NATIONAL FORESTRY ACCOUNTING PLAN

National forestry accounting plan for Spain, including forest reference level 2021-2025.

GOBIERNO DE ESPAÑA

MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA

December 2019

Table of contents

1. General introduction

1.1. Background

Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU (hereinafter referred to as the 'LULUCF Regulation') was published in the Official Journal of the European Union on June 19, 2018.

This Regulation establishes the commitments of the Member States for the sector of land use, land-use change and forestry (hereinafter referred to as the “LULUCF sector”) and thereby to contribute to achieving the objectives of the Paris Agreement and meeting the greenhouse gas emission reduction target of the Union for the period from 2021 to 2030.

Thus, each Member State shall ensure that emissions do not exceed removals on its territory for the accounting categories considered and accounted for[1] in accordance with this Regulation. It also establishes the accounting standards for emissions and removals of the LULUCF sector. For the category of managed forest land (forest land remaining forest land, according to the national inventory reports of greenhouse gases) will be those resulting from the calculation of emissions and removals from the periods 2021 to 2025 and from 2026 to 2030, minus the value obtained by multiplying by five the forest reference level (hereinafter referred to as "FRL") calculated for those periods for each Member State.

FRL is defined in the same regulation as “an estimate, expressed in tonnes of CO_2 equivalent per year, of the average annual net emissions or removals resulting from managed forest land within the territory of a Member State in the periods from 2021 to 2025 and from 2026 to 2030”.

[1] The accounting categories considered in the period from 2021 to 2025 are afforested land, deforested land, managed cropland, managed grassland and managed forest land.

LULUCF Regulation establishes in its Article 8.3 that "Member States shall submit to the Commission their national forestry accounting plans, including a proposed forest reference level, by 31 December 2018 for the period from 2021 to 2025 and by 30 June 2023 for the period from 2026 to 2030". This national forestry accounting plan for Spain meets this requirement.

1.2. General description of the forest reference level (FRL) for Spain

The proposed FRL for Spain for the period from 2021 to 2025 is **-32.833 kt CO_2 eq of which -29,303 kt CO_2 eq correspond to living biomass and -3.862 kt CO_2 eq correspond to harvested wood products (HWP).** N_2O and CH_4 emissions have also been considered for forest fires and prescribed burning (reductions in CO_2 stocks caused by biomass burning are accounted as part of the variations of the living biomass pool).

Emissions(+) and removals (-) 2021-2025 (kt CO_2 eq /year)	
Living biomass (CO_2)	-29.303
HWP (CO_2)	-3.862
Forest fires (N_2O, CH_4)	330
Prescribed burning (N_2O, CH_4)	2
FRL with HWP	**-32.833**
FRL without HWP	**-28.971**

Table 1 - FRL 2021-2025 result for Spain

The proposed FRL for managed forest land is the expected annual average net removals in 2021-2025, based on simulations of the carbon stocks in the managed forest land from 2010, assuming the continuation of the forest management practices carried out in the period 2000-2009.

In the calculations, data from the National Forest Inventory[2] (hereinafter, «NFI») of Spain have been utilised, just as it is done to report the emissions and removals of the LULUCF sector to the EU and the United Nations Framework Convention on Climate Change (UNFCCC), as well as the Forestry Statistics Yearbooks of the Ministry of

[2] https://www.mapa.gob.es/es/desarrollo-rural/temas/politica-forestal/inventario-cartografia/inventario-forestal-nacional/default.aspx

Agriculture, Fisheries and Food[3], and other databases, detailed in this report where applicable.

The Vael model (Rincón-Cristóbal, J.J., 2018)[4] was used to project the development of living biomass based on the NFI data. The output data of harvests from the Vael model have been used as an input to calculate the emissions and removals of HWP according to the methodology followed in the National Inventory Reports of Greenhouse Gases[5] (hereinafter, "NIR"). The basic information for forest fires and controlled burning arises from the General Forest Fire Statistics of the Ministry of Agriculture, Fisheries and Food[6].

The development of the carbon stocks in the Spanish forest land has been simulated from the forest management practices occurred in the period 2000-2009, identified through the information provided by NFI.

Management practices cover the entire forest area (Forest Land remaining Forest Land according to terminology used in national greenhouse gas inventory reports under the UNFCCC). It is worth mentioning that the casuistry and heterogeneity of the Spanish territory is very high, that the aim of many loggings (such as minor operations or thinnings) is to benefit the conservation of forests and its biodiversity, and that the wood often does not have a commercial use, so the harvests are not intended for wood industry purposes. Depending on the tree species or species groups (forest formations) and, therefore, on the region, these procedures may differ slightly in their impact on the living biomass pool.

1.3. Consideration to the criteria as set in the Annex IV of the LULUCF Regulation

Annex IV.A of the LULUCF Regulation establishes that the forest reference levels will be determined according to the following criteria:

[3] https://www.mapa.gob.es/en/desarrollo-rural/estadisticas/forestal_anuarios_todos.aspx
[4] Available in https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/SEI-Metodologias.aspx
[5] https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/Inventario-GEI.aspx.
[6] https://www.mapa.gob.es/va/desarrollo-rural/estadisticas/Incendios_default.aspx.

a) the reference level shall be consistent with the goal of achieving a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century, including enhancing the potential removals by ageing forest stocks that may otherwise show progressively declining sinks;

The LULUCF sector is currently a net sink, with a global result of -38.33 Mt CO_2-eq in 2017 (equivalent to the removal of approximately 11% of total gross emissions in Spain). In view of the evolution of the sector, it has gone from a net absorption of -35.6 Mt CO_2-eq in 1990 to -38.3 Mt CO_2-eq in 2017, which represents an increase of about 7%, largely due to afforestation carried out during this period, as well as to the conversions of herbaceous to woody agricultural crops (citrus, non-citrus, olive, vineyard and other).

Taking into account the transitions between land use categories (historical and projected), and the factors that affect total forest land absorptions (among which are the effects of climate change itself, the forest area with management instruments or the evolution of the risk of desertification), a scenario with existing measures ("WEM") is estimated in which the total absorptions would be -23.6 Mt CO_2-eq in 2050 compared to the -38.3 Mt CO_2-eq of 2017, while the absorptions of the category «forest land» would be -22.1 Mt CO_2-eq in 2050 compared to -34.2 Mt CO_2-eq of 2017. To forecast emissions and removals corresponding to «Forest Land» category within the LULUCF sector Vael model has been partially used, as for the FRL estimation.

Considering the measures proposed in the "Long Term Strategy for a modern, competitive, and climate-neutral Spanish economy in 2050"[7], which can be simplified in the promotion of forest management, a sink potential with additional measures («WAM») is estimated for the LULUCF sector of -36.9 Mt CO_2-eq in 2050, compared to -23.6 Mt CO_2-eq of the trend scenario, while the absorptions of the «Forest Land» category would be -33.8 Mt CO_2-eq in 2050 compared to -34.2 Mt CO_2-eq of 2017.

In both cases, WEM and WAM, the projections suggest that Spain will fulfil its commitment to ensure that emissions do not exceed absorptions until 2050 both in the total LULUCF sector and in the «Forest Land» category. The WAM scenario also includes

[7] Document required under Regulation (EU) 2018/1999, pending publication

the promotion of potential absorptions by forest stands that age or are affected by other factors that affect their sink capacity.

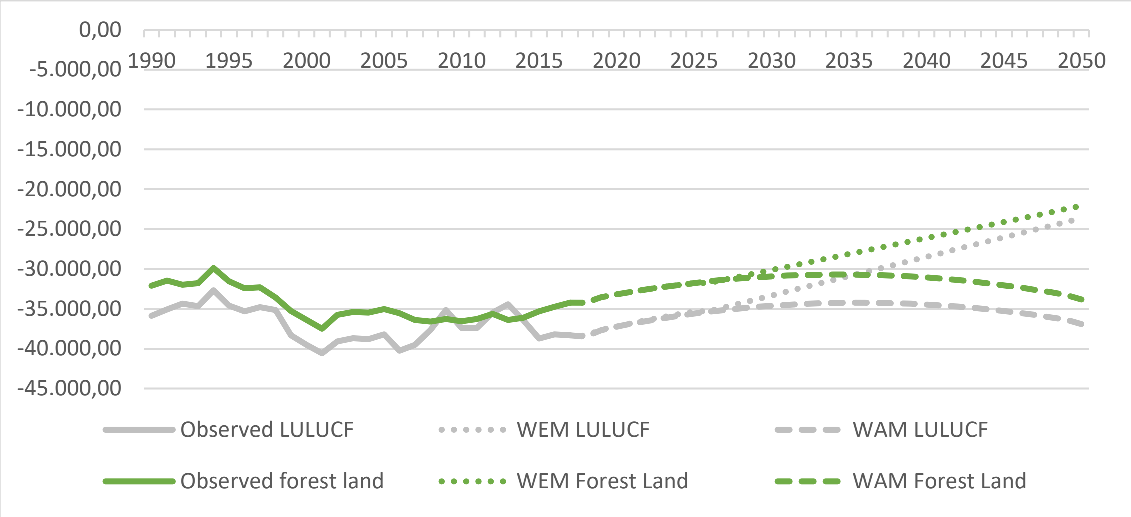

Figure 1 – Evolution of the LULUCF sector and the category of "forest land" in projected scenarios with existing measures (WEM) and with additional measures (WAM)

b) the reference level shall ensure that the mere presence of carbon stocks is excluded from accounting;

The method utilised to calculate the FRL is based on projecting changes in carbon stocks or greenhouse gases flows. The mere presence of carbon stocks does not affect the results.

Gains will be obtained in terms of emissions-removals balance only if additional growth is achieved or if emissions, compared to those calculated in the FRL, decrease.

c) the reference level should ensure a robust and credible accounting system that ensures that emissions and removals resulting from biomass use are properly accounted for;

Any change in carbon stocks in managed forest land is accounted for in the LULUCF sector and reported to the UNFCCC through the National Inventory Report of Greenhouse Gases, including emissions from biomass burning so that it can be accounted for as zero in the energy sector as established by the IPCC guidelines agreed at international level.

The same approach, methodology and sources of information have been applied to construct the FRL, ensuring the comparability of the results.

The consultation of section 3 of this document is recommended, as it contains a complete description of the model used for the estimation of the FRL.

d) the reference level shall include the carbon pool of harvested wood products, thereby providing a comparison between assuming instantaneous oxidation and applying the first-order decay function and half-life values;

Table 1 (FRL 2021-2025 result for Spain) shows the result for the calculation of the FRL. For the required comparison, the FRL with removals from HWP, using the first order decay functions is -32.833 kt CO_2 eq / year and -28.971 kt CO_2 eq / year assuming instant oxidation from HWP, which means that there are no changes in the HWP pool.

e) a constant ratio between solid and energy use of forest biomass as documented in the period from 2000 to 2009 shall be assumed;

The estimated HWPs for calculating the FRL originate exclusively in managed forest land, removing from the accounting those that come from deforestation, in accordance with the NIR procedure.

The disaggregation between industrial wood (sawnwood, wood-based panels, paper and paperboard) and firewood in each stratum of the reference period is replicated in the commitment period, making sure that the ratio between solid and energy use of forest biomass remains constant in the commitment period.

For the documentation of the ratio between solid and energy use of forest biomass, FAOSTAT[8] data has been employed, as shown in table 2. This ratio has been applied to the projections of harvests obtained from the Vael model (table 3).

[8] FAOSTAT-Forestry database. http://www.fao.org/faostat/en/#data/FO

	Non energy use forest biomass (Volume of wood, m^3 under bark)	*Energy use forest biomass (Volume of wood, m^3 under bark)*
2000	*12.723.000*	*1.600.000*
2001	*13.278.001*	*1.855.000*
2002	*13.852.002*	*1.989.000*
2003	*14.077.003*	*2.030.000*
2004	*14.237.004*	*2.055.000*
2005	*13.353.005*	*2.180.000*
2006	*14.111.006*	*1.607.000*
2007	*12.548.007*	*1.982.000*
2008	*14.429.382*	*2.600.000*
2009	*11.902.044*	*2.080.000*
Average 2000-2009	**13.449.041**	**1.997.800**
Ratio %	**87,07%**	**12,93%**

Table 2 - Ratio between solid and energy use of forest biomass in the reference period (FAOSTAT)

	2021	***2022***	***2023***	***2024***	***2025***	***Average 2021-2025***
Projected harvests according to the FRL model (Kt C), of which:	3.702	3.847	4.009	4.167	4.303	4.006
- *Energy use, applying constant ratio 2000-2009 (Kt C)*	*3.223*	*3.350*	*3.491*	*3.628*	*3.747*	*3.488 (87,07%)*
- *HWP, applying constant ratio 2000-2009 (Kt C)*	*479*	*497*	*518*	*539*	*556*	*518 (12,93%)*
HWP emissions/removals (kt CO_2 eq)	-3.273	-3.578	-3.901	-4.182	-4.377	**-3.862**

Table 3 – Projected harvests disaggregated by energy and non-energy uses, and HWP emissions/removals.

f) the reference level should be consistent with the objective of contributing to the conservation of biodiversity and the sustainable use of natural resources, as set out in the EU forest strategy, Member States' national forest policies, and the EU biodiversity strategy;

In Spain, the entire forest area is considered managed for reporting and accounting purposes of greenhouse gas emissions and removals. Therefore, the FRL has been calculated based on a model that takes into account the conservation practices applying in the Spanish forest area, aimed to maintain and improve the conservation of biodiversity and the sustainable use of natural resources, among other considerations.

The Law 43/2003 on Forests[9] guarantees the conservation of Spanish forests and the promotion of their restoration, improvement and rational use. This law is inspired by several principles that are framed in the first and fundamental concept of sustainable forest management. Based on this concept, the other values considered are: multifunction of forest services, integration of forestry planning into the land planning, territorial cohesion and subsidiarity, promotion of forest productions and rural development, conservation of forest biodiversity and integration of forestry policy in international environmental objectives. The principles that inspire this law are, among others:

- The conservation, improvement and restoration of the biodiversity of ecosystems and forest species.
- Integration of the main goals of international action on environmental protection into the Spanish forest policy, especially in the field of desertification, climate change and biodiversity.

g) the reference level shall be consistent with the national projections of anthropogenic greenhouse gas emissions by sources and removals by sinks reported under Regulation (EU) No 525/2013;

The FRL for Spain is consistent with the national projections reported in relation to the considered carbon stocks. The model includes all deposits currently estimated in the NIR; living biomass and HWP. Also, as in the NIR, emissions of gas other than CO_2 due to the occurrence of wildfires and prescribed burning have been included.

As reflected in Table 4, the NIR projections for forest land remaining forest land (4A1 category) notified under Regulation (EU) 525/2013 are consistent and similar to the FRL

[9] https://www.boe.es/buscar/act.php?id=BOE-A-2003-21339

estimate in the commitment period, with slight differences caused by some restrictions used in the calculation of the FRL, mainly:

- The management practices in the FRL are those documented in the reference period projected in the compliance period, while the NIR projections are projected statistically considering changes occurring every year.
- The FRL considers a fixed area projected in the compliance period, while the NIR takes into account area changes occurring every year.

	2021	*2022*	*2023*	*2024*	*2025*
NIR	-28.283	-28.354	-28.428	-28.548	-28.662
FRL	-28.971	-28.971	-28.971	-28.971	-28.971

Table 4 –NIR projections for forest land remaining forest land (category 4A1) and FRL (managed forest land, without HWP) for the 2021-2025 period (data in kt CO_2 eq)

The estimates notified under Regulation (EU) 525/2013, have the same result in the scenarios with existing measures (WEM) and with additional measures (WAM), since the measures projected in this context (i.e. afforestation) for category 4A (forest land) in the WAM scenario only have an impact in subcategory 4A2 (land converted to forest land), and not in subcategory 4A1 (forest land remaining forest land).

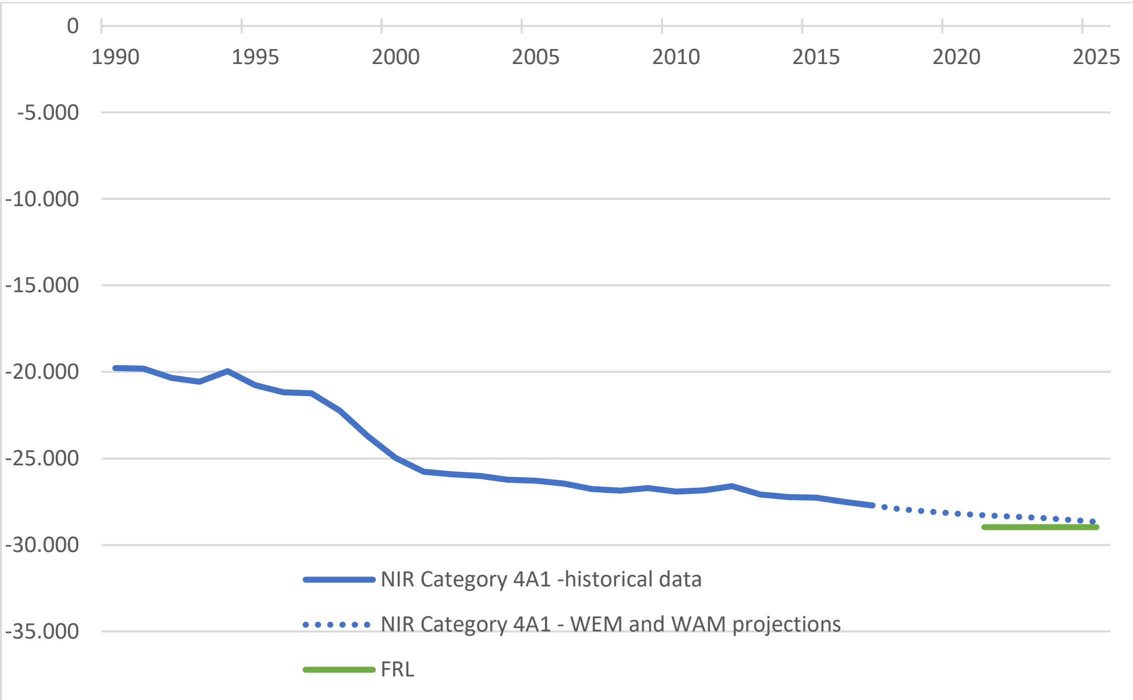

Figure 2 – Historical data and projections in NIR category 4A1 and FRL (managed forest land without HWP) in the 2021-2025 period (data in kt CO_2 eq)

h) The reference level shall be consistent with greenhouse gas inventories and relevant historical data and shall be based on transparent, complete, consistent, comparable and accurate information. In particular, the model used to construct the reference level shall be able to reproduce historical data from the National Greenhouse Gas Inventory.

The model results are consistent with those provided by NIR. This consistency is based on:

- the use of the same basic information (NFI), although at a more detailed level of disaggregation;
- the use of the same forest area, coming from the national cartography commonly employed for the LULUCF sector; and
- The use of the same method ('carbon stock change') and the same parameters for the calculation of living biomass (BEFD, R and CF).

The Vael model is designed to be executed in the 2011-2025 period and is based on information from the NFI, which best represents forest management practices in the reference period. However, the model is not designed to be executed from 2000 covering the period 2000-2009, since this model does not have information on the histograms of "maturity classes" from year 2000, the strata areas and, specially, the development of the growth functions of each of the strata. To obtain this information, it would be necessary to re-analyse the basic information from the NFIs taking into account the NFIs that best fit the period (e.g. if the NFIs for a specific province are in 1994, 2004 and 2014, it would be necessary to process information 1994-2004 for the first part of the period and that information has not been processed, see table 8).

However, the model is consistent with the NIR as required by the LULUCF Regulation and, as explained in other sections, is based on the best information available for the reference period. Since there have been no significant changes in forest management between the reference period and the 2011-2017 period, it would be expected that the model would be able to reasonably predict the behaviour of this period, as roughly represented in Figure 3.

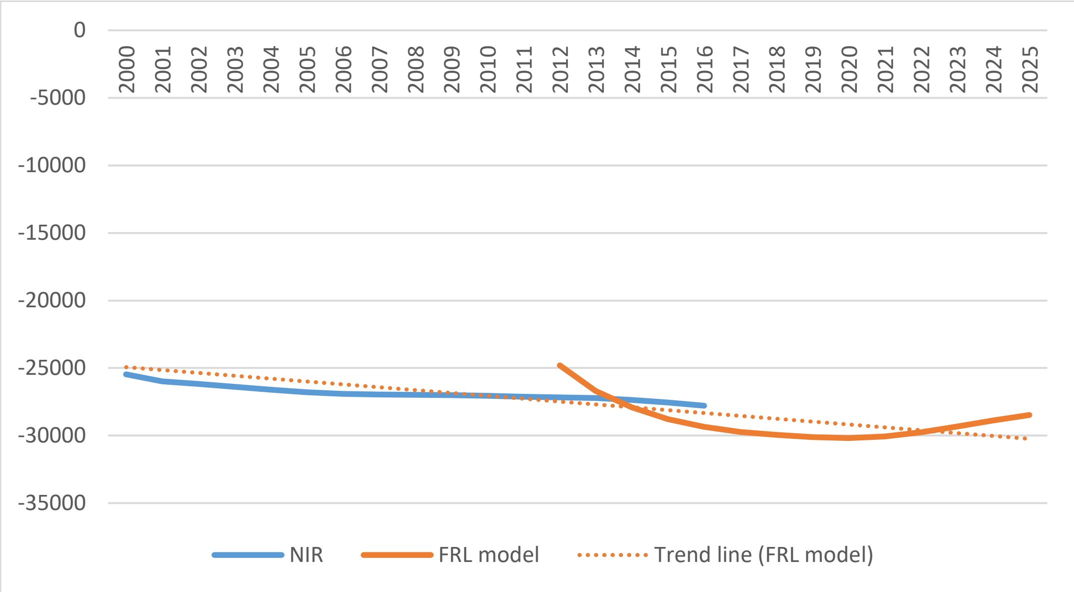

Figure 3 – Emissions and removals of living biomass in managed forest land; comparison between NIR 2000-2016, FRL model 2011-2025 and trend of the FRL model in 2000-2025 (data in kt CO_2 eq)

The NIR reports the living biomass pool in forest land remaining forest land without disaggregated information at province (sub-regional) level, nor by type of forest at the level of emissions and sinks. Therefore, the verification of the model has been carried out at a national level. However, in order to improve verification, the consistency of various disaggregated parameters has been analysed.

Consistency of the living biomass stock

When comparing the results of the FRL model and the NIR data in terms of carbon stock changes (Kt C, figure 4) and emissions/removals (Kt CO_2 eq, figure 5) in living biomass stock, similar values are obtained, after the calibration of the model (see section 3.3 for more details). The average variation of the validation period (2012-2016) is + 0.3%, with variation ranges between -8.7% in 2012 and + 5.7% in 2016.

