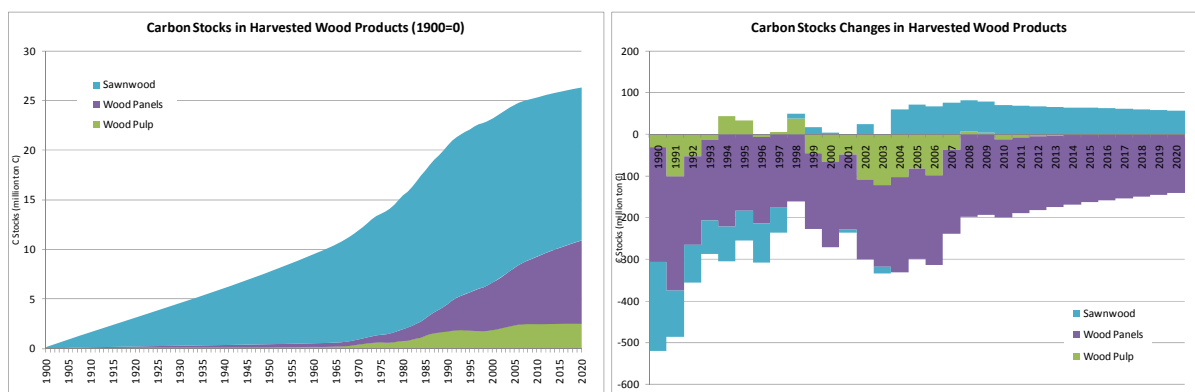


Figure 6: Evolution of Carbon Stocks and Carbon Stock Changes in Harvested Wood Products

FM-RL Assumption: Emissions/Removals from the Harvested Wood Products Pool

Average production levels of the period 2005-2009

Methodological Consistency Issues

In order to maintain methodological consistency, the values presented in Table 12 should be subject to a technical correction when one or more of the following changes are made to the historical time series:

- Changes in reported share of domestic wood consumption (i.e, production, imports or exports of industrial round wood), for the period 2005-2009
- Changes in reported production of sawnwood, wood panels and wood pulp, for the period 2005-2009

Table 12: Harvested Wood Products Pool Carbon Stock Changes considered in Forest Management Reference Level

HWP C Stocks		2013	2014	2015	2016	2017	2018	2019	2020
Pulp		2.499	2.501	2.503	2.504	2.504	2.505	2.505	2.505
Wood Panels		7.340	7.506	7.668	7.825	7.978	8.126	8.271	8.411
Sawnwood		15.821	15.756	15.693	15.631	15.570	15.510	15.451	15.394
HWP C Stocks Changes	FM-RL	2013	2014	2015	2016	2017	2018	2019	2020
Pulp	-1	-3	-2	-1	-1	-1	0	0	0
Wood Panels	-155	-171	-166	-162	-157	-153	-149	-144	-140
Sawnwood	62	66	65	63	62	61	60	59	57
3.4 Forest Management	-95	-108	-104	-100	-96	-93	-89	-86	-83

unit: GgC

Table 13: Production of Harvested Wood Products considered in the Forest Management Reference Level

HWP Production	FM-RL	2013	2014	2015	2016	2017	2018	2019	2020
Wood Pulp	2.038	2.038	2.038	2.038	2.038	2.038	2.038	2.038	2.038
Wood Panels	1.329	1.329	1.329	1.329	1.329	1.329	1.329	1.329	1.329
Sawnwood	1.010	1.010	1.010	1.010	1.010	1.010	1.010	1.010	1.010

unit: wood pulp 1.000ton; wood panels & sawnwood 1.000m3

5.1.3.9 Disturbances in the context of force majeure

Forest fires are the main disturbance to forest management in Portugal. They are highly correlated to weather conditions, both within each year (about 90% of the fires take place during period June-September, usually the hotter and drier months of the year), and between years (years with hot and dry summers have much higher burnt areas than years with mild and wet summers).