The largest increases in carbon stock changes in the last years of the validation period (2014-2016) compared to those of the NIR respond to the different approaches used in the Vael model and in the NIR. While the Vael model applies a trend for the evolution of living biomass observed in the NFI data, the NIR bases its estimates on stock changes between periods of the NFI, keeping the biomass at a constant value from the last year in which NFI data is available.

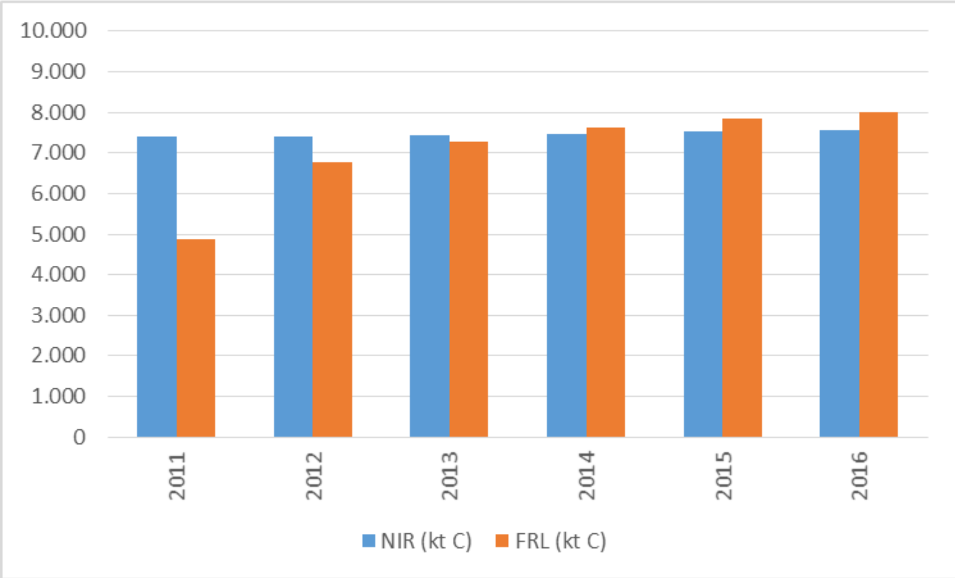

Figure 4 – Increase of living biomass (Kt C) in validation period, FRL model and NIR comparison.

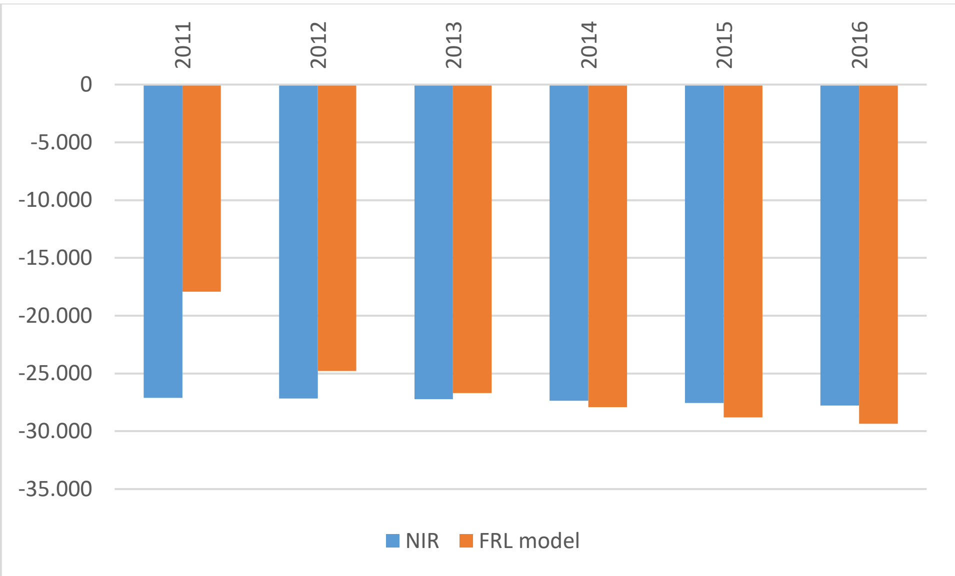

Figure 5 – Emissions and removals of living biomass (Kt CO_2 eq) in validation period, FRL model and NIR comparison

The operation of the Vael model provides an explanation on the apparently anomalous values in 2011; the historical age distribution of a particular stratum is determined by NFI data. The NFI collect this information from field visits carried out throughout the year. Therefore, in the maturity classes in which final cuts are to be made, it may happen that some visited sampling plots are accounted as not cut, but will be cut later that year.

The areas in the Vael model represent the information at the end of every year (or the beginning of the next year). Therefore, when final cuts are to be made in a particular maturity class (according to management practices), the model computes the harvest, sends the percentage of final cuts area to maturity class 1 and reports, at the end of the year, the remaining area as the next maturity class to be harvest.

The difference between the NFI measurements and Vael data is due to the existence of these areas measured but not harvested yet. Thus, the model considers in the first year larger areas than those expected in the final-cut maturity classes. As the model computes the harvest in a percentage of the area, in the first years (not only in 2011, although it's is the most obvious year) it will be calculating values based in that "extra" area and, therefore, accounting for "extra" harvests. As time passes by and the final cut maturity classes commence to be composed of trees from previously lower maturity classes (not harvested and therefore without this bias), the area of final cut classes moves away from the initial bias and the differences fade away.

Consistency of modelled harvests results

For harvests, the Vael model compares the two NFIs closest to the reference period (see table 8) obtaining, by species and diametric class, the wood volume over bark of the harvested trees (trees measured in the previous NFI that are just a stump in the next NFI). So, the harvest percentages are obtained by diametric class, and the harvest patterns of the species studied in the NFI can be acquired.

The results are compared then with the existing bibliography (see section 5 of this document for references) verifying that the results obtained are consistent with the forestry practices described in the aforementioned manuals, especially in the stands where the forest management is carried out under a legal management instrument.

The percentages of harvests by diametric class and forestry management data have been associated with the maturity classes of the corresponding stratum of the Vael model. In this step, the age at which a tree is going to be harvest is identified based on the diametric class and the forestry management practices identified in the bibliography. This data is combined with the modelled net increments to estimate the percentage of harvests in each maturity class.

When comparing the harvests obtained in the Vael model, which uses the NFI data as input as explained above, with the NIR data, which uses FAOSTAT statistics for semifinished products (sawn timber, wood-based boards and paper and paperboard) from a more general "industrial roundwood" product, converted to tons of C, satisfactory results are obtained as shown in Figure 6, with slight differences explained by the different approaches in the FRL model and the NIR estimates.

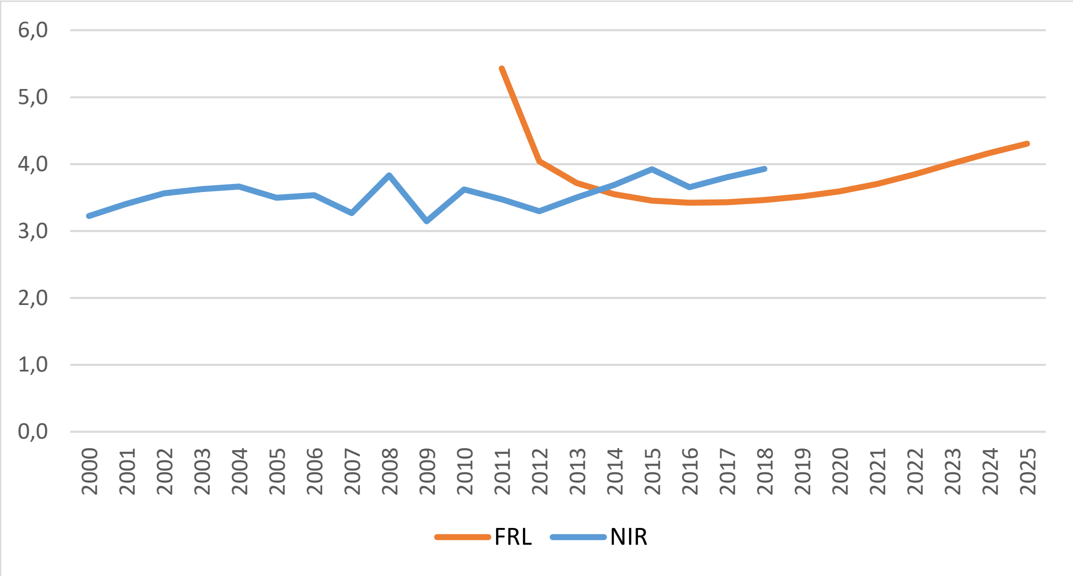

Figure 6 – Estimation of kt C from harvests, NIR vs FRL

Consistency of biomass burning results

The model takes information from NIR on emissions of methane (CH_4) and nitrous oxide (N_2O) due to biomass burning (prescribed burning and forest fires) on managed forest land in the reference period. Therefore, the results of the model are consistent with those of the NIR.

Given the natural variability in the series of historical forest fire data, the average applied is assumed as an adequate value.

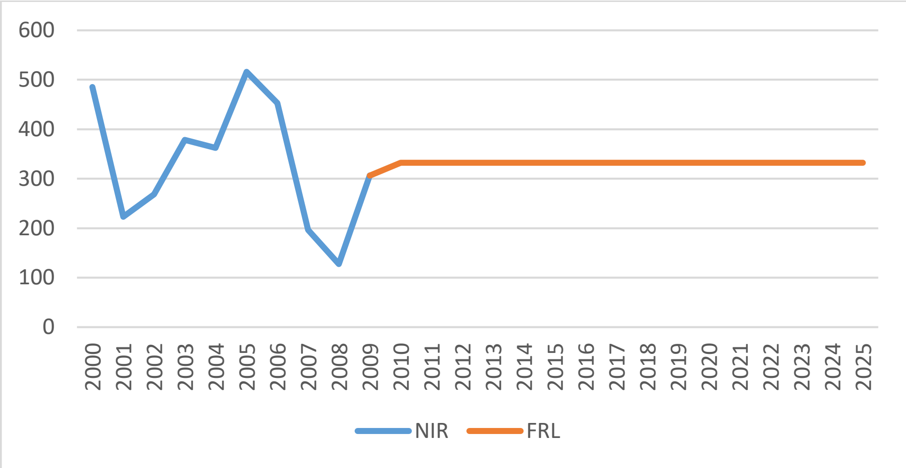

Figure 7 – Biomass burning emissions (kt CO_2 eq)

Annex IV.B of LULUCF Regulation establishes the elements that the national forest accounting plan shall contain. The following table presents the reference for where those elements are documented in this submission.

Elements according to Annex IV.B of LULUCF Regulation	Chapter in the national forestry accounting plan
a) a general description of the determination of the forest reference level and a description of how the criteria in this Regulation were taken into account	3.1, 3.2.2, 1.3
b) identification of the carbon pools and greenhouse gases which have been included in the forest reference level, reasons for omitting a carbon pool from the forest reference level determination, and demonstration of the consistency between the carbon pools included in the forest reference level;	2.1, 2.2, 4.2
c) a description of approaches, methods and models, including quantitative information, used in the determination of the forest reference level, consistent with the most recently submitted national inventory report, and a description of documentary information on sustainable forest management practices and intensity as well as of adopted national policies;	3.1, 3.2, 2.3.1
d) information on how harvesting rates are expected to develop under different policy scenarios;	2.3.2
e) a description of how each of the following elements were considered in the determination of the forest reference level:	
i) the area under forest management;	3.2
ii) emissions and removals from forests and harvested wood products as shown in greenhouse gas inventories and relevant historical data;	1.2
iii) forest characteristics, including dynamic age-related forest characteristics, increments, rotation length and other information on forest management activities under 'business as usual';	3.2.2
iv) historical and future harvesting rates disaggregated between energy and non-energy uses.	4.1

2. Preamble for the forest reference level

2.1. Carbon pools and greenhouse gases included in the forest reference level

The forest reference level for Spain includes changes in the living biomass pool (aboveground and belowground biomass) and harvested wood products (HWP), to ensure consistency with the pools considered in the National Inventory Reports of Greenhouse Gases.

	Pools reported in NIR	*Pools considered in FRL*
Aboveground biomass	R	✓
Belowground biomass	IE	✓
Litter	NR	
Dead wood	NR	
Mineral soil	NR	
Organic soil	NO	
HWP	R	✓

Table 5- Pools considered in NIR and FRL (R: reported; NR: not reported; IE: included elsewhere; NO: not occurring)

Estimates of carbon stock changes in living biomass and HWP included in the FRL accounts for CO_2. The FRL also includes emissions (CH_4 and N_2O gases) from biomass burning; forest fires and prescribed burning.

To comply with the criteria A.h of Annex IV of Regulation (EU) 2018/841 (consistency of the FRL with NIR) the dead wood pool is not included in the calculation of the FRL, since it is not considered in the NIR either. The data included in the NIR to justify this pool as "non-source" (sections A3.2.10 and A3.2.11 of NIR2018) are scarce to make a thorough and accurate estimate of this pool and, specially, its inclusion would imply the non-compliance of the consistency of the FRL with the NIR.

It is expected that new data will be available soon to carry out a reliable estimate of the changes in the dead wood pool and include it in the NIR, at which time the FRL would be recalculated through a technical correction. For more information on this topic, see Annex II.

Also, changes in litter and mineral soil pools are not included in the calculation of the FRL, pursuant to Article 5.4 of the LULUCF Regulation, and on the basis that both pools do not constitute sources, as is manifest in the NIR.

2.2. Demonstration of consistency between the carbon pools included in the forest reference level

The estimation of the carbon stock changes in living biomass (aboveground and belowground) is built from the data collected in the National Forest Inventories (NFI). These inventories provide information on the living biomass stock per hectare (measured in wood volume per hectare -m^3 / ha-, which is converted to C / ha according to the IPCC methodology), at province (sub-regional) level in the year in which the NFI is carried out in each province. To estimate the annual increases in biomass in the rest of the years, a linear interpolation between the data from the two closest inventories is proceeded (carbon stock change method).

To estimate the emissions and removals from the carbon stock changes in the HWP pool, the harvests obtained as an output of the living biomass model (Vael) were applied. The methodology employed for this estimation of the emissions / removals from changes in the carbon stocks of HWP follows the KP 2013 Supplementary Guide (section 2.8 of the 2013 KP Supplementary Guide), which is consistent with the 2006 IPCC Guide (chapter 12, volume 4).

Forest fires and prescribed burning have been taken into account in the construction of the FRL as it is partially consequence of human activity on managed forest land. The FRL is based on the forest management practices of 2000-2009 and the Spanish model does not apply corrections for changes in climate. Additionally, managed forest land area remain constant throughout the projections.

2.3. Description of the long-term forest strategy

In accordance with the Law 43/2003 of 21 November 2003 on Forests, forestry planning in Spain is articulated, at the strategic level, through the Spanish Forestry Strategy, approved in 1999. The Spanish Forest Plan (PFE), as a long-term planning instrument term of Spanish forest policy, develops the Spanish Forest Strategy.

The PFE was approved by the Council of Ministers in July 2002 and projected for a 30 year-period (2002-2032). The PFE proposes 150 measures for the development of a forest policy based on the principles of sustainable development, multifunction of forest services, contribution to territorial and ecological cohesion and public and social participation in the formulation of policies, strategies and programs, proposing the co-responsibility of society in the conservation and management of forests. Many of these actions have an impact on the fight against climate change, such as those that influence the increase of carbon captured by Spanish forests (i.e. restoration of deteriorated forests and afforestation), the monitoring of the state of forests as a tool to identify the impacts of climate change and the research measures undertaken.

This Plan is currently under review. The first step of this review has been the preparation of a Plan for Socioeconomic Activation of the Forestry Sector (PASSFOR)[10], approved in January 2014. This is a strategic document focused, among other issues, on achieving a better integration of socioeconomic aspects of the forestry sector in the PFE during its review. Among the measures proposed in the PASSFOR, there are some directly related with the fight against climate change, such as the increase of sustainable forestry management tools, the foster of demand in forestry products or the support for the use of forest biomass for energy purposes. In addition, the review of the Spanish Forest Strategy is being carried out between 2019 and 2020.

The National Energy and Climate Plans (NECPs) are the new framework within which EU Member States have to plan and submit, in an integrated manner, their climate and energy targets, policies and measures to the European Commission. In the Spanish draft

[10] https://www.mapa.gob.es/es/desarrollo-rural/temas/politica-forestal/plan-pasfor/

NECP[11] some specific programs to foster the use of biomass are proposed, as well as the following measures to improve agricultural and forestry sinks:

- Regeneration of silvo-pastoral systems.
- Promoting poplars as replacements for agricultural crops in flood-prone areas
- Creation of forest areas.
- Forestry activities to prevent forest fires.
- Controlled grazing in strategic areas to prevent forest fires.
- Promoting sustainable coniferous forest management, application of thinning schemes to increase carbon removals.
- Hydrological-forest restoration in areas at high risk of erosion.
- Promoting conservation agriculture (direct sowing).
- Maintenance of plant cover and the incorporation of pruning waste into the soil for woody crops.

The mechanisms for developing this measures strongly depend on the development of several frameworks such as the future strategic plan of the Common Agricultural Policy for Spain, currently under negotiation, and the result of the analysis and study for the promotion of public-private financing instruments.

Regarding adaptation, the National Climate Change Adaptation Plan (PNACC) constitutes the basic planning instrument to promote coordinated and coherent action to face the effects of climate change in Spain. Without prejudice to the responsibilities that correspond to other Public Administrations, the PNACC defines the objectives, criteria, priorities and actions to promote resilience and adaptation to climate change. The second PNACC is currently being developed, which will integrate objectives and recommendations established in the Paris Agreement (2015) and in the evaluation of the European Adaptation Strategy (2018) and will provide guidelines for its implementation through two working programs (2021-2025 and 2026-2030) in which the actions to be developed will be defined in detail.

[11] Available in https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/national-energy-climate-plans

2.3.1. Overall description of the forests and forest management in Spain and the adopted national policies

Description of forests in Spain

For the purposes of this report, it is considered that the forest area is occupied by forests as defined in Annex II of the LULUCF Regulation for Spain (minimum values of 1 ha, 20% tree crown cover and tree height of 3 m).

The Spanish forests are noticeably multifunctional. The protective role of our forests and their role in regulating the hydrological cycle and biodiversity prevail, but its productive capacity is not negligible. Products such as wood, firewood, biomass for energy, cork, resins, edible mushrooms, pinion, livestock or hunting are often underexploited due to problems related with the profitability of exploitations.

Conifers account for approximately 55% of the wood volume over bark, with the remaining 45% corresponding to broadleaved species. However, the proportions are reversed if the individual trees whose diameter at breast height (DBH) is greater than the minimum inventariable diameter set[12] (according to the demands of forestry management) are referred, with 43% of conifers compared to 57% of broadleaved species, which highlights the importance of scrublands on broadleaved tree stands, with species that have the capacity to regenerate themselves indefinitely from stump or root shoots. This circumstance is even more noticeable when referring to stages of natural or artificial regeneration following timber harvesting or other circumstances such as the occurrence of forest fires. Species such as holm oak and *rebollo* (*Quercus ilex* and *Quercus pyrenaica*) account for more than half of the entire territory of the individual trees not reaching the minimum inventariable diameter.

The stands with the highest growth rates within the Peninsula are gathered in the northern region (including the Galician Massif and the Cantabrian Mountains). In most of the Mediterranean region (both wet and dry) growth rates higher than 2.5 m^3 per hectare per year are rarely achieved, except for forests in mountainous areas such as the Central System, the Iberian System and the Baetic Systems, as well as provinces such as Barcelona and Girona, which show higher rates than the average of the biogeographic

[12] In the case of the Spanish NFI is diametric class 10, which corresponds to a minimum DBH of 7.5 cm

region to which they belong. The highest growth rates, above 15 m^3 per hectare per year, are recorded in the *Pinus radiata* pine forests of Vizcaya, Guipúzcoa and Lugo, in the eucalypt forests of Vizcaya and in the production forests of *Populus* sp. of La Rioja.

It is expected that long-term impacts of climate change will affect forests. The frequency, intensity, duration and periods of the alterations already happening will be increased. For example, in the long term it is likely that there will be an increase in the accumulation of fuel (dry biomass) in forests, that the seasons of fires will be longer and that there will be extreme weather conditions more frequently as a result of climate change. However, these effects cannot be estimated by the current model in the short term, which is why Spain has chosen not to include climate change effects in its estimate of the FRL.

Forest management in Spain

Sustainable forest management is defined as the administration and use of forests and forest lands in such a form and intensity that allows to maintain their biodiversity, productivity, regeneration capacity, vitality and potential to satisfy now and in the future the most important ecological, economic and environmental functions at the local, national and international levels, causing no damage to other ecosystems.

From the perspective of climate change mitigation, the sustainable forest management is classified within those actions that allow modifying the amount of carbon stored in forests, since they directly affect the biomass content per hectare. The Law 43/2003 on Forests establishes that forests shall be managed in a sustainable manner, using the criteria established in the resolutions of the Ministerial Conference for the Protection of Forests in Europe (Forest Europe)[13]. This forest management is operated according to management or technical plans (depending on the characteristics of the forest to be managed), which must comply with the requirements established in the national (Spanish Forest Strategy and Spanish Forest Plan), regional (autonomous forest plans) and county (forest resource management plans) planning guidelines, where

[13] https://foresteurope.org/

appropriate. All these instruments incorporate the criteria of sustainable forest management.

Adopted national policies

The forest management policies and measures in Spain are currently a responsibility of the autonomous communities, so most of the actions are carried out by the regional administrations, although there are also some initiatives launched from the National administration to promote actions in the whole territory[14]. According to this, the main forestry measures at the national level are the following:

<u>Restoration of forests and afforestation</u>

The increase of forest area in Spain is a consequence of several policies aimed at establishing new forest stands. These measures are described below.

- Support for afforestation, with protective and productive purposes: These actions are carried out within the framework of various initiatives, especially through forestry measures included in the Rural Development Programs[15] co-funded by the EAFRD (EU). In addition, there are other initiatives such as the "Carbon footprint registry, compensation and carbon dioxide absorption projects"[16], among others.

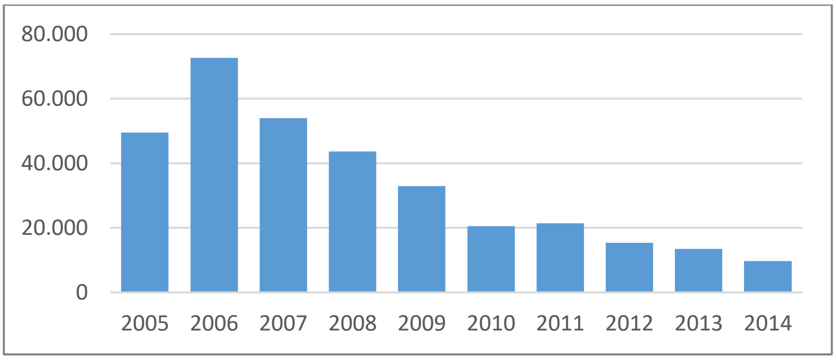

Figure 8 – Area (ha) afforested in recent years in Spain (Source: Yearbooks of Forest Statistics, Ministry of Agriculture, Fisheries and Food).

[14] According to Law 43/2003 on Forests most of the responsibilities in forest planning and forest management are not national but regional, so there may be regional measures not reflected in this document

[15] https://www.mapa.gob.es/es/desarrollo-rural/temas/programas-ue/periodo-2014-2020/programas-de-desarrollo-rural/programas-autonomicos/

[16] https://www.miteco.gob.es/es/cambio-climatico/temas/mitigacion-politicas-y-medidas/proyectos-absorcion-co2.aspx

- Forestry-Hydrological restoration: the National Plan of Priority Actions in the field of Forestry-Hydrological restoration, erosion control and defence against desertification, currently under review, is aimed to maintain and improve the protective function of forests over the soil and water resources, controlling erosion, improving the hydrological regime and contributing to the regulation of dynamics of water flow, as well as carrying out restoration, conservation and improvement of the area covered by trees.

- Post-fire emergency land stabilization and restoration: These actions have as a goal the recovery of the affected ecosystems and the control of the erosive processes that can be triggered after wildfires. Depending on the intensity and severity of wildfires, restoration actions are carried out every year on large areas affected by fires, some of which are co-funded by the EU.

Promotion of sustainable forest management

The main working lines regarding sustainable forest management are summarized below.

- Forest information: to support decision-making and action planning in the forestry sector it is of utmost importance to have quality forestry databases[17] available such as the National Forest Inventory, the Forest Map of Spain, the National Soil Erosion Inventory, the Wildfire Statistics, the ICP Forests Monitoring Networks, production and trade of forest products info and other forest statistics produced by the Autonomous Communities.

- Fight against wildfires: Wildfires are frequent and significant in Spain mainly due to the climatic conditions, and they are expected to be even more relevant in a changing climate. The efforts in preventing and extinguishing wildfires are key in reducing emissions of greenhouse gas into the atmosphere. The national administration, in coordination with the regional administrations, carries out specific programs for the prevention of forest fires, which turn into the following actions:

[17] Article 28, Law 43/2003 on Forests

    - Awareness campaigns.
    - Publishing of available information.
    - Comprehensive Wildfire Prevention Teams (EPRIF).
    - Preventive Brigades (BLP) works around the Wildfire Reinforcement Brigades (BRIF) bases.

- Forest health (monitoring and assessment of forest health): The measures regarding forest health are chiefly preventive and so they are based on the permanent monitoring of the evolution of the forest area. The actions carried out in this regard can be summarized as follows:

    - Promotion of R & D to improve information and knowledge about the health status of forests and the agents involved in it.
    - Management and monitoring of the action and effects of biotic, abiotic, polluting and meteorological agents that affect Spanish forests.
    - Prevention of diseases and pests through the promotion of forest management specifically aimed at improving the health status of forests, including specific treatments and biological control actions with low incidence on the environment.

- Promotion of the use of forest products: The Spanish Forestry Strategy contemplates, along with the use of wood, other forest uses such as pastures, firewood and biomass, cork, resin, forest fruits and fungi, aromatic plants, honey, hunting, and continental fishery. All these uses contribute to a greater or lesser extent to the promotion of sustainable forest management. The Spanish Forest Plan sets as its objective the establishment of programs for the promotion and enhancement of forest productions with an integrating approach to the multiple functions and uses that the forests sustain.

- Conservation and Sustainable Use of Forest Genetic Resources: The conservation and proper use of the genetic resources is essential for the adaptation of species to global change. In this sense, the Strategy for the Conservation and Sustainable Use of Spanish Forest Genetic Resources establishes a number of measures and action plans to be developed. This Strategy is proposed as a framework for the support, development and coordination on forest genetic conservation and improvement activities and programs, which facilitates the cooperation and integration of the initiatives carried out by different administrations and agencies. The final objective of the Strategy is the conservation and sustainable use of forest genetic resources in Spain, preserving its capacity for evolution and guaranteeing its use to future generations.

2.3.2. Description of future harvesting rates under different policy scenarios.

Noting that the forest management plans are drawn up by the forest owners, being approved by the corresponding Autonomous Administration, the current forestry policies cannot provide for any decision on future harvest rates for the whole country. Due to the increase of forest biomass and to the fact that the management has not been very intense in the past, a rise in the harvests rate can be expected, although it is not possible to quantify it. The only available scenario of harvests today is the one calculated in the Vael model, which constitutes a reference scenario or "Business as usual" that is based on forest management practices that occurred in the period 2000-2009 and it is shown in figure 9. The effect on the forest sink capacity of this projected harvests is slightly negative in the living biomass pool (due to the greater harvest rate, among other factors), although this effect is offset by the greater carbon storage in the HWP pool (figure 10).

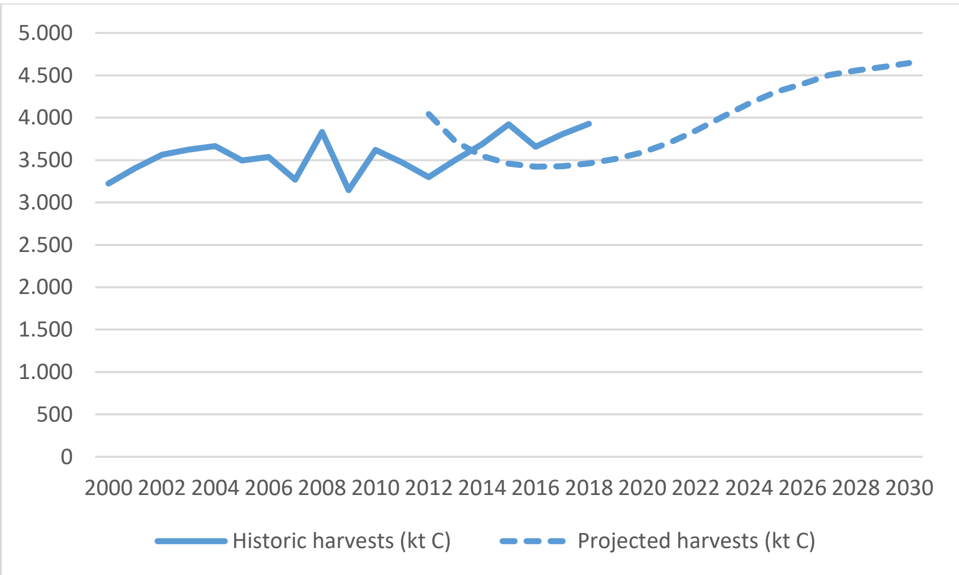

Figure 9 – Historic harvests and projection under the FRL model (Kt C)

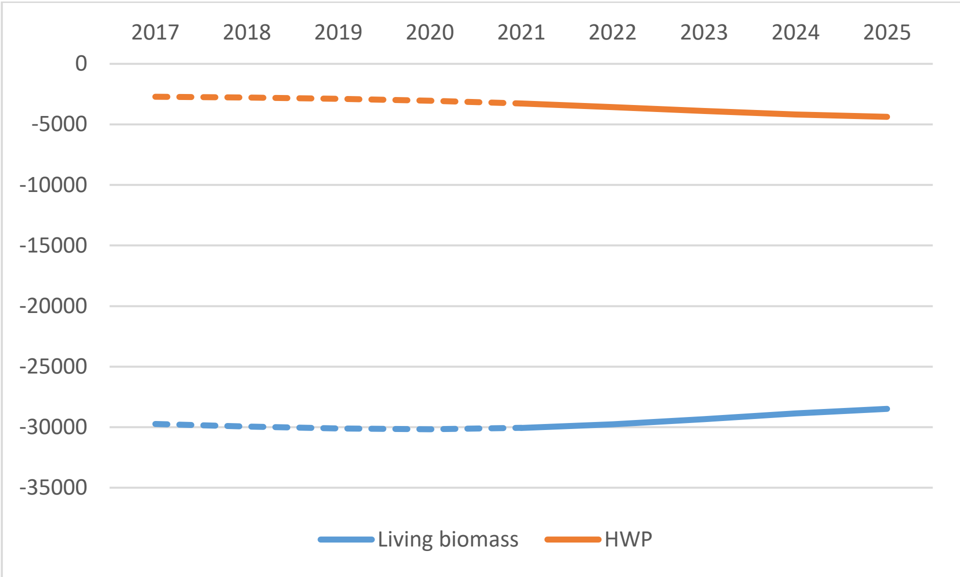

Figure 10 – Evolution of the living biomass and HWP pools in the harvest scenario foreseen in the FRL model (data in Kt CO2-eq)

In relation to energy policies, Spain's perspective regarding forest biomass is favourable to the increase in its use, since it allows the recovery of the rural environment and mitigates the risk of depopulation, and favours a better adaptation of certain territories to the effects of climate change, among other circumstances.

The elaboration of "Specific programmes for fostering the use of biomass" has been introduced as a measure in the Spanish NECP, considering an additional development of energy biomass of about additional 1.600 ktoe/year for the increase of electricity generation and 411 ktoe/year for thermal uses. In the Renewable Energy Plan 2011-2020[18], it was conservatively assessed that the additional potential in Spain is 17.286 ktoe/year, of which 10.433 ktoe/year are sustainable agricultural or forestry residues and the difference are new crops. Therefore, there are more than enough resources without varying the surface or structure of Spanish forests, taking into account that the rate of utilization in relation to annual growth in Spain (around 40%) has a margin of increase within sustainable limits.

With the existing regulations at national level (especially Law 43/2003 on Forests and Law 42/2007 on Natural Heritage and Biodiversity), it is guaranteed that the demand for forest biomass will be met through its collection in forests whose instruments of management comply with the principles of sustainable forest management, that special

[18] https://www.idae.es/tecnologias/energias-renovables/plan-de-energias-renovables-2011-2020

attention is given to areas specifically designated for the protection of biodiversity, landscapes and specific natural elements, that biodiversity resources are conserved and that carbon stocks will be tracked, as established by Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources.

3. Description of the modelling approach

The proposed FRL for the managed forest land is the annual average of the net removals expected in 2021-2025, based on simulations of the carbon pools in the managed forest land from 2010, assuming the continuation of the management practices that have taken place in the reference period (2000-2009).

The Vael model was operated to project the development of living biomass based on the NFI data. The output data of harvests from the Vael model have been transferred to stocks of HWP, ensuring a constant ratio between energy and non-energy uses of biomass, to calculate the emissions and removals according to the methodology used in the NIR.

The model also estimates the projections of CH_4 and N_2O emissions from biomass burning (forest fires and controlled burning) in managed forest land.

3.1. Description of the general approach as applied for estimating the forest reference level

The guidance document on developing FRL (Forsell et al., 2018, chapter 2.3.3, box 13) allows the utilisation of a model based on carbon stock changes. This type of model is suggested for those countries currently using the carbon stock changes methodology in the NIR, as is the case of Spain. These models jointly consider the effect of harvests and other biomass losses and gains in forest formations, management practices and maturity classes[19], although it still requires an attached model to develop the dynamics of the age / maturity classes.

[19] In these paragraphs the nomenclature of the Vael model is used. In the guidance document on developing the FRL (Forsell et al., 2018), forest formations are called strata and maturity classes are age classes.

The Vael model is developed following the suggestions of the guidance document for developing the FRL, although it broadens the proposed method through one extra module for estimating the harvests and yet another one for the dynamics of the age classes. The harvest module allows a direct calculation of harvests by forest formation and maturity class, as well as the quantification of their effect of the living biomass pool. The remaining causes of biomass gains and losses are analysed jointly through the contribution to net growth of the carbon change factors ("CSCF" in the FRL guidance document) resulting from the NFIs.

General characteristics of the FRL estimation model:

- The FRL is based on the forest management practices of the reference period (2000-2009) for each stratum, which are fixed for the commitment period.
- The model considers the surface of each stratum fixed, not allowing changes between strata in the projections. The area under forest management is taken from GHG inventory Table 4.A (“Forest land remaining Forest land”) corresponding to year 2010: 14.480.239 ha.
- The model does not take into account the effect of natural disturbances, like NIR. The LULUCF Regulation establishes the possibility of excluding emissions resulting from natural disturbances that exceed the average of emissions caused in the period 2001-2020. This voluntary exclusion would be carried out by the Member States by calculating and including a “background level” in the FRL. According to chapter 11.4.1.4 of NIR 2018, Spain is not including natural disturbances in its reporting. Therefore, to be consistent with the NIR, natural disturbances in the FRL estimate have not been taken into account.
- The projections of the model begin in the year 2010.
- Land use changes from and to managed forest land have not been taken into account, so the area remains constant in the projections. Losses in the area of managed forest land due to deforestation and the increase in the area due to the inclusion of afforested land after the conversion period will be taken into account as a technical correction, as proposed by the guidance document on developing FRL (Forsell et al., 2018, chapter 2.5.3).

- The future effects of climate are not taken into account as it is included in alternative 1 of box 18 of the guidance document on developing FRL (Forsell et al., 2018, chapter 2.5.2.1).

Assumptions regarding the period 2010-2020:

- The same stratification and forest condition that was identified for the reference period 2000-2009 is used in the projection period 2010-2020.
- The area assigned to each forest formation and, therefore, forest management practices, remains constant over time.
- The forest management practices of the reference period are used for the entire projected period.

3.2. Documentation of data sources as applied for estimating the forest reference level

The Vael model generates strata according to the following parameters: A) Region; B) Forest formation; and C) Management practices.

A) Region

Using the level of data collection in the NFI (provinces), 4 regions have been defined, covering the total area of Spain:

- Northern region: Galicia, Asturias, Cantabria and País Vasco Autonomous Communities.
- Humid Mediterranean: Navarra, Aragón, Cataluña, Castilla y León, Castilla-La Mancha (Guadalajara and Cuenca provinces) and Madrid Autonomous Communities.
- Dry Mediterranean: Comunidades autónomas de Castilla-La Mancha (Albacete, Ciudad Real and Toledo provinces), Comunidad Valenciana, Islas Baleares, Extremadura, Región de Murcia and Andalucía Autonomous Communities.
- Canarias: Autonomous Community of the Canary Islands.

These regions have been selected for the climatic particularities and the homogenous management. Merging into regions has been carried out from a province (sub-regional) level. The table below shows the forest management area considered in each region. The total area match to the value in table 6.1.3 of the NIR 2018, corresponding to year 2010.The area of 2010 has been used as it is considered that the projection period begins on January 1, 2010 and therefore that is the surface to be considered, instead of the surface of the previous year (2009). In any case, the difference between 2009 and 2010 is trifling (+ 0.17%), so the influence on the model is negligible.

Region	*Forest area (ha)*
Northern region	2.138.205
Humid Mediterranean	6.730.995
Dry Mediterranean	5.515.133
Canarias	95.905
Total	**14.480.238**

Table 6 – Forest area (ha) considered in the calculation regions

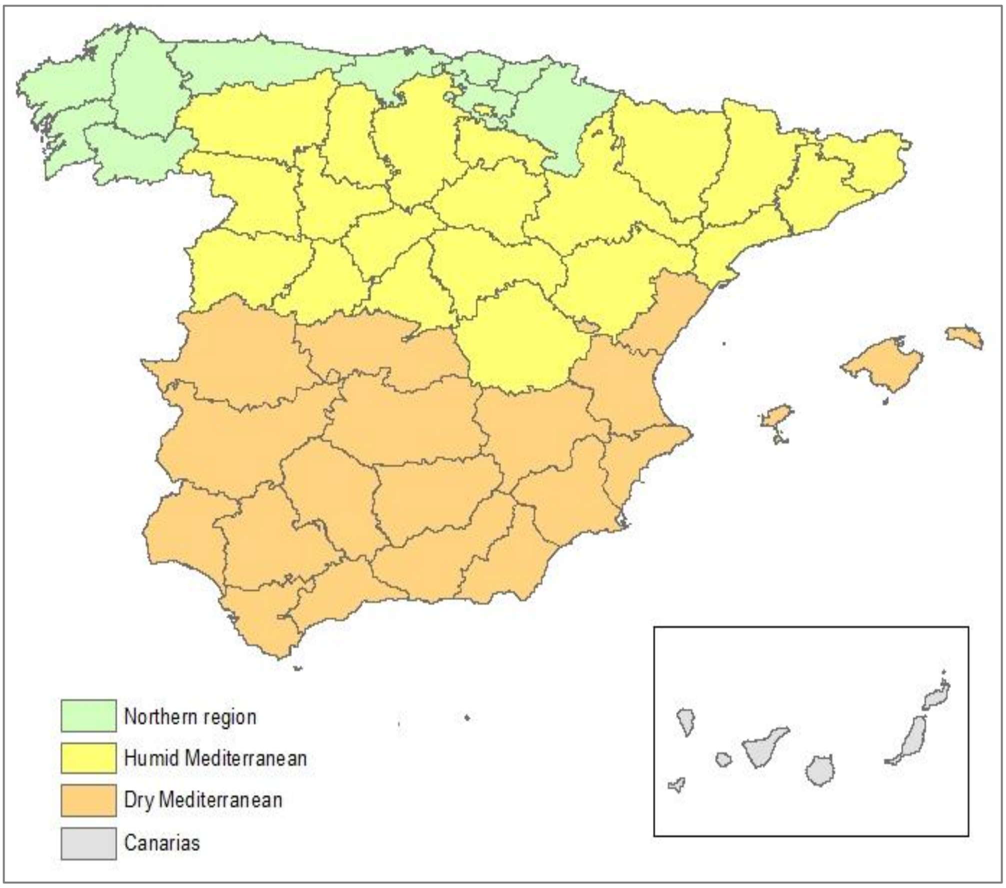

Figure 11- Spatial representation of the regions considered

B) Forest formation

The forest formations considered in the Vael model represent homogenous forest areas with regard to the type of forest, the forest species groups and the management practices. The defined forest formations are specific to each of the regions. The selection of the formations for each region has been made through the analysis of NFI data. The following table shows the formations corresponding to each region.

Northern region	Humid Mediterranean	Dry Mediterranean	Canarias
Eucalypt forests	Pine forests (*Pinus nigra*)	Pine forests (*Pinus halepensis*)	Broadleaved forests
Pine forests (*Pinus pinaster*)	Pine forests (*Pinus pinaster*)	Pine forests (*Pinus nigra*)	Coniferous forests
Pine forests (*Pinus radiata*)	Pine forests (*Pinus pinea*)	Pine forests (*Pinus pinaster*)	
Other coniferous forests	Pine forests (*Pinus sylvestris*)	Pine forests (*Pinus pinea*)	
Broadleaved forests	*Dehesas*	Broadleaved forests	
Mixed forests	Juniper forests	*Encinares* - holm oak (*Quercus ilex*)	
	Broadleaved forests	*Dehesas*	
	Productive broadleaved forests	Mixed forests	
	Encinares - holm oak (*Quercus ilex*)		
	Quercus pyrenaica and *Q. faginea*		
	Mixed forests		

Table 7 – Forest formations considered

It is important to emphasize that, although many of these formations bear the name of a unique species, they do not correspond to monospecific forests, but are composed of several tree species. Most of the groups are named after their dominant species.

C) Forest management practices

The forest management practices have been determined for each forest formation by analysing the NFI data, with the judgment of national forestry expert's support. Therefore, the practices considered are not bibliographic but practices that actually happened.

Each forest formation has been associated with a particular and unique forest management practice, although different formations could have very similar practices. Therefore, the practices are not listed here since they are the same as the forest formations of the previous point (Table 7).

The sources of information for the Vael model are the last three national forest inventories: NFI2 (1986-1996), NFI3 (1997-2007) and NFI4 (2007-currently under development). To determine the status of the forest in the reference period, information is taken from the two NFIs that best cover this period (shaded in Table 8). Although the coverage does not always match with the years of the reference period (2000-2009), this is the best information available on the state of the forest and management practices in the reference period, as stated in Article 8.5 of the LULUCF Regulation.

Province	NFI2	NFI3	NFI4	Province	NFI2	NFI3	NFI4
Álava	1996	2005		La Rioja	1987	1999	2012
Albacete	1993	2004		Lugo	1987	1998	2009
Alicante	1994	2006		Madrid	1990	2000	2013
Almería	1995	2007		Málaga	1995	2007	
Ávila	1991	2002		Murcia	1987	1999	2010
Badajoz	1991	2002	2017	Navarra	1990	1999	2008
Baleares	1987	1999	2010	Orense	1987	1998	2009
Barcelona	1990	2000	2015	Asturias	1988	1998	2010
Burgos	1991	2003		Palencia	1991	2003	
Cáceres	1990	2001	2017	Las Palmas	1992	2002	
Cádiz	1996	2007		Pontevedra	1986	1998	2009
Castellón	1994	2006		Salamanca	1992	2002	
Ciudad Real	1993	2004		Tenerife	1992	2002	
Córdoba	1995	2006		Cantabria	1988	2000	2010
La Coruña	1986	1997	2009	Segovia	1991	2004	
Cuenca	1992	2003		Sevilla	1996	2007	
Gerona	1989	2001	2015	Soria	1991	2004	
Granada	1995	2007		Tarragona	1989	2001	2015
Guadalajara	1992	2003		Teruel	1994	2005	
Guipúzcoa	1996	2006		Toledo	1993	2004	
Huelva	1996	2008		Valencia	1994	2006	
Huesca	1993	2004		Valladolid	1992	2002	
Jaén	1995	2006		Vizcaya	1996	2005	
León	1992	2003		Zamora	1992	2002	
Lérida	1990	2000	2015	Zaragoza	1993	2005	

Table 8 – National Forest Inventories used in each province (shaded)

3.2.1. Documentation of stratification of the managed forest land

Disaggregation levels of the NFI data

The NFI is a network of approximately 90.000 circular plots in which all the values included in its data model are field-collected. The Forest Map of Spain is the cartographic base of the NFI and is utilised both to define the area in which the network of plots is established, and to expand the results to the remaining area, by defining strata that classify the forest area. The definition of strata is carried out at a provincial level, and their statistical values are obtained from the plots contained in each of them.

In the NFI terminology, the strata are areas where plots of similar characteristics are located. The plots are measurement points where the existing trees are analysed. All the plots belonging to a stratum have the same weight in that stratum when defining its composition. The information of 14.140 plots for the northern region, 31.808 for the humid Mediterranean, 25.823 for the dry Mediterranean and 2.347 for the Canary Islands have been utilised to feed up the FRL model.

The data from the plots is offered by species and by diameter class. At the plot level, the volume of timber over bark (VCC) is available, which is the basis of the biomass calculations. The VCC estimation is made through the characteristics of the trees measured in each plot. This information is individual for each tree. More information on how NFI data has been processed can be found in section 3.3 of this document.