As a consequence, annual burnt rates are, as Figure 7 illustrates, highly variable and show no distinctive pattern or trend that could be used to estimate future levels of disturbance. Conversely, the contribution of forest fires in total forest emissions is so high, that it would not be realistic to consider a scenario of a reference level being constructed without taking that reality into consideration.

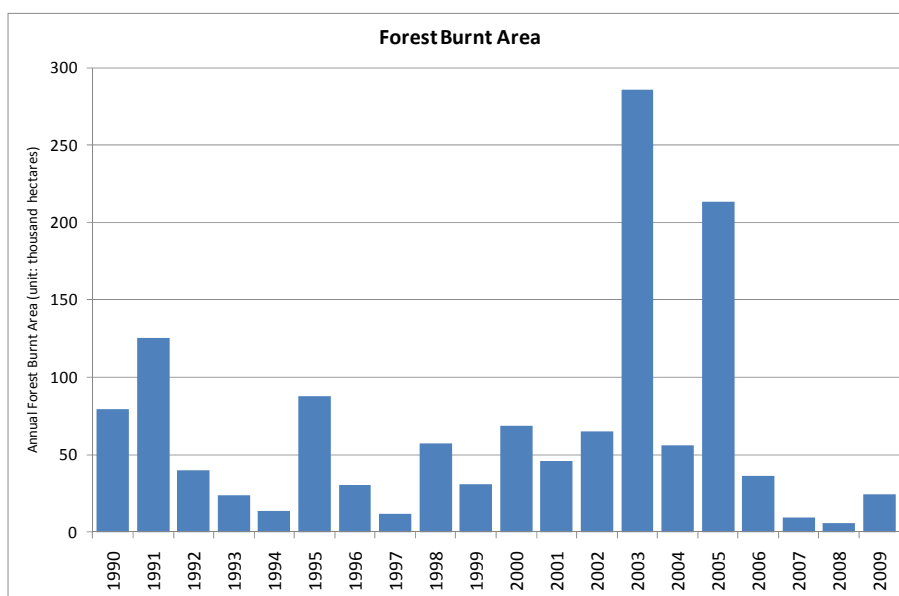


Figure 7: Annual Forest Burnt Area in Portugal 1990-2009

Under the assumption that abnormal (=low probability) levels of emissions would be taken into consideration by including in the future LULUCF accounting rules a set of provisions to deal with force majeure events, the approach was to include in the Forest Management Reference Level a level of emissions that could qualify as “normal”, which Portugal interpreted as an average level, that

excludes years with “abnormal” levels of emissions, both very high or very low. In the absence of agreed international guidance on the topic, Portugal considered the following assumption to characterize a normal level of disturbances:

FM-RL Assumption: Forest Fires

Average annual burnt area in the period 1990-2009, excluding the two highest (2003 and 2005) and two lowest values (2008 and 2007), expressed as % of burnt area in total forest area, by forest type

Methodological Consistency Issues

In order to maintain methodological consistency, the values presented in Figure 8 should be subject to a technical correction when one or more of the following changes are made to the historical time series:

- Changes in reported burnt areas or total forest areas by forest type, for the period 1990-2009
- Changes in the methodology to estimate fire emissions
- Changes in pools and gases reported under fire emissions
- Changes in the methodology to allocate forest fire areas between 3.3 Afforestation and Reforestation and 3.4 Forest Management