Characteristics of forest species

The table of characteristics of forest species provided by the General Directorate of Rural Development, Innovation and Forest Policy (Ministry of Agriculture, Fisheries and Food)[20] has been used. This information includes the biomass conversion and expansion factors (BEFD), the belowground biomass / aboveground biomass (R) ratio and the carbon fractions (CF) that are needed for the estimation of the living biomass carbon pool.

[20] The country-specific values are utilised in the NIR calculations and are available in NIR 2018 (section A. 3.3.1).

Information on harvested wood products

The information on harvested wood products (HWP) has been obtained from FAOSTAT, which in turn draws on the information provided by the Directorate General for Rural Development, Innovation and Forest Policy (Ministry of Agriculture, Fisheries and Food), and is the same source as the one used in the NIR[21]. This information has been used to prepare Module 7 (Estimation of changes in stocks in the harvested wood products pool, see section 3.3), additionally to the checking of the results from the model's module.

Information on biomass burning

The basic information for wildfires and prescribed burning comes from the General Statistics of Forest Fires of the Ministry of Agriculture, Fisheries and Food[22] (burned area and area of preventive burning for every year). This is the same source as the one used in the NIR.

3.2.2. Documentation of sustainable forest management practices as applied in the estimation of the forest reference level

To describe as accurately as possible the management practices that actually took place during the reference period (2000-2009), the actual biomass extractions reflected in the NFIs are used as quantitative information, differentiated by forest formations for each of the 4 geographic regions considered.

Regarding the qualitative information of these management practices, two types of simplified forest management practices in Spain are defined, with the support of expert judgment:

- Conservation practices: With the priority conservation objective, minor interventions (felling of diseased or weakened trees, as well as thinnings) are applied to the stands. The wood does not have a commercial use and is not intended for industrial purposes but it is used as firewood and other local minor uses.

[21] The methodology used for this estimation of emissions / removals from changes in HWP carbon stocks follows the 2013 KP Supplementary Guide (section 2.8 of the 2013 KP Supplementary Guide).
[22] https://www.mapa.gob.es/va/desarrollo-rural/estadisticas/Incendios_default.aspx

- Timber exploitation practices: The main objective is the extraction of wood for industrial purposes. These practices are concentrated in the northern region (which accounts for more than 70% of the total timber production in Spain) and in a few species, specially *Eucalyptus globulus*, *Pinus pinaster* and, to a lesser extent, *Pinus radiata*.

Each forest formation has a specific management practice associated, the latter being understood as the set of actions carried out in the forest stands, from planting to harvesting. The actions or measures that compose the management practices are defined according to different features of the maturity (biomass) classes, namely:

- Function (growth, production or conservation)
- % of biomass extracted
- Number of transition years between classes
- Forest operations (final cuts, thinnings….)

Depending on the different forest formations considered, these practices slightly differ in their impact on the living biomass pool, and are thus reflected in the model. The maturity classes considered in the Vael model are determined by the biomass stock (t C / ha) existing in them.

Summing up, all management practices are described (see Annex I) in:

- Qualitative terms: Description of the objective, rotation and forestry operations for each maturity class.
- Quantitative terms: % of biomass extracted, % of area affected by final cuts and number of years for transitioning between classes.

3.3. Detailed description of the modelling framework as applied in the estimation of the forest reference level

The Spanish FRL model (Vael) is composed of 8 modules. The following describes each of them.

Module 1. Capture and processing of basic information

Module 1 is designed to collect and process the required information for the model, particularly the information contained in the NFIs. The module collects information from the NFI databases, arranges the information from different NFIs (years) and provinces and corrects and standardises anomalous data.

Module 2. Estimation of living biomass pool at plot level

The NFIs provide aggregate data on wood volume over bark per hectare at species and plot level by assembling the collected data from each tree. For each Spanish province and edition of the NFI (see table 8), the data (wood volume) is compiled at plot level, and subsequently this information is utilised to calculate the living biomass pool per hectare of the plot using the methodology of the 2006 IPCC Guidelines and the BEFD, R and CF values also used in the Spanish NIR[23].

Each plot is located in the so-called "strata" (NFI terminology, not to be confused with the forest formations of the model). The number of plots in each strata is a weight factor to analyse the plot values. The large number of strata defined in the NFIs (938, some of which only differentiated by the "maturity" of the forest) made it very difficult to develop a differentiated calculation for each of them, so it was decided to group them into forest formations.

Module 3. Analysis and specification of forest formations

Forest formations represent forest areas in the different regions with similar conditions in terms of species and forest management practices. The initial analysis is done through the study of the NFI strata in the provinces that compose every region. Through an expert judgment, based on the results of the previous modules, the strata from NFI are grouped into forest formations.

Module 4. Analysis and determination of the forest status in each forest formation

This module analyses the data from the NFIs to determine the maturity classes in each forest formation, depending on the biomass ranges observed in the plots.

[23] These values are mostly national. For more information see Annex A3.2.1 of NIR 2018.

Once identified, the state of the forest for each group is estimated, including biomass stocks and average annual biomass increases. The latter is estimated as the average of the biomass differences between the two NFIs considered for the plots belonging to that maturity class (carbon stock change method) and in which there have been no harvests[24][25].

The forest area established in the NIR 2018 corresponding to year 2010 is considered, as already mentioned. This area is taken as a reference to harmonize and weigh the area covered by each maturity class and forest formation.

Module 5. Analysis of the harvesting cycle

The module 5 uses a much more disaggregated information than the rest of the modules from the model. This module allows to determine the harvesting cycle through the analysis of the NFI data collected *in situ* from 1.199.981 trees.

This module allows the determination of the effect of the harvests, both in number of trees and in stock, in a certain species within the strata in which said species prevails[26]. This data is analysed for every diametric class and, depending on the results and expert judgment, it is determined in which maturity classes fellings apply and to which type of operation they refer (final-cut, thinning…). This is a key information to identify forest management practices during the reference period, so that they are defined and do not vary when executing the model in the projected period. This data is also applied, partially and iteratively, in the previous module to define maturity classes.

Module 6. Estimation of the flows of areas, stocks, stocks changes and harvests of the living biomass pool

This module collects all the data documented in the previous modules allowing an estimation of area flows, stocks of biomass and harvests between the different maturity classes in the years of projection.

[24] The values obtained are adjusted through the estimation of the best fit function to avoid outliers.
[25] The plots in which there have been harvests are identified in the NFI checking *in situ* the presence of stumps.
[26] For example, it provides differentiated information on the *Pinus pinaster* fellings from the plots belonging to Pine forest (*Pinus pinaster*) group and other *Pinus pinaster* fellings embedded in other groups.

The gross increment data from module 4 is affected by the forest management practices corresponding to each forest formation, obtaining the net annual stock increases by maturity class. This allows to determine the average time of permanence in every maturity class. Likewise, the information on final cuttings allows to determine the percentage of a maturity class having a final cut and, therefore, moving to class 1 in the following year (see tables 9-14 and Annex I), as well as the total harvests. This data allows, for each forest formation:

1. To establish a starting point in 2010, based on the reference period (2009-2009).
2. To project different parameters in the following years (area flows, carbon stock changes, harvests).

The results of this module for each forest formation are compiled in the different regions to which they belong, obtaining for every year:

- carbon stocks (kt C),
- net stock changes (kt C), and
- harvests, disaggregated in solid and energy uses.

As an example, the description of 3 of the compositions included in the model, based on the processing of NFIs, is detailed below. The description document of the Vael model (Rincón-Cristóbal, J.J., 2018) can be consulted[27] in order to review all compositions. Additionally, a table with the data that served as the basis for the documentation of the forest management practices is included in Annex I: Information on forest management practices.

1. Eucalypt forests in northern region

This group is integrated by eucalypt forests with a productive orientation. The main species is *Eucalyptus globulus* although sometimes *Quercus robur* also appears. The practice of forest management is focused on the final cut (complete) with a rotation period of 12-16 years, matching with maturity classes 10 to 12. This group has no previous thinnings. In the final cut, all the trees in the stand are harvested including all

[27] https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/SEI-Metodologias.aspx

diametric classes (except in the first rotation), given the asymmetric growth in the second and third rotations. It is assumed that 0.5% of the plantations are abandoned and not harvested, moving to a state of conservation (maturity classes 13 and 14). These maturity classes continue to have forest management practices focused on minor treatments in order to improve forest health.

Function	**Maturity class**	**Average Gt (t C/ha)**	**2010 area (ha)**	**Gt gross annual increment (t C/ha and year)**
growth	1	5	57.938	6,41
growth	2	15	21.726	6,58
growth	3	25	25.719	6,75
growth	4	35	23.070	6,91
growth	5	45	25.534	7,06
growth	6	55	22.564	7,21
growth	7	65	20.541	7,35
growth	8	75	22.393	7,48
growth	9	85	19.528	7,61
production	10	105	58.106	7,73
production	11	135	38.361	7,84
production	12	160	17.544	7,94
conservation	13	210	29.658	8,04
conservation	14	307	9.876	-

Table 9 – Gross annual increments obtained as a result of forest management practices in eucalypt forests of the northern region

Function	**Maturity class**	**% area in final cuts (year)**	**% biomass in thinnings (year)**	**% biomass in minor cuttings -health (10 years)**	**Gt losses in thinnings (t C / ha and year)**	**Gt losses in minor cuttings -health (t C / ha and year)**	**Gt net Increment (t C/ha and year)**
growth	1	0%	0%	0%	0,00	0,00	6,41

Function	Maturity class	% area in final cuts (year)	% biomass in thinnings (year)	% biomass in minor cuttings -health (10 years)	Gt losses in thinnings (t C / ha and year)	Gt losses in minor cuttings -health (t C / ha and year)	Gt net Increment (t C/ha and year)
growth	2	0%	0%	0%	0,00	0,00	6,58
growth	3	0%	0%	0%	0,00	0,00	6,75
growth	4	0%	0%	0%	0,00	0,00	6,91
growth	5	0%	0%	0%	0,00	0,00	7,06
growth	6	0%	0%	0%	0,00	0,00	7,21
growth	7	0%	0%	0%	0,00	0,00	7,35
growth	8	0%	0%	0%	0,00	0,00	7,48
growth	9	0%	0%	0%	0,00	0,00	7,61
production	10	24%	0%	0%	0,00	0,00	7,73
production	11	16%	0%	0%	0,00	0,00	7,84
production	12	92%	0%	0%	0,00	0,00	7,94
conservation	13	0%	0%	10%	0,00	2,10	5,94
conservation	14	0%	0%	10%	-	3,07	-

Table 10 – Percentages and t C of final cuts, thinnings and minor cuttings as a result of forest management practices in eucalypt forests of the northern region

2. *Pine forests (*P. sylvestris*) in humid Mediterranean*

This group is made up of pine forests of *Pinus sylvestris* from the humid Mediterranean region, as well as a group of coniferous species with less representation. These forests have a productive orientation based on selective logging, mainly. Two main areas are differentiated according to their age: the Central System with old forests and the rest of the humid Mediterranean region comprising mostly afforestation carried out in the 50s-60s of the 20th century, which have not reached maturity yet. However, after studying the data, it was concluded that there were no significant differences in the actual forest management practices between the two areas, so the decision has been made not to divide these pine forests into two subcategories.

The forest management practice is focused on production. However, a final cut is not identified, but a process of successive clearcuttings. These cleacuttings affect the maturity classes 4 to 14 maintaining a constant intensity. Finally, from maturity class 15 clearcuttings stop, considering that these forests are no longer exploited, although they still have a forest management that focuses on minor treatments in order to improve forest health.

Function	***Maturity class***	***Average Gt (t C/ha)***	***2010 area (ha)***	***Gt gross annual increment (t C/ha and year)***
conservation	1	5	170.250	1,11
conservation	2	15	122.353	1,56
conservation	3	25	110.281	1,82
production	4	35	103.050	2,01
production	5	45	87.551	2,15
production	6	55	90.060	2,27
production	7	65	76.540	2,37
production	8	75	63.667	2,45
production	9	85	48.674	2,53
production	10	95	39.159	2,60
production	11	105	24.689	2,66
production	12	115	24.214	2,72
production	13	125	18.668	2,77
production	14	135	15.296	2,81
conservation	15	145	13.262	2,86
conservation	16	184	35.541	-

Table 11 - Gross annual increments obtained as a result of forest management practices in Pine forests (P. sylvestris) in humid Mediterranean

Function	*Maturity class*	*% area in final cuts (year)*	*% biomass in thinnings (year)*	*% biomass in minor cuttings - health (10 years)*	*Gt losses in thinnings (t C / ha and year)*	*Gt losses in minor cuttings - health (t C / ha and year)*	*Gt net Increment (t C/ha and year)*
conservation	1	0%	0%	0%	0,00	0,00	1,11
conservation	2	0%	0%	0%	0,00	0,00	1,56
conservation	3	0%	0%	0%	0,00	0,00	1,82
production	4	0%	30%	0%	0,60	0,00	1,40
production	5	0%	30%	0%	0,65	0,00	1,51
production	6	0%	30%	0%	0,68	0,00	1,59
production	7	0%	30%	0%	0,71	0,00	1,66
production	8	0%	30%	0%	0,74	0,00	1,72
production	9	0%	30%	0%	0,76	0,00	1,77
production	10	0%	30%	0%	0,78	0,00	1,82
production	11	0%	30%	0%	0,80	0,00	1,86
production	12	0%	30%	0%	0,81	0,00	1,90
production	13	0%	30%	0%	0,83	0,00	1,94
production	14	0%	30%	0%	0,84	0,00	1,97
conservation	15	0%	0%	2%	0,00	0,29	2,57
conservation	16	0%	0%	2%	-	0,37	-

Table 12 - Percentages and t C of final cuts, thinnings and minor cuttings as a result of forest management practices in Pine forests (P. sylvestris) in humid Mediterranean

3. *Encinares (*Quercus ilex*) in dry Mediterranean*

This group is mainly composed of holm oaks in the dry Mediterranean region. These forests have a clearly conservative orientation without the presence of final cuttings or thinnings. The main species is *Quercus ilex*, although it is usually accompanied by other quercineae: *Q. pyrenaica*, *Q. faginea*, *Q. canariensis* and *Q. suber*, as well as a remarkable presence of pinaceae (*Pinus halepensis*, *P. nigra* ...), juniper species, and a minor contribution of other broadleaved and coniferous species.

The forest management practice is focused on the conservation of these areas, not having a final cutting or thinning. However, minor treatments are made to improve the quality and health of the forest in maturity classes 3 to 12. The wood is mainly used as firewood.

Function	***Maturity class***	***Average Gt (t C/ha)***	***2010 area (ha)***	***Gt gross annual increment (t C/ha and year)***
conservation	1	5,0	970.861	0,26
conservation	2	15,0	360.036	0,77
conservation	3	25,0	133.002	0,90
conservation	4	35,0	58.166	0,91
conservation	5	45,0	32.636	0,98
conservation	6	55,0	23.422	1,19
conservation	7	65,0	13.240	1,52
conservation	8	75,0	7.262	1,86
conservation	9	85,0	3.205	2,02
conservation	10	95,0	1.799	1,71
conservation	11	105,0	1.417	0,54
conservation	12	133,0	2.506	-

Table 13 - Gross annual increments obtained as a result of forest management practices in encinares (Q. ilex) *in dry Mediterranean*

Function	Maturity class	% area in final cuts (year)	% biomass in thinnings (year)	% biomass in minor cuttings - health (10 years)	Gt losses in thinnings (t C / ha and year)	Gt losses in minor cuttings - health (t C / ha and year)	Gt net Increment (t C/ha and year)
conservation	1	0%	0%	0%	0,00	0,00	0,26
conservation	2	0%	0%	0%	0,00	0,00	0,77
conservation	3	0%	0%	4%	0,00	0,10	0,80
conservation	4	0%	0%	4%	0,00	0,14	0,77
conservation	5	0%	0%	4%	0,00	0,18	0,80
conservation	6	0%	0%	4%	0,00	0,22	0,97
conservation	7	0%	0%	4%	0,00	0,26	1,26
conservation	8	0%	0%	4%	0,00	0,30	1,56
conservation	9	0%	0%	4%	0,00	0,34	1,68
conservation	10	0%	0%	4%	0,00	0,38	1,33
conservation	11	0%	0%	4%	0,00	0,42	0,12
conservation	12	0%	0%	4%	-	0,53	-

*Tabla 14 - Percentages and t C of final cuts, thinnings and minor cuttings as a result of forest management practices harvests in encinares (*Q. ilex*) in dry Mediterranean*

Module 7. Estimation of stock variations in the harvested wood products deposit

Changes in the carbon stock in harvested wood products (HWP) have been estimated applying a production approach with first order decay function and default half-life values. These values are;

- 2 years for paper
- 25 years for wood panels
- 35 years for sawn wood

The calculations were made in these three product categories (sawnwood, wood-based panels, paper and paperboard). To ensure coherence with NIR 2018 and national projections, the estimation was made from the carbon stocks reported in NIR starting in 2010. The result of the VAEL model (harvests) was used as an input.

For the documentation of the ratio of forest biomass for energy and non-energy purposes in the reference period, FAOSTAT data has been used, as shown in table 2. This ratio has been applied to the projections of harvests obtained from the Vael model (table 3).

Module 8. Estimation of the FRL for the commitment period

In order to ensure a better consistency, the historical series of biomass pools were calibrated, using the methodology established in section 2.4.4 of the FRL guide document (Forsell et al., 2018). This publication suggests that, for time series with the same trend, the adjustment can be done by comparing the overlapping years using the methodology collected in Volume 1, Chapter 5, of the 2006 IPCC Guidelines:

$$y_0 = x_0 \cdot \left(\frac{1}{(n-m+1)} \cdot \sum_{i=m}^{n} \frac{y_i}{x_i} \right)$$

Where:

- y_0 is the recalculated estimate of emissions / removals in the overlapping period (NIR)
- x_0 is the estimate using the previous method (Vael Model)
- x_i and y_i are the estimates obtained by the new and the previous method, during the overlap period for years m to n:
    - x_i, Vael Model
    - y_i, NIR

After this operation, the model data has been calibrated to fit the values of the historical series of the NIR.

With the data gathered in previous steps, an estimate of the living biomass and HWP pools is obtained. In addition, N_2O and CH_4 emissions from wildfires and prescribed burning have been considered (decreases in CO_2 stocks caused by biomass burning are already accounted as variations of the carbon stock in living biomass).

4. Forest reference level

4.1. Forest reference level and detailed description of the development of the carbon pools

The FRL for Spain for the period from 2021 to 2025 is **-32.833 kt CO_2 eq of which -29,303 kt CO_2 eq correspond to living biomass and -3.862 kt CO_2 eq correspond to harvested wood products (HWP).** N_2O and CH_4 emissions have also been considered for wildfires and prescribed burning (reductions in CO_2 stocks caused by biomass burning are accounted as part of the variations of the biomass pool).

Emissions(+) and removals (-) 2021-2025 (kt CO_2 eq /year)	
Living biomass (CO_2)	-29.303
Northern region	*-5.514*
Humid Mediterranean	*-16.726*
Dry Mediterranean	*-6.640*
Canarias	*-423*
HWP (CO_2)	-3.862
Sawnwood	*-1.195*
Wood-based panels	*-2.343*
Paper and paperboard	*-324*
Wildfires (N_2O, CH_4)	330
Prescribed burning (N_2O, CH_4)	2
Total	**-32.833**

Table 12 - Result of FRL 2021-2025 for Spain

	2011-2015	*2016-2020*	*2021-2025*
Living biomass	-25.219	-29.868	-29.303
HWP	-4.934	-2.829	-3.862
Wildfires	330	330	330
Prescribed burning	2	2	2
FRL with HWP	**-30.486**	**-33.029**	**-33.498**
FRL without HWP	**-24.887**	**-29.536**	**-28.971**

Table 13 – Development of carbon stocks and greenhouse gas emissions 2011-2025 (Kt CO_2 eq/year)

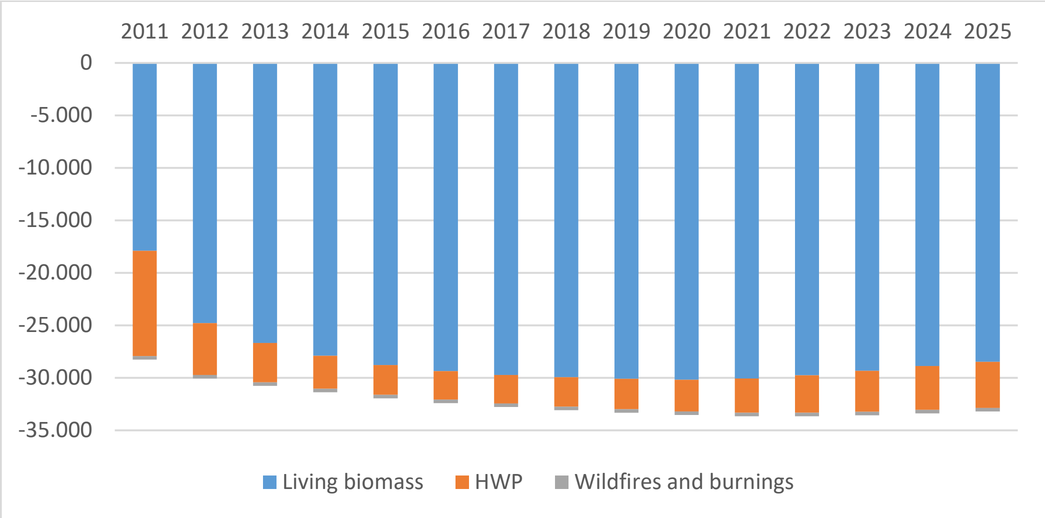

Figure 12 – Development of living biomass, HWP, forest fires and prescribed burning (kt CO2eq)

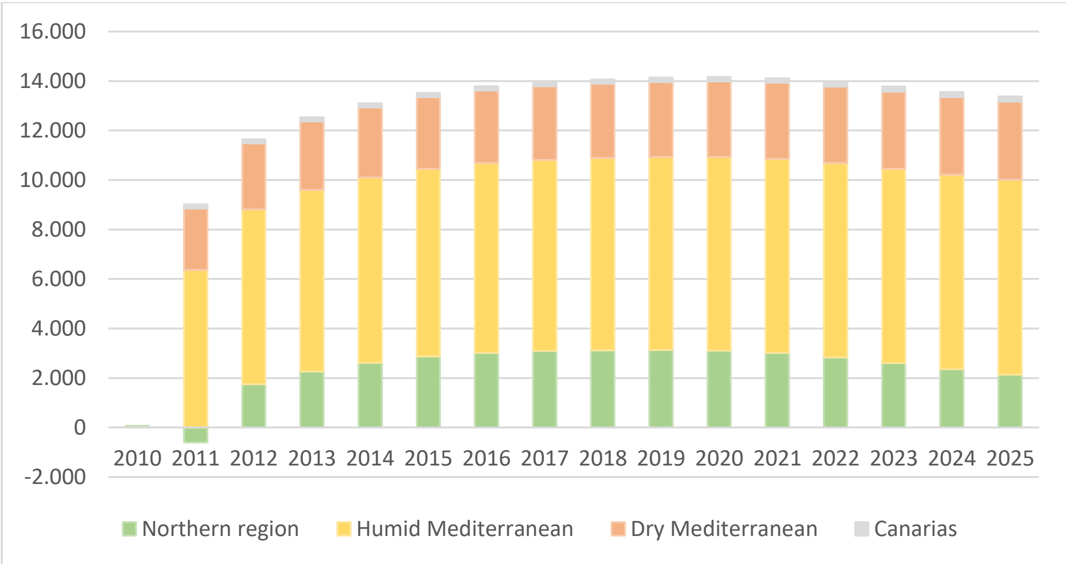

Figure 13 –Living biomass increments in managed forest land by region (kt C)

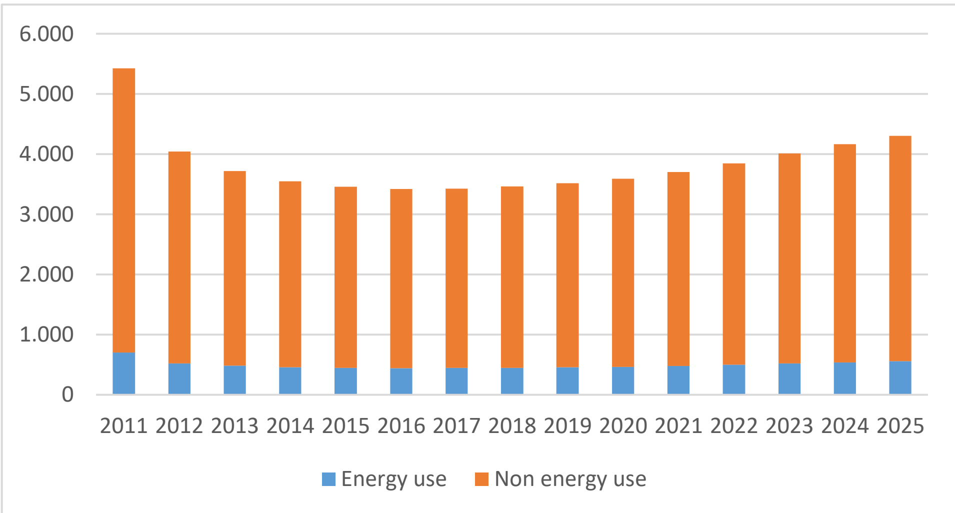

Figure 14 – Evolution of harvests and destination (energy / non-energy, considering constant ratio) (kt C)

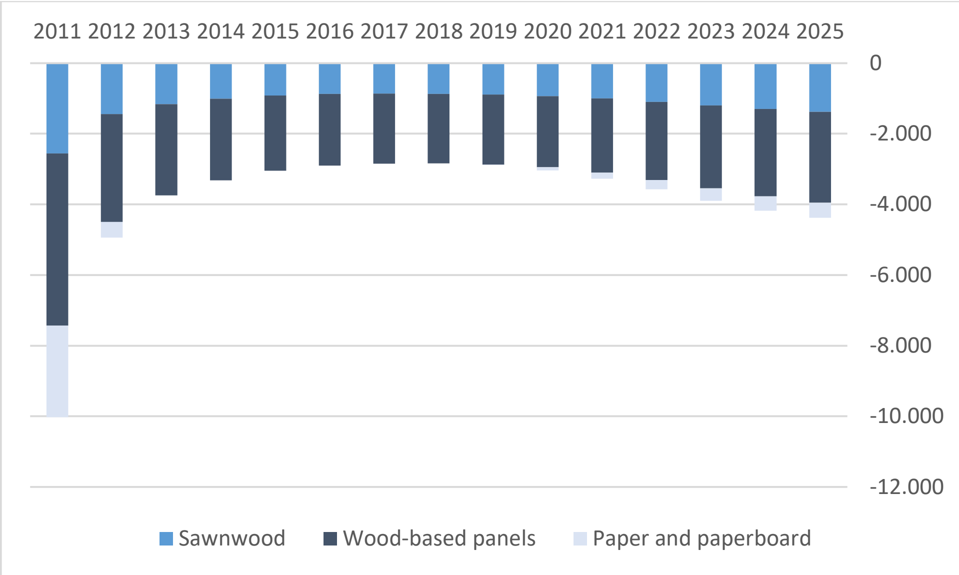

Figure 15 – Emissions and removals (kt CO_2 eq) of the HWP categories (non-energy uses of forest biomass)

4.2. Consistency between the forest reference level and the latest national inventory report

The carbon stocks and other greenhouse gas emissions considered in the FRL are the same as those reported to the EU and the UNFCCC (NIR 2018). The methods applied for carbon stocks and other emissions in the FRL are the same as those utilised in the National Inventory Report of Greenhouse Gases. For more details, the description of the methodology can be consulted in this document.

In addition, the biomass pool provided by the FRL model was compared with the National Inventory Report of Greenhouse Gases in the years 2011-2016 (NIR 2018).

The model outputs in carbon stocks changes are able to reproduce the results of the last NIR edition (see section 1.3.g). Figure 4 of this document details the behaviour of the model in the projected period, 2010-2017, and the comparison with the historical data from NIR.

4.3. Calculated carbon pools and greenhouse gases for the forest reference level

The reference forest level for Spain includes changes in living biomass (aboveground and belowground biomass) and harvested wood products (HWP) pools, to maintain consistency with the pools reported in the National Inventory Report of Greenhouse Gases. In both pools, CO_2 gas is calculated.

The FRL also considers emissions of CH_4 and N_2O gases from biomass burning (forest fires and prescribed burning). Decreases in CO_2 stocks caused by biomass burning are already accounted as a variations of the carbon stock in living biomass.

5. References

- *Rincón-Cristóbal, J.J., (2018). Vael: Modelo para la estimación del nivel de referencia forestal (FRL) de España. Proyecto: Servicio a la Dirección General de Calidad y Evaluación Ambiental y Medio Natural (DGCEAYMN) para el establecimiento de un modelo de cálculo para la fijación del Nivel de Referencia Forestal (FRL) de España en el periodo 2021-2025" (18CASV004). Ministerio para la Transición Ecológica de España.*

- *Forsell N, Korosuo A, Federici S, Gusti M, Rincón-Cristóbal J-J, Rüter S, Sánchez-Jiménez B, Dore C, Brajterman O and Gardiner J. (2018). Guidance on developing and reporting Forest Reference Levels in accordance with Regulation (EU) 2018/841. https://publications.europa.eu/en/publication-detail/-/publication/5ef89b70-8fba-11e8-8bc1-01aa75ed71a1/language-en*

- *IPCC 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan. https://www.ipcc-nggip.iges.or.jp/public/2006gl/*

- *Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.156.01.0001.01.ENG*

- *Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32013R0525*

- *Ley 43/2003, de 21 de noviembre, de Montes (TEXTO CONSOLIDADO. Última modificación: 21 de julio de 2015). https://www.boe.es/buscar/act.php?id=BOE-A-2003-21339*

- *Inventario Forestal Nacional (Ministerio de Agricultura, Pesca y Alimentación). https://www.mapa.gob.es/es/desarrollo-rural/temas/politica-forestal/inventario-cartografia/inventario-forestal-nacional/default.aspx*

- *Estrategia forestal Española (Ministerio de Agricultura, Pesca y Alimentación). https://www.mapa.gob.es/es/desarrollo-rural/temas/politica-forestal/planificacion-forestal/politica-forestal-en-espana/pfe_estrategia_forestal.aspx*

– *Plan Forestal Español (Ministerio de Agricultura, Pesca y Alimentación).* https://www.mapa.gob.es/es/desarrollo-rural/temas/politica-forestal/planificacion-forestal/politica-forestal-en-espana/pfe_descargas.aspx

– *Inventario Nacional de Gases de Efecto Invernadero (Ministerio para la Transición Ecológica).* https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/Inventario-GEI.aspx

– *Plan de activación socioeconómica del sector forestal (Ministerio de Agricultura, Pesca y Alimentación).* https://www.mapa.gob.es/fr/desarrollo-rural/temas/politica-forestal/plan-pasfor/default.aspx

– *FAOSTAT-Forestry database*. http://www.fao.org/forestry/statistics/84922/en/

– *Plan Nacional de Adaptación al Cambio Climático (Ministerio para la Transición Ecológica).* https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/plan-nacional-adaptacion-cambio-climatico/

– *Gregorio Montero, Miren del Río, Sonia Roig. Selvicultura de Pinus silvestris. Instituto Nacional de Investigaciones y Tecnología Agraria y Alimentaria (INIA).* https://gregoriomontero.files.wordpress.com/2016/09/pinus-sylvestrisok.pdf

– *Gregorio Montero, Rafael Calama, Ricardo Ruiz-Peinado. Selvicultura de Pinus nigra. Instituto Nacional de Investigaciones y Tecnología Agraria y Alimentaria (INIA).* https://gregoriomontero.files.wordpress.com/2016/09/2008-01-selvicultura-de-pinus-pinea-l.pdf

– *Miren del Río, Rafael Calama, Gregorio Montero. Selvicultura de Pinus halepensis. Instituto Nacional de Investigaciones y Tecnología Agraria y Alimentaria (INIA).* https://gregoriomontero.files.wordpress.com/2016/09/pinus-halepensis-ok.pdf

– *Gregorio Montero, Rafael Calama, Ricardo Ruiz-Peinado. Selvicultura de Pinus pinea. Instituto Nacional de Investigaciones y Tecnología Agraria y Alimentaria (INIA).* https://gregoriomontero.files.wordpress.com/2016/09/2008-01-selvicultura-de-pinus-pinea-l.pdf

– *Cuidados culturales del pino pinaster en Asturias para producir madera de calidad. Gobierno del Principado de Asturias. 2007.*https://www.asturias.es/Asturias/descargas/PDF_TEMAS/Agricultura/Politica%20Forestal/manual_selvicultura_pinaster_1-32.pdf

– *Roque Julio Rodríguez Soalleiro, Rafael Serrada Hierro, José A. Lucas Santolaya, Reyes Alejano Monje, Miren del Río Gaztelurrutia, Enrique Torres Álvarez, Alejandro Cantero Amiano. SELVICULTURA DE PINUS PINASTER SUBESP. MESOGEENSIS.* http://webspersoais.usc.es/export9/sites/persoais/persoais/roque.rodriguez/descargas/Pinus_pinaster_sub__mesogeensis.pdf

- *Rodríguez Soalleiro, Roque; Álvarez Gozález, Juan Gabriel; Cela González, Miguel; Mansilla Vázquez, Pedro; Vega Alonso, Pilar; González Rosales, Mercedes; Ruíz Zorrilla, Pedro; Vega Alonso, Guillermo. Manual técnico de selvicultura del Pino pinaster. Proyecto Agrobyte. http://www.agrobyte.com/publicaciones/pino/indice.html*
- *Amélie Castro, Fernando Molina Rodríguez, Alberto Rojo Alboreca, Federico Sánchez Rodríguez. Manual de selvicultura del Pino Radiata en Galicia. Proyecto Agrobyte. http://www.agrobyte.com/publicaciones/pinoradiata/indice.html*
- *José Alfredo Bravo, Sonia Roig, Rafael Serrada. Selvicultura en montes bajos y medios de Quercus ilex L., Q. pyrenaica Willd. y Q. faginea Lam. https://www.researchgate.net/publication/288845352_Selvicultura_en_montes_bajos_y_medios_de_Quercus_ilex_L_Q_pyrenaica_Willd_y_Q_faginea_Lam*

Annex I: Information on forest management practices

Northern region

Group	State	Maturity class	Gt minimum (t C/ha)	Gt maximum (t C/ha)	Gt average (t C/ha)	Gt aboveground (t C/ha)	Gt belowground (t C/ha)	Area in 2010 (ha)	Gt gross increase (t C/ha and yr)	% area final cuts (yr)	% area thinnings (yr)	% area minor cuttings(yr)	Gt extratcted in thinnings (t C /ha)	Gt extratcted in minor cuttings (t C /ha)	Gt net increase (t C/ha yr)	Transition years	% anual change to next class	Harvests in final cuts (t C / ha)	Harvests in thinnings (t C / ha)	HHarvests in minor cuttings - health (t C / ha)
Eucalypt forests	growth	1	(t C/ha)	10	5	3,9	1,1	57.938	6,41	0%	0%	0%	0,00	0,00	6,41	1,56	64%	3,90	0,00	0,00
Eucalypt forests	growth	2	10	20	15	11,7	3,3	21.726	6,58	0%	0%	0%	0,00	0,00	6,58	1,52	66%	11,70	0,00	0,00
Eucalypt forests	growth	3	20	30	25	19,5	5,5	25.719	6,75	0%	0%	0%	0,00	0,00	6,75	1,48	67%	19,50	0,00	0,00
Eucalypt forests	growth	4	30	40	35	27,3	7,7	23.070	6,91	0%	0%	0%	0,00	0,00	6,91	1,45	69%	27,30	0,00	0,00
Eucalypt forests	growth	5	40	50	45	35,1	9,9	25.534	7,06	0%	0%	0%	0,00	0,00	7,06	1,42	71%	35,10	0,00	0,00
Eucalypt forests	growth	6	50	60	55	42,9	12,1	22.564	7,21	0%	0%	0%	0,00	0,00	7,21	1,39	72%	42,90	0,00	0,00
Eucalypt forests	growth	7	60	70	65	50,7	14,3	20.541	7,35	0%	0%	0%	0,00	0,00	7,35	1,36	74%	50,70	0,00	0,00
Eucalypt forests	growth	8	70	80	75	58,5	16,5	22.393	7,48	0%	0%	0%	0,00	0,00	7,48	1,34	75%	58,50	0,00	0,00
Eucalypt forests	growth	9	80	90	85	66,3	18,7	19.528	7,61	0%	0%	0%	0,00	0,00	7,61	1,31	76%	66,30	0,00	0,00
Eucalypt forests	production	10	90	120	105	81,9	23,1	58.106	7,73	24%	0%	0%	0,00	0,00	7,73	3,88	26%	81,90	0,00	0,00
Eucalypt forests	production	11	120	150	135	105,3	29,7	38.361	7,84	16%	0%	0%	0,00	0,00	7,84	3,83	26%	105,30	0,00	0,00
Eucalypt forests	production	12	150	170	160	124,8	35,2	17.544	7,94	92%	0%	0%	0,00	0,00	7,94	2,52	40%	124,80	0,00	0,00
Eucalypt forests	conservation	13	170	250	210	163,8	46,2	29.658	8,04	0%	0%	10%	0,00	2,10	5,94	13,47	7%	163,80	0,00	1,64
Eucalypt forests	conservation	14	250	-	307	239,46	67,54	9.876	-	0%	0%	10%	-	3,07	-	-	-	239,46	0,00	2,39
Pine forests (Pinus pinaster)	growth	1	0	10	5	4,05	0,95	71.721	3,27	0%	0%	0%	0,00	0,00	3,27	3,06	33%	4,05	0,00	0,00
Pine forests (Pinus pinaster)	growth	2	10	20	15	12,15	2,85	30.122	3,82	0%	0%	0%	0,00	0,00	3,82	2,61	38%	12,15	0,00	0,00
Pine forests (Pinus pinaster)	growth	3	20	30	25	20,25	4,75	33.621	4,06	0%	0%	0%	0,00	0,00	4,06	2,46	41%	20,25	0,00	0,00
Pine forests (Pinus pinaster)	growth	4	30	40	35	28,35	6,65	31.010	4,11	0%	0%	0%	0,00	0,00	4,11	2,43	41%	28,35	0,00	0,00
Pine forests (Pinus pinaster)	growth	5	40	50	45	36,45	8,55	30.837	4,07	0%	0%	0%	0,00	0,00	4,07	2,46	41%	36,45	0,00	0,00
Pine forests (Pinus pinaster)	growth	6	50	60	55	44,55	10,45	29.685	4,03	0%	0%	0%	0,00	0,00	4,03	2,48	40%	44,55	0,00	0,00
Pine forests (Pinus pinaster)	growth	7	60	70	65	52,65	12,35	32.868	4,04	0%	0%	0%	0,00	0,00	4,04	2,47	40%	52,65	0,00	0,00
Pine forests (Pinus pinaster)	growth	8	70	80	75	60,75	14,25	25.570	4,13	0%	0%	0%	0,00	0,00	4,13	2,42	41%	60,75	0,00	0,00
Pine forests (Pinus pinaster)	growth	9	80	90	85	68,85	16,15	23.466	4,30	0%	0%	0%	0,00	0,00	4,30	2,32	43%	68,85	0,00	0,00
Pine forests (Pinus pinaster)	growth	10	90	100	95	76,95	18,05	17.769	4,54	0%	0%	0%	0,00	0,00	4,54	2,20	45%	76,95	0,00	0,00
Pine forests (Pinus pinaster)	growth	11	100	110	105	85,05	19,95	17.452	4,78	0%	0%	0%	0,00	0,00	4,78	2,09	48%	85,05	0,00	0,00
Pine forests (Pinus pinaster)	production	12	110	130	120	97,2	22,8	26.317	4,95	20%	0%	0%	0,00	0,00	4,95	4,04	25%	97,20	0,00	0,00
Pine forests (Pinus pinaster)	production	13	130	150	140	113,4	26,6	13.982	4,97	20%	0%	0%	0,00	0,00	4,97	4,02	25%	113,40	0,00	0,00
Pine forests (Pinus pinaster)	production	14	150	160	155	125,55	29,45	7.493	4,69	86%	0%	0%	0,00	0,00	4,69	2,13	47%	125,55	0,00	0,00
Pine forests (Pinus pinaster)	conservation	15	160	200	180	145,8	34,2	9.641	3,98	0%	0%	4%	0,00	0,72	3,26	12,28	8%	145,80	0,00	0,58
Pine forests (Pinus pinaster)	conservation	16	200	-	230	186,3	43,7	5.269	-	0%	0%	4%	-	0,92	-	-	-	186,30	0,00	0,75
Pine forests (Pinus radiata)	growth	1	0	10	5	3,75	1,25	74.756	2,83	0%	0%	0%	0,00	0,00	2,83	3,53	28%	3,75	0,00	0,00
Pine forests (Pinus radiata)	growth	2	10	20	15	11,25	3,75	28.561	2,96	0%	40%	0%	1,18	0,00	1,77	5,64	18%	11,25	0,89	0,00
Pine forests (Pinus radiata)	growth	3	20	30	25	18,75	6,25	22.950	3,08	0%	40%	0%	1,23	0,00	1,85	5,41	18%	18,75	0,92	0,00
Pine forests (Pinus radiata)	growth	4	30	40	35	26,25	8,75	26.015	3,17	0%	40%	0%	1,27	0,00	1,90	5,25	19%	26,25	0,95	0,00
Pine forests (Pinus radiata)	growth	5	40	50	45	33,75	11,25	21.113	3,23	0%	0%	0%	0,00	0,00	3,23	3,10	32%	33,75	0,00	0,00
Pine forests (Pinus radiata)	growth	6	50	60	55	41,25	13,75	19.959	3,23	0%	0%	0%	0,00	0,00	3,23	3,09	32%	41,25	0,00	0,00
Pine forests (Pinus radiata)	growth	7	60	70	65	48,75	16,25	20.311	3,18	0%	0%	0%	0,00	0,00	3,18	3,14	32%	48,75	0,00	0,00
Pine forests (Pinus radiata)	growth	8	70	80	75	56,25	18,75	14.975	3,09	0%	0%	0%	0,00	0,00	3,09	3,24	31%	56,25	0,00	0,00
Pine forests (Pinus radiata)	growth	9	80	100	90	67,5	22,5	22.055	2,96	12%	0%	0%	0,00	0,00	2,96	6,77	15%	67,50	0,00	0,00
Pine forests (Pinus radiata)	production	10	100	120	110	82,5	27,5	15.438	2,80	11%	0%	0%	0,00	0,00	2,80	7,15	14%	82,50	0,00	0,00
Pine forests (Pinus radiata)	production	11	120	140	130	97,5	32,5	9.582	2,64	12%	0%	0%	0,00	0,00	2,64	7,58	13%	97,50	0,00	0,00
Pine forests (Pinus radiata)	production	12	140	150	145	108,75	36,25	5.122	2,51	59%	0%	0%	0,00	0,00	2,51	3,99	25%	108,75	0,00	0,00
Pine forests (Pinus radiata)	conservation	13	150	200	175	131,25	43,75	9.064	2,43	0%	0%	4%	0,00	0,70	1,73	28,86	3%	131,25	0,00	0,53
Pine forests (Pinus radiata)	conservation	14	200	-	230	172,5	57,5	992	-	0%	0%	4%	0,00	0,92	-	-	-	172,50	0,00	0,69
Other coniferous forests	growth	1	0	10	5	4,1	0,9	15.131	1,43	0%	0%	0%	0,00	0,00	1,43	7,00	14%	4,10	0,00	0,00
Other coniferous forests	growth	2	10	20	15	12,3	2,7	5.810	1,79	0%	0%	0%	0,00	0,00	1,79	5,60	18%	12,30	0,00	0,00
Other coniferous forests	production	3	20	30	25	20,5	4,5	6.618	2,04	0%	30%	0%	0,61	0,00	1,42	7,02	14%	20,50	0,50	0,00
Other coniferous forests	production	4	30	40	35	28,7	6,3	4.561	2,23	0%	30%	0%	0,67	0,00	1,56	6,40	16%	28,70	0,55	0,00
Other coniferous forests	production	5	40	50	45	36,9	8,1	6.460	2,40	0%	30%	0%	0,72	0,00	1,68	5,95	17%	36,90	0,59	0,00
Other coniferous forests	production	6	50	60	55	45,1	9,9	6.065	2,54	0%	20%	0%	0,51	0,00	2,04	4,91	20%	45,10	0,42	0,00
Other coniferous forests	production	7	60	70	65	53,3	11,7	4.773	2,67	0%	20%	0%	0,53	0,00	2,14	4,68	21%	53,30	0,44	0,00
Other coniferous forests	production	8	70	80	75	61,5	13,5	5.524	2,79	0%	20%	0%	0,56	0,00	2,23	4,48	22%	61,50	0,46	0,00
Other coniferous forests	production	9	80	90	85	69,7	15,3	4.839	2,90	0%	20%	0%	0,58	0,00	2,32	4,31	23%	69,70	0,48	0,00
Other coniferous forests	production	10	90	100	95	77,9	17,1	2.741	3,00	0%	10%	0%	0,30	0,00	2,70	3,71	27%	77,90	0,25	0,00
Other coniferous forests	production	11	100	110	105	86,1	18,9	2.242	3,09	0%	10%	0%	0,31	0,00	2,78	3,59	28%	86,10	0,25	0,00
Other coniferous forests	production	12	110	120	115	94,3	20,7	3.516	3,18	0%	10%	0%	0,32	0,00	2,86	3,49	29%	94,30	0,26	0,00
Other coniferous forests	conservation	13	120	130	125	102,5	22,5	2.149	3,26	0%	0%	4%	0,00	0,50	2,76	3,62	28%	102,50	0,00	0,41
Other coniferous forests	conservation	14	130	140	135	110,7	24,3	1.007	3,34	0%	0%	4%	0,00	0,54	2,80	3,57	28%	110,70	0,00	0,44
Other coniferous forests	conservation	15	140	150	145	118,9	26,1	1.920	3,42	0%	0%	4%	0,00	0,58	2,84	3,53	28%	118,90	0,00	0,48
Other coniferous forests	conservation	16	150	-	178	145,96	32,04	4.335		0%	0%	4%	-	0,71	-	-	-	145,96	0,00	0,58
Broadleaved forests	conservation	1	0	10	5	3,85	1,15	89.620	1,80	0%	0%	0%	0,00	0,00	1,80	5,55	18%	3,85	0,00	0,00
Broadleaved forests	conservation	2	10	20	15	11,55	3,45	61.819	2,07	0%	0%	0%	0,00	0,00	2,07	4,84	21%	11,55	0,00	0,00
Broadleaved forests	conservation	3	20	30	25	19,25	5,75	57.861	2,23	0%	0%	6%	0,00	0,15	2,08	4,81	21%	19,25	0,00	0,12
Broadleaved forests	conservation	4	30	40	35	26,95	8,05	62.976	2,32	0%	0%	6%	0,00	0,21	2,11	4,74	21%	26,95	0,00	0,16
Broadleaved forests	conservation	5	40	50	45	34,65	10,35	64.040	2,35	0%	0%	6%	0,00	0,27	2,08	4,80	21%	34,65	0,00	0,21
Broadleaved forests	conservation	6	50	60	55	42,35	12,65	60.180	2,36	0%	0%	6%	0,00	0,33	2,03	4,93	20%	42,35	0,00	0,25
Broadleaved forests	conservation	7	60	70	65	50,05	14,95	54.567	2,34	0%	0%	6%	0,00	0,39	1,95	5,12	20%	50,05	0,00	0,30