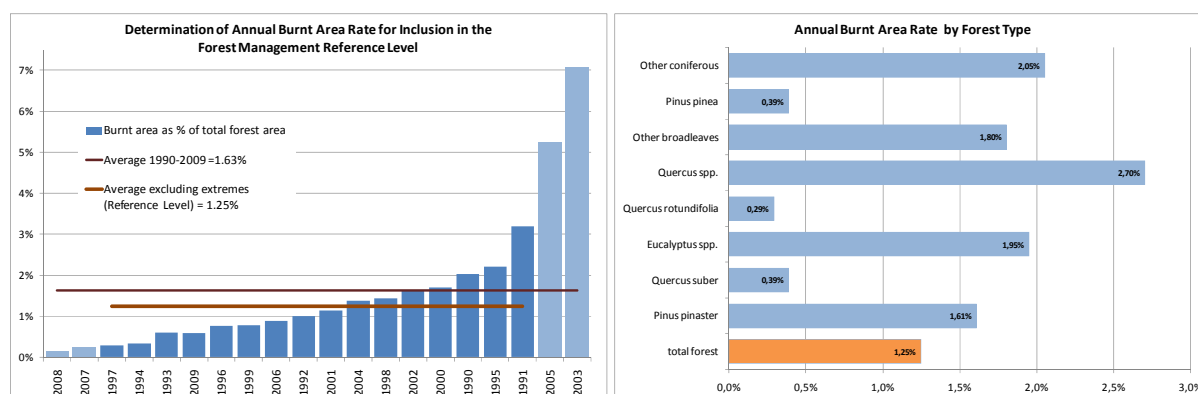


Figure 8: Determination of Annual Burnt Area Rate for Inclusion in Forest Management Reference Level

Table 14: Forest Fire Area Considered in the Forest Management Reference Level

Total Forest Burnt Area		2013	2014	2015	2016	2017	2018	2019	2020
Pinus pinaster		17.627	17.508	17.389	17.271	17.152	17.033	16.914	16.796
Quercus suber		3.602	3.615	3.627	3.639	3.652	3.664	3.677	3.689
Eucalyptus spp.		20.300	20.530	20.760	20.989	21.219	21.449	21.679	21.908
Quercus rotundifolia		1.438	1.426	1.413	1.400	1.387	1.375	1.362	1.349
Quercus spp.		5.709	5.789	5.868	5.948	6.028	6.107	6.187	6.267
Other broadleaves		2.323	2.274	2.224	2.174	2.124	2.075	2.025	1.975
Pinus pinea		831	858	885	912	940	967	994	1.021
Other coniferous		629	625	621	618	614	610	607	603
3.4 Forest Management Burnt Area	FM-RL	2013	2014	2015	2016	2017	2018	2019	2020
Pinus pinaster		14.899	15.574	15.380	15.186	14.994	14.801	14.610	14.419
Quercus suber		3.222	3.233	3.230	3.227	3.223	3.220	3.217	3.214
Eucalyptus spp.		18.923	18.435	18.576	18.716	18.855	18.994	19.132	19.269
Quercus rotundifolia		1.204	1.269	1.250	1.232	1.213	1.194	1.176	1.157
Quercus spp.		5.388	5.199	5.254	5.308	5.362	5.416	5.469	5.522
Other broadleaves		1.811	2.018	1.959	1.899	1.840	1.781	1.722	1.664
Pinus pinea		854	773	797	820	843	866	889	912
Other coniferous		535	558	551	545	539	532	526	520
3.4 Forest Management		46.837	47.060	46.997	46.933	46.869	46.805	46.741	46.676

unit: ha

Table 15: Forest Fire Emissions Considered in the Forest Management Reference Level

Total Forest Fire Emissions		2013	2014	2015	2016	2017	2018	2019	2020
Pinus pinaster		817	812	806	801	795	790	784	779
Quercus suber		65	65	65	65	66	66	66	66
Eucalyptus spp.		476	481	486	492	497	502	508	513
Quercus rotundifolia		8	8	8	8	8	7	7	7
Quercus spp.		87	88	90	91	92	93	95	96
Other broadleaves		61	60	59	58	56	55	54	52
Pinus pinea		14	14	14	15	15	16	16	17
Other coniferous		17	17	17	16	16	16	16	16
3.4 Forest Management Fire Emissions	FM-RL								
Pinus pinaster		691	722	713	704	695	686	677	668
Quercus suber		58	58	58	58	58	58	58	58
Eucalyptus spp.		443	432	435	438	442	445	448	451
Quercus rotundifolia		7	7	7	7	7	6	6	6
Quercus spp.		82	79	80	81	82	83	84	85
Other broadleaves		48	53	52	50	49	47	46	44
Pinus pinea		14	13	13	13	14	14	15	15
Other coniferous		14	15	15	15	14	14	14	14
3.4 Forest Management		1.357	1.379	1.373	1.366	1.360	1.354	1.347	1.341