Broadleaved forests	conservation	8	70	80	75	57,75	17,25	67.046	2,32	0%	0%	6%	0,00	0,45	1,87	5,34	19%	57,75	0,00	0,35
Broadleaved forests	conservation	9	80	90	85	65,45	19,55	52.727	2,31	0%	0%	6%	0,00	0,51	1,80	5,57	18%	65,45	0,00	0,39
Broadleaved forests	conservation	10	90	100	95	73,15	21,85	42.883	2,30	0%	0%	6%	0,00	0,57	1,73	5,78	17%	73,15	0,00	0,44
Broadleaved forests	conservation	11	100	110	105	80,85	24,15	70.583	2,31	0%	0%	6%	0,00	0,63	1,68	5,96	17%	80,85	0,00	0,49
Broadleaved forests	conservation	12	110	130	120	92,4	27,6	49.652	2,33	0%	0%	6%	0,00	0,72	1,61	12,46	8%	92,40	0,00	0,55
Broadleaved forests	conservation	13	130	150	140	107,8	32,2	29.126	2,35	0%	0%	4%	0,00	0,56	1,79	11,17	9%	107,80	0,00	0,43
Broadleaved forests	conservation	14	150	160	155	119,35	35,65	19.494	2,38	0%	0%	4%	0,00	0,62	1,76	5,70	18%	119,35	0,00	0,48
Broadleaved forests	conservation	15	160	200	180	138,6	41,4	9.248	2,39	0%	0%	4%	0,00	0,72	1,67	23,97	4%	138,60	0,00	0,55
Broadleaved forests	conservation	16	200	-	230	177,1	52,9	14.520	-	0%	0%	4%	-	0,92	-	-	-	177,10	0,00	0,71
Mixed forests	conservation	1	0	10	5	3,75	1,25	16.297	1,49	0%	0%	0%	0,00	0,00	1,49	6,70	15%	3,75	0,00	0,00
Mixed forests	conservation	2	10	20	15	11,25	3,75	10.080	1,78	0%	0%	0%	0,00	0,00	1,78	5,61	18%	11,25	0,00	0,00
Mixed forests	conservation	3	20	30	25	18,75	6,25	14.581	1,93	0%	0%	4%	0,00	0,10	1,83	5,46	18%	18,75	0,00	0,08
Mixed forests	conservation	4	30	40	35	26,25	8,75	14.710	1,98	0%	0%	4%	0,00	0,14	1,84	5,44	18%	26,25	0,00	0,11
Mixed forests	conservation	5	40	50	45	33,75	11,25	14.604	1,95	0%	0%	4%	0,00	0,18	1,77	5,65	18%	33,75	0,00	0,14
Mixed forests	conservation	6	50	60	55	41,25	13,75	14.809	1,89	0%	0%	4%	0,00	0,22	1,67	6,00	17%	41,25	0,00	0,17
Mixed forests	conservation	7	60	70	65	48,75	16,25	13.589	1,81	0%	0%	4%	0,00	0,26	1,55	6,44	16%	48,75	0,00	0,20
Mixed forests	conservation	8	70	80	75	56,25	18,75	15.281	1,76	0%	0%	4%	0,00	0,30	1,46	6,86	15%	56,25	0,00	0,23
Mixed forests	conservation	9	80	90	85	63,75	21,25	10.155	1,75	0%	0%	4%	0,00	0,34	1,41	7,11	14%	63,75	0,00	0,26
Mixed forests	conservation	10	90	100	95	71,25	23,75	8.618	1,80	0%	0%	4%	0,00	0,38	1,42	7,05	14%	71,25	0,00	0,29
Mixed forests	conservation	11	100	110	105	78,75	26,25	8.647	1,93	0%	0%	4%	0,00	0,42	1,51	6,61	15%	78,75	0,00	0,32
Mixed forests	conservation	12	110	120	115	86,25	28,75	5.259	2,17	0%	0%	4%	0,00	0,46	1,71	5,85	17%	86,25	0,00	0,35
Mixed forests	conservation	13	120	130	125	93,75	31,25	5.250	2,52	0%	0%	4%	0,00	0,50	2,02	4,95	20%	93,75	0,00	0,38
Mixed forests	conservation	14	130	140	135	101,25	33,75	3.652	3,00	0%	0%	4%	0,00	0,54	2,46	4,07	25%	101,25	0,00	0,41
Mixed forests	conservation	15	140	150	145	108,75	36,25	3.012	3,61	0%	0%	4%	0,00	0,58	3,03	3,30	30%	108,75	0,00	0,44
Mixed forests	conservation	16	150	-	176	132	44	5.353	-	0%	0%	4%	-	0,70	-	-	-	132,00	0,00	0,53

Humid Mediterranean

Group	State	Maturity class	Gt minimum (t C/ha)	Gt maximum (t C/ha)	Gt average (t C/ha)	Gt aboveground (t C/ha)	Gt belowground (t C/ha)	Area in 2010 (ha)	Gt gross increase (t C/ha and yr)	% area final cuts (yr)	% area thinnings (yr)	% area minor cuttings(yr)	Gt extratcted in thinnings (t C /ha)	Gt extratcted in minor cuttings (t C /ha)	Gt net increase (t C/ha yr)	Transition years	% anual change to next class	Harvests in final cuts (t C / ha)	Harvests in thinnings (t C / ha)	HHarvests in minor cuttings - health (t C / ha)
Pine forests (Pinus nigra)	growth	1	0	10	5	4,1	0,9	97.537	0,91	0%	0%	0%	0,00	0,00	0,91	10,97	9%	4,10	0,00	0,00
Pine forests (Pinus nigra)	growth	2	10	20	15	12,3	2,7	86.835	1,23	0%	0%	0%	0,00	0,00	1,23	8,10	12%	12,30	0,00	0,00
Pine forests (Pinus nigra)	growth	3	20	30	25	20,5	4,5	69.441	1,52	0%	0%	0%	0,00	0,00	1,52	6,60	15%	20,50	0,00	0,00
Pine forests (Pinus nigra)	production	4	30	40	35	28,7	6,3	62.897	1,76	0%	20%	0%	0,35	0,00	1,41	7,12	14%	28,70	0,29	0,00
Pine forests (Pinus nigra)	production	5	40	50	45	36,9	8,1	52.399	1,96	0%	20%	0%	0,39	0,00	1,57	6,39	16%	36,90	0,32	0,00
Pine forests (Pinus nigra)	production	6	50	60	55	45,1	9,9	33.875	2,12	0%	20%	0%	0,42	0,00	1,69	5,91	17%	45,10	0,35	0,00
Pine forests (Pinus nigra)	production	7	60	70	65	53,3	11,7	24.677	2,23	0%	20%	0%	0,45	0,00	1,79	5,60	18%	53,30	0,37	0,00
Pine forests (Pinus nigra)	production	8	70	80	75	61,5	13,5	18.264	2,31	0%	20%	0%	0,46	0,00	1,85	5,41	18%	61,50	0,38	0,00
Pine forests (Pinus nigra)	growth	9	80	90	85	69,7	15,3	10.786	2,35	0%	0%	0%	0,00	0,00	2,35	4,26	23%	69,70	0,00	0,00
Pine forests (Pinus nigra)	growth	10	90	100	95	77,9	17,1	8.934	2,34	0%	0%	0%	0,00	0,00	2,34	4,27	23%	77,90	0,00	0,00
Pine forests (Pinus nigra)	production	11	100	110	105	86,1	18,9	4.256	2,30	18%	0%	0%	0,00	0,00	2,30	4,36	23%	86,10	0,00	0,00
Pine forests (Pinus nigra)	production	12	110	120	115	94,3	20,7	4.748	2,21	20%	0%	0%	0,00	0,00	2,21	4,53	22%	94,30	0,00	0,00
Pine forests (Pinus nigra)	production	13	120	130	125	102,5	22,5	5.120	2,08	74%	0%	0%	0,00	0,00	2,08	4,80	21%	102,50	0,00	0,00
Pine forests (Pinus nigra)	conservation	14	130	140	135	110,7	24,3	3.476	1,91	0%	0%	2%	0,00	0,27	1,64	6,08	16%	110,70	0,00	0,22
Pine forests (Pinus nigra)	conservation	15	140	150	145	118,9	26,1	2.143	1,70	0%	0%	2%	0,00	0,29	1,41	7,07	14%	118,90	0,00	0,24
Pine forests (Pinus nigra)	conservation	16	150	1000	180	147,6	32,4	3.122	-	0%	0%	2%	-	0,36	-	-	-	147,60	0,00	0,30
Pine forests (Pinus pinaster)	growth	1	0	10	5	4,1	0,9	79.724	1,16	0%	0%	0%	0,00	0,00	1,16	8,65	12%	4,10	0,00	0,00
Pine forests (Pinus pinaster)	growth	2	10	20	15	12,3	2,7	62.353	1,39	0%	0%	0%	0,00	0,00	1,39	7,21	14%	12,30	0,00	0,00
Pine forests (Pinus pinaster)	production	3	20	30	25	20,5	4,5	68.084	1,54	0%	30%	0%	0,46	0,00	1,08	9,27	11%	20,50	0,38	0,00
Pine forests (Pinus pinaster)	production	4	30	40	35	28,7	6,3	57.983	1,66	0%	30%	0%	0,50	0,00	1,16	8,60	12%	28,70	0,41	0,00
Pine forests (Pinus pinaster)	production	5	40	50	45	36,9	8,1	49.456	1,76	0%	30%	0%	0,53	0,00	1,23	8,11	12%	36,90	0,43	0,00
Pine forests (Pinus pinaster)	production	6	50	60	55	45,1	9,9	36.994	1,85	0%	30%	0%	0,55	0,00	1,29	7,73	13%	45,10	0,45	0,00
Pine forests (Pinus pinaster)	production	7	60	70	65	53,3	11,7	23.864	1,92	0%	30%	0%	0,58	0,00	1,35	7,43	13%	53,30	0,47	0,00
Pine forests (Pinus pinaster)	production	8	70	80	75	61,5	13,5	17.232	1,99	0%	30%	0%	0,60	0,00	1,39	7,17	14%	61,50	0,49	0,00
Pine forests (Pinus pinaster)	growth	9	80	90	85	69,7	15,3	10.903	2,05	0%	0%	0%	0,00	0,00	2,05	4,87	21%	69,70	0,00	0,00
Pine forests (Pinus pinaster)	production	10	90	100	95	77,9	17,1	9.420	2,11	17%	0%	0%	0,00	0,00	2,11	4,74	21%	77,90	0,00	0,00
Pine forests (Pinus pinaster)	production	11	100	110	105	86,1	18,9	4.991	2,17	17%	0%	0%	0,00	0,00	2,17	4,62	22%	86,10	0,00	0,00
Pine forests (Pinus pinaster)	production	12	110	120	115	94,3	20,7	4.913	2,21	64%	0%	0%	0,00	0,00	2,21	4,52	22%	94,30	0,00	0,00
Pine forests (Pinus pinaster)	conservation	13	120	130	125	102,5	22,5	3.044	2,26	0%	0%	2%	0,00	0,25	2,01	4,97	20%	102,50	0,00	0,21
Pine forests (Pinus pinaster)	conservation	14	130	1000	151	123,82	27,18	5.405	-	0%	0%	2%	-	0,30	-	-	-	123,82	0,00	0,25
Pine forests (Pinus pinea)	growth	1	0	10	5,0	4,1	0,9	297.981	0,60	0%	0%	0%	0,00	0,00	0,60	16,70	6%	4,05	0,00	0,00
Pine forests (Pinus pinea)	growth	2	10	20	15,0	12,2	2,9	165.572	0,87	0%	0%	0%	0,00	0,00	0,87	11,48	9%	12,15	0,00	0,00
Pine forests (Pinus pinea)	production	3	20	30	25,0	20,3	4,8	135.878	1,08	0%	30%	0%	0,33	0,00	0,76	13,18	8%	20,25	0,26	0,00
Pine forests (Pinus pinea)	production	4	30	40	35,0	28,4	6,7	84.749	1,27	0%	30%	0%	0,38	0,00	0,89	11,28	9%	28,35	0,31	0,00
Pine forests (Pinus pinea)	production	5	40	50	45,0	36,5	8,6	57.330	1,43	0%	30%	0%	0,43	0,00	1,00	10,00	10%	36,45	0,35	0,00
Pine forests (Pinus pinea)	production	6	50	60	55,0	44,6	10,5	42.753	1,58	0%	30%	0%	0,47	0,00	1,10	9,06	11%	44,55	0,38	0,00
Pine forests (Pinus pinea)	production	7	60	70	65,0	52,7	12,4	20.977	1,71	0%	30%	0%	0,51	0,00	1,20	8,34	12%	52,65	0,42	0,00
Pine forests (Pinus pinea)	production	8	70	80	75,0	60,8	14,3	15.583	1,84	0%	30%	0%	0,55	0,00	1,29	7,76	13%	60,75	0,45	0,00
Pine forests (Pinus pinea)	production	9	80	90	85,0	68,9	16,2	9.968	1,96	0%	30%	0%	0,59	0,00	1,37	7,28	14%	68,85	0,48	0,00
Pine forests (Pinus pinea)	production	10	90	100	95,0	77,0	18,1	4.239	2,08	0%	30%	0%	0,62	0,00	1,45	6,88	15%	76,95	0,50	0,00
Pine forests (Pinus pinea)	conservation	11	100	110	105,0	85,1	20,0	3.347	2,19	0%	0%	2%	0,00	0,21	1,98	5,06	20%	85,05	0,00	0,17
Pine forests (Pinus pinea)	conservation	12	110	1000	130,0	105,3	24,7	3.714	-	0%	0%	2%	-	0,26	-	-	-	105,30	0,00	0,21

Pine forests (Pinus sylvestris)	conservation	1	0	10	5	4,1	0,9	170.250	1,11	0%	0%	0%	0,00	0,00	1,11	8,99	11%	4,10	0,00	0,00
Pine forests (Pinus sylvestris)	conservation	2	10	20	15	12,3	2,7	122.353	1,56	0%	0%	0%	0,00	0,00	1,56	6,41	16%	12,30	0,00	0,00
Pine forests (Pinus sylvestris)	conservation	3	20	30	25	20,5	4,5	110.281	1,82	0%	0%	0%	0,00	0,00	1,82	5,49	18%	20,50	0,00	0,00
Pine forests (Pinus sylvestris)	production	4	30	40	35	28,7	6,3	103.050	2,01	0%	30%	0%	0,60	0,00	1,40	7,12	14%	28,70	0,49	0,00
Pine forests (Pinus sylvestris)	production	5	40	50	45	36,9	8,1	87.551	2,15	0%	30%	0%	0,65	0,00	1,51	6,64	15%	36,90	0,53	0,00
Pine forests (Pinus sylvestris)	production	6	50	60	55	45,1	9,9	90.060	2,27	0%	30%	0%	0,68	0,00	1,59	6,30	16%	45,10	0,56	0,00
Pine forests (Pinus sylvestris)	production	7	60	70	65	53,3	11,7	76.540	2,37	0%	30%	0%	0,71	0,00	1,66	6,03	17%	53,30	0,58	0,00
Pine forests (Pinus sylvestris)	production	8	70	80	75	61,5	13,5	63.667	2,45	0%	30%	0%	0,74	0,00	1,72	5,82	17%	61,50	0,60	0,00
Pine forests (Pinus sylvestris)	production	9	80	90	85	69,7	15,3	48.674	2,53	0%	30%	0%	0,76	0,00	1,77	5,65	18%	69,70	0,62	0,00
Pine forests (Pinus sylvestris)	production	10	90	100	95	77,9	17,1	39.159	2,60	0%	30%	0%	0,78	0,00	1,82	5,50	18%	77,90	0,64	0,00
Pine forests (Pinus sylvestris)	production	11	100	110	105	86,1	18,9	24.689	2,66	0%	30%	0%	0,80	0,00	1,86	5,37	19%	86,10	0,65	0,00
Pine forests (Pinus sylvestris)	production	12	110	120	115	94,3	20,7	24.214	2,72	0%	30%	0%	0,81	0,00	1,90	5,26	19%	94,30	0,67	0,00
Pine forests (Pinus sylvestris)	production	13	120	130	125	102,5	22,5	18.668	2,77	0%	30%	0%	0,83	0,00	1,94	5,16	19%	102,50	0,68	0,00
Pine forests (Pinus sylvestris)	production	14	130	140	135	110,7	24,3	15.296	2,81	0%	30%	0%	0,84	0,00	1,97	5,08	20%	110,70	0,69	0,00
Pine forests (Pinus sylvestris)	conservation	15	140	150	145	118,9	26,1	13.262	2,86	0%	0%	2%	0,00	0,29	2,57	3,89	26%	118,90	0,00	0,24
Pine forests (Pinus sylvestris)	conservation	16	150	1000	184	150,9	33,1	35.541	-	0%	0%	2%	-	0,37	-	-	-	150,88	0,00	0,30
Productive broadleaved forests	growth	1	0	10	5	4,0	1,0	24.911	3,61	0%	0%	0%	0,00	0,00	3,61	2,77	36%	4,00	0,00	0,00
Productive broadleaved forests	growth	2	10	20	15	12,0	3,0	9.931	3,52	0%	0%	0%	0,00	0,00	3,52	2,84	35%	12,00	0,00	0,00
Productive broadleaved forests	growth	3	20	30	25	20,0	5,0	8.713	6,62	0%	0%	0%	0,00	0,00	6,62	1,51	66%	20,00	0,00	0,00
Productive broadleaved forests	growth	4	30	40	35	28,0	7,0	7.368	7,33	0%	0%	0%	0,00	0,00	7,33	1,36	73%	28,00	0,00	0,00
Productive broadleaved forests	growth	5	40	50	45	36,0	9,0	4.593	5,26	0%	0%	0%	0,00	0,00	5,26	1,90	53%	36,00	0,00	0,00
Productive broadleaved forests	growth	6	50	60	55	44,0	11,0	4.871	5,08	0%	0%	0%	0,00	0,00	5,08	1,97	51%	44,00	0,00	0,00
Productive broadleaved forests	growth	7	60	70	65	52,0	13,0	3.489	5,08	0%	0%	0%	0,00	0,00	5,08	1,97	51%	52,00	0,00	0,00
Productive broadleaved forests	production	8	70	80	75	60,0	15,0	3.471	5,08	10%	0%	0%	0,00	0,00	5,08	1,97	51%	60,00	0,00	0,00
Productive broadleaved forests	production	9	80	90	85	68,0	17,0	3.174	5,08	20%	0%	0%	0,00	0,00	5,08	1,97	51%	68,00	0,00	0,00
Productive broadleaved forests	production	10	90	100	95	76,0	19,0	2.619	5,08	10%	0%	0%	0,00	0,00	5,08	1,97	51%	76,00	0,00	0,00
Productive broadleaved forests	production	11	100	110	105	84,0	21,0	1.439	5,08	20%	0%	0%	0,00	0,00	5,08	1,97	51%	84,00	0,00	0,00
Productive broadleaved forests	production	12	110	120	115	92,0	23,0	2.262	5,08	30%	0%	0%	0,00	0,00	5,08	1,97	51%	92,00	0,00	0,00
Productive broadleaved forests	production	13	120	130	125	100,0	25,0	1.498	5,08	90%	0%	0%	0,00	0,00	5,08	1,97	51%	100,00	0,00	0,00
Productive broadleaved forests	conservation	14	130	140	135	108,0	27,0	1.048	5,08	0%	0%	2%	0,00	0,27	4,81	2,08	48%	108,00	0,00	0,22
Productive broadleaved forests	conservation	15	140	150	145	116,0	29,0	882	5,08	0%	0%	2%	0,00	0,29	4,79	2,09	48%	116,00	0,00	0,23
Productive broadleaved forests	conservation	16	150	1000	173	138,4	34,6	2.013	-	0%	0%	2%	-	0,35	-	-	-	138,40	0,00	0,28
Broadleaved forests	conservation	1	0	15	7,5	5,6	1,9	126.033	1,26	0%	0%	0%	0,00	0,00	1,26	11,89	8%	5,63	0,00	0,00
Broadleaved forests	conservation	2	15	30	22,5	16,9	5,6	82.247	1,60	0%	0%	0%	0,00	0,00	1,60	9,37	11%	16,88	0,00	0,00
Broadleaved forests	conservation	3	30	45	37,5	28,1	9,4	72.730	1,89	0%	0%	3%	0,00	0,11	1,78	8,44	12%	28,13	0,00	0,08
Broadleaved forests	conservation	4	45	60	52,5	39,4	13,1	58.866	2,13	0%	0%	3%	0,00	0,16	1,97	7,60	13%	39,38	0,00	0,12
Broadleaved forests	conservation	5	60	75	67,5	50,6	16,9	51.475	2,32	0%	0%	3%	0,00	0,20	2,12	7,07	14%	50,63	0,00	0,15
Broadleaved forests	conservation	6	75	90	82,5	61,9	20,6	37.365	2,47	0%	0%	3%	0,00	0,25	2,22	6,76	15%	61,88	0,00	0,19
Broadleaved forests	conservation	7	90	105	97,5	73,1	24,4	30.675	2,56	0%	0%	3%	0,00	0,29	2,27	6,61	15%	73,13	0,00	0,22
Broadleaved forests	conservation	8	105	120	112,5	84,4	28,1	20.215	2,61	0%	0%	3%	0,00	0,34	2,27	6,61	15%	84,38	0,00	0,25
Broadleaved forests	conservation	9	120	135	127,5	95,6	31,9	19.714	2,60	0%	0%	3%	0,00	0,38	2,22	6,76	15%	95,63	0,00	0,29
Broadleaved forests	conservation	10	135	150	142,5	106,9	35,6	12.351	2,55	0%	0%	3%	0,00	0,43	2,12	7,07	14%	106,88	0,00	0,32
Broadleaved forests	conservation	11	150	165	157,5	118,1	39,4	9.178	2,45	0%	0%	3%	0,00	0,47	1,98	7,59	13%	118,13	0,00	0,35
Broadleaved forests	conservation	12	165	180	172,5	129,4	43,1	5.173	2,30	0%	0%	2%	0,00	0,35	1,95	7,68	13%	129,38	0,00	0,26
Broadleaved forests	conservation	13	180	195	187,5	140,6	46,9	2.475	2,10	0%	0%	2%	0,00	0,38	1,72	8,70	11%	140,63	0,00	0,28
Broadleaved forests	conservation	14	195	210	202,5	151,9	50,6	1.331	1,85	0%	0%	2%	0,00	0,41	1,45	10,37	10%	151,88	0,00	0,30
Broadleaved forests	conservation	15	210	225	217,5	163,1	54,4	853	1,55	0%	0%	2%	0,00	0,44	1,12	13,40	7%	163,13	0,00	0,33
Broadleaved forests	conservation	16	225	1000	265	198,8	66,3	1.983	-	0%	0%	2%	-	0,53	-	-	-	198,75	0,00	0,40
Quercus pyrenaica and Q. faginea	conservation	1	0	10	5	4,0	1,0	328.289	0,66	0%	0%	0%	0,00	0,00	0,66	15,19	7%	4,00	0,00	0,00
Quercus pyrenaica and Q. faginea	conservation	2	10	20	15	12,0	3,0	127.406	0,99	0%	0%	0%	0,00	0,00	0,99	10,06	10%	12,00	0,00	0,00
Quercus pyrenaica and Q. faginea	conservation	3	20	30	25	20,0	5,0	82.716	1,29	0%	0%	4%	0,00	0,10	1,19	8,43	12%	20,00	0,00	0,08
Quercus pyrenaica and Q. faginea	conservation	4	30	40	35	28,0	7,0	52.593	1,54	0%	0%	4%	0,00	0,14	1,40	7,17	14%	28,00	0,00	0,11
Quercus pyrenaica and Q. faginea	conservation	5	40	50	45	36,0	9,0	36.767	1,74	0%	0%	4%	0,00	0,18	1,56	6,40	16%	36,00	0,00	0,14
Quercus pyrenaica and Q. faginea	conservation	6	50	60	55	44,0	11,0	28.673	1,90	0%	0%	4%	0,00	0,22	1,68	5,94	17%	44,00	0,00	0,18
Quercus pyrenaica and Q. faginea	conservation	7	60	70	65	52,0	13,0	19.457	2,03	0%	0%	3%	0,00	0,20	1,83	5,46	18%	52,00	0,00	0,16
Quercus pyrenaica and Q. faginea	conservation	8	70	80	75	60,0	15,0	18.103	2,10	0%	0%	3%	0,00	0,23	1,88	5,33	19%	60,00	0,00	0,18
Quercus pyrenaica and Q. faginea	conservation	9	80	90	85	68,0	17,0	15.289	2,14	0%	0%	2%	0,00	0,17	1,97	5,08	20%	68,00	0,00	0,14
Quercus pyrenaica and Q. faginea	conservation	10	90	100	95	76,0	19,0	9.326	2,13	0%	0%	2%	0,00	0,19	1,94	5,16	19%	76,00	0,00	0,15
Quercus pyrenaica and Q. faginea	conservation	11	100	110	105	84,0	21,0	5.332	2,08	0%	0%	2%	0,00	0,21	1,87	5,35	19%	84,00	0,00	0,17
Quercus pyrenaica and Q. faginea	conservation	12	110	120	115	92,0	23,0	6.468	1,98	0%	0%	1%	0,00	0,12	1,87	5,35	19%	92,00	0,00	0,09
Quercus pyrenaica and Q. faginea	conservation	13	120	130	125	100,0	25,0	2.787	1,85	0%	0%	1%	0,00	0,13	1,72	5,81	17%	100,00	0,00	0,10
Quercus pyrenaica and Q. faginea	conservation	14	130	1000	145	116,0	29,0	5.641	-	0%	0%	1%	-	0,15	-	-	-	116,00	0,00	0,12
Encinares - holm oak (Quercus ilex)	conservation	1	0	10	5,0	3,8	1,3	702.746	0,57	0%	0%	0%	0,00	0,00	0,57	17,44	6%	3,75	0,00	0,00
Encinares - holm oak (Quercus ilex)	conservation	2	10	20	15,0	11,3	3,8	215.848	0,97	0%	0%	0%	0,00	0,00	0,97	10,29	10%	11,25	0,00	0,00
Encinares - holm oak (Quercus ilex)	conservation	3	20	30	25,0	18,8	6,3	102.743	1,21	0%	0%	4%	0,00	0,10	1,11	9,05	11%	18,75	0,00	0,08
Encinares - holm oak (Quercus ilex)	conservation	4	30	40	35,0	26,3	8,8	63.057	1,37	0%	0%	4%	0,00	0,14	1,23	8,13	12%	26,25	0,00	0,11
Encinares - holm oak (Quercus ilex)	conservation	5	40	50	45,0	33,8	11,3	47.164	1,50	0%	0%	4%	0,00	0,18	1,32	7,58	13%	33,75	0,00	0,14
Encinares - holm oak (Quercus ilex)	conservation	6	50	60	55,0	41,3	13,8	36.921	1,60	0%	0%	4%	0,00	0,22	1,38	7,23	14%	41,25	0,00	0,17
Encinares - holm oak (Quercus ilex)	conservation	7	60	70	65,0	48,8	16,3	25.426	1,69	0%	0%	2%	0,00	0,13	1,56	6,40	16%	48,75	0,00	0,10
Encinares - holm oak (Quercus ilex)	conservation	8	70	80	75,0	56,3	18,8	22.227	1,77	0%	0%	2%	0,00	0,15	1,62	6,18	16%	56,25	0,00	0,11
Encinares - holm oak (Quercus ilex)	conservation	9	80	90	85,0	63,8	21,3	18.395	1,84	0%	0%	2%	0,00	0,17	1,67	6,00	17%	63,75	0,00	0,13

Encinares - holm oak (Quercus ilex)	conservation	10	90	100	95,0	71,3	23,8	14.532	1,90	0%	0%	1%	0,00	0,10	1,80	5,55	18%	71,25	0,00	0,07
Encinares - holm oak (Quercus ilex)	conservation	11	100	110	105,0	78,8	26,3	8.032	1,95	0%	0%	1%	0,00	0,11	1,85	5,41	18%	78,75	0,00	0,08
Encinares - holm oak (Quercus ilex)	conservation	12	110	1000	133,0	99,8	33,3	10.319	-	0%	0%	1%	-	0,13	-	-	-	99,75	0,00	0,10
Juniper forests	conservation	1	0	5	2,5	1,8	0,7	138.386	0,37	0%	0%	0%	0,00	0,00	0,37	13,49	7%	1,80	0,00	0,00
sabinar/enebral	conservation	2	5	10	7,5	5,4	2,1	38.502	0,65	0%	0%	0%	0,00	0,00	0,65	7,66	13%	5,40	0,00	0,00
sabinar/enebral	conservation	3	10	15	12,5	9,0	3,5	29.170	0,88	0%	0%	1%	0,00	0,01	0,87	5,74	17%	9,00	0,00	0,01
sabinar/enebral	conservation	4	15	20	17,5	12,6	4,9	21.117	1,06	0%	0%	1%	0,00	0,02	1,04	4,79	21%	12,60	0,00	0,01
sabinar/enebral	conservation	5	20	25	22,5	16,2	6,3	16.906	1,19	0%	0%	1%	0,00	0,02	1,16	4,29	23%	16,20	0,00	0,02
sabinar/enebral	conservation	6	25	30	27,5	19,8	7,7	14.453	1,26	0%	0%	1%	0,00	0,03	1,23	4,05	25%	19,80	0,00	0,02
sabinar/enebral	conservation	7	30	35	32,5	23,4	9,1	9.478	1,28	0%	0%	1%	0,00	0,03	1,25	4,00	25%	23,40	0,00	0,02
sabinar/enebral	conservation	8	35	40	37,5	27,0	10,5	7.403	1,25	0%	0%	1%	0,00	0,04	1,22	4,11	24%	27,00	0,00	0,03
sabinar/enebral	conservation	9	40	45	42,5	30,6	11,9	4.641	1,17	0%	0%	0%	0,00	0,00	1,17	4,27	23%	30,60	0,00	0,00
sabinar/enebral	conservation	10	45	50	47,5	34,2	13,3	4.965	1,04	0%	0%	0%	0,00	0,00	1,04	4,82	21%	34,20	0,00	0,00
sabinar/enebral	conservation	11	50	55	52,5	37,8	14,7	3.019	0,85	0%	0%	0%	0,00	0,00	0,85	5,88	17%	37,80	0,00	0,00
sabinar/enebral	conservation	12	55	60	57,5	41,4	16,1	1.872	0,61	0%	0%	0%	0,00	0,00	0,61	8,17	12%	41,40	0,00	0,00
sabinar/enebral	conservation	13	60	65	62,5	45,0	17,5	1.658	0,32	0%	0%	0%	0,00	0,00	0,32	15,56	6%	45,00	0,00	0,00
sabinar/enebral	conservation	14	65	1000	72,0	51,8	20,2	1.382	-	0%	0%	0%	-	0,00	-	-	-	51,84	0,00	0,00
Dehesas	conservation	1	0	5	2,5	1,9	0,6	77.240	0,14	0%	0%	0%	0,00	0,00	0,14	36,03	3%	1,88	0,00	0,00
Dehesas	conservation	2	5	10	7,5	5,6	1,9	112.756	0,18	0%	0%	0%	0,00	0,00	0,18	27,36	4%	5,63	0,00	0,00
Dehesas	conservation	3	10	15	12,5	9,4	3,1	63.499	0,21	0%	0%	1%	0,00	0,01	0,20	24,73	4%	9,38	0,00	0,01
Dehesas	conservation	4	15	20	17,5	13,1	4,4	32.945	0,24	0%	0%	1%	0,00	0,02	0,22	22,41	4%	13,13	0,00	0,01
Dehesas	conservation	5	20	25	22,5	16,9	5,6	14.302	0,26	0%	0%	1%	0,00	0,02	0,24	20,80	5%	16,88	0,00	0,02
Dehesas	conservation	6	25	30	27,5	20,6	6,9	10.655	0,28	0%	0%	1%	0,00	0,03	0,26	19,60	5%	20,63	0,00	0,02
Dehesas	conservation	7	30	35	32,5	24,4	8,1	2.501	0,30	0%	0%	1%	0,00	0,03	0,27	18,66	5%	24,38	0,00	0,02
Dehesas	conservation	8	35	40	37,5	28,1	9,4	1.636	0,32	0%	0%	1%	0,00	0,04	0,28	17,90	6%	28,13	0,00	0,03
Dehesas	conservation	9	40	1000	48,0	36,0	12,0	1.557	-	0%	0%	1%	-	0,05	-	-	-	36,00	0,00	0,04
Mixed forests	conservation	1	0	10	5	3,95	1,05	294.260	0,78	0%	0%	0%	0,00	0,00	0,78	12,89	8%	3,95	0,00	0,00
Mixed forests	conservation	2	10	20	15	11,85	3,15	104.501	1,14	0%	0%	0%	0,00	0,00	1,14	8,78	11%	11,85	0,00	0,00
Mixed forests	conservation	3	20	30	25	19,75	5,25	63.231	1,43	0%	0%	4%	0,00	0,10	1,33	7,54	13%	19,75	0,00	0,08
Mixed forests	conservation	4	30	40	35	27,65	7,35	51.178	1,67	0%	0%	4%	0,00	0,14	1,53	6,52	15%	27,65	0,00	0,11
Mixed forests	conservation	5	40	50	45	35,55	9,45	40.857	1,89	0%	0%	4%	0,00	0,18	1,71	5,84	17%	35,55	0,00	0,14
Mixed forests	conservation	6	50	60	55	43,45	11,55	36.629	2,09	0%	0%	4%	0,00	0,22	1,87	5,33	19%	43,45	0,00	0,17
Mixed forests	conservation	7	60	70	65	51,35	13,65	26.903	2,28	0%	0%	4%	0,00	0,26	2,02	4,95	20%	51,35	0,00	0,21
Mixed forests	conservation	8	70	80	75	59,25	15,75	19.656	2,46	0%	0%	4%	0,00	0,30	2,16	4,64	22%	59,25	0,00	0,24
Mixed forests	conservation	9	80	90	85	67,15	17,85	13.890	2,62	0%	0%	4%	0,00	0,34	2,28	4,38	23%	67,15	0,00	0,27
Mixed forests	conservation	10	90	100	95	75,05	19,95	11.172	2,78	0%	0%	3%	0,00	0,29	2,50	4,01	25%	75,05	0,00	0,23
Mixed forests	conservation	11	100	110	105	82,95	22,05	9.186	2,93	0%	0%	3%	0,00	0,32	2,62	3,82	26%	82,95	0,00	0,25
Mixed forests	conservation	12	110	120	115	90,85	24,15	5.789	3,08	0%	0%	3%	0,00	0,35	2,73	3,66	27%	90,85	0,00	0,27
Mixed forests	conservation	13	120	130	125	98,75	26,25	4.117	3,22	0%	0%	3%	0,00	0,38	2,84	3,52	28%	98,75	0,00	0,30
Mixed forests	conservation	14	130	140	135	106,65	28,35	3.304	3,35	0%	0%	3%	0,00	0,41	2,95	3,39	29%	106,65	0,00	0,32
Mixed forests	conservation	15	140	150	145	114,55	30,45	2.100	3,48	0%	0%	2%	0,00	0,29	3,19	3,13	32%	114,55	0,00	0,23
Mixed forests	conservation	16	150	1000	182	143,78	38,22	4.750	-	0%	0%	2%	-	0,36	-	-	-	143,78	0,00	0,29

Dry Mediterranean

Group	State	Maturity class	Gt minimum (t C/ha)	Gt maximum (t C/ha)	Gt average (t C/ha)	Gt aboveground (t C/ha)	Gt belowground (t C/ha)	Area in 2010 (ha)	Gt gross increase (t C/ha and yr)	% area final cuts (yr)	% area thinnings (yr)	% area minor cuttings(yr)	Gt extratcted in thinnings (t C /ha)	Gt extratcted in minor cuttings (t C /ha)	Gt net increase (t C/ha yr)	Transition years	% anual change to next class	Harvests in final cuts (t C / ha)	Harvests in thinnings (t C / ha)	HHarvests in minor cuttings - health (t C / ha)
Pine forests (Pinus halepensis)	conservation	1	0	5	2,5	2,025	0,475	311.752	0,37	0%	0%	0%	0,00	0,00	0,37	13,63	7%	2,03	0,00	0,00
Pine forests (Pinus halepensis)	conservation	2	5	10	7,5	6,075	1,425	175.778	0,55	0%	0%	0%	0,00	0,00	0,55	9,15	11%	6,08	0,00	0,00
Pine forests (Pinus halepensis)	conservation	3	10	15	12,5	10,125	2,375	134.124	0,69	0%	0%	10%	0,00	0,13	0,57	8,85	11%	10,13	0,00	0,10
Pine forests (Pinus halepensis)	conservation	4	15	20	17,5	14,175	3,325	95.236	0,81	0%	0%	10%	0,00	0,18	0,64	7,82	13%	14,18	0,00	0,14
Pine forests (Pinus halepensis)	conservation	5	20	25	22,5	18,225	4,275	73.914	0,93	0%	0%	10%	0,00	0,23	0,70	7,14	14%	18,23	0,00	0,18
Pine forests (Pinus halepensis)	conservation	6	25	30	27,5	22,275	5,225	52.840	1,03	0%	0%	8%	0,00	0,22	0,81	6,19	16%	22,28	0,00	0,18
Pine forests (Pinus halepensis)	conservation	7	30	35	32,5	26,325	6,175	38.827	1,12	0%	0%	8%	0,00	0,26	0,86	5,79	17%	26,33	0,00	0,21
Pine forests (Pinus halepensis)	conservation	8	35	40	37,5	30,375	7,125	25.095	1,21	0%	0%	8%	0,00	0,30	0,91	5,48	18%	30,38	0,00	0,24
Pine forests (Pinus halepensis)	conservation	9	40	45	42,5	34,425	8,075	21.392	1,30	0%	0%	8%	0,00	0,34	0,96	5,22	19%	34,43	0,00	0,28
Pine forests (Pinus halepensis)	conservation	10	45	50	47,5	38,475	9,025	14.777	1,38	0%	0%	8%	0,00	0,38	1,00	5,00	20%	38,48	0,00	0,31
Pine forests (Pinus halepensis)	conservation	11	50	55	52,5	42,525	9,975	10.041	1,46	0%	0%	8%	0,00	0,42	1,04	4,82	21%	42,53	0,00	0,34
Pine forests (Pinus halepensis)	conservation	12	55	60	57,5	46,575	10,925	8.719	1,53	0%	0%	2%	0,00	0,12	1,42	3,53	28%	46,58	0,00	0,09
Pine forests (Pinus halepensis)	conservation	13	60	65	62,5	50,625	11,875	7.366	1,60	0%	0%	2%	0,00	0,13	1,48	3,38	30%	50,63	0,00	0,10
Pine forests (Pinus halepensis)	conservation	14	65	70	67,5	54,675	12,825	3.558	1,67	0%	0%	2%	0,00	0,14	1,54	3,25	31%	54,68	0,00	0,11
Pine forests (Pinus halepensis)	conservation	15	70	75	72,5	58,725	13,775	2.633	1,74	0%	0%	2%	0,00	0,15	1,60	3,13	32%	58,73	0,00	0,12
Pine forests (Pinus halepensis)	conservation	16	75	-	133	107,73	25,27	7.799		0%	0%	2%	-	0,27	-	-	-	107,73	0,00	0,22
Pine forests (Pinus nigra)	conservation	1	0	10	5	4,1	0,9	67.216	0,79	0%	0%	0%	0,00	0,00	0,79	12,73	8%	4,10	0,00	0,00
Pine forests (Pinus nigra)	conservation	2	10	20	15	12,3	2,7	40.663	0,98	0%	0%	0%	0,00	0,00	0,98	10,18	10%	12,30	0,00	0,00
Pine forests (Pinus nigra)	conservation	3	20	30	25	20,5	4,5	29.915	1,12	0%	0%	6%	0,00	0,15	0,97	10,32	10%	20,50	0,00	0,12
Pine forests (Pinus nigra)	conservation	4	30	40	35	28,7	6,3	17.540	1,23	0%	0%	6%	0,00	0,21	1,02	9,82	10%	28,70	0,00	0,17
Pine forests (Pinus nigra)	conservation	5	40	50	45	36,9	8,1	12.365	1,32	0%	0%	6%	0,00	0,27	1,05	9,53	10%	36,90	0,00	0,22
Pine forests (Pinus nigra)	conservation	6	50	60	55	45,1	9,9	10.394	1,40	0%	0%	6%	0,00	0,33	1,07	9,35	11%	45,10	0,00	0,27
Pine forests (Pinus nigra)	conservation	7	60	70	65	53,3	11,7	7.906	1,47	0%	0%	6%	0,00	0,39	1,08	9,25	11%	53,30	0,00	0,32
Pine forests (Pinus nigra)	conservation	8	70	80	75	61,5	13,5	4.404	1,54	0%	0%	6%	0,00	0,45	1,09	9,21	11%	61,50	0,00	0,37
Pine forests (Pinus nigra)	conservation	9	80	90	85	69,7	15,3	3.154	1,60	0%	0%	4%	0,00	0,34	1,26	7,97	13%	69,70	0,00	0,28