unit: 1.000 tCO₂e/eq.

5.1.3.10 Factoring out in accordance with paragraph 1(h) (i) and 1(h) (ii) of decision 16/CMP.1

In the calculation of its Forest Management Reference Level, Portugal did not factor out indirect effects of climate change in expected emissions and removals from forest management. This was mostly due to technical difficulties associated with that calculation. However, and in qualitative terms, science on the impacts of climate change impacts in Portugal suggests that the net-effect will most likely result in a reduction of forest productivity. In this sense, ignoring factoring out in the Reference Level results in a conservative estimate, as emissions in the commitment period are likely to be higher than those included in the Reference Level.

“The present capacity of Portuguese forests to store carbon is high. In the future, however, it may not be as high as it could be under present climatic condition due to: (1) decreases or only modest increases in NPP, (2) lower standing biomass due to changes in vegetation and increase in fire frequency and (3) enhanced soil respiration due to warmer winters, thus decreasing the importance of the below ground carbon store” <http://www.siam.fc.ul.pt/SIAMExecutiveSummary.pdf>

5.2 **Description of any other relevant elements considered or treated in the construction of the forest management reference level, including any additional information related to footnote 1 in paragraph 4 of decision [- /CMP.6]**

5.2.1 Policies included

5.2.1.1 Pre-2010 domestic policies included

In Portugal all forests are considered managed, as all have anthropogenic activities. Forest management is guided by the rules defined in 2006 in the National Forest Strategy² and the Regional Forest Plans.

The Regional forest Plans provide silvicultural models for different ecological situations and for different management objectives; they provide goals for the forest area and the species composition at that level. Minimum silvicultural measures are included in the regional plans and are to be applied by all forest owners. Pending on the size of the forest holding, management plans at local level are mandatory (and approved by the National Forest Authority). Those instruments are designed to

² National Forest Strategy / Estratégia Florestal Nacional (2006)
<http://www.afn.min-agricultura.pt/portal/gestao-florestal/ppf/enf>

increase stands productivity, as in average, and mainly due to the effects of forest fires, the standing volume is considered to be very low and below possibility. The quantification of the expected increase is, however, very difficult and can/will only be assessed by subsequent national forest inventories. In order to improve forest management practices, particularly in areas of fragmented forest holdings, there is also support for a special type of collective management, in forest intervention zones.

Concerning fire prevention, the national plan for forest fire prevention³ was approved also in 2006 and it aims at increasing resilience of forests towards fires, reduce the consequences of forest fires, improve fire management and suppression, rehabilitate and recover forest ecosystems and adapt the organization structure. It established a plan of action, measures and goals, and identifies the entities responsible for implementing them.

The existing public support programs followed the objectives and goals defined on the policy instruments mentioned above. They support measures to prevent forest fires, for instance by establishing fuel breaks and by assuring first intervention teams to forest owners association and local authorities.

5.2.1.2 Confirmation of factoring out policies after 2009

The proposed Forest Management Reference Level does not include the impact of policies introduced after 2009 nor assumptions about the expected impact of possible policy changes in the future. This includes both policies affecting directly forest management and policies affecting wood procurement.

³ National (2006) and local Plans (2007-2008) for Protection against Forest Fires
<http://www.afn.min-agricultura.pt/portal/dudf/Resource/pdf/dgrf-2006-pndfci-rcm65.pdf>