Pine forests (Pinus nigra)	conservation	10	90	100	95	77,9	17,1	2.038	1,65	0%	0%	4%	0,00	0,38	1,27	7,87	13%	77,90	0,00	0,31
Pine forests (Pinus nigra)	conservation	11	100	110	105	86,1	18,9	1.447	1,70	0%	0%	4%	0,00	0,42	1,28	7,80	13%	86,10	0,00	0,34
Pine forests (Pinus nigra)	conservation	12	110	120	115	94,3	20,7	1.485	1,75	0%	0%	4%	0,00	0,46	1,29	7,75	13%	94,30	0,00	0,38
Pine forests (Pinus nigra)	conservation	13	120	130	125	102,5	22,5	485	1,80	0%	0%	4%	0,00	0,50	1,30	7,72	13%	102,50	0,00	0,41
Pine forests (Pinus nigra)	conservation	14	130	1000	175	143,5	31,5	1.163	-	0%	0%	4%	-	0,70	-	-	-	143,50	0,00	0,57
Pine forests (Pinus pinaster)	growth	1	0	10	5,0	4,1	0,9	88.230	0,96	0%	0%	0%	0,00	0,00	0,96	10,44	10%	4,10	0,00	0,00
Pine forests (Pinus pinaster)	growth	2	10	20	15,0	12,3	2,7	60.837	1,13	0%	0%	0%	0,00	0,00	1,13	8,88	11%	12,30	0,00	0,00
Pine forests (Pinus pinaster)	production	3	20	30	25,0	20,5	4,5	47.675	1,50	0%	30%	0%	0,45	0,00	1,05	9,53	10%	20,50	0,37	0,00
Pine forests (Pinus pinaster)	production	4	30	40	35,0	28,7	6,3	37.710	1,92	0%	30%	0%	0,57	0,00	1,34	7,46	13%	28,70	0,47	0,00
Pine forests (Pinus pinaster)	production	5	40	50	45,0	36,9	8,1	24.494	2,26	0%	30%	0%	0,68	0,00	1,58	6,33	16%	36,90	0,56	0,00
Pine forests (Pinus pinaster)	growth	6	50	60	55,0	45,1	9,9	14.812	2,46	0%	30%	0%	0,74	0,00	1,72	5,81	17%	45,10	0,61	0,00
Pine forests (Pinus pinaster)	growth	7	60	70	65,0	53,3	11,7	10.476	2,50	0%	0%	0%	0,00	0,00	2,50	4,00	25%	53,30	0,00	0,00
Pine forests (Pinus pinaster)	production	8	70	80	75,0	61,5	13,5	7.353	2,40	19%	0%	0%	0,00	0,00	2,40	4,16	24%	61,50	0,00	0,00
Pine forests (Pinus pinaster)	production	9	80	90	85,0	69,7	15,3	5.580	2,24	18%	0%	0%	0,00	0,00	2,24	4,46	22%	69,70	0,00	0,00
Pine forests (Pinus pinaster)	production	10	90	100	95,0	77,9	17,1	3.489	2,14	56%	0%	0%	0,00	0,00	2,14	4,68	21%	77,90	0,00	0,00
Pine forests (Pinus pinaster)	conservation	11	100	110	105,0	86,1	18,9	1.876	2,25	0%	0%	2%	0,00	0,21	2,04	4,89	20%	86,10	0,00	0,17
Pine forests (Pinus pinaster)	conservation	12	110	1000	121,0	99,2	21,8	2.118	-	0%	0%	2%	-	0,24	-	-	-	99,22	0,00	0,20
Pine forests (Pinus pinea)	growth	1	0	10	5,0	4,3	0,8	137.974	0,70	0%	0%	0%	0,00	0,00	0,70	14,20	7%	4,25	0,00	0,00
Pine forests (Pinus pinea)	growth	2	10	20	15,0	12,8	2,3	66.364	0,98	0%	0%	0%	0,00	0,00	0,98	10,21	10%	12,75	0,00	0,00
Pine forests (Pinus pinea)	production	3	20	30	25,0	21,3	3,8	40.215	1,27	0%	20%	0%	0,25	0,00	1,01	9,87	10%	21,25	0,22	0,00
Pine forests (Pinus pinea)	production	4	30	40	35,0	29,8	5,3	23.411	1,56	0%	20%	0%	0,31	0,00	1,25	7,99	13%	29,75	0,27	0,00
Pine forests (Pinus pinea)	growth	5	40	50	45,0	38,3	6,8	14.337	1,87	0%	0%	0%	0,00	0,00	1,87	5,33	19%	38,25	0,00	0,00
Pine forests (Pinus pinea)	growth	6	50	60	55,0	46,8	8,3	8.238	2,20	0%	0%	0%	0,00	0,00	2,20	4,55	22%	46,75	0,00	0,00
Pine forests (Pinus pinea)	production	7	60	70	65,0	55,3	9,8	5.055	2,53	20%	0%	0%	0,00	0,00	2,53	3,95	25%	55,25	0,00	0,00
Pine forests (Pinus pinea)	production	8	70	80	75,0	63,8	11,3	3.452	2,87	66%	0%	0%	0,00	0,00	2,87	3,48	29%	63,75	0,00	0,00
Pine forests (Pinus pinea)	conservation	9	80	90	85,0	72,3	12,8	1.613	3,23	0%	0%	2%	0,00	0,17	3,06	3,27	31%	72,25	0,00	0,14
Pine forests (Pinus pinea)	conservation	10	90	1000	105,0	89,3	15,8	1.821	-	0%	0%	2%	-	0,21	-	-	-	89,25	0,00	0,18
Broadleaved forests	growth	1	0	10	5	3,75	1,25	307.869	0,50	0%	0%	0%	0,00	0,00	0,50	20,05	5%	3,75	0,00	0,00
Broadleaved forests	growth	2	10	20	15	11,25	3,75	91.948	0,71	0%	0%	0%	0,00	0,00	0,71	14,17	7%	11,25	0,00	0,00
Broadleaved forests	production	3	20	30	25	18,75	6,25	48.413	0,93	0%	30%	0%	0,28	0,00	0,65	15,39	6%	18,75	0,21	0,00
Broadleaved forests	production	4	30	40	35	26,25	8,75	17.590	1,17	0%	30%	0%	0,35	0,00	0,82	12,24	8%	26,25	0,26	0,00
Broadleaved forests	production	5	40	50	45	33,75	11,25	13.082	1,42	0%	30%	0%	0,43	0,00	0,99	10,05	10%	33,75	0,32	0,00
Broadleaved forests	production	6	50	60	55	41,25	13,75	7.646	1,69	0%	30%	0%	0,51	0,00	1,18	8,45	12%	41,25	0,38	0,00
Broadleaved forests	production	7	60	70	65	48,75	16,25	5.618	1,98	0%	30%	0%	0,59	0,00	1,38	7,22	14%	48,75	0,44	0,00
Broadleaved forests	production	8	70	80	75	56,25	18,75	3.755	2,28	0%	30%	0%	0,68	0,00	1,60	6,27	16%	56,25	0,51	0,00
Broadleaved forests	conservation	9	80	90	85	63,75	21,25	3.395	2,60	0%	0%	2%	0,00	0,17	2,43	4,12	24%	63,75	0,00	0,13
Broadleaved forests	conservation	10	90	100	95	71,25	23,75	2.583	2,93	0%	0%	2%	0,00	0,19	2,74	3,65	27%	71,25	0,00	0,14
Broadleaved forests	conservation	11	100	110	105	78,75	26,25	2.408	3,28	0%	0%	2%	0,00	0,21	3,07	3,26	31%	78,75	0,00	0,16
Broadleaved forests	conservation	12	110	120	115	86,25	28,75	1.926	3,65	0%	0%	2%	0,00	0,23	3,42	2,93	34%	86,25	0,00	0,17
Broadleaved forests	conservation	13	120	130	125	93,75	31,25	561	4,03	0%	0%	2%	0,00	0,25	3,78	2,65	38%	93,75	0,00	0,19
Broadleaved forests	conservation	14	130	1000	140	105	35	2.785	-	0%	0%	2%	-	0,28	-	-	-	105,00	0,00	0,21
Encinares - holm oak (Quercus ilex)	conservation	1	0	10	5,0	4,0	1,1	970.861	0,26	0%	0%	0%	0,00	0,00	0,26	38,92	3%	3,95	0,00	0,00
Encinares - holm oak (Quercus ilex)	conservation	2	10	20	15,0	11,9	3,2	360.036	0,77	0%	0%	0%	0,00	0,00	0,77	13,06	8%	11,85	0,00	0,00
Encinares - holm oak (Quercus ilex)	conservation	3	20	30	25,0	19,8	5,3	133.002	0,90	0%	0%	4%	0,00	0,10	0,80	12,56	8%	19,75	0,00	0,08
Encinares - holm oak (Quercus ilex)	conservation	4	30	40	35,0	27,7	7,4	58.166	0,91	0%	0%	4%	0,00	0,14	0,77	12,95	8%	27,65	0,00	0,11
Encinares - holm oak (Quercus ilex)	conservation	5	40	50	45,0	35,6	9,5	32.636	0,98	0%	0%	4%	0,00	0,18	0,80	12,44	8%	35,55	0,00	0,14
Encinares - holm oak (Quercus ilex)	conservation	6	50	60	55,0	43,5	11,6	23.422	1,19	0%	0%	4%	0,00	0,22	0,97	10,30	10%	43,45	0,00	0,17
Encinares - holm oak (Quercus ilex)	conservation	7	60	70	65,0	51,4	13,7	13.240	1,52	0%	0%	4%	0,00	0,26	1,26	7,95	13%	51,35	0,00	0,21
Encinares - holm oak (Quercus ilex)	conservation	8	70	80	75,0	59,3	15,8	7.262	1,86	0%	0%	4%	0,00	0,30	1,56	6,40	16%	59,25	0,00	0,24
Encinares - holm oak (Quercus ilex)	conservation	9	80	90	85,0	67,2	17,9	3.205	2,02	0%	0%	4%	0,00	0,34	1,68	5,94	17%	67,15	0,00	0,27
Encinares - holm oak (Quercus ilex)	conservation	10	90	100	95,0	75,1	20,0	1.799	1,71	0%	0%	4%	0,00	0,38	1,33	7,51	13%	75,05	0,00	0,30
Encinares - holm oak (Quercus ilex)	conservation	11	100	110	105,0	83,0	22,1	1.417	0,54	0%	0%	4%	0,00	0,42	0,12	80,74	1%	82,95	0,00	0,33
Encinares - holm oak (Quercus ilex)	conservation	12	110	1000	133,0	105,1	27,9	2.506	-	0%	0%	4%	-	0,53	-	-	-	105,07	0,00	0,42
Dehesas	conservation	1	0	5	2,5	1,9	0,6	387.224	0,16	0%	0%	0%	0,00	0,00	0,16	30,78	3%	1,90	0,00	0,00
Dehesas	conservation	2	5	10	7,5	5,7	1,8	574.279	0,23	0%	0%	0%	0,00	0,00	0,23	21,35	5%	5,70	0,00	0,00
Dehesas	conservation	3	10	15	12,5	9,5	3,0	279.481	0,26	0%	0%	1%	0,00	0,01	0,25	19,88	5%	9,50	0,00	0,01
Dehesas	conservation	4	15	20	17,5	13,3	4,2	119.553	0,31	0%	0%	1%	0,00	0,02	0,29	16,95	6%	13,30	0,00	0,01
Dehesas	conservation	5	20	25	22,5	17,1	5,4	53.441	0,40	0%	0%	1%	0,00	0,02	0,38	13,12	8%	17,10	0,00	0,02
Dehesas	conservation	6	25	30	27,5	20,9	6,6	19.603	0,53	0%	0%	1%	0,00	0,03	0,50	10,05	10%	20,90	0,00	0,02
Dehesas	conservation	7	30	35	32,5	24,7	7,8	8.114	0,63	0%	0%	1%	0,00	0,03	0,60	8,38	12%	24,70	0,00	0,02
Dehesas	conservation	8	35	40	37,5	28,5	9,0	3.864	0,63	0%	0%	1%	0,00	0,04	0,59	8,44	12%	28,50	0,00	0,03
Dehesas	conservation	9	40	1000	47,0	35,7	11,3	5.908	-	0%	0%	1%	-	0,05	-	-	-	35,72	0,00	0,04
Mixed forests	conservation	1	0	10	5,0	4,0	1,0	68.853	0,50	0%	0%	0%	0,00	0,00	0,50	19,84	5%	4,00	0,00	0,00
Mixed forests	conservation	2	10	20	15,0	12,0	3,0	32.958	0,77	0%	0%	0%	0,00	0,00	0,77	13,05	8%	12,00	0,00	0,00
Mixed forests	conservation	3	20	30	25,0	20,0	5,0	20.484	0,98	0%	0%	4%	0,00	0,10	0,88	11,37	9%	20,00	0,00	0,08
Mixed forests	conservation	4	30	40	35,0	28,0	7,0	11.225	1,17	0%	0%	4%	0,00	0,14	1,03	9,76	10%	28,00	0,00	0,11
Mixed forests	conservation	5	40	50	45,0	36,0	9,0	6.570	1,33	0%	0%	4%	0,00	0,18	1,15	8,67	12%	36,00	0,00	0,14
Mixed forests	conservation	6	50	60	55,0	44,0	11,0	5.382	1,49	0%	0%	4%	0,00	0,22	1,27	7,88	13%	44,00	0,00	0,18
Mixed forests	conservation	7	60	70	65,0	52,0	13,0	2.753	1,63	0%	0%	4%	0,00	0,26	1,37	7,28	14%	52,00	0,00	0,21
Mixed forests	conservation	8	70	80	75,0	60,0	15,0	2.303	1,77	0%	0%	4%	0,00	0,30	1,47	6,80	15%	60,00	0,00	0,24
Mixed forests	conservation	9	80	90	85,0	68,0	17,0	1.708	1,90	0%	0%	4%	0,00	0,34	1,56	6,40	16%	68,00	0,00	0,27

Mixed forests	conservation	10	90	100	95,0	76,0	19,0	1.147	2,03	0%	0%	4%	0,00	0,38	1,65	6,07	16%	76,00	0,00	0,30
Mixed forests	conservation	11	100	110	105,0	84,0	21,0	1.217	2,26	0%	0%	4%	0,00	0,42	1,84	5,43	18%	84,00	0,00	0,34
Mixed forests	conservation	12	110	1000	145,0	116,0	29,0	781	-	0%	0%	4%	-	0,58	-	-	-	116,00	0,00	0,46

Canarias

Group	State	Maturity class	Gt minimum (t C/ha)	Gt maximum (t C/ha)	Gt average (t C/ha)	Gt aboveground (t C/ha)	Gt belowground (t C/ha)	Area in 2010 (ha)	Gt gross increase (t C/ha and yr)	% area final cuts (yr)	% area thinnings (yr)	% area minor cuttings(yr)	Gt extratcted in thinnings (t C /ha)	Gt extratcted in minor cuttings (t C /ha)	Gt net increase (t C/ha yr)	Transition years	% anual change to next class	Harvests in final cuts (t C / ha)	Harvests in thinnings (t C / ha)	HHarvests in minor cuttings - health (t C / ha)
Coniferous forests	conservation	1	0	10	5	4,0	1,0	9.372	0,37	0%	0%	0%	0,00	0,00	0,37	27,13	4%	4,00	0,00	0,00
Coniferous forests	conservation	2	10	20	15	12,0	3,0	10.937	0,61	0%	0%	0%	0,00	0,00	0,61	16,38	6%	12,00	0,00	0,00
Coniferous forests	conservation	3	20	30	25	20,0	5,0	8.814	0,82	0%	0%	2%	0,00	0,05	0,77	12,98	8%	20,00	0,00	0,04
Coniferous forests	conservation	4	30	40	35	28,0	7,0	8.251	1,01	0%	0%	2%	0,00	0,07	0,94	10,62	9%	28,00	0,00	0,06
Coniferous forests	conservation	5	40	50	45	36,0	9,0	6.252	1,19	0%	0%	2%	0,00	0,09	1,10	9,09	11%	36,00	0,00	0,07
Coniferous forests	conservation	6	50	60	55	44,0	11,0	4.946	1,36	0%	0%	2%	0,00	0,11	1,25	8,01	12%	44,00	0,00	0,09
Coniferous forests	conservation	7	60	70	65	52,0	13,0	3.829	1,52	0%	0%	2%	0,00	0,13	1,39	7,20	14%	52,00	0,00	0,10
Coniferous forests	conservation	8	70	80	75	60,0	15,0	3.043	1,67	0%	0%	2%	0,00	0,15	1,52	6,56	15%	60,00	0,00	0,12
Coniferous forests	conservation	9	80	90	85	68,0	17,0	1.245	1,82	0%	0%	2%	0,00	0,17	1,65	6,04	17%	68,00	0,00	0,14
Coniferous forests	conservation	10	90	100	95	76,0	19,0	1.350	1,97	0%	0%	2%	0,00	0,19	1,78	5,62	18%	76,00	0,00	0,15
Coniferous forests	conservation	11	100	110	105	84,0	21,0	1.551	2,11	0%	0%	2%	0,00	0,21	1,90	5,26	19%	84,00	0,00	0,17
Coniferous forests	conservation	12	110	120	115	92,0	23,0	1.281	2,25	0%	0%	2%	0,00	0,23	2,02	4,95	20%	92,00	0,00	0,18
Coniferous forests	conservation	13	120	130	125	100,0	25,0	1.067	2,39	0%	0%	2%	0,00	0,25	2,14	4,68	21%	100,00	0,00	0,20
Coniferous forests	conservation	14	130	1000	135	108,0	27,0	2.280	-	0%	0%	2%	-	0,27	-	-	-	108,00	0,00	0,22
Broadleaved forests	conservation	1	0	10	5	4,0	1,0	11.645	1,65	0%	0%	0%	0,00	0,00	1,65	6,06	16%	4,00	0,00	0,00
Broadleaved forests	conservation	2	10	20	15	12,0	3,0	2.466	2,03	0%	0%	0%	0,00	0,00	2,03	4,94	20%	12,00	0,00	0,00
Broadleaved forests	conservation	3	20	30	25	20,0	5,0	2.585	2,78	0%	0%	2%	0,00	0,05	2,73	3,67	27%	20,00	0,00	0,04
Broadleaved forests	conservation	4	30	40	35	28,0	7,0	1.206	3,68	0%	0%	2%	0,00	0,07	3,61	2,77	36%	28,00	0,00	0,06
Broadleaved forests	conservation	5	40	50	45	36,0	9,0	1.942	4,58	0%	0%	2%	0,00	0,09	4,49	2,23	45%	36,00	0,00	0,07
Broadleaved forests	conservation	6	50	60	55	44,0	11,0	743	5,33	0%	0%	2%	0,00	0,11	5,22	1,92	52%	44,00	0,00	0,09
Broadleaved forests	conservation	7	60	70	65	52,0	13,0	984	5,85	0%	0%	2%	0,00	0,13	5,72	1,75	57%	52,00	0,00	0,10
Broadleaved forests	conservation	8	70	80	75	60,0	15,0	802	6,10	0%	0%	2%	0,00	0,15	5,95	1,68	59%	60,00	0,00	0,12
Broadleaved forests	conservation	9	80	90	85	68,0	17,0	530	6,08	0%	0%	2%	0,00	0,17	5,91	1,69	59%	68,00	0,00	0,14
Broadleaved forests	conservation	10	90	100	95	76,0	19,0	507	5,83	0%	0%	2%	0,00	0,19	5,64	1,77	56%	76,00	0,00	0,15
Broadleaved forests	conservation	11	100	110	105	84,0	21,0	528	5,44	0%	0%	2%	0,00	0,21	5,23	1,91	52%	84,00	0,00	0,17
Broadleaved forests	conservation	12	110	120	115	92,0	23,0	308	5,04	0%	0%	2%	0,00	0,23	4,81	2,08	48%	92,00	0,00	0,18
Broadleaved forests	conservation	13	120	130	125	100,0	25,0	672	4,80	0%	0%	2%	0,00	0,25	4,55	2,20	46%	100,00	0,00	0,20
Broadleaved forests	conservation	14	130	140	135	108,0	27,0	283	4,95	0%	0%	2%	0,00	0,27	4,68	2,14	47%	108,00	0,00	0,22
Broadleaved forests	conservation	15	140	150	145	116,0	29,0	617	5,73	0%	0%	2%	0,00	0,29	5,44	1,84	54%	116,00	0,00	0,23
Broadleaved forests	conservation	16	150	1000	262	209,6	52,4	5.871	-	0%	0%	2%	-	0,52	-	-	-	209,60	0,00	0,42

Annex II: Information on Dead Wood Pool

1.-Background:

The LULUCF Regulation, in its annex IV, section b states that the NFAP shall contain «identification of the carbon pools and greenhouse gases which have been included in the forest reference level, reasons for omitting a carbon pool from the forest reference level determination, and demonstration of the consistency between the carbon pools included in the forest reference level».

The Spanish NFAP states in chapter 2.1 that «To comply with the criteria A.h of Annex IV of Regulation (EU) 2018/841 (consistency of the FRL with NIR) the dead wood deposit is not included in the calculation of the FRL, since it is not considered in the NIR either. The data included in the NIR to justify this deposit as "non-source" (sections A3.2.10 and A3.2.11 of NIR2018) are scarce to make a thorough and accurate estimate of this deposit and, specially, its inclusion would imply the non-compliance of the consistency of the FRL with NIR»

2.-Data sources

If dead wood had been included in the FRL, a comparison with the National Inventory Report of Greenhouse Gases (NIR 2018) would have been impossible. However, Spain is working in a very intensive way to improve data on dead wood pool. Up to now, the two main data sources on this pool are:

- NFI (see NIR A3.2.8): Carbon Stock.

Information from 27.564 plots of the NFI (at province level) has been collected in order to estimate the carbon stock in the dead wood pool. Samplings in this pool began at NFI3, and has continued at NFI4 with the same methodology. At the present time, the NFI4 cycle has not been completed for the whole country, and in the NFI3 not all the provinces were sampled.

In addition, there are no repeated measurements yet (the same measurement on the same plot at two different time points), so it is impossible to assess carbon stock changes based the NFI data source. Nevertheless, this will become the main data source for dead wood pool in the next future, as the first complete cycle (for whole country) will be completed, and the second cycle of sampling (repeated measurements) begins.

- European Large-scale forest condition monitoring (Level I) (see NIR A3.2.11.1) Carbon Change Change (CSC).

The Spanish forest condition monitoring is integrated in the International Program ICP-Forests. The monitoring intensity level I, called European Large-scale forest condition monitoring, is represented in Spain by plots, on a systematic grid of 16 x 16 km over forest lands. Among many other parameters, dead organic matter is surveyed (dead wood and litter). To assess CSC, two measurements are available, in 595 plots, carried out between 2009 and 2017:

- 1st cycle: 2009-2012
- 2nd cycle: 2013- 2017

The surveys´ results shows the balance of dead wood carbon is next to zero. This is the basis for the proof given in the NIR to demonstrate that the dead wood pool is not an emission source. However, it is estimated that the sample is not statistically sufficient, due to the low number of plots, to include the results in the reporting/accounting.

3.-Next steps

The National Institute for Agricultural and Food Research and Technology (INIA), in close collaboration with the Ministry of Agriculture, Food and Fisheries, is currently working in a model to assess the dead wood pool in national forests. A spatial-temporal additive model has been carried out to examine the deadwood carbon trends, based in the information provided by European Large-scale forest condition monitoring (Level I). As a consequence of the data variability, the standard deviations are quite large, preventing conclusions. The lack of comprehensive measures so far and the time framework of this study (2009-2017) limits the fitting of a predictive model capable to forecast the deadwood stocks under future climatic and management scenarios.

However, it is expected that, as the historical series is fed (since the sampling continues), the model can provide reliable data. As regards the European Large-scale forest condition monitoring, simultaneous sampling of live and dead biomass is being promoted, thus contributing effectively to the construction of the model.

4.-Conclusions

The reasons for excluding the dead wood pool in the construction of the FRL for Spain have been set out in section 2.1 of this document, and have been developed in detail in this Annex.

The LULUCF Expert Group determined that it is possible to include the estimate of the changes in the carbon stock of dead wood, as well as the methodology used to estimate them in a technical correction of the FRL, once Spain has sufficient data for a reliable calculation.

Spain plans to have enough data to estimate the changes in the carbon stock of dead wood in the future. At that time the dead wood pool could be considered in the FRL by means of a technical correction.